

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
Honolulu, Hawaii

BOARD OF LAND AND NATURAL RESOURCES

Suzanne D. Case
Chairperson

CONTRACT SPECIFICATIONS AND PLANS

Job No. J43CM74A
MAUI ANNEX OFFICE
Wailuku, Maui, Hawaii

Design Team

Prime Consultant &

Civil Engineer:

Architect:

Structural Engineer:

Mechanical Engineer:

Electrical Engineer:

Landscape Architect:

Soils Engineer:

Environmental Engineer:

The Limtiaco Consulting Group, Inc.

McPeak Architects

Iwamoto and Associates, LLC

Mechanical Enterprises, Inc.

ECS, Inc.

PBR Hawaii & Associates, Inc.

Hirata & Associates, Inc.

EnviroServices & Training Center, LLC

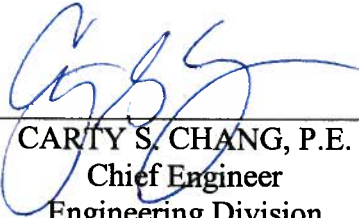
March 2016

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
Honolulu, Hawaii

CONTRACT SPECIFICATIONS AND PLANS

Job No. F93C817D
CENTRAL MAUI REGIONAL SPORTS COMPLEX
PHASE 3
Wailuku, Maui, Hawaii

Approved: _____



CARTY S. CHANG, P.E.
Chief Engineer
Engineering Division

March 2016

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PLANS (Bound Separately)

DEPARTMENT OF LAND AND NATURAL RESOURCES INTERIM GENERAL
CONDITIONS, DATED OCTOBER 1994. (Bound separately)

NOTICE TO BIDDERS
(Chapter 103D, HRS)

COMPETITIVE BIDS for Job No. J43CM74A, Maui Office Annex, Wailuku, Maui, Hawaii shall be submitted to the Department of Land and Natural Resources, Engineering Division on the specified date and time through the Hawaii State e-Procurement (HIePRO). HIePRO is accessible through the State Procurement Office website at www.spo.hawaii.gov.

The Department of Land and Natural Resources Interim General Condition, dated October 1994, as amended, and the General Conditions –AG008, latest revision shall be made part of the specifications.

The project is located at 130 Mahalani Street, Wailuku, Maui, Hawaii.

The work shall generally consist of removal of asbestos cement pipe, hazardous materials abatement, demolition and removal of an existing brick building and accessory structures, and construction of an approximately 7,000 square foot building, boat canopy, storage buildings and carports with associated site improvements.

Due to the nature of work contemplated, bidders must possess a valid State Contractor's license, classification "A" and/or "B".

A voluntary pre-bid conference will be held at the DLNR Maui Annex Office, located at 130 Mahalani Street, Wailuku, HI 96793, on April 8, 2016, at 10 A.M.

All interested parties are invited to attend a State conducted site visit. The site visit will be held at the project site on April 8, 2016, at 10 A.M.

The estimated cost of construction is between \$7,000,000 and \$7,500,000.

The award of the contract, if it be awarded, will be subject to the availability of funds.

This project is subject to preference to Hawaii Products established by Section 103D, Hawaii Revised Statutes. The Hawaii Product List may be examined at the State Procurement Office website.

Since the estimated cost of construction is \$250,000 or more, the apprenticeship agreement preference pursuant to Hawaii Revised Statutes §103-55.6 (ACT 17, SLH 2009) shall apply.

Should there be any questions, please refer to the HIePRO solicitation.

INFORMATION AND INSTRUCTIONS TO BIDDERS

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INFORMATION AND INSTRUCTIONS TO BIDDERS

- A. PROJECT LOCATION AND SCOPE OF WORK: The project location and scope of work shall be as generally described in the Notice to Bidders.
- B. PROPOSALS: Bidders shall submit their bid, including the completed proposal form, bid bond, and any other documents required by the solicitation as part of their bid through the State of Hawaii e-Procurement System (HIePRO). See Item D, PROPOSAL FORM.
- C. GENERAL CONDITIONS: The Department of Land and Natural Resources Interim General Conditions dated October 1994, as amended, shall be made a part of these contract specifications and are referred to hereafter as the General Conditions.
- D. PROPOSAL FORM: **The Bidders shall fill out and upload the electronic copy of the proposal form to the HIePRO website when submitting the bid. Bid Proposals shall not be mailed, faxed or delivered to the State, unless requested to do so after the designated closing date. The successful Bidder shall fill out and print a hard copy of the proposal form, sign and submit the form with the contract award package.**
- E. OMISSIONS OR ERASURES: Any proposal which contains any omission or erasure or alteration not properly initialed, or conditional bid, or other irregularity may be rejected by the Board of Land and Natural Resources (Board).
- F. NOTICE OF INTENT TO BID AND QUESTIONNAIRE:
A Notice of Intent to Bid is not required for this project. In compliance with HRS Section 103D-310, the lowest responsive and responsible bidder may be required to complete a questionnaire. When requested by the State, the completed questionnaire shall be submitted to the Chief Engineer for evaluation. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.
- G. BID SECURITY: A bid security will be furnished by each bidder as provided in sub-section 2.7 of the General Conditions. The successful bidder's bid security will be retained until Contract execution and furnished a performance and payment bond in an amount equal to one hundred percent (100%) of the total Contract price, including an amount estimated to be required for extra work, is furnished.

The Board reserves the right to hold the bid securities of the four lowest bidders until the successful bidder has entered into a contract and has furnished the required performance bond. All bid securities will be returned in accordance with sub-section 3.5 of the General Conditions.

Should the successful bidder fail to enter into a contract and furnish a satisfactory performance bond within the time stated in the proposal, the bid security shall be forfeited as required by law.

- H. CONTRACTOR'S LICENSE REQUIRED: The Board will reject all bids received from contractors who have not been licensed by the State Contractors License Board in accordance with Chapter 444, HRS; Title 16, Chapter 77, Hawaii Administrative Rules; and statutes amendatory thereto.
- I. IRREGULAR BIDS: No irregular bids or propositions for doing the work will be considered by the Board.
- J. WITHDRAWAL OF BIDS: No bidder may withdraw his bid between the time of the opening thereof and the award of contract.
- K. SUCCESSFUL BIDDER TO FILE PERFORMANCE AND PAYMENT BONDS: The successful bidder will be required to file performance and payment bonds each; in the amount equal to the total contract price, including amounts estimated to be required for extra work, as provided in sub-section 3.6 of the General Conditions.
- L. NUMBER OF EXECUTED ORIGINAL COUNTERPARTS OF CONTRACT DOCUMENTS: If requested by the Board, six copies of the Contract, performance and payment bonds shall be executed.
- M. CHANGE ORDERS: No work of any kind in connection with the work covered by the plans and specifications shall be considered as change order work, or entitle the Contractor to extra compensation, except when the work has been ordered in writing by the Chief Engineer (Engineer) and in accordance with sub-section 4.2 of the General Conditions.

The Contractor shall clearly identify and inform the Engineer in writing of any deviations from the contract documents at the time of submission and shall obtain the Engineer's written approval to the specified deviation prior to proceeding with any work.

- N. WAGES AND HOURS: In accordance with sub-sections 7.3 to 7.9 of the General Conditions relative to hours of labor, minimum wages and overtime pay, the current minimum wage rates promulgated by the Department of Labor and Industrial Relations (DLIR) shall be paid to the various classes of laborers and mechanics engaged in the performance of this contract on the job site. The minimum wages shall be increased during the performance of the contract in an amount equal to the increase in the prevailing wages for those kinds of work as periodically determined by the DLIR.

The Department of Land and Natural Resources will not recognize any claim for additional compensation because of the payment by the Contractor of any wage rate in excess of the said minimum wage rates. The possibility of wage increase is one of the elements to be considered by the Contractor in determining his bid, and will not, under any circumstances, be considered as the basis of a claim against the Department under this Contract.

No work shall be done on Saturdays, Sundays, legal State holidays, and/or in excess of eight (8) hours each day without the written consent of the Engineer. Should permission be granted to work at such times, the Contractor shall pay for all inspection administrative costs thereof. No work shall be done at night unless authorized by the Engineer.

- O. PERMITS: The State will process permit applications whenever possible, and the Contractor shall procure the pre-processed permits and pay the required fees. If permit applications are not processed by the State, the Contractor shall process the permit applications, permits and licenses, and pay all charges and fees. In all cases, the Contractor shall give all notices necessary and incident to the due and lawful prosecution of the work.
- P. PROPERTY DAMAGE: It shall be the responsibility of the contractor to respect State property and to prevent damage to existing improvements. The Contractor will be responsible for damages resulting from construction operations. Immediately upon discovery, the Contractor shall repair such damage to the satisfaction of the Engineer.

All trees and shrubbery outside the excavation, embankment or construction limits shall be fully protected from injury.

- Q. TIME: The time of completion is specified in the Proposal. It is the Board's intention to insist the Contractor diligently prosecute the work to completion within the specified time.

Prospective bidders are reminded that the State has the option to proceed with or abandon a project depending on whether the project can be completed for occupancy in the specified time.

It is the bidder's responsibility to check the availability of all materials before bidding. The bidder shall select sub-contractors and suppliers who can warrant availability and delivery of all specified or qualified materials to assure project completion within the specified time.

The successful bidder must assume all risks for completing the project by the specified date. There shall be no extension of time for any reason except for delays caused by acts of God, labor disputes involving unions, or actions of the State. If for any reason the project falls behind schedule, the Contractor shall at its own cost, take necessary remedial measures to get the project back on schedule, i.e., working overtime, air freighting all materials, etc. In addition, if the Contractor fails to fully complete the project by the completion date, Contractor will be required to make the facility usable at its own cost.

- R. BIDDER'S RESPONSIBILITY TO PROVIDE PROPER SUPERINTENDENCE: The successful low bidder shall designate in writing to the Engineer the name of its authorized superintendent (Superintendent), who will be present at the job site whenever any work is in progress. The Superintendent shall be responsible for all work, receiving and implementing instructions from the Engineer in a timely manner. The cost for superintendence shall be considered incidental to the project.

If the Superintendent is not present at the site of work, the Engineer shall have the right to suspend the work as described under sub-section 5.5 c. and 7.20 - Suspension of Work of the General Conditions.

- S. LIQUIDATED DAMAGES: Liquidated damages in the amount specified in the Proposal will be assessed for each and every calendar day from and after the expiration of the time period stated in the Contract for the completion of the project.

- T. HIRING OF HAWAII RESIDENTS: The Contractor shall comply with Act 68, SLH 2010, in the performance and for the duration of this contract. The Contractor shall ensure that Hawaii residents compose not less than eighty percent of the workforce employed to perform the contract work on the project. The eighty percent requirement shall be determined by dividing the total number of hours worked on the contract by Hawaii 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 with shortage trades, as determined by the Department of Labor and Industrial Relations (DLIR), shall not be included in the calculation for this section.

The requirements shall apply to any subcontract of \$50,000 or more in connection with the Contractor, that is, such Subcontractors must also ensure that Hawaii residents compose not less than eighty percent of the Subcontractor's workforce used to perform the subcontract.

- U. WATER AND ELECTRICITY: The Contractor shall make all necessary arrangements and pay all expenses for water and electricity used in the construction of this project.
- V. PUBLIC CONVENIENCE AND SAFETY: The Contractor shall conduct construction operations with due regard to the convenience and safety of the public at all times. No materials or equipment shall be stored where it will interfere with the safe passage of public traffic. The Contractor shall provide, install, and maintain in satisfactory condition, all necessary signs, flares and other protective facilities and shall take all necessary precautions for the protection of the work and the convenience and safety of the public. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the General Conditions.
- W. WORK TO BE DONE WITHOUT DIRECT PAYMENT: Whenever the contract that the Contractor is to perform work or furnish materials of any kind for which no price is fixed in the contract, it shall be understood that the Contractor shall perform such work or furnish said materials without extra charge or allowance or direct payment of any sort. The cost of performing such work or furnishing said material is to be included by the Contractor in a unit price for the appropriate item unless it is expressly specified that such work or material is to be paid for as extra work.
- X. AS-BUILT DRAWINGS: As-built drawings, the intent of which is to record the actual in-place construction so that any future renovations or tie-ins can be anticipated accurately, shall be required. All authorizations given by the Engineer to deviate from the plans shall be drawn on the job site plans. All deviations from alignments, elevations and dimensions which are stipulated on the plans shall be recorded on the as-built drawings. Final as-built drawings shall be submitted to the Engineer for review and approval. After the Engineer approves the as-built drawings, the contractor shall submit an electronic copy in Adobe PDF format on CD ROM.
- Y. ASBESTOS CONTAINING MATERIALS: The use of asbestos containing materials or equipment is prohibited. The Contractor shall insure that all materials and equipment incorporated in the project are asbestos-free

- Z WORKER SAFETY: The Contractor shall provide, install and maintain in satisfactory condition all necessary protective facilities and shall take all necessary precautions for the protection and safety of its workers in accordance with the Occupational Safety and Health Standards for the State of Hawaii. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the General Conditions.
- AA. TOILET FACILITIES: All toilet facilities constructed at the project site shall be in accordance with the Public Health Regulations of the State Department of Health (DOH). All necessary precautions shall be observed at the project site. The use of sanitary facilities shall be strictly enforced and workers violating these provisions shall be promptly discharged.
- BB. SIGNS: Whenever the project involves closing or obstructing any public thoroughfare, the Contractor shall provide traffic signs conforming to the applicable provisions of the current edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways", published by the Federal Highway Administration as directed by the Engineer for the purpose of diverting or warning traffic prior to the construction area. All traffic signs shall bear proper wording stating thereon the necessary information as to diverting or warning traffic.
- When indicated in the Proposal, the Contractor shall provide a project sign, size 4'-0" x 7'-0" to be placed as directed by the Engineer. The sign shall be constructed in accordance with Section 01581 - Project Sign of these specifications and approved by the Engineer. All wording, type and size of lettering and color selection shall be as specified in these specifications or as approved by the Engineer.
- All signs shall be kept neat and clean, and properly erected at all times.
- CC. FIELD OFFICE AREA FOR DEPARTMENT: When indicated in the Proposal, the Contractor shall provide a housed working area of at least 100 square feet adjacent to the Contractor's office for the Department's use. This area will be used by the Engineer to perform tests and to store equipment. As a minimum, the field office shall include the following: standard sized office desk and chair, lighting, ventilation, window-type air conditioning rated at 5,000 BTU, door and window with locking hardware, electrical outlets, and working communications facilities (a cellular telephone is acceptable). The Department will pay for all long distance toll charges made by the Engineer.
- DD. QUANTITIES: All bids will be compared on the basis of quantities of work to be done as shown in the Proposal; the quantities shown in the Unit Price items are estimated, being given as a basis for comparison of bids. The Board reserves the right to increase or decrease the quantities given under the items or delete items entirely as may be required during the progress of the work.
- EE. OTHER HEALTH MEASURES: Forms of work site exposure or conditions which may be detrimental to the health or welfare of workers or of the general public shall be eliminated or reduced to safe levels as required by the DOH codes, standards, and regulations. Suitable first aid kits and a person qualified to render first aid, as specified in the DOH regulations, shall be provided at all times when work is scheduled.

FF. HAWAII BUSINESS OR COMPLIANT NON-HAWAII BUSINESS REQUIREMENT:
Bidders (Contractors) shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR.

GG. COMPLIANCE WITH §3-122-112 HAR:

As a condition for award of the contract and as proof of compliance with the requirements of 103D-310(c) HRS, the apparent low bidder shall furnish the required documents to the Department. If the valid required certificates are not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. Bidder is responsible to apply for and submit the following documents to the Department.

- A. TAX CLEARANCE REQUIREMENTS (HRS Chapter 237): Bidder shall obtain a tax clearance certificate from the Hawaii State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.
- B. Department of Labor (DLIR) “**Certificate of Compliance**”. (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers’ Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawaii State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.
- C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) “**Certificate of Good Standing**”. Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

Alternately, instead of separately applying for these certificates at the various state agencies, bidder may choose to use the Hawaii Compliance Express (HCE), which allows businesses to register online through a simple wizard interface at <http://vendors.ehawaii.gov> to acquire a “Certificate of Vendor Compliance” indicating the bidder’s status is compliant with the requirements of §103D-310(c), HRS, and shall be accepted for contracting and final payment purposes. Bidders that elect to use the new HCE services will be required to pay an annual fee of \$15.00 to the Hawaii Information Consortium, LLC (HIC). Bidders choosing not to participate in the HCE program will be required to provide the paper certificates as instructed in the previous paragraphs.

P R O P O S A L

FOR

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION
State of Hawaii

JOB NO. J43CM74A
MAUI ANNEX OFFICE
Wailuku, Maui, Hawaii

_____, 2016

Chief Engineer
Engineering Division
Department of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

Dear Sir:

The undersigned, having carefully examined the local conditions and all available records and information covering conditions which may affect the cost of the work to be performed, and having carefully examined the Plans and Specifications, and other contract documents, hereby proposes to furnish and pay for all materials, tools, equipment, labor and other incidental work necessary to remove asbestos cement pipe and hazardous materials abatement; demolition and removal of an existing brick building and accessory structures; construction of an approximately 7,000 square foot building, boat canopy, storage buildings and carports with associated site improvements, as required or called for in this Proposal, all according to the true intent and meaning of the Notice to Bidders, Information and Instructions to Bidders, Proposal, Detailed Specifications, Interim General Conditions, Plans, and any and all addenda for:

JOB NO. J43CM74A
MAUI ANNEX OFFICE
Wailuku, Maui, Hawaii

on file in the office of the Engineering Division for the TOTAL BASE BID (Items 1 to 115) of:

_____ Dollars (\$_____)

and will fully complete all work under this contract within 730 consecutive calendar days from the date of written notice to proceed, including date of said order, said total sum being itemized on the following pages.

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
<u>MOBILIZATION</u>				
1.	L.S.	Ea., Project Sign, including installation and all incidentals in place complete	\$ _____	\$ _____
2.	L.S.	Construction survey and layout, utility toning survey, pre-construction survey, post-construction survey, and all incidentals	\$ _____	\$ _____
3.	L.S.	Erosion control measures including inlet protection, ingress/egress pad, filter sock, dust barrier, and all incidentals, in place complete	\$ _____	\$ _____
4.	L.S.	Traffic Control	\$ _____	\$ _____
5.	L.S.	Archaeological Monitoring	\$ _____	\$ _____
6.	L.S.	Field Office	\$ _____	\$ _____
<u>SITE DEMOLITION</u>				
7.	0.38	Acre, Clearing and grubbing, light growth	\$ _____	\$ _____
8.	105	Lin. Ft., Demolition and removal of existing 4" CIP water service line including capping ends of existing pipe to be abandoned-in-place	\$ _____	\$ _____
9.	L.S.	Remove and salvage existing 3" Water Meter and 2" Backflow Preventer including capping ends of 2" CP and 3" GSP water lines to be abandoned-in-place	\$ _____	\$ _____
10.	L.S.	Demolition and removal of all existing structures, storage containers, pavement and fencing; excluding hazardous material abatement	\$ _____	\$ _____
11.	L.S.	Cesspool closure, including cleaning and disposal of existing sludge, backfill, filter fabric, all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
<u>HAZARDOUS MATERIALS ABATEMENT</u>				
12.	300	Lin. Ft., Hazardous materials abatement and removal of 4" underground asbestos containing concrete pipe, including capping end of 4" ACP to be abandoned-in-place, testing, fees, disposal and all incidentals	\$ _____	\$ _____
13.	L.S.	Hazardous materials abatement of asbestos-containing materials, lead-containing materials, lead-based paint, and mercury-containing florescent lamps, including testing, fees, removal, disposal and all incidentals	\$ _____	\$ _____
<u>MASS GRADING</u>				
14.	1,581	Cu. Yd., Excavation for grading, including hauling, embankment, and all incidentals, in place complete	\$ _____	\$ _____
<u>SITE IMPROVEMENTS</u>				
15.	811	Lin. Ft., 6-inch Concrete Curb, including connections to concrete headers, drop curb, curb breaks, and all incidentals, in place complete	\$ _____	\$ _____
16.	386	Sq. Ft., 40-mil Impermeable Membrane including all incidentals, in place complete	\$ _____	\$ _____
17.	76	Lin. Ft., Grade Adjustment Curb, including all incidentals, in place complete	\$ _____	\$ _____
18.	52	Lin. Ft., Concrete Header, including connections to concrete curbs, and all incidentals, in place complete	\$ _____	\$ _____
19.	17	Each, 6-ft Concrete Wheel Stops and all incidentals, in place complete	\$ _____	\$ _____
20.	2,140	Sq. Yd., Asphalt Pavement, including 2" asphalt, 6" aggregate base course, 6" select borrow, and all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
21.	162	Sq. Yd., 6-inch thick Concrete Pavement at Boat Canopy and Trash Enclosure, including reinforcement, base course, and all incidentals, in place complete.	\$ _____	\$ _____
22.	190	Sq. Yd., 4-inch thick Concrete Sidewalk, including synthetic fiber reinforcement, base course, select borrow, and all incidentals, in place complete.	\$ _____	\$ _____
23.	4	Each, Accessible Parking Signage, all incidentals, in place complete	\$ _____	\$ _____
24.	L.S.	Pavement Markings, all incidentals, in place complete	\$ _____	\$ _____
25.	2,657	Sq. Ft., CMU Retaining Wall, and all incidentals in place complete	\$ _____	\$ _____
26.	574	Lin. Ft., 6' H Expanded Metal Fence, incl. barbed wire top section and concrete footings	\$ _____	\$ _____
27.	83	Lin. Ft., 4' H Expanded Metal Fence, incl. barbed wire top section and concrete footings	\$ _____	\$ _____
28.	1	Each, Bicycle Rack and all incidentals, in place complete	\$ _____	\$ _____
29.	L.S.	Telescoping Main Gate (at main driveway); incl. gate operator, exit loop detector, remote controls, gate key pad, and all incidentals, in place complete	\$ _____	\$ _____
30.	L.S.	Telescoping Secondary Gate (exit only from boat canopy); incl. operator, exit loop detector and all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
<u>DRAINAGE IMPROVEMENTS</u>				
31.	60	Lin. Ft., 18-inch HDPE Drain Line, below ground installation, including pipe and fittings, excavation, non-expansive backfill, pipe bedding and all incidentals, in place complete	\$ _____	\$ _____
32.	115	Lin. Ft., 12-inch HDPE Drain Line, below ground installation, including pipe and fittings, excavation, non-expansive backfill, pipe bedding and all incidentals, in place complete	\$ _____	\$ _____
33.	105	Lin. Ft., 8-inch diameter PVC Drain Line, below ground installation, including pipe and fittings, excavation, non-expansive backfill, pipe bedding, and all incidentals, in place complete	\$ _____	\$ _____
34.	210	Lin. Ft., 6-inch diameter PVC Drain Line, below ground installation, including pipe and fittings, excavation, non-expansive backfill, pipe bedding, connection to downspouts, restoration, and all incidentals, in place complete	\$ _____	\$ _____
35.	80	Lin. Ft., 4-inch diameter PVC Drain Line, below ground installation, including pipe and fittings, excavation, non-expansive backfill, pipe bedding and all incidentals, in place complete	\$ _____	\$ _____
36.	16	Lin. Ft., 1-1/4 inch diameter PVC Drain Line, below ground installation, including pipe and fittings, excavation, non-expansive backfill, pipe bedding, and all incidentals, in place complete	\$ _____	\$ _____
37.	7	Each, Area Drains, below ground installation, including fittings, excavation, backfill and all incidentals, in place complete	\$ _____	\$ _____
38.	2	Each, 8-ft Diameter Drywell including excavation, gravel and all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
39.	3	Each, Drainage Cleanout-to-Grade with metal covers, and all incidentals, in place complete	\$ _____	\$ _____
40.	33	Cu. Yd., Infiltration Trench, including excavation, gravel, filter fabric and all incidentals, in place complete	\$ _____	\$ _____
41.	54	Each, Infiltration Chambers and all incidentals, in place complete	\$ _____	\$ _____
42.	177	Cu. Yd., Granular backfill and filter fabric for Infiltration Chambers, and all incidentals, in place complete	\$ _____	\$ _____
43.	331	Cu. Yd., Excavation for Infiltration Chambers	\$ _____	\$ _____
44.	12	Each, End caps for Infiltration Chambers, including and all incidentals, in place complete	\$ _____	\$ _____

ONSITE WATER IMPROVEMENTS

45.	140	Lin. Ft., 2" Copper Water Line, including fittings, pipe cushion, filter fabric, trenching, backfill, testing, chlorination and all incidentals, in place complete	\$ _____	\$ _____
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OFF-SITE UTILITIES (MAHALANI STREET)

46.	54	Lin. Ft., 4" Sewer Lateral, including fittings, pipe cushion, filter fabric, trenching, backfill, and all incidentals, in place complete	\$ _____	\$ _____
47.	58	Lin. Ft., 6" PVC Sewer Lateral, including fittings, pipe cushion, filter fabric, connection to sewer manhole, trenching, backfill, pavement restoration, and all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
48.	131	Lin. Ft., 8-inch PVC Sewer Line, including pipe and fittings, saw cutting, excavation, non-expansive backfill, pipe bedding, manhole connections, manhole rechannelization, pavement and striping restoration, testing, and all incidentals, in place complete	\$ _____	\$ _____
49.	1	Each, 6.5'H Sewer Manhole, including excavation, backfill, restoration, channelization and all incidentals, in place complete	\$ _____	\$ _____
50.	1	Each, Sewer cleanout to grade, and all incidentals, in place complete	\$ _____	\$ _____
51.	1	Each, Sewer drop cleanout to grade, and all incidentals, in place complete	\$ _____	\$ _____
52.	58	Lin. Ft., 6" Ductile Iron Water Line (to Fire Hydrant), including connection to existing main, gate valve, valve box, concrete blocks, restoration, raised pavement marker, trench restoration, testing and chlorination and all incidentals, in place complete	\$ _____	\$ _____
53.	1	Each, 4' Fire Hydrant Assembly and all incidentals, in place complete	\$ _____	\$ _____
54.	41	Lin. Ft., 2" Copper Water Line (to Maui Office Annex), including sawcutting, excavation, pipes and fittings, connection to existing main, ball valves, valve boxes, meter manhole, reduced pressure backflow preventer, trench restoration, testing and chlorination and all incidentals, in place complete	\$ _____	\$ _____
55.	55	Lin. Ft., 3" Ductile Iron Water Line (to Wailuku Health Clinic), including sawcutting, excavation, pipes and fittings, connection to existing main, gate valves, valve boxes, meter manhole, concrete blocks, reduced pressure backflow preventer, double check backflow preventer, testing and chlorination and all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
56.	15	Lin. Ft., 3" Copper Water Irrigation Line (at Wailuku Health Clinic), including connection to existing, gate valve, valve box, concrete blocks, double check backflow preventer, cut and plug existing, testing and chlorination and all incidentals, in place complete	\$ _____	\$ _____
57.	24	Lin. Ft., 2" Copper Water Lateral (at Wailuku Health Clinic), including connection to existing, gate valve, valve box, concrete blocks, cut and plug existing, testing and chlorination and all incidentals, in place complete	\$ _____	\$ _____
58.	52	Sq. Yds, Asphalt pavement restoration in County of Maui roadway (Mahalani Street) with minimum thicknesses of 3" asphalt, 4" asphalt treated base, 6" base course, and all incidentals, in place complete	\$ _____	\$ _____
59.	L.S.	Traffic Control, and all incidentals, in place complete	\$ _____	\$ _____
<u>ARCHITECTURAL</u>				
60.	L.S.	Main Office Building, and all incidentals, in place complete	\$ _____	\$ _____
61.	L.S.	Boat Parking Structure, and all incidentals, in place complete	\$ _____	\$ _____
62.	L.S.	Parking Roof Structures, and all incidentals, in place complete	\$ _____	\$ _____
63.	L.S.	Storage Buildings, and all incidentals, in place complete	\$ _____	\$ _____
<u>STRUCTURAL</u>				
64.	L.S.	Main Office Building, and all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
65.	L.S.	Boat Parking Structure, and all incidentals, in place complete	\$ _____	\$ _____
66.	L.S.	Parking Roof Structures, and all incidentals, in place complete	\$ _____	\$ _____
67.	L.S.	Storage Buildings, and all incidentals, in place complete	\$ _____	\$ _____
<u>MECHANICAL WORK</u>				
68.	35	Each, Plumbing Fixtures	\$ _____	\$ _____
69.	1	Each, Water Fountain	\$ _____	\$ _____
70.	1	Each, Hot Water Recirculation Pump	\$ _____	\$ _____
71.	1	Each, Hot Water Heater	\$ _____	\$ _____
72.	45	Lin. Ft., Trench Drain	\$ _____	\$ _____
73.	1	Each, Oil Water Separator	\$ _____	\$ _____
74.	600	Lin. Ft., Waste/Vent Piping	\$ _____	\$ _____
75.	1,150	Lin. Ft., Water piping	\$ _____	\$ _____
76.	4	Each, Fire Extinguisher	\$ _____	\$ _____
77.	18	Each, Fan Coil Units	\$ _____	\$ _____
78.	5	Each, Air Cooled Condensing Unit	\$ _____	\$ _____
79.	3	Each, Supply Fan	\$ _____	\$ _____
80.	5	Each, Exhaust Fan	\$ _____	\$ _____
81.	4,200	Lbs., Ductwork	\$ _____	\$ _____
82.	40	Each, Air Devices	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
83.	5	Each, Louvers	\$ _____	\$ _____
84.	L.S.	Testing and Balance	\$ _____	\$ _____
85.	L.S.	Controls, and all incidentals, in place complete	\$ _____	\$ _____
<u>ELECTRICAL WORK</u>				
86.	L. S.	Site Utility, including handholes, meter socket, CT cabinet, splice can, ductlines, risers, trenching, backfill, concrete, demolition, testing and all incidentals, in place complete	\$ _____	\$ _____
87.	L.S.	Site Electrical, including feeders, gate operator connection, ductlines, trenching, backfill, concrete, demolition, testing and all incidentals, in place complete	\$ _____	\$ _____
88.	L.S.	Site Lighting, including handholes, light poles with base, ductlines, trenching, backfill, testing and all incidentals, in place complete	\$ _____	\$ _____
89.	L.S.	Building Interior, including main distribution panel, panelboards, breakers, receptacles, manual transfer switch, provision for generator connection, feeders, connections, disconnects, conduit, wiring, control panel, dimmers and switches, sensors, outlets, junction boxes, raceways, cable tray, access controls, testing and all incidentals, in place complete	\$ _____	\$ _____
90.	L.S.	Building Interior Luminaires (LED); in place complete	\$ _____	\$ _____
91.	L.S.	Photovoltaic System, including inverter, panels, supports, wiring, testing and all incidentals, in place complete	\$ _____	\$ _____
92.	L.S.	MECO and HT Utility Charges	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
<u>LANDSCAPING</u>				
93.	4	Each, Loulu Palm, 25 gal., and all incidentals, in place complete	\$ _____	\$ _____
94.	11	Each, Silver Trumpet, 25 gal., and all incidentals, in place complete	\$ _____	\$ _____
95.	6	Each, Lonomea, 25 gal., and all incidentals, in place complete	\$ _____	\$ _____
96.	2	Each, Ohia Lehua, 25 gal., and all incidentals, in place complete	\$ _____	\$ _____
97.	279	Each, Croton (Hedge), 3 gal., and all incidentals, in place complete	\$ _____	\$ _____
98.	17	Each, Green Ti, 1 gal., and all incidentals, in place complete	\$ _____	\$ _____
99.	49	Each, Red Ti, 1 gal., and all incidentals, in place complete	\$ _____	\$ _____
100.	27	Each, Akia, 3 gal., and all incidentals, in place complete	\$ _____	\$ _____
101.	1,980	Each, Beach Morning Glory, 4" pot @ 18" o.c. and all incidentals, in place complete	\$ _____	\$ _____
102.	670	Each, Dwarf Laua'e Fern, 4" pot @ 18" o.c. and all incidentals, in place complete	\$ _____	\$ _____
103.	5,160	Sq. Ft., Soil Amendment @ 2" depth, and all incidentals, in place complete	\$ _____	\$ _____
104.	66	Cu. Yd., Imported Top Soil @ 4" depth and all incidentals, in place complete	\$ _____	\$ _____
105.	33	Cu. Yd., Recycled Wood Chip Cover Mulch @ 2" depth and all incidentals, in place complete	\$ _____	\$ _____

PROPOSAL SCHEDULE

Item No.	Est. Qty.	Description	Unit Price	Unit Total
106.	15	Cu. Yd., Gravel Maintenance Strip @ 3" depth and all incidentals, in place complete	\$ _____	\$ _____
107.	1,600	Sq. Ft., Filter Fabric (under gravel) and all incidentals, in place complete	\$ _____	\$ _____
108.	250	Lin. Ft., Root barrier @ 24" depth, and all incidentals, in place complete	\$ _____	\$ _____
109.	1,000	Lin. Ft., Plastic header and all incidentals, in place complete	\$ _____	\$ _____
110.	L.S.	Entry Sign posts and footings and installation of sign (provided by others) including all incidentals, in place complete	\$ _____	\$ _____
111.	5,390	Sq. Ft., Automatic Irrigation System, and all incidentals, in place complete	\$ _____	\$ _____
112.	L.S.	90-Day Maintenance	\$ _____	\$ _____
113.	Allowance	County of Maui Water System Development Fee for 1-1/2 inch Meter for Maui Office Annex	\$ <u>71,948.00</u>	\$ <u>71,948.00</u>
114.	Allowance	Installation Fee for Department of Water Supply for relocation of 3" water meter to Wailuku Health Clinic, installation of new 1-1/2" water meter for Maui Office Annex, and new fire hydrant connection	\$ <u>5,000.00</u>	\$ <u>5,000.00</u>
SUB-TOTAL BASE BID (ITEMS 1-114)				\$ <u>_____</u>
115.	L.S.	Mobilization (not to exceed 10% of the total sum bid, excluding bid price for mobilization, any allowance or force account items)	\$ _____	\$ _____
TOTAL BASE BID (ITEMS 1-115)				\$ <u>_____</u>

HAWAII PRODUCTS PREFERENCE AND/OR USE OF HAWAII PRODUCTS

In accordance with Act 175, SLH 2009, the Hawaii products preference is applicable to this solicitation. Bidders offering a Hawaii product (“HP”) shall identify the HP in the table below.

Persons desiring to qualify their product(s) not currently on the Hawaii Product List, shall complete Form SPO-38, *Certification for Hawaii Product Preference*, and submit the completed form no later than the deadline specified in the procurement notice and solicitation. The responsibility for certification and qualification shall rest upon the person requesting the preference. One form shall be completed and submitted for each product. Form SPO-38 is available at <http://hawaii.gov/spo/>

For the purpose of selecting the low bid when a solicitation contains both HP and non-HP, the price offered for a HP item shall be decreased by subtracting 10% for the class I or 15% for the class II HP item(s) offered. The lowest total offer, taking the preference into consideration, shall be awarded the contract, unless the offer provides for additional award criteria. The contract amount of any contract awarded, however, shall be the amount of the price offered, exclusive of the preferences.

In the event of any change that materially alters the bidder’s ability to supply the Hawaii product(s), the bidder shall immediately notify the procurement officer in writing and the parties shall enter into discussions for the purpose of revising the contract or terminating the contract for convenience.

Item No.	Pre-Approved Hawaii Product Description & Manufacturer	Class (I or II)	Quantity	Unit Measure	Unit Price	Total Price
1.						
2.						
3.						
4.						
5.						
6.						

RECYCLED PRODUCTS PREFERENCE

This project allows a 10% price preference for recycled products in accordance with HRS 103D-1005. Please indicate your recycled or non-recycled product by indicating its cost FOB jobsite unloaded in the schedule below, including applicable General Excise & Use Taxes.

<u>DESCRIPTION</u>	<u>RECYCLED PRODUCT COST</u>	<u>NONRECYCLED PRODUCT COST</u>
_____	\$ _____	\$ _____
_____	\$ _____	\$ _____
_____	\$ _____	\$ _____
_____	\$ _____	\$ _____

The bidder requesting a recycled product preference shall also complete and submit the form “CERTIFICATION OF RECYCLED CONTENT” as shown in the Interim General Conditions and provide all supporting information with this proposal. Additional information may be requested to qualify a product.

The following definitions are applicable to the CERTIFICATION OF RECYCLED CONTENT form:

"Post-consumer recovered material" means any product used by a consumer, including a business that purchases the material, that has served its intended end use, and that has been separated or diverted from the solid waste stream for the purpose of use, reuse, or recycling.

"Product" includes materials, manufactures, supplies, merchandise, goods, wares, and foodstuffs.

"Recovered material" means waste material and by-products that have been separated, diverted, or removed from the solid waste stream after a manufacturing process for the purpose of use, reuse, or recycling. Recovered material does not include those materials and by-products that are generated and normally reused on-site or within original manufacturing processes (such as mill broke, in the case of paper products).

"Recycled content" means the percentage of a product composed of recovered material, or post-consumer recovered material, or both.

"Recycled product" means a product containing recovered material, or post-consumer recovered material, or both.

The bidder agrees that preference for recycled products shall be taken into consideration to determine the low bidder in accordance with said Section and the rules promulgated, however, the award of contract will be in the amount of the bid offered exclusive any preference.

APPRENTICESHIP AGREEMENT PREFERENCE

1. If applicable to this project, any bidder seeking the preference must be a party to an apprenticeship agreement registered with the State Department of Labor and Industrial Relations (DLIR) at the time the bid is submitted for each apprenticeable trade the bidder will employ to construct the project. “Employ” means the employment of a person in an employer-employee relationship.
 - a. The apprenticeship agreement shall be registered with the DLIR and conform to the requirements of Hawaii Revised Statutes Chapter 372.
 - b. Subcontractors do not have to be a party to an apprenticeship agreement for the bidder to obtain preference.
 - c. The bidder is not required to have apprentices in its employ at the time the bid is submitted to qualify for the preference.
2. A bidder seeking the preference must state the apprenticeable trade the bidder will employ for each trade to be employed to perform the work by submitting a completed signed original *Certification Form 1* verifying participation in an apprenticeship program registered with DLIR. “Apprenticeable trade” shall have the same meaning as “apprenticeable occupation” pursuant to Hawaii Administrative Rules (HAR) §12-30-5.
 - a. The *Certification Form 1* shall be authorized by an apprenticeship sponsor listed on the DLIR list of registered apprenticeship programs. “Sponsor” means an operator of an apprenticeship program and in whose name the program is approved and registered with the DLIR pursuant to HAR §12-30-1.
 - b. The authorization shall be an original signature by an authorized official of the apprenticeship sponsor.
 - c. The completed signed original *Certification Form 1* for each trade must be submitted with the bid. Previous certifications shall not apply.
 - d. When filling out the *Certification Form 1*, the name of Apprenticeable Trade and Apprenticeship Sponsor must be the same as recorded in the List of Construction Trades in Registered Apprenticeship Programs that is posted on the DLIR website. “Registered apprenticeship program” means a construction trade program approved by the DLIR pursuant to HAR §12-301 and §12-30-4.
 - e. The *Certificate Form 1* and the List of Construction Trades in Registered Apprenticeship Programs is available on the DLIR website at: <http://hawaii.gov/labor/wdd>.
3. Upon receiving the *Certification Form 1*, the Procurement Officer will verify that the apprenticeship program is on the List of Construction Trades in Registered Apprenticeship Programs and that the form is signed by an authorized official of the Apprenticeship Program Sponsor. If the programs and signature are not confirmed by the DLIR, the bidder will not qualify for the preference.

4. If the bidder is certified to participate in an apprenticeship program for each trade which will be employed by the bidder for the project, a preference will be applied to decrease the bidder's bid amount by five percent (5%) for evaluation purposes.
5. Should the bidder qualify for other preferences (e.g. Hawaii Products), all applicable preferences shall be applied to the bid price.

CONTRIBUTIONS BY STATE AND COUNTY CONTRACTORS PROHIBITED

Contractors are hereby notified of the applicability of Section 11-355, HRS, 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.

CONDITION OF AWARD

It is understood that the award of the contract will be made on the basis of the lowest responsible Total Base Bid (Items 1 to 115) selected by the Board of Land and Natural Resources. Write the total of bid items 1 to 115 on page P-1.

It is understood and agreed that the Board of Land and Natural Resources reserves the right to reject any and/or all bids and waive any defects when, in the Board's opinion, such rejection or waiver will be for the best interest of the State of Hawaii.

In the event all bids exceed available funds certified by the appropriate fiscal officer, the head of the purchasing agency responsible for the procurement in question is authorized in situations where time or economic considerations preclude resolicitation of work of a reduced scope to negotiate an adjustment of the bid price, including changes in the bid requirements, with the low responsible and responsive bidder, in order to bring the bid within the amount of available funds. It is understood and agreed upon that the head of the purchasing agency may delete a portion or all of any item(s) in the proposal at the stated unit or lump sum price as necessary to stay within the available funding. The bidder is responsible to make an earnest effort to represent the actual cost of each item, including all materials, labor, equipment, overhead and profit in their bid proposal to preclude claims of anticipated profit or loss of profit because of an unbalanced bid proposal.

It is also understood that if a mutually agreeable cost for the reduced scope of work necessitated by a lack of available funds cannot be agreed upon between the bidder and the head of the purchasing agency within 14 calendar days after the bid opening, then the bid may be rejected in the best interest of the purchasing agency, and the head of the purchasing agency may negotiate in progressive order (lowest to highest) with the next lowest responsible and responsive bidder.

It is also understood and agreed that the award of the contract shall be conditioned upon funds being made available for this project and further upon the right of the Board of Land and Natural Resources to hold all bids received for a period of sixty (60) days from the date of the opening thereof, unless otherwise required by law, during which time no bid may be withdrawn.

It is also understood that Notice to Proceed may be delayed up to one (1) year after the bid opening date, and that no additional compensation will be provided for any claim for escalation or delay for issuance of Notice to Proceed on or before that date.

It is also understood and agreed that the quantities given herewith are approximate only and are subject to increase or decrease, and that the undersigned will perform all quantities of work as either increased or decreased, in accordance with the provisions of the Contract Specifications.

It is also understood and agreed that the estimated quantities shown for the items for which a UNIT PRICE is asked in this Proposal are only for the purpose of comparing on a uniform basis, bids offered for the work under this contract, and the undersigned agrees that he is satisfied with and will at no time, dispute said estimated quantities as a means of claims for anticipated profit or loss of profit, because of a difference between the quantities of the various classes of work done or the materials and equipment installed, and the said estimated quantities. On UNIT PRICE bids, payment will be made only for the actual number of units incorporated into the finished project at the contract UNIT PRICE.

After the proposals are opened and read, the figures will be extended and/or totaled in accordance with the bid prices of the acceptable proposals and the totals will be compared. In the comparison of bids, words written in the proposal shall govern over figures and unit prices will govern over totals. Until the award of the contract, however, the right will be reserved to reject any and all proposals and to

waive any defects or technicalities as may be deemed best for the interest of the State.

It is also understood and agreed that liquidated damages in the amount of Seven Hundred Fifty and 00/100 dollars (\$750.00) for each and every calendar day in excess thereof prior to completion of the contract shall be withheld from payments due to the Contractor.

It is also understood and agreed that if this bid is accepted, the successful bidder must enter into and execute a contract with the Board of Land and Natural Resources and furnish a Performance and Payment Bond, as required by law. These bonds shall conform to provisions of Section 103D-324 and 325, Hawaii Revised Statutes and any law applicable hereto.

It is also understood and agreed that the successful bidder will provide all necessary labor, materials, tools, equipment, and other incidentals necessary to do all the work and furnish all the materials specified in the contract in the manner and time herein prescribed, and according to the requirements of the Engineer as therein set forth.

It is understood that by submitting this proposal, the undersigned is declaring that his firm has not been assisted or represented on this matter by an individual who has, in a State capacity, been involved in the subject matter of this contract in the past two years.

It is understood that by submitting this proposal in accordance with HAR 3-122-192, the undersigned is declaring that the price submitted is independently arrived without collusion.

It is also understood that by submitting this proposal, a Certification for Safety and Health Programs for bids in excess of \$100,000 (in accordance with HRS 396-18), the undersigned certifies that his organization will have a written safety and health plan for this project that will be available and implemented by the Notice to Proceed date of this project. Details of the requirements of this plan may be obtained from the Department of Labor and Industrial Relations, Occupational, Safety and Health Division (HIOSH).

It is further understood and agreed that the successful bidder shall comply with paragraph 3.1.a "SUBCONTRACTING" of the General Provisions which requires that the contractor shall perform with his own organization and with the assistance of workmen under his immediate superintendence, work of a value not less than twenty percent (20%) of the value of all work embraced in the Contract, except that certain contract items of work, if specifically referred to in the special provisions, will be exempted from said twenty percent requirement.

Compliance with §103-310 HRS. As a condition of award all bidders shall comply with all laws governing entities doing business in the State, including Chapter 237 HRS (general excise tax); Chapter 383 HRS (employment security – unemployment insurance); Chapter 386 HRS (workers compensation); Chapter 392 HRS (temporary disability insurance); and Chapter 393 HRS (pre-paid health care), and shall produce all documents to the State (DLNR, Engineering Division) required to demonstrate compliance with these subsections. Any bidder making a false affirmation or certification under this subsection shall be suspended and may be debarred from further offerings or awards pursuant to §103D-702 HRS.

RECEIPT OF ADDENDA

The bidder also acknowledges receipt of any and all addenda issued by the Engineering Division, by recording the date of receipt of the respective addenda in the space provided below:

<u>Addendum</u>	<u>Date Received</u>	<u>Addendum</u>	<u>Date Received</u>
No. 1	_____	No. 5	_____
No. 2	_____	No. 6	_____
No. 3	_____	No. 7	_____
No. 4	_____	No. 8	_____

It is understood that failure to receive any such addendum shall not relieve the Contractor from any obligation under this Proposal as submitted.

It is also understood and agreed that if this Proposal is accepted and the undersigned should fail or neglect to contract as aforesaid, the Board may determine that the bidder has abandoned the Contract, and thereupon, forfeiture of the security accompanying his proposal shall operate and the same shall become the property of the Board.

JOINT CONTRACTORS OR SUBCONTRACTORS
TO BE ENGAGED ON THIS PROJECT

The Bidder agrees that the following is a complete listing of all joint contractors or subcontractors covered under Chapter 444, Hawaii Revised Statutes (HRS), who will be engaged by the Bidder on this project to perform the required work indicated pursuant to Section 103D-302, HRS. 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. The Bidder certifies that the completed listing of joint contractors or subcontractors fulfills the requirements for the project and the Bidder, together with the listed subcontractors or joint contractors have all the specialty contractor's licenses to complete the work, except as provided for in HRS §103D-302(b). Failure of the Bidder to comply with this requirement may be just cause for rejection of the bid.

“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 in which 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.

General Engineering “A” Contractors automatically have these “C” specialty contractor’s licenses: C-3, C-9, C-10, C-17, C-24, C-31a, C-32, C-35, C-37a, C-37b, C-38, C-43, C-49, C-56, C-57a, C-57b and C-61.

General Building “B” Contractors automatically have these “C” specialty contractor’s licenses: C-5, C-6, C-10, C-12, C-24, C-25, C-31a, C-32a, C-42a and C-42b.

In completing the Joint Contractors or Subcontractors List, describe the specialty contractor’s nature and scope of work to be performed for this project and provide the complete firm name of the joint contractor or subcontractor in the respective columns. If the Bidder is a general contractor providing the work of a required specialty contractor, whose license is not automatically held pursuant to HAR 16-77-32, fill in the Bidder’s (general contractor’s) name and nature and scope of work to be performed on this project.

List only one joint contractor or subcontractor per required specialty contractor’s classification, unless within the same specialty, the work of each joint contractor or subcontractor can be described so that there is no overlap in work descriptions.

If a contractor’s license is required by law for the performance of the work which is called for in this bid, the bidder and all subcontractors must have the required license before the submission of the bidder’s proposal in the case of a non-federal aid project, and for federal-aid projects, the bidder must have the required license prior to the award of the project and all subcontractors prior to the start of the subcontracted work.

COMPLETE FIRM NAME OF JOINT CONTRACTOR OR SUBCONTRACTOR	NATURE AND SCOPE OF WORK TO BE PERFORMED

Enclosed herewith is a:

- 1. Surety Bond (*1))
- 2. Legal Tender (*2))
- 3. Cashier's Check (*3))
- 4. Certificate of Deposit (*3)) in the
- 5. Certified Check (*3)) amount
- 6. Official Check (*3)) of
- 7. Share Certificate (*3))
- 8. Teller's Check (*3))
- 9. Treasurer's Check (*3))

(Cross Out Those Not Applicable)

Dollars (\$ _____)

as required by law.

Respectfully submitted,

Name of Company, Joint Venture
or Partnership

Contractor's License No.

By _____
Signature (*4)

Title _____

Print Name _____

Date _____

Address _____

Telephone No. _____

E-Mail Address _____

NOTES:

1. Surety bond underwritten by a company licensed to issue bonds in this State;
2. Legal tender; or
3. A certificate of deposit; share certificate; or cashier's, treasurer's, teller's, or official check drawn by, or a certified check accepted by, and payable on demand to the State by a bank, a savings institution, or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration.
 - A. These instruments may be utilized 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 accepted.
4. Please attach to this page evidence of the authority of this officer to submit bids on behalf of the Company and also the names and residence addresses of all officers of the Company.
5. Fill in all blank spaces with information asked for or bid may be invalidated. PROPOSAL MUST BE INTACT, MISSING PAGES MAY INVALIDATE YOUR BID.

End of Proposal

SPECIAL PROVISIONS

Amend INTERIM GENERAL CONDITIONS, dated October 1994, as follows:

Section 2 – Proposal Requirements and Conditions

1. **AMEND** Section 2.1 Qualification of Bidder with the following:

Written Notice of Intent to Bid or Offer: A written Notice of Intent to Bid is not required for the Solicitation.

Standard Qualification Questionnaire: Bidders may be required to complete a standard qualifications questionnaire. When requested, the information shall be furnished within two working days or longer at the discretion of the Engineer. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.

Hawaii Business or Compliant Non-Hawaii Business Requirement: Bidders shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR. A certified letter is not required prior to bid opening.

Compliance with §3-122-112 HAR: As a condition for award of the contract and as proof of compliance with the requirements of 103D-310(c) HRS, the apparent low bidder shall furnish the required documents to the Department. If the valid required certificates are not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. Bidder is responsible to apply for and submit the following documents to the Department.

- A. Tax Clearance (HRS Chapter 237): Bidder shall obtain a tax clearance certificate from the Hawaii State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.
- B. Department of Labor (DLIR) “Certificate of Compliance”. (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers’ Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawaii State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.
- C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) “Certificate of Good Standing”. Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

Hawaii Compliance Express. Alternately, instead of separately applying for these certificates at the various state agencies, bidder may choose to use the Hawaii Compliance Express (HCE), which allows businesses to register online through a simple wizard interface at <http://vendors.ehawaii.gov> to acquire a “Certificate of Vendor compliance” indicating that bidder’s status is compliant with requirements of §103D-310(c), HRS, shall be accepted for contracting and final payment purposes.

Bidders that elect to use the new HCE services will be required to pay an annual fee of \$15.00 to the

Hawaii Information Consortium, LLC (HIC). Bidders choosing not to participate in the HCE program will be required to provide the paper certificates as instructed in the previous paragraphs.

2. **ADD** Section 2.4a, Pre-Bid Conferences

Required Pre-bid Conferences: For construction and design-build projects with an estimated value of \$500,000 or more and solicited under the competitive sealed bid method (103D-302 HRS); and for construction and design-build projects with an estimated value of \$100,000 or more and solicited under the competitive sealed proposal method (103D-303 HRS); a pre-bid conference is required.

Other Pre-Bid Conferences: The Department may require a pre-bid conference for construction or design-build projects that are below the dollar threshold listed in above or when projects have special or unusual requirements.

Other Conditions: The Department may require the prospective Bidders to make a physical inspection of the project site and make attendance at the pre-bid conference a condition for submitting an offer.

Nothing stated at the pre-bid conference shall change the solicitation unless a change is made by written addendum.

3. **DELETE** Section 2.5, Addenda and Interpretations, in its entirety and replace with the following:

“Discrepancies, omissions, or doubts as to the meaning of drawings and specifications should be communicated using the question and answer section on the HIEPRO solicitation for interpretation and must be received in the time frame set in the HIEPRO solicitation. Any interpretation, if made and any supplemental instructions will be in the form of written addenda to the plans and specifications and made available prior to the offer due date. It shall be the prospective bidder’s sole responsibility to verify and obtain any said addenda. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.”

Section 3 – Award and Execution of Contract

1. **AMEND** Section 3.3, Award of Contract, by deleting “sixty (60)” and replacing with “ninety (90)” in the first paragraph.

2. **AMEND** Section 3.3, Award of Contract, by adding the following after the first paragraph:

“If the contract is not awarded within the ninety (90) days, the Department may request the successful Bidder to extend the time for the acceptance of its bid. The Bidder may reject such a request without penalty; and in such case, the Department may at its sole discretion make a similar offer to the next lowest responsive and responsible bidder and so on until a bid is duly accepted or until the Department elects to stop making such requests.”

3. **AMEND** Section 3.9, Notice to Proceed, by deleting “180 days” and replacing with “one (1) year” in the last paragraph.

4. **ADD** Section 3.10, Protests:

“3.10 PROTESTS—Pursuant to Section 103D-701, Hawaii Revised Statutes, an actual or prospective offeror who is aggrieved in connection with the solicitation or award may submit a protest. Any protest

shall be submitting in writing to the Chairperson, Department of Land and Natural Resources, 1151 Punchbowl Street, Honolulu, Hawaii 96813, or designee as specified in the solicitation.

A protest shall be submitted in writing within five (5) working days after the aggrieved person knows or should have known the facts giving rise thereto; provided that a protest based upon the content of the solicitation shall be submitted in writing prior to the date set for receipt of offers. Further provided that a protest of an award or proposed award shall be submitted within five (5) working days after the posting of the award of the contract.

The notice of award, if any, resulting from this solicitation shall be posted on the Procurement System on the SPO website: <http://hawaii.gov/spo2/>.

Section 5 – Control of Work

AMEND Section 5.8 Value Engineering Incentive by deleting “\$100,000” and replacing with “\$250,000” in the first paragraph.

Section 6 – Substitution of Materials and Equipment

ADD the following to Section 6.3 Sub-paragraph b:

4. If the substitution meets all the requirements of the specifications and plans.

Section 7 – Prosecution and Progress

1. **DELETE** Section 7.2d in its entirety and replace with the following:

“d. Insurance Requirements

1. Obligation of Contractor

The Contractor shall not commence any work until it obtains, at its own expense, all required insurance. Such insurance must have the approval of the Department as to limit, form and amount and must be maintained with a company authorized by law to issue such insurance in the State of Hawaii.

All insurance described herein will be maintained by the Contractor for the full period of the contract and in no event will be terminated or otherwise allowed to lapse prior to written certification of final acceptance of the work by the Department.

Certificate(s) of Insurance acceptable to the Department shall be filed with the Engineer prior to commencement of the work. These certificates shall contain a provision that coverages afforded under the policies will not be canceled or changed until at least thirty days written notice has been given to the Engineer by registered mail. The insurance policies shall name the State of Hawaii, its officers and employees as an additional insured and such coverage shall be noted on the Certificate. Should any policy be canceled before final acceptance of the work by the Department, and the Contractor fails to immediately procure replacement insurance as specified, the Department, 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 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 Department harmless pursuant to other provisions of this contract. In no instance will the Department'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 cover the insured for all work to be performed under the contract, all work performed incidental thereto or directly or indirectly connected therewith, including traffic detour work or 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 or a copy of the actual policies 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.

2. Types of Insurance

The 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 the subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable.

- (a) Worker's Compensation. The Contractor and all subcontractors shall obtain full worker's compensation insurance coverage for all persons whom they employ or may 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.
- (b) Commercial General Liability Insurance and Automobile Insurance. Contractor's commercial general liability insurance and automobile liability insurance shall both be obtained in a combined, single limit of not less than \$1,000,000 per occurrence that shall include coverage for bodily injury, sickness, disease or death of any person, arising directly or indirectly out of, or in connection with, the performance of work under this contract.

The Contractor's property damage liability insurance shall provide for a single combined limit of not less than \$1,000,000 for all damages arising out of injury to or destruction of property of others including the Department's, arising directly or indirectly out of or in connection with the performance of the work under this contract including explosion or collapse.

The Contractor shall either:

- i. Require each of its subcontractors to procure and to maintain during the life of its subcontract, subcontractors' comprehensive general liability, automobile liability

and property damage liability insurance of the type and in the same amounts specified herein; or

- ii. Insure the activities of its subcontractors in its own policy.

The Contractor will be permitted, in cooperation with insurers, to maintain a self insured retention for up to 25% of the per occurrence combined single limits of the commercial general liability and the automobile liability policies. The existence of the self insured retention must be noted on the certificate of insurance coverage submitted to the Department or else it will be understood that the insurer is providing first dollar coverage for all claims. For all claims within the self-insured retention amount, the rights, duties and obligations between the Contractor and the Department shall be identical to that between a liability insurer and the Department, as an additional insured, as if there was no self-insured retention.

- (c) **Builder's Risk Insurance.** Unless included in the Specifications of this project, the Contractor shall not be required to provide builder's risk insurance. If required as noted in the Specifications, builder's risk insurance shall be provided during the progress of work and until final acceptance by the Department upon completion of the contract. It shall be "All Risk" (including but not limited to earthquake, windstorm and flood damage) completed value insurance coverage on all completed work and work in progress to the full replacement value thereof. Such insurance shall include the Department as additional name insured. The Contractor shall submit to the Engineer for its approval all items deemed to be uninsurable. The policy may provide for a deductible in an amount of up to 25% of the amount insured by the policy. With respect to all losses up to any deductible amount, the relationship between the Contractor and the Department shall be that of insurer and additional insured as if no deductible existed".

2. DELETE Section 7.16 in its entirety and replace with the following:

"RESPONSIBILITY FOR DAMAGE CLAIMS; INDEMNITY – The Contractor shall indemnify the State and the Department against all loss of or damage to the State's or the Department's existing property and facilities arising out of any act or omission committed in the performance of the work by the Contractor, any subcontractor or their employees and agents. Contractor shall defend, hold harmless and indemnify the Department and the State, their employees, officers and agents against all losses, claims, suits, liability and expense, including but not limited to attorneys' fees, arising out of injury to or death of persons (including employees of the State and the Department, the Contractor or any subcontractor) or damage to property resulting from or in connection with performance of the work and not caused solely by the negligence of the State or the Department, their agents, officers and employees. The State or the Department may participate in the defense of any claim or suit without relieving the Contractor of any obligation hereunder. The purchase of liability insurance shall not relieve the Contractor of the obligations described herein.

The Contractor agrees that it will not attempt to hold the State and its Departments and Agencies and their officers, representatives, employees or agents, liable or responsible for any losses or damages to third parties from the action of the elements, the nature of the work to be done under these specifications or from any unforeseen obstructions, acts of God, vandalism, fires or encumbrances which may be encountered in the prosecution of the work.

The Contractor shall pay all just claims for materials, supplies, tools, labor and other just claims against the Contractor or any subcontractor in connection with this contract and the surety bond will not be

released by final acceptance and payment by the Department unless all such claims are paid or released. The Department may, but is not obligated to, withhold or retain as much of the monies due or to become due the Contractor under this contract considered necessary by the Engineer to cover such just claims until satisfactory proof of payment or the establishment of a payment plan is presented.

The Contractor shall defend, indemnify and hold harmless the State and its Departments and Agencies and their officers, representatives, employees or agents from all suits, actions or claims of any character brought on account of any claims or amounts arising or recovered under the Worker's Compensation Laws or any other law, by-law, ordinance, order or decree.

Section 8 – Measurement and Payment

1. **DELETE** Section 8.7a in its entirety and replace with the following:

- a. Tax Clearances from the State of Hawaii Department of Taxation and Internal Revenue Service, subject to section 103D-328, HRS, current within two months of issuance date indicating that all delinquent taxes levied or accrued under State Statutes against the contractor have been paid.

2. **ADD** Section 8.7d, Certificate of Compliance:

- d. A Certification from the Contractor affirming that the Contractor has, as applicable, remained in compliance with all laws as required by Section 103D-310, HRS, and Section 3-122-112, HAR. A contractor making a false affirmation shall be suspended and may be debarred pursuant to section 103D-702, HRS.
 - 1. Certification of Compliance for Final Payment, State Procurement Office Form-22. Must be Signed Original.

3. **ADD** Section 8.7e, Hawaii Compliance Express:

- e. In lieu of submitting the tax clearances from Taxation and IRS, and SPO Form -22, the Contractor may choose to use the Hawaii Compliance Express as described on page SP-1 of this Special Provisions.

*****DO NOT PRINT THIS PAGE, JUST A NOTE!*****

NOTE: 2/27/2007; SUBMITTAL TO ATTORNEY GENERAL'S OFFICE TO REVIEW REVISED SPECIAL PROVISIONS HAVE NOT YET BEEN RETURNED TO ENGINEERING. THE REVISIONS REFLECTED HERE, SPECIFICALLY, HAWAII COMPLIANCE EXPRESS AND FINAL PAYMENT PROVISIONS, AND CHANGING THE NTP TIME SPAN FROM 180 DAYS TO ONE YEAR, ARE THE ONLY CHANGES INCORPORATED INTO THIS SPECIAL PROVISIONS. Oops . . . also, added provision for Builder's Risk Insurance.

DETAILED SPECIFICATIONS

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DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01019

GENERAL SPECIFICATIONS

PART 1 – GENERAL

1.1 SUMMARY

Work shall consist of furnishing all labor, tools, materials and equipment necessary and required for all work in place complete as indicated on the drawings and as specified herein including but not limited to removal of asbestos cement pipe, hazardous materials abatement and demolition of existing brick building, and construction of an approximately 7,000 square foot building, boat canopy, storage buildings and carports with associated site improvements.

1.2 PROCEDURES

- A. Examination of Premises: The Contractor shall contact the Engineer and obtain permission before visiting the site.
- B. Discrepancies: Any discrepancy shall be immediately brought to the attention of the Engineer. The Contractor shall not be entitled to extra payment for failing to report the discrepancies before proceeding with any work whether within the area affected or not.
- C. Construction Lines, Levels and Grades: The Contractor shall verify all lines, levels and elevations indicated on the drawings before any clearing, excavation or construction begins. Any discrepancy shall be immediately brought to the attention of the Engineer, and any change shall be made in accordance with the Engineer's instruction. The Contractor shall not be entitled to extra payment for failing to report the discrepancies before proceeding with any work whether within the area affected or not.

All lines and grades shall be verified and established by a licensed surveyor or licensed Civil Engineer, registered in the State of Hawaii. The Contractor shall submit evidence of current registration.

- D. Notices: The Contractor shall notify the Engineer and give at least 30 working days' notice before starting any work.
- E. Contractor's Operations
 - 1. The Contractor must employ, insofar as possible, such methods and means of carrying out the work so as not to cause any damage to the adjacent properties, roadways, structures, or utilities. Where the Contractor's operations do result in damages, the Contractor shall be solely responsible for the restoration work.

2. The Contractor shall maintain safe passageway to and from the adjacent properties for the user agency personnel and the public at all times.
- F. Hazardous Materials: The Contractor shall remove hazardous materials in accordance with the applicable sections of these Specifications.
- G. Staging and Storage: The Contractor shall coordinate staging and storage areas with the Engineer prior to mobilization. No staging or storage shall occur within the public right-of-way on Mahalani Street as shown in the drawings. Any damages resulting from the Contractor's use shall be restored as instructed by the Engineer at no cost to the State.
- H. Toilet Accommodations: The Contractor is responsible for providing, maintaining, and cleaning his own portable toilets.
- I. Protection of Property: The Contractor shall continually maintain adequate protection of all its work from damage and shall protect all property, including but not limited to buildings, equipment, furniture, grounds, vegetation, material, utility systems located at and adjoining the project site. The Contractor shall repair, replace or pay the expense of repair of damages resulting from its operations.
- J. Use of Power Driven Equipment: The Contractor is cautioned to take all necessary safety precautions to protect the public whenever power driven equipment is used.
- K. Safety: The Contractor shall carefully read and strictly comply with the requirements of the Hawaii Occupational Safety and Health Law, Chapter 396, Hawaii Revised Statutes, as amended, is applicable and made a part of the Contract.
- L. Clean Up Premises: The Contractor shall clean up and remove from premises all debris and wastewater accumulated from operations as necessary or as directed. See also Section 7.25 of the GENERAL CONDITIONS.
- M. Responsibility
1. The State will hold the Contractor liable for all the acts of Subcontractors and shall deal only with the prime Contractor in matters pertaining to other trades employed on the job. The Contractor shall be responsible for coordinating the work of all trades on the job.
 2. Should the Contractor discover any discrepancy in the plans or specifications, the Contractor shall immediately notify the Engineer before proceeding any further with the work, otherwise, the Contractor will be held responsible for any cost involved in correction of work placed due to such discrepancy.
- N. Cooperation with Other Contractors: The State reserves the right at any time to contract for or otherwise perform other or additional work within the contract zone limits of this Contract. The Contractor of this project shall, to the extent ordered by the State, conduct its work so as not to interfere with or hinder the progress or completion of the work performed by other Contractors.

O. Division of the Work: The Divisions and Sections into which these Specifications are divided shall not be considered an accurate or complete segregation of work by trades. This also applies to all work specified within each Section.

P. Drawings and Specifications

1. The Contractor shall not make alterations in the drawings and specifications. In the event the Contractor discovers any errors or discrepancies, the Contractor shall immediately notify the Engineer in accordance with the GENERAL CONDITIONS.
2. Where devices, or items, or parts thereof are referred to in the singular, it is intended that such reference shall apply to as many such devices, items or parts as are required to properly complete the work.
3. Specifications and drawings are prepared in abbreviated form and include incomplete sentences. Omission of words or phrases such as "the Contractor shall", "as shown on the drawings", "a", "an", and "the" are intentional. Omitted words and phrases shall be provided by inference to form complete sentences.

Q. Required Submittals

1. Required submittals as specified in the Technical Sections of these specifications include one or more of the following: Shop drawings; material samples; technical data; schedules of materials; schedules of operations; guarantees; maintenance manuals; and as-built drawings.
2. The Contractor shall make a comprehensive list of the required submittals, by Specification Section, and submit this list to the Engineer within 15 days after notice to proceed.
3. As-Built Drawings: When as-built drawings are required for submittal, the following shall apply:
 - a. As-built drawings, the intent of which is to record the actual in-place construction so that any future renovations or tie-ins can be anticipated accurately, shall be required.
 - b. All deviations from alignments, elevations and dimensions which are stipulated on the plans shall be recorded in red on the as-built drawings.
 - c. The following procedure shall be followed:
 - 1) Immediately after these changes are constructed in place, the Contractor shall record them on the field office plans.
 - 2) Within two weeks after final inspection of the project, the

Contractor shall transfer the changes marked on the field office plans onto a clean copy of plans using a red pencil. Any deletions shall be so noted and redrawn as necessary. The Contractor shall stamp or mark the tracings "AS-BUILT", and also sign and date each drawing so marked.

- 3) The Contractor shall submit the as-built drawings together with the marked-up field office plans to the Engineer.
- 4) Any as-built drawing which the Engineer determines does not accurately record the deviation shall be corrected by the State, and the Contractor shall be charged for the services.

R. Permits and Clearances: The Contractor shall be responsible to prepare, process, and obtain the approval of all permits necessary for the construction of the Project. All permit fees shall be included in the Contractor's Proposal.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01090

STANDARD REFERENCES

PART 1 – GENERAL

Wherever used in the project, the following abbreviations will have the meanings listed:

<u>Abbreviation</u>	<u>Company</u>
AA	Aluminum Association 1400 Crystal Drive, Suite 430 Arlington, VA 22202
AABC	Associated Air Balance Council 1518 K Street, NW Washington, DC 20005
AAMA	American Architectural Manufacturers Association 1827 Walden Office Square, Suite 550 Schaumburg, IL 60173-4268
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, NW, Suite 249 Washington, DC 20001
AATCC	American Association of Textile Chemists and Colorists 1 Davis Drive Research Triangle Park, NC 27709
ACI	American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331-3439
ADAAG	Americans with Disabilities Act Accessibility Guidelines U.S. Department of Justice Available online at: www.ADA.gov
AF&PA	American Forest & Paper Association 1101 K Street, NW, Suite 700 Washington, DC 20005
AHRI (or ARI)	Air Conditioning, Heating, and Refrigeration Institute 2111 Wilson Boulevard, Suite 500 Arlington, VA 22201

AISC	American Institute of Steel Construction One East Wacker Drive, Suite 700 Chicago, IL 60601-1802
AISI	American Iron and Steel Institute 25 Massachusetts Avenue, NW, Suite 800 Washington, DC 20001
AITC	American Institute of Timber Construction 7012 South Revere Parkway, Suite 140 Englewood, CO 80112
ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, MD 20875-0210
AMCA	Air Movement and Control Association International, Inc. 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute, Inc. 25 West 43 rd Street, 4 th Floor New York, NY 10036
APA	American Plywood Association 7011 S. 19 th Street Tacoma, WA 98466-5333
APWA	American Public Works Association 2345 Grand Blvd., Suite 700 Kansas City, MO 64108-2625
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191
ASHRAE	American Society of Heating, Refrigerating and Air- Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329
ASME	American Society of Mechanical Engineers Two Park Avenue New York, NY 10016-5990

ASTM	American Society for Testing and Materials 100 Barr Harbor Drive P.O. Box C700 West Conshohocken, PA 19428-2959
AWPA	American Wood Protection Association 100 Chase Park South, Suite 116 Birmingham, AL 35244-1851
AWS	American Welding Society 8669 NW 36 Street, #130 Miami, FL 33166-6672
AWS	Architectural Woodwork Standards Published by the Architectural Woodwork Institute 46179 Westlake Drive, Suite 120 Potomac Falls, VA 20165
BHMA	Builders Hardware Manufacturers Association 6300 Interfirst Drive Ann Arbor, MI 48108
CFR	Code of Federal Regulations U.S. Government Publishing Office 732 North Capitol Street, NW Washington, DC 20401-0001
CISPI	Cast Iron Soil Pipe Institute 2401 Fieldcrest Drive Mundelein, IL 60060
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173-4758
DHI	Door and Hardware Institute 141540 Newbrook Drive, Suite 200 Chantilly, VA 20151
EPA	Environmental Protection Agency 1200 Pennsylvania Avenue, NW Washington, DC 20460
FSC	Forest Stewardship Council 212 Third Avenue North, Suite 445 Minneapolis, MN 55401

GA	Gypsum Association 810 First Street NE, Suite 510 Washington, DC 20002
GANA	Glass Association of North America 800 SW Jackson Street, Suite 1500 Topeka, KS 66612-1200
HIOSH	Hawaii Occupational Safety and Health 830 Punchbowl Street, #423 Honolulu, HI 96813
HUD	U.S. Department of Housing and Urban Development 451 7 th Street, SW Washington, DC 20410
IBC	International Building Code Published by the International Code Council (ICC)
IEC	Illuminating Engineering Society 120 Wall Street, Floor 17 New York, NY 10005-4001
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue, 17 th Floor New York, NY 10016-5997
IGMA	Insulating Glass Manufacturers Alliance 27 N. Wacker Drive, Suite 365 Chicago, IL 60606-2800
L.G.P.C.	Liquid Petroleum Gas Code Published by NFPA
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877
NEC	National Electric Code Published by NFPA
NEMA	National Electrical Manufacturers Association 1300 North 17 th Street, Suite 1847 Rosslyn, VA 22209
NESC	National Electrical Safety Code Published by IEEE

NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169-7471
NHLA	National Hardwood Lumber Association P.O. Box 34518 Memphis, TN 38184
NIOSH	National Institute for Occupational Safety and Health U.S. Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30333
NRCA	National Roofing Contractors Association 10255 W. Higgins Road, Suite 600 Rosemont, IL 60018-5607
NSF	NSF International 3475 Plymouth Road P.O. Box 130140 Ann Arbor, MI 48113-0140
OSHA	U.S. Department of Labor Occupational Safety & Health Administration 200 Constitution Avenue Washington, DC 20210
OSHL	Occupational Safety and Health Law Chapter 396, Hawaii Revised Statutes
RCSC	Research Council on Structural Connections Published by AISC
SJI	Steel Joist Institute 234 W. Cheves Street Florence, SC 29501
SDI	Steel Deck Institute P.O. Box 426 Glenshaw, PA 15116
SMACNA	Sheet Metal and Air Conditioning Contractors 4201 Lafayette Center Drive Chantilly, VA 20151-1219
TCNA	Tile Council of North America 100 Clemson Research Boulevard Anderson, SC 29625

UL Underwriters Laboratories Inc.
333 Pfingsen Road
Northbrook, IL 60062-2096

WDMA Window & Door Manufacturers Association
2025 M Street, NW, Suite 800
Washington, DC 20036-3309

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01100

ARCHAEOLOGICAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

This section describes work related to the monitoring of construction activity for archaeological items as specified in the plans or as directed by the Engineer. Consultation with the State Historic Preservation Division (SHPD), Department of Land and Natural Resources has indicated that construction activities may encounter subsurface historic properties. Adverse effects may be mitigated through archaeological monitoring. The Contractor shall be responsible for the incidental procedures and equipment required for full compliance with the requirements of the provisions for archaeological monitoring.

1.2 PROCEDURE

An archaeological monitoring plan (AMP) was prepared in accordance with Hawaii Administrative Rules §13-279-4 and will be provided to the Contractor by the Engineer. The Contractor shall hire a professional archaeologist, hereafter referred to as the "Project Archaeologist", to implement the AMP for the Project in the event remains of archaeologically significant items are encountered. After the Project is completed, the Project Archaeologist will prepare a Monitoring Report as required by SHPD and submit it to SHPD for approval.

1.3 QUALITY ASSURANCE

- A. The Contractor shall obtain the services of an archaeologist meeting the professional requirements listed in Hawaii Administrative Rules §13-281-3, "Archaeology". These requirements include but are not limited to:
1. Having a graduate degree in anthropology, with specialization in archaeology,
 2. Having at least one year of archaeological field experience (which can be made up of discontinuous periods of full-time work adding up to one year) or have participated fully in 10 archaeological field projects, and
 3. Having demonstrated ability to carry research to completion, usually shown by completed thesis, publications and manuscripts.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01300 – SUBMITTALS.
- B. Qualifications: The Contractor shall submit the qualifications of the archaeologist to the Engineer for approval prior to the start of the archaeological work.

- C. Monitoring Report: An archaeological monitoring report documenting findings and interpretation, following SHPD guidelines as delineated in Hawaii Administrative Rules §13-279-5.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 ARCHAEOLOGICAL REQUIREMENTS

- A. A qualified archaeological monitor shall be present during all ground-altering activities within the project limits in order to document any historic properties which may be encountered, and to provide mitigation measures as necessary. Such monitoring shall apply to all excavation activities by the Contractor and for the Project.
- B. In the event any subsurface archaeological sites or remains of historic value such as artifacts or charcoal deposits are encountered, the Contractor shall stop work, protect the find from further damage and immediately notify the Engineer and the State Historic Preservation Officers from the State Department of Land and Natural Resources at phone (808) 692-8015 to assess the significance of the find and recommend an appropriate mitigation measure, if necessary.
- C. The archaeologist on site shall assist the State to work and coordinate with the State Historic Preservation Officers.
- D. The Contractor shall not resume operations suspended without prior written acceptance of the Engineer.
- E. The Contractor and archaeologist shall commence work in accordance with the approved archaeological monitoring plan and recommended mitigation measures.
- F. The Contractor shall not count delays resulting from the discovery, investigation, and handling of such findings against the completion date. The Engineer will govern suspensions of work according to 7.20 - SUSPENSION OF WORK of the General Conditions.
- G. Within 180-days after the completion of the fieldwork, a monitoring report shall be submitted to SHPD and the Engineer for review and approval in accordance with the Archaeological Monitoring Plan and Hawaii Administrative Rules §13-279-5. SHPD report review fees shall be borne by the Contractor.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 – GENERAL

1.1 SUBMITTALS

- A. Manufacturer’s catalog data, material safety and data sheets (MSDS), safety program and other documents shall be required as called for in the plans, specifications or by the Engineer.
- B. Other required submittals shall include:
 - 1. Manufacturer's Data.
 - 2. Certificates of Warranty.
 - 3. Any others as called for in the plans, specifications, or by the Engineer.

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

- A. The Contractor is responsible for the coordination of all contractual work and submittals.
- B. The Contractor shall include the following certification statement and information on each submittal:

CONTRACTOR NAME

PROJECT: **Maui Office Annex**

JOB NO: **J43CM74A**

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

DATE RECEIVED _____

SPECIFICATION SECTION _____

SPECIFICATION PARAGRAPH _____

DRAWING NUMBER _____

SUBCONTRACTOR NAME _____

SUPPLIER NAME _____

MANUFACTURER NAME _____

CERTIFIED BY: _____

- C. The submittal certification statement, "filled in", should appear on the title sheet of each shop drawing, on a cover sheet of submittals in an 8-1/2" x 11" format, or on one face of a cardstock tag (min. 3" x 6") tied to each sample. The tag on the samples should state what the sample is so that, if the tag is accidentally separated from the sample, it can be matched up again. The back of this tag will be used by the Engineer for his receipt, review, and log stamp and for any comments that relate to the sample.
- D. All submittals for material, equipment, and shop drawings listed in the contract documents, shall be required and shall be reviewed by the Engineer, prior to any ordering of materials and equipment.
- E. Unless otherwise noted, the Contractor shall submit to the Engineer for his review eight (8) copies of all shop drawings required for the work. Drawings shall be submitted in sufficient time to allow the Engineer not less than twenty regular working days for examining the drawings.
- F. The drawing shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items, units and assemblies in relation to the contract drawings and specifications.
- G. Unless otherwise approved by the Engineer, shop drawings shall be submitted only by the Contractor, who shall indicate by a signed stamp on the drawings or other approved means that the Contractor has checked the shop drawings and that the work or equipment shown is in accordance with contract requirements and has been checked for dimensions and relationship with work of all other trades involved. All deviations from the plans and specifications shall be listed. The practice of submitting incomplete or unchecked shop drawings for the Engineer to correct or finish will not be acceptable, and shop drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the contract documents and will be returned to the Contractor for resubmission in the proper form.
- H. When the shop drawings have been reviewed by the Engineer, two (2) sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the drawing may be rejected and one (1) set will be returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit eight (8) copies of the drawings, unless otherwise directed by the Engineer. No changes shall be made by the Contractor to the resubmitted shop drawings other than those changes indicated by the Engineer. The resubmittal shall be so indicated on the shop drawing.
- I. The review of such drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for correctness of the dimensions, fabrication details, and space requirements or for deviations from the contract drawings and specifications, unless the Contractor has called attention to such deviations, in writing, by a letter accompanying the drawings and the Engineer approved the change or deviations, in writing, at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the shop drawings. When the Contractor does call such deviations to the

attention of the Engineer, he shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.

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

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01310

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Project meetings.

1.2 PERFORMANCE AND COORDINATION

- A. Contractor is in charge of the Work within the Project Contract Limits, and shall direct and schedule the Work. Include general supervision, management and control of the Work of this project, in addition to other areas more specifically noted throughout the Specifications. Final responsibility for performance, interface, and completion of the Work and the Project is the Contractor's responsibility.
- B. The Contractor is responsible for jobsite Administration. Provide a competent superintendent on the job and provide an adequate staff to execute the Work. In addition, all workers shall dress appropriately and conduct themselves properly at all times. Loud abusive behavior, sexual harassment and misconduct will not be tolerated. Workers found in violation of the above shall be removed from the job site as directed by the Engineer.
- C. The State will hold the Contractor liable for all the acts of Subcontractors and shall deal only with the Prime Contractor in matters pertaining to other trades employed on the job.
- D. Provide project interface and coordination to properly and accurately bring together the several parts, components, systems, and assemblies as required to complete the Work pursuant to the GENERAL PROVISIONS and SPECIAL PROVISIONS.
 - 1. Provide interface and coordination of all trades, crafts and subcontracts. Ensure and make correct and accurate connections of abutting, adjoining, overlapping, and related work. Provide anchors, fasteners, accessories, appurtenances, and incidental items needed to complete the Work, fully, and correctly in accordance with the Contract Documents.
 - 2. Provide additional structural components, bracing, blocking, miscellaneous metal, backing, anchors, fasteners, and installation accessories required to properly anchor, fasten, or attach material, equipment, hardware, systems and assemblies to the structure.

3. Provide excavation, backfilling, trenching and drilling for trades to install their work.
4. Provide concrete foundations, pads, supports, bases, and grouting for trades as needed to install their work.
5. Equipment, appliances, fixtures, and systems requiring plumbing and mechanical services, rough-in, and connections, or other utilities and services shall be provided with such services, rough-in, and final connections.
6. Equipment, appliances, fixtures, hardware, and systems requiring electrical services shall be provided with such electrical services, including outlets, switches, overload protection, interlocks, panelboard space, disconnects, circuit breakers, and connections.
7. Materials, equipment, component parts, accessories, incidental items, connections, and services required to complete the Work which are not provided by Subcontractors shall be provided by the Contractor.
8. Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1.3 COOPERATION WITH OTHER CONTRACTORS

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

1.4 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences as directed by the Engineer at the project site unless otherwise indicated.
 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Engineer of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: The Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including the Engineer, within seven (7) days of the meeting.
- B. Preconstruction Conference: The Engineer shall schedule a preconstruction conference before the start of construction, at a time convenient to the Engineer, but no later than 7

days before the Project start date or jobsite start date whichever is later. Conference will be held at the Project site or another convenient location. The Engineer shall conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: The Engineer, and design consultants; Facility Users; Contractor and its superintendent; major Subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Hazards and risks.
 - b. Tentative construction schedule.
 - c. Critical work sequencing and coordination.
 - d. Designation of responsible personnel.
 - e. Submittal procedures.
 - f. Work scope.
 - g. Tree protection and preservation.
 - h. Use of the premises.
 - i. Parking availability.
 - j. Office, work, and storage areas.
 - k. Equipment deliveries and priorities.
 - l. First aid.
 - m. Security.
 - n. Progress cleaning.
 - o. Working hours.
- C. Progress Meetings: Conduct progress meetings at weekly or other intervals as determined by the Engineer. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to the Engineer, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning,

coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Outstanding Requests for Information (clarification).
 - 2) Interface requirements.
 - 3) Sequence of operations.
 - 4) Status of outstanding submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Force Account work.
 - 15) Change Orders and Change Proposals.

- 16) Documentation of information for payment requests.
 - c. Corrective Action Plan: Contractor shall provide a plan of corrective action for any item which is delayed or expected to be delayed, then that item impacts the contractual dates.
3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
- a. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - b. Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01320

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Submittals Schedule.
 - 3. Schedule of Prices.
 - 4. Payment Application.
- B. Related Sections include the following:
 - 1. Section 01310 – PROJECT MANAGEMENT AND COORDINATION.
 - 2. Section 01300 – SUBMITTALS.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path and control the total length of the project. They must start and finish on the planned early start and finish times.
 - 2. Predecessor activity is an activity that must be completed before a given activity can be started.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of project.
- C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of the Contractor, expiring Project resources available as needed to meet schedule milestones and Contract completion date.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Schedule of Prices: A statement furnished by Contractor allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Payment Applications.

1.3 SUBMITTALS

- A. Required Submittals: Submit 8 sets of the list of the required submittals, by Specification Section, within 15 days after award of the Contract or upon earlier written instructions from the Engineer. A general listing is provided under Section 01300 – SUBMITTALS.
1. The listing shall indicate and include the following:
 - a. The number of copies required for submittal.
 - b. Planned submittal date.
 - c. Approval date required by the Contractor.
 - d. A space where the “date of submittal” can be inserted.
 - e. A space where the “date of approval” can be inserted.
 - f. A space where an “action code” can be inserted.
- B. Construction Schedule: Submit 7 sets of the Construction Schedule for review within 15 days after the Notice to Proceed date or upon earlier written instructions from the Engineer.
- C. Schedule of Prices: Submit 3 sets of the Schedule of Prices integrated with the Construction Schedule for review within 15 days after the Notice to Proceed date or upon earlier written instructions from the Engineer.
- D. Payment Application: Submit the payment application at earliest possible date and no sooner than the last day of the month after all payroll affidavits, updated submittal registers, and schedules have been submitted.
- E. Operation and Maintenance Manuals: Submit preliminary, pre-final, and final Operation and Maintenance Manuals in accordance with Section 01300 – SUBMITTALS.

1.4 COORDINATION

- A. Schedules and Reports: Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.
- B. Construction Schedule: Coordinate Contractor's Construction Schedule with the Schedule of Prices, Submittals Schedule, loaded monthly event activity, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
- C. Schedule of Prices: Coordinate preparation of the schedule with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Prices with other required administrative forms and schedules, including the following:
 - a. The State-approved Payment Application form and the Construction progress Report continuation sheet for the event cost estimate per time period.
 - b. Submittal Schedule.

PART 2 – PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Comply with the GENERAL CONDITIONS. Furnish required submittals specified in this Section and in the Technical Sections. Submittals include one or more of the following: shop drawings, color samples, material samples, technical data, material safety data information, schedules of materials, schedules of operations, guarantees, certifications, operating and maintenance manuals, and field posted as-built drawings.
- B. Furnish a schedule of submittals per Engineer.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Prices, and Contractor's Construction Schedule.
 - 2. The schedule shall accommodate a minimum of twenty-one (21) calendar days for the State's review, as applicable for the island the project is located.

3. Prepare and submit an updated list to the Engineer at monthly intervals or as directed by the Engineer. The listing shall reflect all approvals received since the last update.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE – GANTT CHART METHOD

- A. The construction schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. The progress chart shall indicate the order in which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment).
- B. Upon completion of the Engineer's review, the Contractor shall amend the schedule as necessary to reflect the comments. If necessary, the Contractor shall participate in a meeting with the Engineer to discuss the proposed schedule and changes required. Submit the revised schedule for review within seven (7) calendar days after receipt of the comments.
- C. Use the reviewed schedule for planning, organizing and directing the work, for reporting progress, and for requesting payment for the work completed. Unless providing an update, do not make changes to the reviewed schedule without the Engineer's approval.
- D. If, in the opinion of the Engineer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve progress, including those that may be required by the Engineer. The Engineer may require the Contractor to increase the number of shifts, overtime operations, days of work, or amount of construction plant, and to submit for approval any supplemental schedule or schedules in chart form as the Engineer deems necessary to demonstrate how the approved rate of progress will be regained.
- E. Update the construction schedule at monthly intervals or when directed by the Engineer to revise the schedule. Reflect any changes occurring since the last update with each invoice for progress payment. Submit copies of the purchase orders and confirmation of the delivery dates as directed. The Engineer's review of the updated schedule is to check that the updated schedule does not alter the construction performance period unless the period was revised through a change order or contract modification.
- F. At the Contractor's option a PERT chart may be used.

2.3 SCHEDULE OF PRICES

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

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

2.4 PAYMENT APPLICATION

- A. Use the Schedule of Prices as the Monthly Construction Progress Report. Each Payment Application shall be consistent with previous applications and payments. The Engineer shall determine the appropriateness of each payment application item.
- B. The date for each progress payment is the last day of each month. The period covered by each Payment Application starts on the first day of the month or following the end of the preceding period and ends on the last day of the month.
- C. Update the schedule of prices listed in the Payment application when Change Orders or Contract Modifications result in a change in the Contract Price.
- D. Provide a separate line item for each part of the Work where Payment Application may include materials or equipment purchased or fabricated and stored, but not yet installed.
- E. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.
- F. Provide separate line items for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- G. Use the State-approved forms for Payment Applications. Furnish three (3) original and one (1) copy.
- H. Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of the Contractor. Entries shall match data on the Schedule of Prices and Contractor's Construction Schedule. Use updated schedules if revisions were made. Include amounts of Change Orders and Contract Modifications issued before last day of construction period covered by application.
- I. No payment will be made until the following are submitted each month:
 - 1. Monthly Estimate, 4 copies.
 - 2. Monthly Progress Report, 4 copies.
 - 3. Statement of Contract Time, 4 copies.
 - 4. Updated Submittal Register, 1 copy.
 - 5. Updated Progress Schedule, 1 copy.
 - 6. Updated as-built drawings, 2 copies.

7. All Daily Reports, 1 copy.
8. All Payroll Affidavits for work done, 1 copy.
9. As-Built Drawings, 2 copies.
- J. The State will withhold 5% retainage in compliance with the GENERAL CONDITIONS.
- K. Submit the signed original and 6 copies of each Payment Application for processing.

2.5 AS-BUILT CERTIFICATION

The Contractor shall maintain and update the job site as-built drawings on a daily basis. An as-built certification form shall be attached to the Contractor's monthly payment application. A sample of the As-Built Certification Form is provided as an attachment at the end of this Section. If the as-built certification form is not attached, the Engineer shall reject the monthly payment application and return it to the contractor.

2.6 CONTRACTOR DAILY PROGRESS REPORTS

- A. The General Contractor and all Subcontractors shall keep a daily report of report events.
- B. The form of the Contractor Daily Progress Report shall be as directed by the Engineer.
- C. Submit copies of the previous week's reports on Monday morning at 10:00 a.m.
- D. Submit copies of the reports with the monthly payment request for the whole period since the last payment request submittal.
- E. Deliver the reports in hard copy or by e-mail as directed by the Engineer.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01505

MOBILIZATION AND DEMOBILIZATION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

This section covers the requirements for mobilization and demobilization.

1.2 **MOBILIZATION:** Mobilization shall consist of the transporting, assembling, constructing, installing, and making ready for use at the job site, all the equipment, machinery, structures, utilities, materials, labor, field office, and incidentals necessary to do the work covered by this contract.

1.3 **DEMOBILIZATION:** Demobilization shall consist of the dismantling and removal of the above-mentioned equipment, machinery, structures, utilities, materials, field office, and incidentals, and the cleaning up and restoration of the site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GUIDELINES

- A. The Contractor shall coordinate staging and stockpiling areas for equipment or materials with the Engineer prior to mobilization.
- B. Stockpiles, equipment, vehicles, or any other construction materials shall not be stored or parked in the County right-of-way unless approved by Maui County.
- C. Any and all additional mobilization or demobilization costs in excess of the maximum amounts specified in the Proposal shall be included in the appropriate unit prices bid in the Proposal. The Contractor shall not receive any compensation for mobilization and demobilization in addition to those specified in the Proposal.
- D. All equipment, machinery, buildings, utilities and incidentals mobilized and demobilized under this section shall remain the property of the Contractor.

END OF SECTION

SECTION 01530

BARRICADES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This work shall consist of furnishing, installing and maintaining barricades to prevent people from entering into project area.

1.2 REFERENCES

- A. Latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), Federal Highway Administration; as amended.
- B. The "HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", dated 2005, as revised, of the State of Hawaii Department of Transportation, hereafter referred to as the "State DOT Standard Specifications", or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.)

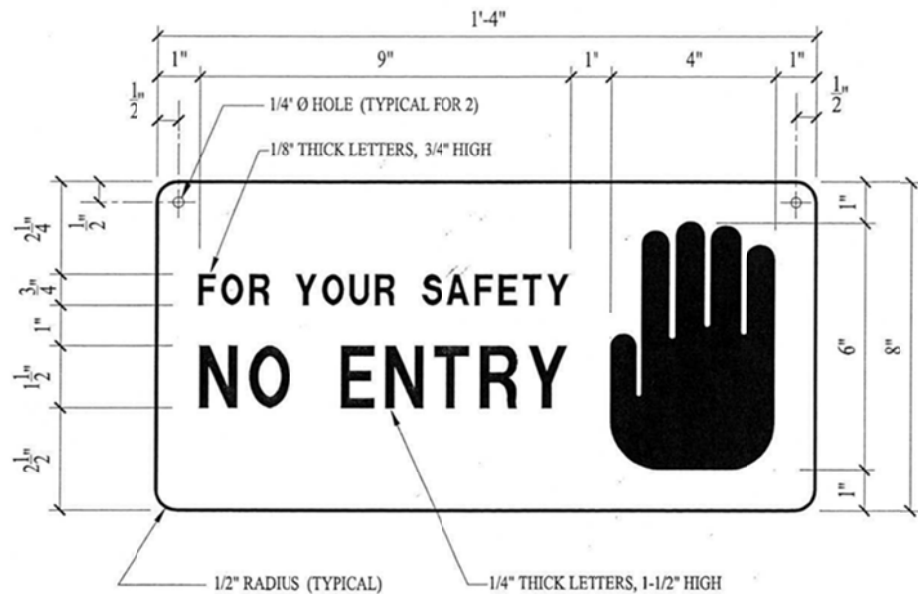
PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber: Lumber for rails, frames and braces shall be dry, sound, undamaged, well seasoned, and free from any defect which may impair their strength and durability.
- B. Hardware: Nails shall be galvanized wire nails. As many and as large a size as is practicable shall be used.
- C. Paints: Paints shall be exterior enamel paint of the best grade or first line as made by approved manufacturers.
- D. Sheet Reflecting Material: Sheet reflecting material shall conform to the applicable requirements of Subsection 712.20(C) of the State DOT Standard Specifications.
- E. Alternate Designs: Alternate barricade designs such as plastic molded barricades may be used subject to the Engineer's approval. The Contractor shall submit shop drawings or catalog cuts for approval.
- F. Plastic Enclosure Fence: Industry standard 6-foot high plastic fencing with metal (or wood) post supports at 10-feet on center connected with a top and bottom 12-gauge soft annealed galvanized tie wires securely connected to posts. Posts shall be capable of resisting a lateral load of 100 pounds measured at the top of the post.

G. Warning Signs:

1. Signs shall be neat and fabricated by personnel normally engaged in the sign industry.
2. Backing: Backing shall be 6061-T6 aluminum 0.032-inch minimum thickness.
3. Paint: Paint shall be satin finish, exterior grade or factory baked enamel or a combination thereof.
4. Colors: Signs shall have white background. Remaining items shall be similar to Rust-Oleum Federal Safety Red.
5. Requirements for Warning Sign: Message configuration and dimensions shall be in accordance with the following illustration.



PART 3 - EXECUTION

3.1 GENERAL

The Contractor shall take precaution to protect people and property from injury and damage. The Contractor shall augment the barricades and enclosures as required to delineate active work areas and provide the appropriate signage and hazard lights, as directed by the Engineer.

3.2 CONSTRUCTION REQUIREMENTS

- A. Barricades: Before construction operations begin, erect temporary construction barricade(s) to prevent unauthorized persons from entering the project area and to the extent required by the Engineer.

1. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
 2. Maintain temporary construction barricade(s) throughout the duration of the Work. During the course of the project, the Engineer may require additional barricades be provided for the safety of the public. Contractor shall erect the additional barricade(s) at no additional cost to the State.
 3. The Contractor shall be responsible for their own security and protection of their property, including mobilization yard barricades.
 4. Barricades, in general, shall be neat, as required for protection and adequately anchored and braced.
 5. Security shall be maintained at all times against access into the work areas by unauthorized personnel.
- B. Warning Signs: Signs shall be located at all entrances to the project site.

3.3 MAINTENANCE

Barricades shall be kept in good condition throughout their usage during construction until the end of the contract. The Contractor shall repair, repaint, clean or replace the barricades as required and as directed by the Engineer to maintain their effectiveness and appearance.

3.4 CLEANING

Upon completion of the construction work, barricades shall be removed and disposed of shall become the property of the Contractor.

END OF SECTION

SECTION 01567

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, material and equipment and perform all work required for the prevention of environmental pollution during and as the result of construction operations under this contract.
- B. This Section contains general specifications pertaining to the prevention of environmental pollution as a result of construction operations under this contract and shall be maintained until completion of the contract and become a part of the work of all other Sections as applicable. The requirements of this Section take precedence over conflicting or contradictory provisions of other Sections.
- C. The work in this Section shall include the following:
 - 1. Obtain all permits required by the State Department of Health (DOH).
 - 2. Provide all air and water quality testing and monitoring work required by the permits during construction.
 - 3. Provide the facilities, equipment, and structural controls for minimizing adverse impacts upon the environment during the construction period.
- D. Related Sections include the following:
 - 1. Section 01100 – ARCHAEOLOGICAL PROTECTION.
 - 2. Section 01715 – EXISTING CONDITIONS – HAZARDOUS MATERIAL SURVEY.
 - 3. Section 02370 – SEDIMENT AND EROSION CONTROL.

1.2 APPLICABLE REGULATIONS

- A. In order to provide for abatement and control of environmental pollution arising from the construction activities of the Contractor and his subcontractors in the performance of this contract, the work performed shall comply with the intent of the applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement, including, but not limited to, the following regulations:
 - 1. State of Hawaii, Department of Health, Administrative Rules, Chapter 54, WATER QUALITY STANDARDS and Chapter 55, WATER POLLUTION CONTROL.

2. State of Hawaii, Department of Health, Administrative Rules, Chapter 62, WASTEWATER SYSTEMS.
3. State of Hawaii, Department of Health, Administrative Rules, Chapter 59, AMBIENT AIR QUALITY; Chapter 60.1, AIR POLLUTION CONTROL LAW.
4. State of Hawaii, Department of Health, Administrative Rules, Chapter 42, VEHICULAR NOISE CONTROL; Chapter 46, COMMUNITY NOISE CONTROLS.
5. Other regulations as noted on the drawings.

1.3 SUBMITTALS

- A. Dust Control Plan: Describe materials, methods and frequency of application of dust control and other temporary methods of stabilization to be used onsite, including but not limited to dust fence assembly.
- B. Wastewater Spill Containment and Mitigation Plan: Prepare Wastewater Spill Containment and Mitigation Plan in conformance with HAR 11-62 Appendix C “Responses for Wastewater Spills, Overflows, and Discharges.” The plan shall include detailed reporting requirements.
- C. Certification: Affidavits certifying that any polluted excavation spoils and dewatered materials have been treated, all pollutants as defined by the DOH have been removed from the materials, and only treated water meeting the DOH basic water quality criteria has been discharged in the existing drainage system and treated soils backfilled into the excavation.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

3.1 LAND RESOURCES PROTECTION

- A. General: Unless otherwise indicated on the drawings, existing land resources within the property lines and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction that will appear to be natural and not detract from the appearance of the project. Insofar as possible, confine construction activities to areas defined by the plans or specifications.
- B. Restoration of Damage: Restore any trees or other landscape feature scarred or damaged by the Contractor’s equipment or operations as nearly as possible to its original condition at the Contractor’s expense. The Engineer will decide what method of restoration shall be used and whether damaged trees or other landscape feature shall be treated and healed or removed from the site and replaced with new.

- C. Location of Storage and Construction Facilities: The Contractor's storage and other temporary construction buildings required temporarily in the performance of the work shall be located on the project site. The location shall be upon cleared portions of the job site or areas to be cleared, as indicated on the plans and approved by the Engineer.
- D. Post-Construction Clean-Up: Obliterate all signs of temporary construction facilities such as work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction as directed by the Engineer. No separate payment will be made for post-construction cleanup or obliteration and all cost thereof shall be considered a portion of the Contract Price, except as otherwise provided for in the Contract Documents.

3.2 DEBRIS AND RUBBISH DISPOSAL

- A. No burning of debris and/or waste materials shall be permitted on the project site.
- B. No burying of debris and/or waste material except for materials which are specifically indicated elsewhere in these specifications as suitable for backfill and/or riprap shall be permitted on the project site.
- C. All unusable debris and waste material shall be hauled away to an appropriate off-site dump area. The Contractor shall provide to the Engineer disposal receipts for all materials disposed of off-site.
- D. During loading operations, debris and waste materials shall be watered down to allay dust.
- E. Clean-up shall include the collection of all waste paper and wrapping materials, cans, bottles, construction waste materials and other objectionable materials, and removal as required. Frequency of clean-up shall coincide with rubbish producing events.

3.3 DUST

- A. The Contractor shall prevent dust from becoming airborne at all times including non-working hours, weekends and holidays in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 60 - Air Pollution Control.
- B. For the duration of the contract, the Contractor, at his own expense, shall keep the project area and the surrounding areas free from dust that would cause a hazard or nuisance to the work or the operations of other contractors or to persons or property.
- C. Contractor shall construct dust fence as designated on plan and submit dust fence assembly and materials used for fence. Approved temporary methods of stabilization consisting of sprinkling or similar methods may be permitted to control dust. If approved, sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor must have sufficient competent equipment on the job to accomplish this if sprinkling is used. Chemicals or oil treating shall not be used.

- D. The Contractor shall be responsible for all damage claims in accordance with Section 7.16 - "Responsibility for Damage Claims" of the GENERAL CONDITIONS.

3.4 NOISE

- A. Noise shall be kept within acceptable levels at all times in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 46 - Community Noise Control for Oahu. The Contractor shall obtain and pay for the Community Noise Permit from the State Department of Health when the construction equipment or other devices emit noise at levels exceeding the allowable limits.
- B. All internal combustion engine-powered equipment shall have mufflers to minimize noise and shall be properly maintained to reduce noise to acceptable levels.

3.5 EROSION

- A. During interim grading operations, the grade shall be maintained so as to preclude any damage to adjoining property from water and eroding soil.
- B. Temporary berms, cut-off ditches and other erosion control provisions which may be required because of the Contractor's method of operations shall be installed at no cost to the State.
- C. All erosion control measures shall be constructed and maintained as shown on the plans to minimize erosion and pollution of waterways during construction.

3.6 WASTEWATER DISCHARGES/SPILLS

- A. The Contractor shall be liable for any treatment of discharges that are required before disposal and for any fines, clean-up costs and damages, which may occur through the violation of any federal, state and County of Maui law or regulation which may be applicable.
- B. The Contractor shall be liable for all clean-up costs, fines and damages resulting from wastewater spill related to any construction activities. The Contractor shall not store chemicals, materials or equipment at the work site unless specifically authorized by the Engineer.
- C. The Contractor shall, prior to commencing construction, prepare a wastewater spill containment and mitigation plan. This plan shall be submitted for approval to the Engineer. The plan shall include reporting requirements in conformance with HAR 11-62 Appendix C "Responses for Wastewater Spills, Overflows, and Discharges", including immediate coordination with DOH and the Engineer.
- D. The Contractor shall anticipate and capture wastewater spills in containers for planned disposal at existing facilities. The disposal of captured wastewater will require approval Engineer and DOH. The wastewater spill containment and mitigation plan shall include, at a minimum, spill containment, disposal, clean up and treatment methods for the captured

wastewater. The Contractor shall be liable for any costs associated with the transport and treatment of wastewater discharges that may be required before ultimate disposal.

3.7 POLLUTANTS AND HAZARDOUS MATERIALS

- A. The Contractor shall provide the appropriate pretreatment methods and/or devices to remove pollutants if discharging into the County of Maui sewer system such that the effluent complies with Chapter 14.21A of the Maui County Code, State and Federal regulations. It will be unacceptable for the Contractor to pump and discharge polluted water into the existing sewer system during dewatering without treatment.
- B. The Contractor shall, at a minimum, remediate polluted water and shall monitor the treatment process on a regular basis. Only treated water meeting County of Maui's basic water quality criteria shall be discharged into the existing sewer system.
- C. During construction, excavation spoils and dewatered materials shall be tested to determine if pollutants, as defined by the DOH, are present in the sediment, excavation spoils and dewatered materials.
- D. Pollutants, if encountered in the sediment, excavation spoils and dewatered materials, shall be removed from the polluted materials in accordance with applicable U.S. Environmental Protection Agency (EPA) rules and regulations, EPA's Resource Conservation and Recovery Act (RCRA), U.S. Department of Transportation regulations and State of Hawaii Department of Health rules, regulations and policies.
- E. If the pollutants are defined as hazardous waste under RCRA, the Contractor shall clean-up, handle, store, treat, remove and dispose the polluted materials as hazardous waste under RCRA.
- F. If the pollutants are not hazardous, the requirements of RCRA shall not apply. However, the Contractor shall remove the pollutants as defined above by DOH from the polluted excavation spoils and dewatered materials by treatment, and then dispose the treated materials and pollutants if necessary, in accordance with DOH policies. Excavations shall not be backfilled with the original untreated excavation material if pollutants are present in this material, unless it can be demonstrated to the DOH that backfilling with clean soils will become contaminated or that backfilling with the treated originally excavated material will become recontaminated due to the existing polluted conditions at the site. In excavations where contamination of the backfill would occur, the backfill to the top of the groundwater table may consist of the original excavated contaminated material covered with uncontaminated material placed on top of the contaminated backfill and a cap of asphalt or concrete as provided to ensure no contaminated materials exist between the groundwater table and the surface.
- G. The Contractor shall submit to the Engineer copies of all test results. The Contractor shall furnish to the Engineer affidavits certifying that polluted excavation spoils and dewatered materials have been treated, all pollutants as defined by the DOH have been removed from the materials, and only treated water meeting the DOH basic water quality criteria has been discharged in the existing drainage system and treated soils backfilled into the excavation.

3.8 OTHERS

- A. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being carried onto the pavement. Waste water shall not be discharged into existing streams, waterways, or drainage systems such as gutters and catch basins unless treated to comply with the State Department of Health water pollution regulations.
- B. Trucks hauling debris shall be covered as required by PUC Regulation. Trucks hauling fine materials shall be covered.
- C. Except in an emergency, such as a mechanical breakdown, all vehicle fueling and maintenance shall be done in a designated area. A temporary berm shall be constructed around the area when runoff can cause a problem.
- D. When spray painting is allowed, such spray painting shall be done by the "airless spray" process. Other types of spray painting will not be allowed.

3.9 SUSPENSION OF WORK

- A. Violations of any of the above requirements or any other pollution control requirements which may be specified in these Specifications herein shall be cause for suspension of the work creating such violation. No additional compensation shall be due the Contractor for remedial measures to correct the offense. Also, no extension of time will be granted for delays caused by such suspensions.
- B. If no corrective action is taken by the Contractor within 72 hours after a suspension is ordered by the Engineer, the State reserves the right to take whatever action is necessary to correct the situation and to deduct all costs incurred by the State in taking such action from monies due the Contractor.
- C. The Engineer may also suspend any operations which he feels are creating pollution problems although they may not be in violation of the above-mentioned requirements. In this instance, the work shall be done by force account as described in Subsection 4.2b - "Additional Work" of the GENERAL CONDITIONS and paid for in accordance with Subsection 8.4b - "Force - Account Work" therein. The count of elapsed working days to be charged against the contract in this situation shall be computed in accordance with Subsection 7.18 - "Contract Time" of the GENERAL CONDITIONS.

END OF SECTION

SECTION 01581

PROJECT SIGN

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

Furnish all labor, materials and equipment necessary to construct and install all project sign as specified hereinafter.

1.2 SUBMITTAL

The Contractor shall provide the Engineer with eight (8) shop drawings of the project sign for review and approval by the Engineer prior to ordering the sign.

1.3 LETTER STYLE

Copy is centered and set in Adobe Type Futura Heavy. If this specific type is not available, Futura Demi Bold may be substituted. Copy should be set and spaced by a professional typesetter and enlarged photographically for photo stencil screen process.

1.4 ART WORK

Constant elements of the sign layout - frame, outline, stripe, and official state information - may be duplicated following drawing measurements, or be reproduced and enlarged photographically using a layout template if provided. The "STATE OF HAWAII" masthead should be reproduced and enlarged as specified, using the artwork provided.

1.5 TITLES

The specific major work of the project under construction is emphasized by using 3-3/4" type, all capitals. Secondary information such as location or buildings uses 2-1/4" type, all capitals. Other related information of lesser importance uses letter heights as indicated on 01581-3, upper / lower case letters. Design should follow the example on page 01581-3.

PART 2 – PRODUCTS

2.1 MATERIALS

A. LUMBER

1. Panel is 3/4" exterior grade high density overlaid plywood, with resin-bonded surfaces on both sides.
2. 4"x4" sign posts shall be Douglas Fir No. 1 or better.

B. PAINTS & INKS

Screen print inks are matte finish. Paints are satin finish, exterior grade. References to Ameritone Color Key Paint are for color match only.

COLOR:	1.	1BL10A	Bohemian Blue
	2.	2H16P	Softly (White)
	3.	2VR2A	Hot Tango (Red)
	4.	1M52E	Tokay (Gray)

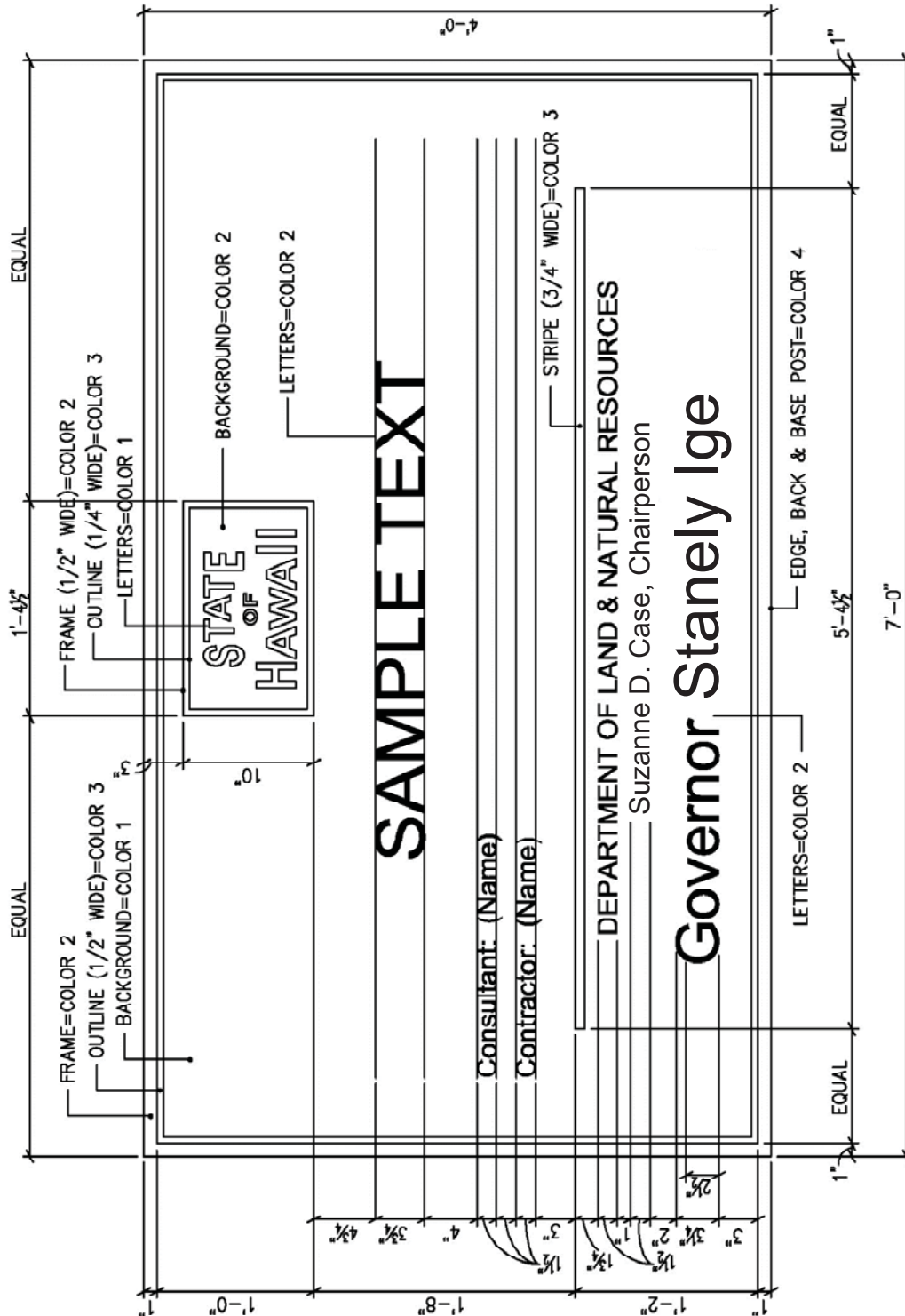
C. CONCRETE

Concrete shall be class B with a 2,500 psi 28-day compressive strength.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Project Sign shall be constructed with new materials as specified above.
- B. The Project sign shall be installed at the location as designated by the Engineer. The project sign shall be erected upon commencement of work.



NOTE: Number of signs required 1

END OF SECTION

SECTION 01680

PHYSICAL CHECKOUT; SHOP, FIELD, AND FUNCTIONAL TESTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section covers the requirements for mobilization and demobilization.
- B. Related Sections include the following:
 - 1. Section 15400 – PLUMBING.
 - 2. Section 15800 – AIR CONDITIONING AND VENTILATION.

1.2 FINAL ACCEPTANCE TESTS

- A. Final acceptance tests shall be conducted in accordance with the provisions stated herein at such time as structures and equipment have been completed to the required extent.
- B. Final acceptance tests shall consist of leakage tests on piping and valves, and tests on mechanical and electrical components.
- C. The Engineer shall witness all tests. The Contractor shall give the Engineer seven (7) days prior notice in writing of the date and time scheduled for any test. Tests requiring observation by State's operation personnel shall not start on Saturday, Sunday or on State or Federal holidays.
- D. Leakage tests performed on equipment and piping do not constitute final acceptance, but due to the nature of work, must be performed as the work progresses.
- E. The Contractor shall submit a detailed plan describing the testing procedure, including services of the Factory Representative, for each testing phase to the Engineer for approval at least 60 days prior to the start of the tests.
- F. The costs of all tests shall be borne by the Contractor. The Contractor shall furnish all labor, equipment, materials, superintendence, expertise, power, water, fuel, oil, grease, and other related incidentals for executing the tests. The Contractor shall pay for all services of State performed for overtime work.
- G. In the event the installation does not meet the requirements of the Specifications during the acceptance test, the Contractor will be permitted to make such changes in the equipment and/or methods of operation as he may deem necessary and as approved by the Engineer at no additional cost to State.

- H. If any workmanship or items of equipment prove to be unsatisfactory during the acceptance tests, the Contractor shall repair or replace such items or workmanship to the requirements specified herein at the Contractor's expense.

1.3 TESTING

A. Mechanical and Electrical Operation Tests

1. Mechanical Operation Tests

- a. All valves shall be tested for proper rotation, clearances, support, unusual noises, and alignment.
- b. Unless otherwise specified herein, each piece of equipment shall then be tested as specified under Division 15 - MECHANICAL of these Specifications and as further required by the manufacturer.

2. Electrical Operation Tests

- a. All electrical devices shall be tested for proper operation.
- b. Unless otherwise specified herein, all electrical devices shall be tested as specified under Division 16 - ELECTRICAL of these Specifications.

B. Final Acceptance Testing

- 1. Upon completion and acceptance of all equipment (mechanical and electrical), the Contractor shall proceed with the final acceptance testing. He shall demonstrate that the facilities can operate as a system for thirty (30) consecutive days without any significant operational problems.
- 2. When completion of a portion of the work is required to be complete before completion of the entire project, the acceptance testing shall be phased to allow testing of that portion of the work.

C. Acceptance Date(s)

- 1. The Engineer shall accept or reject the final acceptance test within 30 days of completion of the final acceptance tests.
- 2. When phase acceptance testing is required to allow completion of portion(s) of the facilities before completion of the entire project, separate final acceptance dates will be issued by the State.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section includes general procedural requirements governing execution of the Work including the following:
1. Construction layout. Field engineering and surveying.
 2. General installation of products.
 3. Progress cleaning.
 4. Starting and adjusting.
 5. Protection of installed construction.
 6. Correction of the Work.
- B. Related Sections include the following:
1. Section 01770 - CLOSEOUT PROCEDURES.
 2. Section 02210 – CONSTRUCTION SURVEYS.

1.2 NOTIFICATION

Contact the Engineer at least 3 working days prior to starting any onsite work.

1.3 PROJECT AND SITE CONDITIONS

- A. Project Contract Limits (Contract Zone Limits) indicate only in general the limits of the work involved. Perform necessary and incidental work, which may fall outside of these demarcation lines. Confine construction activities within the Project Contract Limits and do not spread equipment and materials indiscriminately about the area.
- B. Disruption of Utility Services: Prearrange work related to the temporary disconnection of electrical and other utility systems with the Engineer. Unless a longer notification period is required elsewhere in the Contract Documents, notify the Engineer at least 15 days in advance of any interruption of existing utility service. Time and duration of interruptions are subject to the Engineer's approval. Keep the utility interruptions and duration to a minimum so as not to cause inconvenience or hardship to the facility. If temporary electrical or other utility systems hook-up is required, provide the necessary services. Pay for temporary services as part of the contract, unless specifically noted otherwise.

- C. Contractor's Operations - Provide means and methods to execute the Work and minimize interruption or interference to the facility's operations. Rearrange the construction schedule when construction activities result in interruptions that hamper the operations of the facilities.
- D. Maintain safe passageway to and from the facility's occupied buildings, rooms and other occupied spaces for the using agency personnel and the public at all times.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor with a license to practice in Hawaii.
- B. Professional Engineer Qualifications: A professional engineer with a license to practice in Hawaii.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 EXAMINING THE SITE

- A. Contractor and Subcontractors are expected to visit the site and make due allowances for difficulties and contingencies to be encountered. Compare contract documents with work in place. Become familiar, with existing conditions, the conditions to be encountered in performing the Work, and the requirements of the drawings and specifications.
- B. Verify construction lines, grades, dimensions and elevations indicated on the drawings before any clearing, excavation or construction begins. Bring any discrepancy to the attention of the Engineer, and make any change in accordance with the Engineer instruction.
- C. Obtain all field measurements required for the accurate fabrication and installation of the Work included in this Contract. Verify governing dimensions and examine adjoining work on which the Contractor or Subcontractor's work is in any way dependent. Submit differences discovered during the verification work to the Engineer for interpretations before proceeding with the associated work. Exact measurements are the Contractor's responsibility.
- D. Furnish or obtain templates, patterns, and setting instructions as required for the installation of all Work. Verify dimensions in the field.
- E. Contractor shall accept the site in the condition that exists at the time access is granted to begin the Work. Verify existing conditions and dimensions shown and other dimensions not indicated but necessary to accomplish the Work.

- F. Locate all general reference points and take action to prevent their destruction. Lay out work and be responsible for lines, elevations and measurements and the work executed. Exercise precautions to verify figures and conditions shown on drawings before layout of work.

3.2 SITE UTILITIES AND TONING

- A. Cooperate, coordinate and schedule work to maintain construction progress, and accommodate the operations and work of the owners of underground or overhead utility lines or other property in removing or altering the lines or providing new services.
- B. Contact all the various utility companies before the start of the work to ascertain any existing utilities and to develop a full understanding of the utility requirements with respect to this Project. Furnish the Engineer with evidence that the utility companies were contacted.
- C. Should the Contractor discover the existence and location of utilities in the contract drawings are not correct, do not disturb the utilities and immediately notify the Engineer.
- D. Do not disturb or modify any utilities encountered, whether shown or not on the Contract Drawings, unless otherwise instructed in the drawings and specifications or as directed by the Engineer. Repair and restore to pre-damaged condition any utilities or any other property damaged by construction activities.
- E. Transfer to “Field Posted As-Built” drawings the location(s) and depth(s) of new and existing utilities that differ from the Contract Drawings. Locate by azimuth and distance and depth(s) from fixed referenced points.
- F. Toning: Prior to the start of grading, or excavation or trenching work verify and confirm the presence, location and depth of existing underground utility lines in the area affected by the project, by “toning” or by other appropriate means acceptable to the Engineer. The intent of this advanced toning is to afford the Engineer an opportunity to identify utility lines that may or may not be shown on the drawings and issue a directive to address the existing conditions.
 - 1. Perform toning using instruments specifically developed and designed for the detection of underground pipes and cable utilities.
 - 2. Notify the Engineer 48 hours in advance before toning operations. Provide information on the proposed toning method and other pertinent information.
- G. Recording Toning Information: Upon completion of the toning operation, submit drawings that show the location and approximate depth of the existing and newly discovered utility lines. Identify the type of utility lines. Also, identify where utility lines indicated on the drawings are not shown in their approximate location or where new utility lines are found or pointed out in the field.

- H. After ascertaining the exact location and depth of utilities within the project area, mark and protect the locations.
 - 1. Acquaint personnel working near utilities with the type, size, location, depth of the utilities, and the consequences that might result from disturbances.
 - 2. Do not start trenching or start similar operations until reasonable and appropriate precautions to protect the utilities are taken.
- I. For newly identified utility lines, if directed by the Engineer, manually excavate within 2-feet of the utility line to avoid damage. Under this directive, manual excavation is considered additional work.
- J. Existing Irrigation Systems: Where work is located in areas with existing irrigation systems, Contractor shall test the existing systems and document all deficiencies prior to any work that may damage the existing systems.

3.3 FIELD MEASUREMENTS

- A. Take field measurements to fit and install the Work properly. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Submit a Request For Information (RFI) immediately upon discovery of the need for clarification of the Contract Documents. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.4 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify the Engineer promptly.
- B. General: Engage a licensed land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish and provide benchmarks, control points, property stakes, lines and levels at each story or level of construction and elsewhere as needed to locate each element of Project and conformance with the County Flood Ordinance.
 - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.
 5. Notify the Engineer when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including structures, pavements, grading, fill and topsoil placement, utility location, alignment, and slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level the foundations and piers from 2 or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the Engineer.

3.5 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent or temporary benchmarks, control points and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without the Engineer's approval. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to the Engineer before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base all replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two (2) permanent or temporary benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.6 INSTALLATION

Install materials, items, fixtures required by the various Divisions and Sections of the Specifications in accordance with Contract Documents, by workers specially trained and skilled in performance of the particular type of work, to meet guarantee and regulatory agency requirements. Should the drawings or specifications be void of installation requirements, install the materials, items, and fixtures in accordance with the manufacturer's current specifications, recommendations, instructions and directions.

3.7 CUTTING AND PATCHING

- A. Oversee cutting and patching of concrete, masonry, structural members and other materials where indicated on drawings and as required by job conditions. Unless noted elsewhere in the contract documents, do not cut or patch existing or new structural members without previously notifying the Engineer.
- B. Provide patch materials and workmanship of equal quality to that indicated on the drawings or specified for new work.

3.8 CLEANING

- A. General: Clean the Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste more than 7 days unless approved otherwise by the Engineer.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

- D. **Installed Work:** Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use only cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. **Concealed Spaces:** Remove debris from concealed spaces before enclosing the space.
- F. **Exposed Surfaces:** Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. **Cutting and Patching:** Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. **Waste Disposal:** Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. **During handling and installation,** clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. **Limiting Exposures:** Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions to provide proper temperature and relative humidity conditions.

3.11 CORRECTION OF THE WORK

- A. Repair or replace defective construction. Restore damaged substrates and finishes. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair defective components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01715

EXISTING CONDITIONS – HAZARDOUS MATERIALS SURVEY

PART 1 - GENERAL

1.1 SUMMARY

- A. A report entitled *Limited Hazardous Materials Survey Report, Department of Land & Natural Resources (DLNR), Maui Office Annex Building, Maui, Hawaii*, dated March 16, 2015, was prepared by EnviroServices & Training Center, LLC for the design of this project. To review a copy of this survey report, contact Brandon Kim at (808) 587-0248.
- B. Related Sections include the following:
 - 1. Section 13281 – REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS; for requirements of all work that disturbs Asbestos Containing Materials.
 - 2. Section 13282 – LEAD-CONTAINING PAINT CONTROL MEASURES; for requirements of all work that disturbs Lead-Containing Paint.
 - 3. Section 13284 – REMOVAL AND DISPOSAL OF MERCURY CONTAINING LAMPS; for requirements of all work that disturbs Mercury Lamps.
 - 4. Section 13288 – TESTING/AIR MONITORING; for requirements of all work that disturbs Asbestos Containing Materials and Lead-Containing Paint.

1.2 ASBESTOS

- A. The existing one-story structure to be modified under this contract was surveyed for the presence of asbestos containing materials (ACM). A copy of the initial survey report, as well as any subsequent supplemental survey reports, if performed, is included in the Section.
 - 1. The Contractor may perform further surveys at its own expense if ACM not shown in the reports is suspected in the areas in which work will be performed. If ACM is found, notify the Engineer immediately.
 - 2. If there is ACM outside of the areas in which work will be performed, this ACM shall not be disturbed in any way.
- B. The existing asbestos cement pipe to be removed under this contract was not surveyed.
- C. If applicable, the Contractor shall notify his employees, subcontractors and all other persons engaged in the demolition and abatement 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.

- D. In the event that work is required in any area on the site other than those designated in the project scope, the Contractor shall request copies of the asbestos survey reports for each such area from the Engineer. Based on the information contained in the additional survey(s), notify all persons on the project as indicated in paragraph 1.2 B.

1.3 LEAD CONTAINING PAINT

- A. Inform employees, Subcontractors and all other persons engaged in the project that lead containing paint (LCP) is present in the existing building and at the job site. Follow the requirements of Title 12 (Department of Labor and Industrial Relations), Subtitle 8 (Division of Occupational Safety and Health), Chapter 148 (Lead Exposure in Construction), Hawaii Administrative Rules.
- B. Review the attached lead testing data which identifies the locations LCP was found. Lead testing was for design purposes only and the results do not satisfy any of the requirements of HIOSH Chapter 12-148.

1.4 MERCURY

Inform employees, Subcontractors and all other persons engaged in the project that mercury-containing lamps are present in the existing building and at the job site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01770

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including the following:
 - 1. Project Record Documents.
 - 2. Warranties.
 - 3. Instruction for the State's personnel.
- B. Related Sections include the following:
 - 1. Section 01567 – ENVIRONMENTAL PROTECTION.
 - 2. Section 01700 – EXECUTION REQUIREMENTS.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting a Final Inspection to determine Substantial Completion, complete the following items in addition to requirements of Section 7 - Prosecution and Progress of the GENERAL CONDITIONS.
 - 1. Advise the Engineer of pending insurance changeover requirements.
 - 2. Submit specific warranties, final certifications, and similar documents.
 - 3. Obtain and submit occupancy permits, operating certificates, and similar releases and access to services and utilities, unless waived by the Engineer.
 - 4. Arrange to deliver tools, spare parts, extra materials, and similar items to a location designated by the Engineer. Label with manufacturer's name and model number where applicable.
 - 5. Complete startup testing of systems.
 - 6. Submit test, adjust, and balance records.
 - 7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 8. Advise the Engineer of changeover in other utilities.

9. Submit changeover information related to the State's occupancy, use, operation, and maintenance.
10. Complete final cleaning requirements, including touch up painting.
11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
12. Submit Field-Posted As-Builts.

1.3 FINAL COMPLETION

- A. Preliminary Procedures: Within 10 days from the Project Acceptance Date, complete the following items in addition to requirements of Section 7 - Prosecution and Progress of the GENERAL CONDITIONS:
 1. Instruct the State's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 2. Submit demonstration and training media materials.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit 2 copies of any updated and action taken list. In addition to requirements of Section 7 - Prosecution and Progress of the GENERAL CONDITIONS, include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project Name and Title.
 - b. DLNR Job No.
 - c. Date and page number.
 - d. Name of Contractor.

1.5 PROJECT RECORD DOCUMENTS AND REQUIREMENTS

A. General

1. Definition: "Project Record Documents", including Record Drawings, shall fulfill the requirements of "Field-Posted As-Built Drawings" listed in the GENERAL CONDITIONS.
2. Do not use Project Record Documents for daily construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours. Maintain these documents as specified in paragraph entitled "Record Drawings" hereinafter.
3. The Designer, under contract with the State, will update the drawings to show all addendum, PCD, and sketch changes. The Engineer will transmit these drawings to the Contractor who will make all "red-line" corrections to these drawings to record the changes depicted on the Contractor's Field Posted Record ("As-Built") by accepted drafting practices as approved by the Engineer.
4. Where the recorded changes depicted on the Contractor's Field Posted Record ("As-Built") are in the form of shop drawings, the Contractor shall provide those shop drawings electronically on the same sheet size as the drawings transmitted to the Contractor. The new drawing sheets shall be titled and numbered to conform to the construction drawings and clearly indicate what information they supersede in the actual construction drawings. For example a new drawing that replaces drawing M-3, could be numbered M-3a.
5. The Contractor shall bring to the attention of the Engineer any discrepancy between the changes made by the Designer and those depicted on addendum, PCD, and sketch changes. The Engineer will resolve any conflicts.
6. Submit final Record Documents (Field Posted Record Drawings) before the Final Inspection Date and no later than the Final Settlement of Contract, unless the GENERAL CONDITIONS require otherwise.
7. The Contractor shall guarantee the accuracy of its final Record Documents. The State will hold the Contractor liable for costs the State incurs as a result of inaccuracies in the Contractor's Record Documents.
8. Prepare and submit construction photographs and electronic files and similar final record information as required by the Engineer.
9. Deliver tools, spare parts, extra materials, and similar items to a location designated by the Engineer. Label with manufacturer's name and model number where applicable.

10. Submit a copy of all Federal, State, or County permit closeout procedure requirements.

B. Record Drawings

1. Maintain a duplicate full-size set as the Field Posted Record (“As-Builts”) Drawings at the job site. Clearly and accurately record all deviations from alignments, elevations and dimensions, which are stipulated on the drawings and for changes directed by the Engineer that deviate from the drawings.
2. Record changes immediately after they are constructed in place and where applicable, refer to the authorizing document (Field Order, Change Order, or Contract Modification). Use red pencil to record changes. Make Field Posted Record Drawings available to the Engineer at any time so that its clarity and accuracy can be monitored and can be countersigned for validity.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark the contract drawings or the shop drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on contract drawings.
 - e. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - f. Locate concealed building utilities by dimension from bench marks or permanent structures. Locate site utilities by dimensions, azimuth and lengths from bench marks or permanent structures.
 - g. Note field order numbers, Change Order numbers, Contract Modification numbers, Alternate numbers, post-construction drawing numbers (PCD) and similar identification (RFI numbers) where applicable.
 - h. The Contractor shall initial each deviation and each revision marking.
3. Use the final updated Contract Drawing set (including all addenda, PCD, and sketches) plus applicable shop drawings for making the final Field Posted Record Drawings submittal.
4. Certify drawing accuracy and completeness. Label and sign the record drawings or use digital electronic signature as approved by the Engineer.

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

FIELD POSTED Certified By: _____ Date: _____
RECORD DRAWINGS [Contractor’s Company Name]

6. Revise the Drawing Index and label the set “FIELD POSTED RECORD DRAWINGS”. Include the label “A COMPLETE SET CONTAINS [_____] SHEETS” in the margin at the bottom right corner of each sheet. Quantify the total number of sheets comprising the set.
7. If the Engineer determines a drawing does not accurately record a deviation or omits relevant information, the State will correct any FIELD POSTED RECORD DRAWINGS sheet. Contractor will be charged for the State’s cost to correct the error or omission.
8. Use the final Field Posted Record Drawings sheets and create one electronic version of the set. The set shall be recorded in Adobe Acrobat PDF (Portable Document Format). Create a single indexed, bookmarked PDF file of the entire set of drawings.

1.6 WARRANTIES

- A. Submittal Time: Submit written manufacturer’s warranties at request of the Engineer for designated portions of the Work where commencement of warranties other than Project Acceptance date is indicated.
- B. Partial Occupancy: Submit properly executed manufacturer’s warranties within 45 days of completion of designated portions of the Work that are completed and occupied or used by the State during construction period by separate agreement with Contractor.
- C. Organize manufacturer’s warranty documents into an orderly sequence based on the table of contents of the Specifications.
 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 inch x 11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer and prime contractor.

3. Identify each binder on the front and spine with the typed or printed title “WARRANTIES”, Project Name and Title, DLNR Job Number, and name of Contractor.
4. Use the final submittal of the warranties to create an electronic Adobe Acrobat PDF (Portable Document Format) version of the bound warranty documents files. Each sheet shall be separately scanned, at 600 DPI or better into a PDF file, indexed.

PART 2 – PRODUCTS

2.1 MATERIALS

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

PART 3 – EXECUTION

3.1 DEMONSTRATION AND TRAINING

- A. Instruction: Instruct the State’s personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Provide instructors experienced in operation and maintenance procedures.
 2. Provide instruction at mutually accepted times.
 3. Schedule training with the State’s users, through the Engineer with at least 7 days advanced notice.
 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
- B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
 1. System design and operational philosophy.
 2. Review of documentation.
 3. Operations.
 4. Adjustments.

5. Troubleshooting.
6. Maintenance.
7. Repair.

3.2 FINAL CLEANING

- A. General: Provide final cleaning. In addition to requirements of Section 7 - Prosecution and Progress of the GENERAL CONDITIONS, conduct cleaning and waste-removal operations to comply with local laws and ordinances and federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturers written instructions unless noted otherwise. Complete the following cleaning operations before requesting final inspection for entire Project or for a portion of Project:
 1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits resulting from construction activities.
 3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 4. Remove tools, construction equipment, machinery, and surplus material from Project site.
 5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 6. Remove debris and surface dust from limited access spaces, including: roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 7. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass surfaces, taking care not to scratch surfaces.
 8. Remove labels that are not permanent.

9. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 10. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.
 11. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 12. Replace parts subject to unusual operating conditions.
 13. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 14. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the State’s property. Do not discharge volatile, harmful, or dangerous materials into drainage and sewer systems or onto State property. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

DIVISION 2 – SITEWORK

SECTION 02050

DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY

The work includes demolition and removal as indicated in the plans or specified herein. All materials resulting from demolition work shall become the property of the Contractor and shall be removed from the limits of Project property and disposed offsite in accordance with all regulatory requirements.

1.2 GENERAL REQUIREMENTS

- A. It shall be the responsibility of the Contractor to examine the project site and determine for himself the existing conditions.
- B. Obvious conditions which exist on the site shall be accepted as part of the work, even though they may not be indicated on the drawings and/or described herein, or may vary therefrom.
- C. Burning of any debris on-site will not be permitted.
- D. Permits: The Contractor shall procure and pay for all necessary permits and certificates that may be required in connection with this work.
- E. Related Sections include the following:
 - 1. Section 01567 – ENVIRONMENTAL PROTECTION.
 - 2. Section 01715 – EXISTING CONDITIONS – HAZARDOUS MATERIALS SURVEY.
 - 3. Section 02100 – SITE PREPARATION.
 - 4. Section 02110 – CLEARING AND GRUBBING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Submit proposed demolition and removal procedures to the Engineer for approval before work is started. Procedures shall provide for coordination with other work in progress and a

detailed description of methods and equipment to be used for each operation, and sequence of operations.

- C. Landfill Disposal Receipts: Submit copies of receipts issued by a landfill facility. Include receipts with Contractor Daily Progress Report.

1.4 PROTECTION

- A. Existing Improvements: Protect existing improvements that are to remain in place, that are to be reused, or that is to remain the property of the Engineer, by temporary covers, shoring, bracing, and supports. Repair items damaged during performance of the work or replace with new to the satisfaction of the Engineer. Do not overload structural elements. Provide new supports or reinforcement for existing construction weakened by demolition, removal, and relocation work. Construction equipment and vehicles shall neither be permitted on, nor shall be stored on the existing work that is to remain in place.
- B. Trees and Shrubs: See Section 02100 – SITE PREPARATION and Section 02110 - CLEARING AND GRUBBING.
- C. Public Safety: Where pedestrian and driver safety is endangered in the work or storage areas, use traffic barricades with flashing lights. Notify the Engineer prior to beginning any such work. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, and passageways, etc.
- D. Explosives: Use of explosives will not be permitted.
- E. Hazardous Materials: The presence of hazardous materials including, but not limited to, asbestos and mercury containing materials and lead based paint is present on this project. See Section 01715 – EXISTING CONDITIONS – HAZARDOUS MATERIALS SURVEY. The Contractor shall take the necessary precautions and perform work in accordance with applicable Sections in these Specifications. All materials removed shall be disposed of off-site by the Contractor at his expense in compliance with all regulatory agency requirements.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 EXISTING UTILITIES AND STRUCTURES

- A. The location of utility lines throughout the Site is not definitively known. Should any unknown line be encountered during excavation, the Contractor shall immediately notify the Engineer of such discovery. The Engineer shall then investigate and issue instructions for the preservation or disposition of the unknown line. Authorization for extra work shall be issued by the Engineer only as he deems necessary.

- B. Where demolition occurs adjacent to utilities and structures to remain, the contractor shall provide adequate protection in accordance with Section 01019 – GENERAL SPECIFICATIONS.

3.2 SAFETY

Work shall be done in accordance with safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America and the Department of Labor and Industrial Relations, Occupational, Safety and Health Division (HIOSH).

3.3 DISPOSITION OF MATERIALS

- A. Title to Materials: Title to all materials and equipment to be removed, except as specified otherwise, is vested in the Contractor upon receipt of notice to proceed. The Engineer will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site. Burning or burying of materials on the site will not be permitted.
- B. When removing the materials from the property, truck loads shall be trimmed, covered, and loaded as to prevent spillage.
- C. All waste material shall be hauled away to an appropriate off-site dump area and in accordance with all regulations. The Contractor shall provide to the Engineer disposal receipts for all disposed materials.
- D. Remove rubbish and debris from the job site daily, unless otherwise directed. Store materials which cannot be removed daily in areas specified by the Engineer.

3.4 CLEANUP

- A. Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage into ocean or adjacent areas. Cleanup spillage from ocean and adjacent areas. The Contractor shall leave the premises clean, neat, and orderly.
- B. Regulations: Comply with Federal, State, and local hauling and disposal regulations.

END OF SECTION

SECTION 02100
SITE PREPARATION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. The work to be performed under this section shall clearing the premises of all obstacles and obstructions, the removal of which will be necessary for the proper reception, construction, execution and completion of the other work included in this contract.
- B. Related Sections include the following:
 - 1. Section 01530 – BARRICADES.
 - 2. Section 02362 – SOIL TREATMENT FOR VEGETATION CONTROL.
 - 3. Section 02050 - DEMOLITION.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL

- A. Maintenance of Traffic: The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, passageways, etc.
- B. Barricades: When necessary, the Contractor shall provide and erect barriers, etc., with special attention to protection of personnel as required in Section 01530 – BARRICADES and DIVISION 13 – SPECIAL CONSTRUCTION.
- C. Protection: Throughout the progress of the work, protection shall be provided for all property and equipment, and temporary barricades shall be provided as necessary. Work shall be done in accordance with the safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, and the State of Hawaii's Occupational Safety and Health Standards, Rules and Regulations.
- D. Fires: No burning of fires of any kind will be allowed.
- E. Reference Points: Bench marks, etc., shall be carefully maintained, but if disturbed or destroyed, shall be replaced as directed, at the Contractor's expense.

- F. Disposal: All materials resultant from operations under this Section, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the site in accordance with all regulations. Loads of materials shall be trimmed to prevent droppings.

3.2 EXISTING UTILITY LINES

- A. The location of underground utility lines to each structure is not known other than those indicated in their approximate locations on the Drawings.
- B. Water and Sewer
 - 1. Water shall be secured at the water meter or at other onsite cutoff valve locations with prior notification to the Engineer. Contractor may temporarily shut off water service to the Site, but shall ensure that service is restored to all occupied areas at the end of each work day.
 - 2. Seal and cap utility lines where necessary as required by regulations of the authority having jurisdiction or as directed by the Engineer. Contractor shall recharge the water service line to check for and repair any leaks at cap prior to abandoning-in-place.
- C. Cable Television (CATV), Telephone and Electrical Lines: Removal of infrastructure owned and operated by other agencies shall be coordinated with each agency as required.
- D. Other: Should any unknown line be encountered during excavation, the Contractor shall immediately notify the Engineer of such discovery. The Engineer shall then investigate and issue instructions for the preservation or disposition of the unknown line. Authorization for extra work shall be issued by the Engineer only as he deems necessary.

3.3 REMOVAL OF VEGETATION OBSTRUCTIONS

- A. The Contractor may need to trim vegetation growing into the project limits that prohibit access to complete the work included in this contract. Contractor may trim vegetation only within State property.
- B. If removal is required, plants and hedges shall be removed to a minimum depth of 6 inches. The Contractor shall remove trees and its roots to a minimum of 3 feet below existing ground level. Remove all large roots in excess of 2 inches in diameter, and backfill and compact the resulting depression. All debris accumulated from this operation shall be completely removed from the premises by the Contractor.
- C. Protection of Vegetation to Remain
 - 1. The Contractor shall protect from injury and damage all trees, plants, etc., not within the project limits and shall leave all in as good as condition as at present.

2. The Contractor shall limit activities under the crown of trees to only those activities explicitly required to complete the construction under and/or adjacent to the tree's crown as specified.
3. No grading, compacting, or construction activity shall occur in areas under the crown of existing trees to remain.
4. Any damage to existing improvement shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

3.4 CLEAN UP OF PREMISES

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

END OF SECTION

SECTION 02110

CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. This section covers the requirements for clearing and grubbing, within the areas shown on the plan or as directed by the Engineer and shall cover the work necessary for debris removal.
- B. Related Sections include the following:
 - 1. Section 02050 – DEMOLITION.
 - 2. Section 02100 – SITE PREPARATION.

1.2 REFERENCES

- A. Maui County Code, Chapter 20.08 – Soil Erosion and Sedimentation Control;
- B. Section 10 of the “STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION”, dated September 1986, as revised, except as amended in the plans and/or specifications herewith, of the Department of Public Works, as applicable to the County of Maui, hereafter referred to as the “DPW Standard Specifications”, or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.);
- C. “Geotechnical Investigation DLNR Maui Office Annex Building Design Phase, Mahalani Street, Wailuku, Maui, Hawaii,” prepared by Hirata & Associates, Inc., dated April 23, 2015.

1.3 LIMITS

The limits of clearing and grubbing shall be restricted only to areas where proposed site improvements are indicated on the drawings.

1.4 SUBMITTALS

Land Disposal Receipts: Submit copies of receipts issued by a landfill facility. Include receipts with Contractor Daily Progress Report.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING WORK

- A. The project site should be cleared of all vegetation, debris, and other deleterious materials to the limits shown on the plans.
- B. All boulders, rocks, debris, trees, logs, limbs, branches, brush, plants, pipes, and other protruding obstructions within the clearing limits shall be removed and disposed of, unless otherwise indicated on the Plans or as directed by the Engineer.
- C. Felling, cutting, and trimming methods shall not cause bark damage to standing timber. If damage does occur to standing trees, the injured area shall be treated with a coat of tree-surgery asphalt-based paint.
- D. The Contractor shall consult with a certified arborist if major tree roots of existing trees to remain are exposed during construction to evaluate the stability and health of the affected tree.
- E. All logs, limbs, lopped tops, brush, debris, boulders, and grubbed stumps and roots shall be properly disposed of off-site.
- F. Debris from clearing and grubbing operations shall not be placed in streams, water courses or at locations that will impede flow of the natural drainage pattern or increase the potential for erosion.
- G. All materials resultant from operations under this Section shall become the property of the Contractor and shall be removed from the site unless it is deemed suitable to be reused within this project.
- H. The Contractor shall protect from injury and damage all surrounding houses, roads, structures, trees, plants, etc., and shall leave all in as good condition as at present. Any damage to existing improvement shall be repaired or replaced by the Contractor to the satisfaction of the Engineer at no additional cost to the State of Hawaii.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. A geotechnical report entitled, "Geotechnical Investigation DLNR Maui Office Annex Building Design Phase, Mahalani Street, Wailuku, Maui, Hawaii," dated April 23, 2015, was prepared by Hirata & Associates, Inc. for the design of this project. This geotechnical report, including the recommendations in the report, is not part of the contract documents but is available for examination with the Engineer for informational purposes only.
- B. The subsurface information and data presented in the geotechnical report represent the subsurface conditions at the specific boring locations and at the time of exploration only. No assurance is given that these conditions are representative of the conditions at other locations of the project site or at other times. The bidder is solely responsible for any and all assumptions, deductions, or conclusions which he may make or derive from his examination of the subsurface information and data provided herein. The State and its Consultants assume no responsibility for the bidder's interpretation of such data.
- C. Project Geotechnical Engineer: The Contractor shall retain and pay for the services of a geotechnical engineer to monitor and perform testing during the earthwork operations and prepare and sign the final Grading Report. The geotechnical engineer shall be a licensed civil engineer licensed in the state of Hawaii and specializing in geotechnical engineering with at least five (5) years of licensed experience.
- D. It shall be the responsibility of the Contractor to examine the project site and determine for himself the existing conditions. Obvious conditions of the site existing on the date of the bid opening shall be accepted as part of the work, even though they may not be clearly indicated on the drawings and/or described herein.
- E. Related Sections include the following:
 - 1. Section 01100 – ARCHAEOLOGICAL PROTECTION.
 - 2. Section 01567 – ENVIRONMENTAL PROTECTION.
 - 3. Section 02110 – CLEARING AND GRUBBING.
 - 4. Section 02370 – SEDIMENT AND EROSION CONTROL.
 - 5. Section 02950 – LANDSCAPE PLANTING.

1.2 QUALITY ASSURANCE AND CODES

- A. Source Quality Control: Test import and on-site materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by a qualified independent testing laboratory and paid for by the Contractor.
- B. Test for Moisture-Density Relations: Submit test results for each material at least 7 days prior to compacting of each material.
- C. Field Dry Density and Moisture Content Tests: Submit field test data sufficiently in advance of construction so as not to delay work. Furnish a drawing showing test locations, test numbers, test elevations, and test results. Submit test results within 3 days of test date. Field density tests shall be performed for subgrade of excavation for pavements, areas to receive fill, and backfill and fill lifts.
- D. The Contractor shall verify testing and reporting requirements with the Engineer and prior to the start of earthwork operations.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – Submittals.
- B. Test Reports: Submit test reports as directed by the Engineer. Contractor shall verify all requirements prior to the start of earthwork operations.
- C. Shoring and Sheeting Plan: Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, and details along with calculations by a professional engineer licensed in the State of Hawaii. Indicate sequence and method of installation and removal.
- D. Certification of Compaction: An independent geotechnical testing laboratory working under the supervision of a licensed civil engineer licensed in Hawaii shall test and certify all compaction work. Certifications and test results shall be submitted to the Engineer within three (3) days of the test.
- E. Field Dry Density and Moisture Content Tests: Submit field test data not listed above sufficiently in advance of construction so as not to delay work. Furnish a drawing showing test locations, test numbers, test elevations, and test results. Submit test results within 3 days of test date.
- F. Manufacturer's product literature: Submit manufacturer's product literature including description of material and physical properties and laboratory test data for bedding material, sub-bedding material, general fill, and structural fill to the Engineer for approval at least 15 calendar days prior to construction.

1.4 REMOVAL AND REPAIR WORK

The Contractor shall exercise every precaution to preserve and protect from damage all buildings, structures, roads, embankments, walls, fences, trees, walkways or utility improvements which are to remain.

1.5 CONTRACTOR'S RESPONSIBILITIES

- A. All clearing, site preparation or earthwork performed on the project up to the approximate finish grade or subgrades shall be conducted by the Contractor under the inspection of the Project Geotechnical Engineer.
- B. It is the Contractor's responsibility to prepare the ground surface to receive the fills and to place, spread, mix, moisture condition, and compact the fill in accordance with the specifications herein. The Contractor shall also remove all unsuitable and deleterious materials.
- C. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment shall be shut down to allow completion of compaction. Sufficient watering apparatus will also be provided by the Contractor with due consideration for the fill material, rate of placement, and the time of year.
- D. The Contractor shall not implement blasting as a means for removal of material.
- E. The Project Geotechnical Engineer shall promptly notify both the Contractor and the Engineer verbally of any failing compaction tests and the results of such tests to the extent the tests show a lack of compliance with specifications. These items shall also be documented by the Project Geotechnical Engineer.
- F. If field density test indicate inadequate compaction or moisture content, the Contractor shall moisture condition and recompact and retest until adequate compaction and adequate moisture content is achieved.
- G. During construction, drainage shall be provided to minimize ponding of water adjacent to or on foundation and pavement areas. Ponded areas shall be drained immediately. Any subgrade soil that has become soft due to ponding shall be removed to firm material and replaced with properly compacted structural fill at no cost to the State.

1.6 PROTECTION

- A. Barricade: Erect temporary barricades to prevent people from entering into project area to the extent as approved by the Engineer. Such barricades shall be as defined in Section 01530 - BARRICADES. The extent of barricades may be adjusted as necessary with the approval of the Engineer. This work shall be accomplished at no additional cost to the State.

- B. Take all precautions and safety measures as required to protect the State free and harmless from liability of any kind. Conduct operations with minimum interference to streets, driveways, sidewalks, trails, etc.
- C. Adequate precautions shall be taken before commencing and during the course of the work to ensure the protection of life, limb, and property.
- D. The Contractor shall protect from damage all surrounding buildings, structures, roads, embankments, walls, fences, utilities, trees, walks, pavements, etc. Any damage shall be repaired or replaced by the Contractor to the satisfaction of the Engineer at no additional cost to the State.

1.7 PERMITS

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

1.8 CONSTRUCTION LINES, LEVELS AND GRADES

- A. The Contractor shall verify all lines, levels and elevations indicated on the drawings or as directed by the Engineer before any clearing, excavation or construction begins. Any discrepancy shall be immediately brought to the attention of the Engineer and any changes shall be made in accordance with his instructions. The Contractor shall not be entitled to extra payment if he fails to report the discrepancies before proceeding with any work whether within the area affected or not.
- B. The establishment of grades and staking out the entire work shall be done by a licensed Surveyor or a licensed Civil Engineer, registered in the State of Hawaii. He shall be solely responsible for their accuracy. Erect and maintain substantial batter boards showing construction lines and levels.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Onsite Fill Material:
 - 1. The onsite sands will be acceptable for reuse in compacted fills and backfills. All rock fragments larger than 3 inches in maximum dimension should be removed from the onsite sands prior to use.
 - 2. Due to the cohesionless nature and poorly-graded condition of the onsite sand, it may be difficult to maintain dense condition of the sands to provide the required compaction. As a result, a thin layer of imported granular structural fill may be compacted at the bottom of footing excavations to facilitate the construction of foundations.

- B. Imported Fill Material: Imported general and structural fill shall be well-graded, non-expansive granular material with particles ranging from coarse to fine and classified as GW, GW-GM, GP-GM, SW, SW-SM, or SP-SM according to Unified Soil Classification System. The material shall be free of organic matter, vegetation, debris, asphaltic concrete debris, clayey soils, and particles larger than 3 inches in maximum dimension. It shall have between 8 and 20% of soil by weight passing a No. 200 standard sieve. In addition, the plasticity index of that portion of the soil passing the No. 40 sieve shall not be greater than 10. Certificate of compliance shall be submitted to the Engineer for approval prior to filling.
- C. Granular structural fill should also have a minimum CBR value of 15, a CBR swell of less than 1% when tested in accordance with ASTM D 1883.
- D. Topsoil: See Section 02950 – LANDSCAPE PLANTING.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. All areas within the limits of grading as indicated on the plans shall be cleared of trees, vegetation, and deleterious materials such as rubbish roots and organics and disposed of off-site. This removal shall be completed prior to excavating and filling.
- B. Any abandoned underground structures such as cesspools, cisterns, tunnels, septic tanks, wells, pipelines, or other structures not shown on the drawings that are discovered shall be removed and the resulting depression backfilled and compacted in accordance with these specifications.
- C. The Contractor shall select, install and maintain shoring, sheeting, bracing, and underpinning as necessary to maintain safe excavations. The Contractor shall be responsible for ensuring such measures: (1) comply fully with OSHA Excavations and Trenches requirements, (2) provide necessary support to the sides of excavations, (3) provide safe access to backfill, compaction, and testing within the excavation, (4) prevent settlement and undermining of pavements, existing structures, foundations and slabs, and aboveground and underground utilities, and (5) protect against excavation instability, boiling, and/or blowout of excavation bottoms.
- D. All earthwork shall be performed in strict accordance with applicable law, including local ordinances, and applicable OSHA requirements. All excavations shall be protected and guarded against danger to life, limb, and property.

3.2 EXCAVATION

- A. Protective Measures: All excavations shall be kept free from standing water. The Contractor shall do all pumping and draining that may be necessary to remove water to the extent required in carrying on the work. Grading shall be controlled so that the ground surface is properly sloped to prevent water run-off into structural foundations.

B. General

1. Excavate to contours and dimensions and depths indicated. Notify the Engineer immediately in writing in the event that it becomes necessary to remove material to a depth greater than indicated. Refill excavations cut below the depths indicated with structural fill and compact as specified herein. Excavate soil disturbed or weakened by construction operations or soils softened from exposure to weather at no cost to the State. Refill with structural fill and compact as specified herein.
2. Excavation for footings, foundation, etc., shall have level beds on undisturbed, firm bearing, compacted subgrade. Remove soft or yielding material below the foundation subgrade level and replace with structural fill as directed by the Engineer.
3. Excavated materials declared unsuitable by Engineer shall be removed from the site at the Contractor's expense.
4. Unauthorized excavations carried below specified levels shall be filled with concrete or structural fill to the proper level as directed by the Engineer at the Contractor's expense

3.3 FILL PLACEMENT

- A. Fill and backfill shall not be constructed when weather conditions detrimentally affect the quality of the finished course. Do not construct fill and backfill in the rain or on saturated subgrade. If weather conditions are windy, hot or arid, with high rate of evaporation, schedule the placement in cooler portions of the day and furnish equipment to add moisture to the fill or backfill during and after placement.
- B. Areas to receive fill shall be scarified to a depth of at least 6 inches, moistened as necessary to about 2 percent above the optimum moisture content and compacted to the degree of compaction specified in paragraph 3.4 below. If soft or loose spots are encountered, the loose/soft areas shall be removed to firm material and the resulting depression shall be filled with properly compacted structural fill.
- C. Protect compacted subgrade from exposure to weather elements. If shrinkage cracks appear on the excavated or compacted subgrade, the subgrade shall be scarified and thoroughly moisture conditioned and recompact to provide a firm base and to close all cracks.
- D. Moisten or aerate material as necessary to provide the moisture content and obtaining the specified compaction with the equipment used. Any soft or yielding areas detected during the subgrade compaction shall be treated by removing the soft or loose materials to firm soils and backfilling with structural fill.
- E. In areas where fill is placed on existing ground that is steeper than 5 horizontal to 1 vertical, the existing ground surface shall be benched into firm soil as the fill is placed.

- F. Backfill behind new retaining walls: Both onsite sands and imported structural fill may be used for backfill behind new retaining walls. Backfill should be compacted in lifts to a minimum 90% compaction as determined by ASTM D 1557. Over-compaction of the backfill material should be avoided.
- G. General Fill: General fill in non-structural areas shall be placed in not more than 8-inch thick horizontal loose lifts, moisture conditioned to between optimum and 3 percent wet of optimum moisture content, and compacted to at least 90% of the maximum dry density as determined by ASTM D1557 test method.
- H. Structural Fill
 - 1. Place structural fill and structural backfill under footing, concrete slabs, and pavements.
 - 2. In advance of preparing the subgrade or depositing a specified layer of material, existing material within the area where such materials is to be placed, which in the opinion of the Engineer is unsuitable as subgrade foundation, shall be removed and the resulting space refilled with properly compacted structural fill.
 - 3. The subgrade above which fill is to be placed shall be scarified at least 6 inches, moisture conditioned to between optimum and 2% above optimum moisture, and compacted to at least 90% of the maximum dry density as determined by ASTM D1557 test method.
 - 4. Structural fill shall be placed in not more than 8-inch thick horizontal loose lifts, moisture conditioned to within 2% of its optimum moisture content and compacted to at least 95% of the maximum dry density as determined by ASTM D1557 test method except as indicated otherwise.

3.4 COMPACTION

- A. Compact each lift before placing overlaying lift. Compact each lift of structural fill with equipment well suited to the fill being placed. Compaction shall be accomplished continuously over the entire area. Sufficient passes shall be made to ensure that specified density is obtained. Compact areas not accessible to rollers or compactors with mechanical hand tampers.
- B. Compaction and Testing
 - 1. Compaction shall be accomplished by sheepsfoot roller, pneumatic tire rollers, steel-wheeled rollers, or other suitable equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.
 - 2. Soils materials and compaction of all fill shall be tested by an independent testing agency approved by the Engineer and test results submitted to the Engineer.

Perform one field density test for every 400 square feet or fraction thereof of subgrade and each lift of fill and backfill. All cost of testing shall be borne by the Contractor.

3. Test structural fill for ASTM D2487 gradation limits and ASTM D1557 for moisture density relations. Perform a new set of tests for any source change.
4. Field Density testing shall be made throughout the area for each compacted layer or as directed by the Engineer. Perform field density and moisture content test in accordance with ASTM D 1556 or ASTM D6938. When test results indicate inadequate compaction, the material shall be recompacted and retested to meet specification requirements. Submit a plan showing test locations, test numbers, test elevations, and test results within 3 days of test date.
5. Each layer of fill and backfill shall be thoroughly compacted from edge to edge using suitable compaction equipment designed for the purpose. All field dry density and moisture content testing and reporting shall be conducted under the supervision of a licensed Civil Engineer licensed in the State of Hawaii at no additional cost to the State. If field density test indicate inadequate compaction or moisture content, the Contractor shall moisture condition, recompact, and retest until adequate compaction and adequate moisture content is achieved. Verify that test results conform to the specified requirements, and that sufficient tests are performed.

3.5 GRADING

- A. Grading shall conform to the ordinances of the applicable County issuing the Grading Permit and as amended.
- B. Landscaped areas shall be graded with an allowance for a thickness of topsoil as required in Section 02950 – LANDSCAPE PLANTING. Areas to be top soiled shall be compacted to 85% of maximum dry density before placing topsoil. Topsoil shall be spread evenly, compacted lightly and raked to a uniform place at required contours and grades.
- C. The complete excavation and fill surface shall be true to grade and elevation and shall provide a firm base. Tolerances shall be 0.10 feet.

3.6 CLEANUP

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

END OF SECTION

SECTION 02210

CONSTRUCTION SURVEYS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This section includes requirements for surveys to document conditions prior to, during, and following construction and monitoring for ground settlement and movements prior to, during, and after construction. The Contractor shall be responsible for monitoring for ground settlement and movement due to his construction activities, for continuously comparing and evaluating the surveying and monitoring results, for immediately making adjustments to his excavation, shoring, dewatering, and/or construction methods as required to prevent ground settlement and moving and damage to buildings and structures, and for repairing any resulting damages to the satisfaction of the Engineer.

The Contractor shall be solely responsible for anticipating, planning, and providing any additional provisions that may be required to prevent damage to existing buildings, structures, above ground and below ground utilities, and new improvements within and adjacent to the work site. The work includes, but is not limited to, photographic and video surveys of the surrounding buildings and structures.

1.2 DEFINITIONS

Surface settlement points: Survey control points established as a reference for measuring elevation of the ground surface and adjacent structures using optical survey methods to monitor for settlement. These points shall be measured during the pre- and post-construction surveys as well as on a daily basis during the shoring, underpinning, excavation, dewatering, trenching and backfilling operations.

1.3 QUALITY ASSURANCE

- A. Personnel Qualifications: Employ qualified personnel with a minimum of two (2) years-experience in the installation of geotechnical instrumentation similar to that specified herein.
- B. Each instrument specified herein shall be the product of an acceptable manufacturer currently engaged in manufacturing geotechnical instrumentation hardware of the specified types.
- C. Surveyor Qualifications: Surveying for monitoring surface settlement points shall be performed by a land surveyor licensed in the State of Hawaii with previous experience surveying for the detection of structural deformations and surface movements.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01300 - SUBMITTALS.
- B. Submit a written plan 30 calendar days after the Notice to Proceed summarizing the procedures to be employed in performing the surveys, including the personnel and the specific equipment and methods that are proposed for installing the surface settlement points, method and procedure of monitoring, reference bench marks, and reporting formats to be used to satisfy the requirements of this special provision. Provide sufficient detail to allow the Engineer to determine whether or not the proposed equipment, materials, procedures and qualification meet with the Contract requirements.
- C. Submit sample of required written notification to neighboring residential and commercial property owners at least 30 calendar days prior to establishment of surface settlement points for Engineer's approval.
- D. Provide drawings indicating the proposed locations and numbering system of the surface settlement points based on the manufacturer's literature and the requirements provided in the Plans to be approved by the Engineer.
- E. Provide documentation of pre- and post-construction surveys, including copies of field notebooks, annotated photographs, video, sketches, and inspection reports to the Engineer.
- F. Instrumentation Schedule: Submit the proposed schedule for installing the surface settlement points.
- G. The Contractor shall monitor and evaluate the settlement readings to check if any modification to their operation of equipment is needed. Provide data from readings taken to the Engineer within 24 hours of reading with special notification if ground movement is detected.

1.5 NOTIFICATION

- A. The Contractor shall notify the Engineer at least three (3) weeks prior to conducting the pre- and post-construction surveys. The Engineer will accompany the Contractor on both the pre- and post-construction surveys.
- B. The Contractor shall mail or personally deliver written pre-approved notices to neighboring residential property owners and "The Maui News" Circulation Manager (100 Mahalani Street, Wailuku, HI 96793) at least 30 days in advance of required work.
- C. The Contractor shall also notify each neighboring property owners of cessation of work in writing or verbally after survey settlement points are removed.

PART 2 - PRODUCTS

2.1 MATERIALS

Surface Settlement Points: Surface settlement points shall be established by an inscribed marking on buildings and structures and shall not cause any damage to existing structures. In landscaped areas, surface settlement points shall be established by driving a minimum of 12-inch long, 2-inch by 2-inch timber stake flush with the ground. Each control point shall have a tag or marking indicating the station and offset from centerline of the pipeline.

PART 3 – EXECUTION

3.1 PRE-CONSTRUCTION SURVEY

- A. Prior to the start of construction on the project the Contractor shall perform a pre-construction survey of all adjacent and nearby existing structures, buildings, pavements, sidewalks, and walls that lie within 200 feet outside the property line.
- B. Existing conditions shall be documented in detail and, where applicable, quantified (measurement of lengths, widths, and depths of cracks in structures and pavements, etc.). Information obtained from this pre-construction survey shall be used by the Contractor to develop his plans for repair, restoration, or replacement of existing improvements that will be affected by his construction activities, to develop and control his construction methods, and as a baseline against which post-construction conditions may be compared should claims against the Contractor from the State arise.
- C. Documentation of pre-construction survey information shall include the following:
 - 1. Pre-Construction Survey Report - a comprehensive report presenting detailed descriptions of existing improvements, including special features of note, defects (cracks and other damages), irrigation systems (irrigation heads, valves, laterals), locations, dimensions, sketches, and other pertinent field notebook observations and measurements. Information shall be organized in a logical sequence. The report shall be typewritten on 8-1/2" x 11" bond paper, neatly bound with front and back covers.
 - 2. Pre-Construction Photo Survey - a photo log which provides visual confirmation of the information presented in the Survey Report shall be provided on CD or DVD. Photographs shall be digital with a minimum image resolution of 630x450 pixels, shall be taken by a proficient photographer, and shall be camera date-imprinted. Multiple photographs of each improvement shall be taken to provide sufficient detail (i.e. different angles, close-up, and panoramic views). Photograph subjects shall be properly focused and lighted. Photographs shall be arranged to present information in a sequence similar to the Survey Report. Identifying information (i.e.

brief description of each improvement, location) shall be noted with each photograph.

3. Pre-Construction Video Survey - a video log which provides additional visual confirmation of the information presented in the Survey Report. Video recordings shall be recorded on DVD-format, shall be taken by a proficient video camera-person, and shall be camera date-imprinted. Multiple view angles and close-up and panoramic views shall be utilized similar to the Photo Survey to provide sufficient detail. Video subjects shall be properly focused and lighted. Video recordings shall include audio narrative (i.e. detailed description, features of note, Tax Map Key number, address). Video segments shall be arranged to present information in a sequence similar to the Survey Report. Video survey DVD's shall be individually labeled and shall be accompanied by a detailed typewritten log listing the information presented on each DVD.
 4. Surface Settlement Points
 - a. The Pre-Construction Survey shall also include establishing surface settlement points on existing structures near the planned excavations. These points shall be surveyed at least two (2) weeks prior to any construction or demolition operations to establish a baseline reading.
 - b. Establish surface settlement points at minimum at the locations shown on the Plans.
 - c. Survey settlement points using conventional level surveying techniques to a measurement accuracy of at least 0.01 (one hundredth) of a foot.
 - d. Settlement points that cannot be established due to field conflicts or safety hazards to the survey personnel shall be relocated as directed by the Engineer.
 - e. All settlement readings shall be referenced to a benchmark located in an area that will not be affected by the construction and at least 500 feet from the project site. The surface settlement points shall be surveyed at least twice every work week during the shoring, underpinning, excavation, dewatering, trenching and backfilling operations and a copy shall be submitted within 24-hours to the Engineer.
 - f. Pre-Construction Settlement Point Report shall include, but not be limited to, scale drawings on 22" x 34" sheets showing locations of all settlement points, individual settlement point identification numbers, initial survey readings, benchmark information, property lines and existing major structures. The Pre-Construction Settlement Point Report shall also include an electronic file of the readings in Microsoft Excel on compact disc (CD).
- D. Two (2) copies each of the Pre-Construction Survey Report, Photo Survey, Video Survey and Settlement Point Report documents shall be submitted to the Engineer within thirty

(30) calendar days after the Notice to Proceed date. Such submittals shall be duplicate copies of the Contractor's original documents (i.e. photographs and videos shall be professionally reproduced from originals; bindings, covers, labeling, and other presentation materials shall be identical).

- E. Under no conditions will the Contractor be allowed to start any construction on the Project until the Pre-Construction Survey has been satisfactorily completed and the documents submitted to the Engineer.

3.2 SURVEYS DURING CONSTRUCTION

- A. Due to the proximity of the excavations to existing buildings and structures, ground movement shall be monitored and evaluated at least twice weekly during construction. The surveys conducted during construction shall involve the monitoring of the surface settlement points.
- B. Throughout construction, the Contractor shall be responsible for continually comparing and evaluating the results of all survey readings; for protecting and replacing settlement point markers, for taking additional survey readings as he deems necessary; for establishing additional settlement points as he deems necessary; for maintaining records of ground settlement and movement; and for reporting to the Engineer all ground settlement and movement, cause, damages to existing structures or improvements, corrective action taken, and repairs made.
- C. If more than 0.5 inch of settlement is detected or if ground movement is detected, or if distress is observed in existing buildings, walls, pavements, and other structures to remain, the Contractor shall immediately notify the Engineer and modify his construction, excavation, shoring, underpinning, and dewatering methods to reduce the amount of additional settlement, movements, and distress.
- D. The Contractor shall repair all distress and damage at no cost to the State to the satisfaction of the Engineer.

3.3 POST-CONSTRUCTION SURVEY

- A. After the completion of all Project improvements, but prior to final acceptance of the Project by the Engineer, a post-construction survey shall be completed to verify the condition of all buildings, pavements, and existing facilities. The post-construction survey shall include a photographic and video survey and post construction settlement point report similar in format to the one conducted during the pre-construction survey. Note and document any damage that has occurred.
- B. Two (2) copies each of the Post-Construction Survey Report, Photo Survey, and Video Survey documents shall be submitted to the Engineer within thirty (30) calendar days after Substantial Completion or as specified by the Engineer to commence this Work. Such submittals shall be duplicate copies of the original documents (i.e. photographs and videos

shall be professionally reproduced; bindings, covers, labeling, and other presentation materials shall be identical).

C. Surface Settlement Points

1. Perform a final settlement survey no sooner than one month after completion of the construction.
2. The Contractor shall not remove any settlement point until specifically notified by the Engineer to do so. Removal shall be performed as part of the Project clean-up and site restoration work.

- D. The Post-Construction Settlement Point Report shall be made and submitted to the Engineer along with copies of field notes within 10 days of the survey. The final Post-Construction Settlement Point Report shall also include a summary of all changes in survey readings which occurred from the initial pre-construction survey readings to the final survey readings for each settlement point; damages caused by any ground settlement and movement; and corrective action taken.

END OF SECTION

SECTION 02225

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

This Section covers the requirements for trenching, backfilling, and compacting as needed for installation of underground utilities associated with the Work.

1.2 REFERENCES

- A. The “STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION”, dated September 1986, as revised, except as amended in the plans and/or specifications herewith, of the Department of Public Works, as applicable to the County of Maui, hereafter referred to as the “DPW Standard Specifications”, or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.)
- B. The “STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION”, September 1984, of the Department of Public Works, including all revisions, as applicable to the County of Maui, hereafter referred to as DPW Standard Details, or as herein specified.
- C. “Geotechnical Investigation DLNR Maui Office Annex Building Design Phase, Mahalani Street, Wailuku, Maui, Hawaii,” prepared by Hirata & Associates, Inc., dated April 23, 2015.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Test Reports: Submit test reports as directed by the Engineer. Contractor shall verify all requirements prior to the start of earthwork operations.
- C. Certification of Compaction: Geotechnical testing laboratory shall test and certify all compaction work. Certifications and test results shall be submitted to the Engineer within three (3) days of the test.
- D. Field Dry Density and Moisture Content Tests: Submit field test data not listed above sufficiently in advance of construction so as not to delay work. Furnish a drawing showing test locations, test numbers, and elevations. Submit test results within 3 days of test date.
- E. Manufacturer’s product literature: Submit manufacturer’s product literature including description of material and physical properties and laboratory test data for bedding material, satisfactory fill, structural fill, and woven and non-woven fabric to the Engineer for approval at least 15 calendar days prior to construction.

- F. Shoring and sheeting plan: Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, and details along with calculations by a professional engineer licensed in the State of Hawaii. Indicate sequence and method of installation and removal.
- G. Dewatering plan: Describe methods for removing collected water from open trenches and excavations, and diverting surface water or piped flow away from work area and excavations. Describe equipment and procedures for installing and operating the dewatering system.

1.4 QUALITY ASSURANCE

- A. Compaction requirements are defined by American Society for Testing and Materials (ASTM) publication D 1557 "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb Rammer and 18-inch Drop."
- B. Design of all excavation support systems by a structural engineer licensed in the State of Hawaii. The Contractor's engineers shall verify the actual subsurface conditions are consistent with the subsurface conditions used in their design and shall make modifications to the excavation support and dewatering systems where necessary.
- C. Shoring System Plan: Describe materials or shoring system to be used. Indicate whether or not any components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a licensed professional structural or geotechnical engineer licensed in the State of Hawaii. Indicate sequence and method for installation and removal.
- D. Dewatering System: Describe methods to be employed in removing water from exposed surfaces and diverting surface water from other areas or structures. The dewatering system shall protect against excavation instability, boiling, and/or blow out of the excavation and trench bottoms, damage to existing utilities, and settlement and/or ground movements, instability, and distress to buildings, foundations, walls, structures, and pavements. Describe the basic components of the dewatering system proposed and its planned method of operation. Provide dewatering plan, sketches, or details along with calculations by a licensed professional civil engineer specializing in geotechnical engineering and licensed in the State of Hawaii.

1.5 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall retain and pay for the services of a geotechnical engineer to monitor and perform testing during the utility trench excavation and backfilling operations. The geotechnical engineer shall be a professional civil engineer licensed in the State of Hawaii and specializing in geotechnical engineering with at least five (5) years of licensed experience.
- B. It is the Contractor's responsibility to prepare the ground surface to receive the fills and to place, spread, mix, moisture condition, and compact the fill in accordance with these

Specifications herein. The Contractor shall also remove all unsuitable and deleterious materials.

- C. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment shall be shut down to allow completion of compaction. Sufficient watering apparatus will also be provided by the Contractor with due consideration for the fill material, rate of placement, and the time of year.
- D. The Contractor shall not implement blasting as a means for removal of material.
- E. The geotechnical engineer shall promptly notify both the Contractor and the Engineer verbally of any failing compaction tests and the results of such tests to the extent the tests show a lack of compliance with these Specifications. These items shall also be documented by the geotechnical engineer.
- F. If field density test indicate inadequate compaction or moisture content, the Contractor shall moisture condition and recompact and retest until adequate compaction and adequate moisture content is achieved.
- G. During construction, drainage shall be provided to minimize ponding of water adjacent to or on foundation and pavement areas. Poned areas shall be drained immediately. Any subgrade soil that has become soft due to ponding shall be removed to firm material and replaced with compacted structural fill.
- H. Permits: Obtain all necessary permits required from applicable agencies. All permit fees will be considered incidental to the work and a separate payment shall not be made.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS

- A. General: Refer to the DPW Standard Specifications for materials to be used in County streets and for materials to be used onsite but not specifically listed below.
- B. Satisfactory soil materials are defined as those complying with the Unified Soil Classification System (USCS) and ASTM D 2487 soil classification GW, GP, GM, GW-GM, GP-GM, SW, SP, SM, SW-SM, SP-SM, CL, ML, or CL-ML. Satisfactory material shall be free of organic matter, unsatisfactory materials, asphaltic and concrete debris, and particles greater than 3-inches in any dimension. Fine-grained soils including onsite excavated elastic soils where used as satisfactory materials shall have a California Bearing Ratio (CBR) swell value of less than one percent (1%) when compacted at optimum moisture content and after 4 days of soaking. It shall not be used in the top 24 inches of the backfill under pavements. Satisfactory soil materials may be used as trench backfill zone above the pipe bedding.

- C. Unsatisfactory soil materials are defined as those complying with the Unified Soil Classification System (USCS) and ASTM D 2487 soil classification groups CH, MH, PT, OL, or OH. These materials shall not be used in the trench backfill.
- D. Bedding material shall consist of a clean, granular basaltic gravel conforming to ASTM D448 No. 67 (#3B fine) size aggregate.
- E. Oversized rock particles greater than 3-inch in maximum dimension resulting from the excavation process shall not be used in the trench and excavation backfill unless it can be crushed and screened to provide a well graded, fine to coarse granular mixture conforming to the trench backfill requirements stated herein.
- F. Structural fill and structural backfill shall consist of a granular, well-graded material with particles ranging from coarse to fine and classified as GW, GM, GP-GM, GW-GM, SW, SM, SP-SM, or SW-SM, according to Unified Soil Classification System. It shall be free of vegetation, organics, debris, trash, concrete, old pavements, and particles larger than three (3) inches in maximum dimension. It shall be non-expansive with between 8 and 20 percent passing a U.S. No. 200 standard sieve, a California Bearing Ratio (CBR) value of at least 15, a CBR swell of one percent (1%) or less after 4 days of soaking, and a plasticity index of less than 10.
- G. Imported material for trench backfill shall conform to DPW Standard Specifications, Section 30 - Select Borrow for Subbase Course. It shall also have a plasticity index of 10 or less.
- H. All trench backfill and imported materials shall be checked and tested by a qualified geotechnical engineer before they are used in backfills at the site. All material to be used as trench backfill shall be approved by the Engineer. If in the opinion of the Engineer that the Contractor's proposed backfill do not meet the material requirements specified herein, the Contractor shall resubmit and provide material test results that meet the material requirements of this project.

2.2 FILTER FABRIC

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.
- B. The woven fabric for pipeline trenches and manhole subgrades and beneath gravel walkways and ingress/egress pad shall be MIRAFI 500X or an acceptable equivalent. The fabric shall meet the following minimum physical requirements:

Fabric Property	Test Method	Unit	Min. Avg. Roll Value
Grab Tensile Strength	ASTM D-4632	lb	200
Grab Tensile Elongation, MD/CD	ASTM D-4632	%	15/10
Trapezoid Tear Strength	ASTM D-4533	lb	75
CBR Puncture Strength	ASTM D-6241	lb	700
Apparent Opening Size (AOS)	ASTM D-4751	US Sieve	40
Permittivity	ASTM D-4491	sec ⁻¹	0.05
Flow Rate	ASTM D-4491	gal/min/ft ²	4
UV Resistance (at 500 hours)	ASTM D-4355	% strength retained	70

- C. Any request to substitute an equivalent filter fabric shall be subject to review and approval by the Engineer.
- D. The fabric shall be kept in a dry location and shall be protected from the direct rays of the sun.

2.3 OTHER MATERIALS

Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Prior to trenching for new utility lines and manholes within existing paved areas, the areas along the proposed utility alignment should be prepared by saw-cutting and removing the existing pavements. All old pavements shall be demolished and removed off-site by the Contractor at his own expense in compliance with all regulatory agency requirements.
- B. Prior to trenching and excavating for the new utility lines and manhole installations, the as-built conditions of all underground utilities and structures, including mains and laterals, should be field verified to check on their locations and depths.
- C. The location of the existing utilities shown on the Plans is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall scan the project site with electromagnetic and

sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

- D. Any existing underground utilities and structures that may interfere with the new utility lines shall be removed and/or relocated, if still in use. The remaining portions of any lines to be abandoned and left in-place shall be properly cut and plugged.

3.2 PROCEDURES

A. Utilities:

1. Unless shown to be removed, protect lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the State.
2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the State.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.

- B. Shoring: Adequate shoring and bracing should be provided by the Contractor in accordance with U.S. Department of Labor Occupational Safety and Health Administration guidelines and other governmental regulations for the utility trenches and other similar deep excavations.

C. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect buildings, structures, embankments, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

- D. Blasting for excavation is not permitted.

- E. During the period of construction, the Contractor shall protect the public against mud, dust and similar nuisances and shall take steps to abate such nuisances.
- F. Convenient access to buildings along the line of work shall be maintained and temporary approaches shall be provided and kept in order. Temporary bridges for pedestrian traffic shall have handrails securely fastened to them. Handrails shall be free from any projecting nails, splinters, and rough edges.
- G. Temporary storage of excavated material shall be done in such a manner as not to obstruct traffic. Storage of excavated or backfill materials in the stream is not allowed. Whenever, in the opinion of the Engineer, proper storage of excavated material cannot be made, the material shall be hauled away from the work site. If the excavated material meets the requirements for backfill material and proper storage cannot be made at the site, the material shall be stockpiled at approved locations for later use in backfill.
- H. Surplus Material:

Unless otherwise specified in the Plans or Specifications, or ordered by the Engineer, surplus excavated material shall become the Contractor's property and shall be removed from the work site and disposed of at no cost to the State.

3.3 BACKFILLING

A. General

1. All backfill material shall be placed by hand or by approved mechanical methods. The compaction of backfill material shall be done by tamping with hand tools or other suitable equipment such as pneumatic tampers or vibratory compactors. The method of compaction shall be approved by the Engineer and all compaction shall be done to the satisfaction of the Engineer.
2. When removal of unsuitable excavated material creates a shortage of backfill material, the Contractor shall, at no cost to the State, furnish material as specified in this Section in the amount required to complete the backfill.
3. The bottom of trenches shall be accurately graded to provide uniform bearing and support for the pipes. Compact the bottom of the trench excavation to provide a firm bottom and to check for yielding or soft areas. Excavate yielding or soft areas to firm soils and replace with structural fill as specified in Section 02200 - EARTHWORK. Line the trench with woven geotextile fabric. Overlap fabric at least 24 inches along joints.
4. Where soft or unsuitable material is encountered in the bottom of the trench, remove such material and replaced with properly compacted structural fill.
5. Ensure that no damage is done to the pipes, structures, or their protective coatings.

B. Trench Backfill:

1. All bedding material shall be wrapped in a geotextile filter fabric. Bring up bedding material evenly on both sides of the pipes for the full length of the pipe. Bedding material shall be compacted with suitable compaction equipment to a dense consistency as evident by little to no settlement of the gravel under repeated passes with the compaction equipment, but not less than 5 passes per lift. Use hand operated, plate type, or other suitable hand tampers for compaction of bedding. If necessary, alter, change or modify equipment or compaction method or procedures to meet specified compaction requirements without damaging pipes.
2. The general backfill shall be placed in maximum horizontal loose lift of 8 inches or less, moisture conditioned to between optimum moisture content and 3 percent wet of the optimum moisture content, and compacted to at least 90 % of the maximum dry density as determined by ASTM D1557 test method. For portions of utilities that may be under pavement, the backfill below the pavement shall consist of base course, subbase course, and structural fill, placed and compacted as specified in these Specifications.
3. The Contractor shall reconstruct the base course and pavement of roadway damaged by the construction of the pipeline as covered elsewhere in these Specifications.
4. Other improvements such as driveways, sidewalks, curbs, gutters, stonewalls, fences and other structures damaged during construction shall be replaced or repaired to their original condition or better as approved by the Engineer.

3.4 FIELD QUALITY CONTROL

A. The Engineer will inspect and approve open cuts and trenches before installation of pipeline or structures, and will make the following tests:

1. Assure that trenches are not backfilled until all tests have been completed;
2. Check bedding for proper layer thickness and compaction;
3. Test bedding and general backfill material for ASTM D2487 gradation limits. Test general backfill material for ASTM D1557 for moisture density relations and ASTM D1883 for CBR. Perform new set of test for any source change.
4. Field Density testing shall be performed on each lift of drain line backfill that is located outside of the segmental retaining wall. Perform field density and moisture content test in accordance with ASTM D 1556, or ASTM D 6938. Testing shall be performed at a frequency of one test for every 25 linear feet, or fraction thereof, of utility installation, but not less than one test per lift. When test results indicate inadequate compaction, the material shall be recompacted and retested to meet specification requirements. Submit a plan showing test locations, test numbers, test elevations, and test results within 3 days of test date.

5. Assure that defective work is removed and properly replaced.

END OF SECTION

SECTION 02281

SOIL TREATMENT FOR TERMITE CONTROL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Soil treatment for termite control consists of application of termiticide chemicals to exposed soil and to voids in construction where insects may gain entry to the building.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit to the Engineer for acceptance copies of the label for the chemical proposed for use.
- C. Material Safety Data Sheets (MSDS): Submit MSDS for all products and keep one posted at the project site.
- D. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Soil shall be treated against subterranean termites by a pest control operator licensed by the Hawaii State Pest Control Board in Branch #3 and certified as a commercial applicator under the Hawaii Pesticide Law by the Hawaii State Department of Agriculture in category 7b.
- B. The Contractor shall notify the Engineer at least one day before application of chemicals.
- C. A totalizing meter shall be provided to determine application rates and to indicate the total volume of pesticide applied in U.S. gallons. The meter shall be no more than 5-feet from the applicator at all times.
- D. Pumping equipment shall be a type normally used and be capable of pumping the working solution in a manner accepted and practiced by the pest control industry.
- E. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.4 WARRANTY

The Contractor shall furnish a written warranty in 3 copies to the State stating that:

1. The termiticide applied complies with the concentration, rates, and method of application as directed by the EPA approved label and these specifications;
2. The effectiveness of the treatment is warranted for a period of not less than 2 years from the date of final application of the treatment;
3. All necessary repairs of damages resulting from subterranean termite infestation within a period of 2 years from the date of project acceptance will be made at the Contractor's own expense up to a total cost of \$5,000.00; and
4. If subterranean termite infestation should occur through the treated area within the 2 year warranty period, the soil shall be re-treated to exterminate all infestation without cost to the State as stipulated below. The treatment shall be made according to and in full compliance with the EPA approved label of the termiticide being used. All corrective treatments shall be performed to at least 10-feet around each visible subterranean termite activity.
 - a. Working pressure while applying treating solution shall be held to that which is applicable to and safe under the conditions at the site being treated.
 - b. Drill one hole per block along one course above adjacent grade of hollow tile walls which extend below grade, and treat at a rate consistent with the pesticide label.
 - c. Remove carpets from areas being treated.
 - d. Drill and treat through all interior concrete floors, along both sides of all partitions and walls, and all cracks and expansion joints according to label directions. Drill holes through concrete slab shall be 1/2-inch or 9/16-inch diameter and spaced not more than 12 to 16-inches apart.
 - e. Drill one hole at each plumbing or utility penetration through ground floor slab and treat according to label instructions.
 - f. Patch drill holes with cement/concrete to full depth of slab thickness and refinish walls/floors as necessary to prevent any backflow and to restore original appearance.
 - g. Re-install carpets as applicable / necessary. Installation shall be done by a competent commercial carpet installer.

- h. Replace any materials which are contaminated by spilled chemicals.
- 5. The above-ground areas infested with subterranean termites shall be treated as appropriate with an EPA approved insecticide to eliminate those termites.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver pesticides to the project site in sealed and labeled containers in good condition as supplied by the manufacturer or formulator. Store, handle, and use pesticides in accordance with manufacturer's labels. Labels shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label. The selected termiticide shall be suitable for the soil and climate conditions at the project site.
- B. Chemicals shall be aqueous solutions of Type I repellent termiticides such as Prelude, Dragnet SFR, Demon TC, or Prevail FT or the Type II non-repellant termiticide Premise 75. The chemicals shall be used in accordance with all local laws, ICC IBC as amended, and the labels and provisions related to the use of those pesticides as adopted by the Hawaii Pesticide Law, Chapter 149A, HRS, and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Organophosphate termiticides such as Dursban TC (chlorpyrifos) shall not be used.

PART 3 - EXECUTION

3.1 APPLICATION

- A. The solution shall be applied uniformly and at the maximum rates permitted on the label for the chemical being used.
- B. Treatment shall include the provision of vertical barriers as stated on the product label, including the creation of a vertical barrier around the slab's outer perimeter after the establishment of the final grade. Treatment shall extend down to the top of the footing.

- C. Whenever possible, the solution shall be applied not more than 24 hours before the pouring of concrete over the affected area. The treated areas shall be completely covered by a moisture barrier in the event of rainfall following treatment but prior to the pouring of the concrete.
- D. Where a treated area that is not scheduled to be covered with a moisture barrier in the finished construction (e.g. lanai area) cannot be covered with a poured concrete slab the same day, the area shall be protected with a waterproofing covering such as polyethylene sheeting.
- E. The solution under slabs shall be applied after backfill has been completed and rough plumbing and other utility lines have been installed and just prior to the placement of the moisture barrier. Clear all cellulose debris, including wood scraps from areas beneath the structure. The treatment shall be applied to dry compacted material whenever possible, but in any case shall not be applied under conditions during which the soil does not readily absorb the solution.
- F. Treat voids in masonry and similar construction.
- G. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- H. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- I. Post warning signs in areas of application.
- J. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.2 CLEAN UP

Do not allow chemicals to remain at the project site whenever the Contractor is not present at the site. Remove chemical spills and other applications exceeding label requirements as recommended by the manufacturer and as directed by the Engineer at no additional cost to the State.

END OF SECTION

SECTION 02362

SOIL TREATMENT FOR VEGETATION CONTROL

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials and equipment necessary placing or spraying weed killer on the prepared pavement subgrade within Maui Office Annex site prior to the installation of the wearing course.
- B. Related Sections include the following:
 - 1. Section 02100 – SITE PREPARATION.
 - 2. Section 02512 – ASPHALTIC CONCRETE PAVEMENT.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
 - 1. Product Data:
 - a. Treatments.
 - b. Application instructions.
 - c. Copies of the EPA-registered labels for all chemicals.
 - d. Product Data: Material Safety Data Sheets.
 - 2. Product Certificates: Signed by manufacturers of weed killer products certifying that treatments furnished comply with requirements.

PART 2 – PRODUCTS

2.1 MATERIALS

Weed Killer shall be “Casoron 4G”, “Norosac 4G”, or an approved equal for under asphalt application on new pavement.

PART 3 – EXECUTION

3.1 APPLICATION

- A. Mix the under-asphalt weed killer and uniformly spread using calibrated application equipment at the maximum rates permit for under asphalt use.
- B. Retreat nut grass and weeds two (2) days after initial application and again if growth still exists.
- C. Notify the Engineer 24 hours before application of weed killer.

END OF SECTION

SECTION 02370

SEDIMENT AND EROSION CONTROL

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. The work to be performed under this section shall include furnishing all labor, materials and equipment necessary for the installation and maintenance of the construction sediment and erosion control measures.
- B. All erosion and sediment control measures shall comply with the State Department of Health regulations and Maui County Code 20.08 – Soil Erosion and Sedimentation Control.
- C. All erosion and sediment control measures are to be placed prior to any disturbance caused by grading and or excavation.
- D. The Contractor shall ensure that erosion and sediment control measures are implemented and maintained as necessary.
- E. Related Sections include the following:
 - 1. Section 02050 – DEMOLITION
 - 2. Section 02200 – EARTHWORK

PART 2 – PRODUCTS

2.1 MATERIAL

- A. Filter Sock:
 - 1. Composite Filter Media: Sanitized, mature compost with no identifiable feedstock constituents or offensive odors meeting all local, state, and Federal quality requirements. Biosolids compost shall meet the Standards for Class A Biosolids outlined in 40 Code of Federal Regulations (CFR) Part 503.
 - 2. Compost used for filtration shall meet the following parameters:

Parameter	Unit	Value
pH:		6 - 8
Moisture Content:	%, wet weight	30 - 60
Organic Matter:	%, dry weight	25 - 65
Particle Size:	% passing mesh size, dry weight	2 in. = 100% 0.375 in. = 10 - 30%
Stability (CO ₂ Rate):	Mg CO ₂ -C per gram of organic matter per day	< 8
Physical Contaminants (Manmade Inerts):	%, dry weight	< 1

3. Filter Sock: Filter sock shall utilize an outer layer of filtration mesh, and an inner layer of containment netting. All layers shall collectively enclose the compost filtration media. Filter sock shall be 12" nominal diameters or as indicated on the Drawings.
4. Wood Anchor Stakes: Wood anchor stakes shall have a nominal classification of 3/4" by 3/4" and a minimum length of 24 inches. Contractor shall not use rebar or other metal rods

B. Filter Fabric:

1. The woven geotextile fabric for sediment and erosion control shall be MIRAFI 140N or an acceptable equivalent. The fabric shall meet the following minimum physical requirements:

Fabric Property	Test Method	Unit	Min. Avg. Roll Value
Grab Tensile Strength	ASTM D-4632	lb	120
Grab Tensile Elongation, MD/CD	ASTM D-4632	%	50/50
Trapezoid Tear Strength, MD/CD	ASTM D-4533	lb	50/50
CBR Puncture Strength	ASTM D-6241	lb	310
Apparent Opening Size (AOS)	ASTM D-4751	US Sieve	70
Permittivity	ASTM D-4491	sec ⁻¹	1.7
Flow Rate	ASTM D-4491	gal/min/ft ²	135
UV Resistance (at 500 hours)	ASTM D-4355	% strength retained	70

2. Any request to substitute an equivalent filter fabric shall be subject to review and approval by the Engineer.

3. The fabric shall be kept in a dry location and shall be protected from the direct rays of the sun.

PART 3 – EXECUTION

3.1 CONSTRUCTION

- A. Prior to starting any construction, the Contractor shall install the sediment control measures at the construction limits as indicated on the plans and per manufacturer’s specifications to prevent silt and debris from leaving the project site.
- B. An ingress/egress aisle shall be provided to prevent any mud, dirt, rock or sediment from being tracked onto public roadways. The ingress/egress aisle is to be underlain by filter fabric.
- C. Install temporary berms, cut-off ditches and other provisions needed for construction methods and operations. Should there be a question if the temporary measures are insufficient to prevent erosion, the Engineer shall make the final determination.
- D. Temporary seeding shall be placed on exposed surfaces that will not be brought to final grading or permanent cover treatment within 30 days of the exposure to reduce erosion and sedimentation by stabilizing exposed soils. Seeded areas shall be checked regularly for bare spots, washouts, and healthy growth to assure that a good stand of grass is being maintained. Reseed areas that fail to establish vegetation cover as soon as such areas are identified.
- E. Filter Socks:
 1. Overlap: Where multiple sections of filter socks are required to form a continuous run, the sections shall have a minimum overlap of 12 inches.
 2. Anchoring: The filter sock shall be anchored, as required, using wooden stakes to a minimum depth of 12 inches or as determined to attain an effective anchoring. Finished height of the wooden anchor stake installation shall not exceed 1 inch above the height of the filter sock. Wooden anchor stakes shall be installed according to the following:

Slope Gradient	Anchor Spacing
< 4:1	Not Required
4:1 to 3:1	10’ O.C.
> 3:1 to 2:1	5’ to 10’ O.C.
> 2:1	5’ O.C.

3.2 MAINTENANCE

- A. Sediment control measures shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

- B. Filter socks shall be inspected for depth of sediment, tears, and to see if the device is securely anchored. Any deficiencies shall be repaired immediately.
- C. Should the any portion of the filter sock decompose or become ineffective prior to the end of the expected usable life and the measure is still necessary, the ineffective portion shall be replaced promptly at no additional cost to the State.
- D. Sediment deposits on a filter sock shall be removed after each storm event and/or when deposits reach approximately 2/3 the height of the barrier or when the sediments limit or prevent the flow of water through the filter sock.
- E. Any sediment deposits remaining in place after the filter sock is no longer required shall be graded to conform to the existing grade, prepared, and seeded.
- F. Upon completion of the project the Contractor shall remove all sediment control measures from the Site.

3.3 CONFORMANCE

Failure to conform to the above requirements and regulations will be cause for temporary or permanent suspension of operations. If operations are suspended due to the Contractor's failure to conform, the Contractor shall maintain the project during the period of suspension at no cost to the State.

END OF SECTION

SECTION 02500

CONCRETE CURBS AND SIDEWALKS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials and equipment necessary for the installation of concrete sidewalks, curbs, headers, and curb and gutters as indicated on the drawings and as specified within.
- B. Related Sections include the following:

Section 03300 – CAST-IN-PLACE CONCRETE

1.2 SUBMITTALS

- A. Submit in accordance with Section 01330 – SUBMITTAL PROCEDURES.
- B. Certificates
 - 1. The Contractor shall furnish to the Engineer affidavits from the manufacturers or supplier's certifying that types of materials being supplied meet the requirements of these specifications.
 - 2. The Contractor shall furnish to the Engineer affidavits from the concrete supplier certifying that the approved synthetic fiber reinforcement materials at the rate of 5 lbs. per cubic yard were added to each batch of concrete to be used for concrete sidewalks delivered to the project site.
- C. Design Mixtures: Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Field quality-control test and inspection reports.

PART 2 – PRODUCTS

2.1 MATERIAL

- A. Materials for concrete curbs and headers on DLNR Maui Office Annex site, and curb and gutter and concrete sidewalk in Mahalani Street (owned by County of Maui) shall be constructed in accordance with the below-listed sections of the "Standard Specifications for Public Works Construction", September 1986, of the Department of Public Works, including all revisions, as applicable to the County of Maui, hereafter referred to as the

STANDARD SPECIFICATIONS, shall govern all work except for the subsections of Measurement and Payment which shall not be applicable.

1. Section 29 – Subgrade.
 2. Section 30 – Select Borrow for Subbase Course.
 3. Section 31 – Aggregate Base Course.
 4. Section 37 – Portland Cement Concrete Pavement.
 5. Section 38 – Restoring Pavements and Other Improvements
 6. Section 39 – Portland Cement Concrete.
 7. Section 41 – Concrete Curb and Gutter.
 8. Section 42 – Concrete Sidewalks.
 9. Section 48 – Reinforcing Steel.
- B. Material for concrete sidewalk on DLNR Maui Office Annex site shall conform to the above STANDARDS SPECIFICATION sections, with the following exceptions:
1. Concrete shall have a compressive strength (28 Days) of 3000 psi.
 2. Concrete mix shall contain Synthetic Fiber Reinforcement.
 - i. Fibrillated polypropylene fibers engineered and designed for use in concrete, complying with ASTM C1116 Type III. Average Residual Strength as tested per ASTM C1399 shall be not less than 200 psi.
 - ii. Physical Characteristics
 1. Tensile strength: 86-110 ksi.
 2. Fiber lengths: 2 ¼ inches.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The Contractor shall stake out area of new curbs and sidewalks using wooden stakes on which final finish elevations, base course and subgrade elevations are clearly marked. All such stakes and elevations shall be approved by the Engineer before any work is done.

- B. Concrete Pavement and Sidewalk Curbs: Installation shall be in accordance with the applicable sections noted hereinbefore and as shown on the Drawings.
- C. Concrete Sidewalks and Pavement Repair: Any existing concrete pavements that have been damaged by construction activities shall be repaired to the original condition and to the satisfaction of the Engineer.

3.2 FINAL INSPECTION

At the time of final inspection of the work performed under the Contract, the work covered by this Section shall be complete in every respect and operating as designed. All surplus materials of every character, resulting from the work of this Section, shall have been removed. Any defects discovered in the work, subsequent to this inspection, shall be corrected prior to final acceptance.

END OF SECTION

SECTION 02510

WATER DISTRIBUTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The work included in this section shall consist of furnishing all labor, materials, equipment, tools and incidentals necessary to install exterior water system as indicated on the Plans and specified herein. Work shall be governed by "Water System Standards, 2002," Department of Water Supply, County of Maui, hereafter referred to as the "DWS Standards".
- B. Related Sections include the following:

Section 02225 – TRENCHING AND BACKFILLING.

1.2 REFERENCE CONSTRUCTION STANDARDS

Board of Water Supply, "Water System Standards, State of Hawaii 2002", and the "Water System External Corrosion Control Standards," Volume 3, dated 1991, hereinafter referred to as "DWS Standards."

1.3 SUBMITTALS

- A. Product Data
 - 1. Water service line piping, fittings, joints, valves, and couplings.
 - 2. Backflow preventer.
 - 3. Valve boxes.
- B. Certificates: The Contractor shall furnish to the Engineer affidavits from the manufacturers of pipe, pipe coating, fittings, and valves, furnished and installed under this Section certifying that such materials delivered to the project conform to the requirements of this Section. Certificate of disinfection shall also be submitted to the Engineer.
- C. Shop Drawings: Shop Drawings shall be submitted as specified in the DWS Standards.
- D. Warranty: The Contractor shall furnish to the Engineer warranties from the manufacturers of pipe and fittings furnished and installed under this Section.

1.4 DWS CHARGES

Department of Water Supply Water System Development Fee, connection and installation fees, inspection charges, and charges for other required work by DWS shall be paid by the Contractor using Allowances as listed in the Offer.

1.5 DISRUPTION OF SERVICE

- A. Contractor shall perform work in this section in a method as to minimize the duration of water service disruptions.
- B. Contractor shall not disrupt service to the Wailuku Health Center during the normal work week. If work must be performed during the work week, the Contractor shall provide an alternative potable water service to the Wailuku Health Center at no additional cost to the State. Water service disruption would be acceptable for a short duration of four (4) hours maximum on the weekend or holiday.

1.6 NOTIFICATION

- A. The Contractor shall notify and coordinate any connection or temporary service disruption with the Department of Water Supply personnel and the Engineer at least 30 days in advance of Work.
- B. The Contractor shall further notify neighboring residents and the fire department of any water service disruptions initially at least 10 working days in advance and again at least 24 hours in advance.
- C. The Contractor shall notify the State of Hawaii Department of Health, John Messina at (808) 586-4560, and the Wailuku Health Center at least 30 days in advance of any Work on the Wailuku Health Center property, of any anticipated water service disruption, and of alternative water service provisions as necessary.

1.7 PRODUCT HANDLING

- A. Delivery: Handle pipe carefully to ensure delivery at the project site in sound, undamaged condition. The Engineer will reject damaged pipe on site. Contractor shall replace damaged pipe at no additional expense to the State.
- B. Storage: Do not store materials directly on the ground. Adequately support piping to prevent warpage. Use protective covers where pipe may be damaged by direct sunlight.

1.8 GUARANTEE

The equipment covered by these specifications shall be guaranteed against defective parts due to faulty material or workmanship for one (1) year after date of acceptance of project. The Contractor shall guarantee to replace all defective parts within the period of time specified. All costs for the replacement of defective parts including the removal and reinstallation of the pump shall be paid for by the Contractor at no cost to the State. The

guarantee shall be in writing and shall be submitted to the Engineer prior to the completion of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials for Water Distribution System: In accordance with the appropriate sections of the DWS Standards, except as amended in the drawings and/or revised specifications herewith. Paragraph concerning Measurements and Payments in the Sections are not applicable to this project.

1. Ductile Iron Pipe, Fittings and Appurtenances Section 202.
2. Valves and Appurtenances Section 205.
3. Hydrant and Appurtenances Section 206.
4. Meter Box and Valve Box Covers and Frames Section 207.
5. Service Laterals and Appurtenances Section 208.
6. Backflow Prevention Assemblies: Reduced Pressure Principle
Section 305.

PART 3 - EXECUTION

3.1 LOCATION AND ADJUSTMENTS OF EXISTING UTILITY LINES

- A. The Contractor shall be responsible for precisely laying out the various exterior utility lines shown on the Contract Drawings or as provided elsewhere in these Specifications. The location shown on the Contract Drawings of the various existing utility lines, which the new lines are to cross over or under or connect to where determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the Contract Drawings. The Contractor shall field verify the location of the existing utilities prior to the start of construction, and shall notify the engineer of any discrepancies or problems.
- B. In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor' operations shall be immediately repaired and restored as directed by the Engineer at the Contractor's expense.

3.2 INSTALLATION

A. Water Distribution System: Installation shall be in accordance with the appropriate sections of Division 300 of the Water System Standards as listed below:

1.	General Construction Requirements	Section 302.01
2.	Trench Excavation	Section 302.02
3.	Trench Backfill	Section 302.03
4.	Ductile Iron Pipe	Section 302.12
5.	Fittings and Specials for Ductile Iron Pipe	Section 302.15
6.	Gate Valves	Section 302.16
7.	Service Laterals, Connections and Pipes	Section 302.18
8.	Meter Boxes	Section 302.19
9.	Fire Hydrants	Section 302.20
10.	Fire Hydrant Markers	Section 302.21
11.	Concrete Blocks, Meter Boxes and Valve Box Collar	Section 302.22
12.	Valve Boxes	Section 302.24
13.	Pipe Cleaning	Section 302.27
14.	Pipe Pressure Tests	Section 302.28
15.	Chlorination of Water Pipelines	Section 302.29
16.	Backflow Prevention Assemblies	Section 305

B. Connecting, Testing, Flushing and Disinfection: Install but do not connect new lines until pressure testing is completed. Pressure testing, flushing of valves and mains, disinfection of the system shall be carried out in accordance with the DWS Standards. Supply and install any additional fittings of a temporary nature required for the purpose of working such tests.

C. The Contractor shall submit the results of such test to the Engineer for approval. All charges for services by the Department of Water Supply shall be paid for by the Contractor.

3.3 FINAL INSPECTION

- A. Process: At the time of final inspection of the work performed under the contract, the utilities covered by this Section shall be complete in every respect and operating as designed. Remove all surplus materials of every character resulting from the work of this Section. Correct any defects discovered in the utilities subsequent to this inspection prior to final acceptance.
- B. Coordination: Coordinate Inspection of work within the State Right-of-Way with Department of Water Supply Inspector.

END OF SECTION

SECTION 02530

SANITARY SEWERAGE

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials, tools and equipment necessary for installation of sewer system, including connection to existing sewer manhole, gravity sewer lines, new sewer manhole, sewer lateral and cleanouts as indicated on drawings and as specified herein.
- B. Related Sections include the following:
 - 1. Section 02300 – EARTHWORK.
 - 2. Section 02320 – TRENCHING AND BACKFILLING.

1.2 REFERENCES

The “STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION”, dated September 1986, as revised, except as amended in the plans and/or specifications herewith, of the Department of Public Works, as applicable to the County of Maui, hereafter referred to as the “DPW Standard Specifications”, or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.)

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Certificates: Furnish copies of certificates from the manufacturers of pipe, pipe section, fittings, etc. furnished and installed under this section verifying that such materials delivered to the project conform to the requirements of this specification.

1.4 PRODUCT HANDLING

- A. Delivery: Handle pipe carefully to ensure delivery at the project site in sound, undamaged condition. The Engineer will reject damaged pipe on site. Contractor shall replace damaged pipe at no additional expense to the State.
- B. Storage: Do not store materials directly on the ground. Adequately support piping to prevent warpage. Use protective covers where pipe may be damaged by direct sunlight.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Materials for sanitary sewerage shall be in accordance the below-listed sections of the DPW Standard Specifications, including all revisions, and shall govern all work except for the subsections of Measurement and Payment which shall not be applicable.
1. PVC Sewer Pipe and Appurtenances Section 21
 2. Sewer Manholes Section 23

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Location and Adjustment of Existing Utility Lines:
1. Precisely lay out the various exterior utility lines shown on the contract drawings as provided elsewhere in these specifications. Locations shown on the drawings of the various existing utility lines which the new lines are to cross over or under or connect to, were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract drawings. Contractor shall tone the area prior to excavation and trenching.
 2. In performing all work, exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility line. Immediately repair and restore any damage inflicted on existing lines resulting from the Contractor's operations as directed by the Engineer at the Contractor's expense.
- B. The Contractor shall visually inspect and test all pipes and appurtenances prior to their installation and shall assume full responsibility for the soundness of the pipes and appurtenances installed.
- C. Cleaning: As work progresses, clear the pipe interior of dirt and other debris by keeping swabs in the pipe and pulling them forward past each completed joint.
- D. Pipe Cutting: Cutting for closure or other reasons shall be done neatly by methods recommended by the manufacturer. Sharp edges shall be smoothed to prevent gasket damage.
- E. Excavation and Backfill:
1. Trench excavation and backfill for the laying and installation of sewer pipes to the required line and grade and structure excavation for the construction of the appurtenant structures shall be governed by Section 02300 – EARTHWORK and Section 02320 – TRENCHING AND BACKFILLING.

2. Use surplus material resulting from trench and structure excavation for backfilling, filling and grading to the extent required as specified elsewhere in these specifications. In performing any work within the contract zone shown on the contract drawings, exercise due care to keep to an absolute minimum any damages to existing improvements, including plants and shrubs. Repair, replace and/or restore all damages to existing improvements to the satisfaction of the Engineer.
- F. Jointing: Clean gaskets and seats of foreign materials prior to joint assembly. Apply lubricant as recommended by the pipe manufacturer.
1. Push-On Joint: Carefully insert the spigot end into the bell to prevent entry of dirt and incorrect entry angle. With suitable fork tool, crowbar, or by hand, make the joint to the insertion depth recommended by the manufacturer. When the selected pipe uses joints not designed for full depth insertion, prevent further closure of previously completed joints by restraining movement of the installed line while making succeeding joints
 2. Mechanical Joint: Carefully center the spigot in the bell and position the gasket evenly in the seat. Tighten bolts alternately to an even torque, causing the follower gland to expand the gasket uniformly for a tight seal.
- G. The Contractor shall be responsible for precisely laying out the sewer lines and appurtenances as shown on the Plans.
- H. The Contractor shall exercise due care and caution necessary to avoid any damage to existing utilities. Any damage caused by the Contractor's operations shall be paid for by the Contractor at no expense to the State.
- I. Final Pipe Cleaning: Prior to testing, clean all lines to be tested by high pressure water jet or mechanical means. Remove and dispose of fluidized materials as approved.
- J. Testing of the sewer lines shall be in accordance with the DPW Standards.
- K. Any pipe or appurtenance that has been installed and proven defective shall be removed and replaced by the Contractor at no additional cost to the State.

3.2 FINAL INSPECTION

At the time of final inspection of the work performed under the contract, the utilities covered by this Section shall be complete in every respect and operating as designed. Remove all surplus materials of every character resulting from the work of this Section. Sanitary sewer system shall be free from sand, silt, or other obstructions. Correct any defects discovered in the utilities subsequent to this inspection prior to final acceptance.

END OF SECTION

SECTION 02577

PAVEMENT MARKINGS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

Furnish all labor, materials and equipment necessary to provide pavement markers, striping and markings as indicated on the drawings and as specified herein.

1.2 REFERENCES

The “HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION”, dated 2005, as revised, of the State of Hawaii Department of Transportation, hereafter referred to as the “State DOT Standard Specifications”, or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.)

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Product Data: Material Safety Data Sheets.
- C. Product Certificates: Certificates from manufacturers or supplier’s to verify that types of materials being supplied meet the requirements of these specifications.

1.4 DELIVERY AND STORAGE

Deliver paints and paint material in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site for maintaining materials at temperature recommended by the manufacturer.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. The State DOT Standard Specifications shall govern all work in this section except for subsections on Measurement and Payment which shall not be applicable.
- B. Paint shall be in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer’s formulation number and directions, and name of the manufacturer, all of which shall be plainly legible at the time of use.

- C. The paint shall be homogeneous, easily stirred to a smooth consistency, and shall show no hard settlement or other objectionable characteristics.
- D. Paint shall conform to the State DOT Standard Specifications Section 708 – Paints and Section 755 – Pavement Marking Materials.
- E. Pavement Markings shall include, but not limited to, striping, letters, numbers and raised pavement markers.
- F. Pavement Markers shall conform to the State DOT Standard Specifications Section 632 - Markers.

2.2 EQUIPMENT

- A. All equipment, tools and machinery used in the performance of the work covered by this section of the specifications shall be suitable for pavement markings installation and removal, and shall be maintained in satisfactory operating condition at all times.
 - 1. Paint Applicator
 - a. The equipment for applying paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall be capable of applying the stripe widths indicated on the drawings, shall have a speed during application of not less than five miles per hour, and shall be capable of applying the paint at the coverage rate specified hereinafter and at an even uniform thickness with clear-cut edges.
 - b. The paint applicators shall have a paint reservoir of sufficient capacity and suitable gages to apply paint as specified herein. The reservoirs shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gages in full view and reach of the operator.
 - c. Paint strainers shall be installed in the paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media.
 - 2. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

- A. Bituminous Pavements: New asphalt concrete pavement shall be allowed to cure for a period of not less than seven days before the application of marking materials unless directed otherwise by the Engineer.
- B. Dust, clay, silt and sand shall be removed from the pavement to be marked before application of paint by sweeping, blow with compressed air, rinsing with water or a combination of these methods as required.
- C. Rubber deposits, surface laitance and other substances adhering to the pavement shall be removed with stiff brooms, scrapers, wire brushes, sandblasting or mechanical abrasion.
- D. Marker adhesives and paints shall not be applied when moisture or foreign matter is present on the pavement surface or when wind conditions are such as to cause dust to be deposited on the prepared areas or to prevent satisfactory application of the paint.

3.2 INSTALLATION

- A. Installation of pavement striping and markings shall be in accordance with of the State DOT Standard Specifications Section 629 – Pavement Markers.
- B. Installation of pavement markers shall be in accordance with the State DOT Standard Specifications Section 632 – Markers.

3.3 CONTROL POINTS

The Contractor shall establish and space control points, satisfactory to the Construction Manager, at intervals that will ensure accurate location of pavement markings.

3.4 TRAFFIC CONTROL

- A. The Contractor shall furnish, install and maintain suitable warning and directional signs, barricades and other traffic control devices near the beginning and well ahead of the work site.
- B. Traffic control devices shall be placed along the newly painted lines to control traffic and to prevent damage to the newly painted surfaces.

3.5 INSPECTION AND ACCEPTANCE

- A. Pavement markings shall be subject to rigid inspection at all times and provisions of this specification will be strictly enforced.

- B. Painting will not commence in any area until pavement surfaces have been inspected and the Engineer's approval is given to the Contractor to proceed. Such approval will be obtained each day and after periods of precipitation.
- C. If the Engineer determines that the painted markings have not dried sufficiently in 90 minutes, painting shall be discontinued until the cause of slow drying is determined and corrected.
- D. Areas found to be deficient in accordance with this specification will be rejected and complete replacement or repainting will be required.
- E. Completed work will meet the Engineer approval in all respects. Final acceptance will be contingent upon conformance with specification requirements outlined in this specification.

3.6 PROTECTION OF WORK

- A. Newly painted surfaces will be protected from damage by vehicles during the time required for paint to harden sufficiently to withstand traffic.
- B. During periods of high winds, painting will be discontinued.
- C. Any damage to newly painted markings due to Contractor's failure to provide adequate protection will be repaired by him at no additional cost to the State.

3.7 CLEANING

- A. Any spilled paints will be cleaned from the paved areas to the satisfaction of the Engineer.
- B. The Contractor will keep the premises clean at all times. Paint, empty containers, and other material or equipment will not be stored or allowed to accumulate on or near the paved areas.

END OF SECTION

SECTION 02630

STORM DRAINAGE SYSTEM

PART I - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials, tools, equipment and related necessary to complete, in place, and ready for use, drainage improvements in conformity with the dimensions, profiles, sections, and details shown on the plans. Drainage improvements include trench drain, area drains, cleanouts, polyvinyl chlorine pipes and fittings, drywells and infiltration chambers.
- B. Related Sections include the following:
 - 1. Section 02225 – TRENCHING AND BACKFILLING.
 - 2. Section 03300 – CAST-IN-PLACE CONCRETE.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Certificates: The Contractor shall furnish to the Engineer affidavits from the manufacturers of pipe, pipe coating, fittings, valves, catalog cuts, assembly and instruction manual, etc. for items furnished and installed under this section verifying that such materials delivered to the project conform to the requirements of this specification.
- C. Product data for various storm drainage system components.
- D. Shop Drawings: The Contractor shall submit shop drawings for acceptance by the Engineer before proceeding with the work. Submit shop drawings for the following:
 - 1. Precast concrete drywell rings.
 - 2. Precast drywell cover.

1.3 GUARANTEE

The equipment covered by these specifications shall be guaranteed against defective parts due to faulty material or workmanship for one (1) year after date of acceptance of project. The Contractor shall guarantee to replace all defective parts within the period of time specified. All costs for the replacement of defective parts including the removal and reinstallation of the pump shall be paid for by the Contractor at no cost to the State. The guarantee shall be in writing and shall be submitted to the Engineer prior to the completion of the project.

PART II - PRODUCTS

2.1 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

1. Unless otherwise shown on the plans, drain pipes and fittings 8-inches in diameter and smaller shall be smooth wall PVC pipe in conformance with ASTM D3034, SDR 35.
2. Portion of Infiltration Chamber Vent within the gravel bed shall be smooth wall fully-perforated 4-inch diameter PVC pipe in conformance with ASTM D3034, SDR 35.

B. Cleanouts: Cleanouts shall be provided as shown on the drawings, at the ends of the pipes and junctions and connections of pipelines, and/or directed by Engineer. Junction angles shall be no steeper than 45 degrees where cleanout pipes connect to the subdrain pipes. Cleanout risers shall be protected from damage during backfilling operations.

C. High-Density Polyethylene (HPDE) Pipe

1. Pipe and fittings, 12-inch to 60-inch, shall have a corrugated exterior with an integrally formed smooth interior conforming to the requirements of AASHTO M294 or ASTM F2306, Type S. The pipe shall have a full circular cross-section with annular corrugations. Pipe shall be produced to constant internal diameters.
2. The pipe shall have a bell-and-spigot joint meeting the watertight requirements of ASTM D3212 or shall be joined by a coupling band which provides a silt tight joint. Gaskets shall meet the requirements of ASTM F477.
3. Fitting shall conform to ASTM F2306 and meet joint performance indicated above for fitting connections.

D. Area Drain: Area drain structures shall be manufactured by NDS, Inc., 851 North Harvard Avenue, PO Box 339, Lindsay, California 93247; or approved equal.

E. Trench Drain

1. All components of the trench drain system shall be from one manufacturer.
2. The surface drainage system shall be ACO Drain S100K complete with heavy duty gratings secured with 'PowerLok' locking as manufactured by ACO Polymer Products, Inc. or approved equal.
3. The trench system bodies shall be manufactured from materials with minimum properties as follows:

Compressive strength: 14,000 psi; in accordance with ASTM C579
Flexural strength: 3,000 psi; in accordance with ASTM C78
Water absorption Not to exceed 1 %
Salt proof
Dilute acid and alkali resistant.

4. The nominal clear opening shall be 4.00" with overall width of 6.3". Pre-cast units shall be manufactured with a sloped channel and have a wall thickness of at least 0.67". Each unit will feature full radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring features on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface. The ductile iron edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least ¼" thick.
 5. Provide debris strainer for the 4-inch outlet opening inside of the trench drain channel. Debris strainer shall be specifically for the selected trench drain model and provided by the same manufacturer.
 6. Grates shall meet the requirements of Americans with Disabilities Act Accessibility Guidelines (ADAAG) 302.3 and shall be made of ductile iron to ASTM 536-84 – Grade 65-45-12. After removal of grates there shall be uninterrupted access to the trench to aid maintenance.
- F. Infiltration Trench: Infiltration trench shall be constructed as specified on the Drawings.
1. Drain Rock: Clean, washed 1 ½" to 3" crushed rock. Drain rock shall be free from organics or other deleterious material.
 2. Filter fabric: Non-woven geotextile fabric. Mirafi 140NL or approved equal.
 3. Impermeable Membrane: Smooth-surface, 40 mil PVC waterproof liner and manufacturer-recommended accessories to make seams waterproof. The geomembrane shall meet the following requirements:

Property	Test Method	Unit	Min. Avg. Roll Value
Thickness	ASTM D-5199	inches	0.040 ± 5%
Specific Gravity	ASTM D-792	min.	1.20
Tensile	ASTM D-882	lb/in-width, min.	97
Elongation	ASTM D-882	% min.	430
Modulus	ASTM D-882	lb/in-width, min.	40
Tear Resistance	ASTM D-1004	lb/in-width, min.	10
Resistance to Soil Burial (1) Breaking Factor (2) Elongation at Break (3) Modulus at 100% Elongation	ASTM G-160	\$% change, max.	(1) 5 (2) 20 (3) 20
Dimensional Stability	ASTM D-1204	% change, max.	3
Water Extraction	ASTM D-1239	%, max.	0.20
Volatile Loss	ASTM D-1203(A)	%, max.	0.50
Hydrostatic Resistance	ASTM D-751(A)	psi, min.	120
Average Plasticizer Molecular Weight	ASTM D-2124		400
Factory Fabricated Seams: (1) Peel Strength (2) Shear Strength	ASTM D-7408	lbs/in, min.	(1) 15 (2) 77.6

G. Infiltration Chamber System: Infiltration Chamber System shall be constructed as specified on the Drawings and in accordance to manufacturer recommendations. Infiltration Chamber System shall provide total storage volume, or greater, as shown in the Plans.

1. Infiltration Chambers

- a. Nominal chamber dimensions shall be 30.0 inches tall, 51.0 inches wide and 90.7 inches long, or approved equal.

- b. Chambers shall conform to the requirements of ASTM F2418, “Standard Specifications for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers” and ASTM F2787, “Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers”.
- c. Chamber rows shall provide continuous, unobstructed internal space with no internal support panels.
- d. Chambers shall be analyzed and designed using AASHTO methods for thermoplastic culverts contained in the LRFD Bridge Design Specifications, as amended. Design live load shall be AASHTO HS20.
- e. The ends of the chamber shall be capped with an end plate provided by the manufacturer.
- f. Contractor to follow manufacturer’s minimum cover standards.
- g. Placement of aggregate around chamber rows and around the perimeter shall follow instructions as indicated in the most current version of the manufacturer’s installation instructions.
- h. The Contractor shall report any discrepancies with chamber design as shown on plans and manufacturer instructions.

2. Geotextile Fabrics

- a. Non-woven geotextile fabric conform to the AASHTO M288 Class 2 non-woven geotextile (filter fabric) shall be placed all around angular stone, as indicated on the drawings.
- b. For Isolation Row only
 - 1. Two layers of 5-ft wide woven geotextile (filter fabric) that meets AASHTO M288 Class 1 requirements is required at the bottom of the chambers above the stone foundation, as indicated on the Plans.
 - 2. An 8-ft wide strip of non-woven geotextile that meets AASHTO M288 Class 2 requirements is required to be draped over the Infiltration Chamber Isolation Row, as indicated on the Plans.
 - 3. Infiltration Chamber Isolation Row shall allow stormwater to egress at a rate of 2.25 cfs or greater.

3. Fill Material

- a. Stone shall be clean, washed, crushed, angular No. 4 (AASHTO M43) stone.

- b. Embedment stone surrounding chambers shall have a minimum porosity of 40%.
- c. Refer to Table 1 for acceptable fill materials.

Table 1: ACCEPTABLE FILL MATERIALS

Material Location	Description	AASHTO M43 Designation	AASHTO M145 Designation	Compaction/ Density Requirement
Perimeter Fill for 6" to 18" thickness above chambers.	Granular well-graded soil/aggregate mixtures, <35% fines	3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	A-1 A-2 A-3	Compact in 6" lifts to a minimum 95% Standard Proctor density Roller gross vehicle weight not to exceed 12,000 lbs. Dynamic force not to exceed 20,000 lbs.
Embedment Stone surrounding and to a 6" elevation above chambers	Washed, angular stone with the majority of particles between ¾"-2"	3, 357, 4, 467, 5, 56, 57	N/A	No compaction required.
Foundation Stone below chambers	Washed, angular stone with the majority of particles between ¾"-2"	3, 357, 4, 467, 5, 56, 57	N/A	Plate compact or roll to achieve a 95% Standard Proctor Density

PART III - EXECUTION

3.1 INSTALLATION

- A. Excavation and Backfill: Trench excavation and backfill for the laying and installation of the drain pipes, to the required line and grade and structure excavation for the improvements shall be in accordance with the Drawings and Section 02225 – TRENCHING AND BACKFILLING.
- B. Surplus Material: Use surplus material resulting from trench excavation for backfilling, filling and grading to the extent required as specified elsewhere in these Specifications.
- C. Trench Drain
 - 1. The trench drain system shall be installed in accordance with the manufacturer's installation instructions and recommendations.

2. The trench drain system shall be visually inspected for watertight integrity prior to pouring of concrete.
3. Protect grates and channel interior during pouring of concrete. Place concrete in a manner that will not dislodge the channels.
4. Following final set of concrete, remove grate protection, place grates in final position and engage locking bolts in correct location.

D. Infiltration Trench

1. The infiltration system shall be installed in accordance with the Plans.
2. Provide protection form all vehicle traffic, equipment staging, and foot traffic in proposed infiltration areas prior to, during and after construction.
3. Earthwork: Excavate according to Section 02225 – TRENCHING AND BACKFILLING to the depths, widths and cross-sections shown in the Plans. Trench bottoms, temporary construction benches, and final soil surfaces shall be clear and without any surface imperfections that would inhibit subsurface infiltration.
4. Trench Liners
 - a. Liners shall be laid out in the trench in such a way as to minimize the number of seams.
 - b. Filter fabric shall be laid on the bottom of the trench on undisturbed native soil. Provide 12-inch minimum overlap at seams or secure seams as per manufacturer's recommendation.
 - c. Impermeable membrane: Install as shown in Plans and as per manufacturer's instructions.
5. Compaction: Do not compact drain rock.
6. Sediment Control: Trenches shall be kept clean and a silt barrier placed completely around its perimeter till surrounding vegetation is established. Trenches shall not be used as erosion or sediment control structures during construction.

E. Infiltration System

1. The infiltration system shall be installed in accordance with the Plans and the manufacturer's installation instructions and recommendations.

2. Sediment Control: Infiltration system shall be kept clean and shall not be used as erosion or sediment control structures during construction. Provide additional sediment protection as needed to keep system clean until all Work is complete.

3.2 FINAL INSPECTION

At the time of final inspection of the work performed under the contract, the drainage improvements covered by this section shall be complete in every respect and operating as designed. All surplus materials in every character resulting from the work of this section shall have been removed. All defects discovered in the drainage improvements subsequent to this inspection shall be corrected prior to final acceptance.

END OF SECTION

SECTION 02740

FLEXIBLE PAVEMENT

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all asphaltic concrete pavement as indicated on the drawings and as specified herein.
- B. Related Sections include the following:
 - 1. Section 02362 – SOIL TREATMENT FOR VEGETATION CONTROL.
 - 2. Section 02577 – PAVEMENT MARKINGS.

1.2 REFERENCES

The “STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION”, dated September 1986, as revised, except as amended in the plans and/or specifications herewith, of the Department of Public Works, as applicable to the County of Maui, hereafter referred to as the “DPW Standard Specifications”, or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.)

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Submit eight (8) copies of the job-mix formula including base courses, affidavits from the manufacturers or suppliers of all materials proposed to be furnished and installed under this section certified that such material delivered to the project conforms to the requirements of these Specifications and provide the Material Product Data and Material Safety Data for the materials proposed for use for the Engineer’s approval.
- C. Test Reports: Submit test reports as directed by the Engineer. Contractor shall verify all requirements prior to the start of earthwork operations.
- D. Certification of Compaction: An independent geotechnical testing laboratory working under the supervision of a licensed civil engineer licensed in Hawaii shall test and certify all compaction work. Certifications and test results shall be submitted to the Engineer within three (3) days of the test.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Materials for roads and parking areas shall be in accordance with the below-listed sections of the DPW Standard Specifications, including all revisions, and shall govern all work except for the subsections of Measurement and Payment which shall not be applicable.

1.	Roadway Excavation	Section 12
2.	Embankment	Section 17
3.	Subgrade	Section 29
4.	Aggregate Base Course	Section 31
5.	Asphalt Surface Treatment	Section 33
6.	Asphalt Concrete Pavement (Mix #4)	Section 34

PART 3 – EXECUTION

3.1 PREPARATION

- A. The Contractor shall stake out the areas to be paved, using grade stakes on which the final finish elevations, base course and subgrade elevations are clearly marked. All such stakes and elevations shall be approved by the Engineer before any work is done.
- B. Apply weed killer on the prepared subgrade of the concrete pavement in accordance with Section 02362 – SOIL TREATMENT FOR VEGETATION CONTROL.

3.2 INSTALLATION

Install pavement in accordance with the applicable DPW Standard Specifications noted hereinbefore and as shown in Plans.

3.3 FILL COMPACTION TESTING

- A. All subgrade and pavement section shall be tested by an independent testing agency retained by the Contractor and all test results submitted to the Engineer for approval.
- B. All cost of testing shall be borne by the Contractor. Testing shall be made throughout the area for each 6-inch compacted layer. All test results may be approved before the Contractor can proceed with placing of base course or select borrow subbase course. Testing shall be in accordance with ASTM D1557.

- C. The Contractor shall be responsible for any corrective measure required as a result of inadequate compaction.

3.4 FINAL INSPECTION

- A. At the time of final inspection of the work performed under the Contract, the work covered by this section shall be complete in every respect and operating as designed. All surplus materials of every character, resulting from the work of this section, shall have been removed. Any defects discovered in the work, subsequent to this inspection, shall be corrected prior to final acceptance.
- B. Any existing asphaltic concrete pavements including roads and walkways that have been damaged by construction activities shall be repaired to the original condition and to the satisfaction of the Engineer. Damage done by heavy equipment, especially on roads and yards not stable for such equipment, shall be repaired to the original condition and to the satisfaction of the Engineer.

END OF SECTION

SECTION 02810

IRRIGATION SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide a landscape irrigation system in the areas shown on the Drawings in the phases as indicated on the plans and specifications. All work indicated on the Drawings by notes shall be provided whether or not specifically mentioned in the Specifications. Items not specifically shown in the Drawings or specified, but normally required to conform with such intent, are considered part of the work.
- B. Make minor field adjustments required due to existing site conditions and revisions that are a result of project construction and not noted in the plans to insure adequate coverage and even distribution of water in all landscape areas.
- C. The work in this Section includes, but is not limited to, the following:
 - 1. Excavation and backfilling.
 - 2. Pipe Sleeves, Fittings and sprinkler heads.
 - 3. Valves.
 - 4. Automatic controller, remote control valves and control wire.
 - 5. Adjustments and instructions.
 - 6. Project and record drawings.
 - 7. Warranty.

1.2 CODES AND STANDARDS

- A. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.
- B. The “STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION”, dated September 1986, as revised, except as amended in the plans and/or specifications herewith, of the Department of Public Works, as applicable to the County of Maui, hereafter referred to as the “DPW Standard Specifications”, or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.)

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Substitutions: Substitutions of any equipment or material specified or indicated will not be considered unless Engineer deems the substitute to be of equal or greater quality and for which a cost savings is offered.
- C. Construction Schedule: At the pre-construction meeting, provide a written copy of the projected construction schedule noting the estimated completion date, number of working days required and any special coordination requirements.
- D. Certificates of Warranty: Provide all certificates of warranty from the irrigation equipment manufacturers.

1.4 JOB CONDITIONS

- A. Acceptance of Previous Work: Inspect and accept the condition of the site relative to this Section before commencing with the work covered herein. If not acceptable, notify the Engineer in writing. By proceeding with the work under this Section, the Contractor indicates his acceptance of previous related work.
- B. Meet on Site: Prior to commencing work, meet with the Engineer, Landscape Architect, and all other concerned parties on the site to review the work under this Section. Request this meeting one week prior to the desired meeting time.
- C. Underground Utilities and Obstructions: Verify the location of underground utilities and other obstructions that may affect the work. Any obstructions encountered shall be reported to the Engineer. Repair all damage to any known utility line or other underground obstruction at the Contractor's expense. Report damage to any unknown utilities to the Engineer.
- D. Protection:
 - 1. Provide necessary safeguards and exercise caution against injury or defacement of existing site improvements. Prevent vehicles of any kind from passing over sidewalks, curbs, etc., unless adequate protection is provided. Do not store materials or equipment, or operate equipment near or under the branches of any existing plants that are to remain, except as actually required for construction in those areas.
 - 2. Be responsible for damages caused by leaks in the piping systems being installed or during the Warranty period due to failure of workmanship or materials. Repair all damage to return the area to the previous condition at Contractor's expense.

E. Final Inspection:

1. At the completion of all irrigation work request a final inspection. Notify the Engineer five (5) working days prior to the inspection so a mutually agreeable time for inspection may be arranged.
2. The Engineer shall be present at the inspection.
3. If, after the inspection, the Engineer is of the opinion all work has been performed in accordance with the Drawings and Specifications, written notice of acceptance and completion of the Project will be given. If all or certain portions of the work are not acceptable under the terms and intent of the Drawings and Specifications, a reasonable amount will be retained from the final payment and the defects in the work shall be corrected before the work and accepted by the Engineer.

1.5 WARRANTY

Warranty all work for a period of one (1) year after acceptance. Immediately repair or replace without cost to the Engineer all material and equipment found to be defective due to faulty material or workmanship during the period. This warranty does not include vandalism, negligence by others or acts of God.

PART 2 - PRODUCTS

2.1 GENERAL

Material incorporated in the system shall be new, without flaws or defects and of quality and performance specified. Material overages at the completion of the installation are the property of the Contractor and shall be removed from the site.

2.2 PIPE

- A. Potable Pressure Mains: All main line piping 2½” or smaller shall be Schedule 40 PVC, ASTM D-1785, with Schedule 80 PVC fittings. All main line piping 3” and larger shall be Class 200 PVC with Christy’s detectable marking tape, green color with irrigation line below warning, SDR 21, ASTM D-2241 piping with Integral gasketed bell ends. All fittings on piping 3” and larger shall be Harco, Leemco or approved equal ductile iron gasketed fittings with a protective bituminous coating or poly wrapped.
- B. Ductile Iron Pressure Mains: Ductile Iron Pipe with mechanical joints. AWWA C151, with mechanical-joint bell and spigot ends. Mechanical-joint, ductile-iron fittings shall be AWWA C110, ductile or grey-iron standard pattern or AWWA C153, ductile iron compact pattern.
- C. Laterals: Class 200 PVC, SDR 21, ASTM D-2241; (¾” minimum size) with integral solvent weld bell end, ASTM D-2672; solvent weld coupling, ASTM D-2466. All lateral piping shall use Schedule 40 PVC fittings.

- D. Flexible Tubing: Toro 850-01, Rain Bird Swing Pipe or approved equal thick wall flexible pipe.
- E. Visible Pipe and Fittings:
 - 1. General: Integral gray color.
 - 2. Threaded Risers and Nipples: Schedule 80 PVC.
 - 3. Other Risers and Fittings: Schedule 40 PVC, Type 1, solvent weld.
 - 4. Cement: ASTM D-2564 or as recommended by the manufacturer.
 - 5. PVC to Ductile Iron Transition Sleeve: GripRing by Romac Industries and Tyler/Union solid sleeve mechanical joint, or as recommended by manufacturers.
- F. Sleeves: Schedule 40 PVC (2" minimum size).
- G. Conduit: Schedule 80 PVC Electrical Conduit U.L. Approved.

2.3 VALVES

- A. Quick Coupler Valve: Bronze two-piece, single slot in remote valve box. Refer to drawings for size and model number.
- B. Remote Control Valve: Plastic 200+ psi rated, globe or angle configuration with pressure regulation control. Refer to drawings for size and model number.
- C. Ball Valve: Full ported, PVC manual operated with positive drip-tight shut-off. Size of ball valve shall be the same as that of the largest downstream control valve.
- D. Gate Valves: 2 1/2" or less shall be American made 200 WOG brass, with non-rising stem and threaded ends. Gate valves 3" or larger shall be AWWA C500, bottom wedging double discs, parallel seats, non-rising stems, open by counterclockwise turning. Provide flanged end connections. Provide bronze interior construction of valves including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

2.4 AUTOMATIC IRRIGATION CONTROLLER

- A. The computerized central control system shall be the Rain Bird ESP-LXMEF-MP Series, 8-48 Station or approved equal.
- B. Controller to be pedestal mounted controller installed in a heavy-duty stainless steel NEMA 3R stainless steel enclosure – refer to drawings for size and model number.

2.5 VALVE BOXES

Plastic box with locking lid. Ametek, Brook, Carson or approved equal. Rectangular for remote control valves. Round for gate valves, quick couplers and manual angle valves. Lavender color for non-potable zones.

2.6 SWING JOINTS

Dura, Spears, Rain Bird maximum or Lasco or approved equal.

2.7 FLEX RISERS

King Brothers, Global Water System, Excaliber or approved equal.

2.8 STAKES

#4 rebar - length as noted.

2.9 CLAMPS

All Stainless steel screw clamps.

2.10 CONTROL WIRE

- A. Specifically designed for direct burial use, Type UF with copper conductor, #14 minimum size for control wiring to each individual valve and #12 for the common wire to all valves.
- B. Use white jackets for common wire and different color coded wires (as available) for individual control lines.
- C. Size of conductor shall meet requirements of the installation instructions of the manufacturer of the valves and controllers.

2.11 WIRE CONNECTORS

Spears Dry-Splice, Snap-Tite, 3M DBY, Paige or approved equal.

2.12 THRUST BLOCKS

Thrust blocks for irrigation system shall have minimum 2,500 psi compressive concrete strength at 28 days.

2.13 CONCRETE

Unless otherwise indicated, all concrete shall be Class "B" (no less than 3,000 psi) or better and in accordance with the DPW Standard Specifications.

2.14 POP-UP SPRAY ROTORS

MPR Rotary heads. Refer to Drawings.

2.15 DRIP IRRIGATION TUBES AND FITTINGS

- A. Polyethylene Pipe: Polyethylene pipe shall be PE 2305 or PE 2306 pipe, Class C, SDR 15, ASTM D 2447.
- B. Drip Emitters: Pressure-compensating drip emitters shall include filtration system on inlet side, flexible black rubber diaphragm to allow buildup of excess pressure within chamber for purging of sediment and other debris not captured by disc filter, and hard plastic diaphragm retainer with chamfered edges and recessed groove in center running full length of diaphragm.

Emitters shall independently regulate discharge rates for constant flow, with output pressure of 7 to 70 pounds per square inch and coefficient of variability of 0.03. Discharge rate shall be 0.61 or 0.92 gallon per hour. Emitters shall be continuously self-cleaning and utilize combination turbulent flow/reduced pressure compensation cell mechanism and diaphragm for uniform discharge.

- C. Barbed Insert Fittings: Barbed fittings for insertion of emitters into drip tubing shall be brown, molded plastic and ultraviolet resisting.
- D. PVC Insert and Threaded Fittings: Inserts and threaded fittings shall be unplasticized PVC I or PVC II.
- E. Line Flushing Valve: Line flushing valve shall be black, non-serviceable, molded plastic. Valve shall run automatically during initial system pressure build up and shall discharge at rate of one gallon water for each 15 gallons per minute of demand. Working pressure shall be minimum of 4 pounds per square inch and maximum of 25 pounds per square inch.
- F. Pressure Regulating Valve: Pressure regulating valve shall be black, molded plastic, spring-operated, piston-type valve with regulation unit that can be serviced without having to remove valve.
- G. Disc Filter: Filter shall be black, molded plastic, disc-type filter. Filtration mesh shall be color-coded.
- H. Air and Vacuum Relief Valve: Air and vacuum relief valve shall be gray plastic, with internal sliding poppet.
- I. Stainless Steel Clamp: Stainless steel clamp shall be 304 AISI ear-type.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Do all necessary excavation for the proper installation of the irrigation system.
- B. Trenches shall be of adequate width to lay pipe easily, with extra working space provided where necessary to make joints. Trench depth shall be:
 - 1. 18" minimum cover over mains.
 - 2. 10" minimum cover over laterals.
 - 3. 24" minimum cover over sleeves under paving.
- C. Boulders, roots and other obstructions shall be entirely removed or cut out to the width of the trench and a depth of 6" below the trench bottom. Such debris shall be disposed of off-site.
- D. Any rock over 2" in largest dimension excavated during trenching shall be removed and disposed of off-site.
- E. Over excavation shall be backfilled and carefully tamped to provide a smooth and firm-bearing surface for laying the pipe.
- F. Barricade and/or light the excavated area to prevent undue hazard to the public.
- G. Pipe cushion material shall be imported screened soil or fine sand fine enough to pass 1/4-inch sieve.

3.2 PIPE FITTINGS AND ASSEMBLY

- A. All pipes shall be installed as dimensioned or approximately in the location shown and shall be of the sizes indicated.
- B. Parallel piping shown on the Drawings may be installed in the same trench with all pipe at the same depth and 1 inch (minimum) horizontal separation between pipes. Parallel piping shall not cross in the trench.
- C. Piping shall be laid accurately to the line and grade required, with full bearing on the trench bottom. No pipe shall be laid on soft fill or other unstable material.
- D. Crossing pipes shall have 2" (minimum) vertical separation. No direct contact between other pipes or structures will be permitted.
- E. Work shall be performed in strict accordance with the manufacturer's installation instructions for the various types of pipe herein specified.

- F. Pipes shall be flushed out thoroughly to remove all debris and foreign matter prior to installation of any valves or sprinklers.
- G. Prior to backfilling, pipes shall be inspected for leaks at the joints and fittings and repaired or replaced as required.

3.3 SPRINKLER HEADS

- A. Set heads plumb and level at locations indicated on the Drawings.
- B. Thoroughly clean, adjust and inspect all heads for proper operation and performance.
- C. In turf areas heads shall be initially installed on the risers 1/2" above grade level. Prior to final inspection of the landscape planting adjust all heads as necessary.
- D. Install Flex Risers on all heads adjacent to paved surfaces, walks and curbs.
- E. Install all sprinklers 12" away from buildings, driveways and roadways without curbs, or as directed by the Engineer. Install all sprinklers 6" away from all walkways, curbs and non-structural walls.

3.4 VALVES

- A. Valves connected directly to the main line shall be plumb with sufficient clearance for service and operation.
- B. Ball valves and quick coupler valves shall be installed in the location shown on the Drawings and shall be in valve boxes for accessibility and proper use.
- C. Remote control valves shall be centrally located among the sprinklers as practical, in accordance with the Drawings. All valves shall have their pressure regulations adjusted so the furthest sprinkler on each circuit operates at the pressure shown in the irrigation legend/schedule. Once the pressure regulation is adjusted, the contractor shall make fine adjustments through the use of the flow control assembly.
- D. Thoroughly clean, adjust and inspect all valves for operation and performance.

3.5 VALVE BOXES

- A. Where feasible, several valves shall be grouped together in a large valve box with 4" minimum clearance between valves and from the box.
- B. Position over the valves so all parts can be reached for service.
- C. Install above a 3" deep gravel pit for drainage. The box shall be reasonably free from dirt and debris.
- D. The top shall be level or following the adjacent finish grade as detailed.

- E. When feasible, install valve boxes within planting areas.
- F. Install the valve boxes with their tops one inch above the surface of surrounding grade. In concrete walks or traffic islands, flush the top of the valve boxes with the surrounding grade.
- G. The Contractor may substitute plastic valve boxes for Portland cement concrete valve boxes.

3.6 CONTROL WIRE

- A. All work shall conform with the NEC. Wires shall be installed at a minimum depth of 18".
- B. A minimum loop of 24" shall be left at each valve; at each splice; at each change in direction; at every 500 feet of straight run; and at each controller for expansion and/or servicing.
- C. Wire shall be placed under the pipe in the trench and bundled and tied at 10' intervals.
- D. Splices and connections shall be watertight.
- E. Wire shall be within a protective conduit, for pavement crossings, or where other conditions make it necessary.

3.7 AUTOMATIC CONTROLLER

- A. All controllers shall be installed within a stainless steel NEMA 3R mounted heavy-duty, lockable, enclosures. Install per manufacturer's recommendations and in locations shown on the drawings.
- B. Install the controller on a Portland cement concrete foundation shown in the contract. The concrete for the foundation shall be Class B (no less than 3000 psi) and shall conform to Section 03300 – CAST-IN-PLACE CONCRETE. The Engineer will permit hand mixing of foundation concrete.
- C. Contractor shall properly ground all controllers to insure the ground resistance is 8.0 ohms or less.
- D. Submit a complete maintenance and operations manual for each type of controller to the Engineer before the plant establishment period.
- E. A complete schematic wiring diagram for each controller shall be a part of the maintenance manual. The diagram shall show in detail the circuits and parts. Also, submit one copy of said diagram in a heavy plastic envelope and attached to the inner portion of each controller cabinet door.

3.8 BACKFILLING

- A. As soon as the work has been installed and reviewed, all trenches shall be backfilled.
- B. Use only sand or select backfill material consisting of particles less than 4" within 2" of all pipes.
- C. No debris or rock over 2" in largest dimension shall be used to backfill the remainder of trench.
- D. After backfilling, trenches shall be flush with, or slightly above adjacent finish grade.
- E. Repair paving cuts with material to match original surface.
- F. Reseed, resod, or replant the trenched areas as needed.
- G. Should the soil level of the trenches settle during the Warranty period, refill the trenches as needed at no additional cost.

3.9 ADJUSTING SYSTEMS

- A. Prior to final inspection, adjust all sprinklers to provide adequate and uniform spray coverage within each planting area. Balance spray patterns by adjusting individual sprinkler heads with the adjustment screws.
- B. Adjust and balance each system at the listed water pressure for each type of sprinkler head.

3.10 REPAIR OF LEAKS

All leaking joints, whether discovered at time of installation or at any time during the Warranty period, shall be remade with all new materials. Use of caulking or cement to repair leaks is prohibited.

END OF SECTION

SECTION 02820
FENCES AND GATES

PART I - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials, tools, equipment and related necessary to complete, in place, and ready for use, galvanized expanded metal fences and gates.
- B. Related Sections include the following:
 - 1. Section 01300 – SUBMITTALS
 - 2. Section 02225 – TRENCHING AND BACKFILLING
 - 3. Section 03300 – CAST-IN-PLACE CONCRETE
 - 4. Section 05500 – METAL FABRICATIONS

1.2 REFERENCES

- A. The “STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION”, dated September 1986, as revised, except as amended in the plans and/or specifications herewith, of the Department of Public Works, as applicable to the County of Maui, hereafter referred to as the “DPW Standard Specifications”, or as herein specified. (Paragraphs concerning Measurement and Payment are not applicable to this project.)
- B. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- C. ASTM A123 – Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153 – Zinc (Hot Dip) on Iron and Steel Hardware
- E. ASTM A239 – Standard Test Method for Locating the Thinnest Spot in a Zinc.
- F. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
- G. ASTM B633 – Standard Specification for Electrodeposited Coating of Zinc on Iron and Steel.
- H. ASTM F626 – Fence Fittings.

- I. ASTM F567 – Standard Practice for Installation of Chain Link Fence.
- J. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- K. ASTM F1184 – Standard Specification for Industrial and Commercial Horizontal Slide Gates.
- L. ASTM F1267 – Standard Specification for Metal, Expanded, Steel.
- M. ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.
- N. ASTM F2548 – Standard Specification for Expanded Metal Fences Systems for Security Purposes.
- O. ASTM F2780 – Standard Guide for Design and Construction of Expanded Metal Security Fences and Barriers.
- P. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.3 PERFORMANCE REQUIREMENTS

Fence design, materials and installation shall meet ASTM F2548 and ASTM F2780.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Shop drawings: Site plan showing layout of fence locations with dimensions, location of gates and opening size, cleared area, elevation of fence, gates, footings and details of attachments. Indicate details at unusual conditions.
- C. Product Data: Provide data on mesh, posts, fittings, hardware, operator, access keypad and accessories.
- D. Samples: Submit two (2) samples of fence mesh, 12-inch x 12-inch in size.
- E. Manufacturer’s Installation Instructions: Indicate installation requirements.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with Manufacturer’s instructions.
- B. Maintain one (1) copy of each document on site.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the products specified in this Section with documented experience.

1.7 GUARANTEE

The Work and equipment covered by these Specifications shall be guaranteed against defective parts due to faulty material or workmanship for one (1) year after date of acceptance of project. The Contractor shall guarantee to replace all defective parts within the period of time specified. All costs for the replacement of defective parts shall be paid for by the Contractor at no cost to the State. The guarantee shall be in writing and shall be submitted to the Engineer prior to the completion of the project.

PART II - PRODUCTS

2.1 MANUFACTURERS

The Contractor shall furnish, prior to starting work, a complete list of the sources and manufacturers from which he proposed to obtain material and shall notify the Engineer prior to any changes in the source of such materials.

2.2 MATERIALS

- A. Fence materials not specified in this Section shall be in accordance with the below-listed sections of the DPW Standard Specifications, including all revisions, shall govern all work except for the subsection of Measurement and Payment which shall not be applicable.

Chain Link Fence

Section 54

- B. Fencing materials and fittings shall be new, and all ferrous materials shall be hot-dipped galvanized in accordance with the requirements under ASTM A123 and ASTM F626. All galvanized materials shall be free from barbs, icicles or other hazardous projections resulting from galvanizing.

- C. Expanded Metal Mesh:

1. 1/2 inch #13 in accordance with the requirements under ASTM F1267.

- a. Type I – Expanded
- b. Class 2 – Hot-dip zinc-coated (galvanized)
- c. Design Size SWD: 0.500 inch
- d. Design Size LWD: 1.200 inch
- e. Random Side and End Shearing

- D. Tie Wire: Shall be 7-gauge galvanized steel wire.

- E. Tension Bar: Shall be 1/4 inch thick by 3/4 inch wide mild steel bar for attachment of a fabric to a terminal post.
- F. Tension Band and Brace Band: Shall be formed from steel bands at least 12 gauge thick by 3/4 inch wide.
- G. Tension Rod: Shall be a 3/8 inch diameter mild steel rod threaded at one end and hooked 180° at the other.
- H. Fittings: (Note: Pressed steel fittings shall not be allowed)
 - 1. Post cap and eye top shall be of one-piece cast iron or malleable iron construction and shall attach securely onto their respective posts.
 - 2. Coupling for top rails shall be outside sleeve type, at least 6 inches long and crimped at center.
 - 3. Rail ends shall be snug, one-piece cast iron or malleable iron fittings for top and brace rails with holes to receive 5/16 inch bolts for securing to rail end bands.
 - 4. Two-hole rail end shall be similar to rail end except for an additional 2 inch hole to receive the hooked end of a tension rod.
 - 5. C-Clamps are 11 ga x 1 inch steel and shall be sized to match outside diameter of line posts and rails. Typical placement of clamps is every 15 inches on line posts and rails.
 - 6. Bar Clamps are 11 ga x 1 inch steel bars and shall be used in pairs to join mesh vertically between rails.
 - 7. Band Clamps are 11 ga x 1 inch steel and shall be sized to match outside diameter of terminal, corner and gate posts. Bands shall be used to attach expanded metal mesh to posts. Typical placement of bands is every 15 inches.
- I. Fasteners
 - 1. General: Provide plated fasteners complying with ASTM B 633, Class B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use. Provide 316 stainless steel materials and where dissimilar metals are joined or where indicated. Select fasteners for the type, grade, and class required or as indicated.
 - 2. Steel Bolts: Regular hexagon-head type, ASTM A 307, hot-dip galvanized in conformance to ASTM A 153.
 - 3. Stainless Steel Bolts: ASTM F 593, Type 316 stainless steel.
 - 4. Washers and Nuts: Same material and finish as bolts.

5. Cast-in-Place Anchors in Concrete: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized, ASTM A 153/A 153M.
- J. Posts, Rails and Braces: Shall be the schedule 40 standard weight, hot-dipped galvanized, welded and seamless steel pipes conforming to ASTM A53.
1. Line Posts: 2.875 inch diameter.
 2. Corner, Gate, and Terminal Posts: 4.0 inch diameter.
 3. Top, Bottom and Brace Rail: 1.625 inch diameter, plain end, sleeve coupled.
- K. Concrete for post footings shall be type specified in Section 03300 – CAST-IN-PLACE CONCRETE.
- L. Horizontal Slide Gates:
1. Slide gate shall be manufactured and installed to comply with the safety requirements of ASTM F2200 and UL 325.
 2. Slide gates shall be in compliance with ASTM F1184 Type II Class 1.
 3. Gate frame shall be welded from 2 inch square galvanized steel tubing in accordance to Section 05500 – METAL FABRICATIONS.
 4. The gate frame shall be supported on the bottom with a pair of two 4”, tandem, V-wheel steel guide wheels each rated for gates up to 3000 lbs. Wheel cover protectors shall be included with bottom guides to comply with UL 325. Wheel track and wheel guides shall be compatible with each other.
 5. Gap protectors shall be provided and installed, compliant with ASTM F 2200-05.
 6. Post: A single support post shall be 4”x4”x3/16” wall square steel tubing, grade 500. Gate posts shall be galvanized or coated and supported in concrete footings as specified in the plans or by the manufacturer recommendations and/or requirements.
 7. Gate stops shall be hot-dipped galvanized with nylon bumper.
 8. Nylon guide block shall have a minimum load rating of 1,300 pounds and be suitable for a 4-inch wide aluminum channel.
 9. Sheaves shall be steel and rated for a minimum working load of 3,000 lbs. Installation of sheaves shall be installed to comply with ASTM F2200 and UL 325. Sheave shall be sized appropriately for galvanized wire rope.

10. Wire rope shall be galvanized aircraft cable with a flexible vinyl PVC coating.
11. Brackets shall be steel ASTM A 36/A 36M, hot-dip galvanized in accordance with Section 05500 – METAL FABRICATIONS.

M. Automatic Gate Operator

1. The slide gate operator shall open and close telescoping slide gate. Operator shall be DoorKing Model 9220 manufactured by DoorKing, 3013 Alhambra Drive, Suite C, Cameron Park, CA, 95682, or approved equal, and shall include:
 - a. Anti-tailgating feature.
 - b. Adjustable mid-stop.
 - c. Gate tracker reporting output.
 - d. Ports for plug-in loop detectors.
 - e. Manual operation.
 - f. Programming switches.
 - g. Built-in reset switch.
 - h. Built-in power On/Off switch.
 - i. Min. 2000 lb. capacity.
 - j. #60 corrosive resistant chain.
 - k. Adjustable speed control.
 - l. Slow start / slow stop function, variable speed.
 - m. Chain brackets.
 - n. Secondary entrapment prevention devices required to comply with UL 325.
2. The gate operator shall be UL 325 compliant for Class III, and IV.
3. Gate shall open at a speed of 12 inches/second. Front telescoping gate panel will open at a speed 2 times faster than the operator setting. Operator shall be adjusted to operate at speed of 6 inches/second.
4. Control devices include push buttons, radio controls, or keypads.
5. Factory Inspection and Testing:

- a. Manufacturer shall test each operator at factory to assure smooth, quiet operation.
- b. Manufacturer shall test all control inputs to ensure proper function.

N. Preformed Loop Detectors

1. General: Loop detectors shall be pre-formed and compatible with gate operator.
2. Wire: 16-gauge TFFN standard.
3. Loop Casing: Nylon 11 – approximate weight 3.80 per 100 foot OD ½”, ID 0.275 inch, wall 0.05 inch.
4. Asphalt: Rubberized asphalt.

O. Fire Department Lock Box

1. Lock box shall be designed to accept Knox 3501 key switch or as required by the Maui Fire Department.
2. Lock box may be manufactured in combination with the gate keypad.
3. Gate shall open automatically when lock is removed and door is open.
4. Gate shall remain open until lock box door is closed and lock is replaced.
5. Built-in micro-switch for gate/door activation.
6. 14-gauge steel.
7. Faceplate painted bright red, enclosure painted black.

- P. Other Materials: All other materials not specifically listed herein, but required for the successful installation of the work included, are subject to acceptance by the Engineer.

PART III - EXECUTION

3.1 INSTALLATION AND WORKMANSHIP

A. General

1. Fencing shall be erected in strict conformance with the plans and these Specifications.

2. Posts shall be plumb and in line, in concrete footings. Slope top of concrete for water runoff.
3. Welding shall be done in accordance with latest AWS standards. However, no splicing of posts, rails or braces shall be accepted.
4. Where changes in line occur with an angle of deflection of 30 degrees or more, the change point will be considered a corner and a corner post shall be installed thereat.
5. End and corner posts for fences with 5-foot and wider fabric shall be braced to the nearest line post with horizontal braces and tension rods. The horizontal braces shall be spaced midway between top rail and ground and securely fastened to posts as shown on plans.
6. Where fencing is placed along a curve with radius of 50 feet, or less, horizontal braces (and tension rods) shall be installed between all posts in like manner.
7. Pull posts, at maximum intervals of 300 feet, shall be braced and trussed in both directions as specified above.
8. Field Touch-Ups: Field welds shall be cleaned of flux and spatter and all damaged galvanizing removed, all hazardous projections ground off, properly prepared, and then heavily coated with self-curing inorganic zinc coating. Manufactured coatings shall be applied in strict accordance with manufacturer's printed specifications. Damage to existing painted surfaces shall be touched up.
9. Fence posts, except as otherwise indicated or specified, shall be spaced not more than 9 feet 9 inches apart.
10. Line posts shall be set so that the eye top will receive the top rail and fence fabric at the proper height as shown on the plan.
11. Top rails shall pass through and bear firmly on base of eye tops, form a continuous brace from end to end of each stretch of fence, and be securely fastened to terminal posts with rail ends and brace bands.

B. Expanded Metal Mesh:

1. Install expanded metal mesh vertically, overlapping panels by the width of 3 diamonds. Attach panels to posts and rails with 10 gauge Galvanized bands and C-clamps, per Manufacturer's instructions at maximum 15 inches on centers.
2. Position bottom of mesh approximately 1 inch with a maximum of three inches above finish grade.
3. Position top of mesh approximately 6 inches above top rail. Mesh to be randomly sheared at top edge to create a sharp edge.

4. Attach mesh to end and corner posts with bar clamps.
5. Join mesh vertically between rails with 10 gauge bar clamps in pairs.
6. All fence framework and shall be grounded for the purposes of eliminating stray electrical currents.
7. Tighten all nuts and peen, scarf or weld threads of bolts.

C. Gates:

1. Install in strict accordance with the company's printed instructions and as per applicable Sections of referenced standard specifications and as indicated on drawings.
2. The gate and installation shall conform to ASTM F1184 standards for aluminum cantilever slide gates, Type II, Class 2.
3. The gate system is to comply with ASTM F2200 and UL 325.
4. Gate stops shall be positioned to contact gate frame.

D. Preformed Loop Detectors: Install in strict accordance with the company's printed instructions.

3.2 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch.
- B. Maximum Offset from True Position: One inch.
- C. Components shall not infringe on adjacent property lines.

3.3 ADJUSTING

Adjust gates for smooth and balanced operation.

3.4 SYSTEM ACCEPTANCE & VALIDATION

A. Acceptance Test:

1. Test each system function.
2. Supply all equipment necessary for system adjustment and testing.

B. Test and Explain Safety Features:

1. Each system feature and device is a separate component of the gate system.

2. Read and follow all instructions for each component.
3. Ensure that all instructions for mechanical components, safety devices and the gate operator are available for everyone who will be using the gate system.
4. The warning signs shipped with the gate operator shall be installed in prominent position on both sides of the gate.

C. System Validation:

1. The complete system shall be adjusted to assure it is performing properly.
2. The system shall be operated for a sufficient period of time to determine that the system is in proper working order.
3. Ensure the owner is clear with regard to the safety points concerning the basic operational guidelines of the safety features of the gate operator system. These safety points are listed in the operator manual and shall be read prior to system use.
4. Installer and customer shall complete Operated Gate System Installation Checklist (see operator manual).

3.5 FINAL CLEANUP

All exposed metal surfaces shall be clean and free of cement and any such deleterious material.

END OF SECTION

SECTION 02950

LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide landscape plantings in the areas shown on the Drawings with plants in a healthy, vigorous growing condition. All work indicated on the Drawings by notes shall be provided whether or not specifically mentioned in the Specifications. Any items not specifically shown in the Drawings or specified, but normally required to conform with such intent, are considered part of the work.
- B. The work of this Section includes but is not limited to the following:
 - 1. Screening and placement of imported screened topsoil.
 - 2. Pre-planting weed control.
 - 3. Soil preparation.
 - 4. Fine grading.
 - 5. Planting operations.
 - 6. Maintenance.
 - 7. Warranty.
- C. Related Sections include the following:

Section 02200 – EARTHWORK.

1.2 CODES AND STANDARDS

Perform work in accordance with all applicable laws, codes and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State and local authorities in furnishing, transporting and installing materials.

1.3 SUBMITTALS

- A. Substitutions:
 - 1. If any plant specified is not obtainable, submit a written substitution request to the Engineer during the bidding period. This request may present either a different size

of the same species or a similar alternate species with the proposed adjustments to the Contract price for each.

2. Substitutions of plant materials will not be permitted unless authorized in writing by the Engineer.
- B. Construction Schedule: At the preconstruction meeting, provide a written projected planting schedule noting the estimated completion date, number of working days required and any special coordination requirements.
- C. Selection, Tagging and Ordering Plant Material:
1. Submit a request for inspection and documentation to Engineer at least one month prior to start of work under this section that all plant material has been ordered.
 2. Plants shall be subject to inspection and rejection by Engineer at place of growth and after delivery for conformity to specifications.
 3. Plants identified as specimen, field grown, or field stock will be inspected at place of growth by the Engineer.
- D. Imported Screened Soil Material:
1. The Landscape Contractor shall provide an even 6" layer of screened soil material over all ground level planting areas unless otherwise noted on drawings. The Landscape Contractor shall be responsible for screening, amending, hauling and installing the screened soil material over all ground level planting areas on the project site.
 2. The Landscape Contractor shall be responsible for submitting a soils analysis of the imported screened soil material at the beginning of the project for review and approval by the Engineer.
- E. Samples and Producers Specifications:
1. Various samples, certificates, and specifications of seed, fertilizer, sand, compost, soil amendments, and other material shall be submitted for approval.
 2. Sixty (60) days prior to placement, Contractor shall submit soil specified pre-mixed soil mix sample(s) in 1-gallon reclosable zipper plastic bag(s) to the Engineer. Contractor shall not place any soil mix on the project site until the Engineer has given the Contractor written notification to proceed.
- F. Certificate Submittal: Prior to hydroseeding operations, provide the Engineer with the State Certificate stating analysis of purity of the seed material.
- G. Delivery Receipts and Invoices: Delivery receipts and copies of invoices for material used will be subject to checking by the Engineer and subsequently delivered to the Engineer.

1.4 PLANT ALLOWANCE LIST

Plant materials and other landscape related materials identified on this list shall be provided and installed by the Contractor under the direction of the Engineer.

1.5 JOB CONDITIONS

- A. **Acceptance of Previous Work:** Inspect and accept the condition of the site relative to this section before commencing with the work covered herein. If not acceptable, notify the Engineer in writing. By proceeding with the work under this section, the Contractor indicates his acceptance of all previous related work.
- B. **Meet on Site:** Prior to commencing work, meet with the Engineer and all other concerned parties on the site to review the work under this section. Request this meeting one-week prior to desired meeting time.
- C. **Underground Utilities and Obstructions:** Verify the location of all underground utilities and other obstructions that may affect the work. Any obstructions encountered shall be reported to the Engineer. Repair all damage to any known utility line or other underground obstruction at Contractor's expense. Report damage to any unknown utilities to the Engineer.
- D. **Protection:**
 - 1. Provide necessary safeguards and exercise caution against injury or defacement of existing site improvements. Prevent vehicles of any kind from passing over sidewalk, curbs, etc., unless adequate protection is provided. Do not store materials or equipment, or operate equipment near or under the branches of any existing plants that are to remain, except as actually required for construction in those areas.
 - 2. Be responsible for any damage resulting from landscape planting operations. Repair all damage to return the area to the previous condition at Contractor's expense.
- E. **Clean Up:** Keep all areas of work clean, neat and orderly at all times during the period of Contract. Clean all construction areas at the end of each day.
- F. **Samples and Test:** Engineer reserves the right to take and evaluate samples of materials for conformity to Specifications at any time. Furnish samples upon request by the Engineer. Rejected materials shall be immediately removed from the site at Contractor's expense.
- G. **Pre-maintenance Inspection and Final Inspection:**
 - 1. At the completion of all landscape planting operations and prior to the beginning of the formal maintenance period, the pre-maintenance inspection shall be held. At the completion of the one (1) year formal maintenance period, the final inspection shall be held.

2. Request these inspections of the Engineer five (5) working days prior to the completion of work in order that a mutually agreeable time for inspection may be arranged.
3. The Engineer, Contractor, and Landscape Architect, or their representatives, shall be present at the inspection.
4. At the time of inspection, the Contractor shall have all the areas under the contract free of weeds, dead leaves and trash, neatly cultivated and raked. All stakes guys and plant basins shall be in good order. At the final inspection, lawns shall be neatly cut and all clipping removed.
5. If, after the pre-maintenance inspection, the Engineer is of the opinion that all work has been performed in accordance with the drawings and specifications, written notice of preliminary acceptance will be given. This report will note any items which shall be corrected and state the date of commencement and completion of the formal maintenance period.
6. If, after the final inspection, the Engineer is of the opinion that all work has been performed in accordance with the drawings and specifications, written notice of acceptance and completion of the project will be given. If all or certain portions of the work are not acceptable under the terms and intent of the drawings and specifications, a reasonable amount will be retained and the final payment and the formal maintenance period for the unaccepted work and any related items shall be extended at no cost to the Engineer until the defects in the work have been corrected and the work is accepted by the Engineer.

1.6 WARRANTY

A. Plant Material:

1. Plant materials furnished or relocated under this section shall be warranted in writing, for a period of one year (simultaneous with the one year maintenance period), against improper installation, defective, unsound or diseased conditions that may appear.
2. Upon receipt of written notice from the Engineer of the death of any warranted plant materials shall be promptly replaced with same species as originally planted, and shall be of a size closely approximating the size of the plant if normal growth had occurred since the original planting. Replacement shall be subject to all requirements of the specifications.
3. When plants are replaced, advise the Engineer, in writing, of the necessary establishment maintenance which shall be performed. If this information is not provided, the Contractor will be liable for total cost of replacement should the replaced plant die.

4. The expense of replacement shall be borne by the Contractor if replacement is necessary during the one year maintenance period.
5. Contractor shall not be held liable for loss of plant materials after final acceptance due to lack of care, vandalism, acts of God, or accident during the one year maintenance period.

B. Special Warranty:

1. All plant materials furnished under this section shall be warranted as to the species, hybrid, flower color and/or variety specified.
2. If after acceptance of the project, any warranted plant material proves to be of a different species, hybrid, flower color and/or variety not initially determinable, replace that plant with a new plant of the originally specified species, hybrid, flower color and/or variety. The new plant shall be equal in size to that of the incorrect plant at the time of its removal. The new plant shall meet the quality standards, be subject to the warranty, and be installed according to the specifications.
3. There is no time limit to this warranty, although it does not include plants reverting to the general species. The Engineer will determine the nonconformance of plant materials, and notify the Landscape Contractor in writing of the required replacement work. All materials and work shall be at the expense of the Landscape Contractor. All work shall be completed within 15 working days from the date of the Engineer's letter.

C. Liability: The liability under the warranty shall include the repair of damage to the work of other contractors, or damage to the Engineer's property caused by the failure of the work performed under this section. All of the provisions of this section apply to work performed to satisfy the requirements of the warranty.

D. Other Work: All other work shall be warranted for a period of one year from the completion of all landscape planting operations.

PART 2 - PRODUCTS

2.1 SOURCE OF SOIL MATERIAL

- A. Contractor shall provide amended imported screened soil as source of soil material for this project.
- B. Contractor responsible for providing a 6" layer of amended imported screened soil over all planting areas.

2.2 SCREENED SOIL MATERIAL

- A. Natural, fertile, friable soil free from stones, noxious seeds, weeds (especially nut grass), roots, subsoil or other material detrimental to normal plant growth.
- B. Physical Properties

Designation: Loam or silt loam, USDA classification of fraction passing sieves.

Class	Particle Size Range	Maximum Percentage	Minimum Percentage
Coarse Sand	0.5-2.0 mm	40	0
Clay	< 0.05 mm	20	10
Silt	< 0.05 mm	40	10
Gravel	2-13 mm	20	0
Rock	½ - 1 inch	---	10% Volume
Organic	---	15	0

- C. Chemistry:
 - 1. Salinity: Saturation Extract Conductivity (ECe), less than 3.0 mmhos. Cm at 25 degrees C.
 - 2. Sodium: Sodium Absorption Ratio (SAR), optimum range is 3-5.
 - 3. Boron: Saturation Extraction Concentration, less than 1.0 ppm.
 - 4. Reaction: pH of saturated paste: 6.0 - 7.0.
- D. Imported screened soil shall contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth in accordance to the soil analysis recommendations.
- E. Red Humic latasol soils, or types known as "Palolo Clay" or "Lualualei Clay" or similar materials will be not accepted.
- F. Screened to pass through 1/2" screen.
- G. Soils shall have minimum 5% OM as Humus content. Utilize Walkley-Black soil testing method for determining percent OM as humus.
- H. Backfill Mix for Trees, Palms and Shrubs: Mix thoroughly prior to placing:
 - 3 parts 75% screened soil
 - 1 part 25% "Menehune Magic"/organic soil amendment
 - 15 lbs. Gro-Power

- I. Planting Area Soil Mixture, 6" layer: Mix thoroughly prior to placing:

3 parts 75% screened soil
1 part 25% "Menehune Magic"/organic soil amendment
15 lbs. Gro-Power per cubic yard of mix.

2.2 FERTILIZER

- A. General: N-P-K as recommended by soil analysis, uniform in composition, free-flowing and suitable for application with approved equipment, delivered to the site in unopened containers, each fully labeled, conforming to the applicable fertilizer laws, and bearing the name or mark of the manufacturer.
- B. Plant Tablet: Agriform 21 gram tablet, Woodace 15 gram size or approved equal.
- C. Maintenance Period: 15-15-15 or 16-16-16 or as required by soils analysis test.

2.3 ORGANIC SOIL AMENDMENT

- A. Soil Amendment: Organic non-nutrient soil conditioner shall be "Menehune Magic", as manufactured by Hawaiian Earth Products, (Ewa, Oahu), "Kellogg's Nitrohumus Soil Conditioner" or approved equal.
- B. Organic nutrient soil conditioners (humus) shall be Gro-Power Plus (5-3-1), Ferto (6-4-2) or approved equal.
- C. Peat Moss: Partially decomposed stems and leaves of moss, free from dirt, salt, coarse roots and other deleterious materials.

2.4 PRE-PLANTING HERBICIDE

Round-Up or equal.

2.5 PRE-EMERGENT WEED CONTROL

Ronstar-G, Treflan, Eptam, Vegitex or equal.

2.6 PLANT MATERIAL

- A. Quantities: Provide sufficient quantities of plant materials needed to complete the work as shown on the planting plans and indicated in the drawings. Quantities indicated on the plant list are approximate only and are provided for the convenience of the Contractor. The planting plans shall have precedence over the plant list.
- B. Nomenclature: Names of plants shall conform with names generally accepted in the local nursery trade, and as interpreted by the Engineer.

C. Condition:

1. All trees, palms, shrubs, vines and groundcovers shall have a normal habit of growth and shall be sound, healthy, vigorous and free from insect infestations.
2. The minimum acceptable size of all trees and shrubs measures after pruning, with branches in normal positions, shall conform to the measurements specified on the plant list.
3. Caliper measurement shall be taken at a point on the trunk 6" above natural ground line for trees up to 4" in caliper and at a point 12" above the natural ground line for trees over 4" in caliper.
4. Plants that meet the measurements specified, but do not possess a normal configuration or balance of height and spread will be rejected.
5. Trees and shrubs shall have been grown in containers of the size stated on drawings, and shall have sufficient roots to hold the rootball together after removal from containers without being rootbound.
6. Specimen, field grown and field stock trees and palms shall have a rootball of sufficient size to support the plant's recovery from transplanting. Trees delivered with small or inadequate rootballs will be rejected.
7. Any tree, palm or shrub with weak, thin trunk not capable of supporting itself when planted in the open will be rejected.
8. Trees will be straight and of uniform shape without damaged, crooked, or multiple leaders, unless specified. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 1/2" which have not been pruned and painted or completely calloused will be rejected.
9. Divisions shall be healthy, vegetative material with well-established roots at one or more nodes.

2.7 MISCELLANEOUS MATERIALS

- A. Wood Tree Stakes: 2 x 2 x 8 feet rough construction grade redwood or eucalyptus with no paint or stain.
- B. Hose and Wire Ties: 1/2" diameter hose with #12 ga. galvanized iron wire.
- C. Guy Wire: #12 ga. galvanized iron for 15 and 25 gallon trees. #9 ga. galvanized iron for field grown trees.
- D. Rebar: #4 24" minimum length for 15 and 25 gallon trees. #7 36" minimum length for larger trees.

- E. Marker: Plastic surveyor tape. Bright color, minimum 18" long. Use same color throughout project.
- F. Plastic Header: Slim Edge or approved equal available locally at Exacta Sales, Inc.
- G. Root Barriers: Deep Root Barrier UB-24" depth or approved equal.
- H. Filter Fabric: Poly Filter-X, Typar or approved equal.
- I. Gravel and Rubble: No. 3 blue rock, 3/4" size for gravel maintenance strips irrigation valve boxes, under valves. See details for depth. 4 inch minimum average diameter size for drain pipe outlet. Selection to be approved by project Engineer 4 weeks prior to installation.
- J. Cover Mulch: Wood fiber cover mulch shall be produced from clean disease free wood cut into chips approximately 1/2" – 3" length, 1/2" – 1 1/2" width, 1/8" – 1/2" depth. Cover mulch shall be free from leaves, twigs, shavings, bark or material injurious to plant growth and contain 5% nitrogen. Contractor shall install 2" layer wood fiber mulch under all groundcover planting areas including shrubs and tree pits.

PART 3 - EXECUTION

3.1 CLEARING

- A. Clear all planting areas of existing vegetation not specified to remain and all other debris and foreign material considered a hindrance to planting operations and/or unsightly in appearance.
- B. Maintain previously established grades and swales.

3.2 PRE-PLANTING WEED CONTROL

Apply pre-planting herbicide to all visible weeds, before and after soil placement.

3.3 SCREENED SOIL

- A. Provide and place an even 6" layer of imported screened soil over all planting areas. Screened soil material shall be amended and uniformly blended according to the following rate:
 - 3 parts or 75% screened soil
 - 1 part or 25 % "Menehune Magic"/organic soil amendment
 - 15 lbs. Gro-Power per cubic yard of mix.
- B. All planting areas will be graded lower to attain required finish grade after soil placement. Coordinate all work with the General Contractor to insure proper placement of screened soil material and fine grading in relation to the sites overall grading and drainage plan.

3.4 SOIL PREPARATION

- A. Uniformly distribute and blend screened soil, organic soil conditioner and the fertilizer specified by the soil analysis over all planting areas.
- B. Blend the soil mix uniformly to evenly incorporate the amendments into the soil.

3.5 FINE GRADING

- A. Adjust finish grading with screened soil as necessary. Grades shall be smooth and even on a uniform plane with no abrupt changes or pockets, and shall slope away from all buildings. Verify the surface drainage of all planting areas, and notify the Engineer of any discrepancies, obstructions, or other conditions considered detrimental to proper execution of the work.
- B. Landscape work shall be tied to existing conditions and controls such as existing trees and landscape features, utility lines, pavement and curbs, etc. Finished grades shall bear proper relationship to such controls. Adjust all new work as necessary to meet the conditions and fulfill the intention of the drawings.
- C. After initial settlement, the finish grade shall be lower than adjacent walks, curbs and headers or as shown in Plans, whichever is lower:
 - 1. Lawn: 1/2" through 3/4".
 - 2. Shrubs and Groundcovers: 1" through 1-1/2".
- D. Immediately prior to planting operations, all planting areas shall be cleaned of weeds, debris, rocks over 1" in diameter, and clumps of earth that will not break up.

3.6 SOIL AND DRAINAGE CONDITIONS

- A. Apply soil retention material on all slopes greater than 2:1 after planting operations. Assure that mulching machinery used to apply soil retainer is sterile and free of all seed.
- B. Notify Engineer in writing of all soil or drainage conditions encountered during planting operations which the Contractor considers detrimental to growth of plant material. Include a cost proposal for the correction of the problem for approval before proceeding with work.
- C. If drainage conditions of plant pits appear unsatisfactory, test drainage by filling with water. Conditions permitting the retention of water in planting pit for an excessive period of time shall be brought to the attention of Engineer.

3.7 STONE, BRICK OR PLASTIC HEADERS

Install headers between all groundcover and grass areas where shown. The header shall smoothly follow the finish grade with even radii and straight runs. Headers shall meet

walkway edges or other features at a 90 degree angle unless otherwise directed by the Engineer.

3.8 PLANTING OPERATIONS

A. Handling Plants:

1. Handle plants in a manner to avoid any damage to the plant.
2. Protect plants at all times from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well protected and adequately watered.
3. All specimen, field grown and field stock trees and palms shall be planted the same day they are delivered to the site.

B. Plant Pits: All trees, palms and shrubs shall be installed in round pits with vertical sides, twice the diameter and 1-1/2 times the depth of the rootball or container.

C. Setting Container and Larger Plant:

1. Plants shall be centered and set on the appropriate compacted backfill mix that has been puddled and settled.
2. Plants shall be set with the soil level even with the finish grade and planted to give the best appearance in relationship to adjacent structure or surroundings.
3. Use appropriate backfill mix to continue filling plant pits. Set plant plumb and brace rigidly in position until backfill mix has been tamped solidly around rootball. When three-fourths of the pit is backfilled, water thoroughly, saturating the rootball.
4. Evenly distribute planting tablets per manufacturer's instructions. Continue filling pit to finish grade with backfill mix.
5. When the plant pit is filled, form saucer berm around plants as noted on details.
6. Water all plants immediately after planting.

D. Staking and Guying: Immediately after planting, stake all 15 gallon and smaller trees. Guy all larger trees as detailed.

3.2 GROUND COVER

Install plant material in moist soil in the areas and at the spacings shown, in neat rows, ensuring complete coverage of all planting areas including under and around trees and shrubs. Spacings shown in the plant list or on the drawings are triangular spacing, unless otherwise noted.

3.3 PRE-EMERGENT WEED CONTROL

Immediately after planting, apply pre-emergent weed control materials to all planted areas which will not be seeded.

3.4 PLANTING MAINTENANCE

- A. Maintain all plants and planted areas in optimum growing condition and appearance.
- B. Maintenance, as specified below, shall coincide with the delivery of the first plant materials to the site and shall continue 365 days after commencement of the formal maintenance period or until the approval of the final inspection. Care of plant materials during installation is not considered part of the formal maintenance period.
- C. Maintenance shall include, but is not limited to:
 - 1. Protect areas susceptible to traffic by erecting barricades immediately after planting.
 - 2. Irrigate planting areas as required to insure active growth keeping areas moist but not saturated. Regulate irrigation as necessary to avoid erosion and gullyng.
 - 3. Fertilize as needed in accordance with the manufacturer's recommendations and five (5) days prior to final inspection. Exercise proper caution and take measures necessary to avoid plant burn.
 - 4. Keep planting areas free of weeds and undesirable grasses through daily weeding, if required. Remove the entire root system. Dispose of all weeds in appropriate trash containers.
 - 5. Inspect all plants, including lawn, for disease or insect damage weekly. Treat affected material immediately.
 - 6. Remove damaged or diseased growth from trees and shrubs. Treat cuts larger than 1/2" diameter with specified tree paint.
 - 7. Immediately remove any dead or dying plants not in a vigorous thriving condition. Replacement shall be the same species and size as originally planted.
 - 8. Restake, tighten, repair guys and reset to proper grades or upright position any plants that are not in their proper growing position.

9. As it becomes evident that certain groundcovers have not uniformly or properly established, replant the areas immediately with the same plants and quantity as specified for the initial planting and maintain as specified for 90% coverage of healthy, actively growing grass and groundcovers for approval during the final inspection.

END OF SECTION

DIVISION 3 – CONCRETE
SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the following:
 - 1. Section 02100 - SITE PREPARATION.
 - 2. Section 02200 – EARTHWORK.
 - 3. Section 02500 – CONCRETE CURBS AND SIDEWALKS.
 - 4. Section 07190 – WATER REPELLENT SEALER.
 - 5. Section 07920 – SEALANTS.
 - 6. Section 09900 – PAINTING.
 - 7. Section 16530 – EXTERIOR LIGHTING.

1.2 DEFINITIONS

Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Product Data for Reinforcing steel: Certified mill test results or laboratory test results. Indicate bar size, yield strength, ultimate tensile strength, elongation and bend test.
- C. Design Mixes
 - 1. For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

2. Indicate amounts of mix water to be withheld for later addition at project site.
- D. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures. Also include location, sizes, and layout of any conduit to be placed within concrete. Shop Drawings shall be originally produced by the contractor. Any reproduction of the contract Drawings being used for shop drawings will be rejected.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Form materials and form-release agents.
 2. Steel reinforcement and reinforcement accessories.
 3. Fiber reinforcement.
 4. Bonding agents.
 5. Adhesives.
 6. Vapor retarders.
 7. Joint-filler strips.
 8. Repair materials.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- D. ACI Publications: Comply with the following, unless more stringent provisions are indicated and maintain a copy at the field office.
1. ACI 301, "Specification for Structural Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 347R "Guide to Formwork for Concrete."

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Comply with ACI 347R for plywood, metal, or other ACI 347R approved panel materials. Provide new or good finish form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4" by 3/4", minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Form oils or waxes shall not be used for concrete surfaces intended to be painted. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than one inch to the plane of the exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes not larger than 1 1/2" in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed, unless otherwise noted on the drawings.
- B. Plain-Steel Wire: ASTM A 82, as drawn.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place that will not puncture the vapor retarder. Use plastic straps or brightly colored tie wires to secure reinforcing. Manufacture bar supports according to CRSI's (Concrete Reinforcing Steel Institute) "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports. Refer to paragraph 3.06 for chair support spacing.

- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.
- B. Pozzolans
 - 1. Fly Ash: ASTM C 618, Class C or F.
 - 2. Blended Hydraulic Cement: ASTM C 595M.
 - 3. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Moderate weathering region, but not less than 3M.
 - 2. Aggregate size: No. 57 (One inch to No. 4).
 - 3. Aggregate size: No. 67 (3/4 inch to No. 4).
- D. Size of Coarse Aggregate: Except when otherwise specified or permitted, maximum size of coarse aggregate shall not exceed three-fourths of the minimum clear spacing between reinforcing bars (or bundled bars), one-fifth of the narrowest dimension between the sides of forms, or one-third of the thickness of slabs or toppings.

- E. Water: Potable and complying with ASTM C 94 or non-potable meeting ASTM C 94 Acceptance Criteria for Questionable Water Supply. Use only potable water for job site mixing.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1% water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Water-Reducing Admixture: ASTM C 494, Type A.
- C. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- D. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- E. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class A except as modified in subparagraph 1. below, nylon or polyester-cord-reinforced three-ply high-density polyethylene sheet, or one ply extruded polyolefin sheet; 15-mil minimum thickness. Compliance to ASTM standards shall be confirmed by an independent testing agency. Vapor barrier shall be Stego Wrap Vapor Barrier by Stego Industries, LLC or approved equal.

Permeance rating: ASTM E 96, ASTM E 154 not exceeding 0.01 grains/ft²/hr.

2.7 CURING MATERIALS AND EVAPORATION RETARDERS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz/sq yd dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18% to 22% solids.

- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.8 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C 881, 2-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Cementitious Coatings: Cement based polymer modified concrete finishing material, ProFinish by Bonded Materials or approved equal.
- E. Reglets: Fabricate reglets of not less than (0.0217") thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8" and that can be feathered at edges to match adjacent floor elevations. Products shall contain no added gypsum.
 - 1. Cement binder: ASTM C 50, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8" to 1/4" or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4". Products shall contain no added gypsum.
1. Cement binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8" to 1/4" or coarse sand as recommended by topping manufacturer.
 4. Compressive strength: Not less than 5500 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

- B. Footings: Proportion normal-weight concrete mix as follows:

Compressive strength (28 Days): 3000 psi.

- C. Slabs-on-Grade: Proportion normal-weight concrete mix as follows:

1. Compressive strength (28 Days): 4000 psi.
2. No fly ash shall be used in mixes for interior concrete floor slabs.

- D. Columns: Proportion normal-weight concrete mix as follows:

Compressive strength (28 Days): 4000 psi.

- E. Electrical Handholes and Boxes; Drainage Sewer and Plumbing Systems; Manholes, Catch Basins, Valve Boxes and Other Appurtenances:

Compressive strength (28 Days): 3000 psi.

- F. Electrical Ducts, Conduit Encasements; Sidewalks, Equipment Pads on Grade; Thrust Blocks and Trench Encasements:

Compressive strength (28 Days): 3000 psi.

- G. Slab Vapor Emissions Rates: At the time of finished flooring installation, vapor emissions shall not exceed a maximum of 5 lbs per 1000 square feet per 24 hours or the maximum emission established by the flooring manufacturer whichever is less. If the vapor emission rate exceeds the limit specified, take measures specified in paragraph 3.17 to reduce the emissions to an acceptable level without delaying the project.

- H. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Combined Fly Ash and Pozzolan: 10%.
2. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50%.
3. Portland Cement Minimum, with fly ash or pozzolan not exceeding 10%.

- I. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete required to have low permeability, interior slabs with vapor sensitive floor coverings.

- J. Do not add air entrainment to concrete of trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3%.

- K. Limit water-soluble, chloride-ion content in hardened concrete per ACI 318 Chapter 4 for corrosion protection of reinforcing steel.

- L. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 FABRICATING REINFORCEMENT

Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and ASTM C 1116 and furnish batch ticket information. Batch ticket information shall include design mix reference, water that can be added at the job site, and admixtures. For transit mixing, complete not less than 70 revolutions of the drum at the manufacturer's rated mixing speed. Discharge concrete into its final position within 90 minutes after introduction of batch water to the cement. If a retarder admixture is used, the discharge time limit of 90 minutes may be increased by the time specified for retardation by the admixture manufacturer or the concrete supplier. Mix concrete a minimum of one minute at mixing speed immediately prior to discharge.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8", for surfaces prominently exposed to public view, where appearance is especially important.
 - 2. Class B, 1/4", for coarse-textured surfaces to receive plaster, stucco or wainscoating.
 - 3. Class C, 1/2", for permanently exposed surfaces without additional finish.
 - 4. Class D, one inch, for surfaces, usually permanently concealed, where roughness is not objectionable.
- D. Construct forms to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
- F. Do not use rust-stained steel form-facing material.

- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds. Maintain the integrity of the vapor retarder membrane.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the work. Determine sizes and locations from trades providing such items.
- K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor bolts, accurately located, to elevations required.
 - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.
 - 4. Install inserts, hangers, metal ties, nailing strips, blocking, grounds and other fastening devices needed for attachment of other work.
- B. Locate electrical or mechanical conduits and fittings so that the strength of the concrete member is not impaired. "Conduits" include pipes, ducts, and electrical conduits. Unless required otherwise on the drawings, conform to the following:
 - 1. Concrete Columns: Do not embed conduits columns unless otherwise indicated on the drawings.

2. Concrete Beams: Do not embed conduits larger than 1 1/2" outside diameter vertically in any beam. Place conduits in the middle third of the beam depth and space a minimum of 10 times their outside diameter. Do not embed conduits horizontally in beam lengthwise. Provide sleeve for conduits passing through beams.
 3. Concrete Slabs-On-Grade: Do not embed conduits within the thickness of any concrete slab on grade. Place conduits in the subgrade below the concrete slabs.
- C. Obtain Engineer approval to install conduit or pipe penetrations that may unduly impair the strength of the structural member (for example, multiple pipe penetrations near the face of a column).

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained. The 24-hour period may be reduced to 12 hours in compliance with ACI 347R with prior approval from the Engineer.
- B. Leave formwork, for beam soffits and other structural elements, that supports weight of concrete in place until concrete has achieved the 28-day design compressive strength.
- C. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 318M, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 "Standard Practice for Installation of Water Vapor Retarders" and manufacturer's written instructions. The more stringent shall apply.

1. Use the greatest widths and lengths practical to minimize lap joints. Seal laps joints and edges with tape or materials compatible with the vapor retarder. Remove and replace torn, punctured, or damaged vapor barrier materials, except when minor repairs or patches are allowed by manufacturer's instructions.
2. Do not cut or puncture vapor retarder. No penetrations of the vapor barrier allowed except for reinforcing steel and permanent utilities. Seal all penetrations including pipes and reinforcing. Repair damage and reseal vapor retarder before placing concrete.
3. Do not leave the vapor retarder exposed to ultraviolet radiation for more than a few days prior to the concrete pour. Remove standing water from the vapor retarder prior top concrete pour.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
 1. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 2. Support slab reinforcing bars and welded wire fabric (WWF) as follows:

BAR SIZE	MAXIMUM DISTANCE BETWEEN SUPPORTS
#3	2 feet
#4	3 feet
#5	4 feet
#3 at 12" E.W.	4'-6" o.c. each way

- C. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- D. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
1. Grooved joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8". Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8" wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2" or more than one inch below finished concrete surface where joint sealants, specified in Section 07920 - SEALANTS, are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Provide one day notification to Engineer for each scheduled pour.
- B. Do not add water to concrete during delivery, at project site, or during placement, unless approved by Engineer.
- C. Convey concrete from mixer to the place of final deposit rapidly by methods that prevent segregation or loss of ingredients and will insure the required quality of concrete. Use conveying equipment, conveyors, hoppers, baffles, chutes, pumps that are sized and designed to prevent cold joints from occurring and prevent segregation in discharged concrete. Clean conveying equipment before each placement.
- D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
- E. Deposit concrete in forms in horizontal layers with proper consolidation into previous layers and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints. For high wall pours (above 12 feet), Contractor shall show its experience and demonstrate its proficiency before Engineer will permit pours in excess of 12 feet.
 - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
 - 3. Make construction joints only where located on drawings unless otherwise approved by the Engineer. Plan pours to continuously place concrete from one construction joint to another.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleed-water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 CONCRETE SLABS-ON-GRADE

- A. For interior areas, unless specified elsewhere, place concrete floor slabs directly over vapor retarder overlain atop granular fill-capillary barrier and reinforce slabs with grade 60, No. 10 (#3) steel bars at 12 inches on center each way.
1. Place floor slabs in alternate panels, long strip pattern, and following construction or contraction joints. "Keyed Kold Joint" may be used in lieu of placement in alternate panels in areas where floor covering is specified provided all shrinkage cracks are sealed prior to installation of floor covering.
 2. Provide a bond-break filler strip, between concrete slab and abutting vertical surfaces and as detailed.
- B. For exterior areas, unless specified elsewhere, place concrete floor slabs directly over granular fill and reinforce slabs. Provide isolation and contraction joints where detailed and, at intersections, corners and at abutments. Place contraction joints not more than 40 feet apart, unless detailed otherwise.

Finish concrete true to grade, section and cross slope for sloped or crowned walks at 1.5% (1% minimum and 2% maximum). Round edges to 1/8" radius except saw-cut joints or as otherwise shown in Plans. Finish steps in connection with walks with same finish as walks.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8" in height.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Do not apply rubbed finish to smooth-formed finish.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quart tile, Portland cement terrazzo, and other bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low sports. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.

3. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot-long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/8 inch.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, walkways, steps, and ramps, and elsewhere as indicated. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- F. Slip-Resistive Aggregates Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq ft of dampened slip-resistive aggregate over surface in one or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
 2. After broadcasting and tamping, apply float finish.
 3. After curing, lightly work surface with a steel wire brush or an abrasice stone, and water to expose slip-resistive aggregate.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Electrical Work: Use 3/4" maximum size of aggregates for duct encasement. Unless detailed otherwise, encase underground ducts or conduits as follows:

1. Provide 3 inches minimum concrete cover around ducts or conduits. Use spacers to place and hold ducts. Provide 18 inches minimum earth cover over top of concrete encasement unless otherwise detailed.
 2. For future connections, provide a one foot section of ducts or conduits to extend beyond concrete encasement and terminate with a coupling or end cap.
- E. Concrete for Drainage, Sewer and Plumbing Systems:
1. Do not use calcareous coarse aggregates in sewerage structures or components
 2. Unless specified elsewhere, construct sewer manholes in accordance with the latest adopted/amended edition of Section 23 - SEWER MANHOLES of the “STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION”.

3.13 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces before and during finishing operations. Apply according to manufacturer’s written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the curing methods listed in paragraph 3.13.D.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
1. Moisture curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 2. Moisture-retaining-cover curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not

less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- a. Moist cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moist cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
3. Curing compound: Apply uniformly in continuous operation by spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 4. Curing and sealing compound: Apply uniformly to floors and slabs indicated in a continuous operation by spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application where recommended by the manufacturer. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions. Defer joint filling as long as possible. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2" in any dimension in solid concrete but not less than one inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01" wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4" to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes one-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original

concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes one-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 DRYING CONCRETE SLABS TO LIMIT MOISTURE VAPOR EMISSIONS AND ALKALINITY

A. For concrete slabs (on grade or suspended) receiving floor finish susceptible to vapor emissions, protect, dry or seal concrete slabs to meet the required vapor emission level(s) of the intended floor finish systems. If choosing to use a floor sealing system, furnish submittals for approval.

1. Once slab drying has started, protect it from getting wet prior to floor finish installation.

2. Test floor for vapor emission at locations and quantities recommended by the test kit manufacturer. Test pH levels of concrete.

3. If the concrete slab does not meet the vapor emission or alkalinity level(s), use other means such as mechanical drying or floor sealing system(s) (penetrants, coatings, or membranes) to achieve the required levels.

4. If the concrete floor slab does not meet the required alkalinity level, neutralize, cure, dry or seal concrete to bring the concrete to an acceptable alkalinity level.

5. Be aware that no additional time or costs will be granted to meet the required vapor emission levels or alkalinity levels of the concrete surfaces.

B. Floor Vapor Emission Control System:

1. Acceptable products: Subject to compliance with requirements, products that may be incorporated into the work include the following. Other products shall be specifically approved by the Engineer for use in this project.

a. Koster VAP I 2000 by Koster American Corporation

- b. VaporSeal 309 by Floorseal Technology, Inc.
 - c. VapoSeal-DB by Dependable Floor Products.
2. Install per manufacturer's requirements to achieve a guaranteed vapor emission rate that meets the finished flooring recommended rates. Treatment shall not provide detrimental conditions to the concrete slab or floor covering materials. Make sure flooring adhesives are compatible with the treatment materials.
 3. Installer shall provide proof of installer's certification by the treatment manufacturer.
 4. Guarantee:
 - a. Manufacturer's guarantee: Warrant against bond failure with concrete and failure of the system due to vapor emission and alkalinity levels. Guarantee Period: Ten (10) years. This guarantee period supersedes the guarantee provisions of the GENERAL CONDITIONS.
 - b. Project guarantee: Replace original finished flooring materials and vapor emission control system due to failure of the vapor emission control system to control vapor emission and prevent unacceptable alkalinity levels. Provide extended warranty that is covered by a separate material and installation bond or by the manufacturer's product liability insurance policy specifically covering the work on this project. The Engineer shall have final approval of accepting the bond or manufacturer's insurance policy.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu yd (4 cu m), but less than 25 cu yd (19 cu m), plus one set for each additional 50 cu yd (38 cu m) or fraction thereof.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F (4.4 degrees C) and below and when 80 degrees F (27 degrees C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

Cast and field cure one set of four standard cylinder specimens for each composite sample.
6. Compressive-strength tests: ASTM C 39; test 2 laboratory-cured specimens at 7 days and 2 at 28 days.
 - a. Test 2 field-cured specimens at 7 days and 2 at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- E. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Engineer but will not be used as sole basis for approval or rejection of concrete.
- G. Moisture Vapor Emission Test: Standard test method meeting ASTM F 1869.
- H. Alkalinity (pH Level) Testing: Standard test required for floor slabs and all wall and ceiling surfaces to receive painted finishes. Testing of concrete to receive paint finish may be conducted under Section 09900 - PAINTING.
- I. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other

requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by the Engineer.

3.18 CLEANUP

- A. Any spilled concrete will be cleaned from the surfaces to the satisfaction of the Engineer.
- B. Upon completion of the construction work and before final acceptance of work, remove all surplus materials, equipment, etc. and leave entire jobsite clean and neat.

END OF SECTION

DIVISION 4 - MASONRY
SECTION 04810
UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Mortar and grout.
3. Reinforcing steel.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Miscellaneous masonry accessories.

B. Related Sections include the following:

1. Section 02281 – SOIL TREATMENT FOR TERMITE CONTROL.
2. Section 05500 - METAL FABRICATIONS.
3. Section 07920 – SEALANTS.
4. Section 09900 – PAINTING.

1.2 DEFINITIONS

Reinforced Masonry: Masonry-containing reinforcing steel in grouted cells.

1.3 SUBMITTALS

A. Submit in accordance with Section 01300 - SUBMITTALS.

B. Product Data: For each different masonry unit, strength classification, additive, accessory, and other manufactured product specified.

1. Reinforcing steel: Certified mill test results or laboratory test results. Indicate bar size, yield strength, ultimate tensile strength, elongation and bend test. Provide chemical composition for rebars that are to be welded.
 2. Sealers and Admixtures.
- C. Shop Drawings: Show fabrication and installation details for the following:
1. Reinforcing steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
 2. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- D. Samples for Initial Selection:
1. Colored mortar samples showing the full range of colors available.
 2. Sample of Masonry Unit (Full block not required).
- E. List of Materials Used in Constructing Sample Panels: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 2. Grout mixes. Include description of type and proportions of ingredients to assure compliance with the compressive strength in IBC Table 2105.2.2.1.2.
 3. Each material and grade indicated for reinforcing bars.
 4. Each type and size of joint reinforcement.
 5. Each type and size of anchor, tie, and metal accessory.
- H. Test Reports: Manufacturer's tests shall be in accordance with ASTM C 140 for conformance with the requirements of ASTM C 90.
- I. Quality Control Inspection Documents: Provide one copy of the following industry documents for use by Engineer, NCMA TEK 8-2A (1998) - Removal of Stains from Concrete Masonry Walls.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

Block plant shall maintain a quality control program to monitor and control block chloride ion content. Soluble chloride ion content should not exceed 0.30% by volume of the cement material in the block, based on ACI 318-02 Table 4.4.1.

- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- C. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. Carefully stack and handle masonry units so as to prevent chipping, marring or cracking of corners, edges and faces.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Masonry: In rainy locations and conditions, cover tops of walls, projections and sills with waterproof sheeting to repel water.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

- C. Stain Prevention: Protect to prevent stain damage to mar final finish or finishing techniques. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed, stained or painted.
- D. Hot-Weather Requirements:
 - 1. Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
 - 2. When ambient temperature exceeds 90 degrees F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sash, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners, unless indicated as bullnose.
 - 3. Provide "H" blocks for below grade foundation walls and scheduled to be fully grouted.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
 - 1. Unit compressive strength: Provide load bearing units with minimum average net-area compressive strength of 1900 psi.
 - 2. Size (width): Manufactured to the following dimensions within variations in dimensions only as permissible per ASTM C 90:
 - a. 8 inches nominal; 7 5/8" actual.
 - b. 10 inches nominal; 9 5/8" actual.
 - c. 16 inches nominal; 15 5/8" actual.
 - d. Screen Block; Style 414.
 - 3. Admixture: Rheopel Plus or approved equal.

- C. Concrete Block Admixture: Water repellent and efflorescence control admixture.
Rheapel Plus by BASF or approved equal.

2.2 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type II. Provide natural color or white cement as required to produce mortar color indicated.
- B. Mortar Cement: ASTM C-1329. Type as scheduled in mix designs in Article 2.09.
- C. Masonry Cement: ASTM C-91. Type as scheduled in mix designs in Article 2.09.
- D. Aggregate for Mortar: ASTM C 144.
- E. Aggregate for Grout: ASTM C 404.
- F. Plasticizer Additive:
 - 1. Acceptable for use in ASTM C-1329 Mortar Cement as a substitute for hydrated lime in masonry mortar.
 - a. Powder type: Proprietary pozzolanic mortar plasticizer.
 - b. Liquid Type: Proprietary mixture of resins.
- G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
- H. Water for use in mixing Mortar and Grout: Potable and complying with ASTM C 94. Clean and free from injurious amounts of oils, acids alkalis, salts, organic materials or other substances that may be deleterious to both mortar and reinforcement.
- I. Mortar Block Admixture: Water repellent and efflorescence control mortar admixture.
Rheapel Plus Mortar Admixture by BASF or approved equal.

2.3 REINFORCING STEEL

Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, deformed, Grade 60 unless otherwise indicated on the drawings or specified herein.

2.4 MASONRY JOINT REINFORCEMENT

- A. General: IBC Sections 2103.13.2, 2104, 2106; ASTM A 951, A 82; and ACI 530. 2.4C and as follows:

1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
 2. Wire size for side rods: No. 9, 0.14-inch diameter.
 3. Wire size for cross rods: No. 9, 0.14-inch diameter.
 4. Provide in lengths of not less than 10 feet. Provide prefabricated corner and tee units in lengths not less than 2 feet where indicated.
- B. For masonry walls, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches on center.

2.5 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this article, unless otherwise indicated.
- B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

2.6 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.
- B. Anchor Bolts: Steel bolts complying with F1554 Grade 36; with ASTM A 563/A 563M hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
1. Headed bolts.
 2. Non-headed bolts, bent in manner indicated.
- C. Post-installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
1. Type: Chemical anchors.
 2. Type: Expansion anchors.
 3. Corrosion protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35%; of width and thickness indicated.
- B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - 1. Styrene-butadiene-rubber compound: ASTM D 2000, Designation M2AA-805, or
 - 2. PVC: ASTM D 2287, Type PVC-65406.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Commercial plastic or wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142" steel wire, hot-dip galvanized after fabrication. Commercial plastic units are fabricated for the intended purpose.
 - 1. Provide units with either 2 loops or 4 loops as needed for number of bars indicated.
 - 2. Other suitable devices: Other suitable devices may be used, upon proper submittal to and approval by Engineer.
- E. Adhesive: Type recommended by insulation board manufacturer for application indicated.
- F. Color Enhancer: Water based protective treatment for horizontal masonry.
Color Enhancer WB by Prosoco or approved equal.

2.8 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2 cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in one gallon of water.
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar or grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

Do not use calcium chloride in mortar or grout.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to the job site.

C. Mortar for Unit Masonry:

1. The proportioning of materials for mortar and grout shall be by volume and done in such manner that the specified proportions can be controlled and accurately maintained. Measure fine aggregate in a damp loose condition. Mix materials in a mechanical batch mixer for at least 3 minutes for mortar and 5 minutes for grout, but do not mix more than 10 minutes. Hand mixing is permitted only for small batches of 3 cubic feet or less.
2. Prepare Mortar Mix Design 1 with sufficient water to provide a workable consistency. Use and place mortar within 1 1/2 hours after mixing.
3. Prepare Mortar Mix Designs 2 through 5 strictly in accordance with the admixture manufacturer's instructions. Place mortar within 2 1/2 hours after mixing. No materials which start to set shall be retempered.
4. Mortar shall attain not less than 2,500 psi 28-day compressive strength per ASTM C 270 unless noted otherwise on drawings.

D. Mortar Mix Designs: Mortar shall be freshly prepared and uniformly mixed in one of the following proportions unless directed otherwise by manufacturer of plasticizer additive:

1. Mortar Mix 1:

Type M Mortar	
1 part	masonry cement
2 1/2 to 3 parts	mortar aggregate
2. Mortar Mix 2:

Type M Mortar	
2 sacks	Portland cement
1/2 to 1 bag	powdered plasticizer additive (7 pound bag)
6 cu ft	mortar aggregate
3. Mortar Mix 3:

Type M Mortar:	
1 sack	Portland cement
3 ounces	liquid plasticizer additive
2 1/4 to 2 3/4 cu ft	mortar aggregate

4. Mortar Mix 4:
 Type S Mortar:
 2 sacks Portland cement
 1 bag powdered plasticizer additive (7 pound bag)
 9 cu ft mortar aggregate

5. Mortar Mix 5:
 Type S Mortar
 1 sack Portland cement
 3 ounces liquid plasticizer additive
 2 1/2 to 3 cu ft mortar aggregate

E. Grout for Unit Masonry: Sufficient water shall be used to produce a consistency just fluid enough for pouring or pumping without segregation. Grout shall be used and placed in final position within 90 minutes after mixing, but shall in no case be used after initial set has occurred. This time limitation is permitted to be waived, if the grout is of such slump that it can be placed without addition of water.

1. Grout shall attain not less than 2,500 psi 28-day compressive strength per ASTM C 1019 unless noted otherwise on drawings.
2. Use plasticizers additives for below grade foundation walls scheduled to be grouted to ensure full dispersal of mix.

F. Grout Mixes: Conform to ASTM C 476 for grout mixed on-site. Prepare and uniformly mix grout in the following proportion:

1. Fine grout:
 Portland cement 1 part
 Fine aggregate 2 1/4 to 5 times the sum of the volumes of the cementitious materials

2. Ready-mix grout: Conform to ASTM C 476 for grout designed by ready-mix suppliers.

G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's directions.

H. Mortar Block Admixture: Water repellent and efflorescence control mortar admixture.

Rheapel Plus Mortar Admixture by BASF or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Verify that floor levels, footing levels or foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. General: All masonry units shall be clean and handled to protect and minimize chipping, spalling and cracking. All bed on which masonry is to be laid shall be clean.
- B. Masonry units shall not be wetted prior to use. Units which have become wet shall be allowed to dry thoroughly before laying. If water is splashed on the block and a color difference does not occur (from the water) then the block units are too wet to be laid. (Source: Reinforced Concrete Masonry Construction Inspector's Handbook, Fourth Edition, paragraph 12.3.4)
- C. Build chases and recesses to accommodate items specified in this section and in other sections of the specifications.
- D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with the tolerances in the national concrete masonry association Specification for Structures ACI 530-02/ASCE 6/TMS 602 as applicable to climate indigenous to Hawaii and as noted.
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4" in 20 feet, nor 1/2" maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4" in 10 feet, nor 1/2" maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4" in 20 feet, nor 1/2" maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not vary from bed-joint thickness of adjacent courses by more than 1/8".
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8". Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8".

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. When foundation is at specified levels, lay first course masonry units in a mortar bed not exceeding 3/4" thick. Bed webs of adjoining cells that contain reinforcement in mortar to prevent escape of grout.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal horizontal face dimensions at corners or jambs.

One-half running bond with vertical joint in each course centered on units in courses above and below unless otherwise indicated on drawings.
- D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 inches horizontal face dimensions at corners or jambs.
- E. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

- F. Built-in Work: As construction progresses, build in items specified under this and other sections of the specifications. Fill in solidly with masonry around built-in items.
- G. Grout space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
 - 1. Grout mix: Use one of the following:
 - a. One of the mortars mixed specified in Part 2 above.
 - b. One of the grout mixes specified in Part 2 above.
 - 2. Gypsum board joint compound or other gypsum containing compounds are not permitted.
- H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- I. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated or directed.
- J. Fill cores in hollow concrete masonry units with grout for foundation walls and below grade walls up to underside of floor slab unless otherwise indicated.
- K. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 3. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with firestopping provisions of the construction drawings and specifications.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
 4. Bed cross webs.
- B. Lay horizontal-cell units with full bed joints, unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
 - C. Maintain joint thicknesses indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4" to 3/8" thick joints.
 - D. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4" and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
 - E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
 - F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 BONDING OF MASONRY

Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches on center.
2. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches on center.
 2. Space reinforcement not more than 8 inches on center in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings. This reinforcement is in addition to continuous reinforcement.

- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated “L” and “T” sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than one inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches on center vertically and 36 inches on center horizontally.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
 2. Install preformed control-joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
 4. Install temporary foam-plastic filler in head joints and remove excess filler and seal joint when unit masonry is complete.
- C. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07920 - SEALANTS. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.10 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

Provide built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make it tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

- B. Placing Reinforcement: Comply with requirements ACI 530 Sec 3.4/ASCE 6/TMS 602.

- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure. Comply with requirements of ACI 530 Sec. 3.5/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.13 MOCK-UP

The Contractor shall complete a mock-up of the exterior concrete masonry wall. The concrete masonry block and mortar shall represent the same material and color used in the project. The mock-up shall be 10'-0" x 10'-0" minimum and fully grouted. It will be the Contractor's prerogative to complete the mock-up as a separate entity or as part of the project. Acceptance from the Engineer is required prior to continuing work. If the mock-up is acceptable to the Engineer, the mock-up may be incorporated as part of the project if the Contractor elected to do so. The location of the mock-up will be left up to the Contractor.

END OF SECTION

DIVISION 5 - METALS
SECTION 05120
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Structural steel.
2. Grout.

B. Related Sections include the following:

1. Section 02831 – EXPANDED METAL FENCE.
2. Section 05210 – STEEL JOISTS.
3. Section 05310 - STEEL DECKING.
4. Section 05500 - METAL FABRICATIONS.
5. Section 09900 – PAINTING.

1.2 DEFINITIONS

Structural Steel: Elements of structural-steel frame, as classified by AISC 303, “Code of Standard Practice for Steel Buildings and Bridges.”

1.3 SUBMITTALS

A. Submit in accordance with Section 01300 - SUBMITTALS.

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

C. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS (American Welding Society) symbols, distinguishing between shop and field welds, and show size, length, and type of

each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

- D. Qualification Data: For qualified Installer, fabricator, testing agency.
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- G. Mill test reports for structural steel, including chemical and physical properties.
- H. Product Test Reports: For the following:
 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength bolt-nut-washer assemblies.
 4. Shop primers.
 5. Nonshrink grout.
- I. Source quality-control reports.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 360.
 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Preinstallation Conference: Conduct conference at project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
- B. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Contractor's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.6 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel pipes: ASTM A 53/A 53M.
- F. Welding Electrodes: E70XX and comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325/A 325M, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1, hardened carbon-steel washers; all with plain finish.

Direct-tension indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325/A 325M, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-tension indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.

- C. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563/A 563M heavy-hex carbon steel.
2. Plate washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436/F 436M, Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

- D. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563/A 563M heavy-hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
4. Manufacturers: Subject to compliance with requirements.

2.3 PRIMER

- A. Primer: Comply with Section 09900 - PAINTING.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
- Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces.
 2. Baseplate holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- Apply two (2) coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish:
1. Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

2. Fill vent and drain holes that will be exposed in the finished work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Contractor shall engage and pay for an independent testing and inspecting agency to perform shop tests and inspections, and prepare and submit test reports. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in work that test reports and inspections indicate does not comply with the contract documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 1. Liquid penetrant inspection: ASTM E 165.
 2. Magnetic particle inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Ultrasonic inspection: ASTM E 164.
 4. Radiographic inspection: ASTM E 94.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and

loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

Joint type: Snug tightened.

- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage and pay for a qualified independent testing and inspecting agency to test and inspect field welds and high-strength bolted connections, and prepare and submit test reports.
- B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, attesting agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in work that test reports and inspections indicate does not comply with the contract documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touch-up Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
2. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 05210

STEEL JOISTS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. This Section includes Work for the following:
 - 1. Open-web K-series steel joists.
 - 2. Open-web joist girders.
 - 3. Joist accessories including blocking, bracing, bridging, cross-bridging, and any other required accessories necessary for a complete installation.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Product Data: For each type of joist, accessory, and product indicated.
- C. Shop Drawings: Show layout, mark, number, type, location, and spacing of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction. Provide comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Mill Certificates: Signed by manufacturers of bolts certifying that their products comply with specified requirements.
- F. Qualification Data: For firms and persons specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects, owners, and other information provided.
- G. Research/Evaluation Reports: Evidence of steel joists’ compliance with 2006 International Building Code.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding the design loads within limits and under conditions indicated on the drawings.

- B. Design joists to withstand design loads with total and live load deflections no greater than the following minimum requirements:

Roof Joists: Vertical deflection of 1/240 of the span under total load. Vertical deflection of 1/360 of the span under live load.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Manufacturer shall be certified by the Steel Joist Institute, "SJI", to manufacture joists complying with SJI standard specifications and load tables.
 - 2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.
- B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders", applicable to types of joists indicated.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code – Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for chord and web members.

- B. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

Finish: Plain, uncoated

- C. High-Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers where indicated on the drawings.

Finish: Plain, uncoated.

- D. Welding Electrodes: Comply with AWS standards.

- E. Galvanizing Repair Paint: ASTM A 780.

2.2 PRIMERS

SSPC-Paint 15, Type I, red oxide; FS TT-P-636, red oxide; or manufacturer's standard shop primer complying with performance requirements of either of these red-oxide primers.

2.3 OPEN-WEB K-SERIES STEEL JOISTS

- A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, under slung ends, and parallel top chord; of joist type indicated.

Joist Type: K-series steel joists.

- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended ends: Extend bearing ends of joists with SJI's Type R extended Ends where indicated, complying with SJI's "Specifications."
- F. Camber joists according to SJI's Specifications.
- G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.4 OPEN-WEB JOISTS GIRDERS

- A. Manufacture steel joist girders according to "Standard Specifications for Joist Girders," in SJI's "Specifications," with steel-angle top- and bottom-chord members, under slung ends with bottom chord extensions, and parallel top chord.
- B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Camber joists according to SJI's Specifications.

2.5 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Bridging is indicated on drawings for schematic purposes only. Bridging shall be detailed and fabricated to SJI's "Specifications." Furnish additional erection bridging and bracing as required.
- B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated, with hot-dip zinc coating according to ASTM A 123/A 123 M.
- C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.
- D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.6 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
- C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage and pay for a qualified independent testing and inspecting agency to inspect field welds.
- B. Field welds will be visually inspected according to AWS D1.1.
- C. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as determined necessary by the special inspector:
 - 1. Radiographic Testing: ASTM E 94 and ASTM E 142.
 - 2. Magnetic Particle Inspection: ASTM E 709.
 - 3. Ultrasonic Testing: ASTM E 164.
 - 4. Liquid Penetrant Inspection: ASTM E 165.
- D. Bolted connections will be visually inspected.

High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Allowable Stress Design Specification for Structural Joints using ASTM A 325 or ASTM A 490 Bolts."

- E. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.
- F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories and abutting structural steel.
 - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05310

STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the requirements for Steel Roof Decking.
- B. Related Sections include the following:
 - 1. Section 05120 - STRUCTURAL STEEL FRAMING.
 - 2. Section 05500 - METAL FABRICATIONS.
 - 3. Section 09900 – PAINTING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Product Data: For each type of deck, accessory, and product indicated.
- C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- D. Product Certificates: For each type of steel deck, signed by product manufacturer.
- E. Welding certificates.
- F. Field quality-control test and inspection reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - 2. Acoustical roof deck.
- H. Research/Evaluation Reports: For steel deck.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

- B. Welding: Qualify procedures and personnel according to AWS D1.3, “Structural Welding Code - Sheet Steel.”
- C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's “North American Specification for the Design of Cold-Formed Steel Structural Members.”

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Available Manufacturers: Subject to compliance with requirements.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with “SDI Specifications and Commentary for Steel Roof Deck,” in SDI Publication No. 30, and with the following:
 - 1. Galvanized steel sheet: ASTM A 653 SS Grade 33, G90 zinc coating.
 - 2. Deck profile: As indicated on the contract drawings.
 - 3. Profile depth: As indicated on the contract drawings.
 - 4. Design uncoated-steel thickness: As indicated on the contract drawings.
 - 5. Span condition: Triple span or more.
 - 6. Side laps: Interlocking seam.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359" design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi of same material and finish as deck, and of thickness and profile indicated.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747" thick with factory-punched hole of 3/8" minimum diameter.
- I. Galvanizing Repair Paint: ASTM A 780.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

2.4 MATERIAL SELECTION FOR LEED COMPLIANCE

- A. Provide products that contain the highest percentage available of post-consumer and/or post-industrial recycled content as defined by LEED-NC 2009.
- B. Provide material that contains the highest percentage available of locally harvested, extracted, and manufactured materials as defined by LEED-NC 2009.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.

- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1 1/2" long, and as follows:
 - 1. Weld diameter: As indicated.
 - 2. Weld spacing: Weld edge and interior ribs of deck units with a minimum of 2 welds per deck unit at each support. Space welds as indicated.
 - 3. Weld washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 24 inches (450 mm), and as follows:

Fasten with a minimum of 1 1/2" long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1 1/2", with end joints as follows:

End joints: Lapped 2 inches minimum.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: The Contractor shall engage and pay for a qualified independent testing and inspecting agency to perform field tests and inspections, and prepare and submit test reports.
- B. All field welds shall be inspected.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Engineer.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05400

COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes requirements for exterior load-bearing wall framing.
- B. Related Sections include the following:

Section 05500 - METAL FABRICATIONS.
- C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Mechanical fasteners.
 - 2. Miscellaneous structural clips and accessories.
- E. Research/Evaluation Reports: For cold-formed metal framing.

1.3 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
- B. AISI Specifications and Standards:
 - 1. Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: ASTM A 653 of grade and coating weight as follows:
 - 1. For members 16, 14, and 12 gage grade and coating weight shall be:
 - a. Grade: 50 Class 1.
 - b. Coating: G90.
 - 2. For members 20 and 18 gage grade and coating shall be:
 - a. Grade: 33.
 - b. Coating: G90.

2.2 EXTERIOR BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

1. Minimum Base-Metal Thickness: As indicated by designation on the contract drawings.
 2. Flange Width: As indicated by designation on the contract drawings.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Flange Width: As indicated by designation on the contract drawings.

2.3 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 653 of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.

2.4 ANCHORS, CLIPS, AND FASTENERS

- A. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- B. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.6 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by screw fastening.

Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch

PART 3 - EXECUTION

3.1 EXAMINATION

Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

Screw wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by screw fastening. Wire tying of framing members is not permitted. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

- H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

- I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 EXTERIOR BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track, unless otherwise indicated. Space studs as indicated in drawings.

- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
- E. Install solid blocking at 96-inch centers maximum spacing.
- F. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Install solid blocking at 96-inch centers maximum spacing.
 - 2. Bridging: Cold-rolled steel channel, mechanically fastened to webs of punched studs.
- G. Install miscellaneous framing and connections, including web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.4 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to the manufacturer and Installer that ensures that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all miscellaneous metal fabrication work, including, but not limited to, the following:
 - 1. Metal ladder.
 - 2. Metal gates.
 - 3. Bollards.
 - 4. Steel header for operable partitions.
 - 5. Miscellaneous fabrications.
 - 6. Furnish miscellaneous steel attachments, anchors, plates, angles, etc., to be set in concrete.
 - 7. Include all anchors, angles, bolts, expansion shields for items in this section only, and other accessories shown in details and/or required for the complete installation of all work.
- B. Related Work Described Elsewhere: Roof hatch and ladder extension are provided under Section 07720 - ROOF ACCESSORIES.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturers product data for all manufactured products. Include color charts for all materials exposed and requiring selection of finish color.
- C. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others under this project. Where materials or fabrications are indicated to comply with certain requirements for design loadings include structural computations, material properties, and other information needed for structural analysis. Indicate weld connections using standard AWS welding symbols.

- D. Samples: Submit 4 each samples of the stair prefinished metal.
- E. Maintenance Manual: Submit manufacturer's maintenance manual for prefinished aluminum finishes.

1.3 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.
- B. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Qualifications of Welders: Only welders certified in the arc welding process shall perform work in connection with the work in this section. Comply with AWS D1.1/D1.1M for welding procedure and performance qualification.
- D. Ladders shall conform with OSHA 1910.27, "Fixed Ladders".
- E. Bollards protecting components subject to vehicular damage shall be protected in accordance with NFPA 1, Section 60.1.2.13.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

General: Engineer systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:

1. Cold-Formed Structural Steel: AISI "Specification for Design of Cold-Formed Steel Structural Members".
2. Aluminum: AA 30 "Specifications for Aluminum Structures".

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Deliver, store, and handle materials in strict conformance of the manufacturer's instructions and recommendations.
- B. Protection: The Contractor shall use all means necessary to protect all materials before, during, and after installation and to protect the installed work and materials of all other trades.
- C. Replacement: In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the satisfaction of the Engineer and at no additional cost to the State.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel Shapes, Plates, and Bars: ASTM A 36/A 36M.
- B. Steel Pipe: ASTM A 53/A 53M; Type and grade (if applicable) as selected by fabricator and as required for design loading; hot-dipped galvanized, G90; standard weight (schedule 40), unless otherwise indicated. Pipe for bollards shall be Type E or S, standard weight, black finish.
- C. Steel Tube: ASTM A 500/A 500M Grade B or ASTM A 501/A 501M.
- D. Aluminum Bar and Tube: ASTM B 221, Alloy 6063-T5, 6063-T6, and 6063-T52.
- E. Aluminum Extruded Structural Pipe and Tube: ASTM B 429/B 429M, Alloy 6063-T5, 6063-T6, and 6063-T52.
- F. Aluminum Plate and Sheet: ASTM B 209 or ASTM B 209M, Alloy 6061-T6.
- G. Electrodes for Welding: Comply with AWS Code. Use E70XX electrodes unless recommended otherwise for the specified metal.
- H. Anchors and Fasteners: Where exposed, shall be of the same material, color, and finish as the metal to which applied.
 - 1. Expansion Shields: Expansion anchors shall be carbon steel threaded studs with integral tapered cone expanders and segmented expansion collars. Provide anchors with electroplated zinc coating, length identification markings, and required nuts and washers. Expansion anchors shall be evaluated in accordance with ACI 355.2/355.2R, Category 1 or 2 and shall be tested in accordance with ICC ES AC 193 for all mandatory and optional tests. Provide shields recessed not less than 2-1/2 inches into concrete or masonry, unless as directed by the manufacturer.
 - 2. Lag Screws and Bolts: ANSI/ASME B18.2.1, type and grade best suited for the purpose.
 - 3. Toggle Bolts: ANSI/ASME B18.2.1.
 - 4. Bolts, Nuts, Studs, and Rivets: ANSI/ASME B18.2.2 and ASTM A 307.
 - 5. Powder Driven Fasteners: Follow safety provisions of ASSE/SAFE A10.3.
 - 6. Screws: ANSI/ASME B18.2.1, ANSI/ASME B18.6.2, and ANSI/ASME B18.6.3.

7. Washers: Provide plain washers to conform to ANSI/ASME B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ANSI/ASME B18.21.1.
 8. Metal Anchor Bolts, Straps, Hangers, Brackets, and Other Inserts: Furnish to other trades the anchor bolts, straps, hangers, brackets, and other inserts which are necessary for the final installation of work under this and other trades, where not specified to be furnished under the other sections of the specifications. This trade shall also furnish templates if required by others and shall check the installation of all bolts and inserts for accuracy. Furnish anchor bolts and washers of same quality as bolt.
 9. Finish: All fasteners shall be hot dip galvanized except as indicated or specified otherwise. Exterior fasteners shall be stainless steel.
- I. Shop Paint:
1. Metal Primer Paint: Fabricator's standard fast-curing, "universal" primer free from asbestos, lead, mercury, chromate, and cadmium, and compatible with finish paint systems.
 2. Coordinate selection of metal primer with finish paint requirements specified in Section 09900 - PAINTING.
- J. Galvanizing Repair Paint: SSPC - Paint 20.
- K. Nonshrink Nonferrous Cementitious Grout: ASTM C 1107/C 1107M, BASF "Masterflow 713 Plus", Sonneborn "SonogROUT 10K", Anti-Hydro Co. "Axpanacrete", Thoro System Products "Thorogrip", or pre-approved equal non-metallic grout, premixed, specially manufactured for this purpose, with mix and setting characteristics as recommended by the manufacturer for the purpose intended. Use as fill for embedment of railing posts in floor sockets and for similar uses. Mix and place in strict accordance with manufacturer's instructions.
- L. Prefabricated Aluminum Ladder: Ladder shall conform to ANSI A14.3. Ladders shall be premanufactured fixed ladders, heavy duty tubular rail type O'Keeffe's 500 or pre-approved equal. Rungs shall be not less than 1-1/4 inch in section from tubular aluminum extrusions, alloy 6063-T6 and shall be squared and deeply serrated on all sides. Rungs shall be able to withstand 1,500 pound load without failure. Provide as indicated with off-floor mounting bracket. Prefinish in safety green (RAL 6001).
- M. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.2 FABRICATION

A. Workmanship:

1. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32-inch unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
4. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
5. Provide weep holes or another means to drain entrapped water in hollow sections of members that are exposed to exterior or to moisture from condensation or other sources. Fill voids below weep level to assure utility of weep holes.

B. Welding shall be done by approved certified welders who have been previously qualified by tests. Welding shall be in accordance with AWS D1.1/D1.1M for steel and AWS D1.2/D1.2M for aluminum. Any welds which are found to be defective must be cut out and replaced. "Code for Arc and Gas Welding in Building Construction", latest edition, Sections II, III, and IV formulated by American Welding Society, shall be followed in design and execution of structural welding.

1. All welding of steel shall be done by electric-arc process with coated rods, not fluxed, so as to produce shielded arc, and shall comply with the requirements of above specified manual.
2. Surfaces, seams, or joints to be welded shall be free from rust, scale, grease, and other foreign material.
3. All welds shall be ground and pressed smooth and all weld flux, slag, and spatter shall be completely removed.
4. Connections not indicated shall be designed and provided by the Contractor and shall be made to conform with AISC ASD Manual of Steel Construction, Vol II: Connections. Develop full strength of members in all connections. One side connections will not be permitted.

5. For aluminum use welding of inert gas, shield-arc type. Weld in a manner to prevent permanent distortion of connected parts. Weld continuously along entire area of contact (except where tack welding is permitted).
 6. Do not tack weld exposed connections.
 7. Grind smooth visible welds in finished installation and clean welds immediately by chipping or wire brushing.
- C. Galvanizing: Provide a zinc coating for those items shown or specified to be galvanized, as follows:
1. ASTM A 153/A 153M for galvanizing iron and steel hardware.
 2. ASTM A 123/A 123M for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch thick and heavier; and for assembled steel products.
 3. Provide minimum G90 coating designation.
- D. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning".
 2. Interior (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".
- E. Shop Painting:
1. Shop paint miscellaneous steel metal work, except galvanized surfaces and surfaces to be embedded into concrete, unless otherwise specified.
 2. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at a rate to provide uniform dry film thickness of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.
- F. Repair of Damaged Zinc-Coated Surfaces: ASTM A 780/A 780M, Annexes A1, "Repair Using Zinc-Based Alloys", A2, "Repair Using Zinc-Rich Paints", or A3, "Repair Using Sprayed Zinc (Metallizing)".
- G. Miscellaneous Framing and Supports:
1. Provide miscellaneous steel framing and supports as required to complete work.

2. Fabricate miscellaneous units to sizes, shapes, and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars. Cut, drill, and tap units to receive hardware and similar items.

2.3 METAL FINISHES

- A. Steel: Galvanized and treated for painting under Section 09900 - PAINTING unless indicated or specified otherwise.
- B. Aluminum: All exposed aluminum surfaces shall be free of scratches and other blemishes. Provide bronze finish conforming to Aluminum Association Standard AA DAF-45, "Designation System for Aluminum Finishes", AA-M12-C22-A42 or AA-M12-C22-A44, Architectural Class I, (0.7 mil or greater) for all exposed surfaces, including fasteners and hardware.

2.4 ANCHORAGE, FASTENINGS, AND CONNECTIONS

- A. Anchorage: Provide anchorage for fastening work securely in place. Set anchors in concrete as work progresses and space maximum 2-feet on centers, unless indicated otherwise. Sizes, kinds, and spacings of anchors not indicated or specified shall be as necessary for the purpose, as accepted. Anchorage not otherwise specified or indicated includes slotted inserts, expansion shields, and powder-driven fasteners, when accepted for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Provide inserts of suitable and accepted types where required for support or anchorage of equipment and finish construction. Inserts shall be gray or malleable iron castings or galvanized steel unless indicated or specified otherwise. Slotted inserts shall be of types required to engage with anchors, except where specified otherwise.
- B. Fastenings: Do not use wood plugs in any material. Use non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, and harmonizing with the material to which fastenings are applied. Conceal fastenings where practicable. Drill and punch to produce clean true lines and surfaces. Countersink metal work to receive hardware.
- C. Threaded Connections: Make threaded connections up tight so that threads are entirely concealed. Make bolted work up tight and nick the threads or bush the stem to prevent loosening. Abutting bars shall be shouldered and headed, dowelled and pinned. Pass small bars through larger bars and pin. Rivet, bolt, and screw heads shall be flat and countersunk in exposed work and elsewhere as required. Machine removable members and fit and secure by means of screws or bolts of proper size and accepted spacing.
- D. Anchors and Connecting Members: Provide in concrete or masonry as the work progresses, to avoid unnecessary cutting and drilling. Cut, fit, and drill as necessary so materials are properly set in place and to permit engaging work to be properly installed.

- E. Design Connections: AISC "Detailing for Steel Construction"; where not shown or indicated otherwise, provide connections using common steel bolts. Provide necessary holes for securing work to building. Use lock washers under nuts.
- F. Built-In Work: Form metal work built-in with concrete or masonry for anchorage, or provided with suitable anchoring devices as shown or as required. Furnish metal work in ample time for securing in place as work progresses.
- G. Grouting: Grout metal fabrications and anchors in a manner that will assure filling of spaces and intimate contact of grouting materials with surface to be grouted. Place grout rapidly and continuously so to avoid cold joints and voids.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.
- B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- C. 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.

3.2 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, toggle bolts, throughbolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
- C. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth, and touch-up shop paint coat. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of weld made, and methods in correcting welding work.

3.3 MISCELLANEOUS METAL FABRICATIONS

The following fabricated assemblies are described in brief outline to indicate, in addition to the drawings, the general design and details desired. Standard products of manufacturers specializing in similar work will be considered insofar as they fulfill the requirements and do not violate governing codes for building and standards of good construction work. Hot dip galvanize steel components after fabrication in as large components as possible.

1. Metal Gates: Metal gates shall be fabricated of aluminum tubes, bars, and plates, welded to form frame sections as detailed, with mitered and welded corners. Provide vertical ballusters, arranged as indicated, with all joints full welded or fastened. Grind all welds smooth. Provide 4 by 8-inch aluminum gate stop welded to the frame. Provide weeps to allow trapped water to escape as accepted by the Engineer. Anodize finish the gate and frame. Hardware is provided under Section 08710 - FINISH HARDWARE.
2. Bollards: Pipes guards shall be set vertically as indicated. Piers shall be constructed of 6-inch diameter steel pipe, unless indicated otherwise, and the hollow cores of the pipe filled with concrete specified in Section 03300 - CAST-IN-PLACE CONCRETE having a compressive strength of 3,000 psi. Round off top of concrete fill.

3.4 CLEAN UP

- A. After installation, all surfaces shall be cleaned and ready to receive final treatment. All unused materials, tools, and equipment shall be removed from the project site.
- B. From time to time, and as directed by the Engineer and at the completion of the work, all rubbish, debris, fines, etc., accumulated from the work of this section shall be removed from the project site and the area left neat and clean to the satisfaction of the Engineer.

3.5 TOUCH UP

- A. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780/A 780M.
- B. Touch-Up Painting: Immediately after erection, clean bolted connection and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

- C. Prefinished Aluminum: Clean prefinished aluminum and repair all scratches and defects as recommended by the coating manufacturer.

END OF SECTION

DIVISION 6 – WOODS AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood blocking and nailers.

B. Related Sections include the following:

Section 06160 - SHEATHING.

1.2 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- B. Exposed Framing: Framing not concealed by other construction.

1.3 SUBMITTALS

A. Submit in accordance with Section 01300 – SUBMITTALS.

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

C. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSA Board of Review.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Power-driven fasteners.
3. Metal framing anchors.

1.4 DELIVERY, STORAGE, AND HANDLING

Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all rough carpentry unless otherwise indicated. Insert other items that require treatment but are not likely to be indicated on Drawings.

2.3 DIMENSION LUMBER FRAMING

- A. Load-Bearing walls: No. 2 grade.
 - 1. Application: Exterior walls and interior load-bearing partitions.
 - 2. Species: Douglas fir-larch; WCLIB or WWPA.
- B. Beams and Posts: No. 1 grade.
Species: Douglas fir-larch; WCLIB or WWPA.
- C. Other Framing Not Listed Above: No. 2 grade.
Species: Douglas fir-larch; WCLIB or WWPA.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. Dimension Lumber Items: No. 2 grade lumber of the following species:
Douglas fir-larch; WCLIB or WWPA.
- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

- B. Nails and Staples: ASTM F 1667.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.6 METAL FRAMING ANCHORS

- A. Manufacturer: Simpson Strong-Tie Co., Inc. or approved equal.
- B. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G90 coating designation.

Use for interior locations unless otherwise indicated.

- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel, high-strength low-alloy steel Type A, or high-strength low-alloy steel Type B; G185 coating designation; and not less than 0.036 inch thick.

Use for wood-preservative-treated lumber and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

- D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

- G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with indicated fastener patterns where applicable.
 - 2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide 2-by-6-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06160

SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.

B. Related Sections include the following:

Section 06100 – ROUGH CARPENTRY.

1.2 SUBMITTALS

A. Submit in accordance with Section 01300 – SUBMITTALS.

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 QUALITY ASSURANCE

Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.4 DELIVERY, STORAGE, AND HANDLING

Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat all plywood unless otherwise indicated.

2.3 INTERIOR WALL SHEATHING

- A. Plywood Sheathing: DOC PS 1 sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: As indicated on the drawings

2.4 EXTERIOR WALL SHEATHING

- A. Plywood Sheathing : Exposure 1 sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: As indicated on the drawings

2.5 ROOF SHEATHING

- A. Plywood Sheathing: Exposure 1 sheathing.
 - 1. Span Rating: Not less than 48/24.

2. Nominal Thickness: As indicated on the drawings

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 2. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

- B. Fastening Methods: Fasten panels as indicated below:

- 1. Wall and Roof Sheathing:

- a. Nail to wood framing.
- b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION

SECTION 06180

GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes framing using structural glued-laminated timber.
- B. Related Sections include the following:

Section 06100 – ROUGH CARPENTRY.

1.2 DEFINITIONS

Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Product Data: For each type of product.
 - 1. Include data on lumber, adhesives, fabrication, and protection.
 - 2. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 3. For connectors. Include installation instructions.
- C. Shop Drawings:
 - 1. Show layout of structural glued-laminated timber system and full dimensions of each member.
 - 2. Indicate species and laminating combination.
 - 3. Include large-scale details of connections.
- D. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glued-laminated timber including variations due to specified treatment.

Apply specified factory finish to three sides of half-length of each Sample.

- E. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in AITC A190.1.
- F. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.
- G. Research/Evaluation Reports: For structural glued-laminated timber, from ICC-ES.

1.4 QUALITY ASSURANCE

Manufacturer Qualifications: An AITC- or APA-EWS-licensed firm.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with provisions in AITC 111.
- B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Structural glued-laminated timber and connectors shall withstand the effects of structural loads shown on Drawings without exceeding allowable design working stresses listed in AITC 117 or determined according to ASTM D 3737 and acceptable to authorities having jurisdiction.
- B. Seismic Performance: Structural glued-laminated timber and connectors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with AITC A190.1 and AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.
 - 1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.
 - 2. Provide structural glued-laminated timber made from single species.
 - 3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
 - 4. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.

5. Adhesive shall not contain urea-formaldehyde resins.
- B. Certified Wood: Glued-laminated timber shall be certified as "FSC Pure", "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- C. Species and Grades for Structural Glued-Laminated Timber: Douglas fir-larch that complies with structural properties and beam stress classifications indicated.
- D. Species and Grades for Beams:
 1. Species and Beam Stress Classification: Douglas fir-larch, 24F-1.8E.
 2. Lay-up: balanced.
- E. Appearance Grade: Architectural, complying with AITC 110.

For Architectural appearance grades, fill voids as required by AITC 110.

2.3 PRESERVATIVE TREATMENT

- A. Preservative Treatment: Where preservative-treated structural glued-laminated timber is indicated, comply with AWPA U1, Use Category 1.
 1. Use preservative solution without substances that might interfere with application of indicated finishes.
 2. Do not incise structural glued-laminated timber or wood used to produce structural glued-laminated timber.
- B. Preservative: Propiconazole tebuconazole imidacloprid (PTI) in a water emulsion.
- C. After dressing members, apply a copper naphthenate field-treatment preservative to comply with AWPA M4 to surfaces cut to a depth of more than 1/16 inch.

2.4 TIMBER CONNECTORS

- A. Fabricate beam seats from steel as indicated.
- B. Fabricate beam hangers from steel as indicated.
- C. Fabricate strap ties from steel as indicated.
- D. Provide bolts, 3/4 inch unless otherwise indicated, complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); nuts complying with ASTM A 563/A 563M; and, where indicated, flat washers.
- E. Materials: Unless otherwise indicated, fabricate from the following materials:

1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.
 2. Hot-rolled steel sheet complying with ASTM A 1011/A 1011M, Structural Steel, Type SS, Grade 33.
- F. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness.
- G. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A 123/A 123M or ASTM A 153/A 153M.

2.5 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.6 FABRICATION

- A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

Dress exposed surfaces as needed to remove planing and surfacing marks.

- B. Camber: Simple span beams shall have 3,500 foot radius camber unless otherwise noted.

- C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWWA M4.

1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

- D. End-Cut Sealing: Immediately after end cutting each member to final length and after preservative treatment, apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.

- E. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit except for preservative-treated wood where treatment included a water repellent.

2.7 FACTORY FINISHING

- A. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.

Color: As indicated by manufacturer's designations.
- B. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew and fungus.
- C. Finishing materials shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- C. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.
 - 1. Pre-drill for fasteners using timber connectors as templates.
 - 2. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 - 3. Coat cross cuts with end sealer.
 - 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.

- a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- D. Install timber connectors as indicated.
- 1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
 - 2. Install bolts with orientation as indicated or, if not indicated, as directed by the Engineer.

3.3 ADJUSTING

Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by the Engineer.

3.4 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.
- 1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.
 - 2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all finish carpentry work, complete, including, but not limited to, the following items.
 - 1. Finish carpentry work.
 - 2. Wood trim.
 - 3. Millwork.
 - 4. Custom casework.
 - 5. Solid polymer surfacing.
 - 6. Wood polymer composite lumber.
 - 7. Fiber cement panels.
 - 8. Deal tray.
 - 9. Rough hardware.
 - 10. Install wood doors, finish hardware, built-in equipment, whiteboards, and any other items specified to be installed under this section but furnished under other sections of these specifications.

- B. Related Work Specified Elsewhere:
 - 1. Wood blocking and concealed framing is specified under Section 06100 - ROUGH CARPENTRY.
 - 2. Preservative treatment is specified under Section 06311 - PRESERVATIVE TREATED LUMBER.
 - 3. Finish hardware for custom cabinetry is provided under Section 08710 - FINISH HARDWARE.
 - 4. Stainless steel countertops are provided under Section 11414 - STAINLESS STEEL COUNTERTOPS.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's product data for all manufactured items such as the following:
 - 1. Solid polymer surfacing.
 - 2. Plastic laminate.
 - 3. Fiber cement panels.
 - 4. Deal tray.
 - 5. Wood polymer composite lumber.
- C. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, materials, large scale details, attachment devices, and other components. Submit shop drawings for the following:
 - 1. Millwork.
 - 2. Custom casework.
- D. Samples: Submit 4 each samples of the following:
 - 1. Laminated plastic.
 - 2. Solid polymer surfacing.
 - 3. Fiber cement panels.
 - 4. Wood polymer composite lumber.
- E. Certificates: Provide a certificate of treatment showing compliance with the specifications.
- F. Material Safety Data Sheet (MSDS): Submit MSDS for each material.

1.3 QUALITY ASSURANCE

- A. Grading Marks: Factory mark each piece of lumber and plywood 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.

- B. Qualifications of Manufacturer: Cabinets used in work of this section shall be produced by manufacturers or custom cabinet shops regularly engaged in manufacturing of similar items and with a minimum 5 year history of successful production acceptable to the Engineer.
- C. Qualifications of Installers: Use adequate number of skilled workmen who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work of this section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect finish carpentry materials during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.
- B. Do not deliver finish carpentry materials, until painting, wet work, grinding, and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.
- C. Store materials away from threat of termite or other insect infestation.
- D. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 WOOD PRODUCT QUALITY STANDARDS

- A. Softwood Lumber Standards: Comply with American Lumber Standards Committee (ALSC) PS 20 and with applicable grading rules of the respective grading and inspection agency for the species and product indicated.
- B. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.
- C. Plywood Standards: Comply with American Plywood Association (APA) PS 1 for softwood plywood and PS 51 for hardwood plywood.
- D. Architectural Woodwork Quality Standards: Comply with Architectural Woodwork Institute, Architectural Woodwork Standards (AWS), Guide Specifications and Quality Certification Program, latest edition.
- E. Particleboard, flakeboard, or fiberboard solid panels shall not be used for any cabinet components.

2.2 MATERIALS

- A. General: Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and pattern as shown, unless otherwise indicated.
- B. Exterior Finish Carpentry:
 - 1. Fiber Cement HZ10 Panels: ASTM C 1186, Grade II, Type A.
 - a. Fiber Cement Soffit Panel: Fiber reinforced cement sheet, HardieSoffit 1/4-inch thick, width as required for soffit, 8-foot lengths, Cedarmill texture panels non-vented or pre-approved equal. Provide factory primed material.
 - b. Fiber Cement Wall Panels: Fiber reinforced cement sheet, HardiePanel, 5/16-inch thick, Cedarmill texture panels or pre-approved equal in maximum size panels to minimize joints or pre-approved equal. Provide factory prefinished materials.
 - c. Fiber Cement Trims: Fiber reinforced cement boards, HardieTrim, widths as indicated, Rustic Grain Batten Boards and 4/4 Rustic texture in maximum lengths to minimize joints or pre-approved equal. Provide factory primed materials.
 - 2. Wood-Polymer Composite Lumber: Material shall be approximately 40 to 50 percent recycled thermoplastic and 50 to 60 percent recycled wood fiber. Fibers shall raise slightly when wet for deck slip resistance. Material shall be resistant to termites, ants, rot, and decay and be equivalent to Trex as manufactured by Trex Company LLC, saddle color or pre-approved equal. Materials shall conform to physical properties as indicated.
- C. Miscellaneous Materials:
 - 1. Plastic Laminate (PL-#): NEMA LD-3 unless noted otherwise.
 - a. Sheet plastics shall be standard finish, high pressure plastic laminate. Sheet plastic shall be in colors as selected by the Engineer from the manufacturer's catalogs or sample colors. Provide sheets for countertops in minimum 8-foot lengths for counter 8-foot and longer in length to minimize joints.
 - b. Core material shall be not less than 3/4-inch. Core material shall be plywood or engineered plywood unless indicated otherwise.

- c. Adhesives for use with treated wood other than SBX preservative shall be resorcinol type as recommended by manufacturer and equal to INDSPEC G1149/G1131B for application over preservative treated wood. Installation shall be in strict accordance with the manufacturer's written directions. (Material is resistant to delamination of surface over copper containing treatment).
 - d. Adhesive for use over substrate treated with SBX preservative shall be as recommended by the adhesive manufacturer. (Core material shall be dried below 19 percent moisture content).
 - e. Installation over melamine covered treated plywood core or other pre-accepted method to ensure permanent plastic laminate bonding will be considered by the Engineer.
 - f. Sheet plastic shall be as manufactured by Formica, WilsonArt, Pionite, Nevamar, or an pre-approved equal.
2. Solid Polymer Surfacing: Non-porous homogeneous filled acrylic. Material shall not be coated or laminated to substrates. Material shall be thickness indicated but not less than 1/2-inch. Superficial damage to a depth of 0.01-inch shall be repairable by sanding and polishing. Provide lavatories with integral bowl as indicated. Provide Corian, Gibraltar, Hi-Macs, Starion, or pre-approved equal. Material shall conform to the following minimum requirements:
- a. Tensile Strength: ASTM D 638, 5,800 psi.
 - b. Hardness: ASTM D 2583, Barcol Impressor, 55 minimum.
 - c. Flammability: ASTM E 84, Class 1/A, flame spread of 25 maximum and smoke development of 30 maximum.
 - d. Thermal Expansion: ASTM D 696, 0.00002 inch/inch/degree F.
 - e. Boiling Water Resistance: NEMA LD3, no effect.
 - f. High Temperature Resistance: NEMA LD3, no effect.
 - g. Liquid Absorption: ASTM D 570, 24 hours, 0.10 percent maximum.
 - h. Mold and Mildew Growth: ASTM G 21, no growth, no effect.
 - i. Bacteria Growth: No growth, no effect.
 - j. Sanitation: NSF/ANSI 51, "Food Contact", approval for food area applications.

- k. Impact Resistance: NEMA LD3, 1/2 pound ball drop; 1/4-inch material, 36-inch drop, no failure; and 1/2-inch material, 120-inch drop, no failure.
3. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create color matched inconspicuous, non-porous joints with a chemical bond.
4. Panel Adhesive: Manufacturer's standard neoprene based panel adhesive, UL listed.
5. Panel Sealant: Manufacturer's standard mildew resistant, FDA compliant and UL listed silicone sealant in color matched finish.
6. Weather Barrier: Weather barrier and secondary weather resistive membrane, when applied on exterior walls, as manufactured by James Hardie Building Systems, DuPont Co., Raven Industries, Griffolyn Reinforced Vapor Barrier, Fortifiber Corp., PRO Installer, or pre-approved equal. Provide with self-adhering flashing and seam tape as required. Material shall be Class A tested in accordance with the procedures of ASTM E 84.
7. Fasteners and Anchorages: Provide nails, screws, and other anchoring devices of the proper type, size, material, and finish for application indicated to provide secure attachment, concealed where possible, and complying with ASTM F 547 and applicable ANSI standards. Provide all fasteners and anchorages with a hot-dipped zinc coating ASTM A 153/A 153M, Class C or D as applicable except that fasteners used with ACQ-C and ACQ-D, CBA-A, CA-B, and borate non-DOT type treated wood shall be G185 or stainless steel. Fasteners at wet areas shall be stainless steel.
8. Deal Tray: Interbank-Exchange LLC QS-1612, 16-inch by 12-inch stainless steel or pre-approved equal.

2.3 FABRICATION

- A. Millwork and custom casework shall be fabricated at the mill or casework shop in accordance with detailed drawings, in as large units as practicable for shipment and introduction into permanent position in an orderly arrangement for neat and rigid field assembly. All units when erected in place shall be straight, square, plumb, level and free from damage and tool marks. All joints shall be made up with waterproof glue. Nails and screws shall be placed in concealed surfaces to the maximum extent possible. Particleboard core shall not be used.
- B. Plastic Laminate Faced Cabinets: Provide shop fabricated casework for plastic laminate finish as follows:
 1. Quality Standard: AWS Section 10, premium.

2. Cabinet Construction, including Countertops: 3/4-inch plywood or engineered plywood throughout unless noted otherwise. Flush overlay type casework construction, unless detailed otherwise.
 3. Cabinet Doors and Exposed Cabinet Sides: 3/4-inch plywood or engineered plywood with solid wood edging for plastic laminate finish.
 4. Cabinet Trim shall be solid wood for plastic laminate finish.
 5. Shelves shall be minimum 3/4-inch plywood or engineered plywood with solid wood edging, unless otherwise noted for plastic laminate finish.
- C. Countertops: Countertops shall be as detailed.
- Solid Surfacing: AWS Section 11.
- D. Plastic Laminate Grades: Provide grades as follows:
1. Exposed Surfaces: Provide high pressure laminate in grades specified for the following types of surfaces:
 - a. Horizontal Surfaces: GP-50 and PF42 as applicable.
 - b. Vertical Surfaces: GP-28.
 2. Semi-Exposed Surfaces:
 - a. Cabinet Liner: CL20.
 - b. Backer Sheet: BK20.
- E. Custom Casework:
1. Visible plywood edges banded with solid wood. No visible nails.
 2. Division and end panels shall be dadoed to receive bottoms, web frames, and stretchers.
 3. Drawers: Sides blind dovetail dadoed and securely glued into fronts. Sides multiple dovetailed or lockjointed and nailed, or dadoed and nailed to backs. Sides and front plowed to receive bottom.
 4. Pre-Cut Openings: Fabricate casework with pre-cut openings, where possible, to receive hardware, plumbing fixtures, and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges

of cutouts and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.

5. Measurements: Before proceeding with fabrication of casework required to be fitted to other construction, obtain measurements and verify dimensions and shop drawing details as required for accurate fit. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.
6. Cabinet Drawer and Door Tolerances: Clearance gap between adjoining drawers or doors shall be 1/8-inch maximum, with a 1/32-inch maximum allowable variation in gap width.
7. Maximum warp or twist allowed in any surface shall be 1/32-inch per lineal foot.
8. Coordinate deal tray with adjoining window.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.
- B. Install the work plumb, level, true, and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8-inch in 8-feet for plumb and level countertops; and with 1/16-inch maximum offset in flush adjoining 1/8-inch maximum offsets in revealed adjoining surfaces.
- C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum lengths of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint. Use scarf joints for end-to-end joints. Sand smooth for imperceptible joints. Make exterior joints water-resistant by careful fitting.
- E. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and where prefinished matching fasteners heads are required, use fine finishing nail for exposed nailings, countersunk and filled flush with finished surface.

F. Casework:

1. Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
2. Fasten each individual cabinet to floor with fasteners spaced a maximum of 24-inches on center. Fasten to walls at framing or blocking. Attachment to gypsum wallboard alone is not permitted. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16-inch.
3. After installation, carefully dress joints smooth, remove any surface scratches, clean, and polish entire surface.
4. Provide holes and cutouts as required for mechanical and electrical service fixtures. Provide scribe moldings for closures at perimeter walls as recommended by manufacturer for materials involved. Use chemical resistant, permanently elastic sealing compound where recommended by manufacturer.

G. Solid Polymer Counter Surfacing: Install as recommended by the manufacturer in as large pieces available to minimize joints. Form all edges as indicated. Form joints to be imperceptible in the finish work.

H. Weather Barrier Underlayment: Install as recommended by the manufacturer.

I. Fiber Cement Siding: Install with screws to framing as recommended by the manufacturer with all fasteners concealed. Any fastener at exposed surface shall be filled with patching compound to match adjacent finish.

J. Re-treat cut and penetrated lumber in accordance with Section 06311 - PRESERVATIVE TREATED LUMBER.

3.2 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION

- A. Repair damaged and defective casework wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace casework. Adjust joinery for uniform appearance.
- B. Clean hardware, lubricate, and make final adjustments for proper operation.
- C. Clean casework on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

- D. Protection: Installer of architectural casework shall advise Contractor of procedures required to protect architectural casework during remainder of construction period to ensure that work will be without damage or deterioration at time of project acceptance.

END OF SECTION

SECTION 06311

PRESERVATIVE TREATED LUMBER

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Preservative treat all lumber and plywood unless specified or noted otherwise.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical product information on all products to be used, including recommendations and restrictions on wood species and uses.
- C. Manufacturer's Instructions: Submit manufacturer's written instructions for handling, disposing, and field treating treated lumber.
- D. Certificate of Treatment: Submit a certificate of treatment to the Engineer showing compliance with these specifications, both as to kiln drying and type of treatment performed, including dip treatment.
- E. Certification: The Contractor shall submit a written certification to the Engineer that all wood used and left in place on this job was treated in accordance with these specifications and that all cuts and penetrations made subsequent to the treatment were coated with preservatives in compliance with item entitled "INSTALLATION" hereinbelow.
- F. Material Safety Data Sheet (MSDS): Submit MSDS for products used and keep one posted at the project site.
- G. Treatment Schedule: Prior to treatment, submit a complete list of all wood products, including each species if treated with different preservative material and the treatment material proposed for use.
- H. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Preservatives containing arsenic such as Chromated Copper Arsenate (CCA) and Ammoniacal Copper Zinc Arsenate (ACZA) shall not be used.
- B. Perma-Clear 65 or other zinc naphthanate products shall not be used.

- C. Comply with all State OSHL and pollution control regulations of the State of Hawaii and EPA.
- D. Do not use treatments containing EPA banned chemicals.
- E. Materials shall be specifically recommended by the manufacturer for species of wood, use intended, and exposure indicated.
- F. Structural lumber shall be treated in accordance with AWWPA Standard U1, "Use Category System: User Specification for Treated Wood", (UC1 thru UC4B) in accordance with ICC IBC, as amended.
- G. Labeling: Permanent ink stamp or durable tag permanently fastened as stipulated in ICC IBC, as amended.
- H. Do not use oil-borne preservatives where food contact is possible.

1.4 WARRANTY

- A. The Contractor shall issue to the State a written warranty that he will replace all treated wood which is attacked by subterranean termites within a period of 2 years from the date of project acceptance (unless a longer period of time is standard with the manufacturer) up to a total cost of \$5,000.00 (unless higher amount standard with the manufacturer) or is attacked by dry wood termites or deteriorates due to dry rot within the first 5 years of the project acceptance date.
- B. The Surety shall not be held liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Wood treated with oil-borne preservatives shall be kiln-dried before treatment to an average moisture content of 12 percent to 15 percent per AWWPA standards unless specified otherwise.
- B. Wood treated with water-borne preservatives (with the exception of SBX treated wood) shall be air dried or kiln-dried before treatment to an average moisture content of 28 percent or less per AWWPA standards. Wood having a moisture content higher than 28 percent is acceptable when treating with SBX materials.
- C. Wood shall be treated as noted below.
- D. Lumber shall be milled to finish size and shape prior to treating, and it shall be treated before assembly. Plywood may be treated in regular panel sizes.

2.2 MATERIALS

- A. Water-Borne Preservatives: Water-Borne Preservatives shall be Preserve ACQ, Preserve Plus ACQ, Wolman E CBA, Hi-Bor SBX, and Timber Saver PT SBX, or pre-approved equal, except as stipulated otherwise in accordance with American Wood Preservers Association (AWPA) Standard P5 - "Standards for Waterborne Preservatives", and permitted by EPA. Preservatives shall be EPA registered. (Hawaii use only treatment is not acceptable).
1. Treatment for ACQ and CBA treated wood shall be as recommended by the manufacturer. Preservatives shall be EPA registered.
 2. Water-Borne Preservatives used to coat end cuts and penetrations in SBX treated wood shall be Clear-Bor F.T. or an equivalent solution of 10 percent inorganic boron. The end coating solution must be approved and labeled by the Environmental Protection Agency and must be accepted by the State of Hawaii, Department of Agriculture, Pesticides Branch, for this purpose. The treatment solution shall have a colorant added which will tint the wood surface to indicate treatment where wood will be unexposed. The Contractor shall be held responsible for all bleed through of dye.
- B. Oil-Borne Preservatives: Oil-Borne Preservatives shall be TRIB II Type B, Permethrin/IPBC (3-iodo-2 propynyl butyl carbonate) in a base solution of mineral spirits, manufactured to the manufacturer's quality control and EPA registered, or pre-approved equal. The solvent used in formulating the preservative solution shall meet the requirements of AWPA Standard P9 - "Standard for Solvents for Organic Preservative Systems". For interior application use low odor mineral spirits as the solvent.

PART 3 - EXECUTION

3.1 WOOD PRESERVATION WITH WATER-BORNE PRESERVATIVES

- A. Unless otherwise stipulated, all lumber and plywood shall be pressure treated.
- B. Lumber and plywood, except as stipulated in items entitled "WOOD PRESERVATION BY PRESSURE TREATMENT WITH OIL-BORNE PRESERVATIVES" and "WOOD PRESERVATION BY DIP TREATMENT" hereinbelow, shall be treated with ACQ and CBA materials as specified and in accordance with American Wood Preservers Association (AWPA) Standards C2 - "Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Process", C9 - "Plywood Preservative Treatment by Pressure Processes", and C15 - "Wood for Commercial-Residential Construction", or SBX material, using the full cell pressure method in conformance with AWPA Standard C1 - "All Timber Products - Preservative Treatment by Pressure Processes", or C31, "Lumber Used Out of Contact with the Ground and Continuously Protected from Liquid Water - Treatment by Pressure Processes". Lumber and plywood treated with SBX shall attain the following penetration and retention requirements:

1. Lumber:
 - a. Penetration Requirement for Lumber Under 5-inch Nominal Thickness: 0.40-inch in heartwood and 90 percent in sapwood.
 - b. Penetration Requirement for Lumber 5-inch Nominal Thickness and Over: 0.50-inch in heartwood and 90 percent in sapwood.
 - c. Retention requirement for lumber shall be a minimum of 1.50 percent weight/weight or 0.42 pound per cubic foot in an assay zone of 0.0 - 0.6 inch for lumber under 5-inches nominal thickness and 0.0 - 0.75 inch for lumber over 5-inches in nominal thickness.

2. Plywood:
 - a. Penetration requirement for plywood shall be identical to that noted in AWWA Standard C9.
 - b. Retention requirement for plywood shall be a minimum of 1.27 percent weight/weight or 0.40 pound per cubic foot through the full thickness.
- C. Lumber 2-inches or less in thickness and all plywood shall be dried to a moisture content of 19 percent or less after treatment.

3.2 WOOD PRESERVATION BY PRESSURE TREATMENT WITH OIL-BORNE PRESERVATIVES

- A. Exposed lumber 1-1/2 inch (net thickness) and over shall be unincised and pressure treated in accordance with the process specifications noted in the latest edition of AWWA Standards C1, C2, and C9.
- B. Wood shall be kiln-dried to an average moisture content of 12 to 15 percent per AWWA standards prior to treatment.
- C. Treated wood shall attain the following net retention requirements: 0.052 pound of dry ingredient per cubic foot of treated wood.
- D. Lumber and plywood shall be thoroughly dried and virtually odor-free prior to installation.

3.3 WOOD PRESERVATION BY DIP TREATMENT

- A. Finish lumber under 1-1/2 inch net thickness; finish plywood; and mill work items, such as for cabinet work, shelving, and similar wood work that will be exposed to view in the finished work shall be immersion treated for a minimum period of 15 minutes in any of the preservatives listed in paragraph entitled "Oil-Borne Preservatives" hereinabove or in accordance with the requirements of the Window and Door Manufacturers Association

(WDMA) Industry Standard I.S. 4, "Water-Repellent Preservative Non-Pressure Treatment for Millwork", or in a solution of 1 quart Permethrin in 55 gallons of a 0.50 percent IPBC solution.

- B. Lumber and plywood shall be thoroughly dried and virtually odor-free prior to installation.

3.4 GLUE LAMINATED TIMBER

Treat structural glue laminated timber in accordance with AWWA C1, AWWA C28, "Preservative Treatment of Structural Glued Laminated Members, and Laminations Before Gluing of Southern Pine, Pacific Coast Douglas Fir, Hemfir and Western Hemlock by Pressure Processes", and AWWA U1 (UC1 thru UC4B) in accordance with ICC IBC, as amended.

3.5 INSTALLATION

- A. Wherever it is necessary to end cut or penetrate into (such as by drilling or notching) treated wood on the job, all such cuts and penetrations shall be treated in accordance with AWWA Standard M4, "Care of Preservative Treated Wood Products", or in accordance with the approved preservative manufacturer's ICC Evaluation Services report requirements, using two heavy brush coats of a treating solution as recommended by the manufacturer. Where allowed by preservative manufacturer, spray cut ends and bored holes with "Hudson Bay" type sprayer, 2 coats. Exception: Cuts and penetrations made in SBX treated wood 2-inches or less in nominal thickness need not be field treated.
- B. 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 finishing material.
- C. Workers, in the field or in applicable millwork shops, shall read and follow all instructions and recommendations of the preservative treatment manufacturer and wood treatment applicator.

3.6 CLEAN UP

Dispose of treated wood in a sanitary landfill or other authorized disposal area. Do not burn treated wood.

END OF SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 07190

WATER REPELLENT SEALER

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Extent of water repellent sealer is shown on the drawings and includes concrete and masonry surfaces.
- B. Related Work Described Elsewhere:
 - 1. Coordinate compatibility of compounds used in concrete work with Section 03300 - CAST-IN-PLACE CONCRETE.
 - 2. Concrete masonry is provided under Section 04810 - UNIT MASONRY ASSEMBLIES.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturers technical product data and installation instructions for all materials.
- C. Samples: Submit 4 samples of water repellent on accepted concrete and masonry finish samples, with repellent treatment to be applied to half of each sample.
- D. Material Safety Data Sheets (MSDS): Submit MSDS for all materials. Keep one copy on site.
- E. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.
- B. Applicator: Company specializing in performing the work of this section with minimum 3 years documented experience.

- C. Jobsite Sample: Test a small area of surface where directed by the Engineer before starting general application to assure desired results. Sample shall be accepted prior to application at remaining areas.

1.4 PRODUCT HANDLING

- A. Deliver materials in the original manufacturer's sealed containers.
- B. Store materials in such a way as to prevent damage to containers or product.
- C. Sealer shall be thoroughly stirred before and occasionally during use.

1.5 PROJECT CONDITIONS

- A. Surface, air, and material temperatures shall conform to manufacturer's requirements.
- B. Weather shall be clear and there shall be no precipitation during application or within a subsequent period as recommended by the manufacturer.
- C. Areas not subject to natural ventilation shall have positive ventilation provided throughout the application.
- D. Surfaces to be treated shall be dry.
- E. Personnel shall be warned against contact of materials with skin or eyes.
- F. Surfaces unintentionally coated during application shall be cleaned as recommended by the manufacturer.
- G. Upon completion of the work, trash, and debris created by work completed under this section shall be removed from the site.
- H. Restrict traffic from area where materials are being installed until material has cured.

1.6 WARRANTY

- A. Provide written 10 year warranty signed by Contractor and applicator.
- B. Include coverage for replacement of collateral work from failure of installation to resist penetration of moisture.
- C. The Surety shall not be held liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 MATERIALS

Penetrating Water Repellent: An oligomeric siloxane micro emulsion that dries to a clear appearance without altering the surface appearance in any way. Provide Zinsser Okon S-40 or pre-approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate work done under other sections meets requirements for application of water repellent sealer. Notify Engineer in writing of any conditions requiring additional treatment prior to application.
- B. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coating.
- C. Verify joint sealants where installed are cured.

3.2 PREPARATION

- A. All concrete, mortar, and patches shall be sufficiently cured prior to application of sealer.
- B. Surfaces shall be cleaned to have all laitance, dirt, dust, efflorescence, mold, salt, grease, oil, and curing compounds removed prior to application. Acceptable surface cleaning methods include shotblasting, sandblasting, waterblasting, and chemical cleaners.
- C. Surfaces shall be free of alkali, efflorescence, chemical films, and other contaminants.
- D. Surface shall be dry prior to application.
- E. Mask joints and drains to prevent migration of materials as required.

3.3 APPLICATION

- A. Apply to saturation. Flood the substrate with a minimum 8 - 12 inch controlled rundown using a low-pressure, airless spray.
- B. Coverage Rates: Apply at maximum rate as recommended by the manufacturer for material and porosity of the substrates.
- C. Coats: Apply in two continuous, uniform applications.

3.4 PROTECTION OF FINISHED AND ADJACENT WORK

- A. Protect adjacent surfaces, including pavement not scheduled to receive coating.
- B. Protect landscaping, vehicles, and construction not to receive coatings.
- C. If applied to unscheduled surfaces, remove immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The extent of building insulation work is shown on the drawings, by the generic name.
- B. The types of building insulation specified in this section include, but are not limited to, the following:
 - 1. Thermal batt insulation for walls and partitions.
 - 2. Thermal rigid insulation for roof at supported (deck) framing.
- C. Related Work Specified in Other Sections: Rigid insulation for built-up roofing is provided under Section 07535 - MODIFIED BITUMEN SHEET ROOFING (TORCHED-ON).

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for types of insulation required. Include data substantiating that materials comply with specified requirements.
- C. Material Safety Data Sheets (MSDS): Submit MSDS for each material.

1.3 QUALITY ASSURANCE

- A. Thermal Resistivity: Where thermal resistivity properties of insulation materials are designated by "R"-values they represent the rate of heat flow through a homogenous material exactly 1-inch thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.
- B. Fire and Insurance Ratings: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Surface Burning Characteristics: ASTM E 84.

2. Fire Resistance Ratings: ASTM E 119.
 3. Combustion Characteristics: ASTM E 136.
- C. Recycled Materials: Provide insulation containing recycled materials to the extent practicable, provided the materials meets all other requirements of this section. The minimum required recycled materials content by weight are:
1. Rock Wool: 75 percent slag.
 2. Fiberglass: 20 to 25 percent glass cullet.

1.4 SAFETY PRECAUTIONS

- A. Respirators and Other Concerns: Comply with OSHA 29 CFR 1910.134, "Respiratory Protection", ASTM C 930, "Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories", and other Federal, State, and local regulations governing safety. Provide workers with dust/mist respirators, training in their use, and protective clothing as approved by the National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA).
- B. Smoking: Do not smoke during installation of blanket insulation.
- C. Do not use unfaced insulation in exposed applications where there is potential for skin contact and irritation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled or crushed. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.
- B. Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Thermal Batt Insulation for Walls: ASTM C 665, Type I, unfaced, flame spread of 25 or less and a smoke developed rating of 150 or less when tested in accordance with the procedures of ASTM E 84, R = 13 or as indicated. Provide widths as necessary to snugly fit framing spacing as indicated.

- B. Thermal Rigid Insulation for Roof at Supported (Deck) Framing Below Preformed Metal Roofing with Polyisocyanurate Board: ASTM C 1289 Type II, felt faced, or Type I, foil-faced, except minimum compressive strength shall be 20 pounds per square inch, R = 15 minimum.
- C. Cover Board: ASTM C 1177/C 1177M, glass mat faced, water resistant treated gypsum core intended for use under metal roofing and recommended by roofing system manufacturer; 1/4-inch thick minimum unless indicated otherwise.

2.2 ACCESSORIES

- A. Adhesive: As recommended by the insulation manufacturer as applicable.
- B. Mechanical Fasteners: Corrosion resistant fasteners as recommended by the insulation manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specified recommendations before proceeding with the work.
 - 2. Extend roof and wall insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
 - 3. Apply a single layer of insulation of the required thickness, unless otherwise shown or required to make up the total thickness.
 - 4. Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the R-values shown or specified. For acoustical insulation, maintain acoustical rating of assembly.
 - 5. When unfaced insulation is used and the stud depth is larger than the insulation thickness, install wire or metal straps to hold insulation in place.
 - 6. Space insulation from heat producing devices as recommended by the manufacturer, but not closer than 3-inches.

- 7. Electrical Wiring: Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

- B. Thermal Rigid Roof Insulation at Metal Roofing: Install over decking with either mechanical fasteners or adhesive to secure in place prior to installation of roofing.

- C. Thermal Batt Wall Insulation: Install as specified in Section 09250 - GYPSUM WALLBOARD after cover material has been installed on one side of cavity.

3.2 PROTECTION

Protect installed insulation and facing from harmful weather exposures and from possible physical abuses, where possible by nondelayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

END OF SECTION

SECTION 07410

PREFORMED METAL STANDING SEAM ROOFING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Extent of preformed roofing is indicated on the drawings and by provisions of this section. Provide all materials, including all flashings for a complete system.
- B. Type of panels required include the following: Formed sheet panels, intended for concealed fastener installation.
- C. Related Work Described Elsewhere: Roof insulation is provided under Section 07210 - BUILDING INSULATION.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's product specifications, standard details, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total system of preformed panels.
- C. Shop Drawings: Submit shop drawings of all roofing, flashing, fastenings, supports, anchors, and clearances, and connection details to the Engineer for acceptance.
- D. Samples: Furnish 4 each, 4-inch long samples of full width panel materials and samples of all other materials to be used to Engineer for acceptance.
- E. Test Reports: Provide test data demonstrating structural capacity, wind uplift and resistance to water infiltration performance as specified.
- F. Warranty: Submit warranty as noted under item entitled "WARRANTY" hereinbelow.

1.3 QUALITY CONTROL

- A. Installer: The roofing system installer shall be factory-trained, approved by the metal roofing system manufacturer to install the system, and shall have a minimum of 3 years experience as an approved applicator with that manufacturer. The applicator shall have applied five installations of similar size and scope as this project within the previous 3 years.

- B. Installation Crew: Provide and maintain same foreman and crew from start to finish of work unless change is accepted by the Engineer. Workmen who will be walking on roof panels shall wear soft-soled shoes that will not damage the panels.
- C. Preroofing Conference: After submittals are received and accepted but before roofing work, including associated work are performed, the Contractor shall hold a preroofing conference to review the following:
 - 1. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system.
 - 2. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing.
 - 3. Attendees: The preroofing conference shall be attended by the Contractor and personnel directly responsible for the roofing installation. Conflicts among those attending the preroofing conference shall be resolved and confirmed in writing before roofing work, including associated work, is begun. Prepare written minutes of the pre-roofing conference and submit to the Engineer.

1.4 WARRANTY

- A. Furnish written 5-year warranty to the Engineer jointly signed by Roofing Contractor, Sheet Metal Contractor and General Contractor which shall provide for repairs or replacement of roofing and flashing where leaking occurs due to faulty materials and workmanship at no extra cost to the State from the date of project acceptance.
- B. The Surety shall not be held liable beyond 2 years from the project acceptance date.
- C. Provide manufacturers warranty for coating system under Hawaiian weather conditions, provide following as a guide for expected warranty:
 - 1. The roofing panels and matching flashings with a factory applied Fluoroceram (Kynar 500 or equivalent) paint finish are free from material defects and shall be warranted for 20 years against peeling, chipping, cracking or color change in excess of 5 NBS units during the term of this warranty. For 20 years in the event that the above paint system fails under normal wind and weathering conditions, the manufacturer/supplier shall replace or repair as necessary any panels whose factory color finish that fails. This paint finish warranty commences upon Project Acceptance.
 - 2. Additionally, the metal roofing system components for the project as identified by the Contract Drawings for this project, shall be warranted for a period of 15 years from the date of Project Acceptance. Manufacturer/supplier shall replace or repair as necessary any component of the roof system supplied by them, when installed and maintained according to Manufacturer's instructions, which fail to provide a

watertight and weatherproof system due to defective materials. All labor, materials, general condition, and equipment required to perform any repair work shall be provided by the manufacturer/supplier. Repair work shall be done in a manner that will not disrupt State access to the building.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle preformed panels, bulk roofing products, and other manufactured items in a manner to prevent damage or deformation.
- B. Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, dampness, and staining. Replace damaged or permanently stained materials that cannot be restored to like-new condition with new material. If materials are wet, remove moisture, restack, and protect panels until used.
- C. Stack materials stored on the site on platforms or pallets and cover with tarpaulins or other suitable weathertight coverings which prevent water trapping or condensation. Store panels so that water which might have accumulated during transit or storage will drain off. Do not store the panels in contact with materials that might cause staining, such as mud, lime, cement, fresh concrete or chemicals. Protect stored panels from wind damage.
- D. Handle material carefully to avoid damage to surfaces, edges, and ends.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Roof Panels: Formed from minimum 24 gauge "Zincalume" or "Galvalume" coated steel conforming to ASTM A 792/A 792M, Grade 33 with a minimum AZ50 coating. Panel configuration shall be structural standing seam roofing with concealed fasteners. Panel width shall be 24-inches with 1-3/4 inch vertical leg and 2 or 3 intermediate stiffening beads as manufactured by HPM Building Supply Custom Metal Roofing, Shur-Lock 24-inch or equivalent by Kloeckner Metals, Tomen Building Components, Inc., Centria, MBCI Metal Roof and Wall Systems, Architectural Metal Products, or pre-approved equal. Panels shall be prefinished as specified.
- B. Flashing and Closures: Formed of prefinished material to match roof panels of manufacturer's standard flashings for the panels specified. Configuration of flashings shown on the drawings are intended to indicate basic intent. Other flashings which accomplish the basic intent will be acceptable if standard with the panel manufacturer. Provide metal flashings for locations indicated. Furnish sheet metal flashing items in 8- to 10-foot lengths. Single pieces less than 8-feet long may be used at corners, and at ends of runs. Provide accessories and other items essential to complete the sheet metal installation of the same materials as the items to which they are applied. Connect all pieces of linear

flashing by a slip joint to permit thermal movement. Exposed flashings and metal closure strips shall match finish of roof panel.

2.2 METAL FINISH

- A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Provide color indicated or, if not otherwise indicated, as selected by the Engineer.
- B. For exposed exterior surfaces, provide thick finish of Kynar 500 or equivalent conforming to AAMA 621 with a primer from 0.2 to 0.3 dry mils and Kynar topcoat from 0.7 to 0.9 dry mils for a total thickness of 0.9 to 1.2 dry mils.
- C. Interior/underside finish shall be off white polyester.

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners: Fasteners shall be stainless steel with composite metal and neoprene composition washers. Where required, exposed fasteners shall be gasketed on the exterior side of the covering to waterproof the covering and finished to match roof finish. Concealed fastener and clip system shall be manufacturer approved for system provided and uplift specified.
- B. Accessories: Except as indicated as work of another specification section, provide components required for a complete roofing system, including stainless steel clips, standoff clips, sidelap clips, and uplift clips; trim, flashings and expansion joint flashing; single component polyurethane sealants, gaskets, fillers, closure strips, and similar items. All clips shall be stainless steel. Match materials/finish of preformed roof panels where exposed.
- C. Closure Strips: Formed specifically for this purpose of laminated cross-linked polyethylene closed cell-foam or neoprene materials and as standard with manufacturer. Molded closure strips shall be free of open voids and shall not absorb or retain water. Closure strips shall be formed to match configurations of the roofing and shall be provided where indicated and where necessary to provide weathertight construction.
- D. Sealants: ASTM C 920, Type S, Grade NS, Class 25, Use NT, polyurethane or as recommended by the roofing manufacturer. Color, where exposed, shall match roofing.
- E. Mastic: As recommended by the roofing manufacturer.
- F. Bituminous Coating: Cold-applied asphalt mastic, SSPC paint 12, compounded for 15-mil dry film thickness per coat.

- G. Prefabricated Pipe Flashing System: A premolded flexible pipe sleeve of EPDM in pleated concentric rings, and bond to a square, corrosion-resistant base of soft, aluminum alloy, allowing conformance of base by hand pressure to roofing panel profile. Pipe flashing system shall be equivalent to "Master Flash" by Aztec Washer or Oatey, "Dektite" by Buildex, Aluminum Flashing by LSP Products Group, or pre-approved equal.
- H. Self-Adhering Underlayment: ASTM D 1970/D 1970M polymer modified bituminous sheet materials, minimum 40 mils thick as recommended by the roofing manufacturer. Provide with non-slip surface for safety during roofing operations.
- I. Slip Sheet: As recommended by the manufacturer.
- J. Flexible Flashing: Aluminum foil faced 45 mil rubberized asphalt or butyl rubber roll sheet as recommended by roofing manufacturer for waterproofing top set flashings.

2.4 PANEL FABRICATION; PERFORMANCES

- A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, and as required to fulfill performance requirements, which have been demonstrated by factory testing. Comply with indicated profiles and dimensional requirements, and with structural requirements. Fabricate panels in full lengths from ridge to eave to the greatest extent possible.
- B. Metal Gages: Thicknesses required for structural performances, but not less than manufacturer's recommended minimums for profiles and applications indicated, and not less than specified under "Roof Panels".
- C. Required Performances: Fabricate panels and other components of roof system for the following installed-as-indicated performances:
 - 1. Roof Loading: As indicated.
 - 2. Project Windloads: 105 mph, Exposure C.
 - 3. Panels must meet minimum UL windload uplift classification of 90. Provide additional row of clips at eaves for high wind conditions.
- D. Performance Criteria:
 - 1. Provide wind uplift resistance in accordance with the current local ICC IBC as amended, minimum UL580 Class 90.
 - 2. Structural capacity of metal roofing system shall be determined in accordance with ASTM E 1592. A minimum of two tested spans are required in order to interpolate allowable load data between tested spans. Extrapolation of data outside the tested spans is not allowed.

3. Provide a design analysis signed by a registered Professional Engineer, confirming that the structural capacity of the metal roofing system as determined in accordance with ASTM E 1592 is adequate to resist the design loads required by the ICC IBC. Analysis shall include calculation verifying the design loads, the uplift pressures, and how those loads affect the various areas of discontinuity clearly shown and distinguished from the typical field roof elements.
4. Resistance to Water Infiltration: Roofing system shall show no infiltration at seams, edges, flashings, counterflashings, and penetrations when subjected to a rainfall of 5-inches per hour with 80 mph wind.
5. Thermal Movement: The system shall be capable of withstanding thermal movement based on a temperature range of 10 degrees F below design low air temperature and 140 degrees F for light colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive standing seam metal roofing and flashing. Provide plumb and true surfaces, clean, even, smooth, and as dry as possible. Ensure that surfaces are free from defects and projections which might affect the installation.
- B. Report unsuitable conditions to the Engineer. The Manufacturer's Technical Representative shall approve roof substrate as suitable for roofing system application.

3.2 INSTALLATION

- A. General: Comply with panel fabricator's and material manufacturers' instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place in full and firm contact with concealed anchor clips with provisions for thermal/structural movement as well as carrying the weight of the panels. Obtain acceptance prior to installation on prefinished panels cut in the field and factory applied coverings or coatings that were repaired after being abraded or damaged during handling or installation. Make repairs with material of same color as weather coating. Completely seal openings through panels. Correct defects or errors in materials in an accepted manner. Replace materials which cannot be corrected in an accepted manner with new materials. Provide molded closure strips where indicated and where necessary for weathertight construction.
- B. Provide underlayment with 2-inch minimum head lap and 6-inch end laps. Arrange side laps of roofing to leeward of prevailing wind direction. Apply roofing panels with standing seams parallel to slope of roof. Attach clips with a minimum of 3 stainless steel screws per clip unless manufacturer's data allows otherwise for the required performance specified. Attach panels to structure with concealed clips which are incorporated into the panel seams. Clip attachment shall allow roof to move freely and independently of the structure.

With clip screws in place, test all clips for freedom of movement before covering with the next panel. All clips that bind and cannot be moved with hand pressure shall be replaced. Before applying roofing over flashing such as at eaves, valleys, and penetrations, place additional sealant on the underside of the pan in the pencil ribs to assure a continuous seal.

- C. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4-inch in 20'-0" on level/plumb/slope and location line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles. Layout lines parallel to the rakes at intervals. Use a spacing gage at each row of panels to ensure that panel width is not stretched or shortened.
- D. All field cutting of roofing panels shall be done as recommended by manufacturer's written instructions.
- E. Joint Sealers: Install joint fillers and sealants where indicated and where required for weatherproof performance of panel system. Provide types of sealants/fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer. Refer to Section 07920 - SEALANTS of these specifications for installation requirements applicable to indicated joint sealers.
- F. Roof installation shall be for conditions indicated. Roof installation shall include rigid insulation between zee standoff clips. Structural zeeps and cees and insulation provided under Section 07210 - BUILDING INSULATION shall be coordinated for the same thickness.
- G. Flashings: Provide flashing and related closures and accessories in connection with preformed metal panels as indicated and as necessary to provide a weathertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal roof at ridge, valleys, eaves, and rakes, at projections through roof, and elsewhere as necessary. Accomplish placement of closure strips, flashing, and sealing material in an accepted manner that will ensure complete weathertightness. Details of installation which are not indicated shall be in accordance with the NRCA CD, SMACNA ASMM, panel manufacturer's printed instructions and details of the accepted shop drawings. Installation shall allow for expansion and contraction of flashing.
- H. Flashing Fasteners: Fastener spacings shall be in accordance with the panel manufacturer's recommendations and as necessary to withstand the indicated design loads. Install exposed fasteners in panel valleys as recommended by the manufacturer of the panels. Install fasteners in straight lines within a tolerance of 1/2-inch in the length of a bay. Drive exposed penetrating type fasteners normal to the surface and to a uniform depth to seat gasketed washers properly and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered. Do not drill through sealant tapes. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

- I. Closure Strips: Install closure strips as indicated and as recommended by the manufacturer.
- J. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with wood or other substrate materials which are noncompatible (i.e. copper and aluminum) or could result in corrosion or deterioration of either material or finishes.

3.3 CLEAN UP AND PROTECTION

- A. Damaged Units: Replace panels and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures. Touch-up paint shall not be used without the permission of the Engineer.
- B. Cleaning: Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction. Remove metal shavings, filings, nails, bolts, and wires from roofs and gutters on completion to prevent discoloration and harm to the panels and flashing. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings, and drilling debris and scrub the work clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.

END OF SECTION

SECTION 07535

MODIFIED BITUMEN SHEET ROOFING (TORCHED-ON)

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide 2 ply modified bitumen sheet roofing over tapered insulation for low slope roofing conforming to uplift requirements.
- B. Related Work Described Elsewhere:
 - 1. Coordinate installation of wood nailers related to roofing with Section 06100 - ROUGH CARPENTRY.
 - 2. Coordinate installation of metal edging, counterflashing, gutter, etc. with SECTION 07600 - FLASHING AND SHEET METAL.
 - 3. Coordinate installation of roof hatch with Section 07720 - ROOF ACCESSORIES.
 - 4. Coordinate installation of tubular skylights with Section 08625 - TUBULAR SKYLIGHTS.
 - 5. Coordinate installation of vent pipe flashing with Section 15400 - PLUMBING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit complete sets of the following information for the roofing system proposed for use. Submittals shall be marked-up as necessary to clearly identify the item being submitted and its conformance to the requirements of these specifications.
 - 1. Manufacturer's material product data and Material Safety Data Sheets (MSDS) for the following items:
 - a. Insulation.
 - b. Fasteners, of required length(s) and plates.
 - c. Cover board.
 - d. Base sheet.

- e. Modified bitumen cap sheet.
 - f. Base flashing system.
 - g. Walk-on pads.
 - h. Cant strip.
 - i. Neoprene flashing cement.
 - j. Pourable sealer.
2. Detailed installation drawings and specifications for the proposed roofing system/assembly. The roofing system/assembly shall be a published list of materials and recommended installation instructions applicable to warranty and site conditions. The installation drawings shall indicate the layout of insulation system, the location and pattern of fasteners, and all special conditions.
 3. Listing from a nationally recognized testing laboratory (Warnock Hersey, Factory Mutual, or Underwriters Laboratories) indicating that the proposed roofing system has a fire classification rating of either Class A or Class B. The listing shall also indicate the maximum roof slope permitted for the proposed assembly.
 4. Where required, Factory Mutual or UL approval for the proposed roofing system in accordance with ICC IBC.
 5. All materials, except the insulation and cover board, shall be as labeled or approved by one manufacturer.
- C. Shop Drawings: Submit complete sets of shop drawings detailing all roofing conditions.
- D. Certificates:
1. Prior to the start of any work, submit a signed certificate from the proposed roofing manufacturer stating that the roofer is a trained and authorized applicator of the assemblies and that the installation crew has been trained in the system's proper installation by the Manufacturer or the Technical Representative of the Manufacturer.
 2. Submit a signed certificate from the proposed roofing manufacturer naming their technical representative and their independent roofing auditor/inspector (where applicable) and attesting that this person is authorized to act on and make commitments on their behalf in respect to a complete roofing system.
 3. Warranty Certificate: Submit sample of the Complete Roofing System Warranty from the manufacturer exhibiting conformance with item entitled "WARRANTIES" hereinbelow.

Note: Warranty shall not contain any exclusions for materials not furnished by the Manufacturer, exclusions for ponding, or any requirement for periodic inspections by the Engineer.

- E. Samples: Submit 4 samples of finished roofing sheets for acceptance.
- F. Inspection Reports: Submit detailed roofing inspection reports by the Manufacturer's Technical representative or their independent roofing auditor/inspector documenting each inspection, including pre and post warranty inspections.
- G. Pre-roofing conference records.
- H. Warranties as noted under item entitled "WARRANTIES" hereinbelow.

1.3 QUALITY ASSURANCE

- A. The roofing operations shall be coordinated with appurtenant work such as sheet metal work so that roof surfacing operations, once started, shall be continuous to completion.
- B. The Roofing Contractor shall be an approved and experienced applicator of the manufacturer whose insulation and roofing system that is proposed for application and the workers shall have been instructed by that roofing system manufacturer (or their technical representative or independent roofing auditor/inspector) in the proper application of the system.
- C. Notify roofing system manufacturer in writing of need for manufacturer's warranty complying with this section's requirements prior to Contractor-Applicator-Manufacturer Review.
 - 1. Obtain manufacturer's written review of project details and specifications.
 - 2. Submit samples and product data of materials not supplied by system manufacturer to manufacturer for written approval.
 - 3. Comply with manufacturer's requirements for specified warranty, including field inspections by manufacturer's technical representative.
- D. The Roofing Manufacturer's Technical Representative and their independent roofing auditor/inspector (where applicable) shall be competent, thoroughly trained and experienced in the work and shall be completely familiar with the products, equipment and the specified requirements and methods needed for the proper installation of the insulation, roofing membrane and flashings.

- E. The Contractor, Roofer, the authorized Roofing Manufacturer's Technical Representative and/or their independent roofing auditor/inspector, sheet metal contractor, and all other contractors working on the roof or penetrating the roof membrane shall attend a pre-construction conference and shall also inspect the roof surfaces at the following times:
1. Prior to the start of the roofing installation as noted under item entitled "INSPECTION OF SURFACES" hereinbelow where required by the manufacturer to validate his warranty.
 2. At the actual start of the roofing application.
 3. At least once during the roofing application.
 4. At job completion.

(Note: It shall be the responsibility of the Contractor to notify the Roofer, Manufacturer's Technical Representative or their independent roofing auditor/inspector (where applicable) and the Engineer of the schedule of operations. Parties shall be notified at least 5 days in advance to enable their attendance.

- F. Contractor-Applicator-Manufacturer Review: Review Drawings and Specifications with manufacturer's agent and applicator. Obtain manufacturer's written agreement that selected system is proper, compatible, and adequate for application shown and that conditions and details do not conflict with manufacturer's warranty.
- G. Should the Manufacturer's warranty requirements necessitate different drawings and details which exceed the requirements of those shown or specified, provide shop drawings and field adjustments at no cost to the State.
- H. Pre-Roofing Conference: Prior to installation of roofing and associated work, meet at project site, or other mutually agreed location, with installer, roofing sheet manufacturer, installers of related work such as flashing and sheet metal, Roofing System Manufacturer's Technical Representative and/or their independent roofing auditor/inspector, and other entities concerned with roofing performance, including (where applicable), test agencies, governing authorities, and Engineer. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours' advance notice to participants prior to convening preroofing conference. Final inspection for warranty shall be made by Factory Technical Representative.
- I. UL Listing: Provide labeled materials that have been tested and listed by UL in "Building Materials Directory" or by other nationally recognized testing laboratory for application indicated, with "Class A" or "Class B" rated materials/system for roof slopes shown.
- J. Code Conformance: Manufactured products standard with the manufacturer for adherence to substrate and designed to meet code requirements, but minimum 90 pound uplift.

- K. Low Slope Edge Flashing: Conform with ICC IBC edge securement for low slopes per ANSI/SPRI ES-1.
- L. Insulation on Steel Decks: Roof insulation shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in lieu of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM Approval Guide. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.4 WARRANTIES

The Contractor shall furnish to the Engineer the following:

1. A written warranty on the roofing membrane system and built-up base flashing for a 2-year period after the Project Acceptance Date. The warranty shall provide the following at no cost to the State:
 - a. Repair of roofing, flashings, pitch pockets, drains, curbs, etc. as necessary to seal and repair all leaks which are attributable to faulty materials and/or workmanship;
 - b. Repair or replacement of damage to the building and/or its finishes, equipment and/or furniture when occasioned by such leaks; and
 - c. Inspection of the roofing and flashings together with the Engineer or designated representative, on or about the 1st and 2nd anniversaries of the Project Acceptance Date, and repair or replacement of roofing as necessary to correct any deficiencies in workmanship or materials, such as by eliminating blisters exceeding 12-inches in any dimension or re-adhering open seams. Such repair or replacement of roofing and/or flashings shall be done in a manner which will preserve the integrity of the roofing membrane.
2. A 25-year roof membrane system warranty and flashing endorsement from the project acceptance date from the roofing manufacturer. The warranty shall cover both material and workmanship and shall provide that in the event of failure due to normal weathering and wind conditions during the remainder of the warranty period (the 3rd through 25th years after the Project Acceptance Date), the roofing system manufacturer will make repairs as necessary to maintain the roof in a watertight condition at no cost to the State.
3. The Surety shall not be held liable beyond 2 years from the project acceptance date.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: Roofing materials shall be delivered to the site in the original unbroken manufacturer's wrapping material and containers with the original labels thereon intact. If any unlabeled materials are to be used, a properly attested certificate from the manufacturer stating that such materials comply with the requirements of the Contract Documents shall be furnished to the Engineer prior to installation.
- B. Storage of Materials at Job Site:
1. Except when placed on roof decks immediately prior to installation, roofing materials shall be stored above the supporting surfaces, such as on pallets.
 2. Roll goods, insulation, and any other materials which either absorb or are adversely affected by moisture shall be kept dry. Wet materials and/or materials which appear to have been deteriorated after getting wet shall not be permitted to be used on the job and shall be promptly removed.
 3. Materials containing solvents shall be stored in a dry, cool area with proper fire and safety precautions.
 4. Roll goods shall be stored on end.
 5. If stored on other than the ground, all materials shall be distributed so that their resultant weight does not exceed the design live load on the deck (normally 20 pounds per square foot on roofs and 40 pounds per square foot on floors).
 6. Store flammable products away from sparks or open flame.
 7. Insulation must be stored from the time of manufacture to installation in a dry area and be protected from moisture and inclement weather at all times. Insulation found to have an unacceptable concentration of moisture or which has been contaminated by water will be rejected.
- C. Handle manufactured materials as recommended by the manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

Proceed with roofing work only when weather conditions comply with the manufacturer's recommendations. Do not exceed temperature limitations recommended by the manufacturers.

1.7 SAFETY

- A. Personnel must wear proper clothing while applying the roofing and other asphalt products. Long sleeve shirts, long pants without cuffs, leather or durable shoes or boots with flat soles or heels, and gloves with knit wrists are necessary. Eye protection should also be worn.
- B. Follow all OSHA and NRCA provisions for fire protection, including, but not limited to, those in OSHA 1926.150, 151, 153, 1191-110 which apply to torch application.
- C. Workers should use extra caution around exposed edges of insulation to prevent flame from coming in contact with any combustible material.
- D. The Contractor should be familiar with L.P.G.C. 58 "Standard for the Storage and Handling of Liquified Petroleum Gas" and any other appropriate publications of the National LP Gas Association.
- E. Do not use torching equipment in an enclosed area.
- F. At a minimum, there should be one 20 pound fully charged ABC type fire extinguisher per torch.
- G. No flammable liquids should be stored on the roof excluding LP gas in approved containers. All LP gas not in use shall be stored on the ground.
- H. Provide a fire watch during torch application and continue for one hour after completion of torch application.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Performance: Provide roofing materials recognized to be of generic type indicated and tested to show compliance with indicated performances, or provide other similar materials certified in writing by manufacturer to be equal to, or better than, materials specified in every significant respect, and acceptable to Engineer.
- B. Compatibility: Provide products that are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

2.2 MATERIALS

- A. General: Each package of modified bitumen roof covering materials shall bear the label of a recognized agency having a service for the inspection of material and finished products during manufacture (e.g., ASTM, UL, etc.).

- B. Asphalt Primer: Standard brand complying with ASTM D 41/D 41M, "Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing".
- C. Roof Insulation: Faced polyisocyanurate insulation boards complying with ASTM C 1289, "Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board", Class 1, Type II, (polyisocyanurate only, polyurethane not permitted) as approved by the roofing manufacturer. Insulation shall have an in-service R-value of

5.6 degrees F x ft² x hr per inch thickness.
BTU

Insulation containing chlorofluorocarbon (CFC) is not permitted. Insulation shall have a minimum thermal resistance (R factor) of 15 btu/hr./sq. ft., average.

- D. Roof Insulation for Slope Build-Up: Insulation as specified above or roofing manufacturer approved ASTM C 578, "Rigid, Cellular Polystyrene Thermal Insulation", Type II, minimum 1.5 pcf density, pre-tapered EPS (expanded polystyrene) applied over the insulation in the field to ensure positive drainage.
 - 1. Over non-combustible decks, unless otherwise required by the testing laboratory's report for a fire rated assembly, the EPS insulation shall be faced in the field with cover board. The maximum roof slope where a mineral surfaced cap sheet is provided is 1-inch per foot.
 - 2. Over combustible decks, a thermal barrier board and/or facing board as required by the testing laboratory's report for a fire rated system shall be provided over the EPS insulation.

(Note: If the Contractor elects to use insulation with a thickness other than that shown on the plans, the Contractor shall be responsible for preparing any revised detail drawings and to coordinate the work with other trades as may become necessary because of the thickness change. Any additional costs to implement such a change shall be borne by the Contractor.)

- E. Roof Insulation Tape: Minimum 6-inch wide fiberglass roof insulation tape.
- F. Cover Board: ASTM C 1177/C 1177M, glass mat faced, water resistant treated gypsum core, 5/8-inch thick minimum, conforming to Fire Resistive Design as indicated.
- G. Cant Strip: Fire retardant perlite cant strips compatible with the insulation and roofing system as per the manufacturer's recommendations. Height shall be as minimum 4-inches or as indicated with an exposed face at 45 degrees to the plane of the roof.

- H. Mechanical Fasteners and Plates for Insulation: Manufactured products of the appropriate type and length for the proposed roof deck and insulation installation as recommended by the insulation manufacturer and recommended by the manufacturer as a component of the roofing system. Fasteners shall be heat treated steel and plates shall be aluminum-zinc coated steel unless accepted otherwise.
- I. Roofing Nails: Galvanized, of the appropriate type and length for the proposed installation as recommended by the roofing membrane manufacturer.
- J. Flashing Cement: ASTM D 4586/D 4586M, Type I for horizontal surfaces and Type II for vertical and sloped surfaces asbestos-free as recommended by the roofing manufacturer.
- K. SBS Base Sheet: ASTM D 6162/D 6162M or ASTM D 6164/D 6164M or ASTM D 6163/D 6163M, Type I or II, Grade S, minimum 120 mils thick.
- L. Modified Bitumen Cap Sheet:
 - 1. SBS Cap Sheet: ASTM D 6162/D 6162M or ASTM D 6164/D 6164M or ASTM D 6163/D 6163M; Type II, Grade G, minimum 160 mils thick, and as required to provide specified fire safety rating.
 - 2. Finish surface of cap sheet shall be factory applied fine mineral granules. Color of finish shall be white.
- M. Modified Bitumen Roof and Base Flashing: Flashing materials shall be modified bitumen base sheet and cap sheet as specified above. The finish of the surface layer shall match the adjacent roof surface.
- N. Walk-On Pads: Walk-on pads shall be cut APP or SBS membrane or special pads composed of chopped rubber particle and synthetic binders or as recommended by roofing manufacturer. Pads shall be cut from rolls to the sizes indicated. Adhesive for pad application shall be compatible rubber based adhesives approved by the roofing membrane manufacturer or torch applied. Finish surface of the pad shall match the adjacent roof surface except as indicated otherwise.
- O. Pourable Sealer: Two-component, solvent free, polyurethane based sealant as furnished by membrane manufacturer to fill and seal pipe penetrations; to create a temporary seal of membrane to substrate when work is interrupted.
- P. Temporary Fire Retardant: Chemical solution for temporary fire resistance of combustible roofing components during torch application of roofing materials as recommended by the roofing manufacturer to inhibit combustion.
- Q. Penetration Flashing: Proprietary flashing system as recommended by the roofing manufacturer where required for manufacturer's warranty or as specified under Section 07600 - FLASHING AND SHEET METAL.

2.3 MODIFIED BITUMEN ROOFING ASSEMBLIES:

A. General Requirements:

1. Roof covering shall be fire retardant either Class A or B as stipulated in the ICC IBC and tested in accordance with ASTM E 108 or UL 790 or as approved in published Building Code reports. All materials shall be labeled in accordance with the appropriate requirements they meet, such as U.L. labeling and FM listing.
2. Roofing materials shall conform to ASTM specifications as indicated.

B. Built-Up Roofing Assemblies:

1. Roof insulation shall be installed over entire roof and sloped insulation shall be installed where shown on the plans or as necessary to eliminate ponding and direct water to the drains and scuppers.
2. Acceptable roofing membrane system shall be Firestone, Johns Manville, GAF, or pre-approved equal.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

- A. Before the work under this section is started, the Roofer, together with the Manufacturer's Technical Representative or their independent roofing auditor/inspector (where applicable) and the Contractor shall meet with the Engineer, and others as stipulated in the General Requirements at the job-site to examine all surfaces on which roofing will be placed and all adjoining work, including inserts, which will affect or be affected by the roofing work. All unacceptable areas and/or conditions such as those listed in item entitled "APPLICATION" hereinbelow shall be corrected by the Contractor and verified and accepted by the Roofer and the Manufacturer's Technical Representative or their independent roofing auditor/inspector prior to start of the work.
- B. Fill Voids: All surface voids, of the immediate substrate, greater than 1/4-inch wide shall be properly filled with an acceptable fill material.
- C. Before the work under this section is started, the Contractor and Engineer shall inspect and record the conditions of the building interior rooms and ceilings and adjoining work to remain. The Contractor shall protect the interior finishes, furniture, and equipment and adjoining work to remain against damage.

3.2 APPLICATION

A. General:

1. Workmanship: The Roofer shall have a responsible foreman on the job during roofing operations who shall ensure that all work is done in accordance with the plans and specifications. The Contractor shall be responsible for achieving a watertight condition and will be held responsible for consequential and incidental damages caused by water intrusion.
2. No roofing shall be installed during precipitation and shall not be started in the event there is a possibility of precipitation during application.
3. No roofing shall be started in the absence of the Engineer or their representative. The Contractor shall call the Engineer to give at least one day (24 hours minimum) advance notice of the starting of roofing operations.
4. The application of roofing shall be as specified or as shown in the plans or the NRCA, "Roofing and Waterproofing Manual", unless otherwise stipulated in the specifications and details of the manufacturer of the assembly being installed or material being used as submitted to and accepted by the Engineer.
5. Absolutely no roofing shall be applied before the deck and the work in connection therewith have met the following conditions:
 - a. Sheet metal panels for insulated steel decks shall be so secured to supporting framework and to each other, and shall be in such condition, that insulation will bear on each rib and not have to bridge over deck discontinuities.
 - b. Wood decks shall be dry (moisture content 19 percent or less as measured on the Moisture Meter's Wood Scale); smooth; free from loose materials; properly graded to outlets; and swept clean. Knot holes or loose knots over one-inch in diameter and cracks over 3/8-inch wide shall be covered with 24 gauge galvanized sheet metal nailed in place.
 - c. Adjoining work, such as roof drains, metal edging, metal counterflashing, pitch pocket pans, and lead collars for vent pipes, etc. shall either be in place, ready for the Roofer to work in, or shall be available for installation by others, as applicable. This work shall be coordinated so that the total roofing system will be watertight at all times.
 - d. Verify deck is free from depressions, waves, or projections that will interfere with positive drainage.
 - e. Verify deck surfaces are dry and free from moisture in any form.

- f. Verify locations of through roof penetrations. In the event that the penetration does not conform to N.R.C.A. guidelines and roofing manufacturer warranty requirements, special consideration and appropriate action must be taken to ensure a roof manufacturer approved long term watertight termination at no additional cost to the State.
 - g. Verify proper securement of penetrating or roof mounted equipment.
6. All layers of roofing shall be laid free of wrinkles, creases or fishmouths. Sufficient pressure or brooming shall be exerted on the roll during application to ensure prevention of air pockets.
 7. Before application of the cap sheet, build-up all "bird-baths" by torching in place one or more overlapping layers of inter-ply sheet(s) to provide positive drainage. Filling "bird-baths" with asphalt or other materials that will resoften will not be permitted.
 8. Loose ceramic granules, of matching color shall be broadcast over excess bitumen seepage, spillage, etc., in order to maintain the aesthetic quality of the surfacing sheet.
 9. Phased construction (roofing purposely interrupted for a period to permit other work and trafficking over the membrane) shall not be permitted.
 10. Protect building and adjacent surfaces from bitumen spillage.
 11. Do not permit traffic or material storage on completed roof surfaces.
 12. In the event that inclement weather halts work, any areas contaminated with moisture prior to the successful waterproofing, shall be removed and replaced to the satisfaction of the Engineer.

B. Insulation:

1. Installation:
 - a. Coordinate installation of roofing system components so that cover board and insulation is not exposed to precipitation or left exposed at end of workday.
 - b. The application of cover board and insulation shall be as specified herein or as shown in the plans unless otherwise stipulated in the specifications and details of the manufacturer of the insulation being used, as submitted to and accepted by the Engineer.
 - c. Insulation shall be laid so that edges parallel to flutes bear on the deck flange surface. Joints shall not terminate over rib openings.

- d. Units of insulation and cover board shall be laid with their long joints perpendicular to the direction of laying of the roofing plies.
 - e. Units of insulation and cover board shall be laid so that they touch adjacent units along all sides. Butt edges without forcing.
 - f. Insulation shall be mechanically secured to substrates with fasteners and plates specifically designed for fastening boards to deck types indicated, and in accordance with board manufacturer's written recommendations and as otherwise approved by Factory Mutual Class I-90 installation. Where multiple layers are installed, all joints between layers shall be staggered.
 - g. Carefully lay-out and neatly fit insulation to all penetrations, projections, and nailers. Fill all gaps greater than 1/4-inch wide with insulation. Do not leave membrane unsupported in an area greater than 1/4-inch. Install factory tapered and/or field tapered insulation to slope all surfaces to the roof drains.
 - h. Verify preservative treated wood nailers are identical to the thickness of the installed insulation.
 - i. Install no more insulation and cover board than can be covered and protected with roof membrane and completed before the end of the day's work, or before the onset of inclement weather.
 - j. Set insulation with long joints continuous and short joints staggered in one direction as recommended by the roofing manufacturer.
 - k. The insulation shall be fastened to the deck using mechanical fasteners in the numbers and patterns as recommended by the manufacturer and as otherwise approved for minimum 90 pound uplift installation.
2. Acceptability:
- a. Insulation and cover board which shows signs of deterioration (such as reduced resistance to delamination, edge disintegration, etc.) shall not be used.
 - b. Insulation and cover board which have been installed but are still exposed shall be covered immediately when there is any danger that it will become wet.
 - c. Installed boards which become wet shall be completely dried out as determined by a moisture meter before any roofing is applied over it.
 - d. Insulation and cover board units with broken corners or similar defects shall be trimmed and repaired (gap filled with similar material) or discarded.

- e. Any EPS insulation which is damaged because it is subjected to excessive heat shall be removed and replaced with properly installed units.
- C. Cant Strips: Install cant strips at the intersections with curbs, walls, and parapets. They shall be continuous, installed in lengths as long as possible and secured in place.
- D. Base Sheet: Unroll base sheet and allow to relax for a minimum of 30 minutes prior to attaching. Install one ply of base sheet over the insulation. Lap sides 2-inches and ends 4-inches. Mechanically fasten base sheet and insulation to deck as recommended by FM.
- E. APP Modified Bitumen Sheets: Torch-on or electric heat-apply fully adhered sheets. Unroll sheets, set in place as recommended by the manufacturer, but not less than 3-inch side laps and 6-inch end laps. Apply heat to underside of roll and 3-inch side lap of preceding roll and fully adhere membrane to the substrate by unrolling the heated portion of the roll onto the substrate. Ensure a minimum flow of modified bitumen of at least 3/8-inch, not to exceed one-inch, on side and end laps as the membrane is rolled forward and adhered to the substrate. Care shall be taken so as not to overheat the top surface of the roll. After membrane has been adhered to substrate, check laps with a hot trowel to ensure laps are fully adhered. At areas where full adhesion of the laps are not obtained, reheat and trowel into place so that adhesion of the entire lap is accomplished.
- F. Roofing Assembly and Built-Up Flashings: The application of roofing and flashings shall be as specified or shown in the drawings unless otherwise stipulated in the specifications and details of the manufacturer of the roofing assembly being installed or material being used, as submitted to and accepted by the Engineer. Prime metal surfaces prior to flashing application at a minimum rate of 1 gallon per 100 square feet. Provide termination bars and sealant as indicated or recommended by the manufacturer.

3.3 INSTALLATION OF ADJOINING WORK

- A. All adjoining work (such as vent pipe flashings, etc.) shall be as specified or as shown in the drawings unless otherwise stipulated in the specifications and details of the manufacturer of the roofing assembly being installed or material being used, as submitted to and accepted by the Engineer.
- B. Wood Nailer: Wood nailers shall be installed where shown on the plans and shall be secured to the deck with appropriate fasteners spaced at maximum 48-inches on center. Total wood nailer height shall match the total thickness of insulation being used, and shall be installed with a 1/8-inch gap between each length and each change of direction. Treatment of wood nailer shall be as approved by the roof membrane manufacturer.
- C. Metal Edging: Metal edging shall be set in softened top of the modified bitumen membrane not including the cap sheet. The edging shall be overlapped (nested not cut) at least 5-inches at joints, with a flexible non-hardening sealant compatible with the flashing cement and modified bitumen, placed between the two layers of metal in such manner that metal does not touch metal anywhere. The edging flange shall be securely fastened to edge

nailing strips using large headed-nails at least 1-1/2 inches long. Nailing shall be 3-inches on-center and staggered on either side of flange centerline. Laps shall be double nailed. The flange shall then be primed and flashed with one strip of the modified bitumen ply sheet 6-inches wider than the flange width torched-on onto the substrate. The cap sheet shall then be torched-on with the edge 1/4-inch away from the outside corner of the metal edging. A continuous bead of flashing cement shall be applied and pressed into this edge. The face flange of the metal edging shall be anchored as shown in the plans.

- D. Metal Counter-Flashing at Curbs and Walls - Sheet Metal Reglet: Reglets shall be installed where shown in the drawings. Metal counter-flashing shall be installed, anchored, and sealed as specified herein, as detailed in the plans or, if a manufactured system is used, as instructed by the manufacturer. Sealant material and application shall be as specified in Section 07920 - SEALANTS.
- E. Vent Pipe Flashing: The flashing flange shall be set on top of the completed modified bitumen inter-ply membrane. It shall then be flashed with a square piece of the specified roofing ply and shall have dimensions 3-inches more than the pipe flashing flanges on each side. A hole about 1/8-inch larger than the pipe flashing shall be cut out of the center of the modified bitumen mineral surface cap sheet, which shall then be installed over the primed flashing flange. A cant of flashing cement shall be formed around the base of the collar after the cap sheet is in place. Finally, the roofer shall ensure that the flashing sleeve is turned down a minimum of 2-inches into and snugly against the pipe.
- F. Roof Drains:
 - 1. Install roofing membrane and lead flashing as indicated on the plans or as recommended by the roofing manufacturer.
 - 2. Clean all drainage channels through locking rings thoroughly after roofing to ensure unimpeded flow of water into the drain.
 - 3. Test all drains for proper flow and watertightness. Correct all defects.
- G. Walk-On Pads: Pads shall be cut to size and installed with a compatible rubber based adhesive or torch applied as approved by the roofing system manufacturer. Space pads to not inhibit waterflow for roof drainage.

3.4 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's authorized representative to inspect roofing installation on completion and submit report to the Engineer. Notify the Engineer 48 hours in advance of the date and time of inspection.

- B. Correct deficiencies in or remove roofing and insulation that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Project Acceptance and according to warranty requirements.

3.5 PROTECTION AND CLEANING

A. Protection:

1. Any work or materials damaged during the handling of roofing materials shall be restored to their original (undamaged) condition or replaced.
2. The work of other trades shall not be marred or injured. Asphalt daubed or splashed surfaces shall be removed and the surface or finish restored to its original finish and appearance.
3. Protective coverings shall be installed at all pavement and exposed building walls as necessary to prevent the marring of existing surfaces.
4. Protection shall remain in place for the duration of the roofing work.
5. Contractor shall have on hand at the roof appropriate weather protection materials to protect the substrate during inclement weather.
6. Upon completion of roofing (including associated work), institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, make a final inspection of roofing and prepare a written report to the Engineer describing nature and extent of deterioration or damage found.
7. Repair or replace (as required) deteriorated or defective work found at time of final inspection to a condition free of damage and deterioration at time of Project Acceptance and in accordance with requirements of specified warranty.

B. Cleaning:

1. Debris from roofing work shall be removed from the premises and disposed of at the end of each working day and upon completion of the work to the satisfaction of the Engineer. The roof shall be left in good, clean condition.
2. Bitumen, modified and otherwise, shall be removed completely from all surfaces other than the roofing, especially those to which sealants must be bonded and/or metal flashings which are to be painted.

3. Gutters, downspouts, roof drains, and overflow roof drains shall be cleaned out and all blockages shall be removed prior to acceptance of the project.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all labor, materials, and equipment necessary to fabricate and install flashing, counterflashing, metal edging, gutters, downspouts, and other related work as shown on drawings and as specified herein.
- B. Related Work Described Elsewhere:
 - 1. Coordinate installation of sheet metal work with Section 07410 - PREFORMED METAL STANDING SEAM ROOFING and Section 07535 - MODIFIED BITUMEN SHEET ROOFING (TORCHED-ON).
 - 2. Sealants are specified under Section 07920 - SEALANTS.
 - 3. Roof drains and associated piping is provided under Section 15400 - PLUMBING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's product data on all manufactured items.
- C. Shop Drawings: Submit shop drawings with reference made to detail numbers on the contract drawings to the Engineer for acceptance. 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 acceptance is secured. Tracing or reproducing drawing details is unacceptable.
- D. Certificates: Submit certificates that edge securement, for low-slope roofing, conform with ANSI/SPRI ES-1.
- E. Samples: Submit 4 samples of prefinished metal finishes to match colors as indicated or scheduled.
- F. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Sheet metal fabrications shall conform to State and local codes, SMACNA (latest edition), and industry standards.
- B. Roof penetrations shall be installed weathertight in such a manner to maintain integrity of the roofing.
- C. Fastening and cleating shall withstand all positive and negative wind pressures for 105 mph, Exposure C winds in accordance with current ICC IBC as amended. Edge securement for low slope roofing shall conform with ANSI/SPRI ES-1.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Handle manufactured materials as recommended by the manufacturer.

1.5 WARRANTY

- A. The Contractor shall furnish to the Engineer a written warranty on the sheet metal for a 2-year period after the Project Acceptance Date. The warranty shall provide for the repair of all leaks as well as repair and replacement of damage to the building and/or its finishes at no cost to the State. Where flashing is associated with a system with longer warranty period, flashing warranty shall match applicable system.
- B. The Surety shall not be held liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Minimum 0.032-inch thick, ASTM B 209 or ASTM B 209M, form, alloy, and temper appropriate for use, prefinished 1.0 mil polyester finish on the exposed side in color as indicated or as selected by the Engineer and same finish on the opposite face. Aluminum flashings associated with modified bitumen sheet roofing (torched-on) shall be minimum 0.040-inch thick by the roofing manufacturer.
- B. Lead Sheet for Vent Pipe Flashing: ASTM B 749, Type L51121, copper-bearing sheet lead, minimum 2-1/2 pounds per square foot, unless indicated otherwise.
- C. Nails and Fasteners: Use the same metal or a metal compatible with the item. Use stainless steel fasteners to fasten dissimilar metals.

- D. 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, and removable.
- E. Asphaltic Roof Cement: ASTM D 4586/D 4586M, Type I for horizontal surfaces and Type II for vertical surfaces as recommended by the roofing manufacturer under Section 07535 - MODIFIED BITUMEN SHEET ROOFING (TORCHED-ON).
- F. Stainless Steel Vent Screen: 8 mesh, minimum 0.017 diameter wire unless indicated otherwise.
- G. Stainless Steel Clamp: As indicated for screwdriver adjustment.
- H. Prefabricated Pipe Flashing System: A premolded flexible pipe sleeve of EPDM in pleated concentric rings bonded to a square corrosion-resistant base of soft aluminum alloy allowing forming of base by hand pressure to roof panel profile. Pipe flashing system shall be equivalent to "Master Flash" by Aztec Washer or Oatey, "Dektite" by Buildex, Aluminum Flashing by LSP Products Group, or pre-approved equal.
- I. Self-Adhering Underlayment: ASTM D 1970/D 1970M polymer modified bituminous sheet materials, minimum 40 mils thick as recommended by roofing manufacturer. Provide with non-slip surface for safety during roofing operations.
- J. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

PART 3 - EXECUTION

3.1 INSTALLATION AND WORKMANSHIP

- A. 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 Engineer. In the absence of such a report, the Contractor shall be held responsible for the finished product.
- B. 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.
- C. 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 acceptance of the Engineer. 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.

- D. 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 8-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 32-feet for aluminum. Gutter to downspout transition shall be fabricated from same material as gutter.
- E. Downspout Leader: Provide cross sectional area not less than the size indicated and complete, including elbow and offsets. Provide downspouts in approximately 10-foot lengths; end joints shall telescope not less than 1/2-inch, and longitudinal joints shall be locked. Provide gutter outlets with stainless steel wire ball strainers of a standard type. Position downspouts not less than 1/2-inch away from walls and fasten to the walls at top, bottom, and at not to exceed 5-foot centers intermediately between with manufacturer's standard type leader straps, or concealed type fasteners. Form straps and fasteners from a metal compatible with the downspouts. Connect to drain pipes as indicated.
- F. Seams: Straight and uniform in width and height with no sealants showing on the face.
 - 1. Flat-Lock Seams: Finish not less than 3/4-inch wide.
 - 2. Lap Seams: Finish soldered seams not less than one-inch wide. Overlap seams not soldered, not less than 3-inches.
 - 3. 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.
 - 4. Flat Seams: Make seams in the direction of the flow.
- G. 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.
- H. 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.
- I. Reglets: Type and size as indicated.

- J. Vents Thru Roof (VTR): Provide vent pipe flashing with flashing turned down into vent as indicated. Provide stainless steel screen with clamp over all vents. Cut vents to heights indicated. Extend vents when required to conform to heights indicated.
- K. 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.

3.2 PROTECTION

Protect sheet metal work until final acceptance of the building.

3.3 CLEAN UP

- A. Clean 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. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.
- B. At completion of the work, clean up and remove rubbish and debris from the premises which resulted from this work.

END OF SECTION

SECTION 07720

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Extent and locations of roof accessories are indicated on the drawings. Roof accessories include the following:
 - 1. Roof hatch
 - 2. Safety post
- B. Related Work Described Elsewhere:
 - 1. Access ladder is provided under Section 05500 - METAL FABRICATIONS.
 - 2. Coordinate with adjacent roofing provided under Section 07535 - MODIFIED BITUMEN SHEET ROOFING (TORCHED-ON.
 - 3. Skylights are provided under Section 08625 - TUBULAR SKYLIGHTS.
 - 4. Exterior components shall be painted under Section 09900 - PAINTING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical product data, including rough-in diagrams, details, and installation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products to avoid any distortion or damage due to moisture, physical abuse or other cause. Roof accessory finishes shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.
- B. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 PREFABRICATED ROOF HATCH

Bilco Model S-50, size 3'-0" x 2'-6" for ladder access, fabricated of aluminum insulated cover with aluminum steel liner and aluminum insulated curb, or equivalent roof scuttle by

O'Keeffe, Milcor, WASCO Products, Inc., Dur-Red Products, Inc., Babcock-Davis, Acudor Products, Precision Ladders LLC, or pre-approved equal. Unit shall include interior padlock hasp and interior and exterior handles.

2.2 SAFETY POST

Safety post shall conform to ANSI A14.3, OSHA, and equivalent to Bilco Model LU-4, aluminum or accepted equal products of accepted roof hatch manufacturer. Unit shall have hot-dip galvanized finish. Unit shall have a vertical telescoping tubular shaft with a safety clamping device that fully locks in any position. Unit shall securely mount to access ladder provided under Section 05500 - METAL FABRICATIONS.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's instructions and rough-in diagrams. Coordinate with installation of roof deck to receive roof accessory units, roofing, and flashing; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward wind loading pressures of not less than 105 mph, Exposure C in accordance with the current ICC IBC as amended or as specified for the adjoining roof.
- B. Isolation: Where metal surfaces of units are to be installed in contact with noncompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation.
- C. Flange Seals: Except as otherwise indicated, set flanges of accessory units in a thick bed of neoprene sealant or roofing cement, to form a seal.
- D. Operational Units: Test operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.
- E. Safety Post: Attach safety post to access ladder as recommended by the manufacturer.

3.2 CLEAN UP

Clean exposed metal surfaces in accordance with manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION

SECTION 07840

FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing tested and listed firestop systems, a combination of materials or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls and partitions, including through-penetrations and construction joints and gaps. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables, and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. **Manufacturer's Data:** Submit copies of manufacturer's product data and specifications for type of sealant required. Data shall indicate product characteristics, typical uses, performance and limitation criteria, shelf life, and test data.
- C. **Shop Drawings:** Submit detail drawings, including manufacturer's typical details conforming to UL Fire Resistance Directory or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgement, derived from similar UL system designs or other tests, shall be submitted for review and acceptance prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" and "T" ratings, and type of application.
- D. **Material Safety Data Sheets (MSDS):** Submit MSDS for each firestop product.
- E. **UL Tested Systems:** Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings and steel thickness.
- F. **Engineering Judgments:** Submit manufacturer's drawings for all non-standard applications where no UL tested system exists. All drawings must indicate the "Tested" UL system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.

- G. Installation Procedures: Submit manufacturer's installation procedures for each type of product.
- H. Applicator: Submit document from manufacturer wherein manufacturer recognizes the installer as qualified and submit a list of past projects to demonstrate experience and capability to perform intended work.
- I. Color Samples: Submit 4 sets of color finish samples of sealants that will be exposed in finish spaces.
- J. Upon completion, installer shall provide written certification and report that materials were installed in accordance with the manufacturer's installation instructions and details and by UL number.

1.3 QUALITY ASSURANCE

- A. Workmanship: The Contractor shall engage an experienced installer who is:
 - 1. FM Research approved in accordance with FM AS 4991, "Approval of Firestop Contractors", or
 - 2. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer. The installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures.
- B. Regulatory Requirements:
 - 1. Firestop systems shall be installed in all openings and around all penetrating elements or devices as required by these Contract Documents, and as required by applicable design, building and construction codes, subject to the interpretation of the authority having jurisdiction.
 - 2. Firestop materials shall have the acceptance of the authority having jurisdiction.
- C. Certification:
 - 1. The performance of the firestop designs shall have been demonstrated by third party testing in accordance with the applicable reference standards. Evidence of third-party acceptance shall include labeling or listing by an acceptable agency.
 - 2. Manufactured assemblies and material formulations shall be prepared under a third party monitored Quality Control Program, e.g., U.L. Followup Service.

3. Contractor shall certify compliance with the provisions of this section.

- D. Finish: Exposed surfaces of the firestop shall be finished to the standard of the adjacent faces of the partition being penetrated.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground and protect from damage and exposure to elements. Remove damaged and deteriorated materials from the site.
- B. Firestop materials shall be installed prior to expiration of shelf life.
- C. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

- A. Materials: Provide asbestos-free firestopping material capable of maintaining an effective barrier against flame, gases, and temperature. Provide non-combustible firestopping that is non-toxic to human beings during installation or during fire conditions. Devices and equipment for firestopping service shall be listed in the UL Fire Resistance Directory or FM P7825a "Approval Guide Fire Protection" and approved for use with applicable construction, and penetrating items.
- B. Fire Hazard Classification: Material shall have a flame spread of 25 or less, a smoke developed rating of 50 or less, and a fuel contribution of 50 or less when tested in accordance with the procedures of ASTM E 84, "Surface Burning Characteristics of Building Materials", UL 723, "Surface Burning Characteristics of Building Materials", or UL listed and accepted.
- C. Fire Resistance and Hose Stream Tests: Firestopping materials shall be rated "F" and "T" in accordance with ASTM E 814, "Fire Tests of Penetration Firestop Systems", or UL 1479, "Fire Tests of Through-Penetration Firestops", except that the "T" rating may be based on thermocouples placed one-inch from a penetrating item in lieu of direct attachment to penetrating items. Rating periods shall conform to the following: Time-rated wall or ceiling assemblies shall be rated at minimum one hour unless rated otherwise, but not less than the construction in which they occur.
- D. Nontoxicity: Firestopping materials shall be non-toxic to human beings during installation and during fire conditions.
- E. Construction Joints and Gaps: Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E 119, "Fire Tests of Building Construction and Materials", ASTM E 1966, "Fire-Resistive Joint

Systems", or UL 2079, "Tests for Fire Resistance of Building Joint Systems", to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E 1399/E 1399M, "Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems", or UL 2079.

PART 3 - EXECUTION

3.1 FIRESTOPPING LOCATIONS

Provide firestopping in the following locations:

1. Around duct, cable, conduit, piping, and their supports that penetrate through time-rated assemblies.
2. Around openings between surfaces of time-rated assemblies.
3. Around openings and penetrations in enclosures with time-rated fire doors.
4. Other locations indicated.

3.2 PREPARATION

- A. Coordination: The specified work shall be coordinated with other trades. Firestopping materials, at penetrations of pipes and ducts, shall be applied prior to insulating, unless insulation meets requirements specified for firestopping. Firestopping materials at building joints and construction gaps shall be applied prior to completion of enclosing walls or assemblies.
- B. Surface Preparation: Remove dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or the required fire resistance from surfaces in contact with firestopping materials, unless otherwise directed by the manufacturer's instructions.
- C. Verify that environmental conditions are safe and suitable for installation of firestopping products.
- D. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestopping.

3.3 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping shall be installed in accordance with manufacturer's written instructions.

1. Filling of Voids: Completely fill voids at the surface; the depth of the material shall be as approved by UL.

2. Insulated Pipes and Ducts: Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Thermal insulation shall be replaced with a material having equal thermal insulating and firestopping characteristics.
3. Electrical and Data Cables or Conduits: Firestopping at penetrations shall comply with the requirements of NFPA 70, "National Electrical Code", and be sealed with re-enterable firestopping materials that do not cure over time. Firestopping shall be modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, adds, or changes without the need to remove or replace any firestop materials.
4. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Non-combustible damming materials may be left as a permanent component of the firestop system.

3.4 FIELD QUALITY CONTROL

- A. To ensure proper installation, firestopped areas shall not be covered or enclosed until inspection is complete and acceptance has been received.
- B. The Contractor shall submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.5 CLEAN UP

- A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
- B. Leave finished work in neat, clean condition with no evidence of spill overs or damage to adjacent surfaces.

END OF SECTION

SECTION 07920

SEALANTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Completely close with sealant all joints indicated or specified to be sealed to a watertight and airtight condition without staining substrates.
- B. Related Work Described Elsewhere: Firestopping joint filler is provided under Section 07840 - FIRESTOPPING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit copies of manufacturer's product data and specifications for type of sealant required, to the Engineer for acceptance.
- C. Material Safety Data Sheets (MSDS): Submit MSDS for each sealant product.
- D. Color Samples: Submit 4 sets of color finish samples of sealants.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of sealant through one source from a single manufacturer.

- C. Preconstruction Compatibility and Adhesion Testing: Submit to sealant manufacturers, for testing samples of materials that will contact or affect sealants. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain optimum adhesion of sealants to joint substrates. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Stain-Test Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Storage: Carefully handle and store all materials to prevent inclusion of foreign materials. Remove from project site all damaged and deteriorated materials and materials exceeding shelf life.
- C. Sealant materials shall be handled in accordance with the manufacturer's specifications and installed prior to expiration of shelf life.

1.5 WARRANTY

- A. Provide a 2-year written warranty against leaks, air infiltration, cracks, and other failures of the installation and materials. Where sealant is associated with a system with longer warranty period, sealant warranty shall match applicable system.
 - 1. Repair of sealants to seal leaks caused by faulty materials or workmanship;
 - 2. Repair or replace damage to the building or its finishes, equipment or furniture when occasioned by such leaks at no additional cost to the State.
- B. The Surety shall not be held liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Sealants:

1. At Exterior and Interior Vertical and Overhead Moving Joints: One-part polyurethane-based sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT. Provide one of the following, or pre-approved equal:
 - a. Vulkem 116; Tremco, Inc.
 - b. Chem-Calk 900; Bostik Construction Products Div.
 - c. Sikaflex 1a; Sika Corp.
 - d. DynaTrol 1-XL; Pecora Corp.
 - e. NP-1; Sonneborn.
2. At Interior Vertical and Overhead Non-Moving Joints: Non-Elastomeric Sealant; acrylic-emulsion type, conforming to ASTM C 834. Provide one of the following, or pre-approved equal:
 - a. AC-20 Acrylic Latex; Pecora Corp.
 - b. Tremco Acrylic Latex 834; Tremco, Inc.
 - c. Chem-Calk 600; Bostik Construction Products Div.
 - d. Sonolac; Sonneborn.
3. At Horizontal Traffic-Bearing Joints: Two-part polyurethane based sealant, conforming to ASTM C 920, Type M, Grade P, except provide NS at sloped conditions, Class 25, Use T. Provide one of the following, or pre-approved equal:
 - a. Sikaflex 2c SL or Sikaflex 2c NS TG; Sika Corp.
 - b. THC-900 or Vulkem 227; Tremco, Inc.
 - c. Urexpam NR-200 or Dynatred; Pecora Corp.
 - d. SL-2 or NP-2; Sonneborn.
4. Silicone Sealant: At Perimeter of All Plumbing Fixtures and Fittings: One-part mildew-resistant silicone sealant conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT, formulated with fungicide; intended for sealing interior joints with non-porous substrates. For use in kitchens and food preparation areas provide sealant complying with FDA requirements. Provide one of the following, or pre-approved equal:

- a. Dow Corning 786; Dow Corning Corp.
 - b. SCS 1700 Sanitary; Momentive.
 - c. Tremsil 600 White; Tremco, Inc.
 - d. Omni Plus; Sonneborn.
 - e. 898 or 893, No. 345; Pecora Corp.
5. Bedding Compound: For installation of thresholds and similar items indicated to be bedded in sealant, use a preformed butyl-polyisobutylene sealant tape. Size of tape as required for the specific application. Provide one of the following, or pre-approved equal:
- a. Extru-Seal; Pecora Corp.
 - b. 440 Tape; Tremco, Inc.
 - c. Chem-Tape 40; Bostik Construction Products Div.
6. Acoustical Sealant: Provide one of the following, or pre-approved equal:
- a. Exposed and Concealed Joints: Non-sag, paintable, non-staining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - (1) AC-20 FTR; Pecora Corp.
 - (2) Sheetrock Acoustical Sealant; USG.
 - b. Concealed Joints: Non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
 - (1) BA-98; Pecora Corp.
 - (2) Tremco Acoustical Sealant; Tremco.
 - (3) Pro-Series SC-170; Ohio Sealants.
- C. Primer for Sealants: Non-staining, as recommended by the sealant manufacturer.

- D. 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 conforming with ASTM C 1330 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. Do not use oakum or other types of absorptive materials as backstops.
- E. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer. Provide self adhesive tape where required.
- F. Masking Tape: Non-staining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.
- G. Bituminous Joint Filler:
 - 1. Provide resilient and non-extruding type premolded bituminous composition of organic fiber or granulated cork, between 2 bituminous felt liners, complying with ASTM D 2475 or ASTM D 1751, AASHTO M 33 or M 213, and (if fiber type) Fed. Spec. HH-F-341, Type III.
 - 2. Provide one of the following products, or pre-approved equal:
 - a. "Elastite"; Celotex.
 - b. "Tex-Mastic"; J.P. Petroleum Products.
 - c. "Corkfill"; W.R. Meadows.

PART 3 - EXECUTION

3.1 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.

3.2 EXAMINATION

Examine joint widths, 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.

3.3 JOINT PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
1. Remove foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and accepted for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; and surface dirt.
 2. Clean concrete, masonry, and unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, 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.
 3. Remove laitance and form release agents from concrete.
 4. Steel Surfaces in Contact with Sealant: Scrape and wirebrush to remove loose mill scale. Remove dirt, oil, or grease by solvent cleaning, and wipe surfaces with clean cloths.
 5. Clean metal, glass, glazed surfaces of ceramic 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.
 6. Do not permit solvents to air dry. Wipe surfaces free of solvent using clean, dry white cloth or white lintless paper.
- B. 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.
- C. 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.
- D. Examine joint size and correct to achieve depth ratio of 1/2 of joint width with a minimum width and depth of 1/4-inch, maximum width of 1-inch unless specifically allowed otherwise by the sealant manufacturer.

3.4 INSTALLATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions. Proceed with the work only when weather conditions are favorable for proper cure and development of high early bond strength.
- C. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- D. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- E. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. 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.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.
 - 2. 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.
 - 3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.
- F. 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.

- G. 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.
- H. Tooling of Nonsag 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.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 2. Provide flush joint configuration per Figure 5B in ASTM C 1193, where indicated.

3.5 CLEAN UP

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.

3.6 PROTECTION

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.

END OF SECTION

DIVISION 8 - DOORS AND WINDOWS

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide standard steel doors and frames as indicated and scheduled on drawings.
- B. Related Work Described Elsewhere:
 - 1. Building in of anchors and grouting of frames in masonry construction is specified in Section 04810 - UNIT MASONRY ASSEMBLIES.
 - 2. Finish hardware is specified in Section 08710 - FINISH HARDWARE.
 - 3. Glazing is specified under Section 08800 - GLAZING.
 - 4. Field applied painting is specified in Section 09900 - PAINTING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical product data substantiating that products comply with requirements.
- C. Shop Drawings: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections, gauges, and finishes. Show anchorage and accessory items.
- D. Schedule: Furnish schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
- E. Label Construction Certification: For assemblies required to be fire-rated and exceeding sizes of tested assemblies, submit manufacturer's certification for that each door and frame assembly has been constructed to conform to design, materials, and construction equivalent to requirements for labeled construction.

1.3 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI A250.8, "Recommended Specifications for Standard Steel Doors and Frames", and as herein specified.
- B. Fire-Rated Assemblies: Where fire-rated assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with ICC IBC Section 715, "Opening Protectives", NFPA 80, "Fire Doors and Fire Windows", and have been tested, listed, and labeled in accordance with UL 10C, "Fire Tests of Door Assemblies", and NFPA 252, "Fire Tests of Door Assemblies", by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction. These requirements shall take precedence over details indicated or specified.
- C. Door Hardware Mounting Heights: The Contractor shall be responsible to coordinate all mounting heights of various finish hardware with all project requirements. Accessible hardware shall be mounted per ADAAG Section 404.2.7.
- D. Wind Pressure Requirements: Exterior doors shall have been tested, rated, and factory marked for the positive and negative wind pressures as indicated or as calculated in accordance with ASCE-7 for the windspeed, exposure, and importance factor for this project and ICC IBC.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Engineer; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover in a dry, secure place. Place units on minimum 4-inch high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chambers. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.
- D. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Sheets: All doors and frames shall be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM A 1008/A 1008M, "Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable", and ASTM A 568/A 568M, "Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for". Sheet shall be galvanized to 'A-60' minimum coating weight for interior applications and galvanized to 'G-90' minimum coating weight for exterior applications per ASTM A 924/A 924M, "Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process". Internal reinforcing shall be manufactured of hot rolled pickled and oiled steel per ASTM A 1011/ A 1011M, "Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength".
- B. Core Materials: Polystyrene foam core, self extinguishing, non-toxic, or 1 pound density mineral fiber at steel reinforced doors and as standard with the manufacturer for rated doors to conform to design requirements.
- C. Supports and Anchors: Fabricate of not less than 18 gauge galvanized sheet steel.
- D. Frame Anchors:
 - 1. Wall Anchors for Frame Attachment to Masonry Construction: Masonry anchors, adjustable, flat, corrugated or perforated 'T' shaped anchors with leg not less than 2-inches wide by 10-inches long or masonry "wire" type not less than 3/16-inch diameter.
 - 2. Wall Anchors for Attachment to Drywall Partitions:
 - a. Use manufacturer's adjustable type compression anchors with knocked down die mitered frames at drywall locations.
 - b. Use stud anchors sized to accommodate frame jamb depth and face dimension on all welded frames.
 - 3. All frame jamb anchors to be provided; one each jamb per 30-inches of frame height or fraction thereof, (3 minimum).

4. Floor Anchors: Angle clip type:
 - a. 16 gauge minimum.
 - b. To receive 2 fasteners per jamb.
 - c. Welded to the bottom of each jamb.
 5. In-Place Masonry or Concrete: 3/8-inch countersunk flat head stove bolt and expansion shields.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize, complying with ASTM A 153/A 153M, "Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware", Class C or D as applicable.
- F. Factory Applied Primer Paint: Rust-inhibitive enamel paint, either air-drying or baking, suitable as a base for specified finish paints conforming to ANSI/SDI A250.10, "Test Procedures and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames". Primers shall be free from asbestos, lead, mercury, chromate, and cadmium.

2.2 FABRICATION, GENERAL

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI A250.8 requirements as follows:
1. Exterior Flush Panel Doors: Level 3, extra heavy-duty, Model 2, minimum 16 gauge faces.
 2. Doors shall conform to ANSI/SDI A250.4, "Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing", minimum Level A performance for doors as applicable.
- B. Fabricate exposed faces of doors and panels from only cold-rolled steel.
- C. Fabricate frames, concealed stiffeners, reinforcement, edge channels, and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).
- D. Fabricate all doors and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16 gauge inverted steel channels, flush end cap cover plate, and sealed to prevent water intrusion. Door hinge edge shall be one-piece full height, 14 gauge channel, formed and tapped for hinges. Doors shall have a beveled (1/8-inch in 2-inches) lock edge and square hinge edge.

- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.

- F. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI/SDI A250.8, ANSI/SDI A250.6, and additional requirements of ANSI/BHMA A156.115 specifications for door and frame preparation for hardware.
 - 1. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site. Provide minimum gauge hardware reinforcing for mortise or surface applied hardware as follows:
 - a. Hinges:
 - (1) 10 gauge or equivalent number of threads on doors.
 - (2) 7 gauge on frames.
 - b. Locks: 12 gauge or equivalent number of threads.
 - c. Surface Closers: 12 gauge.
 - d. Panic Devices: 12 gauge.
 - 2. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with ANSI/SDI A250.8, "Recommended Specification for Standard Steel Doors and Frames", and the Americans with Disabilities Act Accessibility Guidelines (ADAAG) Section 404.2.7.

- G. Factory Painting:
 - 1. Clean, phosphatize, and prime paint exposed surfaces of steel door and frame units, including galvanized surfaces.
 - 2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
 - 3. Apply factory coat of prime paint to an even consistency to provide a uniformly finished surface ready to receive finish paint.

2.3 STANDARD STEEL DOORS

- A. Provide metal doors of types and styles indicated on drawings or schedule. Fill all doors with mineral fiber insulation at steel reinforced doors, or polystyrene foam panel reinforcement at standard hollow metal or as standard with manufacturer for rated doors to conform to design requirements.
- B. Glazing: Glazing shall be safety type as specified in Section 08800 - GLAZING and secured with removable glazing beads on the secure side of door. Beads shall be snap-on or screw-on type.
- C. Louvers: SDI-111-C, "Recommended Louver Details for Standard Steel Doors". Louvers, where indicated, shall be sight proof type inserted into the door. Louvers in exterior doors shall be inverted Y type. Form louvers of 16 gauge galvanized steel for exterior doors. Louvers shall be non-removable from the outside of exterior doors. Insect screen for exterior doors shall be removable type with 18 by 16 mesh aluminum or bronze cloth.

2.4 STANDARD STEEL FRAMES

- A. Provide metal frames for doors of type and style as shown on drawings and schedules conforming with ANSI/SDI A250.8. Conceal fastenings, unless otherwise indicated. Fabricate frames of cold-rolled furniture steel minimum 14 gauge for exterior and 16 gauge for interior to conform with door physical performance level.
 - 1. Fabricate frames with mitered corners, welded construction for exterior applications and either knock-down (mechanical interlock joint) with hairline seam or welded construction for interior frames.
 - a. Welded Frames: Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth. Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M, and in accordance with the practice specified by the producer of the metal being welded.
 - b. Knock-Down Frames: Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.
 - 2. Form all frames of hot dip galvanized steel.
 - 3. Frames shall comply with ANSI/SDI A250.4, minimum Level A, one million cycle swing test performance for a 4070 door frame.

- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.
- C. Plaster Guards: Provide 26 gauge steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- D. Template Hardware: Factory cut doors and frames for all template hardware, including hinges, bolts, etc.

2.5 FIRE-RATED ASSEMBLIES

Assemblies shall bear the listing identification label of the Underwriters Laboratories, Inc. (UL), Factory Mutual Engineering Corp. (FM), Warnock Hersey International (WHI), or a nationally recognized testing laboratory qualified to perform tests of fire assemblies in accordance with ANSI/UL 10C and NFPA 252 and having a listing for the tested assemblies. Doors exceeding the sizes for which listing label service is offered shall be inspected in accordance with NFPA 80 and NFPA 80A. Listing identification labels shall be constructed and permanently applied by a method which results in their destruction should they be removed. Labels shall be metal with raised letters and shall bear the rating followed by the letter "s", and name and file number of the door and frame manufacturer and service conducting the inspection. Labels shall be factory applied and shall not be painted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of ANSI/SDI A250.11, "Recommended Erection Instructions For Steel Frames", unless otherwise indicated.
 - 1. Anchors: Provide sufficient anchorage to attach to wall and floor in accordance with ANSI/SDI A250.4, test compliance minimum Level A of one million cycles, or anchorage as detailed on drawings to specific wall conditions. Anchor exterior door frames for wind pressure requirements.
 - 2. Except for frames located at in-place concrete and masonry installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

3. In concrete and masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.
4. At in-place concrete and masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
5. Install fire-rated frames in accordance with the more restrictive requirements of NFPA 80 and current ICC IBC as amended.
6. At frames to be grouted, the inside of the frame shall be given a coat of heavy-bodied bituminous paint.

C. Door Installation:

1. Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI A250.8.
2. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation.
3. Place fire-rated doors with the more restrictive clearances as specified in NFPA 80 and current ICC IBC as amended. Smoke rated assemblies shall conform with NFPA 105, "Installation of Smoke Door Assemblies".

D. Door Clearances: Unless otherwise recommended by the manufacturer, provide uniform clearances as listed below:

1. Head, Jamb, and Lock Edge: 1/8-inch maximum.
2. Meeting Stile: 1/4-inch maximum (3/16-inch maximum for fire doors).
3. Top of Decorative Floor Finish or Covering: 5/8-inch maximum.
4. Threshold: 1/8-inch (1/4-inch maximum).

3.2 ADJUST AND CLEAN

- A. Factory Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of factory coating and apply touch-up of matching air-drying coating.
- B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating conditions.

END OF SECTION

SECTION 08210

WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Extent and location of each type of wood door is indicated on drawings and in schedules.
- B. Types of doors required include the following:
 - 1. Solid core flush wood doors with wood veneer faces.
 - 2. Plastic laminate faced doors.
- C. Related Work Described Elsewhere:
 - 1. Metal door frames for wood doors are specified in Section 08110 - STEEL DOORS AND FRAMES.
 - 2. Door hardware is provided under Section 08710 - FINISH HARDWARE. Door producer shall review and certify the finish hardware schedule is in conformance with the doors being furnished.
 - 3. Glazing requirements for doors, including doors to be factory glazed, are included in Section 08800 - GLAZING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, and trim for openings.
- C. Shop Drawings: Submit shop drawings indicating location and size of each door, door swing, stile and rail dimensions, veneers, elevation of each kind of door, details of construction, all openings and louvers, location and extent of hardware blocking, fire ratings, and other pertinent data.
- D. Samples: Submit 4 samples of each veneer, plastic laminate, door construction, and finish.
- E. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Quality Standards: Comply with the following standards:
 - 1. WDMA Quality Standard: ANSI/WDMA I.S.-1A, "Wood Flush Doors", of Wood Door Manufacturers Association (WDMA).
 - 2. AWI Quality Standards: "Architectural Woodwork Standards" (AWS), including Section 9, "Doors", for grade of door, core construction, finish, and other requirements exceeding those of WDMA quality standard.
- B. WDMA Quality Marking: Mark each wood door with WDMA Wood Door Certification Hallmark certifying compliance with applicable requirements of ANSI/WDMA I.S.-1A Series. For manufacturers not participating in WDMA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.
- C. WDMA Performance Duty Levels: Architectural wood flush doors shall be heavy duty unless indicated otherwise.
- D. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ICC IBC Section 715, "Opening Protectives", NFPA 252, "Fire Tests of Door Assemblies", and UL 10C, "Fire Tests of Door Assemblies", and which are labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to authorities having jurisdiction. These requirements shall take precedence over details indicated or specified. Labels shall be metal with raised letters and shall bear the rating followed by the letter "s", name and file number of the door manufacturer and the service conducting the inspection. Labels shall be factory applied and shall not be painted.
- E. Factory seal all doors on all 6 sides using manufacturer's standard.
- F. Manufacturer: Obtain doors of similar finish from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standards and recommendations of ANSI/WDMA I.S.-1A Section G-20, "Care and Installation at Job Site", as well as with manufacturer's instructions.
- B. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

- C. Do not walk on or stack other materials on top of stacked doors. Do not drag doors across one another.
- D. For all doors not factory finished, seal all four edges immediately after delivery.
- E. Store doors away from threat of termite or other insect infestation.
- F. Plastic wrapping shall be cut to allow doors to acclimatize once they are protected from the weather.
- G. Handle manufactured materials as recommended by the manufacturer.

1.5 PROJECT CONDITIONS

Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location: AWS "Architectural Woodwork Standards", "Care and Installation at the Job Site", for door type as indicated.

1.6 WARRANTY

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the State may have under the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, installer and Contractor, agreeing to repair or replace defective doors which have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.
 - 1. Warranty shall be in effect during following minimum period of time after date of Project Acceptance, unless longer warranty is standard with the manufacturer.
 - 2. Solid Core Interior Doors: Life of installation.
 - 3. Interior Plastic Laminated Faced Doors: Two years.
 - 4. The Surety shall not be held liable beyond 2 years from the project acceptance date.
- C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 INTERIOR FLUSH WOOD DOORS

- A. Solid Core Doors for Transparent (Natural) Finish: Comply with the following requirements:
1. Faces: White Oak, plain sliced, Grade AA.
 2. Grade: AWS Premium, WDMA Premium or above.
 3. Construction: SLC-5 or SLC-7 (Stave lumber core, 5 or 7-ply) or EC-5 or EC-7 (Engineered Core).
- B. Fire-Rated Solid Core Doors: Comply with the following requirements:
1. Faces and Grade: Provide faces and grade to match non-rated doors in same area of building, unless otherwise indicated.
 2. Construction: Manufacturer's standard core construction and hardware reinforcement blocking as required to provide fire-resistance rating indicated.
 3. Pairs: Furnished formed steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.

2.2 INTERIOR PLASTIC LAMINATE FACED DOORS

Flushed Faced Plastic Laminate Finish: Comply with the following requirements:

1. Faces: NEMA LD-3 high pressure plastic laminate SP-125 (0.125-inch nominal thickness).
2. Grade: AWS Custom, WDMA Custom.
3. Construction: SLC-HPDL (Stave lumber core).
4. Stiles: Plastic laminate to match door face.

2.3 FABRICATION

- A. Wood Doors: Fabricate wood doors to produce doors in sizes indicated for job-site fitting. Stile edge bands of doors to receive natural finish shall be hardwood, compatible with face veneer. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware. Provide book match veneer.

- B. Adhesives: Adhesives shall be in accordance with WDMA I.S.-1A, requirements for Type II Bond Doors (water repellent) for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining. Adhesives for interior doors shall contain no formaldehydes.
- C. Metal Astragals: Premachine astragals and formed steel edges for hardware where required for pairs of fire-rated doors.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.

Light Openings: Trim openings with moldings of material and profile indicated or if not indicated, as standard with the manufacturer.

- E. Finish Hardware: Locate hardware to comply with DHI-WDHS-3 and each door that is an element of an accessible route shall comply with Americans with Disabilities Act Accessibility Guidelines (ADAAG) Section 404.2.7. Comply with finish hardware schedules, door frame shop drawings, ANSI/SDI A250.8, ANSI/SDI A250.6, and additional requirements of ANSI/BHMA A156.115, and hardware templates.

2.4 PRESERVATIVE TREATMENT

Treat all solid core doors at factory with water repellent after manufacturing has been completed, in accordance with WDMA Industry Standard I.S.-4, "Water-Repellent Preservative Non-Pressure Treatment for Millwork".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installed door frames prior to hanging door:
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects that cannot be repaired in a manner that is imperceptible. Replace doors which cannot be field repaired to match new as accepted by the Engineer at no additional cost to the State. Doors warped in excess of 1/4-inch when measured in accordance with ANSI/WDMA I.S.-1A shall be rejected.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation see Section 08710 - FINISH HARDWARE.

B. Manufacturer's Instructions:

1. Install wood doors to comply with manufacturer's instructions and of referenced AWS and WDMA standard and as indicated.
2. Install fire-rated doors in corresponding fire-rated frames in accordance with the more restrictive requirements of NFPA 80, "Fire Doors and Fire Windows", and current ICC IBC as amended. Securely affix installation instructions to each door.

C. Job Fit Doors: Align and fit doors in frame with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Fitting Clearances for Non-Rated Doors: Provide 1/8-inch at jambs and heads; 1/16-inch per leaf at meeting stiles for pairs of doors; and 1/2-inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 3/8-inch clearance from bottom of door to top of threshold unless indicated for undercut.
2. Fitting Clearances for Fire-Rated Doors: Comply with the more restrictive requirements of NFPA 80 and the current ICC IBC as amended.
3. Bevel non-rated doors 1/8-inch in 2-inches at lock and hinge edges.
4. Bevel fire-rated doors 1/8-inch in 2-inches in lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Prefit Doors: Fit to frames for uniform clearance at each edge.

3.3 ADJUSTING AND PROTECTION

- A. Operation: Rehang or replace doors which are hinge bound and do not swing or operate freely. Replace or rehang doors which are warped, twisted, or which are not in true planes.
- B. Protection: Protect doors as recommended by door manufacturer to assure that wood doors will be without damage or deterioration at time of Project Acceptance.

END OF SECTION

SECTION 08305

ACCESS DOORS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Provide access doors as shown or required by drawings as specified herein. Mechanical and electrical contractors shall furnish locations and numbers of required access doors to General Contractor.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions, and directions for installation of anchorage devices. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, finishes, latching provisions, and other data pertinent to installation.
- C. Verification: Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment, and indicate on submittal schedule.

1.3 QUALITY ASSURANCE

- A. Size Variations: Obtain the Engineer's acceptance of manufacturer's standard size units which may vary slightly from sizes indicated.
- B. Coordination: Furnish inserts and anchoring devices which must be built into other work for installation of access doors. Coordinate delivery with other work to avoid delay.
- C. Manufacturers: Provide access doors from one of the listed manufacturers or pre-approved equal.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle materials in strict conformance of the manufacturer's instructions and recommendations.

PART 2 - PRODUCTS

2.1 STEEL FLUSH PANEL DOORS

- A. For Gypsum Board Non-Rated Installation:
 - 1. Karp Assoc. Model KDW.
 - 2. Milcor Style DW.
 - 3. J.L. Industries Model WB.
 - 4. Pre-approved equal.
- B. Finish: Baked on prime finish on steel doors and frames. Primers shall be free of asbestos, lead, mercury, chromate, and cadmium.

2.2 STAINLESS STEEL FLUSH PANEL DOORS

- A. For Non-Rated Ceramic Wall Tile and Wet Areas:
 - 1. Karp Assoc. Model DSC-214M for masonry and concrete and KDW for gypsum board.
 - 2. Milcor Style MS for masonry and concrete and DW for gypsum board.
 - 3. J. L. Industries Model TMS for masonry and concrete and WB for gypsum board.
 - 4. Pre-approved equal.
- B. Finish: No. 4 satin finish stainless steel for doors and exposed frames.

2.3 SIZES

Unless otherwise shown, provide access doors in sizes as indicated.

2.4 OPERATION

Locks shall be flush with door surface and shall be screw driver operated stainless steel cam and studs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's instructions for installation of access doors.

- B. Coordinate installation with work of other trades.
- C. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

3.2 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames which are warped, bowed or otherwise damaged.

END OF SECTION

SECTION 08410

ALUMINUM ENTRY DOORS AND WINDOW WALL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Extent of aluminum entrances and window wall work for exterior and interior and exterior sun control devices are shown on the drawings.
- B. Related Work Specified in Other Sections:
 - 1. Sealants shall be exterior type for moving joints as specified in Section 07920 - SEALANTS.
 - 2. Lock cylinders for entrance doors are provided under Section 08710 - FINISH HARDWARE.
 - 3. Glazing requirements for entrance doors and window wall, including entrances specified to be factory glazed, are included in Section 08800 - GLAZING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit complete manufacturer's technical literature, including full description of all materials and hardware, including weather resistance data.
- C. Shop Drawings: Submit complete shop drawings to the Engineer for acceptance. Shop drawings shall include large scale detail sections of every typical composite member. Also show method of anchorage, joint systems, expansion provisions, glazing details, hardware, and its attachment and other pertinent details, and indicate all materials and finishes. Do not fabricate prior to acceptance.
- D. Samples: Submit 4 samples of finishes, including hardware to the Engineer for acceptance.
- E. Test Reports: Where manufacturer's data does not clearly indicate conformance with performance requirements submit test reports from an independent laboratory certifying performance requirements of all exterior systems.
- F. Certification: Supply certification by the manufacturer that the entry doors and window wall, including finish, conform to specifications.
- G. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

- H. Maintenance Manual: Submit 3 maintenance manuals for each type of aluminum door, hardware, and finish.

1.3 QUALITY ASSURANCE

- A. Standards: Comply with the applicable provisions of "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" of the Architectural Aluminum Manufacturers Association (AAMA).
- B. Manufacturer: Provide systems produced by a firm with at least 5 years of experience in the fabrication of aluminum entrance doors and window wall, of the types required for this project.
- C. Perform work in accordance with Americans with Disabilities Act Accessibility Guidelines ADAAG Section 404.2.7 and NFPA 101 as applicable.

1.4 WARRANTY

Provide a written warranty from the manufacturer or his authorized representative and countersigned by the Contractor, that the completed work will not be defective in workmanship, materials or installation (including watertightness of the entire application) for a period of 2 years from the date of final acceptance and that repair or replacement of any defective work will be done promptly. This warranty does not extend to defects caused by unusual abuse.

1.5 PERFORMANCE REQUIREMENTS

- A. Submit evidence of compliance to the following minimum requirements.
 - 1. Thermal Movement: Fabricate exterior components from manufacturer's stock systems which have been designed to provide for expansion and contraction resulting from ambient temperature range of 120 degrees F.
 - 2. Wind Loading: Fabricate exterior components from manufacturer's stock systems which have been tested at 1.5 times design load in accordance with ASTM E 330/E 330M, "Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference", to withstand wind velocity of 105 mph, Exposure C in accordance with current ICC IBC with a deflection of not more than 1/175 times the length of the member. Provide internal reinforcement if required to withstand all design loads.
 - 3. Wind Pressure Requirements: Exterior doors shall have been tested, rated, and factory marked for the positive and negative wind pressures as indicated or as calculated in accordance with ASCE-7 for the windspeed, exposure, and importance factor for this project and ICC IBC.

4. Weather Resistance: Fabricate exterior window wall components from manufacturer's stock systems which have been tested to demonstrate permanent resistance to leakages as follows with test pressure differential of 10 percent of design loading (excluding operable door edges).
 - a. Air Infiltration: Not more than 0.06 cfm per square foot, tested in accordance with ASTM E 283, "Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen", at a pressure differential of 6.24 psf.
 - b. Water Infiltration: No uncontrolled water penetration, tested in accordance with ASTM E 331 at 10 psf.
 - c. Uniform Load: A static air design load of 20 psf shall be applied in the positive and negative direction in accordance with ASTM E 330/ E 330M. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2 percent of their clear spans shall occur.
5. Seismic Load: As indicated.

- B. Field Measurement: Wherever possible, take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of work. However, proceed with fabrication and coordinate installation tolerances as necessary when field measurements might delay work.

1.6 PROTECTIVE COVERING

Prior to shipment from the factory, finished surfaces of aluminum shall receive a protective covering. Covering shall not chip, peel, or flake due to temperature or weather, and shall protect against discoloration and surface damage from transportation, storage, and construction activities. Covering shall be readily removable without affecting the finish. Covering shall be either adhesive paper, waterproof tape, or strippable plastic.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Use care in handling entry doors and window wall during transportation and at the jobsite. Store entry doors and window wall and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the materials. Entry doors and window wall shall not be covered with tarps, polyethylene film, or similar coverings. Provide care and handling conforming to AAMA CW-10, "Care and Handling of Architectural Aluminum from Shop to Site".

- B. Damaged entry doors and window wall shall be repaired to an "as new" condition as approved. If materials cannot be repaired, provide a new unit.
- C. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 or ASTM B 221M, 6063-T5 or T6 alloy and temper.
- B. Aluminum Bars and Rods: ASTM B 211 or ASTM B 211M.

2.2 ALUMINUM DOORS AND WINDOW WALL

- A. Aluminum Entrance Doors:
 - 1. Exterior doors shall be equivalent to Arcadia MS362 medium stile heavy wall doors with integral 7/8-inch true muntins arranged as shown, 1-3/4 inch thick with major portions of the door members 0.125-inch thick and glazing moldings 0.050-inch thick.
 - 2. Entry Door Hardware: Each door that is an element of an accessible route shall comply with Americans with Disabilities Act Accessibility Guidelines Section 404. Hardware shall conform to applicable ANSI/BHMA A156 series standard and be equivalent to the following:
 - a. Exterior Pair Swinging Entry Doors (Both Doors Active):
 - (1) Threshold: T407.
 - (2) Sill Sweep: Concealed.
 - (3) Weatherstripping by manufacturer.
 - (4) Hinging: Continuous.
 - (5) Closers: Surface mounted LCN 4041-18PA.
 - (6) Panic Hardware:
 - (a) Active Leaf: EL3347-NLOP-33-628.
 - (b) In Active Leaf: 3347-EO-36-628.
 - (7) Push/Pulls: 10-inch wire off-set pulls 34053; 10-inch offset wire pulls CTC exterior only.

- (8) Transom decal.
- (9) Door stops.
- (10) Door Loop: DL-18 Keedex.
- (11) Power Supply: PS873-2.
- b. Interior Swinging Doors:
 - (1) Electric Strikes: AR 4300 electrified dead latch; 4300-3-0-2-01-628.
 - (2) PS-1: Power Supply AR.
 - (3) 4590 Dead Latch Paddle: 628 at interior.
 - (4) Closer: Surface mounted, LCN-4041-18PA.
 - (5) Door Loop: DL-18 Keedex.
 - (6) 34053-10-inch offset wire pull exterior.
 - (7) Hinges: Continuous.
- c. Remaining Hardware: Remaining hardware is provided under Section 08710 - FINISH HARDWARE.
- B. Window Wall (Fixed Glass) System and Door Frames: Nominal 2-inch wide x 4-1/2 inch deep frame size for exterior and 1-3/4 inch x 4-1/2 inch deep frame size at interior with 0.050-inch thick glazing stops, arranged as shown and detailed with EPDM rubber glazing gaskets. Extruded aluminum sill shall be supplied at all exterior openings to maintain water performance standards, equivalent to Arcadia AG451 and A400 Series as applicable or pre-approved equal.
- C. Exterior Sun Control Devices: Awning Works, Inc. or pre-approved equal.
 - 1. Horizontal Outriggers with Louvers: See Drawings A5.02 and A5.03 for product information.
 - 2. Vertical Shades: See Drawings A5.04, A5.05, and A5.06 for product information.
- D. Fasteners: All exposed fasteners shall be stainless steel. Perimeter anchors shall be stainless steel or galvanized steel. Exposed fasteners shall match finish of adjoining material.

- E. Weatherstripping: Weatherstripping shall be continuous silicone-treated wool pile type, or a type recommended by the door manufacturer, stile mounted, and shall be provided on head and jamb of exterior door frames. Weatherstripping for bottom of doors shall be as shown. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors.

2.3 FINISH

All exposed aluminum surfaces shall be free of scratches and other blemishes. Provide light champagne finish conforming to Aluminum Association Standard AA DAF-45, "Designation System for Aluminum Finishes", AA-M12-C22-A42, Architectural Class I, (0.7 mil or greater) and AAMA 611, "Anodized Architectural Aluminum", for all exposed surfaces, including fasteners and hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive entry door and window wall units and sill plate is level in accordance with manufacturer's acceptable tolerances. Verify field measurements for entry door and window wall installation.

3.2 PREPARATION

Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.3 INSTALLATION

- A. Install component parts level, plumb and true to line with uniform joints. Do not use defective parts (warped, twisted, bowed, dented or abraded). Secure to structure with non-staining non-corrosive shims, anchors, fasteners, spacers, and fillers. Provide structural galvanized steel vertical stiffener members where required by height or design conditions. Use care in erection so as not to mar, abrade or stain finished surfaces. Where aluminum is to be placed in contact with steel, concrete, concrete block, and other dissimilar surfaces, back paint the aluminum before erection with an acceptable bituminous paint.
- B. Anchors: Anchors of the sizes and shapes required shall be provided for securing aluminum frames to adjacent construction. Anchors shall be placed near top and bottom of each jamb and at intermediate points not more than 25-inches apart. Mullions shall be anchored at head and sill. The bottom of each frame shall be anchored to the rough floor construction with 3/32-inch thick stainless steel angle clips secured to the back of each jamb and to floor construction. Door frames free of window wall system shall be reinforced and securely anchored to floor construction. Anchor exterior frames for wind pressure requirements.

- C. Doors shall be accurately hung with proper clearances.
- D. Seal frames with an elastomeric sealant in color to match frames, making a neat fully weatherproof job complying with requirements of Section 07920 - SEALANTS.
- E. Set metal thresholds for exterior doors in full bed of butyl rubber, polyisobutylene mastic sealant, or preformed butyl-polyisobutylene sealant tape as specified under Section 07920 - SEALANTS.
- F. Dissimilar Materials: Provide separation of aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points by complying with ANSI/AAMA 101, Appendix, titled "Dissimilar Materials". Do not coat surfaces in contact with sealants after installation with any type of protective material.

3.4 PROTECTION

- A. After installation, protect by masking or other acceptable covering all exposed parts of the work from damage by grinding and polishing machines and/or by cement, acid or other harmful substances.
- B. Initiate and maintain all protection and other precautions required to ensure that doors and window wall units will be without damage or deterioration (other than normal weathering) at time of project acceptance.

3.5 ADJUST AND CLEAN

- A. Adjust doors and hardware to provide tight fit at contact points and at weatherstripping, for smooth operations and weathertight closure. Adjust closers to operate noiselessly and evenly and to conform to ADAAG Section 404.2.8 and Section 404.2.9.
- B. Clean and maintain aluminum surfaces in accordance with AAMA 609 & 610, "Cleaning and Maintenance Guide for Architecturally Finished Aluminum".
- C. Clean surfaces promptly after installation, exercising care to avoid damage to protective finishes. Remove temporary coverings and protection from adjacent surfaces. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and moving parts. Repair or replace damaged installed materials.
- D. After completion of all other work in the vicinity of the aluminum doors and window wall, remove all masking and/or other covering used to protect the work and thoroughly clean the aluminum surfaces with plain water or a commercial product as recommended by the manufacturer. Do not use abrasive cleaning agents.

END OF SECTION

SECTION 08520

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Extent of aluminum windows is shown on drawings. Types of windows include awning windows and fixed windows.
- B. Related Work Described Elsewhere:
 - 1. Sealants shall be exterior type for moving joints as specified in Section 07920 - SEALANTS.
 - 2. Fixed storefront profile windows are provided under Section 08410 - ALUMINUM ENTRY DOORS AND WINDOW WALL.
 - 3. Glazing requirements, including windows specified to be factory glazed are included under Section 08800 - GLAZING.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's descriptive literature and data along with shop drawings for acceptance.
- C. Shop Drawings: Submit shop drawings to the Engineer for acceptance. Do not fabricate prior to acceptance.
- D. Samples: Submit 4 samples of finishes, including hardware to the Engineer for acceptance.
- E. Test Reports: Where manufacturer's data does not clearly indicate conformance with performance requirements submit test reports from an independent laboratory certifying performance requirements of all exterior systems.
- F. Certification: Supply certification by the manufacturer that the windows, including finish, conform to specifications.
- G. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.
- H. Maintenance Manual: Submit 3 maintenance manuals for each type of aluminum window and finish.

1.3 QUALITY ASSURANCE

Manufacturer: Provide systems produced by a firm with at least 5 years of experience in the fabrication of aluminum windows of the types required for this project.

1.4 WARRANTY

Furnish a written warranty from the manufacturer or his authorized representative and countersigned by the Contractor, that the completed work will not be defective in workmanship, materials or installation (including watertightness of the entire application) for a period of 2 years from the date of final acceptance and that repair or replacement of any defective work will be done promptly. This warranty does not extend to defects caused by unusual abuse.

1.5 PERFORMANCE REQUIREMENTS

Submit evidence of compliance to the following minimum requirements for exterior windows.

1. Thermal Movement: Fabricate exterior components from manufacturer's stock systems which have been designed to provide for expansion and contraction resulting from ambient temperature range of 120 degrees F.
2. Wind Loading: Fabricate exterior components from manufacturer's stock systems which have been tested in accordance with ASTM E 330/E 330M to withstand wind velocity of 105 mph, Exposure C in accordance with current ICC IBC as amended.
3. Weather Resistance: Fabricate window components from manufacturer's stock systems which have been tested to demonstrate permanent resistance to leakages as follows:
 - a. Air Infiltration: Not more than 0.30 cfm per foot of sash when tested in accordance with ASTM E 283 at pressure difference of 6.24 psf.
 - b. Water Infiltration: No uncontrolled water shall pass the interior vertical face of the window when tested in accordance with ASTM E 331 at pressure difference of 12.0 psf.
4. Forced Entry Resistance: All windows shall conform to AAMA 1302.5 or ASTM F 588, Performance Level 10.

1.6 PROTECTIVE COVERING

Prior to shipment from the factory, finished surfaces of aluminum shall receive a protective covering. Covering shall not chip, peel, or flake due to temperature or weather, and shall protect against discoloration and surface damage from transportation, storage, and construction activities. Covering shall be readily removable without affecting the finish.

Covering shall be either adhesive paper, waterproof tape, or strippable plastic.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the materials. Windows shall not be covered with tarps, polyethylene film, or similar coverings.
- B. Damaged windows shall be repaired to an "as new" condition as accepted. If materials cannot be repaired, provide a new unit.
- C. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

Aluminum extrusions shall conform to ASTM B 221 or ASTM B 221M, 6063-T5 alloy and temper.

2.2 ALUMINUM WINDOWS

- A. General: All windows shall conform to the requirements of ANSI/AAMA 101, and shall bear the AAMA label for type of classification specified.
- B. Awning window shall comply with AP-AW80, and fixed window shall comply with F-AW55. Window shall be equivalent to Arcadia T200 Series (thermal) as indicated, arranged as detailed or equivalent products of Architectural Products, EFCO Corp., Kawneer, Peerless Products, Inc., Vistawall, or other accepted manufacturer. All window and vent framing shall be 2-inch in depth. Frame and ventilator extrusions shall have minimum wall thicknesses of 0.125-inch. Extruded head and jamb receptors, and extruded sill flashing, as called for in details. Ventilators shall be tubular and corner construction shall be with clip, stake and epoxy methods.
- C. Hardware: Hinging hardware shall be heavy duty 4 bar stainless steel hinges conforming to AAMA 904. Vents shall be adjusted for specific maximum opening criteria in accordance with notes on the drawings or direction from the Engineer. Hinges shall have a positive stop and an adjustable friction shoe. Cam locking hardware, strikes, and keepers shall be high pressure die-cast zinc. Finishes shall be white bronze or stainless steel. All hardware fasteners penetrating frame or inside plane of window shall be factory sealed with resilient non-hardening compound. Roto operated hardware is not acceptable.

- D. Fasteners: All exposed fasteners shall be stainless steel. Perimeter anchors shall be hard aluminum or stainless steel. Exposed fasteners shall match finish of adjoining material.
- E. Weatherstripping: Provide for ventilating sections of all windows to ensure a weathertight seal meeting the infiltration requirements specified in ANSI/AAMA 101. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do not use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.
- F. PVC Filler: Provide manufacturer's PVC filler to assist in shimming and sealing the perimeter of the units.

2.3 SCREENS

- A. Insect screens shall be provided for sash or ventilators of all window units unless noted otherwise. Screens shall conform to ANSI/AAMA 101. Screen fabric shall be 14 x 18 or 16 x 18 mesh fiberglass or aluminum alloy, stationary inside-mounted type, unless indicated or accepted otherwise, as selected by the Engineer. Insect screens shall be designed for the type of window with which they will be used and shall be interchangeable with other units of the same size and type.
- B. Screen fabric color shall be charcoal gray. Screen frame shall match window finish.

2.4 FINISH

All exposed aluminum surfaces shall be free of scratches and other blemishes. Provide light champagne finish conforming to Aluminum Association Standard AA DAF-45, "Designation System for Aluminum Finishes", AA-M12-C22-A42, Architectural Class I, (0.7 mil or greater), and AAMA 611, "Anodized Architectural Aluminum", for all exposed surfaces, including fasteners and hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive window units and sill plate is level in accordance with manufacturer's acceptable tolerances. Verify field measurements for window installation.

3.2 PREPARATION

Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.3 INSTALLATION

- A. Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, and other components of work. Anchor windows for wind pressure requirements.
- B. Set units plumb, level, and true to line, without warp or rack of frames or sash. Anchor securely in place.
- C. Seal frames with an elastomeric sealant in color to match frames, making a neat fully weatherproof job, comply with requirements of Section 07920 - SEALANTS.
- D. Dissimilar Materials: Provide separation of aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points by complying with ANSI/AAMA 101, Appendix, titled "Dissimilar Materials". Do not coat surfaces in contact with sealants after installation with any type of protective material.
- E. Secure insect screens securely in place.

3.4 PROTECTION

- A. After installation, protect by masking or other acceptable covering all exposed parts of the work from damage by grinding and polishing machines and/or by cement, acid or other harmful substances.
- B. Initiate and maintain all protection and other precautions required to ensure that window units will be without damage or deterioration (other than normal weathering) at time of project acceptance.

3.5 ADJUSTING AND CLEANING

- A. Adjust operating sash and hardware to provide tight fit at contact points and at weatherstripping, for smooth operations and weathertight closure.
- B. Clean and maintain aluminum surfaces in accordance with AAMA 609 & 610, "Cleaning and Maintenance Guide for Architecturally Finished Aluminum".
- C. Clean surfaces promptly after installation of windows, exercising care to avoid damage to protective finishes. Remove temporary coverings and protection from adjacent surfaces. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and moving parts. Repair or replace damaged installed materials.

- D. After completion of all other work in the vicinity of the aluminum windows, remove all masking and/or other covering used to protect the work and thoroughly clean the aluminum surfaces with plain water or a product as recommended by the window manufacturer. Do not use abrasive cleaning agents.

END OF SECTION

SECTION 08625

TUBULAR SKYLIGHTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly; configuration as indicated on the drawings.
- B. Related Work Described Elsewhere:
 - 1. Coordinate work with Section 07535 - MODIFIED BITUMEN SHEET ROOFING (TORCHED-ON).
 - 2. Flashing is provided under Section 07600 - FLASHING AND SHEET METAL.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Submit shop drawings for all roofing and ceiling conditions.
- D. Verification Samples: As requested by Engineer.
- E. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.
- F. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

Manufacturer Qualifications: Engaged in manufacture of tubular skylights for minimum 10 years.

1.4 PERFORMANCE REQUIREMENTS

Completed skylight assemblies shall be capable of meeting the following performance requirements:

1. Air Infiltration Test: Air Infiltration maximum 0.30 cfm per foot of crack length at 1.57 psf pressure differential when tested in accordance with ASTM E 283, "Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen".
2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hours/sf when tested in accordance with ASTM E 331, "Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference".
3. Uniform Load Test: No breakage, permanent damage to fasteners, hardware parts, or damage to make tubular skylight inoperable, or cause permanent deflection of any section when tested at a Positive Load of 150 psf or Negative Load of 70 psf. All units shall be tested with a safety factor of 3 for positive pressure and 2 for negative pressure, acting normal to plane of roof in accordance with ASTM E 330/E 330M, "Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference".
4. Fire Testing:
 - a. Class 'B' Burning Brand: The burning brand shall self-extinguish without transferring the fire to the dome in accordance with Class 'B' Burning Brand Test as specified in ASTM E 108, "Test Methods for Fire Tests of Roof Coverings", and UL 790, "Tests for Fire Resistance of Roof Covering Materials".
 - b. Self-Ignition Temperature: Greater than 650 degrees F in accordance with ASTM D 1929, "Test Method for Determining Ignition Temperature of Plastics".
 - c. Smoke Density: Rating no greater than 75 in accordance with ASTM D 2843, "Test Method for Density of Smoke from the Burning or Decomposition of Plastics", or no greater than 450 in accordance with ASTM E 84, "Test Method for Surface Burning Characteristics of Building Materials", in way intended for use.
 - d. Rate of Burn - Minimum Burning Rate: 2.5-inches/minute or less Classification CC-2 in accordance with ASTM D 635, "Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position".

5. Wind Loading: Fabricate exterior components from manufacturer's stock systems which have been tested at 1.5 times design load in accordance with ASTM E 330/E 330M, "Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference", to withstand wind velocity of 105 mph, Exposure C in accordance with current ICC IBC with a deflection of not more than 1/175 times the length of the member. Provide internal reinforcement if required to withstand all design loads.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Handle manufactured materials as recommended by the manufacturer.

1.6 PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

- A. Skylights: Manufacturer's standard warranty for 10 years.
- B. The Surety shall not be held liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Acceptable Manufacturer: Solatube International, Inc. or equivalent by VELUX America, Inc., Natural Light Energy Systems, or pre-approved equal.

2.2 TUBULAR SKYLIGHTS

- A. Tubular Skylights General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16. All components made and assembled by one manufacturer.
- B. Solatube SolaMaster Series Model 750 DS-O Open Ceiling 21-inch Diameter Tubes: Transparent, UV, and impact resistant dome with flashing base supporting dome and top of tube or pre-approved equal.

1. Roof Dome Assembly Glazing: Type DA, 0.125-inch minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B, and 98.5 percent UV A), impact modified acrylic blend.
2. Inner Dome Glazing: Type DAI, 0.115-inch minimum thickness acrylic classified as CC2 material.
3. Roof Flashing Base: One piece, seamless, leak-proof corrosion resistant steel flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M or ASTM A792/A 792M, 0.028-inch plus or minus 0.006-inch thick. Self mounted 11-inch base.
4. Roof Flashing Turret Extensions: Provide manufacturer's standard extensions for applications as requiring:
 - Type T24: Additional lengths of 24-inches extension.
5. Tube Ring: Attached to top of base section; 0.090-inch nominal thickness injection molded high impact PVC; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
6. Tube Ring Seal: Attached to the base of the dome ring; butyl glazing rope 0.24-inch diameter; to minimize air infiltration.
7. Dome Seal: Adhesive backed weatherstrip, 0.63-inch tall by 0.28-inch wide.
8. Reflective Tube: Aluminum sheet, thickness 0.015-inch.
 - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Specular reflectance for visible spectrum greater than 99 percent. Total solar spectrum reflectance less than 80.2 percent.
 - b. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
 - c. Tube Diameter: Approximately 21-inches.
9. Diffuser Assemblies for Tubes Not Penetrating Ceilings (No Ceiling): 21-inch diameter diffuser attached directly to bottom of tube.
 - a. Lens: Type L2, Prismatic lens designed to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.100-inch thick. Classified as CC2.

- b. Diffuser Seal: Open cell foam, acrylic adhesive backed, 0.75-inch wide by 0.125-inch thick to minimize condensation and bug, dirt, and air infiltration per ASTM E 283.
- c. Diffuser Trim Ring: Injection molded acrylic. Nominal wall thickness 0.172-inch.

2.3 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Engineer or their designated representative. Correct if needed before proceeding with installation of subsequent units.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Hardware for all doors other than hardware specified in specific door sections.
- B. Weatherstripping for exterior doors.
- C. Furnish and deliver to the building site, all finishing hardware required for all doors, etc., complete as indicated on Drawings and as specified.
- D. It is the intent of this Specification to cover in general the class and character of all finish hardware required.
- E. The hardware list specified has been made for the convenience of the Contractor and covers in general the necessary hardware for doors, casework, etc., but all other doors, etc., shown on the Drawings and not covered by the general characterization shall be fitted with appropriate hardware of the same standards as the hardware described throughout these specifications. Contractor shall furnish hardware schedule as specified.
- F. Suppliers proposing substitutes of equivalent products of other than the manufacturers named shall submit schedules listing the product and manufacturer specified and the product and manufacturer of proposed substitute.
- G. Products Furnished But Not Installed Under This Section:
 - 1. Section 08110 - STEEL DOORS AND FRAMES: Furnish templates for door and frame preparation.
 - 2. Section 08210 - WOOD DOORS: Furnish templates for door preparation.
- H. Related Work Described Elsewhere:
 - 1. Door silencers are provided under Section 08110 - STEEL DOORS AND FRAMES.
 - 2. Provide cylinders for doors provided under Section 08410 - ALUMINUM ENTRY DOORS AND WINDOW WALL.
 - 3. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Schedule: Furnish copies of the schedule of hardware in compliance with specifications and Drawings. Schedule format shall be vertical type as listed in DHI document "Sequence and Format for the Hardware Schedule". List each opening and hardware to be applied. State materials finish and manufacturer's number for each item. Required types are listed.
- C. Manufacturer's Data: Submit manufacturer's descriptive literature along with schedule.
- D. Keying Schedule: Submit a keying schedule for acceptance by the Engineer; using keying nomenclature as listed in ANSI/BHMA A156.28, "Keying Systems". Door designation listed in the Keying Schedule shall be same as those used on Drawings and Hardware Schedule. Keying of locks shall be as directed by the Engineer.
- E. Templates: Furnish hardware templates of each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware. Upon request, check Shop Drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.
- F. Tools and Maintenance Instructions: Furnish a complete set of special wrenches, tools, maintenance instructions, lubrication requirements, and inspection procedures applicable to each different or special hardware component.
- G. Certification: After completion and inspection by hardware supplier of all construction work, certify on an accepted form, that all items of finish hardware have been adjusted and are working properly.
- H. Record of Keying: Submit record of actual locations of installed cylinders and their master key code.
- I. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with Americans with Disabilities Act Accessibility Guidelines ADAAG Section 206.5, NFPA 80, "Fire Doors and Fire Windows", NFPA 101, "Life Safety Code", UL10C, "Fire Tests of Door Assemblies", NFPA 252, "Fire Tests of Door Assemblies", and ICC IBC as applicable. Each door that is an element of an accessible route shall comply with ADAAG Section 404 and shall be mounted no higher than 48-inches above finish floor.

- B. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience. Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.
- C. Hardware Supplier: Company specializing in architectural finish hardware, with a local stock warehouse, who has furnished hardware in Hawaii for a period of not less than three years. Products which are not locally stocked or serviced or which must be special ordered are not acceptable.
- D. Hardware Supplier Personnel: Employ an experienced Architectural Hardware Consultant (AHC), or Engineer pre-approved equal, who is available at reasonable times during the course of the Work, to the Engineer and Contractor for consultation about Project's hardware requirements, to verify specified hardware with door function and hardware finishes, and to establish keying system.
- E. Wind Pressure Requirements: Finish hardware for exterior doors shall have been tested, rated, and factory marked for the positive and negative wind pressures as indicated or as calculated in accordance with ASCE-7 for the windspeed, exposure, and importance factor for this project and ICC IBC.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for accessibility and requirements applicable to fire rated doors and frames.
- B. Definition: "Door Hardware" includes items known commercially as finish hardware which are required for swing and sliding doors, except special types of unique and non-matching hardware specified in same section as door and door frame.
- C. Requirement: Doors shall conform to ADAAG Section 206.5.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriter's Laboratories, Inc., as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to prevent damage of any kind and to maintain security of materials at the site.
- B. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- C. Deliver individually packaged hardware items at proper times to proper locations (shop or project site) for installation.

- D. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
- E. Deliver permanent keys to the Engineer by security shipment direct from hardware manufacturer.
- F. Provide secure lock-up for hardware delivered to project but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the Work will not be delayed by hardware losses, both before and after installation.
- G. Handle manufactured materials as recommended by the manufacturer.

1.6 WARRANTY

- A. Furnish one year warranty. Ten years from manufacturer on Door Closers and 2 years on electrical components. Where longer warranty is standard with the manufacturer, furnish the longer warranty.
- B. The Surety shall not be held liable beyond 2 years from the project acceptance date.

1.7 MAINTENANCE MATERIALS

- A. Furnish special wrenches and tools applicable to each different or special hardware component.
- B. Furnish maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 - PRODUCTS

2.1 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware is indicated in HARDWARE GROUPS at end of this section. Products are identified by using proprietary catalog numbers, and are used to establish quality and function of products desired.
- B. Product numbers indicated in the HARDWARE GROUPS are those of the manufacturers listed and are used to establish the quality of products intended.

2.2 MATERIALS AND FABRICATION

- A. Hand of Door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of indicated door.

- B. Base Metals: Produce hardware units of basic metal and forming method specified, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standard for each type hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish optional materials or forming methods for those indicated, except as otherwise specified.
- C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated. Fasteners exposed to the weather shall be non-ferrous metal or stainless steel.
- D. Furnish appropriate screws for installation with each hardware item. Provide Phillips flat head screws except as otherwise indicated. Finish exposed screws to match hardware finish. If exposed in surfaces of other work, to match finish of such other work as closely as possible, including prepared-for-paint finish in surfaces to receive painted finish.
- E. Expansion shields in concrete or masonry shall fill the depth and diameter of drilled holes.
- F. Provide concealed fasteners for hardware units which are exposed when door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the Work. In such cases, provide sleeves for each through bolt or use sex screw fasteners.
- G. Bring to the attention of the Engineer any discrepancy between the Hardware Groups and door schedule prior to ordering.

2.3 HINGES

- A. General: Hinges shall conform to ANSI/BHMA A156.1 and the requirements of this specification.
- B. Templates: Except for hinges to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Screws: Furnish Phillips flat head or machine screws for installation of units, except furnish Phillips flat head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges.
- D. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Nonferrous Hinges: Stainless steel pins.
 - 2. Exterior, Out-Swing Doors: Non-removable pins (NRP).

- 3. Interior Doors: Nonrising pins.
- 4. Tips: Flat button and matching plug, finished to match leaves.
- E. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90-inches or less in height and one additional hinge for each 30-inches of additional height.
- F. Size of hinges shall be as follows:

<u>Door Thickness/Width</u>	<u>Hinge Height</u>	<u>Hinge Width</u>
1-3/4 inch to 36-inches	4-1/2 inch	4 or 4-1/2 inch
1-3/4 inch over 36-inches	5-inch	4-1/2 Extra Heavy Ball Bearing
1-3/4 inch over 48-inches	5-inch	4-1/2 Extra Heavy Ball Bearing

Note: Hinge width shall be of sufficient size to clear frame and trim when door swings 180 degrees.

2.4 LOCK CYLINDERS AND KEYING

- A. Keys: Provide 4 keys per lock with 2 keys stamped with bitting number and 2 without bitting stamping. All keys shall be stamped "DO NOT DUPLICATE" at the point of manufacture. All locks shall be construction master keyed with construction removable cores. Provide minimum 10 construction master keys, 2 control keys for removable core, 6 master keys per set, and 2 key blanks (stamped) per cylinder.
- B. All lock cylinders shall be minimum 6 pin heavy duty type furnished in Schlage removable core key system or pre-approved equal.
- C. Permanent Keying Instructions:
 - 1. All new locks shall be keyed as directed by the Engineer.
 - 2. Prior to acceptance of the keys, the Contractor shall remove the construction cores and install the operational cores and together with the Engineer shall inspect each lock with the cut keys and building Grand Master Key.
 - 3. Upon acceptance of the project, the Contractor shall arrange for temporary keys, obtained from facility manager if further access is required.

2.5 LOCKS, LATCHES, AND BOLTS

- A. General: Mortise locks and latches shall conform to ANSI/BHMA A156.13, bored locks and latches shall conform to ANSI/BHMA A156.2, bolts shall conform to ANSI/BHMA A156.16, ADAAG Section 404.2, and the requirements of this specification.
- B. Mortise locksets shall be manufactured in a single sized case formed from 12 gauge minimum steel. The case shall be closed on all sides and back. The lockset shall have a field-adjustable, beveled armored front, with a 0.125-inch minimum thickness.
- C. Mortise locksets shall have freewheeling outside levers on all exterior doors. The freewheeling lever design shall allow the lever to swing freely up to 70 degrees, when the door is locked.
- D. Strikes: Provide manufacturer's standard wrought box strike for each latch of lock bolt, with lip extended to protect frame, finish to match hardware set. Provide dustproof strikes for foot bolts, except where special threshold construction provides nonrecessed strike for bolts.
- E. Lock Throw:
 - 1. Provide 3/4-inch minimum throw of latch and 1-inch minimum for deadbolt.
 - 2. Flush Bolt Heads: Minimum of 1/2-inch diameter rods of brass, bronze or stainless steel, with minimum 12-inches long rod for doors up to 7-feet in height; minimum 42-inches long rod for doors up to 9'-6" in height.
- F. Provide locksets, latches, and cylinders equal in all respects to those specified in the Hardware Groups. All thumb turns shall conform to ADAAG Section 309.4.

2.6 PANIC EXIT DEVICES

- A. General: Panic exit devices shall conform to ANSI/BHMA A156.3 and the requirements of this section. Exit device vertical rods shall be one-piece construction. No splicing will be allowed. Provide recessed floor strikes.
- B. All exit devices shall be heavy duty push rail and cast chassis construction. Mounting rails shall be formed from a solid single piece of stainless steel. Push rails shall be constructed of stainless steel. Painted or anodized aluminum finish will not be acceptable.
- C. Exit devices shall have freewheeling outside levers on all exterior doors. The freewheeling lever design shall allow the lever to swing freely up to 70 degrees, when the door is locked.
- D. Where panic hardware is to be installed on hollow metal or FRP doors, they shall be mounted with theft resistant through bolts.

2.7 CLOSERS AND DOOR CONTROL DEVICES

- A. General: Closers shall conform to ANSI/BHMA A156.4, ADAAG Section 404.2.8 and Section 404.2.9 and the requirements of this specification.
- B. Size of Units: Comply with manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use. Where parallel arm closers are installed, provide closer unit one size larger than recommended for use with standard arms.
- C. Maximum effort to operate doors shall not exceed 8.5 pounds for exterior doors and 5 pounds for interior doors, such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the door may be increased not to exceed 15 pounds.
- D. Provide parallel arm or regular arm closer as required to mount closer on door face least exposed to public traffic.
- E. Closers shall have brass adjustment operating valves for closing speed, latching speed, and backcheck control as a standard feature.
- F. Closer covers shall be rectangular, full cover type, high impact non-corrosive, and flame retardant.
- G. Closer shall not require removal for adjustments to be made.

2.8 WEATHERSTRIPPING AND DOOR SEALS

- A. Provide noncorrosive fasteners as recommended by manufacturer for application indicated.
- B. Weatherstrip: ANSI/BHMA A156.22, except where furnished as part of an entrance door package or as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf.
- C. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
- D. Smoke Seals: Provide continuous seals at each edge of door leaf.
- E. Thresholds: Provide all thresholds as indicated on the door schedule conforming to ANSI/BHMA A156.21 and ADAAG Section 404.2.5.

2.9 CABINET HARDWARE

ANSI/BHMA A156.9, "Cabinet Hardware".

2.10 FINISHES

- A. Finishes: Identified in schedule at end of section.
 - 1. Designations used are those listed in ANSI/BHMA A156.18 "Materials and Finishes", including coordination with traditional U.S. finishes shown by certain manufacturers for their products.
 - 2. If no BHMA finish is established, match specified product.
- B. Provide matching finishes for hardware units at each door or opening to greatest extent possible, except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where base metal or metal forming process is different for individual units of hardware exposed at same door or opening.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified for applicable units of hardware by referenced standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Pre-Installation Meeting: Before start of work under this contract, the Contractor, hardware installer, hardware manufacturer's representative or supplier and the Engineer shall meet to review the hardware installation instructions and installation conditions.
- B. Verify that doors and frames are ready to receive Work and dimensions are as indicated.

3.2 INSTALLATION

- A. Install each hardware item in compliance with manufacturer's instructions and recommendations.
- B. Mount hardware units at height indicated in ANSI/SDI A250.8, "Recommended Specification for Standard Steel Doors and Frames", except:
 - 1. As otherwise indicated or as required to comply with governing regulations and ADAAG Section 404.2.7.
 - 2. Mount deadbolt (if any) centerline to conform with ADAAG Section 404.2.7 above latchset handle centerline.

- C. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work. Do not install surface mounted items until finishes have been completed on the substrate.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set metal thresholds for exterior doors in full bed of butyl rubber, polyisobutylene mastic sealant, or preformed butyl-polyisobutylene sealant tape as specified under Section 07920 - SEALANTS.
- G. Fit face of all mortise parts snug and flush.
- H. Operating parts shall move freely and smoothly without binding, sticking or excessive clearance.
- I. Protect hardware from damage or marring of finish during construction. Use strippable coatings, removable tapes or other accepted means.
- J. Ensure that hardware displays no evidence of finish paint after building cleanup with exception of prime coated hardware installed for finish painting. The Contractor may achieve this by sequencing installation, removing after fittings, and reinstalling after painting is completed, providing protection, cleaning original hardware finish, or other accepted means.
- K. Latch and Bolt: Install latch and bolt to automatically engage in keeper, whether activated by closer or manual push. In no case shall additional manual pressure be required to engage latch or bolt in keeper.
- L. Closers:
 - 1. Do not mount closers on corridor side of door except at exterior doors.
 - 2. Carefully adjust closers to operate noiselessly and evenly and to conform to ADAAG Section 404.2.8 and Section 404.2.9.
 - 3. Have manufacturer's representative regulate closers prior to Engineer's acceptance of building.
- M. Cabinet Work: Install cabinet hardware to conform with manufacturer's instructions, Architectural Woodwork Institute, "Architectural Woodwork Standards", for quality of cabinet as specified.

3.3 FIELD QUALITY CONTROL

- A. Required certified Architectural Hardware Consultant from door hardware supplier to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.
- B. The manufacturer's representative shall instruct the user's staff on the hardware's maintenance procedures (type of lubricant needed and frequency of maintenance).

3.4 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace items which cannot be adjusted to operate freely and smoothly as intended for application made.
- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the Work during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area.
 - 1. Clean operating items as necessary to restore proper function and finish of hardware and doors.
 - 2. Adjust door control devices to compensate for final operation of ventilating equipment and to conform to ADAAG Section 404.2.8 and Section 404.2.9 requirements.
 - 3. Lubricate bearings surface of moving parts and adjust latching and holding devices for proper function.
 - 4. Test keys in every lock for proper operation and conformance with keying system.

3.5 HARDWARE GROUPS

GLY	Glynn Johnson
HAG	Hager
IVE	H.B. Ives
LCN	LCN Commercial
PEM	Pemko Mfg. Co.
SCE	Schlage Electronic Security
SCH	Schlage Lock
VON	Von Duprin

Hardware Group No. 01

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 EA	POWER TRANSFER	EPT2 CON	689	VON
1 EA	ELEC PANIC HARDWARE	98-L-E996-07-FSE-CON	626	VON
1 EA	SURFACE CLOSER	4040XP EDA SRI	689	LCN
1 EA	FLOOR STOP	FS444	626	IVE
1 EA	DOOR SWEEP	3452AV	AL	PEM
1 EA	THRESHOLD	271A	AL	PEM
1 EA	DOOR VIEWER	698	626	IVE
1 EA	POWER SUPPLY	PS902	LGR	SCE

Card reader and wiring by others.
Verify threshold condition.

Hardware Group No. 02

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 EA	PANIC HARDWARE	98-EO	626	VON
1 EA	SURFACE CLOSER	4040XP CUSH SRI	689	LCN
1 EA	DOOR SWEEP	3452AV	AL	PEM
1 EA	THRESHOLD	271A	AL	PEM

Verify threshold condition.

Hardware Group No. 03

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
1 EA	FLOOR STOP	FS444	626	IVE
	BALANCE OF HARDWARE BY DOOR MANUFACTURER			

Hardware Group No. 04

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
3 EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1 EA	ENTRANCE/OFFICE LOCK	ND50RD ATH	626	SCH
1 EA	CLASSROOM DEADBOLT	B663R	626	SCH
1 EA	WALL STOP	WS406/407CVX	630	IVE
1 EA	DOOR SWEEP	3452AV	AL	PEM
1 EA	THRESHOLD	271A	AL	PEM

Verify threshold condition.

Hardware Group No. 05

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
1 EA	WALL STOP	WS406/407CVX	630	IVE
		BALANCE OF HARDWARE BY DOOR MANUFACTURER		

Hardware Group No. 06

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
3 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA	ENTRANCE/OFFICE LOCK	ND50RD ATH	626	SCH
1 EA	FLOOR STOP	FS439	682	IVE

Hardware Group No. 07

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
3 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA	ENTRANCE/OFFICE LOCK	ND50RD ATH	626	SCH
1 EA	SURFACE CLOSER	1461 RW/PA	689	LCN
1 EA	FLOOR STOP	FS439	682	IVE

Hardware Group No. 08

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
3 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA	DOOR PULL, 1" ROUND	8103EZHD 10" L	630	IVE
1 EA	PUSH PLATE	8200 4" X 16"	630	IVE
1 EA	SURFACE CLOSER	1461 RW/PA	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1 EA	FLOOR STOP	FS439	682	IVE

Hardware Group No. 09

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
3 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA	ELEC OFFICE LOCK	CO-100-CY-50-KP-ATH-RD	626	SCE
1 EA	SURFACE CLOSER	1461 RW/PA	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1 EA	WALL STOP	WS406/407CVX	630	IVE

Hardware Group No. 10

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
2 EA	FLOOR STOP	FS444	626	IVE
		BALANCE OF HARDWARE BY DOOR MANUFACTURER		

Hardware Group No. 11

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
6 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
2 EA	MANUAL FLUSH BOLT	FB458	626	IVE
1 EA	DUST PROOF STRIKE	DP2	626	IVE
1 EA	ENTRANCE/OFFICE LOCK	ND50RD ATH	626	SCH
1 EA	CLASSROOM DEADBOLT	B663R	626	SCH
2 EA	OH STOP	90S	630	GLY
2 EA	DOOR SWEEP	3452AV	AL	PEM
1 EA	THRESHOLD	271A	AL	PEM

Verify threshold condition.

Hardware Group No. 12

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
6 EA	HINGE	5BB1 5 X 4.5 NRP	630	IVE
2 EA	MANUAL FLUSH BOLT	FB458	626	IVE
1 EA	DUST PROOF STRIKE	DP2	626	IVE
1 EA	ENTRANCE/OFFICE LOCK	ND50RD ATH	626	SCH
1 EA	CLASSROOM DEADBOLT	B663R	626	SCH
2 EA	OH STOP	90S	630	GLY
2 EA	DOOR SWEEP	3452AV	AL	PEM
1 EA	THRESHOLD	271A	AL	PEM

Verify threshold condition.

Hardware Group No. 13

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
8 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2 EA	ROLLER LATCH	RL32	626	IVE
2 EA	SINGLE DUMMY TRIM	ND170 ATH	626	SCH

Hardware Group No. 14

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
6 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2 EA	ROLLER LATCH	RL32	626	IVE
1 EA	SINGLE DUMMY TRIM	ND170 ATH	626	SCH

Hardware Group No. 15

<u>Qty</u>	<u>Description</u>	<u>Catalog Number</u>	<u>Finish</u>	<u>Mfr</u>
1 SET	TRACK & HARDWARE	9675		HAG
2 EA	FLUSH PULL	227	626	IVE

END OF SECTION

SECTION 08800

GLAZING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all glass and glazing materials to complete all glazing work as shown and as specified herein.
- B. Related Work Described Elsewhere:
 - 1. Skylight systems are provided under Section 08625 - TUBULAR SKYLIGHTS.
 - 2. Framed mirrors at toilet rooms are provided under Section 10800 - TOILET ACCESSORIES.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit copies of manufacturer's product specifications, and instructions for handling, storing, installing, cleaning, and protecting each type of glass and glazing material. Provide data indicating structural and physical characteristics of each type of glass and glazing.
- C. Samples: Submit 4 each minimum 4-inch x 4-inch samples of each type and thickness of glass, except for clear monolithic glass, and minimum of 4-inch long samples of each color required, except black, for each type of sealant and gasket exposed to view, for acceptance prior to ordering.
- D. Installation Specifications: Submit manufacturer's and referenced glass and glazing manual, etc. for installation of field installed glazing.
- E. Warranty: Submit warranty as stipulated in item entitled "WARRANTY FOR INSULATED GLASS UNITS" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Glass Standards: All glass, except as noted otherwise, shall comply with ASTM C 1036, "Flat Glass". Tempered glass shall comply with ASTM C 1048, "Heat-Strengthened and Fully Tempered Flat Glass". Laminated glass shall comply with ASTM C 1172, "Laminated Architectural Flat Glass".

- B. Safety Glass Standard: All glass indicated on the drawings or as required to be safety glass shall meet all the requirements of the "Safety Standard for Architectural Glazing Material", 16 CFR Part 1201 dated January 6, 1977 of the Consumer Product Safety Commission or ANSI Z97.1, "Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings", as applicable.
- C. Exterior glass thickness and strengths (annealed or heat-treated) shall be as indicated but no less than required to withstand a 105 mph windloading pressure (positive and negative) acting normal to pane of glass as calculated in accordance with the ICC IBC, Exposure C, and ASTM E 1300, "Determining Load Resistance of Glass in Buildings", and ASTM E 330/E 330M, "Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference".
- D. Limit glass deflection to 1/200 flexure limit of glass with full recovery of glazing materials.
- E. Sealants for glazing shall conform to AAMA 800, "Voluntary Specifications and Test Methods for Sealants", and AAMA 850, "Fenestration Sealant Guide Manual".
- F. Sealed Insulating Glass Unit Surfaces and Coating Orientation:
 - 1. Surface 1: Exterior surface of outer pane (surface facing outdoors of outboard lite).
 - 2. Surface 2: Interior surface of outer pane (surface facing indoors of outboard lite).
 - 3. Surface 3: Exterior surface of inner pane (surface facing outdoors of inboard lite).
 - 4. Surface 4: Room side surface of inner pane (surface facing indoors of inboard lite).
- G. Insulated Glass: Insulated glass shall be certified through the Insulated Glass Certification Council (IGCC) to ASTM E 2190, "Standard Specification for Insulating Glass Unit Performance and Evaluation".

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, dry locations and do not unpack until needed for installation.
- B. Comply with manufacturer's instructions for shipping, handling, storing, and protecting glass and glazing materials. Exercise exceptional care to prevent edge damage to glass.

1.5 LABELING

- A. Each piece of glass shall be of domestic manufacture and label, except as noted otherwise, showing the name of the manufacturer and the grade or quality thereof. The labels shall be intact before and after installations. When glass is not cut to size by the manufacturer, and

is furnished unlabeled from local stock, the Contractor shall submit an affidavit stating the quality, thickness, type, and manufacturer of the glass furnished.

- B. All safety glass shall bear a marking as specified in ANSI Z97.1 on each separate glass panel that shall remain visible after installation as required by IBC Section 2403.1 and Section 2406.2 as applicable.

1.6 ENVIRONMENTAL REQUIREMENTS

Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.7 WARRANTY FOR INSULATED GLASS UNITS

- A. Furnish warrant for insulation glass units against development of material obstruction to vision (such as dust or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a minimum 5-year period, unless longer period is standard with the manufacturer, following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the State.
- B. The Surety shall not held be liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Glass: All glass products shall be of the quality as manufactured by PPG Industries, Inc., Pilkington LOF, ASG Industries, CE Glass Company, Globe Amerada Glass Co., Guardian Industries, Interpane Glass Co., Sierracin/Sylmar, Viracon, Inc., or pre-approved equal.
 1. Float Glass, Clear, Tempered (Safety Glass): ASTM C 1048, Kind FT (fully tempered), Condition A, Type I, Class 1, Quality q3, 1/4-inch thick unless indicated or required otherwise.
 2. Laminated Glass (Safety Glass): ASTM C 1172, two pieces of Type I, Class 1, Quality q3 glass laminated together with a clear 0.030-inch thick polyvinyl butyral interlayer under pressure or alternatives such as resin laminates conforming to requirements of 16 CFR 1201 or ASTM C 1172. Total thickness shall be not less than nominal 1/4-inch.
 3. Insulated Glazing: Insulating glass shall be Class A preassembled units of dual-seal construction consisting of two lites of tempered glass with low-e coating for reducing heat gain for warm climates as specified, separated by a spacer with desiccant and dehydrated space hermetically sealed. The insulating glass units shall be free of parallax or optical distortions. Glass shall be heat treated as recommended by the

coating manufacturer. Dimensional tolerances shall be as specified in the Insulating Glass Manufacturers Alliance (IGMA) TR-1200, "Commercial Insulating Glass Dimensional Tolerances". Air space shall be 1/2-inch. Glazing shall have the following minimum performance requirements:

- a. Ultra Violet Transmittance: 10 percent.
 - b. Visible Transmittance: 61 percent.
 - c. Total Solar Energy Transmittance: 25 percent.
 - d. Visible Light Reflectance: 10 percent.
 - e. Total Solar Energy Reflectance: 10 percent.
 - f. U-Value (Winter Night-Time): 0.29.
 - g. U-Value (Summer Day-Time): 0.27.
 - g. Shading Coefficient: 0.37.
 - h. Solar Heat Gain Coefficient: 0.32.
 - i. Light to Solar Gain (LSG): 1.91.
- B. Glazing Compounds - Sealant for Exterior Glazing: One-Part silicone, medium modulus, ASTM C 920, Type S, Grade NS, Class 50, Use NT, M, G, A, and O, equivalent to Dow Corning 795 Silicone Building Sealant, General Electric Corp. SilGlaze II SCS2800, or Tremco, Inc. Spectrum 2, Pecora 895NST, or pre-approved equal as recommended by the glass manufacturers.
- C. Glazing Tape for Interior Glazing: Preformed butyl-polyisobutylene glazing tape. Provide one of the following, or pre-approved equal:
1. "Chem-Tape 401"; Bostick Construction Products Div.
 2. "Extru-Seal"; Pecora Corp.
 3. "Tremco 440 Tape"; Tremco, Inc.
- D. Miscellaneous Glazing Materials:
1. Cleaners, Primers, and Sealers: Of type recommended by sealant manufacturer.
 2. Setting Blocks: Neoprene, EPDM, or 100 percent silicone, 80-90 Shore A durometer hardness as recommended by the glass manufacturer.

3. Spacers: Neoprene or EPDM, 50-60 Shore A durometer hardness.
4. Speak-Thru: Advanced Protection Products, Inc., #N666, 6-inch round stainless steel or pre-approved equal.

2.2 FABRICATION

Fabricate glass to sizes required to comply with wind loads for glazed openings indicated with edge clearances, bite, and tolerances complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform all glazing, bite on glass, minimum edge and face clearances, glazing material tolerances, and weep system in strict accordance with applicable provisions of the "Glazing Manual" and "Sealant Manual" published by the Glass Association of North America (GANA).
- B. Verify that openings for glazing are correctly sized, within tolerance, and glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- C. Insulated glass shall be installed in accordance with manufacturer's instructions and IGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units", and as herein specified.

3.2 INSTALLATION

- A. Glass shall be set true and tight by skilled glaziers. Glazing compound shall be neatly and cleanly run with corners carefully made, using putty knife for all work. Glazing stops shall be carefully handled and accurately secured in place.
- B. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6-inches from corner, unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- C. Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- D. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

- E. Set units of glass in each series with uniformity of draw, bow, and similar characteristics.
- F. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.
- G. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- H. Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement.
- J. Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacture to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- K. Glass where secured by glazing stops, shall unless shown on drawings or specified herein, be set in full bed of glazing compound. Then force glazing stop into glazing compound on both sides and strikeoff flush.
- L. Glass where required or recommended by glass frame manufacturer shall be set in extruded vinyl or neoprene glazing strips provided by others and shall be installed in strict accordance with manufacturer's instructions.
- M. Laminated Glass: Conform to manufacturer's recommendations for edge clearance, type of sealant and tape, and method of installation.
- N. Sheet glass shall be cut and set with the visible lines or waves horizontal.
- O. Insulating Glass Units: Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of IGMA TM-3000.
- P. Speak-Thru: Cut glass and install speak-thru as indicated and recommended by the manufacturer.

3.3 PROTECTION AND REPLACEMENT

Glass shall be immediately protected against damage. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, or other acceptable method that will not damage glazing or surrounding materials. At completion of work, imperfect glass which cannot be properly cleaned shall be replaced in kind. Broken, chipped, abraded, cracked or otherwise damaged glass must be replaced subject to the acceptance of the Engineer.

3.4 CLEANING AND WASHING

- A. At the completion of construction, this Contractor shall clean and wash all of the glass provided by him, removing all labels, dirt, putty stains, paint, etc., and shall leave the glass perfectly cleaned and polished.
- B. Glass to be cleaned according to:
 - 1. GANA Glass Informational Bulletin GANA 01-0300 - Proper Procedures for Cleaning Architectural Glass Products.
 - 2. GANA Glass Informational Bulletin GANA TD-02-0402 - Heat-Treated Glass Surfaces Are Different.
- C. Do not use scrapers or other metal tools to clean glass.

END OF SECTION

DIVISION 9 - FINISHES

SECTION 09250

GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Complete all gypsum wallboard work as indicated or required by the drawings and as specified herein. Work shall include, but not be limited to, the following:
 - 1. Gypsum wallboard on metal framing and furring.
 - 2. Metal stud framing for wallboard.
 - 3. Metal ceiling suspension system.
- B. Related Work Described Elsewhere:
 - 1. Thermal insulation is provided under Section 07210 - BUILDING INSULATION.
 - 2. Acoustical sealants are specified in Section 07920 - SEALANTS.
 - 3. Access panels are provided under Section 08305 - ACCESS DOORS.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Material description and manufacturer's recommended installation procedures for each material.
- C. Shop Drawings: Submit shop drawings indicating fabrications and location of control and expansion joints, including plans, elevations, sections, details, and attachment to adjoining work.
- D. Material Safety Data Sheets (MSDS): Submit MSDS for each product.

1.3 QUALITY ASSURANCE

- A. Fire Resistive Design and Smoke Barriers: The construction shall comply with the applicable provisions of the ICC IBC, including all local amendments thereto and shall have been tested according to ASTM E 119 by an independent testing and inspecting agency acceptable to the authorities having jurisdiction. Installation and materials shall be

in strict accordance with the above mentioned code. The Fire Resistant Design shall be as indicated from UL's "Fire Resistance Directory", FM's "Approval Guide, Building Products", GA-600, "Fire Resistance Design Manual", GA-618, "Building and Inspecting Smoke Barriers", or as listed otherwise.

- B. Industry Standard: Comply with applicable requirements of GA-216, "Application and Finishing of Gypsum Board", GA-214, "Recommended Specification: Levels of Gypsum Board Finish", and GA-201, "Using Gypsum Board for Walls and Ceilings", by the Gypsum Association, except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
- C. Transverse Loading: The non-load bearing metal framing shall be capable of carrying a transverse load of 5 psf without exceeding the allowable stress or a deflection of $L/360$. Increase stud gauge, decrease stud spacing, or provide hidden from view lateral bracing to comply with these requirements at no additional cost to the State.
- D. Gypsum Board Terminology: Refer to ASTM C 11, "Terminology Relating to Gypsum and Related Building Materials and Systems", for definition of terms for gypsum board assemblies not defined in this section or in referenced standards.
- E. Provide support systems and attachments conforming with AISC 341, "Seismic Provisions for Structural Steel Buildings".
- F. Seismic: Brace partitions in accordance with ICC IBC Section 1621, Architectural, Mechanical, and Electrical Component Seismic Design Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver gypsum wallboard 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. Joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.
- B. Environmental Limitations: Comply with GA-238, "Guidelines for the Prevention of Mold Growth on Gypsum Board", and ASTM C 840, "Application and Finishing of Gypsum Board", requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

1.5 SAFETY PRECAUTIONS

- A. Respirators and Other Concerns: Comply with OSHA 29 CFR 1910.134, "Respiratory Protection", ASTM C 930, "Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories", and other Federal, State, and local regulations governing safety. Provide workers with dust/mist respirators, training in their use, and protective clothing as approved by the National Institute for Occupational Safety

and Health (NIOSH)/Mine Safety and Health Administration (MSHA) when installing insulation or sanding joint compound.

- B. Smoking: Do not smoke during installation of blanket insulation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide panels in maximum lengths and widths available that will minimize joints and correspond with the applicable support system. All gypsum board shall achieve a score of 10 for mold resistance per ASTM D 3273, "Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber".
- B. Gypsum Wallboard: ASTM C 1396/C 1396M, "Gypsum Board", 5/8-inch thick, tapered edge type, 48-inches wide, Type "X" (Special Fire Retardant) for fire rated partitions and elsewhere as indicated.
- C. Water Resistant Board: ASTM C 1396/C 1396M, Type "WR" water-resistant backing board, 5/8-inch thick unless indicated otherwise, with tapered edges, 48-inches wide, unless indicated otherwise (for walls only).
- D. Cementitious Backer Board (CBB): ANSI A118.9, "Cementitious Backer Units", or ASTM C 1325, "Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units", glass mesh reinforced mortar backer board, nominal 5/8-inch thick, for hard tile backing. Provide tape and joint compound materials as recommended by manufacturer.
- E. Wallboard and Sheathing Fasteners: ASTM C 1002, "Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs", 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 and fire rating test. Screws for structural studs shall conform to ASTM C 954, "Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033-inch (0.84 mm) to 0.112-inch (2.84 mm) in Thickness". Fasteners for cementitious backer board shall have a polymer coating.
- F. Reinforced Tape and Cement: ASTM C 475/C 475M, "Joint Compound and Joint Tape for Finishing Gypsum Board", materials for treating joints and fastener heads shall be as manufactured or recommended by the Manufacturer of the wallboard used. Provide "setting" type joint compound and fiberglass tape that is unaffected by humidity for water resistant board.
- G. Non-Load Bearing Studs: Comply with ASTM C 754, "Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products", for conditions indicated. ASTM C 645, "Nonstructural Steel Framing Members", studs shall be 1-5/8, 2-1/2, 3-5/8, and 6-inches unless indicated otherwise on the drawings. Studs shall be rolled formed

channel of 25, 22, and 20 gauge galvanized steel, ASTM A 653/A 653M, "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process", G60 coating. ProSTUD Drywall Framing System gauges for equivalent structural and composite limiting height studs are acceptable. Provide holes and notches for conduit or electrical wiring. Provide minimum 20 gauge at ceramic tile partitions.

- H. Tracks: Metal floor and ceiling tracks shall be rolled formed channel of gauge electro-zinc plated steel of same gauge as stud with width dimensions suitable to corresponding stud sizes indicated on the drawings.
- I. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch deep flanges.
- J. Furring Channels: ASTM C 645, hat-shaped, 7/8-inch deep, hot-dipped galvanized, 25 gauge.
- K. Framing Fasteners: ASTM C 754 or ASTM C 1513, "Steel Tapping Screws for Cold-Formed Steel Framing Connections", except as specified otherwise. Screws used in fire-resistant rated construction shall be of type approved for use by governing building code and fire rating test.
- L. 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 Panel Products", unless indicated otherwise.
 - 2. Direct Suspension Systems: Manufacturer's standard zinc-coated or painted steel system of furring runners, furring tees, and accessories designed for concealed support of gypsum drywall ceilings; of proper type for use intended. Equivalent to one of the following:
 - a. Armstrong World Industries, Inc.
 - b. Chicago Metallic Corp.
 - c. USG Interiors, Inc.
 - d. Pre-approved equal.
 - 3. Wire for Hangers and Ties: ASTM A 641/A 641M, "Zinc-Coated (Galvanized) Carbon Steel Wire", Class 1 zinc coating, soft temper, 8 gauge for hangers supporting up to 12.5 square feet and 6 gauge where supporting up to 16 square feet and 18 gauge for ties.

- M. Wallboard Accessories: ASTM C 1047, "Accessories for Gypsum Wallboard and Gypsum Veneer Base", Vinyl Corp., Plastic Components Inc., Vinyl Tech or pre-approved equal.
1. Standard Corner Bead: Vinyl Corp. Corner Bead CB 125 at all outside corners of wall, ceiling, and soffit as indicated.
 2. Casing Trim: Vinyl Corp. "L" Bead SB 50 or 58, "J" Bead MJB 50 or 58, as applicable, or as indicated.
 3. Control Joint: Vinyl Corp. CJV 16.
 4. Other Accessories: As indicated or necessary for complete installation.
 5. All accessories shall be vinyl, PVC, or pre-approved equal.
- N. Joint Treatment Materials: ASTM C 475/C 475M; type recommended by manufacturer for the application indicated, except as otherwise noted. Perforated tape, and joint and topping compound, or "all-purpose" compound.

PART 3 - EXECUTION

3.1 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, existence of mold, and other conditions affecting performance of drywall construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with ASTM C 840, "Application and Finishing of Gypsum Board", Gypsum Association GA-216, and ASTM C 754 as applicable to the type of substrate and drywall support system indicated.
- B. Tolerances:
1. Maximum variation of finish surface from true flatness shall be 1/8-inch in 10-feet in any direction unless specified otherwise.
 2. Maximum variation of plumbness of wall shall be 1/8-inch in 10-feet of height.
 3. Maximum variation from true position shall be 1/8-inch.

C. Ceiling Support Suspension Systems:

1. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners as indicated. Ensure that structural anchorage provisions have been installed to receive ceiling anchors in a manner that will develop their full strength and at spacing required to support ceiling.
2. Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.
3. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
5. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
6. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
7. Sway brace ceiling to conform to the applicable seismic load and uplift, applicable requirements of ASTM E 580/E 580M, "Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions", and the manufacturer's recommendations.
8. Space main runners 4-feet on center and space hangers 4-feet on center along runners, except as otherwise shown.
9. Level main runners to a tolerance of 1/8-inch in 12-feet, measured both lengthwise on each runner and transversely between parallel runners.

10. Wire-tie or clip furring members to main runners and to other structural supports as indicated or as recommended by the manufacturer.
11. Direct-Hung Metal Support System: Attach perimeter wall track or angle wherever support system meets vertical surfaces. Mechanically join support members to each other and butt-cut to fit into wall track.
12. Space furring member 16-inches on center, except as otherwise indicated.
13. Install auxiliary framing at termination of drywall work and at openings for light fixtures and similar work, as required for support of both the drywall construction and other work indicated for support thereon.
14. Do not connect or suspend steel framing from ducts, pipes or conduit.
15. Do not attach hangers to steel deck tabs.
16. Do not attach hangers to steel roof deck. Attach hangers to structural members.
17. Keep hangers and braces 2-inches clear of ducts, pipes, and conduits.

D. Metal Wall and Soffit Framing:

1. Install supplementary framing, blocking, and bracing to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work which cannot be adequately supported on gypsum board alone 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.
2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
3. Install runner tracks at floors, ceilings, and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
4. Extend partition stud system through ceilings and elsewhere as indicated to the structural support or substrate above the ceiling except where indicated to terminate at the ceiling line.
5. Space studs and furring 16-inches on center, except as otherwise indicated.
6. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

7. Do not bridge building expansion joints with steel framing or furring. Frame both sides of joints independently.
8. Frame door openings with vertical studs securely attached by screws at each jamb either directly to frames or to jamb anchor clips on door frame in accordance with door manufacturer's recommendations; install runner track sections (for jack studs) at head and secure to jamb studs. Provide runner tracks of same gauge as jamb studs. Space jack studs same as partition studs.
9. Install 20 gauge studs at each jamb for all doors 2'-8" wide to 4-feet wide weighing not more than 200 pounds; and for all doors less than 2'-8" wide weighing more than 100 pounds but not more than 200 pounds.
10. Install double 20 gauge studs for single doors up to 4-feet wide, weighing more than 200 pounds but not more than 300 pounds; screw attach web of back-to-back studs direct to jamb anchor clips nested between flange of stud.
11. Frame openings other than door openings in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.
12. Install each steel framing and furring member so that fastening surface does not vary more than 1/8-inch from plane of faces of adjacent framing.

E. Gypsum Wallboard, General:

1. Locate exposed end-butt joints as far from center of walls and ceilings as possible.
2. 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.
3. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that both tapered edge joints abut and mill-cut or field-cut end joints abut. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
4. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
5. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts.

6. Cover both faces of stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are properly braced internally. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 square foot area, and may be limited to not less than 75 percent of full coverage.
7. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4-inch to 3/8-inch space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.
8. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.
9. Install insulation at framing as indicated after cover material has been installed on one side of cavity. Size insulation to width of members spacing. Press friction fit insulation between members as recommended by the insulation manufacturer. When unfaced insulation is used and the stud depth is larger than the insulation thickness, install wire or metal straps to hold insulation in place. Insulation is provided under Section 07210 - BUILDING INSULATION.
10. Cementitious Backer Board: Install cementitious backer board in accordance with ANSI A108.11, "Installation of Cementitious Backer Units", and TCNA methods specified in Section 09310 - CERAMIC TILE.

F. Methods of Gypsum Wallboard Application:

1. On ceilings, apply gypsum board prior to wall/partition board application, to greatest extent possible and at right angle to framing, unless otherwise indicated.
2. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Single-Layer Application:
 - a. On partitions/walls higher than 8'-1", apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
 - b. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular); use maximum length sheets possible to minimize end joints.
4. Single-Layer Fastening Method: Apply gypsum boards to supports by fastening with screws, spaced not to exceed 16-inch centers for walls and 12-inch centers for ceilings.

5. Gypsum wallboard construction for fire rated assemblies shall be in accordance with the design number indicated or if not indicated in accordance with the ICC IBC.

G. Installation of 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, attach trim in accordance with manufacturer's instructions and 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 except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
4. Install J or LC-type semi-finishing trim where indicated.
5. Install control joints where indicated or necessary in large ceiling and wall expanses per GA-201. Use door header to ceiling or floor to ceiling in long partitions and wall furring runs and from wall to wall in large ceiling areas. Where joint will be conspicuous, obtain acceptance prior to installation.

3.3 DRYWALL FINISHING

- A. General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fasteners heads, surface defects, and elsewhere in accordance with ASTM C 840 and Gypsum Association GA-216 and GA-214 as required to prepare work for decoration. Prefill open joints, rounded or beveled edges, and damaged surfaces using type of compound recommended by manufacturer.
1. Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated that does not require tape.
 2. Apply joint compound in 3 coats (not including prefill of openings in base) and sand between last 2 coats and after last coat. Fastener heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded.
 3. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded in accordance with manufacturer's instructions and MSDS to produce surfaces ready for gypsum board finishes.
 4. Treatment for water-resistant gypsum wallboard shall be as recommended by the gypsum wallboard manufacturer.

B. Finish interior gypsum wallboard by applying the following levels of gypsum board finish in accordance with GA-214.

1. Level 1: For ceiling plenum areas and other concealed areas.
2. Level 2: Where wall panels form substrates for tile.
3. Level 3: For wall surfaces to receive heavy-duty wallcoverings.
4. Level 4: For ceiling surfaces to receive flat paint.
5. Level 5: For wall surfaces to receive semi-gloss enamel.
6. Where Level 5 gypsum board finish is indicated, 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.
7. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
8. Where Level 3 gypsum board finish is indicated, embed tape in joint compound and apply first and fill (second) coats of joint compound.
9. Where Level 2 gypsum board finish is indicated, embed tape in joint compound and apply first coat of joint compound.
10. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.

3.4 CLEANING AND REPAIRING

- A. After installation and before painting, correct surface damage and defects. Leave surface clean and smooth, satisfactory to the painter. No painting shall be done over gypsum board work until the joints are thoroughly dry. Joints and fastenings are to be invisible after painting.
- B. Remove drywall materials from electrical boxes, hardware, fixtures, flooring, and similar items and surfaces not intended to receive drywall materials.

END OF SECTION

SECTION 09310

CERAMIC TILE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Complete all tile, accessories, and related work as indicated or required by drawings and as specified herein.
- B. Related Work Described Elsewhere:
 - 1. Sealants are specified under Section 07920 - SEALANTS.
 - 2. Cementitious tile backer board is provided under Section 09250 - GYPSUM WALLBOARD.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical information and installation instructions for selected tile, grout, and sealer materials.
- C. Material Safety Data Sheets (MSDS): Submit MSDS for each product.
- D. Samples: Submit 4 each samples of various tiles and accessories required to the Engineer for acceptance and for color and pattern selection. Identify samples as to grade and manufacturer. Submit samples of selected tile in color required, not less than 12-inch square, mounted on plywood or hardboard backing, with selected colored grout.
- E. Certificate: Before installation of tile, submit to the Engineer the Standard Form of Master Grade Certificate signed by the Contractor and Manufacturer, stating grade and kind of tile. Deliver all packages of tile to the job in sealed cartons bearing grade seals in compliance with ANSI A137.1.
- F. Warranties: Warranty for a minimum of 2 years against defects resulting from the use of defective or inferior materials, equipment or workmanship.
- G. Installation Specifications: Submit manufacturer's installation specifications.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect tile, mortar materials, and accessories during delivery, storage, and construction against moisture, soiling, staining, and physical damage.

- B. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ceramic Wall and Floor Tiles (CT-#): Standard grade, complying with ANSI A137.1. The Contractor shall submit test reports, from an independent laboratory, indicating conformance of the tile to ANSI A137.1 upon request by the Engineer.
 - 1. Porcelain Tile: Porcelain tile and trim shall be in size and finish as scheduled.
 - 2. Trim Units: Provide all trim shapes as detailed and/or as required. External corners shall be rounded convex. Internal vertical corners shall be rounded. Top of wainscot shall be rounded with full bullnose cap. Bottom of wall shall be concave with cove base. Base tile shall be 4-inch high, sanitary coved base unless indicated otherwise. Provide other shapes such as curbs, beads, shoes, round out corners and square in corners, etc. to achieve a neat complete installation.
- B. Setting Materials: Laticrete 3701 fortified mortar bed or pre-approved equal or components as listed below.
 - 1. Cement: Portland cement, ASTM C 150/C 150M, Type I.
 - 2. Sand: ASTM C 144.
 - 3. Hydrated Lime: ASTM C 206, Type S or ASTM C 207, Type S.
 - 4. Reinforcing Wire Mesh: ASTM A 1064/A 1064M, 2 x 2 - 16/16, galvanized welded wire fabric.
 - 5. Latex-Portland Cement Mortar: ANSI A118.4, with manufacturer's standard dry polymer additive, Laticrete 254 Platinum or pre-approved equal.
 - 6. Water: Fresh, clean, and potable.
- C. Grouting Materials: Colors as indicated or selected by the Engineer.
 - Epoxy Grout: ANSI A118.3. Laticrete-Spectralock Pro premium grout or pre-approved equal.
- D. Edge Trim: Edge trim shall be aluminum in sizes as indicated or required by thicknesses of materials, including setting materials. Exposed finish shall be clear anodized. Trim shall be equivalent to Schluter Systems Inc. or pre-approved equal components.

- E. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match accepted samples.

2.2 WATERPROOF MEMBRANES

Thin-Set Floor Waterproofing: Laticrete HydroBan or pre-approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas where waterproofing and tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for installing waterproofing and setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
- B. Report unsatisfactory conditions to the Contractor for corrective measures; send copy of report to the Engineer. Do not proceed with installation until unsatisfactory conditions have been corrected. Proceeding with tile work will imply acceptance of the substrate condition by the ceramic tile contractor. Wall substrate must be plumb to within tolerances specified in Section 09250 - GYPSUM WALLBOARD and in complete alignment.
- C. Do not proceed with floor tile work until waterproofing has been installed and tested.

3.2 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.
- B. TCNA Installation Guidelines: TCNA "Handbook for Ceramic Tile Installation"; comply with TCNA installation methods indicated.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.
- E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
- F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles. Locate joints in tile surfaces directly above joints in concrete substrates. Expansion joints shall conform to TCNA Installation Method EJ171.
- G. Grout: Grouts shall comply with ANSI A108.10. Epoxy grout shall conform with ANSI A108.6.
- H. Allow tiles to set a minimum of 48 hours prior to grouting. The grout shall be forced into the joints to the full depth. Take special care not to scratch glazed tile during this operation. Remove surplus grout before it has hardened and leave the face of the tile clean. Keep expansion and control joints free of grout.
- I. Sound tiles after setting to ensure proper bonding. Hollow sounding tiles shall be replaced.
- J. Curing Floors: Apply reinforced kraft paper over floor as soon as pointing or grouting is completed. Lap the paper not less than 6-inches and leave in place for 3 full days. Cure in accordance with applicable ANSI installation procedure.
- K. Waterproof Membrane: Install waterproof membrane as recommended by the manufacturer at slabs and surfaces as indicated or scheduled by TCNA installation method.

3.3 FLOOR INSTALLATION METHODS

- A. Install types of tile to comply with requirements indicated below for setting bed methods, TCNA installation methods related to types of subfloor construction, and grout types:
 - 1. Portland Cement Mortar Bed: ANSI A108.1 B or C (Thickset).
 - a. Bond Coat: Portland cement paste or dust coat on plastic bed or thin-set Latex-Portland cement mortar on cured bed, ANSI A108.5, at Contractor's option.

- b. Concrete Slab: TCNA Installation Method F121 where waterproof membrane is required.
2. Latex Portland Cement Mortar: ANSI A108.5 (Thinset).

Concrete Slab at Non-Depressed Slabs: TCNA Installation Method F113.

3. Grout: Epoxy.
- B. Metal Edge Trim: Install edge trim in mortar setting bed while bed is in a plastic state. Set trim where indicated in straight, unbroken lines, flush with finished floor surface. Provide edge trim at joints where floor tile abuts and is flush with other types of floor finishes, except at doors where thresholds are provided. Changes in level shall conform to ADAAG Section 303.

3.4 WALL TILE INSTALLATION METHODS

Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCNA installation methods related to subsurface wall conditions, and grout types:

1. Latex-Portland Cement Mortar: ANSI A108.5.
 - a. Cementitious Backer Board: TCNA Installation Method W244C.
 - b. Concrete Masonry: TCNA Installation Method W202.
2. Grout: Epoxy.

3.5 CLEANING AND PROTECTION

- A. Cleaning: Upon completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible. Clean in accordance with applicable ANSI installation procedure.
 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Project Acceptance.
 - 1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 - 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
 - 3. Protect tiled corners and external angles with board corner strips in areas used as passageways by workers.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 09510

ACOUSTICAL CEILING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide suspended lay-in acoustical ceiling systems as indicated and herein specified.
- B. Related Work Specified Elsewhere:
 - 1. Acoustical sealants are specified in Section 07920 - SEALANTS.
 - 2. Coordinate location of all mechanical items with DIVISION 15 - MECHANICAL.
 - 3. Coordinate location of all electrical items with DIVISION 16 - ELECTRICAL.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for suspension system and lay-in panels substantiating that all products comply with project requirements.
- C. Shop Drawings: Submit shop drawings which clearly show all components of the systems to be installed at this project. Include suspension system, furring, jointing, method of anchoring and fastening, and locations of mechanical and electrical features. Jointing diagrams shall show typical arrangement of the panels in each space, including the terminations at margins of ceilings and at intersections with vertical surfaces. Include typical details of the following:
 - 1. Intermediate framing for hanger supports that fall between structural framing members.
 - 2. Hanger fastenings at structural framing members and at main runners.
 - 3. Acoustical-unit support at ceiling penetrations.
 - 4. Splicing method for main and cross runners.
 - 5. Seismic restraint system.
- D. Samples: Submit 4 samples of each type of acoustical unit, edge molding, and suspension runner.

- E. Maintenance Instructions: Submit manufacturer's maintenance instructions for acoustical ceilings.
- F. Receipt of Delivery: Three copies of the receipt signed by the user's representative, attesting to delivery of extra lay-in panels as required under item entitled "EXTRA LAY-IN PANELS" hereinbelow.

1.3 DESIGN CRITERIA FOR CEILING SYSTEMS

- A. Suspended Ceiling Attenuation Class: The ceiling attenuation class (ceiling CAC range) of the ceiling system shall be as specified when determined in accordance with ASTM E 1414/E 1414M, "Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum". Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project.
- B. Ceiling Sound Absorption: Determine the NRC in accordance with ASTM C 423, "Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method".
- C. Light Reflectance: Determine light reflectance factor in accordance with ASTM E 1477, "Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers", test method.
- D. Seismic: Install ceiling system in accordance with ASTM E 580/E 580M, "Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions", and ICC IBC Section 1613, Earthquake Loads.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical units in the manufacturer's original unopened containers with brand name and type clearly marked. Handle materials carefully and store them under cover in dry, watertight enclosures.
- B. Handle manufactured materials as recommended by the manufacturer.

1.5 ENVIRONMENTAL CONDITIONS

For 24 hours before, during, and 24 hours after installation of acoustical units, maintain temperature and relative humidity at typical in-service conditions. Interior finish work such as concrete work shall be completed and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and accepted prior to the start of acoustical ceiling installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acoustical Ceiling Tile Units: ASTM E 1264, "Classification for Acoustical Ceiling Products", and the requirements for each type. For convenience and to establish standards of quality and design, the following list indicates items manufactured by Armstrong World Industries, Inc. Equivalent products, accepted by the Engineer, of the following manufacturers will be accepted:

1. USG Interiors Inc.
2. Celotex Corporation
3. Pre-approved equal.

The products of other manufacturers are acceptable provided they meet or exceed the materials and construction requirements as specified.

- B. Composition Lay-In Panels (ACT-1):

1. Type: Type XII (Glass fiber base) with white membrane faced overlay.
2. Form: 2.
3. Class: A, flame spread 25 or less.
4. Pattern: E.
5. Noise Reduction Coefficient (NRC) Grade: Minimum 0.95.
6. Light Reflectance (LR) Coefficient: LR-0.90 or greater.
7. Nominal Size: 24 x 24-inches.
8. Edge Detail: Square Tegular lay-in.
9. Design: Armstrong Optima Open Plan, No. 3251 or pre-approved equal.

2.2 SUSPENSION SYSTEM

- A. Suspension System: ASTM C 635/C 635M, "Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings", and the following requirements:

1. Type: Exposed grid, 9/16-inch narrow width. Provide grid for high humidity exposure.
 2. Structural Classification: Heavy duty for main runners as required by Seismic Load per ICC IBC.
 3. Finish: Surfaces exposed to view shall be of uniform width and shall be aluminum or galvanized steel with factory applied white baked enamel finish in colors to match ceiling tile. Zinc coated steel shall receive a phosphate treatment prior to painting.
 4. Accessories: Provide manufacturer's standard wall or edge moldings.
 5. Design: Armstrong Seismic Rx conforming to ICC ESR-1308 Suprafine XL or pre-approved equal.
- B. Hanger Wires: ASTM A 641/A 641M, "Zinc-Coated (Galvanized) Carbon Steel Wire", Class 1, 12 gauge, galvanized steel.
- C. Fasteners: Rust-resistant of the type recommended by the manufacturer. Size fasteners for 5 times design load indicated in ASTM C 635/C 635M, Table 1, Direct Hung, unless indicated otherwise.

PART 3 - EXECUTION

3.1 PREPARATION

The Acoustical Contractor shall be responsible for the examination and acceptance of all surfaces and conditions affecting the installation of his work. Start of this work shall constitute acceptance of all work conditions. Unsatisfactory conditions shall be reported to the Engineer so that corrective measures can be taken.

3.2 INSTALLATION

- A. General: Installation shall conform to the manufacturer's directions for the suspension system and lay-in panels used and to the layout shown on the drawings for the size grid to be installed.
- B. Suspended Ceilings: ASTM C 636/C 636M, "Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels", and ASTM E 580/E 580M.
1. Hangers: Space hangers 4-feet on centers each direction. Lay hangers out for each individual room or space. Install additional hangers where required to support framing around beams, ducts, columns, grilles, and other penetrations through the ceiling.

2. Suspension Members: Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span.
3. Acoustical Units: Edges of ceiling tiles shall be in close contact with metal supports and in true alignment. Arrange units so that units less than 1/2 width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, at units weighing less than 1 psf or for vertical panels.
4. Wall or Edge Molding: Install wall molding at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.
5. Tolerance: Ceilings shall be flat and level within 1/8-inch in 10-feet.
6. Sealing: Apply a continuous ribbon of acoustical sealant on vertical leg of wall or edge mouldings.
7. Where cut edges of lay-in panels are exposed or panel face is scratched, paint edges or face to match standard facing with coating as recommended by the manufacturer.

3.3 CLEANING AND REJECTION

- A. The Contractor shall exercise all necessary precautions to avoid damaging or soiling the units. All damaged units shall be replaced with new units by the Contractor.
- B. Following defects shall be cause for rejection or replacement of tiles or panels by Contractor:
 1. Crooked or open joints.
 2. Soiled tiles or panels not cleaned to original condition.
 3. Fractures, cracks or corner chips.
 4. Color variation.
 5. Loose or fallen tiles and panels.
 6. Warped tiles and panels.
 7. Units damaged from leaking roof.

3.4 EXTRA LAY-IN PANELS

The Contractor shall provide a minimum of 2 percent extra lay-in panels in labeled full original manufacturer's containers for each type and color used for ceilings to the facility upon completion of the project. Materials shall be in the same lot number used in the project.

END OF SECTION

SECTION 09650

RESILIENT FLOORING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Extent of resilient flooring is shown on the drawings and schedules and indicated by requirements of this section.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical data and installation instructions for resilient flooring, wax, and accessories.
- C. Samples: Submit 4 samples of all flooring, bases, and accessories to the Engineer for color and/or pattern selection.
- D. Maintenance Instructions: Submit manufacturer's recommended cleaning and maintenance practices for resilient flooring and accessories.
- E. Test Reports: Submit copies of all concrete floor moisture and alkalinity tests to the Engineer.
- F. Material Safety Data Sheets (MSDS): Submit MSDS for adhesives, patching and leveling compounds, and sealers.

1.3 QUALITY ASSURANCE

- A. Right of Rejection: The Engineer shall have the right to reject all work that is not in compliance with the plans and specifications. Rejected work shall be redone at no cost to the State.
- B. It may sometimes be desirable to apply the mastic for the floor tiles the day before the actual laying of the tiles. If the Contractor decides to do so, care must be taken to prevent particles of rubbish to settle on the adhesive and cause a bumpy appearance on the tiles.
- C. Special Adhesives: Where special adhesives are required, adhesive manufacturer's warranty shall take precedence over flooring manufacturer for flooring adhesion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in good condition to job site in manufacturer's original unopened containers bearing name and brand of the manufacturer, color identification, and handling and storage instructions.
- B. Store materials in clean, dry, enclosed space protected from weather, and maintained at a temperature of between 65 degrees F and 100 degrees F.
- C. Observe ventilation and safety procedures specified in the MSDS.

1.5 PROJECT CONDITIONS

- A. Maintain temperature in spaces to receive flooring and accessories between 65 degrees F and 85 degrees F for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Properly cure and dry concrete to eliminate vapor emissions that may affect the long term performance of the adhesives and installation. Install flooring after building air conditioning, dehumidifiers, etc. have operated to reduce moisture or provide approved sealer.
- B. Install flooring and accessories after other finishing operations, including painting, have been completed. Close spaces to traffic during installation of the flooring.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Luxury Vinyl Tile (LVT-#): Solid vinyl tile, 6-inch by 36-inch by 0.118-inch thick. Color and pattern shall be as scheduled.
- B. Resilient Wall Base (RB-#): Base shall conform to ASTM F 1861, "Resilient Wall Base", Type TP, rubber, Group 1 or 2, 4-inch high, topset type, 1/8-inch thick with a smooth exposed surface and a textured building surface on the unexposed face. Provide Style B, cove type, at vinyl composition tile floors and Style A, straight edge, at carpet floors. Provide preformed outside corners. The rubber material shall be free from offensive odor and its color shall be uniform throughout the thickness of the base. Base shall be equivalent to Burke Mercer Flooring Products Cove Base and Carpet Base, Johnsonite, Roppe, Mannington, Azrock, Armstrong, Tarkett, or pre-approved equal.
- C. Adhesives:
 - 1. Flooring adhesives shall be brush-on, roll-on, or trowel-on water-resistant type, as recommended by the manufacturer for the specified materials used. Do not use adhesive not intended for its purpose. Material shall be beige or cream colored, water based, rubber-resin formula that dries to a clear film. Adhesives shall be solvent free with zero VOC content, low odor, no ammonia and non-flammable in

wet state. Provide specialty adhesives for elevated slab moisture vapor transmission where required by slab conditions.

2. Base adhesive shall be water based, rubber-resin formula, as recommended by the manufacturer for the specific materials used. Material shall be beige or white, solvent free with zero VOC content, low odor, no ammonia, and non-flammable in wet state. Do not use adhesive not intended for its purpose.
- D. Patching and Leveling Compounds: Patching and leveling compounds shall be latex-modified, Portland cement based formulation unless otherwise required by the flooring manufacturer for the applications indicated. Gypsum based compounds shall not be used.
 - E. Floor Finishing Accessories: Reducers shall be beveled vinyl strip, approximately one-inch wide, same thickness as flooring, color to match flooring as selected by the Engineer in accordance with ADAAG Section 303. Metal edge strips shall not be used. Edge transition for carpet is provided under Section 09684 - CARPET TILE.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Flooring installer shall examine substrates where resilient flooring will be installed for compliance with the flooring manufacturer's requirements. Inspect subfloors to determine that surfaces are smooth, free of cracks, holes, ridges, and other defects that might impair durability or appearance of flooring.
- B. Report conditions contrary to contract requirements which would prevent a proper installation.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.
- D. Failure to call attention to any defects or imperfections will be construed as acceptance and approval of subfloor. Installation indicates acceptance of substrates with regard to conditions existing at time of installation.

3.2 PREPARATION OF SUBFLOORS

- A. General: Comply with the flooring material manufacturer's installation instructions for the preparation of substrates to receive resilient flooring.
- B. Unless otherwise required by the flooring manufacturer, the subfloor shall be broomed, damp mopped, and scrubbed until it is free from dust, dirt, grease, or other foreign material. It shall also be scraped to make surface smooth and level. Ensure that concrete is free of curing compounds and sealers.

- C. Defects such as ridges, holes, and cracks shall be repaired and leveled as part of this contract.
- D. Concrete subfloor shall be prepared to comply with ASTM F 710, "Preparing Concrete Floors to Receive Resilient Flooring", and shall be free of materials that may interfere with adhesive bond and shall be clean, dry, and smooth before flooring is laid. Fill all cracks, holes, and depressions with patching and leveling compound as approved by the flooring manufacturer. Cut out and fill all cracks 1/16-inch wide and wider with crack filler.
- E. If flooring is laid on defective subfloors, such flooring shall be removed and replaced at Contractor's expense.

3.3 PROJECT CONDITIONS

- A. Flooring materials and the spaces to receive flooring materials shall be conditioned in accordance with the flooring manufacturer's recommendation and instructions.
- B. Provide adequate ventilation to remove moisture and fumes from the areas where flooring is being installed.

3.4 TESTING

- A. Flooring materials shall not be installed over concrete slabs until the slabs have cured and are sufficiently dry and the slabs have been protected from rain for a minimum of 90 days.
- B. After cleaning, test concrete slabs for alkalinity, moisture, and adhesive bond as recommended by the flooring material manufacturer. Floor installation shall not proceed until unsatisfactory conditions have been corrected.
- C. Test concrete floors for moisture in accordance with ASTM F 1869, "Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride", or ASTM F 2170, "Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes", and as recommended by the adhesive manufacturer. Concrete slabs shall be free of moisture that will impair the adhesion of flooring as specified under project conditions. Provide calcium chloride vapor emission testing (one per 1,000 square feet of concrete slab-on-grade). Floor emission levels shall be below resilient flooring and adhesive manufacturer's maximum acceptable moisture emission level prior to installation. All corrective measures, including floor sealer systems, shall be at Contractor's expense to allow installation in conformance with flooring manufacturer's recommendations.
- D. Test concrete floors for alkalinity in accordance with ASTM F 710, "Practice for Preparing Concrete Floors to Receive Resilient Flooring". Provide corrective action for substrate with a pH above 9 or as recommended by the adhesive manufacturer.

3.5 INSTALLATION OF MATERIALS

- A. See drawings for locations and types of flooring required. Flooring and base shall continue, respectively under and behind removable and/or portable cabinets, cases, etc. Flooring shall continue into closets where floor of closets and adjacent floor are at same level. Installation shall not begin until work of other trades, including painting, has been completed.
- B. All work shall be done by experienced tradesmen in strict accordance with recommended specifications of the respective manufacturer. Where not contrary to manufacturer's recommendations, adhesive shall be applied with a notched trowel in a thin and even coat. Flooring shall be laid with tight joints in true alignment both ways. Flooring shall be cut to fit accurately at joining with other materials and at vertical surfaces. The under side of the flooring shall be heated if necessary to obtain satisfactory bond to the subfloor. Changes in floor level shall conform to ADAAG Section 303.
- C. Adhesives: Apply adhesives in accordance with the adhesive manufacturer's printed directions, unless specified or directed otherwise. Smoking, the use of open flames and other immediate sources of ignition are strictly prohibited in the area where solvent-containing adhesives are being used or spread. Post conspicuous signs reading "NO SMOKING OR OPEN FLAME" in the area of spread adhesive.
- D. Tiles: Tiles shall be laid symmetrically about the center lines of the room in both directions, starting at the center of the room and working toward the wall so that border tiles shall not be less than half the width of the field tiles. Pattern shall be as indicated and accepted by the Engineer. Edging shall be installed with contact adhesive at all marginal edges of flooring not stopped by raised thresholds or other vertical surfaces. Edge tile shall be cut, fitted, and scribed to walls after field flooring has been installed.
- E. Resilient Base: Resilient base shall be applied on thoroughly-dried walls with base adhesive only. Because of the thermoplastic character of base, care shall be taken not to stretch it during installation since it will shrink and leave a gap at joints. The top and bottom edges shall be in firm contact with the wall and floor. Premolded exterior corners shall be used unless otherwise accepted by the Engineer. If corners are formed on job, the legs from corner shall not be less than 12-inches long. Otherwise, the resilient base shall be continuous around corners. On masonry and similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- F. Prohibit traffic on finished floor for 24 hours after installation.

3.6 CLEANING AND PROTECTION

- A. Spots of adhesive shall be removed immediately as work progresses. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions. Floor shall not be washed or waxed until the adhesive has completely set (48 hours minimum), and in no case until after the minimum length time recommended by the manufacturer has

elapsed. During this period there shall be no furniture or other heavy traffic movement on the floor. The flooring shall be cleaned with a neutral cleaner as recommended by the manufacturer and then damp mopped with clear water. Flooding of the floor is not permitted.

- B. Except for flooring designated as "no-wax" or "never wax" by manufacturer, apply 2 coats of accepted floor finish with a clean lambs wool mop when the floor is dry to protect flooring until project acceptance in accordance with cleaning and maintenance instructions. Each coat shall be buffed thoroughly when dry with weighted rotary electric floor polishing machine.
- C. Clean bases, but do not polish them.
- D. From the time of laying until project acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered shall be removed and replaced.

END OF SECTION

SECTION 09684

CARPET TILE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Provide glue-down carpet tile and accessories as indicated and scheduled.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's product data for carpet tile, adhesives, and accessories, including installation instructions. Submit written data on physical characteristics, construction, durability, resistance to fading, and flame resistance characteristics.
- C. Samples:
 - 1. Contractor shall submit to the Engineer 4 samples of the carpet tile the Contractor proposes to furnish. Sample size shall be full size tile. Submit samples of floor finishing accessories, minimum 8-inch lengths in scheduled colors.
 - 2. At the same time, the Contractor shall also submit to the Engineer one set of carpet tile samples of the manufacturer's standard colors. The manufacturer, carpet designation, and color designation shall be indicated on the back of each sample. After receiving notification of the color selection, the Contractor shall submit to the Engineer 4 full size samples of carpet tile in the selected color(s).
- D. Certification: The Contractor shall certify in writing that the carpet as proposed meets or exceeds the requirements of these specifications.
- E. Installation Drawings: Together with the samples, the Contractor shall submit sets of 1/8-inch or 1/4-inch scale floor plans showing the proposed carpet tile layout of all areas to the Engineer for acceptance. The drawings shall clearly indicate and accurately locate all tiles and edge guards. Wherever possible, the lay of carpet tile in adjoining areas shall be in the same grid layout and in the same direction. Completed work shall conform to accepted drawings.
- F. Material Safety Data Sheets (MSDS): Submit MSDS for each product.
- G. Test Reports: Submit copies of all concrete floor moisture and alkalinity tests to the Engineer.

- H. Maintenance Instructions: Submit manufacturer's printed maintenance instructions, recommended cleaning products, and suggested cleaning schedule, including precautions for use of cleaning materials which could damage carpet.
- I. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Carpet tile manufacturer shall have been manufacturing Commercial/Contract Carpeting continuously for a period of not less than 10 years.
- B. Carpet tile Installation must be done by installers with a minimum of 5 years experience in the installation of commercial carpeting.
- C. Carpet and installation shall conform with ADAAG Section 302.2.

1.4 PROJECT CONDITIONS

- A. Maintain spaces to receive flooring and accessories not less than 60 degrees F and not more than 65 percent relative humidity for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation.
- B. Properly cure and dry concrete to eliminate vapor emissions that may affect the long term performance of the adhesives and installation. Install flooring after building air conditioning, dehumidifiers, etc. have operated to reduce moisture or provide accepted sealer.
- C. Install flooring and accessories after other finishing operations, including painting, have been completed. Close spaces to traffic during installation of the flooring.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Conform to Carpet and Rug Institute CRI 104, "Standard for Installation Specification of Commercial Carpet".
- B. Deliver carpet tile to the site in original cartons. Store in a safe, clean, dry, and well ventilated area.
- C. Handle manufactured materials as recommended by the manufacturer.

1.6 WARRANTY

- A. Upon completion, the carpet tile manufacturer shall submit a certificate warranting carpet against manufacturing defect for a period of not less than 2 years.

- B. Upon completion, the carpet contractor shall submit a certificate warranting the installation to be free of defects in workmanship for a period of one year to include the statement: "The carpet contractor shall, at his own expense and upon written notice from the Engineer, promptly correct/replace any and all improper work and material that may become apparent within 12 months after the date of final completion".
- C. Manufacturer shall furnish to the State a standard wear warranty for 10 years.
- D. The Surety shall not be held liable beyond 2 years from the project acceptance date.

1.7 EXTRA STOCK

Contractor shall provide 5 percent extra carpet tiles of each pattern and color in addition to the quantity required for installation. Extra carpet tile, for replacement use, shall be of same manufacture, type, and quality as the installed carpet tile, provided in original cartons, and properly marked.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Carpet Tile (CPT-1):

1. Components:

- a. Face Yarn: 100 percent bulked, continuous filament, second and third generation soil hiding nylon (Antron Legacy, Anso, Zeftron, Spectron, Ultron or pre-approved equal).
- b. Primary Backing: Reinforced synthetic.
- c. Secondary Backing: Fiberglass reinforced thermoplastic composite.

2. Construction:

- a. Surface: Tufted textured loop.
- b. Gauge: 1/12-inch.
- c. Total Height: 0.205-inch minimum (1/2-inch ADAAG Section 302.2 maximum).
- d. Stitches Per Inch: 10.1 minimum.
- e. Pile Density: 6013 ounces per cubic yard.

- f. Total Weight: 79 ounces per square yard.
- 3. Color and Pattern: As indicated. Carpet tiles shall have XTERA soil protection system or pre-approved equal.
- 4. Size: 18-inch by 36-inch.
- 5. Performance: The following requirements shall be met:
 - a. Static Resistance: Carpet construction shall provide a minimum of 3.5 kV resistance for 20 percent relative humidity at 70 degrees F in accordance with AATCC 134.
 - b. Flammability Requirements:

<u>TEST</u>	<u>RESULT</u>
ASTM D 2859 Methenamine Pill Test (DOC FF 1-70); or	Resistant to Flammability (both faces)
ASTM E 648 Radiant Panel Test; or	NFPA Class 1
ASTM E 84 Steiner Tunnel Test	Flame Spread of 75 or less

- B. Carpet Adhesive: Adhesive shall be white or beige latex base, permanent type as recommended by the carpet manufacturer.
- C. Seam Adhesive: Latex seam sealer or thermoplastic adhesives.
- D. Underlayment: Polymer-fortified as recommended by the manufacturer.
- E. Floor Finishing Accessories: Vinyl or rubber as indicated and as manufactured by Burke Mercer, Johnson Rubber Co., and Textile Rubber Co., or pre-approved equal in accordance with ADAAG Section 303 requirements as selected by the Engineer.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

Before work under this section is started, the carpet contractor, together with the Contractor and the Inspector, shall examine all surfaces that are to receive carpet tile to ensure that they are in the proper condition for same. The carpet contractor shall notify the Contractor of unacceptable areas and/or conditions (in terms of potential damage to the carpet) in writing. A copy of such notification shall be sent to the Engineer. All such areas and/or conditions shall be corrected by the Contractor under this project prior to start of the work.

3.2 PREPARATION

- A. Defects such as ridges, holes, and cracks shall be repaired and leveled as part of this contract. Fill cracks and depressions with patching/leveling compound accepted, by the flooring manufacturer to produce an acceptable substrate. Remove debris and scrape up cementitious deposits from surfaces. Apply primer at porous or highly alkaline substrates.
- B. Surface to receive carpet must be free of dirt, moisture, and irregularities in order to present a clean, smooth surface for installation.
- C. Test concrete floors for moisture in accordance with ASTM F 1869, "Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride", or ASTM F 2170, "Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes", and as recommended by the adhesive manufacturer. Concrete slabs shall be free of moisture that will impair the adhesion of flooring as specified under project conditions. Provide calcium chloride vapor emission testing (one per 1,000 square feet of concrete slab-on-grade). Floor emission levels shall be below carpet tile and adhesive manufacturer's maximum acceptable moisture emission level prior to installation. All corrective measures, including floor sealer systems, shall be at Contractor's expense to allow installation in conformance with flooring manufacturer's recommendations.
- D. Test concrete floors for alkalinity in accordance with ASTM F 710, "Practice for Preparing Concrete Floors to Receive Resilient Flooring". Provide corrective action for substrate with a pH above 9 or as recommended by the adhesive manufacturer.

3.3 INSTALLATION

- A. Materials shall be installed by a licensed carpet installer.
- B. Floor areas shall be cleaned thoroughly to remove all materials which could affect the adhesion of the carpet to the floor.
- C. Carpet tile in an enclosed area shall be matched as closely as possible in color and shade. To achieve this, all the flooring laid in such an area shall be from the same dye lot, with tiles laid adjacent to one another in the same order as packaged.
- D. Carpet tiles shall be laid with full tiles wherever possible. Tiles shall be cut to fit snugly (with slight compression rather than loose) against all vertical surfaces and shall be installed in those cabinets which do not have raised bottoms as well as under movable shelving and casework. The number of cut tiles shall be held to a minimum. Carpet tile shall be aligned so that lines of carpet tile joints are straight and uniform. Method of installation shall be as indicated.
- E. Carpet tiles shall be prepared for laying as follows: Install full tiles as recommended by the carpet tile manufacturer with edge tiles not less than half size except where made necessary by unusual conditions. Carpet tile edges at all field cuts shall be trimmed to

match the carpet nap. Pile loops which are frayed in cutting shall be trimmed at the top of the primary backing. However, cutting of pile loops shall be kept to a minimum, and any edge which becomes objectionable because excessive trimming is required shall be rejected and replaced with a new carpet tile.

- F. The surface of the floor to receive carpet tile shall be primed if/as necessary to insure positive bonding of the adhesive to the substrate.
- G. Carpet tile shall be laid smoothly into a uniformly applied layer of adhesive. Carpet tile edges shall be tucked neatly against all abutting vertical surfaces and edge guard. Edge guards shall be mitered at corners.
- H. Roll the carpet tiles with a 50 to 100 pound roller while the adhesive is still tacky to ensure transfer of adhesive from the floor to the carpet tile for permanent adhesion. Traffic over field-applied adhesive installations shall be restricted for a minimum of 24 to 48 hours to allow adhesives to cure properly.

3.4 CLEAN UP

- A. Upon completion of the installation, the Contractor shall remove all waste and excess materials, all tools and equipment, and shall carefully and thoroughly vacuum the entire floor surface.
- B. Dirt and debris shall be cleaned off, all spots shall be removed from the carpet tiles with a proper type of spot remover, and all loose threads shall be snipped from the carpet tile with a sharp pair of scissors. The entire installation shall be left clean and in a condition acceptable to the Engineer.

3.5 PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure carpet tile is not damaged or deteriorated at time of Project Acceptance.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The work includes painting and finishing of exterior and interior items and surfaces throughout the project, whether scheduled or not, except as otherwise indicated. Painting shall include new work and existing new surfaces made bare or damaged during construction. Surface preparation, priming, and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of the work and is included in this section.
- B. The work includes field painting of exposed bare and covered pipes and conduits (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the electrical work, such as junction boxes, raceways, and cabinets, except as otherwise indicated.
- C. "Paint" as used herein means all coating systems materials, including primers, enamels, sealers, stain, varnish, and fillers, and other applied materials whether used as prime, intermediate, or finish coats, except as specifically noted herein.
- D. Paint all exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the Engineer will select these from standard colors available for the materials systems specified.
- E. Related Work Specified Elsewhere: Water repellent sealer for exterior concrete and exterior and interior concrete masonry is provided under Section 07190 - WATER REPELLENT SEALER.

1.2 PAINTING NOT INCLUDED

The following categories of work are not included as part of the field-applied finish work, or are included in other sections of these specifications.

- 1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for miscellaneous metal, hollow metal work, and similar items. Also, for fabricated components such as shop-fabricated or factory-built mechanical and electrical equipment or accessories.
- 2. Mechanical and Electrical Work: The prime coat for mechanical and electrical work is specified in DIVISION 15 - MECHANICAL and DIVISION 16 - ELECTRICAL, respectively. Finish coats are as specified herein.

3. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items as (but not limited to) solid phenolic, plastic laminate, acoustic materials, high performance organic coated metal, and finished mechanical and electrical equipment, including light fixtures, switchgear, and distribution cabinets.
4. Concealed Surfaces (Present and Future): Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, and pipe spaces.
5. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, and similar finished materials will not require finish painting, unless otherwise indicated.
6. Labels: Do not paint over any code-required labels, such as Underwriters' Laboratories, or any equipment identification, performance rating, name, or nomenclature plates.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Schedule of Finishes: Submit sets of the proposed painting finish schedule to the Engineer for acceptance. The schedule shall indicate the wet film thickness (mils) at which the proposed paints/coatings will be applied that are necessary to achieve the final dry film thickness indicated on the Schedule of Finishes under item entitled "SCHEDULE OF FINISHES" hereinbelow.
- C. Color Samples: Submit the following to the Engineer for acceptance.
 1. Sets of each color finish sample.
 2. After the color finish sample has been accepted, one set of color finish samples painted onto 8-1/2 inch x 11-inch cardboard shall be submitted. The cardboard shall be divided into three horizontal strips and painted as follows:
 - a. Prime 3 strips.
 - b. First coat bottom 2 strips.
 - c. Second coat bottom strip.
- D. Schedule of Operations: Before work on the project is commenced, submit complete sets of a work schedule showing Contractor's sequence of operations and dates.

- E. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.
- F. Certifications: Submit copies of asbestos-free, lead-free, zinc-chromate-free, strontium-chromate-free, cadmium-free, and mercury free paint certificates.
- G. Manufacturer's Product Data Sheets: Submit copies of the Manufacturer's Product Data Sheets for the primers, paints, coatings, solvents, sealing and patching materials, sealants and caulking, and other materials being used. Data sheets shall indicate thinning and mixing instructions, required film thickness (mil) and application instructions.
- H. Manufacturer's Material Safety Data Sheets (MSDS): Submit copies of the Manufacturer's Material Safety Data Sheets for coatings, solvents, and other hazardous materials.
- I. Receipt of Delivery: Submit copies of the receipt signed by the user's representative, attesting to delivery of extra paint as required under paragraph entitled "Extra Paint" hereinbelow.
- J. Comprehensive Spray Plan: Where the Contractor proposes to employ airless spraying, submit a Comprehensive Spray Plan, including the following information for acceptance:
 - 1. Documentation that the individual spray applicator(s) on the project have completed an accepted "Spray Applicator Certification Program".
 - 2. The overspray protection methods proposed.
 - 3. The spray application instructions and recommendations of the paint manufacturer he proposes to use.
- K. Certificate of Public Liability and Property Damage Insurance

1.4 ANALYZING AND TESTING

- A. All paints and their applied thickness shall be subject to testing whenever the Engineer deems necessary to determine conformation to the requirements of these specifications. Should testing by a laboratory be required, the laboratory shall be selected by the State and the cost of testing shall be borne by the Contractor. However, should test results show that the paint is in compliance with this specifications, the cost will be borne by the State.
- B. All rejected material shall be removed from the job site immediately. Surfaces painted with the rejected material shall be redone at no additional cost to the State.
- C. Where the required paint thickness is deficient, the affected surface(s) shall be recoated as necessary to provide the required paint thickness at no additional cost to the State.

1.5 QUALITY ASSURANCE

- A. Painting Terminology: Refer to ASTM D 16, "Standard Terminology for Paint, Related Coatings, Materials, and Applications".
- B. Gloss/Sheen Levels: ASTM D 523, "Specular Gloss", as follows:

<u>Description</u>	<u>Units @ 60 degrees</u>	<u>Units @ 85 degrees</u>
Matte or Flat	0 to 5	10 max
Velvet	0 to 10	10 to 35
Eggshell	10 to 25	10 to 35
Satin	20 to 35	35 min
Semi-Gloss	35 to 70	
Gloss	70 to 85	
High Gloss	more than 85	

- C. Where the Contractor proposes to employ airless spraying, the applicator(s) shall have completed an accepted "Spray Applicator Certification Program" conducted by the Painting Industry of Hawaii.
- D. As a minimum, the certification shall include material and equipment selection, use and maintenance, hands-on application, and safety training.

1.6 WARRANTY

- A. The Contractor shall warrant that the work performed under this section conforms to the contract requirements and is free of any defect in the materials used and workmanship performed by the Contractor. Such warranty shall continue for a period of two years from the project acceptance date and the Contractor shall remedy any such defect which is discovered during that period at no cost to the State.
- B. The State will notify the Contractor in writing within a reasonable time after discovery of any failure or defect.
- C. Should the Contractor fail to remedy any failure or defect described in Paragraph A above within 10 working days after receipt of notice thereof, the State shall have the right to repair or otherwise remedy such failure or defect and charge the Contractor for the cost of same.

1.7 SPECIAL REQUIREMENTS

- A. Codes: The Contractor shall comply with the State OSHL (Occupational Safety and Health Law) and all pollution control regulations of the State Department of Health.

- B. Safety methods used during coating application shall comply with SSPC-PA Guide 3.
- C. Protection:
1. Persons:
 - a. The Contractor shall take all necessary precautions to protect public pedestrians, including tenants from injury.
 - b. The Contractor shall provide, erect, and maintain safety barricades around scaffolds, hoists, and wherever Contractor's operation create hazardous conditions in order to properly protect the public and workmen.
 2. Completed Work: The Contractor shall provide all necessary protection for wet paint surfaces.
 3. Protective Covering: The Contractor shall provide and install protective covering over equipment, floor, and other areas that are not scheduled for treatment. Protective covering shall be clean, sanitary drop cloth or plastic sheets. Paint applied to surfaces not scheduled for treatment shall be completely removed and surfaces shall be returned to original condition. Where paint application will be performed by use of airless spraying, the Contractor shall ensure that protective enclosures are erected to prevent the escape of overspray from the work area.
 4. Safeguarding of Property: The Contractor shall take whatever steps may be necessary to safeguard his work and also the property of the State and other individuals in the vicinity of the work area during the execution of this Contract. Contractor shall be responsible for and make good on any and all damages and for losses to work or property caused by his or his employee's negligence. Where the damaged property cannot be cleaned and restored to its original condition (i.e. prior to being damaged) it shall be replaced with a new product of equal quality. No proration or use of "used" products will be permitted.
 - a. The Contractor shall assume that cars will not be temporarily relocated from parking areas during spray painting work.
 - b. Paint overspray shall not carry more than 5 linear feet beyond the building eave line nor within 10 linear feet of pedestrians or property and surfaces not scheduled to be painted. Spray painting shall immediately cease when overspray carries beyond these specified limits and will not continue until protective barriers are erected to properly contain the overspray and damages caused by the overspray have been corrected.
 - c. The Contractor shall be assessed \$500.00 for each incidence of property or personal damage caused by overspray until such time that a satisfactory settlement has been agreed upon by the damaged party and corrective action

has been completed. All corrective action shall be settled within 24 hours from the time the damage is discovered. Should the Contractor fail to take corrective action in a timely and expeditious manner, the Engineer will contact the Contractor's Insurance company to seek resolution on the matter.

- d. The Engineer will withhold payment due the Contractor until damages have been corrected or damage claims resolved. The amount of payment withheld shall be equal to a minimum of \$2,000.00 plus the estimated cost of corrective action as determined by the Engineer.
5. Fire Safety: The Contractor shall direct his employees not to smoke in the vicinity and to exercise precautions against fire at all times. Waste rags, plastic (polyester sheets), empty cans, etc., shall be removed from the site at the end of each day.
- D. Right of Rejection: The Engineer will have the right to reject all work which is not in compliance with the plans and specifications. Rejected work will be redone at no additional cost to the State. In addition, the Engineer will have the right to require the immediate removal of any paint applicator who demonstrates negligence, lack of competence or repeated non-compliance with the contract requirements.
- E. Sequence of Operations: The sequence of operations shall divide the surfaces into work areas and present a schedule for:
1. Surface preparation and spot prime.
 2. Prime coat.
 3. First finish coat.
 4. Second finish coat.
- F. Inspection and Acceptance: The Contractor shall obtain written acceptance from the Engineer upon completion of each phase of work (phases of work are: surface preparation and spot prime; prime; first finish coat; second finish coat) before proceeding into the next phase of work. The Contractor shall give the Engineer one day (24 hours minimum) advance notice of completion of any phase of work for a work area only when he deviates from the previously submitted work schedule. The Contractor shall provide necessary access to areas to be inspected. Failure to obtain acceptance of any phase of work for a work area may result in redoing the operation at no cost to the State.
- G. Sample Panels: Prior to commencing with the work, the Contractor shall prepare a sample panel(s) of approximately 10 square feet indicative of the specified surface preparation and required number of paint coats to be applied for acceptance by the Engineer. The intent of this requirement is to ensure adequate coverage/thickness and/or hiding value of the paint and proper hue. The location where the sample panel(s) is to be prepared will be selected by the Engineer.

- H. Ventilation of Interior Spaces Following Painting: Following the completion of interior painting and prior to final acceptance, the interior spaces shall be ventilated and allowed to "air-out" to remove paint odors such that no odors exist at State's occupancy date. Where necessary and as deemed by the Engineer, the Contractor shall provide fans to mechanically ventilate the space(s).

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint materials to the job site in original unopened containers with original labels intact.
- B. No paint material, empty cans and paint brushes and rollers, drop cloths and rags, may be stored in buildings, but shall be stored in separate storage facilities away from the buildings. Receiving, opening, and mixing of painting materials shall be done in this area.
- C. The Contractor may furnish a job site storage facility. Such facility shall comply with requirements of the local Fire Department. The storage area shall be kept clean and facility shall be locked when not in use or when no visual supervision is possible.
- D. Ensure the safe storage and use of paint materials and the safe storage or disposal of waste, at the end of each work day.
- E. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asbestos Prohibition: All paint shall be asbestos-free.
- B. Lead Prohibition: All paint shall be lead-free.
- C. Mercury Prohibition: All paint shall be mercury-free.
- D. Chromate Prohibition: All paint shall be free of zinc-chromate and/or strontium-chromate.
- E. Cadmium Prohibition: All paint shall be cadmium-free.
- F. Material shall be equal in quality to that specified under the Schedule of Finishes and any given finish shall be as labeled by one manufacturer.
- G. All materials shall be delivered to the job site in undamaged original containers bearing the manufacturer's label and shall be stored in such a manner as to prevent damage. All rejected materials shall be removed from the job site immediately.

- H. Paints shall be as manufactured by Ace, Benjamin Moore, Cabot's, Carboline, Corotech, Dupont, Dutch Boy, Fine Line Paint Corp., Devoe, Devoe Coatings, Glidden, Glidden Professional, Martin Senour, General Polymers, Olympie Stain, Pervo, PPG Protective & Marine Coatings, Pittsburg, Porter Intl., Pratt & Lambert, Rust-Oleum, Sherwin-Williams, Smiland (Styletone), Spectra-Tone, Thoro Systems, Tnemec, United Paint and Coatings, Zinsser, or pre-approved equal.
- I. Thinning of paint shall be done using material recommended by the manufacturer. Mix proprietary products according to manufacturer's printed specifications. Compound thinner, mineral oil, kerosene, refined linseed oil, or gasoline shall not be used for thinning.
- J. Except for metal primers, all paint shall contain maximum amount of mildewcide per gallon of paint permitted by the mildewcide manufacturer without adversely affecting the quality of the paint.
- K. The supplier shall submit a signed certificate indicating the amounts of mildewcide added by both the paint manufacturer and the paint supplier. Mercurial fungicide shall not be used.

2.2 SCHEDULE OF FINISHES

- A. The Schedule of Finishes is made for the convenience of the Contractor and indicates the types and quality of finishes to be applied to the surfaces. Refer to Finish Schedule for symbols indicating location for various finishes. Provide additional systems for surfaces to be painted not listed hereinafter.
- B. All paints unless otherwise noted, are the products of Benjamin Moore and Corotech and are so named to establish desired quality and standard of materials. Painting materials, equal to those mentioned by trade name under the various treatments may be used, provided they meet with the acceptance of the Engineer.
- C. Treatments shall be applied on exposed surfaces of designated materials, in conformity with instructions of the paint product used.
- D. Exterior Painting: Spread rates are approximate.
 - 1. Typical Coating System for Steel: Follow SSPC-SP-1 for solvent cleaning, for maximum protection follow SSPC-SP-10 near white metal blast.

<u>Producer</u>	<u>Coat</u>	<u>Products</u>	<u>DFT (mils)</u>	<u>Minimum Time to Recoat</u>	<u>Maximum Time to Recoat</u>
Corotech	1st	V175*	1.5-2.1	2 hours	2 weeks exterior 3 months interior
Corotech	2nd	V150	2.2-2.8	8 hours	4 weeks
Corotech	3rd	V500	2.3-3.3	8 hours	3 days

* for galvanized surfaces

2. Wood and Fiber-Cement Panels:

Prime Coat: N023 Fresh Start Multi-Purpose Latex Primer
1.2 mils DFT @ 425 sf/gal

2nd and
3rd Coats: N448 Ultra Spec Ext Satin Finish
1.5 mils DFT @ 403 sf/gal/coat

Note: Factory primed materials require touch-up of factory prime coat as recommended by the paint manufacturer. Factory finished panels shall be touched up as recommended by the manufacturer.

3. Glu-Lam Beams for Stain Finish:

1st Coat: 638 Arborcoat Waterborne Exterior Stain Semi-Transparent
200 - 400 sf/gal, dependent upon substrate

2nd Coat: 636 Arborcoat Waterborne Exterior Stain Protective Clear Coat
400 - 600 sf/gal, do not apply at less than 300 sf/gal

E. Interior Paints: Use low VOC/low odor paint to maximum extent possible. Spread rates are approximate.

1. Gypsum Wallboard:

Prime Coat: N372 Eco Spec WB Interior Latex Primer
1.2 mils DFT @ 577 sf/gal

2nd and
3rd Coats: N373 Eco Spec WB Interior Latex Flat Finish
1.5 mils DFT @ 417 sf/gal/coat

or

N374 Eco Spec WB Interior Latex Eggshell Finish
1.4 mils DFT @ 412 sf/gal/coat

2. Ferrous Metal:

Prime Coat: P04 Super Spec HP Acrylic Metal Primer
1.7 mils DFT @ 406 sf/gal
or
Bulls Eye 1-2-3 Water-Base Primer for All Surfaces
1.5 mils DFT @ 364 sf/gal

2nd and
3rd Coats: N373 Eco Spec WB Interior Latex Flat Finish
1.5 mils DFT @ 417 sf/gal/coat

3. Galvanized Metal:

Prime Coat: P04 Super Spec HP Acrylic Metal Primer
1.7 mils DFT @ 406 sf/gal
or
Bulls Eye 1-2-3 Water-Base Primer for All Surfaces
1.5 mils DFT @ 364 sf/gal

2nd and
3rd Coats: N373 Eco Spec WB Interior Latex Flat Finish
1.5 mils DFT @ 417 sf/gal/coat

4. Wood Surfaces for Paint:

Prime Coat: N372 Eco Spec WB Interior Latex Primer
1.2 mils DFT @ 577 sf/gal

2nd and
3rd Coats: N373 Eco Spec WB Interior Latex Flat Finish
1.5 mils DFT @ 417 sf/gal/coat

5. Glu-Lam Beams for Stain Finish:

Stain: Lenmar Quickstain Alkyd Wiping Stain 1AS Series
400 - 500 sf/gal dependent upon substrate

2nd and
3rd Coats: N435 Benwood Interior Wood Finishes Polyurethane
Low Lustre
1.7 mils DFT @ 547 sf/gal/coat

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. General:

1. Surface preparation shall be in accordance with the Painting and Decorating Contractors of America, "Architectural Specification Manual", methods are applicable to all substrates.
2. Scrub surfaces with stiff nylon bristle brush and T.S.P. solution at rate of 3/4 cup T.S.P. per gallon of warm water to remove accumulated film of wax, oil, grease, smoke, dust, dirt, chalky, or other foreign matter which would impair bond or bleeding through new finish. Thoroughly sponge wipe surfaces with clean water. Allow surfaces to thoroughly dry before priming, painting, calking, or sealing.
 - a. Following sponge wiping, the surfaces shall be allowed to dry for a minimum of 24 hours.
 - b. Wood surfaces shall have a maximum moisture content of 12 percent when measured with an electronic moisture meter.
3. Cracks and openings found at joints and where different materials abut each other (e.g. CMU/concrete, CMU or concrete/wood, etc.) shall be sealed with a caulking compound compatible with the substrate and primer/paint. The caulking shall be applied and allowed to set in accordance with the manufacturer's recommendations and instructions.

B. The painting contractor shall be wholly responsible for the finish of his work and shall not commence any part of it until surfaces are in proper condition. If painting contractor considers any surfaces unsuitable for proper finish of his work, he shall notify the Engineer of this fact in writing and he shall not apply any material until the unsuitable surfaces have been made satisfactory, or until the Engineer has instructed him to proceed. Major defects shall be restored by the proper trades. In general, follow paint manufacturer's directions for surface preparation for the paint to be applied.

C. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

D. Puttying of nail holes, cracks, and blemishes shall be done after priming coat has become hard and dry and before second coat is applied.

- E. Concrete surfaces shall be wire brushed and cleaned to remove all dust and loose mortar.
- F. Alkalinity and Moisture Testing of Cementitious Surfaces:
 - 1. Prior to paint application, interior and exterior concrete and masonry scheduled to receive paint shall be tested to determine the alkalinity level of the surface. Testing shall be performed in strict accordance with the test kit manufacturer's instructions.
 - 2. Perform alkalinity and moisture content tests of surfaces to be painted. Cementitious surfaces shall be cured for not less than 30 days prior to painting, but no less than 14 days and then only if the moisture meter tests indicated moisture of less than 17. Make surface moisture test by use of a commercially available moisture meter. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition as specified before application of paint. Efflorescence is caused on cementitious surfaces by moisture entering or contained in the substrate. Water-soluble salts are brought to the surface where the water evaporates, leaving a deposit of residual salts, a white, salty deposit. Here they carbonate and destroy the bond within the substrate components, causing the surface to crumble and break away.
 - 3. Where the alkalinity level exceeds the resistance level of the primer proposed for use, the surface shall be neutralized (e.g. muriatic acid wash) as necessary to reduce the levels to within that acceptable by the primer and thoroughly rinsed with clean water.
- G. Top, bottom, and side edges of doors to be finished the same as face of doors after they are fitted by the carpenter.
- H. Surfaces adjacent to areas being finished shall be protected and left clean of paints, stains, etc. Clean drop cloths shall be used until completion of job.
- I. Unprimed galvanized metal shall be washed with a solution of chemical phosphoric metal etch and allowed to dry.
- J. Metal surfaces shall be made clean and free of any defects or condition that may produce unsatisfactory finish. Touch-up any chipped or abraded places on surfaces that have been shop coated with the proper primer.
- K. Gypsum Board Surfaces:
 - 1. Surface Cleaning: Surfaces shall be dry. Remove loose dirt and dust by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material.

2. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

L. Plywood and Wood Surfaces:

1. Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition accepted by the Engineer prior to receiving paint or other finish. Do not use water to clean uncoated wood.
2. Knots and Resinous Wood: Prior to application of paint, treat knots and resinous wood with an application of surface sealer.
3. Open Joints and Other Openings: Fill with whiting putty. Sand smooth after putty has dried.
4. Checking: Where checking of the wood is present, sand the surface, wipe, and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.
5. Prime Coat for New Exterior Surfaces: Prime coat wood doors, frames, and trims before wood becomes dirty, warped, or weathered.

- M. PVC Trims and Accessories: Paint to match adjoining surfaces unless specifically indicated to remain unpainted.

3.2 PAINT APPLICATION

A. General:

1. Apply coating materials in accordance with SSPC-PA 1. SSPC-PA 1 methods are applicable to all substrates, except as modified herein. Thoroughly work coating materials into joints, crevices, and open spaces. Touch-up damaged coatings before applying subsequent coats.
2. Work shall be done in a workmanlike manner by skilled and experienced mechanics and shall conform to the best painting practices.
3. Materials shall be applied in accordance with the manufacturer's specifications and the finished surfaces shall be free from runs, sags, drips, ridges, waves, laps, streaks, brush marks, and variations in color, texture, and finish (glossy or dull). The coverage shall be complete and each coat shall be so applied as to produce a film of uniform thickness. No paint, varnish or enamel shall be applied until the preceding coat is thoroughly dry and acceptance.
4. No exterior painting of unprotected surfaces shall be done in rainy, damp weather. Coats shall be applied only to surfaces that are thoroughly dry.

5. Interior areas shall be broom clean and dust free before and during the application of coating material.
6. Mixing shall be done outside the building.

B. Application:

1. Paint application shall be by brush, roller, airless spray painting or combination thereof or as required by manufacturer. Spray painting for CMU shall be backrolled immediately after spray application and satisfactorily fill the pores of the CMU. Nuts and bolts shall be brush painted in lieu of spray-painted.
2. Where airless spraying is provided, a nozzle of the proper size in accordance with the paint manufacturer's recommendations to properly apply the paint shall be used.
3. Spray painting method shall be used only under accepted conditions. Spraying shall be done only when there is no wind, or under very low wind velocity. When wind velocity increases, all spraying operation shall be stopped. Before start of spraying, all surfaces that do not require painting shall be completely masked and protected. Adequate drop cloths shall be provided over floors, adjacent sidewalks, and over all cars parked nearby that may be stained or damaged from the spray work.
4. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying. Provide each coat in specified condition to receive the next coat.
5. Primers and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by the manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover the surface of the preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
6. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in selected colors.

C. Colors: Each coat shall be tinted a different shade from the preceding coat. Colors shall be in accordance with the color schedule on the drawings or as selected by the Engineer.

D. Finish Film Thickness: Apply primer, intermediate, and finish coats to not less than 1.5 mils dry film thickness, 4 mils wet unless recommended otherwise in writing by the manufacturer, for each coat and in accordance with the manufacturer's recommendations. Verify mil thickness by use of a suitable wet film gauge. Use a Tooke or other dry film gauge to test for total dry film thickness.

3.3 MECHANICAL AND ELECTRICAL WORK

- A. Paint visible surfaces of ductwork or plenum spaces, and interior surfaces visible through grilles.
- B. Paint shop primed metal surfaces of mechanical and electrical equipment with two finish coats of paint to match adjoining wall or ceiling surfaces. Prime unprimed bare metal surfaces with specified prime coat.
- C. Stencil all exposed piping with painted black letters indicating the service and with an arrow indicating the direction of flow. Stencil where pipes enter and leave each area and at not over 30-foot intervals within an area. Width of color band, size of legend letters, and position of legend shall conform to the requirements of ASME A13.1, "Scheme for the Identification of Piping Systems".

3.4 MISCELLANEOUS

- A. Installation of Removed Items: After completion of final paint coat, removed items shall be reinstalled.
- B. At the completion of other trades, touch up damaged surfaces.
- C. Extra Paint: The Contractor shall provide extra paint in each of the different colors of exterior and interior paint and stain used for walls, eaves, and ceilings to the Facility Manager upon completion of the project. The paint shall be in unopened one gallon cans and shall be in the quantities listed below:
 - 1. Paint used over large areas, such as the exterior of the building and in several rooms - 5 gallons of each color.
 - 2. Paint used in single room areas and in small areas, such as toilets and doors - 1 gallon of each color.

3.5 CLEAN UP

- A. During the progress of the work, all debris, empty crates, waste, drippings, etc., shall be removed by the Contractor and the grounds about the areas to be painted shall be left clean and orderly at the end of each work day.
- B. Upon completion of the work, staging, scaffolding, containers, and all other debris shall be removed from the site. All paint, shellac, oil or stains splashed or spilled upon adjacent surfaces not requiring treatment (hardware, fixture, floor) shall be removed and the entire job left clean and acceptable.

END OF SECTION

DIVISION 10 - SPECIALTIES

SECTION 10100

WHITEBOARDS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Provide all whiteboards (markerboards) and accessories as indicated and scheduled on the drawings.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's brochures with specifications and installation instructions and copies of all warranties.
- C. Shop Drawings: Submit shop drawings with construction and installation details.
- D. Material Samples and Samples for Color Selection: Submit 4 each manufacturer's samples of facing material for color and material selection for all materials and finishes.
- E. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the building site in the manufacturer's original unopened containers and shall be stored in a clean dry area. Materials shall be stacked according to manufacturer's recommendations.
- B. Handle manufactured materials as recommended by the manufacturer.

1.4 WARRANTY

- A. Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.
- B. The Surety shall not be held liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 MATERIALS

Whiteboard: Provide Elite WhiteBoardScreen with StarBright4 WB80V surface, size as indicated or pre-approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

The installer shall examine the areas and conditions under which whiteboards are to be installed. Should any condition be found unsuitable, no work shall be done until the unsatisfactory conditions have been corrected and are acceptable to the installer. Proceeding with work will imply acceptance of the conditions by the installer.

3.2 INSTALLATION

- A. Layout and arrangement of whiteboards and sizes shall be as indicated.
- B. Whiteboard shall be installed in strict accordance with the manufacturer's instructions for fastening onto substrates indicated.
- C. Whiteboards shall be installed in single lengths.
- D. Surfaces shall be absolutely flat without any buckling, bending, sagging or looseness.

3.3 CLEANING

Whiteboards shall be carefully washed with hot, soapy water and rinsed in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 10161

SOLID COLOR REINFORCED COMPOSITE TOILET PARTITIONS AND URINAL SCREENS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work under this section shall include, but not be limited to, floor and wall anchored solid color reinforced composite toilet compartment doors and partitions and urinal screens.
- B. Related Work Described Elsewhere: Coordinate the installation of doors and partitions with grab bars, toilet tissue dispensers, and other accessories provided under Section 10800 - TOILET ACCESSORIES.

1.2 GENERAL

Toilet compartments which are accessible to the physically handicapped shall be in conformance with the criteria noted in the Americans with Disabilities Act Accessibility Guidelines (ADAAG) Section 404 and Section 604. Outswinging doors shall have self closing hinges conforming with ADAAG Section 604.8.1.2.

1.3 PERFORMANCE REQUIREMENTS

- A. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D 6578/ D 6578M, "Standard Practice for Determination of Graffiti Resistance", in accordance with Section 9, "Graffiti Removal Procedure Using Manual Solvent Rubs":

Cleanability: Five required staining agents shall be cleaned off material.

- B. Scratch Resistance: Partition material shall have the follow mg characteristics when tested in accordance with ASTM D 2197, "Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion", using Gardner Stock #PA-2197/ST pointed stylus attachment on scrape tester:

Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.

- C. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D 2794, "Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)", using 0.625-inch hemispherical indenter with 2-lb impact weight:

Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.

D. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials":

1. Smoke Developed Index: Not to exceed 450.
2. Flame Spread Index: Not to exceed 75.
3. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA): Class B.
 - b. International Code Council (ICC): Class B.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit sets of the proposed (selected) manufacturer's current brochures and specifications.
- C. Shop Drawings: Submit shop drawings showing construction and installation details. Indicate the elevations of partitions/screens, hardware, fittings, mounting brackets, proposed method of anchoring, and other related items and installation details.
- D. Samples: Submit 4 sets of solid color reinforced composite samples for color selection.
- E. Certification: Submit manufacturer's certificate attesting that materials meet or exceed the specified requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered to the job-site in their original sealed containers bearing the name of the manufacturer and brand designation.
- B. Items shall be delivered and stored in a manner that ensures they will be protected against damage.
- C. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. General: Compartments shall be equivalent to Bobrick 1090 Series gap free option 1092G or pre-approved equal of the type and size specified and as shown on the plans or pre-approved equal.
- B. Reinforced Composite Doors, Partitions, Stiles, and Pilasters:
 - 1. Shall be fabricated with a solid color reinforced composite material which is composed of dyes, organic fibrous material, and polycarbonate/phenolic resins.
 - 2. The exposed finish surfaces shall be non-ghosting; waterproof; non-absorbent; stain, chemical, and graffiti resistant surface bonded to core by thermal and mechanical pressure.
 - 3. Material shall have a Class A or B Flame Spread Rating and a maximum Smoke Developed Rating of 450 when tested in conformance with the procedures of ASTM E 84.
 - 4. Edges shall be same color as surface.
- C. Doors:
 - 1. Doors shall be of solid color reinforced composite a minimum of 3/4-inch thick.
 - 2. Unless otherwise noted on the drawings, a minimum clear door opening width of 32-inches shall be provided at the door leading to an accessible toilet stall. This clear width shall be measured between the edge of the door bumper/keeper and the face of the door when opened 90 degrees.
- D. Partitions, Stiles, and Pilasters:
 - 1. Pilasters and stiles for compartments shall have adjustable floor anchors with leveling devices, studs, and locking nuts to firmly secure pilasters and stiles to the floor.
 - 2. Partitions, stiles, and pilasters shall be of solid color reinforced composite having partitions a minimum of 1/2-inch thick and stiles and pilasters a minimum of 3/4-inch thick.
 - 3. Partitions to which grab bars are fastened, along with their respective brackets and connectors, shall be capable of supporting the imposed loads noted in the ADAAG Section 609.8.

- E. Headrails: Headrails for overhead-braced compartments shall be of anodized, extruded aluminum alloy with end-caps, of anti-grip design or as standard with the manufacturer; or solid wood core surfaced with plastic laminate and having minimum cross-sectional dimensions of 1-1/4 inch x 2-inch.
- F. Urinal Screens:
1. Shall be of the types and sizes shown on plans, 1095 Series or pre-approved equal.
 2. Screens shall be of solid color reinforced composite a minimum of 3/4-inch thick for wall-hung installations.
- G. Hardware and Fittings:
1. Doors, partitions, pilasters, and screens shall be furnished with the necessary hardware and fittings to provide a complete installation. They shall be pre-cut to facilitate erection and minimize field errors.
 2. Materials: Hardware and fittings shall be either satin-finish Type 304 or 316 stainless steel or anodized extruded aluminum. Chrome plated brass is not desired. Non-ferrous alloys such as Zamac castings shall not be used.
 3. Door Hinges: Either spring or cam-action type and adjustable to hold the door open about 12-inches in a pre-set position. All parts shall be non-rusting such as stainless steel pintles; nylon or delrin cams; nylon, delrin or self-lubricating bronze bushings; and housings of anodized extruded aluminum alloy or satin-finish stainless steel.
 4. Latches: The latch shall be of a shape which is easy to grasp with one hand and which does not require tight grasping, tight pinching or twisting of the wrist to operate and shall be operable by a person on the outside in the event of an emergency. Mechanisms such as slide bolts with a projecting handle on the inside of the stall which can be opened by a person on the outside reaching over the door with a stick are acceptable.
 5. Door Pulls: Handicap accessible toilet stall doors shall be furnished with a grab bar/door pull, conforming with ADAAG Section 404.2.7.
 6. Coat Hook/Door Bumper: Furnish one each per door, mount at middle of door. At accessible stalls, coat hook shall be mounted at middle of door at maximum 48-inches above the finish floor and no lower than 15-inches above the finish floor conforming with ADAAG Section 308.2.1.
 7. Shoe: All pilasters and stiles shall have a 3-inch high minimum trim cover or shoe at the floor.

8. Hardware Mounting Heights: The highest part of any handle, pull, grab bar, latch, or operating mechanism shall be at 36-inches maximum above the finished floor.
 9. Fasteners: Hardware and fittings shall be fastened with theft-resistant one-way stainless steel or chrome plated brass through-bolts or machine screws in factory installed steel inserts. Do not use "one-way" screws.
- H. Backer Plates: Provide manufacturer's galvanized steel or stainless steel backer anchor plates for all stud wall anchorage.

PART 3 - EXECUTION

3.1 INSPECTION

The installer together with the Contractor and the Engineer shall examine the areas and conditions under which toilet stall doors, partitions, stiles/pilasters, and screens are to be installed. Should any condition be found unsuitable, no work shall be performed until the unsatisfactory conditions have been corrected and are acceptable to the installer. Proceeding with the work will imply acceptance of the conditions by the installer.

3.2 INSTALLATION

- A. Compartments and urinal screens shall be erected in strict accordance with the manufacturer's instructions.
- B. All parts shall be securely screwed and/or bolted tight, well-anchored to the wall, true to line, level, and plumb, with doors and hardware placed at the proper heights and in proper operating condition.
- C. The following uniform clearances shall be provided:
 1. 1/2-inch maximum between the stiles/pilasters and partitions.
 2. 1-inch maximum between stiles/pilasters/partitions and walls.
 3. 3/16-inch maximum between stiles/pilasters and doors.
- D. Anchorage to concrete or to masonry at grouted cells shall be bolts with lead or steel expansion shields. Anchorage to masonry at ungrouted cells or to gypsum board walls shall be with toggle bolts.
- E. Adjust hardware and lubricate moving parts as necessary to ensure smooth operation.

3.3 PROTECTION AND CLEANING

- A. Protect the work of other trades against damage, injury or soiling.

- B. After installation, clean exposed surfaces with cleaners recommended and approved by the manufacturer and protect from damage.
- C. Repair and restore adjacent surfaces that are marred or damaged as a result of the installation of toilet partitions and urinal screens to their original condition. Leave adjacent surfaces in a neat and clean condition.

END OF SECTION

SECTION 10200

METAL WALL LOUVERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Provide wall louvers where scheduled and as specified herein.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit copies of manufacturer's product specifications and installation instructions along with shop drawings.
- C. Shop Drawings: Submit shop drawings for fabrication and erection. Include plans, elevations, sections, large scale details, materials, thicknesses, and anchorages.
- D. Certificates: Submit certificates indicating conformance with performance ratings.
- E. Samples: Submit 4 samples of color and finish for factory finished louvers for acceptance.

1.3 QUALITY ASSURANCE

- A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements or are specified by model number, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500 and equal to the units specified.
- B. Thermal Movement: Fabricate exterior components from manufacturer's stock systems which have been designed to provide for expansion and contraction resulting from ambient temperature range of 120 degrees F.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products to avoid any distortion or damage due to moisture, physical abuse or other cause. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.
- B. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Extruded Aluminum: Aluminum extrusions shall conform with ASTM B 221 or ASTM B 221M, 6063-T5 or T52 alloy and temper.
- B. Fasteners: Fasteners shall be stainless steel. Do not use metals which are corrosive or incompatible with materials joined.
 - 1. Use types, gauges, and lengths to suit unit installation conditions.
 - 2. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- C. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use hardened aluminum or stainless steel anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
- D. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

2.2 FABRICATION, GENERAL

- A. General: Fabricate louvers to comply with requirements indicated for design, dimensions, materials, joinery, and performance with respect to water penetration, strength, durability, and uniform appearance.
- B. Size:
 - 1. Fabricate louvers in concrete and masonry walls to outside dimensions indicated, with allowance of 1/4-inch on all sides for sealant joints.
 - 2. Verify sizes with final HVAC shop drawings, including detail dimensions of ductwork, dampers or other fittings abutting louvers.
- C. Field Measurements: Verify size, location, and placement of louver units prior to fabrication.
- D. Preassemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- E. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

- F. Fabricate frames, including integral sills, to fit in openings of size indicated with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.
- G. Include supports, anchorages, and accessories required for complete assembly.
- H. Provide vertical mullions of type and at spacings indicated but not further apart than recommended by manufacturer for wind exposure specified. Where vertical mullions are not indicated, provide concealed interior stiffeners, blade braces, and increased blade thickness to conform to wind loading specified. Where individual units are joined, provide mullion covers at exterior and interior to match frames.
- I. Join frame members to one another and to fixed louver blades with fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer, unless otherwise indicated, or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED WALL LOUVERS

- A. For convenience and to establish standards of quality and design, the following items are manufactured by Construction Specialties, Inc. Equivalent products, accepted by the Engineer, of the following manufacturers will be accepted:
 - 1. Airolite Co.
 - 2. Greenheck
 - 3. Industrial Louvers, Inc.
 - 4. Ruskin Manufacturing
 - 5. Pre-approved equal.
- B. The products of other manufacturers are acceptable provided they meet or exceed the materials and construction requirements as specified.
- C. Fixed Blade Louvers: Frames and louver blades fabricated from metal of kind and in form specified below; complying with the following requirements:

Storm Resistant Louver: Construction Specialties Model RS-4300, 4-inch deep, with 0.060-inch blade and 0.080-inch frame.

2.4 EXTERIOR ALUMINUM SILL

Provide 0.050-inch thick sill flashing of same material and finish as louvers where indicated on the drawings.

2.5 LOUVER SCREENS

- A. General: Provide each exterior wall louver with louver screens complying with the following requirements.
 - 1. Screen Location for Fixed Louvers: Interior face, unless otherwise indicated.
 - 2. Bird Screening: 1/2-inch mesh 0.063-inch diameter stainless steel wire for all louvers.
- B. Secure screens to louver frames with stainless steel machine screws, spaced at each corner, and at 12-inch on center between.
- C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:
 - 1. Metal: Same kind and form of metal as indicated for louver frames to which screens are attached.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Rewireable frames with a driven spline or insert for securing screen mesh.

2.6 FINISHES

All exposed aluminum surfaces shall be free of scratches and other blemishes. Pre-clean surfaces and provide a conversion coating and provide exposed surfaces of aluminum with a 2 coat fluoropolymer coating system containing at least 70 percent by weight polyvinylidene fluoride, PVDF/PVF2 resin, factory-applied, oven baked conforming to AAMA 2605, "Superior Performing Organic Coatings on Aluminum Extrusions and Panels", with a total dry film thickness of not less than 1.2 mils. Color shall be #609 Champagne Bronze unless indicated otherwise or as selected by the Engineer from manufacturer's standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages which are to be embedded in concrete construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

- A. Louvers shall be installed in accordance with manufacturer's directions, accepted shop drawings and as shown. Provide all necessary fastenings and anchors required for a complete installation.
- B. Locate and place louver units plumb, level, and in proper alignment with adjacent work.
- C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- D. Form closely fitted joints with exposed connections accurately located and secured.
- E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated. Provide closed cell PVC compression gaskets between jambs and sill frame and surrounding construction.
- F. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units.
- G. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete or dissimilar metals.

3.3 ADJUSTING AND PROTECTION

- A. Protect louvers from damage of any kind during construction period, including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore louvers damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by the Engineer, remove damaged units and replace with new units.
- C. Touch-up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.4 CLEANING

- A. Periodically clean exposed surfaces of louvers which are not protected by temporary covering, to remove fingerprints and soil during construction period; do not let soil accumulate until final cleaning.

- B. Before final inspection, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes.
- C. Clean and maintain aluminum surfaces in accordance with AAMA 609 & 610, "Cleaning and Maintenance Guide for Architecturally Finished Aluminum".

END OF SECTION

SECTION 10440

SIGNAGE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide all signage as shown and as specified herein, including the following:
 - 1. Plastic Signs
 - 2. Fiberglass Signs
 - 3. International Symbol of Accessibility
- B. Sign Locations: As indicated and scheduled.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.
- C. Shop Drawings: Submit shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details. Furnish message list for each sign required, including large-scale details of wording and layout of lettering.
- D. Samples: Submit the following samples of each sign component for initial selection of color, pattern, and surface texture as required and for verification of compliance with requirements indicated.
 - 1. Samples for Initial Selection of Color, Pattern, and Texture: Manufacturer's color charts consisting of actual sections of material, including the full range of colors available for each material required.
 - 2. Samples for Verification of Color, Pattern, and Texture Selected, and Compliance with Requirements Indicated:
 - a. Submit a full size sample panel for each material indicated. Include a panel for each color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

- b. Acceptable samples will be returned and may be used in the work.

1.3 QUALITY ASSURANCE

Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

1.4 ACCESSIBILITY COMPLIANCE

- A. The Americans with Disabilities Act Accessibility Guidelines (ADAAG). Signage shall comply with ADAAG Section 206, Section 216, and Section 703 and for mounting heights, finish, Braille characters and type of characteristics. See DCAB Interpretive Opinions for further clarification.
- B. Where a required illuminated "EXIT" sign occurs, provide an additional companion "FIRE EXIT" sign matching the interior signage as specified, mounted on the latch side of the door conforming with ADAAG Section 216.4.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle materials in strict conformance of the manufacturer's instructions and recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

General Requirements: Character proportion, color contrast, dimension, depth, and heights of symbols, Grade II braille, and letters, location, and mounting heights shall be in accordance with the requirements noted in the Americans with Disabilities Act Accessibility Guidelines (ADAAG) Section 216 and Section 703, and HRS 103-50.

2.2 PLASTIC SIGNS (FOR INTERIOR LOCATIONS)

- A. Melamine plastic laminate, approximately 1/8-inch thick, with contrasting core color, non-static, fire-retardant, and self-extinguishing. Plastic laminate shall have a contrasting core color and shall be impervious to most acids, alkalies, alcohol, solvents, abrasives, and boiling water.
- B. Characters and borders shall be raised. Individual cutout letters and symbols which are applied to the sign plaque shall not be used.
- C. Where a white or light colored background (core color) is provided, the background surface shall be coated with white or clear graffiti resistant coating as approved by the signage manufacturer. The coating shall provide a finish which is resistant to pencils, pens, and felt tip markers.

- D. Signs shall be mounted with double-stick tape.
- E. The products of the following manufacturers are acceptable provided they meet the materials and construction specified and are installed as specified hereinafter:
 - 1. Allen Marking Products, Inc.
 - 2. Best Manufacturing Company
 - 3. Mohawk Sign Company
 - 4. Signs, Letters & Nameplates, Inc. (SL & N)
 - 5. Pre-approved equal.
- F. The products of other manufacturers are acceptable provided they meet or exceed the materials and construction requirements as specified.

2.3 FIBERGLASS SIGNS (FOR EXTERIOR LOCATIONS)

- A. Fiberglass, non-corrosive, 3-ply laminate, approximately 3/16-inch to 1/4-inch thick with contrasting core color.
- B. Characters and borders shall be raised. Individual cutout letters and symbols which are applied to the sign plaque shall not be used.
- C. Where a white or light colored background (core color) is provided, the background surface shall be coated with white or clear graffiti resistant coating as approved by the signage manufacturer. The coating shall provide a finish which is resistant to pencils, pens, felt tip markers, and spray paint.
- D. Signs shall be mounted with double-stick tape.
- E. The products of the following manufacturers are acceptable provided they meet the materials and construction specified and are installed as specified hereinafter:
 - 1. Architectural Graphics, Inc.
 - 2. Best Manufacturing Company
 - 3. Mohawk Sign Company
 - 4. Signs, Letters & Nameplates, Inc. (SL & N)
 - 5. Pre-approved equal.

- F. The products of other manufacturers are acceptable provided they meet or exceed the materials and construction requirements as specified.

2.4 INTERNATIONAL SYMBOL OF ACCESSIBILITY (ISA)

Provide "International Symbol of Accessibility" in conformance with ADAAG Section 703.6 and Section 703.7 requirements and in locations shown on drawings. See DCAB Interpretive Opinions for further clarification.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Installation of all signage shall be in strict accordance with manufacturer's printed instructions and accepted shop drawings. Installation shall be accomplished by experienced mechanics and in a workmanlike manner.
2. Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
3. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance in accordance to ADAAG Section 703.4.

- B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using double-stick tape.

3.2 CLEANING AND PROTECTION

At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Engineer. Remove all tools, equipment, debris, and surplus materials.

END OF SECTION

SECTION 10617

OPERABLE PARTITIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Provide all operable partitions including tracks, seals, and accessories of the acoustical ratings specified.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's technical product data and installation instructions substantiating that all products comply with requirements.
- C. Shop Drawings: Submit shop drawings which clearly show all components of the operable partitions and how they attach and relate to all adjoining work. Include track attachment and all associated work to achieve the specified acoustical ratings. Indicate loading to be imposed on the supporting structure.
- D. Samples: Submit 4 samples of panel finish for selection by the Engineer.
- E. Certification: Submit certifications of STC ratings specified.
- F. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.
- G. Operations and Maintenance Manual: Submit operations and maintenance manuals covering all materials provided under this section.

1.3 QUALITY ASSURANCE

- A. The contract drawing details are intended only as a guide to the installation and operation of the partitions. If modifications are necessary for the partition being proposed, the complete installation details must be included and the Contractor shall be responsible to ensure that any necessary building modifications are planned for and made at no additional cost to the State.
- B. Coordination: Furnish inserts and anchoring devices which must be built into other work for installation of operable partitions. Coordinate delivery with other work to avoid delay.
- C. The operable partitions herein specified shall be furnished and installed by an authorized local distributor licensed by the operable partition manufacturer. Local distributor is required to ensure prompt project coordination and future customer service.

- D. Preparation of the opening shall conform to the criteria set forth per ASTM E 557, "Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions". The partition STC (Sound Transmission Classification) shall be achieved per the standard test method ASTM E 90. Noise isolation classifications shall be achieved per the standard test methods ASTM E 336 and ASTM E 413.
- E. Acoustical performance shall be tested at a laboratory accredited by the U.S. Dept. of Commerce, National Institute of Standard and Technology, and in accordance with ASTM E 90 Test Standards.
- F. Operable partitions are typically a long-lead time material and submittals and ordering shall be accomplished as expeditiously as possible.

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver materials to project site in the manufacturer's original, unopened, and undamaged packages with labels legible and intact. Provide labels to indicate the manufacturer, brand name, size, finish, and placement location. Store operable partitions and accessories in unopened packages in a manner that will prevent damage. Handle partition materials in accordance with manufacturer's instructions.

1.5 WARRANTY

Partitions shall be warranted against defects in material and workmanship for a period of 2 years from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Operable partitions shall be as produced by Hufcor, Modernfold, Panelfold, Kwick-Wall, or pre-approved equal.

2.2 OPERABLE PARTITION

- A. Type: Paired flat panels, multi-directional, manual operation.
- B. System Components:
 - 1. Operable partition shall be a series of paired flat panels, manually operated, top supported with operable floor seals as indicated. Size of panels shall be custom sized so that panels of equal size fit each opening. Final closure shall be accomplished with an expandable panel.

2. Panel shall be all steel construction, nominal 3-inch thick in manufacturer's standard panel widths (48-inch maximum). All panel framing elements, horizontally and vertically shall be formed steel. Frame shall be fully unitized with overlapped and welded corners to create a rigid structure independent of panel skin and facing materials. Panel shall have a protective edge which fully surrounds and protects the edges of the surface material.
 3. Panel skin shall be 1/2-inch fire core C gypsum board with manufacturer's standard wall covering, minimum 12 ounces per linear yard, Woentex III or pre-approved equal.
 4. Sound Seals shall be as follows:
 - a. Vertical interlocking sound seal between panels shall be required in each panel edge and be of a reversible tongue and groove configuration. Astragals shall be steel for maximum durability. Rigid plastic astragals are not acceptable.
 - b. Horizontal top seals shall be low-friction continuous-contact extruded vinyl sweeps with pairs of non-contacting vinyl fingers to prevent distortion and no operating parts as required to achieve acoustical rating.
 - c. Operable Floor Seals: Automatic operable bottom seals providing nominal 2-inch operating clearance with an operating range of plus 1/2-inch to minus 1-1/2 inch.
 5. Suspension System for Partitions: As necessary for STC rating specified.
 - a. Track shall be roll formed steel or extruded aluminum track as standard with the manufacturer as indicated. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 0.38-inch diameter threaded rods. Brackets must support the load bearing surface of the track.
 - b. Exposed track soffit shall be steel, integral with track, off-white pre-painted.
 - c. Panels shall have carriers of low-friction polymer reinforced with steel.
- C. Operable partitions shall have not less than an STC rating of 52 when tested in accordance with ASTM E 90.

2.3 POCKET DOORS

- A. Type: Doors hinged to jambs as indicated.
- B. System Components:
 1. Panels shall be manufacturer's standard width. All panel horizontal and vertical framing elements shall be formed steel.

2. Panel skin shall be gypsum board, class "A" rated single material or composite layers continuously bonded to panel frame with wall covering to match operable partition.
 3. Panel hinges shall be color coordinated full leaf butt hinges, attached directly to panel frame. Welded hinge anchor plates within panel shall further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragal are not acceptable.
 4. Pocket door jambs shall be continuous channels anchored to a fixed wall. Welded hinge anchor plates shall support pocket door hinges to permit a full 180-degree swing.
- C. Pocket doors shall have not less than STC rating of 52 when tested in accordance with ASTM E 90.

PART 3 - EXECUTION

3.1 INSPECTION

Inspect flooring to determine that surfaces are level and allow for proper operation and acoustical sealing of bottom seals. Inspect overhead support and adjoining partitions for support and connection of operable partitions. Report all discrepancies to the Contractor with a copy to the Engineer so that correction can be made under this contract prior to installation of operable partitions.

3.2 INSTALLATION

- A. The operable partitions and pocket doors shall be neatly fitted to building conditions, erected in a rigid and substantial manner, straight and plumb with horizontal lines level. Installer shall be an authorized factory trained installer. Installation shall be in accordance with approved shop drawings and in accordance with ASTM E 557 installation procedures.
- B. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.3 CLEAN UP

All cartons and rubbish shall be removed and work left broom clean. Minor blemishes and defects shall be touched up. Defects that cannot be repaired to the satisfaction of the Engineer shall be replaced with new to match accepted materials.

3.4 DEMONSTRATION

Demonstrate proper operation and maintenance to the State.

END OF SECTION

SECTION 10800

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The extent of each type of toilet accessory is shown on the drawings and herein specified.
- B. Related Work Described Elsewhere:
 - 1. Coordinate surface applied and through partition accessories with Section 10161 - SOLID COLOR REINFORCED COMPOSITE TOILET PARTITIONS AND URINAL SCREENS.
 - 2. Electrical connections for electric hand dryers are specified in DIVISION 16 - ELECTRICAL.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: For information only, submit copies of manufacturer's specifications and installation instructions for each toilet accessory.
- C. Schedule: Submit a schedule listing types, quantities, and installation locations by room for each toilet accessory to be provided.
- D. Samples: When requested, submit full-size samples of units to the Engineer for review of finishes. Acceptable samples will be returned and may be used in the work. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.3 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish inserts and anchoring devices for toilet accessories. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
- B. The structural strength of all grab bars, shower seats, and all fasteners and mounting devices shall meet or exceed the accessibility requirements of Americans with Disabilities Act Accessibility Guidelines (ADAAG) Section 609.8.

C. Products:

1. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas, wherever possible.
2. Coordinate with the Engineer for acceptable designs and finishes.
3. Stamped names of labels on exposed faces of units will not be permitted, except where otherwise specified.
4. Provide locks where specified or standard with the manufacturer. One key shall fit all locks of one brand. Provide a minimum of 4 keys.

D. Accessibility: Mount accessories for accessible toilets in accordance with ADAAG Sections 308.1, 309.1, 603.3, 603.4, 604.5, and 604.7, where either in an accessible stall or accessible by all.

E. Drawings may be general in nature. Accessories shown for one stall or room shall be repeated in similar stalls or rooms unless noted otherwise.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

B. Handle manufactured materials as recommended by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: AISI, Type 302/304. Provide satin finish, unless otherwise specified.

B. Galvanized Steel Mounting Devices: Hot-dip galvanized after fabrication ASTM A 123/A 123M.

2.2 LIST OF TOILET ACCESSORIES (Refer to drawings for locations)

A. For convenience and to establish standards of quality and design, the following list indicates items manufactured by Bobrick Washroom Equipment Co. Equivalent products of the following manufacturers will be accepted:

1. Bradley Corp., Washroom Accessories Division.
2. McKinney Parker Products Co.

3. Pre-approved equal.
- B. The products of other manufacturers are acceptable provided they meet or exceed the materials and construction requirements as specified.
 - C. Toilet Paper Holder (TPH): B-2888, surface-mounted, and B-3888, recess mounted, stainless steel with satin finish, multi-roll as indicated. Provide one per compartment as noted.
 - D. Toilet Seat Cover Dispenser (TSCD): B-221, surface mounted, and B-301, recess mounted, for single or half-fold toilet seat covers as indicated.
 - E. Wall Mounted Soap Dispenser (SD): 818615, wall mounted, capacity 40 fluid ounces, vandal resistant.
 - F. Grab Bars (GB): B-5806 Series, with concealed mounting and snap flange covers, 1-1/4 inch outside diameter, extra heavy stainless steel grab bar, peened gripping finish surface. Anchor plate with vandal-proof set screws. Provide sizes indicated. Provide manufacturer's metal backer plates 2562 series as applicable and appropriate stainless steel mounting kits for substrate. Provide as shown on the drawings.
 - G. Tilt Mirror: B-293 Series, with stainless steel angle frame members, full width stainless steel piano hinge welded to bottom of frame; 24 by 36-inches unless indicated otherwise.
 - H. Mop and Broom Holder with Shelf (MBH): B-239 x 34, surface mounted; stainless steel with 3 anti-slip mop holders with spring-loaded cam grips, and 4 hooks and shelf.
 - I. Towel Pin: B-677.
 - J. Folding Shower Seat: B-5181, solid phenolic, configuration as indicated conforming to ADAAG Section 608.4.
 - K. Electric Hand Dryer: B-778, surface mounted, 115 V single phase, chrome finish cover, infrared sensor automatic control.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine the areas and conditions under which toilet accessories are to be installed. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

- B. Determine that all blocking and concealed backer plates have been installed to allow mounting of accessories.

3.2 INSTALLATION

- A. Use concealed fastenings wherever possible.
- B. Provide anchors, bolts, backer plates, and other necessary fasteners, and attach accessories securely to walls and partitions in locations as shown or directed.
- C. Install concealed mounting devices and fasteners fabricated of the same material as the accessories or of galvanized steel.
- D. Install exposed mounting devices and fasteners finished to match the accessories.
- E. Provide theft-resistant fasteners for all accessory mountings.
- F. Secure toilet room accessories to adjacent walls and partitions complying with the manufacturer's instructions for each item and each type of substrate construction.
- G. Where accessories transition uneven substrates such as between ceramic tile wainscote and wall surface above, provide finish wood spacers to completely fill all voids. Finish to match wall surface or as directed.

3.3 CLEAN UP

Clean surfaces as recommended by the manufacturer and restore damaged work to its original condition or replace with new.

END OF SECTION

DIVISION 11 - EQUIPMENT

SECTION 11414

STAINLESS STEEL COUNTERTOPS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide stainless steel counters where indicated.
- B. Related Work Described Elsewhere: Plywood substrates are specified under Section 06200 - FINISH CARPENTRY.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Shop Drawings: Submit shop drawings of shop-fabricated counters and framing, indicating materials, thicknesses, profiles, dimensions, and anchoring methods. Details shall be minimum 3-inch scale.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle materials in strict conformance of the manufacturer's instructions and recommendations.

PART 2 - PRODUCTS

2.1 PRODUCT/MATERIAL

- A. Stainless Steel Sheets: ASTM A 167 and ASTM A 1008/A 1008M, Type 304, with a No. 4 finish on all visible surfaces. Gages specified are U.S. Standard.
- B. Counters and Splashes: Counters and splashes shall be 14 gauge stainless steel unless indicated otherwise in profiles as shown on the drawings.

2.2 FABRICATION

- A. General: In joining pieces of similar metal, fastening devices and metal used for welding shall be of the same material as the metal being joined. When a corrosion resisting material is joined to a dissimilar metal, fastening devices and metal used for welding shall be corrosion resisting steel.

- B. **Welding:** Welds shall be strong and ductile, with excess metal on exposed working surfaces ground off and joints finished smooth to match adjoining surfaces. Welds shall be free of pits, runs, spatter, and cracks, and shall have the same color as the adjoining surfaces. Joints in top of counter may be welded by any process other than by carbonarc welding or any process that permits carbon pickup. Butt welds made by welding straps under seams, filled with solder, and grinding will not be acceptable. Welded joints shall be homogenous with the sheet metal. In no case shall spot welding be substituted for full welding. Wherever unexposed welds occur on surfaces not finished by grinding or polishing, such welds and the accompanying discoloration shall be suitably coated in the shop with a metallic-base paint in such a manner as to prevent the possibility of progressive corrosion of such joints.
- C. **Soldering:** Corrosion-resisting steel requiring soldering shall be first thoroughly cleaned of discoloration and shall then have a suitable soldering flux applied. After the soldering has been completed, excess or remaining flux shall be washed clean, and the entire soldered joint and adjacent metallic surfaces cleaned with a liquid alkaline or neutralizing reagent to prevent any attack on the surrounding surfaces by the soldering flux. In no case shall soldering be relied upon for the stability of seams or joints. The soldering shall serve only as a filler to prevent leakage. Soldering shall not be considered as replacing welding or brazing.
- D. **Grinding, Polishing, and Finishing:** Exposed welded joints shall be ground flush with the adjoining material and finished to match the adjoining surface. Wherever material has been depressed or sunken by a welding operation, such depression shall be hammered and peened flush with the adjoining surface and if necessary, again ground to eliminate low spots. Ground surfaces shall then be polished or buffed to match adjoining surfaces. In grinding operations, care shall be exercised to avoid excessive heating of the metal and metal discoloration. Abrasives, wheels, and belts used in grinding shall be iron free and shall not have been used on carbon steel. In all cases, the grain of rough grinding shall be removed by several successively finer polishing operations. The texture of the final polishing operation shall be uniform and smooth. Butt joints and contact joints, wherever such joints occur, shall be close fitting and shall not require solder as a filler. Wherever brake bends occur, the bends shall be free of open-texture or orange-peel appearance. Where brake mark does mar the uniform appearance of the material, such marks shall be removed by suitable grinding, polishing, and finishing. Sheared edges shall be free of burrs, projections, and fins. Where miters or bull-nosed corners occur, such miters and corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition, and in no case will overlapping material be acceptable.
- E. **Protection Against Corrosion:** Wherever a welding operation occurs on corrosion-resisting steel, the possibility of corrosion shall be entirely eliminated. Bolts and screws may be welded by any accepted process that will minimize the possibility of carbide precipitation.

PART 3 - EXECUTION

3.1 INSTALLATION

Install stainless steel counters, including fittings, in accordance with approved shop drawings.

1. Cutting and Patching of Construction: Work shall be carefully laid out in advance. Cutting shall be carefully done, and damage to finishes, building, piping, and equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved.
2. Setting and Connecting: Counters, sink, and shelves shall be installed plumb and level. Counters shall be securely fastened to adjoining construction as indicated.
3. Trim and Sealants: Seal counters to walls with elastomeric type mastic sealing compound as specified in Section 07920 - SEALANTS. All contact fillers shall be continuous, without opening.

3.2 CLEANING

Prior to acceptance of the project, clean all exposed surfaces of counters and other stainless steel surfaces and leave free of defects, damage, and blemishes.

END OF SECTION

DIVISION 12 - FURNISHINGS

SECTION 12494

ROLLER SHADES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Provide manually operated sunscreen roller shades.
- B. Related Work Described Elsewhere:
 - 1. Section 06100 - ROUGH CARPENTRY: Wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 08520 - ALUMINUM WINDOWS: Coordinate with windows for inside mounting where indicated.
 - 3. Section 09250 - GYPSUM WALLBOARD: Coordination with gypsum board assemblies for installation of closures and related accessories.
 - 4. Section 09510 - ACOUSTICAL CEILING: Coordination with acoustical ceiling systems for installation of closures and related accessories.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
 - 3. Storage and handling requirements and recommendations.
 - 4. Mounting details and installation methods.
- C. Shop Drawings: Submit plans, elevations, sections, product details, installation details, operational clearances, and relationship to adjacent work.

- D. Window Treatment Schedule: Submit for all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- E. Selection Samples: Submit for each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: Submit for each finish product specified, 4 complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.
- G. Maintenance Data: Submit documentation on methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- H. Warranty: Submit warranty as stipulated in item entitled "WARRANTY" hereinbelow.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of 10 years experience in manufacturing products comparable to those specified in this section.
- B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of 10 years experience in installing products comparable to those specified in this section.
- C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings.

1.5 PROJECT CONDITIONS

Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.6 WARRANTY

- A. Roller Shade Hardware, Chain, and Shadecloth: Manufacturer's standard non-depreciating 25 year limited warranty.
- B. Roller Shade Installation: One year from date of Project Acceptance, not including scaffolding, lifts or other means to reach inaccessible areas.
- C. The Surety shall not be held liable beyond 2 years from the project acceptance date.

PART 2 - PRODUCTS

2.1 ROLLER SHADES

Provide roller shades as manufactured by MechoShade Systems or equivalent by Hunter Douglas, DOW, or pre-approved equal of the following type:

Shade Type 1: Manual operating, chain drive, sunscreen roller shades in all exterior windows of rooms and spaces shown on the Drawings.

2.2 SHADE CLOTH

Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., ThermoVeil group, single thickness non-raveling 0.030-inch thick vinyl fabric, woven from 0.018-inch diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.

Dense Linear Weave: "1500 series", 3 percent open, dense linear-weave pattern.

2.3 SHADE BAND

Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

- 1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade Band and Shade Roller Attachment:

- a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55-inch in diameter for manual shades, and less than 2.55-inches for motorize shades are not acceptable.
- b. Provide for positive mechanical engagement with drive/brake mechanism.
- c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable/replaceable with a "snap-on" "snap-off" spline mounting, without having to remove shade roller from shade brackets.
- d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
- e. Any method of attaching shade band to roller tube that requires the use of adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.4 SHADE FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8-inch in either direction per 8-feet of shade height due to warp distortion or weave design. Fabricate with:
 1. Bottom hem weights.
 2. Concealed hemtube.
- C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Engineer. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

- E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

2.5 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and/or polyester, or reinforced polyester will not be acceptable.

B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.

7. Provide shade hardware constructed of minimum 1/8-inch thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
 8. Drive Bracket/Brake Assembly:
 - a. MechoShade Drive Bracket model M5 or equivalent shall be fully integrated with all MechoShade accessories, including, but not limited to, SnapLoc fascia, room darkening side/sill channels, center supports and connectors for multi-banded shades.
 - b. Drive sprocket and brake assembly shall rotate and be supported on a welded 3/8-inch steel pin.
 - c. The brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 pounds in the stopped position.
 - d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
 - e. The entire drive bracket assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
- D. Drive Chain: #10 qualified stainless steel chain rated to 90 pound minimum breaking strength. Nickel plate chain shall not be accepted.

2.6 ACCESSORIES

Fascia:

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket/fascia end caps where mounting conditions expose outside of roller shade brackets.

5. Notching of Fascia for manual chain shall not be acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2-inches to interior face of glass. Allow proper clearances for window operation hardware.
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- D. Engage Installer to train State's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Project Acceptance.

END OF SECTION

DIVISION 13 – SPECIAL CONSTRUCTION

SECTION 13280

REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials, and equipment necessary to carry out the safe removal and disposal of all asbestos containing materials (ACM) and suspected ACM as necessary for the safe performance of the abatement Project in compliance with the Specifications and all applicable Federal, State and Local laws and regulations. If there is a conflict with the requirements, the more stringent requirement shall apply. Ignorance of the above requirements and any applicable regulations resulting in additional cost to the Contractor shall not be reimbursable or billable to the State. Any question regarding conflict or inconsistency between Specification and/or regulations should be directed to the Engineer.
- B. The asbestos abatement work shall include, but may not be limited to:
 - 1. Removal and disposal of ACM from the areas affected by the Project. ACM is identified the *Limited Hazardous Materials Survey Report, Department of Land & Natural Resources (DLNR), Maui Office Annex Building, Maui, Hawaii*, dated March 16, 2015, prepared by EnviroServices & Training Center, LLC.
 - 2. The Contractor is responsible for conducting his own site visit to verify all quantities and material locations.

1.2 REFERENCES

- A. 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:
- B. 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
 - 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

C. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 560/5-85-024 Guidance for Controlling ACM in Buildings

D. 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

E. 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

F. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

G. UNDERWRITERS LABORATORIES INC. (UL)

UL 586 (1990) High-Efficiency, Particulate, Air Filter Units

1.3 DEFINITIONS

A. Abatement: Procedure to control fiber release from asbestos containing material.

1. 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.
2. Post-Removal Surface Encapsulation: Procedures necessary to coat surfaces from which ACM have been removed to control any residual fiber release.

B. 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.

C. Asbestos: The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered.

- D. Asbestos Containing Material (ACM): Materials that contain more than one percent asbestos as determined by Polarized Light Microscopy or Transmission Electron Microscopy.
- E. 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.
- F. Asbestos Fibers: Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by NIOSH Method 7400.
- G. 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.
- H. 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.
- I. Certified Asbestos Project Monitor: The independent third party person or persons hired by the General Contractor, who performs inspection activities during abatement work and shall have the authority to initiate engineering controls. The Certified Asbestos Project Monitor must have an active asbestos certification from the State of Hawaii Department of Health and shall not be an employee of the abatement entity performing the abatement.
- J. 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.
- K. Competent Person: As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of asbestos hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the asbestos hazards.
- L. 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.
- M. 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.
- N. Fixed Object: A unit of equipment or furniture in the work area which cannot be removed from the work area without dismantling.
- O. Friable Asbestos Material: ACM that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

- P. 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.
- Q. 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.
- R. 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).
- S. Qualified Testing Laboratory – Asbestos: An independent laboratory retained by the Contractor. The Laboratory shall be accredited by the American Industrial Hygiene Association (AIHA) for each type of asbestos analysis performed by the laboratory.
 - 1. Environmental and Work Area Monitoring Laboratory – The testing laboratory employed by the Contractor to perform analysis of environmental and work area air monitoring samples and report concentrations of airborne asbestos.
 - 2. Personal Air Monitoring Laboratory – The testing laboratory utilized by the air monitoring firm retained by the Contractor to perform analysis of personal air monitoring samples and report airborne concentrations of asbestos. Collection of the Contractor’s OSHA personal air samples will be performed by a firm independent of the Contractor, at the Contractor’s expense.
- T. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.
- U. 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.

1.4 ABBREVIATIONS

- A. ANSI: American National Standards Institute, Inc.
- B. CFR: Code of Federal Regulations
- C. HIOSH: Division of Occupational Safety and Health, Department of Labor and Industrial Relations, State of Hawaii
- D. EPA: U.S. Environmental Protection Agency
- E. NESHAP: National Emission Standards for Hazardous Air Pollutants

- F. NIOSH: National Institute for Occupational Safety and Health
- G. OSHA: Occupational Safety and Health Administration
- H. The State: The State of Hawaii

1.5 AUTHORITY TO STOP WORK

- A. The Engineer and Certified Asbestos Project Monitor have the authority to stop the abatement work at any time they determine that conditions are not within the drawing/specification requirements and applicable regulations. The work stoppage shall continue until corrective steps have been taken and specified conditions restored to the satisfaction of the Engineer and Certified Asbestos Project Monitor. 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:
 - 1. Excessive airborne fibers inside (>0.5 f/cc) and/or outside (>0.01 f/cc) the work area.
 - 2. Visible emissions of dust or debris going beyond the work area boundaries.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Detailed Schedule: Submit the actual start date and completion dates for each phase of the asbestos removal.
- C. 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 Hawaii Administrative Rules, Title 11, 501. Send notice with copies to the Engineer, Certified Asbestos Project Monitor and to the following agencies:

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.
- D. 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 Engineer or Certified Asbestos Project Monitor.
- E. Landfill Approval: Submit written evidence that the landfill for disposal is approved for asbestos disposal by the EPA and Hawaii regulatory agency(s).
- F. 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.

G. Samples: Submit samples of the following items for approval prior to ordering materials:

1. Asbestos Encapsulant(s): Copies of manufacturer's literature including all laboratory data, MSDS, and application instructions.
2. Plastic Sheeting: Three 8-1/2 by 11-inch pieces of each thickness and type with labels indicating actual mil thickness.
3. Surfactant: Copies of manufacturer's literature including all laboratory data, MSDS, and mixing and application instructions.
4. Tapes and Adhesives: Copies of manufacturer's literature including all laboratory data.
5. Warning labels and signs.
6. 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.
7. 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.

H. Shop Drawings: Submit no later than 10 consecutive working days from award notice, copies of shop drawings for the following items as a minimum:

1. Description of any equipment to be employed not discussed in this Section.
2. Security provisions, if any, in and around the project area.
3. Outline of work procedures to be employed.
4. Location and construction of all airtight barriers.
5. Staging of the work.
6. Entrances and exits to the work place.
7. Location and construction of worker and equipment decontamination units.
8. Type of respiratory protection to be used.
9. Water filtration system for all contaminated water.
10. Existence and location of negative air exhaust ports and containment.

- I. **Asbestos Abatement Plan:** Contractor shall develop, submit for approval to the Engineer no later than 10 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 a State of Hawaii Certified 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 Engineer shall meet prior to the start of work to discuss in detail the standard operating procedures. Once approved by the Engineer, the plan will be enforced as if an addition to the Specification.
- J. **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 Hawaii Administrative Rules, Title 11, 504 and 40 CFR Part 763, "Asbestos Materials in Schools". These courses shall be approved by the State of Hawaii Department of Health in the most current listing of the Federal Register. Also submit documentation that all individuals have current certification for the appropriate course from the State of Hawaii. No worker shall be allowed on site if they are found to have either an expired certification or do not comply with the requirements set forth in Hawaii Administrative Rules, Title 11, 501-504 and 40 CFR Part 763 on training. The Contractor shall be responsible for keeping the documentation up to date and submitting subsequent documentation to the Engineer before any additional employee or individual, not currently on the list, is allowed within the project site.
- K. **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 12-145.1 Appendix C, Qualitative and Quantitative Fit Testing.
- L. **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.

- M. 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.
- N. 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.
- O. 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.
- P. 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.
- Q. 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.
- R. 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 Engineer.
- S. Testing Laboratory: Submit no later than 10 consecutive working days from notice of award name, address and telephone number of testing laboratory responsible for analysis and report of airborne fiber concentration for compliance with HIOSH 12-145.1 and this specification, 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).
- T. Emergency Planning and Procedures: The Contractor shall submit an emergency plan prior to abatement initiation for review and acceptance by the Engineer.
 - 1. 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.

2. 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.
 3. 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.
- U. 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 Certified Asbestos Project Monitor weekly:
1. Date of visit.
 2. Visitor's name, employer, business address, and telephone number.
 3. Time of entry and exit from work area.
 4. Purpose of visit.
 5. Type of protective clothing and respirator worn.
 6. Certificate of release signed and filed with the Contractor.
- V. Field Test Reports
1. Employee Exposure Sampling Results: Submit test results to the Certified Asbestos Project Monitor, the Engineer and the affected Contractor's employees within three (3) working days, signed by the testing laboratory employee performing the analysis.
 2. Asbestos Disposal Quantity Report.
 3. Qualified Testing Laboratory shall submit air monitoring reports directly to the Certified Asbestos Project Monitor
- W. 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.

1.7 PRODUCT HANDLING

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 Engineer. 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.

1.8 PROTECTION

A. Site Security

1. The work area is to be restricted only to authorized, trained and protected personnel. These may include the Contractor's employees, the Engineer, the Certified Asbestos Project Monitor, State and local inspectors and any other designated individuals. A list of authorized personnel shall be established prior to job start.
2. Entry to the work area by unauthorized individuals shall not be permitted without the express approval of the Certified Asbestos Project Monitor and any such entry shall be reported immediately to the Certified Asbestos Project Monitor by the Contractor.
3. A Visitor/Worker Entry Log shall be maintained.
4. The Contractor shall have control, subject to approval of the Certified Asbestos Project Monitor, of security in the work area and in proximity of Contractor's equipment and materials.

B. 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.

C. Protective Covering: The Contractor shall provide and install protective covering as required or upon request by the Certified Asbestos Project Monitor. Protective covering shall be unused plastic sheets.

D. Safeguarding of Property: The Contractor shall take whatever steps necessary to safeguard his work area, any property of the State, 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.

1.9 ADDITIONAL REQUIREMENTS

A. 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:

1. Hawaii Administrative Rules, Title 11, Chapters 501, 502, 503 and 504;
 2. Title 29 Code of Federal Regulations Part 1926.62; Safety and Health Standards;
 3. Title 29 Code of Federal Regulations Part 1926.1101; Asbestos;
 4. Title 29 Code of Federal Regulations Part 1910.134; Respiratory Protection;
 5. Title 40 Code of Federal Regulations Part 261; Identification and Listing of Hazardous Waste;
 6. Title 40 Code of Federal Regulations Part 262; Standards Applicable to Generators of Hazardous Waste;
 7. Title 40 Code of Federal Regulations Part 263; Hazardous Waste Transporters;
 8. Copies of any other applicable Federal, State and local regulations, standards, documents and codes;
 9. 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;
 10. 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;
 11. 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;
 12. Copies of the Contractor's Respiratory Protection Program, Hazardous Communication Program, Safety Program and Asbestos Abatement Plan;
 13. Copies of Material Safety Data Sheets for all chemicals used;
 14. Copies of all relevant certificates held by abatement workers and abatement contractors/supervisors actively engaged in the abatement project;
 15. Certification of the Project Designer who wrote procedures for the job;
 16. 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
 17. Records of all air sampling as required in HIOSH section 12-145.1-5.
- B. Whenever approval of the Certified Asbestos Project Monitor is required prior to proceeding with other work, the Contractor shall comply with the following:

1. The Contractor shall give, at a minimum, five (5) days notification to the Certified Asbestos Project Monitor prior to the start of any asbestos work.
2. The Contractor shall not begin any work without the Certified Asbestos Project Monitor present onsite.
3. The Contractor shall allow the Certified Asbestos Project Monitor 24 hours from notification to respond to the request for site inspection(s).
4. The Contractor shall 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 Engineer prior to commencing work. Requests from any other person will not be considered official requests.
5. The designated person requesting an inspection shall provide the following information:
 - a. Name of caller.
 - b. Building and rooms to be inspected.
 - c. Work phase of inspection, as specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plastic Sheeting: 6-millimeter-minimum-thickness polyethylene film.
- B. 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

- C. 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.
- D. 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.

- E. Encapsulant: The encapsulant shall be capable of being applied to surfaces of ACM and surfaces from which ACM has been removed to control the possible release of asbestos fibers. The encapsulant shall be capable of either creating a membrane over the surface (i.e. a bridging encapsulant) or penetrating into the material and binding its components (i.e. a penetrating encapsulant) and shall be compatible with the existing finishes.
- F. 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.
- G. Surfactant (Wetting Agent): 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether, or pre-approved equal, and shall be mixed with water to provide a minimum concentration of one ounce of surfactant to five (5) gallons of water.
- H. Warning Labels, Tape and Signs: As required by OSHA 29 CFR 1926.1101 and HIOSH regulation 12-145.1.
- I. Protective Clothing: The Contractor shall have all the coveralls required for this Project on site prior to the start of work.
- J. 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.

2.2 TOOLS AND EQUIPMENT

- A. Provide sufficient and suitable tools for the asbestos abatement procedures, including but not limited to:
 - 1. Water Sprayer: Airless or pressure sprayer for amended water application as applicable.
 - 2. Paint/Encapsulant Sprayer: Airless type only.
 - 3. HEPA vacuum.
 - 4. Negative Air Pressure Units: Portable “exhaust units with air purification equipment in accordance with “Guidance for Controlling Asbestos Containing Materials in Buildings” (the Purple Book) EPA 560/5-85-024 June 1985, Appendix J – Recommended Specifications and Operating Systems Procedures for the Use of Negative Air Pressure Systems for Asbestos Abatement. Ensure that at least one functional back-up negative air pressure unit is on-site.
 - 5. 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 Certified Asbestos Project Monitor, the Engineer and other inspectors. Scaffold joints and ends shall be sealed with tape to prevent migration of asbestos fibers.

6. 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.
7. 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.
8. Other tools and equipment as necessary.

2.3 ELECTRICAL EQUIPMENT PROTECTION

- A. Non-current carrying metal parts of the Contractor's 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. All light and power circuits in the asbestos removal area shall be protected by ground fault circuit interrupters.
- B. 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.
- C. As necessary, 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.

2.4 PERSONAL PROTECTION REQUIREMENTS

- A. 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.
- B. Personal Protective Equipment (PPE):
 1. 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.
 2. 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.

3. 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.

PART 3 - EXECUTION

3.1 DECONTAMINATION AREA

- A. The decontamination area as outlined below shall be employed during removal work involving only exterior materials that do not extend to the interior, where all work is performed from the exterior and the work area is fully sealed off from the interior.
- B. General: The Contractor shall construct the decontamination area, acceptable to the Certified Asbestos Project Monitor, 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.
- C. Access: In all cases, access between contaminated rooms or areas and clean rooms or areas shall be through the decontamination system.
- D. Cleaning: 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.
- E. 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.

3.2 DECONTAMINATION ENCLOSURE SYSTEM

- A. The decontamination enclosure system as outlined below shall be employed during any abatement work involving indoor materials, including materials extending from the exterior to the interior such as window or vent sealant, except where openings to the interior are fully sealed and all work is performed from the exterior of the building.
- B. General: The Contractor shall construct the decontamination enclosure system or use portable units acceptable to the Certified Asbestos Project Monitor that are connected to the work area with framed-in or accordion tunnels. The Contractor shall line all tunnels with 6-mil plastic and shall seal this lining with tape at all joints. All vertical surfaces subject to observation from the exterior, non-contaminated areas shall be constructed of opaque materials.

- C. Access: In all cases, access between contaminated rooms or areas and the decontamination enclosure unit shall be through an airlock. In all cases, access between any two rooms/areas within the decontamination enclosure unit shall be through a curtained doorway.
- D. Decontamination Unit: Provide personnel decontamination unit within the asbestos control area in an area approved by the Certified Asbestos Project Monitor. The Unit shall contain the following:
 - 1. An Equipment Area with two doorways, one leading to the Work Area and another leading to the Shower Area
 - 2. A Shower Area with two doorways, one leading to the Equipment Area and another leading to the Clean Area. An adequate supply of soap shall be maintained within this Shower Area. The Contractor must ensure that no leakage from the shower area occurs and that all wastewater shall be disposed of as contaminated or filtered through the wastewater filtering system.
 - 3. A Clean Area with two doorways, one leading to the Shower Area and another leading to a non-contaminated area outside the asbestos work area. The Clean Area shall have sufficient space for storage of any worker's and agent's street clothes, personal effects and other non-contaminated items.

3.3 NEGATIVE PRESSURE SYSTEM

- A. The negative pressure system outlined below shall be employed for all interior asbestos abatement work, including materials extending from the exterior to the interior such as window or vent sealant, except where openings to the interior are fully sealed and all work is performed from the exterior of the building.
- B. Local Exhaust System: Provide a local exhaust system in the asbestos control area in accordance with ANSI Z9.2 and 29 CFR 1926.1101 that will provide at least six air changes per hour within the negative enclosure. Local exhaust equipment shall be operated continuously until the asbestos control area is removed and shall be leak proof. To lengthen the life of the HEPA filter, the local exhaust system shall be equipped with a 10 micron particle arrestance pre-filter, a 5 micron particle arrestance secondary filter placed ahead of the HEPA filter. Maintain a minimum pressure differential in the work area of (-)0.08 inches of water gauge relative to the air pressure outside the work area. HEPA filters shall conform to ANSI Z9.2 and UL 586.
- C. Location of Exhaust Units: Locate units to ensure that the flow of air moves from the decontamination unit and passes through as much of the work area as is possible. The local exhaust system shall not terminate in an occupied space or near a ventilation intake.
- D. Filter Replacement: Change filters in the local exhaust units in accordance with the manufacturer's recommendations or when there is a loss of negative pressure. With the unit in operation change the prefilter and check for pressure drop. If the pressure drop remains, with the unit in operation change the secondary filter. If the pressure drop still remains,

stop work, shut off the unit and replace the HEPA filter as per the manufacturer's recommendations. All used filters are to be disposed of as asbestos waste.

3.4 WASTEWATER FILTERING SYSTEM

- A. All wastewater shall be treated as contaminated with asbestos and shall be filtered. All filtered wastewater shall then be removed from the site by the Contractor and disposed of in accordance with Federal, State, and local wastewater disposal regulations. No onsite disposal will be permitted.
- B. The wastewater 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.
- C. 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.
- D. 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.
- E. When the final filters become clogged, remove the filters, replace with new, and dispose of the clogged filters as contaminated waste.
- F. 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.

3.5 WORK AREA PREPARATION

- A. 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.
- B. Inspection of 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.
- C. Critical Barrier Enclosures: Cover all openings including, but not limited to, glazed openings, doors, corridors, ducts, grilles, floor drains or plates, diffusers, vents, windows, electrical outlets, and any other penetrations to the work areas with two layers of 6-mil plastic and seal with tape.

- D. Decontamination System: Provide a decontamination area as described in section 3.1 for exterior work and decontamination enclosure system as described in section 3.2 for interior work.
- E. Pre-Cleaning/Wet-Wiping:
 - 1. Pre-clean fixed objects within the work area by using HEPA vacuum equipment and then wet-wiping as appropriate. All such fixed object will then be covered in 6-mil plastic sheeting and sealed with tape.
 - 2. Clean the work area using HEPA vacuum equipment and the wet-wiping as appropriate. Do not use dust generating methods such as dry sweeping or non-HEPA vacuuming.
- F. 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.
- G. 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.
- H. 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.
- I. 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 Engineer.
- J. 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.
- K. 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.
- L. 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 Certified Asbestos Project Monitor.
- M. 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 Engineer 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 ENGINEER FOR APPROVAL BEFORE PROCEEDING WITH THE ABATEMENT.

3.6 NOTIFICATION

After the all site preparation is completed, including but not limited to posting of warning signs, sealing, and providing of temporary facilities, notify the Certified Asbestos Project Monitor for approval prior to proceeding with abatement.

3.7 REMOVAL OF ASBESTOS CONTAINING MATERIALS

- A. Surfaces to remain in areas where asbestos containing materials will be removed shall be covered with one layer of 6-mil plastic sheeting. Ventilation intake air sources shall be isolated or the system shall be shut down.
- B. Wet the asbestos containing materials 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.
- C. Carefully remove asbestos containing 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 material.
- D. The Contractor is prohibited from using methods or removal that creates excessive amounts of dust and debris.
- E. Waste debris shall be double bagged and sealed leak-tight in properly labeled 6-mil plastic bags immediately after removal. The Contractor shall not 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.
- F. Asbestos containing roof 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.
- G. Intact asbestos containing roof 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.
- H. The Contractor shall minimize contamination of the work floor, the exterior of disposal containers, and all other surfaces within the work area.

3.8 CLEANUP

All 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.

3.9 CLEARANCE

- A. Remove all visible accumulation of ACM and debris by HEPA vacuums, sponging, and wet-wiping.
- B. The Certified Asbestos Project Monitor will visually inspect the affected areas for residual asbestos debris and waste. The Contractor shall re-clean areas showing asbestos debris and waste. If re-cleaning is required, the Certified Asbestos Project Monitor will visually inspect for asbestos debris and waste after re-cleaning. This process will be repeated until the Certified Asbestos Project Monitor deems the area free of visible asbestos debris and waste.
- C. The work area shall be totally visibly clean before the remaining material is encapsulated. After the visual inspection has been passed, encapsulate all remaining materials.
- D. The Contractor shall remove all signs, temporary barriers and materials when their use is no longer required.

3.10 DISPOSAL OF ASBESTOS CONTAINING MATERIAL

- A. 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.
- B. 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.
- C. 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. The compartments shall be thoroughly wet-cleaned and HEPA vacuumed following the disposal of each load at the approved disposal sites.
- D. Workers unloading bags at the disposal sites shall wear full body protective clothing and dual HEPA cartridge full-face air purifying respirators.
- E. 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 Certified Asbestos Project Monitor. Copies shall be submitted to the Engineer and Certified Asbestos Project Monitor 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.

3.11 PAYMENT

Payment for removal, hauling and disposal of ACM shall be made at the lump sum price bid as scheduled in the Proposal. The final payment will not be made until proper documentation of the disposal of ACM and related waste are submitted.

END OF SECTION

SECTION 13281

REMOVAL AND DISPOSAL OF ASBESTOS CEMENT PIPE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials, and equipment necessary to carry out the safe removal and disposal of all asbestos containing materials (ACM) and suspected ACM as necessary for the safe performance of the abatement Project in compliance with the Specifications and all applicable Federal, State and Local laws and regulations. If there is a conflict with the requirements, the more stringent requirement shall apply. Ignorance of the above requirements and any applicable regulations resulting in additional cost to the Contractor shall not be reimbursable or billable to the State. Any question regarding conflict or inconsistency between Specification and/or regulations should be directed to the Engineer.
- B. The asbestos abatement work shall include, but may not be limited to:
 - 1. Removal and disposal of approximately 300 linear feet of concrete ACM water main piping from the areas affected by the Project.
 - 2. The Contractor is responsible for conducting his own site visit to verify all quantities and material locations.
 - 3. The Contractor is responsible for conducting all work without disturbing ACM to remain in place

1.2 REFERENCES

- A. 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:
- B. 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
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

C. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 560/5-85-024 Guidance for Controlling ACM in Buildings

D. 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

E. 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

F. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

G. UNDERWRITERS LABORATORIES INC. (UL)

UL 586 (1990) High-Efficiency, Particulate, Air Filter Units

1.3 DEFINITIONS

A. Abatement: Procedure to control fiber release from asbestos containing material.

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. 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.

C. Asbestos: The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered.

D. Asbestos Containing Material (ACM): Materials that contain more than one percent asbestos as determined by Polarized Light Microscopy or Transmission Electron Microscopy.

- E. 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.
- F. Asbestos Fibers: Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by NIOSH Method 7400.
- G. 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.
- H. 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.
- I. Certified Asbestos Project Monitor: The independent third party person or persons hired by the General Contractor, who performs inspection activities during abatement work and shall have the authority to initiate engineering controls. The Certified Asbestos Project Monitor must have an active asbestos certification from the State of Hawaii Department of Health and shall not be an employee of the abatement entity performing the abatement.
- J. 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.
- K. Competent Person: As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of asbestos hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the asbestos hazards.
- L. 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.
- M. 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.
- N. Fixed Object: A unit of equipment or furniture in the work area which cannot be removed from the work area without dismantling.
- O. Friable Asbestos Material: ACM that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.
- P. 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.

- Q. 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.
- R. Qualified Testing Laboratory – Asbestos: An independent laboratory retained by the Contractor. The Laboratory shall be accredited by the American Industrial Hygiene Association (AIHA) for each type of asbestos analysis performed by the laboratory.
 - 1. Environmental and Work Area Monitoring Laboratory – The testing laboratory employed by the Contractor to perform analysis of environmental and work area air monitoring samples and report concentrations of airborne asbestos.
 - 2. Personal Air Monitoring Laboratory – The testing laboratory utilized by the air monitoring firm retained by the Contractor to perform analysis of personal air monitoring samples and report airborne concentrations of asbestos. Collection of the Contractor’s OSHA personal air samples will be performed by a firm independent of the Contractor, at the Contractor’s expense.
- S. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.
- T. 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.

1.4 ABBREVIATIONS

- A. ANSI: American National Standards Institute, Inc.
- B. CFR: Code of Federal Regulations
- C. HIOSH: Division of Occupational Safety and Health, Department of Labor and Industrial Relations, State of Hawaii
- D. EPA: U.S. Environmental Protection Agency
- E. NESHAP: National Emission Standards for Hazardous Air Pollutants
- F. NIOSH: National Institute for Occupational Safety and Health
- G. OSHA: Occupational Safety and Health Administration
- H. The State: The State of Hawaii

1.5 AUTHORITY TO STOP WORK

- A. The Engineer and Certified Asbestos Project Monitor have the authority to stop the abatement work at any time they determine that conditions are not within the drawing/specification requirements and applicable regulations. The work stoppage shall continue until corrective steps have been taken and specified conditions restored to the satisfaction of the Engineer and Certified Asbestos Project Monitor. 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:
 - 1. Excessive airborne fibers inside (>0.5 f/cc) and/or outside (>0.01 f/cc) the work area.
 - 2. Visible emissions of dust or debris going beyond the work area boundaries.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Detailed Schedule: Submit the actual start date and completion dates for each phase of the asbestos removal.
- C. 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 Hawaii Administrative Rules, Title 11, 501. Send notice with copies to the Engineer, Certified Asbestos Project Monitor and to the following agencies:

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.
- D. 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 Engineer or Certified Asbestos Project Monitor.
- E. Landfill Approval: Submit written evidence that the landfill for disposal is approved for asbestos disposal by the EPA and Hawaii regulatory agency(s).
- F. 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.
- G. Samples: Submit samples of the following items for approval prior to ordering materials:
 - 1. Asbestos Encapsulant(s): Copies of manufacturer's literature including all laboratory data, MSDS, and application instructions.

2. Plastic Sheeting: Three 8-1/2 by 11-inch pieces of each thickness and type with labels indicating actual mil thickness.
 3. Surfactant: Copies of manufacturer's literature including all laboratory data, MSDS, and mixing and application instructions.
 4. Tapes and Adhesives: Copies of manufacturer's literature including all laboratory data.
 5. Warning labels and signs.
 6. 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.
 7. 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.
- H. Shop Drawings: Submit no later than 10 consecutive working days from award notice, copies of shop drawings for the following items as a minimum:
1. Description of any equipment to be employed not discussed in this Section.
 2. Security provisions, if any, in and around the project area.
 3. Outline of work procedures to be employed.
 4. Location and construction of all airtight barriers.
 5. Staging of the work.
 6. Entrances and exits to the work place.
 7. Location and construction of worker and equipment decontamination units.
 8. Type of respiratory protection to be used.
 9. Water filtration system for all contaminated water.
 10. Existence and location of negative air exhaust ports and containment.
- I. Asbestos Abatement Plan: Contractor shall develop, submit for approval to the Engineer no later than 10 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 a State of Hawaii Certified 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 Engineer shall meet prior to the start of work to discuss in detail the standard operating procedures. Once approved by the Engineer, the plan will be enforced as if an addition to the Specification.

- J. 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 Hawaii Administrative Rules, Title 11, 504 and 40 CFR Part 763, "Asbestos Materials in Schools". These courses shall be approved by the State of Hawaii Department of Health in the most current listing of the Federal Register. Also submit documentation that all individuals have current certification for the appropriate course from the State of Hawaii. No worker shall be allowed on site if they are found to have either an expired certification or do not comply with the requirements set forth in Hawaii Administrative Rules, Title 11, 501-504 and 40 CFR Part 763 on training. The Contractor shall be responsible for keeping the documentation up to date and submitting subsequent documentation to the Engineer before any additional employee or individual, not currently on the list, is allowed within the project site.
- K. 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 12-145.1 Appendix C, Qualitative and Quantitative Fit Testing.
- L. 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.

- M. 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.
- N. 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.
- O. 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.
- P. 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.
- Q. 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.
- R. 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 Engineer.
- S. Testing Laboratory: Submit no later than 10 consecutive working days from notice of award name, address and telephone number of testing laboratory responsible for analysis and report of airborne fiber concentration for compliance with HIOSH 12-145.1 and this specification, 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).
- T. Emergency Planning and Procedures: The Contractor shall submit an emergency plan prior to abatement initiation for review and acceptance by the Engineer.
 - 1. 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.
 - 2. 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.

3. 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.

U. 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 Certified Asbestos Project Monitor weekly:

1. Date of visit.
2. Visitor's name, employer, business address, and telephone number.
3. Time of entry and exit from work area.
4. Purpose of visit.
5. Type of protective clothing and respirator worn.
6. Certificate of release signed and filed with the Contractor.

V. Field Test Reports:

1. Employee Exposure Sampling Results: Submit test results to the Certified Asbestos Project Monitor, the Engineer and the affected Contractor's employees within three (3) working days, signed by the testing laboratory employee performing the analysis.
2. Asbestos Disposal Quantity Report.
3. Qualified Testing Laboratory shall submit air monitoring reports directly to the Certified Asbestos Project Monitor

W. 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.

1.7 PRODUCT HANDLING

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 Engineer. 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.

1.8 PROTECTION

A. Site Security:

1. The work area is to be restricted only to authorized, trained and protected personnel. These may include the Contractor's employees, the Engineer, the Certified Asbestos Project Monitor, State and local inspectors and any other designated individuals. A list of authorized personnel shall be established prior to job start.
2. Entry to the work area by unauthorized individuals shall not be permitted without the express approval of the Certified Asbestos Project Monitor and any such entry shall be reported immediately to the Certified Asbestos Project Monitor by the Contractor.
3. A Visitor/Worker Entry Log shall be maintained.
4. The Contractor shall have control, subject to approval of the Certified Asbestos Project Monitor, of security in the work area and in proximity of Contractor's equipment and materials.

B. 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.

C. Protective Covering: The Contractor shall provide and install protective covering as required or upon request by the Certified Asbestos Project Monitor. Protective covering shall be unused plastic sheets.

D. Safeguarding of Property: The Contractor shall take whatever steps necessary to safeguard his work area, any property of the State, 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.

1.9 ADDITIONAL REQUIREMENTS

A. 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:

1. Hawaii Administrative Rules, Title 11, Chapters 501, 502, 503 and 504;
2. Title 29 Code of Federal Regulations Part 1926.62; Safety and Health Standards;

3. Title 29 Code of Federal Regulations Part 1926.1101; Asbestos;
 4. Title 29 Code of Federal Regulations Part 1910.134; Respiratory Protection;
 5. Title 40 Code of Federal Regulations Part 261; Identification and Listing of Hazardous Waste;
 6. Title 40 Code of Federal Regulations Part 262; Standards Applicable to Generators of Hazardous Waste;
 7. Title 40 Code of Federal Regulations Part 263; Hazardous Waste Transporters;
 8. Copies of any other applicable Federal, State and local regulations, standards, documents and codes;
 9. 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;
 10. 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;
 11. 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;
 12. Copies of the Contractor's Respiratory Protection Program, Hazardous Communication Program, Safety Program and Asbestos Abatement Plan;
 13. Copies of Material Safety Data Sheets for all chemicals used;
 14. Copies of all relevant certificates held by abatement workers and abatement contractors/supervisors actively engaged in the abatement project;
 15. Certification of the Project Designer who wrote procedures for the job;
 16. 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
 17. Records of all air sampling as required in HIOSH section 12-145.1-5.
- B. Whenever approval of the Certified Asbestos Project Monitor is required prior to proceeding with other work, the Contractor shall comply with the following:
1. The Contractor shall give, at a minimum, five (5) days notification to the Certified Asbestos Project Monitor prior to the start of any asbestos work.

2. The Contractor shall not begin any work without the Certified Asbestos Project Monitor present onsite.
3. The Contractor shall allow the Certified Asbestos Project Monitor 24 hours from notification to respond to the request for site inspection(s).
4. The Contractor shall 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 Engineer prior to commencing work. Requests from any other person will not be considered official requests.
5. The designated person requesting an inspection shall provide the following information:
 - a. Name of caller.
 - b. Building and rooms to be inspected.
 - c. Work phase of inspection, as specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plastic Sheeting: 6-millimeter-minimum-thickness polyethylene film.
- B. 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
- C. 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.
- D. 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.
- E. Encapsulant: The encapsulant shall be capable of being applied to surfaces of ACM and surfaces from which ACM has been removed to control the possible release of asbestos fibers. The encapsulant shall be capable of either creating a membrane over the surface (i.e. a bridging encapsulant) or penetrating into the material and binding its components (i.e. a penetrating encapsulant) and shall be compatible with the existing finishes.

- F. 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.
- G. Surfactant (Wetting Agent): 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether, or pre-approved equal, and shall be mixed with water to provide a minimum concentration of one ounce of surfactant to five (5) gallons of water.
- H. Warning Labels, Tape and Signs: As required by OSHA 29 CFR 1926.1101 and HIOSH regulation 12-145.1.
- I. Protective Clothing: The Contractor shall have all the coveralls required for this Project on site prior to the start of work.
- J. 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.

2.2 TOOLS AND EQUIPMENT

- A. Provide sufficient and suitable tools for the asbestos abatement procedures, including but not limited to:
 - 1. Water Sprayer: Airless or pressure sprayer for amended water application as applicable.
 - 2. Paint/Encapsulant Sprayer: Airless type only.
 - 3. HEPA vacuum.
 - 4. 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 Certified Asbestos Project Monitor, the Engineer and other inspectors. Scaffold joints and ends shall be sealed with tape to prevent migration of asbestos fibers.
 - 5. 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.
 - 6. 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.
 - 7. Other tools and equipment as necessary.

2.3 ELECTRICAL EQUIPMENT PROTECTION

- A. Non-current carrying metal parts of the Contractor's 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. All light and power circuits in the asbestos removal area shall be protected by ground fault circuit interrupters.
- B. 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.
- C. As necessary, 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.

2.4 PERSONAL PROTECTION REQUIREMENTS

- A. 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.
- B. Personal Protective Equipment (PPE):
 - 1. 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.
 - 2. 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.
 - 3. 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.

PART 3 - EXECUTION

3.1 DECONTAMINATION AREA

- A. The decontamination area as outlined below shall be employed during removal work involving only exterior materials that do not extend to the interior, where all work is performed from the exterior and the work area is fully sealed off from the interior.
- B. General: The Contractor shall construct the decontamination area, acceptable to the Certified Asbestos Project Monitor, 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.
- C. Access: In all cases, access between contaminated areas and clean areas shall be through the decontamination system.
- D. Cleaning: 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.
- E. 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.

3.2 WASTEWATER FILTERING SYSTEM

- A. All wastewater shall be treated as contaminated with asbestos and shall be filtered. All filtered wastewater shall then be removed from the site by the Contractor and disposed of in accordance with Federal, State, and local wastewater disposal regulations. No onsite disposal will be permitted.
- B. The wastewater 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.
- C. 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.
- D. 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.

- E. When the final filters become clogged, remove the filters, replace with new, and dispose of the clogged filters as contaminated waste.
- F. 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.

3.3 WORK AREA PREPARATION

- A. 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.
- B. Inspection of 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.
- C. Critical Barrier Enclosures: Cover all openings including, but not limited to, glazed openings, doors, corridors, ducts, grilles, floor drains or plates, diffusers, vents, windows, electrical outlets, and any other penetrations to the work areas with two layers of 6-mil plastic and seal with tape.
- D. Decontamination System: Provide a decontamination area as described in section 3.1 for exterior work.
- E. 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.
- F. 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.
- G. 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.
- H. 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 Engineer.
- I. 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.
- J. 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.

- K. 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 Certified Asbestos Project Monitor.
- L. 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 Engineer may also require that the Contractor post additional warning signs around the work area or at other potential exposure points.

3.4 NOTIFICATION

After the all site preparation is completed, including but not limited to posting of warning signs, sealing, and providing of temporary facilities, notify the Certified Asbestos Project Monitor for approval prior to proceeding with abatement.

3.5 REMOVAL OF ASBESTOS CONTAINING MATERIALS

- A. Surfaces to remain in areas where asbestos containing materials will be removed shall be covered with one layer of 6-mil plastic sheeting. Ventilation intake air sources shall be isolated or the system shall be shut down.
- B. Wet the asbestos containing materials 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.
- C. Carefully remove asbestos containing 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 material.
- D. The Contractor is prohibited from using methods or removal that creates excessive amounts of dust and debris.
- E. Waste debris shall be double bagged and sealed leak-tight in properly labeled 6-mil plastic bags immediately after removal. The Contractor shall not 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.
- F. The Contractor shall minimize contamination of the work floor, the exterior of disposal containers, and all other surfaces within the work area.

3.6 CLEANUP

All contaminated equipment and tools used for removal work shall be washed and cleaned in the contamination area prior to removing them from the work area. No washing of contaminated equipment and tools will be allowed outside the work area.

3.7 CLEARANCE

- A. Remove all visible accumulation of ACM and debris at the end of each work shift.
- B. The Certified Asbestos Project Monitor will visually inspect the affected areas for residual asbestos debris and waste. The Contractor shall re-clean areas showing asbestos debris and waste. If re-cleaning is required, the Certified Asbestos Project Monitor will visually inspect for asbestos debris and waste after re-cleaning. This process will be repeated until the Certified Asbestos Project Monitor deems the area free of visible asbestos debris and waste.
- C. The work area shall be totally visibly clean before the remaining material is encapsulated. After the visual inspection has been passed, encapsulate all remaining materials.

3.8 DISPOSAL OF ASBESTOS CONTAINING MATERIAL

- A. 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.
- B. 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.
- C. 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. The compartments shall be thoroughly wet-cleaned and HEPA vacuumed following the disposal of each load at the approved disposal sites.
- D. Workers unloading bags at the disposal sites shall wear full body protective clothing and dual HEPA cartridge full-face air purifying respirators.
- E. 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 Certified Asbestos Project Monitor. Copies shall be submitted to the Engineer and Certified Asbestos Project Monitor 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.

3.9 PAYMENT

Payment for removal, hauling and disposal of ACM shall be made at the lump sum price bid as scheduled in the Proposal. The final payment will not be made until proper documentation of the disposal of ACM and related waste are submitted.

END OF SECTION

SECTION 13282

LEAD-CONTAINING PAINT CONTROL MEASURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials and equipment necessary to complete the safe removal, transportation and disposal of lead-containing material in areas that may be affected by the abatement activities in compliance with the Specifications and all applicable Federal, State and Local laws and regulations. If there is a conflict with the requirements, the more stringent requirement shall apply. Ignorance of the above requirements and any applicable regulations resulting in additional cost to the Contractor shall not be reimbursable or billable to the State. Any question regarding conflict or inconsistency between Specification and/or regulations should be directed to the Engineer.

- B. The lead work shall include, but may not be limited to:
 - 1. Areas including any lead-containing paint that is loose and flaking or areas where lead-containing paint has the potential to become airborne or otherwise create dust (i.e. from sanding, drilling, friction, etc.) during the abatement activities. Lead was detected on painted surfaces of structures at the site as specified in the *Limited Hazardous Materials Survey Report, Department of Land & Natural Resources (DLNR), Maui Office Annex Building, Maui, Hawaii*, dated March 16, 2015, prepared by EnviroServices & Training Center, LLC. The Contractor shall be responsible for conducting a site visit to verify all quantities and material locations.

 - 2. Preparation of work areas and removal, transportation and disposal procedures. All work shall be performed as required of lead-containing and lead-contaminated materials by persons trained, knowledgeable and qualified in the techniques of handling and disposing of lead-containing and lead-contaminated materials and in the subsequent cleaning of lead-contaminated areas. Workers shall be EPA-certified lead workers and capable and willing to perform the work of this contract.

 - 3. Separation and recycling as scrap metal of abatement debris, steel components and miscellaneous metal elements. Debris and waste resulting from abatement work, except as otherwise specified, shall become the property of the Contractor.

1.2 REFERENCES

- A. 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.

B. CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.33	Access to Employee Exposure and Medical Record
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead Exposure in Construction
29 CFR 1926.65	Hazard Waste Operations and Emergency Response
29 CFR 1926.103	Respiratory Protection
40 CFR 260	Hazardous Waste Management Systems: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 265	Interim Status Standard for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restriction
40 CFR 745	Lead; Requirement for Lead-Based Paint Activities
49 CFR 172	Hazardous Materials, Tables, and Hazardous Materials Communications Regulations
49 CFR 178	Shipping Container Specification

C. HAWAII OCCUPATIONAL SAFETY AND HEALTH DIVISION (HIOSH)

12-114.2	Personal Protective Equipment
12-121.2	Fall Protection
12-122.2	Materials Handling, Storage, Use, and Disposal
12-148.1	Lead
12-151	Hazardous Waste Operations and Emergency Response

D. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2	(1992) Respiratory Protection
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E. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD Guidelines for the Evaluation and Control of Lead Based Paint Hazards in Housing

F. UNDERWRITERS LABORATORIES INC. (UL)

UL 586	(1990) High-Efficiency, Particulate, Air Filter Units
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1.3 DEFINITIONS

A. Action Level: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period.

B. Authorized Visitor: The Engineer, Inspector, QEC, or a representative of any regulatory or other agency having jurisdiction over the Project.

- C. 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, has the authority to take prompt corrective actions to control the lead hazards and is an EPA-certified lead inspector or risk assessor.
- D. Contaminated Area: An area where unwanted toxic or harmful substance exists.
- E. Contractor: The Contractor is that individual, or entity engaged under contract to the Engineer or General Contractor to perform the herein listed work.
- F. EPA: United States Environmental Protection Agency
- G. High Efficiency Particulate Air (HEPA) Filter: HEPA filtered vacuuming equipment with a filter system capable of collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.
- H. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.
- I. Lead-Based Paint (LBP): Protective or decorative coating which contains at least 1.0 mg per square centimeter of lead by area or at least 0.5 percent (5,000 milligrams per kilogram) of lead by weight.
- J. Lead Containing Paint (LCP): Protective or decorative coating which contains any detectable quantity of lead; includes Lead-Based Paint.
- K. Lead Control Area: A temporary area or structure or containment, sometimes equipped with HEPA filtered local exhaust that prevents the spread of lead dust or debris. Usually critical barriers and physical boundaries are employed to isolate the lead control area and to prevent migration of lead contamination and unauthorized entry of personnel.
- L. OSHA: United States Department of Labor, Occupational Safety and Health Administration
- M. Permissible Exposure Limit (PEL): 50 micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more or less than 8 hours in a work day, the PEL shall be determined by the following formula: $PEL \text{ (micrograms per cubic meter of air)} = 400/\text{number of hours worked per day}$
- N. Physical Boundary: Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.
- O. Qualified Environmental Consultant (QEC): The independent third party, EPA-certified Lead Inspector/Assessor who is hired by the General Contractor. The QEC is an Industrial Hygienist or similar safety professional with experience in enforcing lead safety regulations and performing airborne lead sampling.

P. State: The State of Hawaii

1.4 QUALITY ASSURANCE

A. The QEC's responsibilities:

1. Review and approve Contractor personnel training.
2. Review and approve Contractor's Work Procedure Plan for conformance to the applicable reference standards.
3. Be onsite to observe worksite preparation and cleaning, be available by telephone, pager or answering service at all other times during the work and able to be present at the work site in no more than 2 hours.
4. After final cleanup, verify that the lead control area is free of any visible lead paint chip debris, waste or dust and that final area air samples have lead concentrations at or below the background level.

B. Safety and Health Compliance:

1. In addition to the detailed requirements of this Specification, the Contractor shall comply with laws, ordinances, rules, and regulations of Federal, State, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials.
2. Comply with the applicable requirements of the current issue of 29 CFR 1926.62, HIOSH 12-148.1, and HIOSH 12-202-33.
3. Where requirements of this Specification and the referenced documents vary, the most stringent requirement shall apply.

C. Pre-Construction Conference:

1. The QEC shall meet with the Contractor and Engineer to discuss in detail the work procedures, precautions and area and personal air monitoring to be employed.
2. If rental equipment is to be used during lead-containing material handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Submit a copy of the written notification to the Engineer and QEC.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor acknowledges that he alone is responsible for the instruction of personnel in and enforcement of personal protection requirements. The Contractor shall comply with all requirements of 29 CFR 1926.62 and HIOSH 12-148.1. The Contractor shall also be responsible for complying with all applicable EPA regulations in regards to lead-containing materials.

- B. The Contractor shall examine and have at all times at his office (one copy) and in view at each job site (one copy) the following materials:
1. State of Hawaii Department of Labor and Industrial Relations; Occupational Safety and Health Standards; Part 8, Section 12-148.1;
 2. Department of Housing and Urban Development; Office of Public and Indian Housing; Lead Paint Guidelines;
 3. Title 29 Code of Federal Regulations Part 1926.62; Safety and Health Standards;
 4. Title 29 Code of Federal Regulations Part 1910.134; Respiratory Protection;
 5. Title 40 Code of Federal Regulations Part 261; Identification and Listing of Hazardous Waste;
 6. Title 40 Code of Federal Regulations Part 262; Standards Applicable to Generators of Hazardous Waste;
 7. Title 40 Code of Federal Regulations Part 263; Hazardous Waste Transporters;
 8. Title 40 Code of Federal Regulations Part 745; Lead; Requirement for Lead-Based Paint Activities;
 9. Copies of any other applicable Federal, State and local regulations, standards, documents and codes;
 10. Copies of the procedures to be followed during medical emergencies, including phone numbers of the nearest hospital or other emergency medical facility, which shall be posted by the nearest telephone;
 11. Copies of the Contractor's Respiratory Protection Program, Hazardous Communication Program, Safety Program, and Work Procedure Plan;
 12. Copies of Material Safety Data Sheets for all chemicals used;
 13. Copies of the Contractor's Competent Person's qualifications and employee training Certificates; and
 14. Copies of Personal Air Monitoring results.
- C. Whenever approval of the QEC is required prior to proceeding with other work, the Contractor shall comply with the following:
1. The Contractor shall give, at a minimum, ten (10) days notification to the Engineer and QEC prior to the start of any lead work.
 2. The Contractor shall not begin any work without the QEC present onsite.

3. The Contractor shall allow the QEC 24 hours from notification to respond to the request for site inspection(s).
 4. The Contractor shall 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 Engineer and QEC prior to commencing work. Requests from any other person will not be considered official requests.
 5. The designated person requesting an inspection shall provide the following information:
 - a. Name of caller.
 - b. Building and rooms to be inspected.
 - c. Work phase of inspection, as specified.
- D. Pollution Control: The Contractor shall not contaminate the air, water, soil or other items with hazardous materials such as cleaning solutions, lead-containing paint or lead-contaminated debris and wastes, etc. The Contractor shall immediately clean the contaminated area and dispose of the waste in compliance with all Federal, State and local laws, ordinances, rules and regulations at his or her own expense.
- E. Use of Site:
1. Confine operation at the site to the areas permitted under the contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting work while at the project site.
 2. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage to the areas authorized by the Engineer.

1.6 COMMENCEMENT OF WORK

- A. Each time work that calls for the disturbance of lead-containing paint is to begin in a new work area the Contractor shall not commence work unless the following requirements have been met.
1. Submittals: All submittals, notifications, posting and permits must be provided and be satisfactory to the Engineer and QEC.
 2. Equipment: All equipment required for the work such as removal, clean-up and disposal must be on hand.

1.7 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.

- B. **Manufacturer's Catalog Data:** Submit copies of manufacturer's specifications, installation instructions and field test materials for all chemicals and equipment related to lead-containing and lead-contaminated materials, including any other data that may be required to demonstrate compliance with these Specifications and proposed uses. This includes, but is not limited to, data for vacuum filters and respirators.
- C. **Material Safety Data Sheets:** Submit copies of the Material Safety Data Sheets for all chemicals used.
- D. **Notifications:** Submit written notification to the Engineer and QEC 10 days prior to the start of any abatement or demolition work involving lead-containing materials.
- E. **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.
- F. **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.
- G. **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.
- H. **Work Procedure Plan:** Submit no later than 10 consecutive working days from notice of award, a copy of the Contractor's Work Procedure Plan. The following are required components of a Work Procedure Plan:
 - 1. A sketch showing the location, size, and details of lead control areas, signage, security, decontamination and support areas including eating, drinking, smoking, and restroom areas;
 - 2. Procedures, interface of trades, sequencing of lead-related work, respirators, protective equipment;
 - 3. A detailed description of the methods of control of the work to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded;
 - 4. Work plan and schedule for waste containment and disposal including daily cleanup and disposal of stray paint chips and paint dust;
 - 5. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment;
 - 6. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes;

7. Estimated quantities of wastes to be generated and disposed of as well as a description of the methods used to identify hazardous wastes encountered with the work;
 8. Spill prevention, containment, and cleanup contingency measures to be implemented;
 9. Description of procedures to stop work in the event that area monitoring and laboratory analysis indicate air concentrations of lead in excess of the action level; and
 10. Methods to eliminate runoff of the water used to minimize dust created by abatement work, and collection and disposal plan for wastewater and paint debris.
- I. Rental Equipment: When rental equipment is to be used during lead-containing material handling and disposal, a written notification concerning intended use of the rental equipment must be provided to the rental agency with a copy submitted to the Engineer and QEC.
 - J. 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.
 - K. Contractor's Competent Person's Qualifications: The Contractor shall submit no later than 10 consecutive working days from notice of award the Contractor's Competent Person's name, contact information, valid qualifications, and current certification of completion of the EPA Lead Inspector/Assessor course.
 - L. Certification of medical examinations: The Contractor shall submit documentation from a physician that all employees or agents who may be exposed to airborne lead-containing dust or fumes have been medically monitored to determine whether they are physically capable of working while wearing the respirator required without suffering adverse health effects. In addition, the Contractor shall document that his personnel have received medical monitoring as required in the HIOSH lead standard (12-148.1).
 - M. Employee EPA Lead Worker/Supervisor Certifications: 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 lead dust and who may be responsible for any aspects of lead-containing paint removal activities which may occur, has currently attended and passed the EPA Lead Worker and/or EPA Lead Supervisor course, whichever is relevant to that worker's responsibilities. 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 in the lead control area if they are found to have an expired accreditation certificate. The Contractor shall be responsible for keeping the documentation up to date and submitting subsequent documentation to the Engineer and

QEC before any additional employee or individual, not currently on the list, is allowed within the lead control area.

- N. Employee training certifications: Submit documentation within 10 consecutive calendar days of award, satisfactory to the Engineer and QEC, that the Contractor's employees, including foreman, supervisors and any other company personnel or agents who may be exposed to airborne lead dust or who may be responsible for any aspects of lead work activities, have received training in accordance with OSHA 29 CFR 1926.62 and the HIOSH lead standard (12-148.1). Training shall include, but not be limited to, the dangers of lead exposure, respirator use and decontamination procedures.
- O. Laboratory Qualifications
 - 1. Personal Air Monitoring Laboratory Qualifications - Submit name, address and telephone number of testing laboratory responsible for analysis of personal air monitoring samples and reporting concentrations of airborne lead.
 - 2. TCLP Testing Laboratory - Submit name, address and telephone number of testing laboratory responsible for TCLP analysis.
- P. Personal Air Monitoring Results: Submit test results to the Engineer, QEC and the affected Contractor's employees within three (3) working days of collection, signed by the testing laboratory employee performing the analysis and the Contractor's Competent Person. Test results for the first two full days of initial personal air monitoring shall be submitted to the Engineer and QEC within 48 hours after completion of sampling.
- Q. TCLP Results: Submit test results to the Engineer and QEC within three (3) working days of collection, signed by the testing laboratory employee performing the analysis and the Contractor's Competent Person.
- R. Log of Lead Disturbance Work: Complete and submit a daily log of all lead disturbance work performed.
- S. Certification of work performance: Certification in writing that the regions both inside and outside of the lead control area have airborne lead concentrations below the background level, that the respiratory protection for the employees was adequate, and that the work procedures were performed in accordance with 29 CFR 1926.62 and this Specification.
- T. Waste Disposal Manifest Forms: Submit copies of all transport manifests, trip tickets and disposal receipts for all hazardous waste removed from the work area and disposed of at a disposal facility during the work process.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Respirators: Select respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services. Respirators shall comply with the requirements of 29 CFR 1926.62 and HIOSH 12-148.1. For this Project, respirators shall be worn at all times throughout the abatement or as deemed necessary by the Contractor's Competent Person.
- B. Protective Clothing: Furnish personnel exposed to lead dust with appropriate personal protective equipment as required by 29 CFR 1926.62 and HIOSH 12-148.1. For this Project, respirators shall be worn at all times throughout the abatement or as deemed necessary by the Contractor's Competent Person.
- C. Chemicals: Submit applicable Material Safety Data Sheet for all chemicals used on this project. Use the least toxic product approved by the Engineer.

PART 3 - EXECUTION

3.1 LEAD CONTROL AREA REQUIREMENTS

- A. Boundary Requirements:
 - 1. Establish a lead control area to contain abatement operations by demarcating a boundary around the structure to be demolished or renovated in accordance with the Contractor's approved Work Procedure Plan. The lead control area shall be isolated by physical boundaries, such as temporary fencing, boundary tape and rope, to prevent unauthorized entry of personnel.
 - 2. Post Warning and Danger signs in accordance with 29 CFR 1926.62 and HIOSH 12-148.1. Signs shall be placed at all approaches to lead control area and at the boundary of the lead control area. Signs shall be posted at all locations where airborne lead concentrations may exceed ambient background levels. Locate signs at such a distance that personnel may read the sign and take necessary protective measures to avoid exposure. In addition, post signs with "Authorized Entry Only, Lead Control Area" and "PPE Required" at every entry point.
- B. Personal Protection Requirements:
 - 1. No one will be permitted in the lead control area unless they have been given appropriate training, Personal Protective Equipment (PPE) and medical examinations. PPE is required for all employees and persons within the lead control area.
 - 2. Eating, drinking, smoking and application of cosmetics shall be permitted only in areas designated by the Contractor, approved by the Engineer, and which are free of

dust generated by the abatement. Eating, drinking, smoking and application of cosmetics are not permitted in the lead control area.

3. Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

C. Environmental Protection Requirements:

1. Ensure airborne lead levels outside the lead control area are below the Action Level.
2. Perform work without damage to or contamination of the areas adjacent to locations where lead-containing or lead-contaminated material will be disturbed as a result of abatement activities. If any part of the work area is damaged or contaminated during the disturbance of lead-containing materials, restore the damaged or contaminated area to its original condition or better, as determined by the Engineer.
3. Drainage inlets, downspouts, and all entrances to underground utilities which lie within, or provide drainage for, a lead control area shall be sealed until that lead control area has been cleaned, visually inspected and cleared.
4. Within a lead control area, any windows, doors or vents shall be sealed and air-conditioning units with intake or exhaust in a lead control area shall be shut down and sealed until that lead control area has been cleared with a level of airborne lead below the background level.

D. Exit Procedures: Whenever personnel exit the lead control area, they shall perform the following procedures and shall not leave the work place wearing any clothing or other equipment worn in the lead control area.

1. Vacuum themselves off with HEPA-filtered vacuum equipment, using UL-586 labeled HEPA filters;
2. Remove protective clothing in the designated changing area within the lead control area and place them in an approved impermeable disposal bag;
3. Wash their hands and faces in the designated changing area before exiting to the designated clean area outside of lead control area; and
4. Prevent migration of mud, dust and/or debris carried on work boots, clothing or equipment from the abatement site into areas beyond the lead control area.

3.2 ABATEMENT INVOLVING LEAD-CONTAINING PAINT

- A. Perform lead work as specified herein. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when abatement is performed in accordance with 29 CFR 1926.62 and as specified herein.

- B. Disturbance of lead-containing paint as a result of abatement activities shall be kept to a minimum. Spot remove lead-containing paint only as necessary for the safe abatement of LCP painted structures. Water spray, vacuuming and other engineering controls shall be used to minimize airborne lead dust. Care shall be taken to avoid pulverizing, scraping, or crumbling lead debris.
- C. Dispose of all lead-containing paint and associated waste in compliance with all Federal, State and local requirements.
- D. Clean, as needed, all floor surfaces adjacent to the lead control area using a HEPA filtered vacuum.
- E. Use 6-mil polyethylene sheeting to cover ground underneath the work area.
- F. Use 6-mil polyethylene sheeting to cover any surfaces and equipment that will not be painted, disturbed or utilized during disturbance of lead-containing paint. After completion of work, the Contractor shall repair all damage from fastening and sealing and remove all adhesive residues from surfaces at no additional cost to the Owner.
- G. Manual or power sanding, grinding, abrasive or sand blasting of interior and exterior painted surfaces is not permitted. Select removal processes (describe in the Work Procedure Plan) to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste.
- H. Open flame burning or torching of lead-containing paint is prohibited.
- I. The use of heat guns or hot knives which reach temperatures above 650 degrees Fahrenheit, on surfaces containing lead-containing paint, is prohibited.
- J. Use of vacuum equipment without HEPA filters in areas containing lead-containing paint is prohibited.
- K. The use of chemical paint strippers containing methylene chloride is prohibited.
- L. Control of Airborne Lead Level – The Contractor shall control the lead level outside of the work boundary to less than the action level at all times.
- M. Control of Visible Emissions – The Contractor shall control lead dust emissions from the project site so that no visible lead dust emissions leave the project work areas during abatement work. Wet methods or other engineering controls shall be used to control the emission of dust and/or debris from the abatement site in accordance with all applicable Federal, State, and local regulations. Emissions in excess of the above shall be cause for immediate shut down of the project until corrective measures are implemented.
- N. Control of Water Runoff – Water used to control emissions of dust from the abatement activities shall not be allowed to flow uncontrolled from a lead control area, to any adjacent area or to enter the sanitary or storm water sewer system. All water runoff from lead control areas shall pass through a filter berm to remove particulate matter prior to discharge

to water sewer system. The Contractor shall use only sufficient water to adequately control dust. Under no conditions shall wastewater be disposed of in storm drains or dumped on the ground.

- O. Perform abatement involving lead-containing paint as indicated in Federal, State, and local regulations. The worksite preparation (barriers or containments) shall be job dependent.

3.3 CLEANUP

- A. Clean surfaces and surrounding ground within the lead control area daily. Do not allow paint chips, dust and debris to accumulate.
- B. Restrict and minimize the spread of dust and debris. Keep waste from being distributed over the general area. Do not dry sweep or use compressed air to clean the area.
- C. When the operation has been completed, the area will be cleaned of all visible lead contamination. The QEC will visually inspect the affected areas for residual lead paint chips and debris, and the Contractor shall re-clean areas showing residual paint chips and debris.
- D. If re-cleaning is required, the QEC will visually inspect for lead debris after the re-cleaning. This process will be repeated until the QEC deems the area free of visible paint chips and debris.
- E. Do not remove the lead control area barriers or roped-off perimeter and warning signs prior to the Engineer's receipt of the QEC's lead clearance certification.

3.4 DISPOSAL

- A. Disposal of Non-Hazardous Lead Construction Debris (TCLP for Lead Not Exceeding EPA Limit of 5.0 Milligrams per Liter):
 1. Remove non-hazardous lead waste including debris, scraps, waste materials, rubbish, and trash from the site and dispose of such waste at a landfill approved for such purposes.
 2. The Contractor shall submit to the Engineer documentation that the lead-containing waste material removed from the work area has been accepted by the landfill owner.
- B. Disposal of Hazardous Lead Construction Debris (TCLP for Lead Exceeding EPA Limit of 5.0 Milligrams per Liter):
 1. Collect lead-contaminated wastes, scraps, debris and any other lead-contaminated materials and place into U.S. Department of Transportation approved and appropriately labeled containers.
 2. Store lead wastes and debris in U.S. Department of Transportation approved containers in an interim storage area assigned by the Engineer at the site. Any and

all hazardous wastes shall be removed from the site to an EPA approved disposal facility within 90 days of the removal work (as applicable).

3. Handle, store, transport, and dispose of lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
4. The Contractor shall submit to the Engineer documentation that the lead-containing waste material removed from the work area has been accepted by the landfill owner.

3.5 CERTIFICATION

- A. The Contractor or his authorized representative shall certify in writing that the regions both inside and outside of the lead control area have airborne lead concentrations below the background level, that the respiratory protection for the employees was adequate, and that the work procedures were performed in accordance with 29 CFR 1926.62 and this Specification.
- B. Upon inspection and approval of the area by the QEC, the Contractor shall certify that there were no visible accumulations of lead-contaminated paint, dust and debris remaining on the work-site.
- C. The Contractor shall not remove the lead control area boundary and warning signs prior to the submittal and approval by the Engineer of the Contractor's certification that there were no visible accumulations of lead contaminated paint, dust and debris remaining on the work-site.
- D. The Contractor shall re-clean areas showing residual paint chips, debris or wastes. Chips, debris and wastes shall be disposed of properly, in accordance with this Specification and all applicable Federal, State and local regulations.

3.6 MEASUREMENT AND PAYMENT

Payment for removal, hauling and disposal of all lead-related wastes shall be made at the lump sum price bid as scheduled in the Proposal. The final payment will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-contaminated material delivered is submitted to the Engineer.

END OF SECTION

SECTION 13284

REMOVAL AND DISPOSAL OF MERCURY CONTAINING LAMPS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials and equipment necessary to carry out the safe removal and disposal of mercury-containing lamps throughout the buildings to be demolished in compliance with the Specifications and all applicable Federal, State and Local laws and regulations including all incidental and pertinent operations. If there is a conflict with the requirements, the more stringent requirement shall apply. Ignorance of the above requirements and any applicable regulations resulting in additional cost to the Contractor shall not be reimbursable or billable to the State. Any question regarding conflict or inconsistency between Specification and/or regulations should be directed to the Engineer.
- B. Mercury-containing lamps are identified in the *Limited Hazardous Materials Survey Report, Department of Land & Natural Resources (DLNR), Maui Office Annex Building, Maui, Hawaii*, dated March 16, 2015, prepared by EnviroServices & Training Center, LLC. The Contractor shall be responsible for conducting a site visit to verify all quantities and material locations.

1.2 REFERENCES

- A. 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.
- B. CODE OF FEDERAL REGULATIONS (CFR)
 - 29 CFR 1910.1000 Air Contaminants
 - 49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communication, Emergency Response Information, and Training Requirements.
 - 49 CFR 178 Shipping Container Specification
- 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
 - 12-151 Hazardous Waste Operations and Emergency Response

1.3 DEFINITIONS

Mercury-Containing Lamps: As used in this Specification shall mean all fluorescent and high-intensity discharge (HID) lamps, including exit signs, without labeling stating “No Mercury”.

1.4 TRAINING REQUIREMENTS

Within one (1) year prior to assignment to mercury work, each employee shall be instructed by an Industrial Hygienist or equivalent safety specialist concerning the hazards of mercury, necessary safety and health precautions, the use of and requirements for protective clothing, equipment and respirators. Training shall include engineering and other hazard control techniques and procedures.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Documentation of Instruction: Each worker and supervisor shall submit current training certificates required for removing mercury-containing fluorescent lamps, as described in Section 1.4 of this specification. Certificates shall be signed and dated by the Industrial Hygienist or equivalent safety specialist providing the training.
- C. Mercury-Containing Lamp Removal Plan: The Contractor shall submit to the Engineer a detailed job-specific plan of the work procedures to be used in the removal of mercury-containing lamps. The plan shall be approved prior to the start of any mercury-containing lamp removal work.
- D. Mercury-Containing Lamp Disposal Plan: The plan shall comply with all applicable requirements of Federal, State, and local regulations. The plan shall also include:
 - 1. Identification of mercury waste associated with the work.
 - 2. Estimated quantities of waste to be generated and disposed of.
 - 3. Names and qualifications of personnel who shall be working on-site with mercury wastes.
 - 4. Names, qualifications, facility locations and 24-hour point of contact information for each contractor that shall be transporting, storing, treating, disposing of waste.
 - 5. List of waste handling equipment to be used in performing the work, including cleaning, volume reduction, and transport equipment.
 - 6. Spill prevention, containment, and cleanup contingency measures to be implemented.

- E. Emergency Planning Procedures: Emergency planning shall be developed prior to initiation of work and approved by the Contractor and the Engineer. It shall include, but not be limited to, considerations of fire, explosion, electrical hazards, slips, trips and falls and heat related injuries. The Contractor shall develop written emergency procedures and provide employee emergency training.
- F. Notification: Notify the Engineer 10 working days prior to the start of any removal work.
- G. Permits/Arrangements: Submit copies of all permits and arrangements for transportation and disposal of mercury waste.
- H. Waste Disposal Manifest Forms: Submit copies of all transport manifests, trip tickets and disposal receipts for all mercury waste removed from the work area during the abatement process.
- I. Other Documents: Submit copies of all documents, laboratory data and field notes necessary for the preparation of the final report.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Protective Clothing: Furnish personnel exposed to mercury material with appropriate protective clothing, including safety glasses and rubber gloves.
- B. Mercury Spill Kit: Assemble a spill kit to include several pairs of the following items:
 - 1. Disposable coveralls and polyethylene gloves and foot covers;
 - 2. Chemical safety glasses or face shields;
 - 3. Mercury caution signs displaying "Mercury Spill -- Authorized Personnel Only";
 - 4. 100 foot caution tape;
 - 5. Absorbent material;
 - 6. Aspirator bulbs;
 - 7. Disposable plastic dustpan;
 - 8. Polyethylene waste bags;
 - 9. Cloth backed tape;
 - 10. Mercury resistant sponges;

11. Paper and writing equipment; and
12. Non-breakable, wide-mouth waste containers with airtight-seal lids.

PART 3 - EXECUTION

3.1 WORK PROCEDURES

- A. The Contractor shall not be allowed to perform any on-site work unless the Engineer is present.
- B. Personnel shall wear and use protective clothing and equipment as outlined in Section 2.1.
- C. No one shall be permitted in the mercury work areas unless the person is provided with appropriate training and protective equipment.
- D. Personnel shall package and mark mercury materials as required by EPA, and DOT regulations and dispose of in accordance with all Federal, State, and local regulations.
- E. The Engineer shall perform an inspection following the mercury removal operation. If any area is contaminated, the contaminated area shall be cleaned, and visually inspected.
- F. All light fixtures shall be de-energized by a licensed electrician prior to the light fixture removal.
- G. Remove light fixtures whole and intact. Handle mercury such that neither skin contact nor inhalation occurs.
- H. Remove, package and dispose of/recycle mercury containing lamps as specified in this section. Lamps labeled "No Mercury" shall be segregated from the hazardous waste stream and disposed of as normal demolition debris. Lamps without the "No Mercury" label shall be assumed to contain mercury.

3.2 MERCURY LAMP DEBRIS CLEANUP REQUIREMENTS

- A. Mercury Lamp Breakage: Immediately report to the Engineer any mercury lamp breakage.
- B. Mercury Lamp Debris Control Area: Rope off an area around the edges of any mercury lamp debris and post a "Mercury Spill -- Authorized Personnel Only" caution sign.
- C. Mercury Lamp Debris Cleanup: The mercury lamp debris cleanup shall be in accordance with all applicable Federal, State and local regulations. Initiate cleanup of spills as soon as possible, but no later than 24 hours after discovery. Cleanup personnel shall wear gloves that prevent both mercury exposure and physical injury due to broken glass. All debris shall be placed in a non-breakable container with an airtight-seal lid. Any items that came in

contact with the mercury lamp debris shall be cleaned, labeled and disposed of as mercury contaminated waste.

3.3 STORAGE FOR DISPOSAL

- A. Storage Containers for Mercury Lamps: The Contractor shall store mercury lamps in appropriate transport containers. The boxes shall be stored and labeled for transport in accordance with 40 CFR 262 and 40 CFR 263.
- B. Labeling of Waste Containers: Label all containers with the date the item was placed in storage. Label mercury-containing lamp waste containers in accordance with 49 CFR 172.

3.4 CLEANUP

- A. Clean surfaces within mercury control areas daily. Do not allow mercury material, debris and dust to accumulate.
- B. Restrict the spread of dust, debris, vapors and fumes; keep waste from being distributed over the general area.
- C. The Engineer shall visually inspect the affected areas for any residual mercury material and accumulated dust.
- D. The Contractor shall re-clean areas showing dust or residual mercury material at no additional cost to the Owner.

3.5 DISPOSAL

- A. Mercury disposal shall comply with requirements and procedures outlined in 40 CFR 263.
- B. Transporter Certification: Comply with disposal requirements and procedures outlined in 40 CFR 263. Before transporting the mercury lamp waste, sign and date the manifest acknowledging acceptance of the mercury-containing waste. Hazardous waste will not be removed from site without proper manifest documentation and verification of waste destination. The Contractor shall submit transporter certification of notification sent to EPA of lamp waste activities.
- C. Certificate of Disposal and/or Recycling: Certificates for the disposal of mercury lamps, shall be submitted to the Engineer within 30 days of the date of completion of disposal identified in the manifest was completed. Certificates of Disposal shall include:
 - 1. The identity of the disposal and/or recycling facility, by name, address, and EPA identification number.
 - 2. Identification of mercury waste affected by the Certificate of Disposal including reference to the shipment manifest number.

3. A statement certifying disposal and/or recycling of the identified mercury lamp waste that includes the date(s) of disposal, and the disposal process used.

3.6 MEASUREMENT AND PAYMENT

Payment for removal, hauling and disposal of ACM shall be made at the lump sum price bid as scheduled in the Proposal. Final payment will not be made until a signed copy of the Certificate of Disposal is furnished to the Engineer.

END OF SECTION

SECTION 13288

TESTING/AIR MONITORING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Furnish all labor, materials, and equipment necessary to carry out the personnel monitoring, record keeping, air monitoring and inspectional services in compliance with the Specifications and all applicable Federal, State and Local laws and regulations during the performance of the Project. If there is a conflict with the requirements, the more stringent requirement shall apply. Ignorance of the above requirements and any applicable regulations resulting in additional cost to the Contractor shall not be reimbursable or billable to the State. Any question regarding conflict or inconsistency between Specification and/or regulations should be directed to the Engineer.

1.2 REFERENCES

A. 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:

B. CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.33	Access to Employee Exposure and Medical Record
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead Exposure in Construction
29 CFR 1926.103	Respiratory Protection
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
40 CFR 745	Lead; Requirement for Lead-Based Paint Activities
49 CFR 172	Hazardous Materials, Tables, and Hazardous Materials Communications Regulations

C. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 560/5-85-024	Guidance for Controlling ACM in Buildings
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D. HAWAII OCCUPATIONAL SAFETY AND HEALTH (HIOSH)

12-114.2	Personal Protective Equipment
12-145.1	Asbestos

12-148.1 Lead
12-151 Hazardous Waste Operations and Emergency Response

E. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD Guidelines for the Evaluation and Control of Lead Based
Paint Hazards in Housing

F. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2 (1992) Respiratory Protection

1.3 DEFINITIONS

- A. Action Level - Lead: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period.
- B. Air Monitoring Personnel: The person or persons designated by the Contractor to act on his/her behalf, who performs Area Sampling and inspection activities during abatement and demolition work and shall have the authority to initiate engineering controls. The Air Monitoring Personnel must have an active certification from the State of Hawaii Department of Health for the contaminant he/she is sampling for and shall not be an employee of the abatement entity performing the abatement.
- C. Area Sampling: Sampling of concentrations which is representative of the airborne concentrations but is not collected in the breathing zone of personnel (approximately 1.5 to 1.8 meters above the floor).
- D. 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 locations.
- E. Competent Person - Asbestos: As used in relation to asbestos, refers to a person employed by the Contractor who is trained in the recognition and control of asbestos hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the asbestos hazards.
- F. Competent Person - Lead: As used in relation to lead, 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, has the authority to take prompt corrective actions to control the lead hazards and is an EPA certified lead inspector or risk assessor.
- G. Permissible Exposure Limit (PEL) - Asbestos: 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.

- H. Permissible Exposure Limit (PEL) - Lead: 50 micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more or less than 8 hours in a work day, the PEL shall be determined by the following formula: $PEL \text{ (micrograms per cubic meter of air)} = 400/\text{number of hours worked per day}$
- I. Personal Sampling: Air sampling which is performed to determine concentrations within the breathing zone of a specific employee. Samples shall be representative of the employee's work tasks. The breathing zone shall be considered an area within 12 inches of the nose or mouth of an employee.
- J. Qualified Testing Laboratory – Asbestos: Laboratories shall be accredited by the American Industrial Hygiene Association (AIHA) for each type of asbestos analysis performed by the laboratory.
1. Environmental and Work Area Monitoring Laboratory – An independent testing laboratory retained by the Contractor to perform analysis of environmental and work area air monitoring samples and report concentrations of airborne asbestos.
 2. Personal Air Monitoring Laboratory – The testing laboratory utilized by the air monitoring firm retained by the Contractor to perform analysis of personal air monitoring samples and report airborne concentrations of asbestos. Collection of the Contractor's OSHA personal air samples will be performed by a firm independent of the Contractor, at the Contractor's expense.
- K. Qualified Testing Laboratory – Lead: Laboratories shall be accredited under the EPA's National Lead Laboratory Accreditation Program (NLLAP) by the American Industrial Hygiene Association's (AIHA's) Environmental Lead Laboratory Accreditation Program (ELLAP) and successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program for each lead matrix analyzed by the laboratory. The laboratory shall fulfill all requirements of accreditation for analyzing lead in air. Laboratory personnel performing the work shall have been judged proficient in the analysis of lead in the applicable parameter by successful participation within the last year in AIHA's ELPAT.
1. Environmental and Work Area Monitoring Laboratory – An independent testing laboratory retained by the Contractor to perform analysis of environmental and work area air monitoring samples and report concentrations of airborne lead.
 2. Personal Air Monitoring Laboratory – The testing laboratory utilized by the air monitoring firm retained by the Contractor to perform analysis of personal air monitoring samples and report airborne concentrations of lead. Collection of the Contractor's OSHA personal air samples will be performed by a firm independent of the Contractor, at the Contractor's expense.
 3. Toxicity Characteristic Leaching Procedure (TCLP) Testing Laboratory - The testing laboratory employed by the Contractor to perform TCLP tests of a representative sample of the debris waste stream of each structure and of any lead-contaminated chips or debris generated through abatement to determine whether or

not the waste is hazardous or non-hazardous. The laboratory shall be experienced in and analyze TCLP samples using the EPA Method 1311/6010.

- L. In addition, Definitions as outlined in Section 13280 – REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS and Section 13282 – LEAD-CONTAINING PAINT CONTROL MEASURES.

1.4 ABBREVIATIONS

- A. ANSI: American National Standards Institute, Inc.
- B. CFR: Code of Federal Regulations
- C. HIOSH: Division of Occupational Safety and Health, Department of Labor and Industrial Relations, State of Hawaii
- D. EPA: U.S. Environmental Protection Agency
- E. NESHAP: National Emission Standards for Hazardous Air Pollutants
- F. NIOSH: National Institute for Occupational Safety and Health
- G. OSHA: Occupational Safety and Health Administration
- H. The State: The State of Hawaii

1.5 AUTHORITY TO STOP WORK

- A. The Engineer and Air Monitoring Personnel have the authority to stop the abatement work at any time they determine that conditions are not within the drawing/specification requirements and applicable regulations. The work stoppage shall continue until corrective steps have been taken and specified conditions restored to the satisfaction of the Engineer and Air Monitoring Personnel. 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:
 - 1. Excessive airborne fibers inside (>0.5 f/cc) and/or outside (>0.01 f/cc) the work area.
 - 2. Excessive dust outside (>30 micrograms per cubic meter of air) the work area.
 - 3. Visible emissions of dust or debris going beyond the work area boundaries.

1.6 COORDINATION

- A. The Contractor shall coordinate with the Engineer for the testing/air monitoring requirements included in these specifications for testing/air monitoring consultants or inspectors and all applicable Federal, State and local regulations.

- B. Whenever approval of the Engineer is required prior to proceeding with other work, the Contractor shall comply with the following:
1. The Contractor shall give, at a minimum, ten (10) days notification to the Engineer prior to the start of any work.
 2. The Contractor shall allow the Engineer 24 hours from notification to respond to the request for site inspection(s).
 3. The Contractor shall 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 Engineer prior to commencing work. Requests from any other person will not be considered official requests.
 4. The designated person requesting an inspection shall provide the following information:
 - a. Name of caller.
 - b. Building and rooms to be inspected.
 - c. Work phase of inspection, as specified.

1.7 PRE-CONSTRUCTION CONFERENCE

A conference shall be held prior to construction and shall be conducted by the State Project Manager assisted by the Engineer.

- A. Attendance: The Contractor, Project Designer, industrial hygienist/air monitoring personnel shall also attend.
- B. Agenda:
1. Review final schedule for project.
 2. Verify legal requirements and special conditions
 3. Verify compliance with pre-construction requirement
 4. Obtain copies of all mandatory notifications.
 5. Inspect sample respiratory equipment and other abatement equipment.
 6. Review procedures and responsibilities.
 7. Clarify the scope of work and its best impact on the users of the building.

1.8 SUBMITTALS

As specified in Section 13280 – REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIALS and Section 13282 – LEAD-CONTAINING PAINT CONTROL MEASURES.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 AIR SAMPLING - ASBESTOS

- A. Sampling for airborne concentrations of asbestos fibers shall be performed by the Certified Asbestos Project Monitor. 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.
 - 1. Sampling Prior to Asbestos Work: Baseline air sampling may be conducted by the Certified Asbestos Project Monitor one-day prior to the masking and sealing operations for each removal site.
 - 2. Sampling During Asbestos Work: The performance and execution of the Contractor's work shall be closely and continuously monitored by the Certified Asbestos Project Monitor. Air monitoring and inspection by the Certified Asbestos Project Monitor 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. The Contractor shall provide full cooperation and support to the Certified Asbestos Project Monitor and to their technicians throughout the work.
- B. Air Monitoring With Respect To Contractor's Employees
 - 1. 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.
 - 2. The Contractor shall provide own personal sampling of 25 percent of his workers or minimum of two workers, whichever is greater as indicated in 29 CFR 1926.1101 and governing environmental regulations.
 - 3. Laboratory performing analysis shall be an independent party, not financially or managerially connected with the Contractor. Laboratory shall also be approved by the Engineer and AIHA accredited in the type of analysis being performed.

4. At the conclusion of each day's sampling, copies of all air monitoring records shall be provided to the Engineer.
 5. Results of sample analysis shall be provided to the Engineer within forty-eight (48) hours of collection.
- C. All other air sampling for compliance with the Specification shall be performed by the Certified Asbestos Project Monitor.

3.2 AIR SAMPLING – LEAD

- A. Environmental and work area air monitoring of airborne lead concentrations shall be performed by the Qualified Environmental Consultant in accordance with 29 CFR 1926.62 and as specified herein.
1. **Sampling Prior to Lead Work:** The Qualified Environmental Consultant shall collect area air samples outside the work area prior to the start of work in order to establish the background level of lead in the air. The samples shall be analyzed by the Environmental and Work Area Monitoring Laboratory for the airborne concentration of lead. This concentration shall be the background level.
 2. **Sampling During Lead Work:** The Qualified Environmental Consultant shall perform area air monitoring during the entire abatement operation. The Contractor shall allow access to the work area and assist the Qualified Environmental Consultant as needed.
 - a. Sufficient area air monitoring shall be conducted at the border of the lead control area to ensure unprotected personnel are not exposed to lead concentrations above 30 micrograms per cubic meter of air at all times. As a minimum, conduct area monitoring in areas immediately adjacent to the lead control area daily during each shift in which abatement operations are performed. At least one sample on each shift shall be taken on the downwind side of the lead control area.
 - b. If the outside boundary of the lead control area is determined to have air lead levels above the background levels the Contractor shall be required to adequately correct the conditions causing the increased lead levels. Any work necessary to correct the condition will be completed by the Contractor at no additional cost to the State.
 - c. If the outside boundary of the lead control area is determined to have air lead levels at or above 30 micrograms per cubic meter of air, the Contractor shall immediately stop work and correct the conditions causing the increased level.
 - d. Work shall resume only when approval is given by the Qualified Environmental Consultant.

B. Air Monitoring With Respect To Contractor's Employees

1. The Contractor's Competent Person shall perform initial personal air monitoring to determine employee exposure during abatement work. During initial personal monitoring, the first two full days of work (two 8-hour work shifts), all workers shall be provided with a minimum of air-purifying half-mask respirators and disposable protective clothing.
2. Personal monitoring samples shall be taken on at least 25 percent of the employees or a minimum of 2 employees, whichever is greater, or a representative sample of employees with the greatest potential for exposure as determined by the Qualified Environmental Consultant during each work shift.
3. At the end of the period of initial determination all results shall be submitted to a laboratory for analysis by NIOSH Method 7082.
4. Results from the first two full days (two 8-hour work shifts) of initial air monitoring, signed by the testing lab employee performing the analysis and the Competent Person, shall be provided to the Engineer within 48 hours after completion of sampling. Results of initial air monitoring shall be used by the Contractor's Competent Person to determine appropriate worker protection requirements for similar work activities. Determination shall be submitted to Engineer within 48 hours.
5. Regardless of initial air monitoring results, continue personal air monitoring during the entire abatement operations.
6. If the personal air monitoring tests covering a period of two full work days (two 8-hour work shifts) show airborne lead concentrations below the action level, the Contractor's Competent Person may determine that the use of HEPA-filtered air purifying respirators is not required. Other elements of protective clothing shall continue to be worn throughout the abatement operation.
7. If exposure to lead at or in excess of 30 micrograms per cubic meter of air as an 8-hour time weighted average is indicated, the Contractor's Competent Person will immediately notify the Contractor and Engineer. The Contractor will provide and require all persons exposed to this concentration of airborne lead dust to wear, at a minimum, half mask air purifying respirators with HEPA filters. In addition, the Contractor's work procedures will be immediately reviewed by the Engineer and the Contractor and modifications in the Contractor's work performance shall be implemented to lower the concentration of airborne lead.
8. Results of air monitoring shall be submitted to the Engineer within three (3) working days of collection, signed by the testing lab employee who performed the analysis and the Competent Person.

3.3 LEAD WASTE CHARACTERIZATION

- A. TCLP testing of the gross solid lead abatement debris shall be performed by the Contractor to characterize the debris as either non-hazardous or hazardous waste. Metal items to be demolished and removed shall be recycled.
- B. The Contractor shall not concentrate, treat, or intermix wastes from outside this project with the debris and wastes generated by this project.
- C. For lead wastes generated by abatement operations, including used disposal PPE, lead paint chips and waste from paint stripping operations, TCLP testing of the waste shall be provided and paid for by the Contractor as specified herein.
- D. All TCLP test samples shall be collected by the Qualified Environmental Consultant in accordance with SW 846, "Test Methods for Evaluating Solid Waste – Physical/Chemical Methods."
- E. All TCLP test samples shall be analyzed for lead concentration using EPA Method 1311/6010 by the TCLP Testing Laboratory.
- F. Submit results of TCLP tests to the Engineer within 3 working days of collection, signed by the testing lab employee performing the analysis and the Contractor's Competent Person.

3.4 PAYMENT

Payment for abatement monitoring shall be included at the lump sum price bid under Hazardous Material Testing and Monitoring as scheduled in the Proposal. The final payment will not be made until proper documentation of the disposal of hazardous waste is submitted.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15000

GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

This section shall apply to all phases of work indicated in contract drawings, or required to provide for a complete installation of mechanical systems included in this project.

1.2 GENERAL REQUIREMENTS

- A. These general mechanical requirements apply to all sections of DIVISION 15 – MECHANICAL 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/or as shown on the drawings.

1.3 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 system, 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 by engineer 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 date of acceptance of the work as a whole by the Engineer, 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 date 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. References to standards are 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.

1.4 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 this 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.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS. Submittal requirements are specified in each mechanical section, as well as in this section.
- 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 quality 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 interference. 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 State 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. Backflow preventer, valves, and valve boxes shall be properly integrated with the existing piping.

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 Conformances or Compliance:

1. **Manufacturer's Certification:** Submit certification from the manufacturer attesting that 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 Guarantee:** Submit certificate of guarantee as detailed in "Guarantee and Certificate" paragraph in this Section.
3. **Standards of 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.

M. Field Posted As-Built Drawings: 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 in reproducible prints of the drawings affected and submit to the Engineer at the completion of the project.

- N. Guarantee: Submit guarantee as noted under item entitled “GUARANTEE AND CERTIFICATE” hereinbelow.

1.6 LAWS, REGULATIONS AND CODES

The following shall govern where applicable: the Uniform Plumbing Code – as adopted by the County of Maui, the International Building Code of the County of Maui, the Division of Wastewater Management, 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.

1.7 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.

1.8 MANUFACTURER’S RECOMMENDATIONS

- A. Equipment installed under this division of the specifications shall be installed according to manufacturer’s recommendations, unless otherwise shown on the drawings or herein specified. 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 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 can be cause for rejection of the equipment.
- B. Certain specified construction and details may not be regularly included in the manufacturer’s catalogued product. The Contractor shall provide the material or equipment complete as specified.

1.9 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. The instruction sheets shall be approximately 8-1/2 x 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, backflow preventer and all equipment layout;
 2. Description of the function of each principle item of equipment;
 3. Shutdown instructions;
 4. Maintenance instructions;
 5. Safety precautions, test procedures; performance data; and
- B. The manual shall be complete in all respects for equipment, fixtures, controls, accessories, and associated appurtenances provided.

1.10 SUBSTITUTION OF EQUIPMENT OR MATERIAL

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.

1.11 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 an 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, he shall make good any resultant damage, re-work, extra work or defect at no additional cost to the State. All interpretations of drawings and specifications shall be clarified by the Engineer.

1.12 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.

1.13 GUARANTEE 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 date of acceptance of the work as a whole by the Engineer, 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.
- B. The above guarantee shall not be interpreted as voiding, limiting or reducing any equipment manufacturer's warranty of any guarantee permitted by law.
- C. The State 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 date of acceptance of the work as a whole by the Engineer.
- E. Terms of this guarantee are in addition to other guarantee provisions of the specifications, and do not substitute for other more stringent terms, if any.

1.14 PRODUCT DELIVERY, STORAGE AND HANDLING

Furnish new equipment, materials, piping and accessories bearing the manufacturers identification. Coordinate deliveries to avoid interference or construction delays. Protect products during delivery, storage, installation and the remainder of the contract period after installation.

PART 2 – PRODUCT

2.1 MATERIALS AND EQUIPMENT

- A. As specified in all sections of DIVISION 15 – MECHANICAL.
- B. Materials 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 2 years 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. 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.
- 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.

2.2 NAMEPLATES

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, 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 upper case. Nameplates shall be fastened by means of corrosion resisting metal screws, rivets or minimum, 14-gauge wire.

2.3 TOOLS AND SUPPLIES

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.

PART 3 – EXECUTION

3.1 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.

3.2 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.

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

Plumbing work to include new sanitary, vent, and water piping, new trench drain and oil water separator, and installation of new plumbing fixtures and other appurtenant plumbing items (including associated plumbing lines, supports, accessories, etc.) for a complete and operable plumbing system for the Maui Office Annex as indicated in plans and specifications.

1.2 GENERAL REQUIREMENTS

- A. Provide complete plumbing system. "Provide" shall mean "furnish and install" when used herein. Connect to utility systems as shown on drawings.
- B. Connect all fixtures and equipment to plumbing system as indicated in contract documents.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 – SUBMITTALS.
- B. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for types of materials and equipment required. Include data substantiating that materials comply with specified requirements.
- C. Unless specified under Section 01330 – SUBMITTALS, submit eight (8) copies of each submittal required hereinafter.
 - 1. Equipment Submittal: Before beginning work, submit for review certified literature showing dimensions of equipment, 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.
 - 2. 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.
 - 3. 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 field posted as-built drawings for review as required by Section 01330 – SUBMITTALS.

- D. Certificates: Submit certificated as stipulated on item entitled “CERTIFICATES” hereinbelow.
- E. Guarantee: Submit guarantee as stipulated on item entitled “GUARANTEE” hereinbelow.

1.4 QUALITY ASSURANCE

- A. Comply with all the requirements of the County of Maui.
- 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 “acceptable equal” after the brand name requires approval in accordance with Section 6.3 "Substitution of Materials and Equipment" of the GENERAL CONDITIONS. Equivalent models listed in the Index Creations Cross Reference Blue Books as similar need not be pre-qualified. Acceptable equal products of the following manufacturers are acceptable in lieu of those specified hereinafter by specific manufacturer and model number.
 - 1. Valves: Nibco, Watts, Hammond, Crane, Walworth, Dezurik, Lunkenheimer, or Stockham.
 - 2. Fixtures: American Standard, Kohler, Eljer, or Elkay.
 - 3. Drainage System Specialties: Josam, Zurn, or J.R. Smith.
 - 4. Pipe Supports: Elcen, Fee and Mason, Grinnell or Unistrut.
 - 5. Fixture Trim: Symmons, Speakman, Bradley, Chicago, Elkay, or T&S.
- 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 74-82	Cast Iron Soil Pipe and Fittings
B 88-86	Seamless Copper Water Tube
B 306-86	Copper Drainage Tube (DWV)
C564-70	Rubber Gaskets for Cast Iron Soil Pipe and (R-1982) Fittings

2. American National Standards Institute Publications (ANSI):

- B16.18-84 Cast Copper Alloy Solder-Joint Pressure Fittings
- B16.22-80 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- B16.23-76 Cast Copper Alloy Solder Joint Drainage Fittings - DWV
- B16.26-83 Cast Copper Alloy Fittings for Flared Copper Tubes
- C2-1982 National Electrical Safety Code

3. Cast-Iron Soil Pipe Institute Publication (CISPI):

- Standard No. Hubless Cast Iron Soil Pipe and Fittings for Sanitary 301-90 and Storm Drain, Waste, and Vent Piping Applications
- Standard No. Couplings Joint for Use in Connection with Hubless 310-90 Cast Iron Soil Pipe and Fitting

1.5 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 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 of test was satisfactorily passed.

1.6 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.

1.7 GUARANTEE

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 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.

PART 2 – PRODUCTS

2.1 EQUIPMENT

Requirements of the manufacturer's equipment that is a component of a systems provided under this work is included with the system's specifications hereinafter. Capacities and characteristics of the equipment are indicated on the drawings.

2.2 PLUMBING FIXTURES

- A. Provide chrome-plated, all brass faucets, flush valves, angle stops, tube risers, chrome plated p-traps, escutcheons and cover plates. Provide connecting fittings, china bolt caps, wall support brackets, etc. as required. Furnish masonry and concrete contractor with wall sleeves and inserts required for fixture installation. All valves shall be bronze and brass with chrome plating. All sinks and lavatories shall have 2.0 gpm cold water flow restrictors. All water closets shall be maximum 1.6 gallons per flush. All urinals shall be maximum 1.0 gallons per flush. Provide access panels as required for servicing of flush valves, valves, etc. Mount accessible flush valve/actuator on wider side of stall. Provide brass closet bolts, nuts, washer, bolt caps, escutcheon plates and water closet flange/seal for all water closets. Toilet seats shall be white, open front, elongated type. P-trap guard, offset drain guard and angle stop covers shall be white in color. All sinks shall have cleanouts on traps.
1. Accessible Water Closet (AWC): Kohler K-4325, Kingston, wall mounted, white vitreous china, 1.28 gallon flush, siphon jet, elongated bowl, bolt caps, 16-1/2-inch high bowl, 1-1/2-inch top spud. Kohler K-4731-SA toilet seat, white solid plastic, elongated, open front, self-sustaining check hinge, and anti-microbial agent. Brass closet bolts, nuts, washers, and plastic bolt caps. Sloan 111-1.28, 1.28 gallon flush, sensor activated flushometer. Exposed flush valve with vacuum breaker, spud coupling, control stop, and flange. Fixture shall be in full compliance with ADAAG Section 604 requirements.
 2. Water Closet (WC): Kohler K-4325, Kingston, wall mounted, white vitreous china, 1.28 gallon flush, siphon jet, elongated bowl, bolt caps, 16-1/2-inch high bowl, 1-1/2-inch top spud. Kohler K-4731-SA toilet seat, white solid plastic, elongated, open front, self-sustaining check hinge, and anti-microbial agent. Brass closet bolts, nuts, washers, and plastic bolt caps. Sloan 111-1.28, 1.28 gallon flush, sensor activated flushometer. Exposed flush valve with vacuum breaker, spud coupling, control stop, and flange.
 3. Accessible Lavatory (ALAV): Kohler K-2005 Kingston 21-1/4"x18-1/8"x10", white vitreous china wall-mounted lavatory, 4" centers, front overflow and backsplash with concealed arm wall mounted support. Provide with Sloan ETF-80-4 sensor activated lavatory faucet with trim plate, transformer, and temperature mixing valve. Provide strainer, P-Trap, continuous waste, supply risers with couplings, angle stops, escutcheons, p-trap guard and angle stop covers. Install Accessible Lavatory in accordance to ADAAG Section 606.3.

4. Accessible Urinal (AUR): Kohler K-4991-ET Bardon white vitreous china wall hung urinal with 3/4-inch top spud, 2-inch outlet, washout flushing, wall hanger support, and removable bee hive strainer. Provide Sloan 186 ES-S, 1.0 gallon sensor activated flushometer supply with transformer, 3/4-inch I.P.S. screwdriver angled stop with vandal resistant top cap, adjustable tailpiece, vacuum breaker, spud coupling, wall and spud flange. Mount urinal in accordance with ADAAG Section 605.2.
5. Breakroom Sink (SK-1): Elkay LRAD Lustertone single bowl sink, Type 304 18 gauge nickel bearing stainless steel, satin finish, 3-1/2" drain opening, fully undercoated underside and LK-18 perforated grid strainer. Provide Sloan EAF-700-P-ISM sensor activated faucet with gooseneck spout, integral spout mixer, 1.5 gpm. Provide Insinkerator Badger 5 disposer, 1/2 HP, 120 V, 60 Hz. Provide angle stops, risers, offset P-trap and escutcheons.
6. Outdoor Sink (SK-2): Elkay LRAD Lustertone single bowl sink, Type 304 18 gauge nickel bearing stainless steel, satin finish, 3-1/2" drain opening, fully undercoated underside and LK-18 perforated grid strainer. Provide Kohler Coralais K-15171-FL-G faucet with 10" swing spout, 2.2 gpm. Provide angle stops, risers, offset P-trap and escutcheons.
7. Mop Sink (M/S): Kohler K-6710 floor-mounted service sink, drain grid 18-gauge stainless steel, flat type. Provide with Chicago Faucet 897-CP 8" wall mounted faucet, vacuum breaker spout with pail hook and wall brace.
8. Shower (SH-1): Kohler K-T10276-4-G, Forte, 2.5 gpm wall-mounted showerhead and valve trim. K-304-KS pressure-balancing valve with screwdriver stop, high-temperature limit. Brushed Chrome finish.
9. Shower (SH-2): Kohler K-10298-G Forte 1.75 gpm handshower, K-9514-G shower hose, K-355-G supply elbow, K-352-G wall-mount handshower holder, K-T10277-4-G valve trim. K-304-KS pressure-balancing valve with screwdriver stop, high-temperature limit. Brushed Chrome finish.

2.3 PLUMBING SYSTEM SPECIALTIES

- A. Hose Bibb (HB): Chicago Faucets 998 or approved, brass, chrome plated, non-removable vacuum breaker, 3/4" inlet, loose key handle with bronze square head stop.
- B. Floor cleanouts (FCO): J.R. Smith 4020 series or approved. Provide clamp device when installed in floor with waterproofing membrane. Provide nickel bronze heavy duty cleanout covers.
- C. Cleanout to Grade (COTG): J.R. Smith 4220 series or approved equal installed in concrete pad.
- D. Wall cleanouts (WCO): J.R. Smith 9776 or approved equal.

- E. Water Hammer Arrestor (WHA): J.R. Smith Series 5000 or approved equal, all stainless steel, PDI certified. Provide access panel. Size to accommodate fixtures on the pipe branch served in accordance with manufacturer's recommendations.
- F. Floor drains (FD): J.R Smith 2005Y or approved equal, square top, nickel bronze strainer.
- G. Water Fountain (WF): Elkay VRCHDTLDDSC non-refrigerated, non-electric, wall-mounted water cooler with vandal resistant bubbler and front vandal resistant push button activation.

2.4 PIPE AND FITTINGS

- A. Waste and Vent Pipes Below Grade: Service weight cast iron soil pipe, ASTM A74, no-hub cast-iron soil pipe conforming to CISPI 301 with stainless steel bands.
- B. Waste and Vent Pipes Above Grade: Service weight cast iron soil pipe, ASTM A74, no-hub cast-iron soil pipe conforming to CISPI 301 with stainless steel bands. For Exposed vent piping, provide Schedule 40 galvanized steel with screwed fittings. Exposed piping to be painted to match existing background surfaces.
- C. 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. All solder shall be non-lead; flux shall be non-corrosive complying with Copper Development Association Standard 1.0.

2.5 INSULATION

- A. Apply in accordance with manufacturer's recommendations by skilled mechanics. Flame spread rating not to exceed 25 and smoke development rating not to exceed 50.
 - 1. Insulate condensate piping with 1-inch thick fiberglass insulation with all service jacket vapor barrier, Owens-Corning or equal.
 - 2. On pipe insulation exposed to weather, apply 16 mil embossed aluminum jacket with 2-inch overlap at longitudinal and circumferential joints, secured in place with 3/4-inch x 0.015 gauge aluminum bands on 18 inch centers. Apply humped aluminum ells or fabricated 16 mil aluminum to fittings and band in place.
 - 3. Saddles: Provide 180 degree galvanized sheet metal protective saddles at each hanger or support on insulated piping and shall be no less than 16 gauge and no less than 12 inches long.

PART 3 – EXECUTION

3.1 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 head room 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.

3.2 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 all extra materials and labor for a complete operable system at no extra cost to the State.

3.3 FIXTURE INSTALLATION

Set fixtures in an approved workmanlike manner. Point up all edges against building structure with white grout. Provide adequate supports for wall-mounted fixtures. Provide supplies for all waterlines to fixtures, except those using flush valves; Brass-Craft or equivalent, compression joint type with chromium plated brass escutcheon and cover tube, loose-key angle stop valve and drawn copper tube riser. Provide chromium plated brass P-trap, waste fittings and escutcheon and cover tube, loose key angle stop valve and drawn copper tube riser. Provide chromium plated brass P-trap, waste fittings and escutcheon as required for fixture. Exposed metal including pipe shall be polished chromium plated.

3.4 PIPING INSTALLATION

Conform to the requirements of the Uniform Plumbing code. Inspect all pipes inside and outside. Remove interior obstructions and ream out pipe ends. Tool markings on polished fittings are not acceptable. 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. Caulk watertight around pipes passing through sleeves. Wrap pipe with polyethylene tape where it passes through sleeve and when it contacts concrete or masonry. Grout with fireproof material around all pipe penetrations through slabs and walls full length of penetrations. Provide chrome-plate brass escutcheons, set tight on the pipe and to the wall where pipes are exposed in finished areas. 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.

3.5 PIPING SYSTEM SUPPORTS

- A. Pipe Hangers: Steel clevis hanger with adjustable hanger rod; 3/8" for pipe 2" and smaller, 1/2" for pipe 2-1/2" through 3-1/2" and 5/8" for pipe 4" and larger.
- B. Pipe Supports: Support steel and copper pipe at maximum spacing of 6 feet for pipes 1-1/2" and smaller, 10 feet for pipes 2" through 4".

3.6 DRAINAGE, WASTE AND VENT PIPE SYSTEMS

Slope drain lines at 1/4" 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.

3.7 WATER PIPING SYSTEM

Secure each water line where it penetrates partitions to serve equipment, hose bibb 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" above finished grade, unless otherwise indicated. Install dielectric unions at connections of copper and ferrous pipes.

3.8 INSULATION SYSTEM

- A. Thermal insulation shall be furnished and installed as specified. Should alternate construction methods other than called for in this specification be required, the Contractor shall so submit during prequalification and substitution portions of bidding.
- B. Where observation of work or workmen indicates specification is not being complied with, entire section or all of the installed insulation shall be removed and reinstalled as specified.
- C. All components of the insulation for piping, including facings, mastics and adhesives, shall have a fire hazard rating not to exceed 25 for flame spread and 50 for fuel contributed and smoke developed. Ratings shall be as determined by Underwriter's Laboratories, Inc. or other approved testing laboratory.
- D. Insulate condensate piping with 1-inch thick fiberglass insulation with all service jacket vapor barrier. Seal all joints with insulation manufacturer's approved adhesive.
- E. Insulation to be applied on clean, dry surfaces free of any foreign matter and only after tests and approvals required by the specifications have been completed.
- F. Insulate all piping in a neat, workmanlike fashion in accordance with recommended thicknesses. All joints and seams shall be butted tightly together. Jackets to be secured tightly and smooth over the insulation.

- G. All pipe insulation shall be continuous through wall and ceiling openings and sleeves.
- H. All surface finishes to be extended to protect all surfaces, ends, and raw edges of insulation.

3.9 FIELD QUALITY CONTROL

- A. Test plumbing systems in accordance with the Uniform Plumbing Code. Perform tests in the presence of, and to the satisfaction of inspectors having jurisdiction over the work. Ask for final inspection by the Engineer after all tests, adjustments, and balancing has been performed.
 - 1. Test drainage systems in accordance with Section 318 of the Plumbing Code.
 - 2. Hydrostatically test the domestic water piping system at 100 psi. Inspect the entire system while under pressure and correct all deficiencies.
 - 3. Test equipment to demonstrate its operations and compliance with the specifications.

3.10 BALANCE, ADJUST, AND CLEAN

Clean up work areas and fixtures. Adjust system for proper operation, ready for use.

END OF SECTION

SECTION 15800

AIR CONDITIONING AND VENTILATION

PART 1 - GENERAL

1.1 SUMMARY

Air conditioning and ventilation work to include installation of a new VRF and split system air conditioners, exhaust fans, supply fans, ductwork and accessories and other appurtenant items for a complete and operable air conditioning and ventilation system for the Maui Office Annex as indicated in plans and specifications.

1.2 GENERAL REQUIREMENTS

- A. Provide all labor and materials necessary for a complete and operating air conditioning and ventilation system. "Provide" shall mean "furnish and install" when used herein. Project drawings show general requirements as to size, arrangement of ducts and piping, and location of equipment. Manufacturer of equipment shall have Hawaii stocked spare parts, representation and support of a service organization which has serviced manufacturer's units of comparable type, size and capacity as specified herein. 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 years prior to bid opening. All equipment with local manufacturer's representative shall be purchased through local distributor.
- B. Electrical: Provide all indicating controls for this work. Mount control devices and provide control wiring and conduit. Furnish motor starters and enclosures for equipment under this section.
- C. Related Work Described Elsewhere:
 - 1. Concrete: Concrete equipment bases and supports under DIVISION 3 – CONCRETE.
 - 2. Painting: Painting of equipment and materials under Section 09900 - PAINTING.
 - 3. Electrical Work: Mounting of starters and providing of fused or non-fused disconnect switches, circuit protection and power wiring conduit are under DIVISION 16 - ELECTRICAL.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01330 - SUBMITTALS.

B. Shop Drawings and Product Data

1. Submit shop drawings and product data in one complete package. Piecemeal submittals are not acceptable.
2. Reproductions of Contract Drawings for the use of shop drawings are not acceptable.
3. Shop Drawings: After review of equipment, contract documents and field conditions, 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, blockouts, inserts in slabs and openings in structure. Drawings shall also indicate adequate clearances for operation, maintenance, and replacement of operating equipment. The shop drawing review is confined to arrangement of equipment only and will not relieve the Contractor from responsibility for proper fit, performance, or construction. Any deviation from Contract documents including dimensional, performance or material changes shall be clearly notes on shop drawings.
4. Equipment Submittal: Before beginning work, submit for review certified literature showing ratings and dimensions of equipment, and of a list indicating all materials and items that are of a different manufacturer or model than those specified.
 - a. Submittals shall include the following items:
 - 1) All fans with sound data, performance data, fan curves, electrical data.
 - 2) Split system air conditioners with sound data, performance data, electrical data.
 - 3) Air devices, flex duct, insulation and duct accessories with sound data, mounting data and performance data.
 - 4) Control wiring, devices and diagrams.
 - 5) Exhaust Fans with sound data.
 - 6) Control diagrams, control modules and devices.
 - 7) Accessories and insulation.
 - b. Submittals shall include the following as a minimum:
 - 1) System design information sheet with dimensional data, weights, finishes, corrosion protection, performance information with sound data.

- 2) Description of system operation.
- 3) Electrical power and control wiring diagram, motor efficiencies, starter/enclosure ratings.
- 4) Catalog information on valves, strainers and control components.
- 5) Packaged system dimension and general arrangement drawing.

C. Site Maintained Drawings

1. Maintain an accurate record of all changes made in installation from layout and materials shown on Contract Drawings and/or approved shop drawings.
2. Indicate location of items requiring maintenance or inspection.
3. Submit reproducible vellums of these drawings to Engineer prior to final inspection.

D. As-Built Drawings: Record changes from the contract drawings of all ductwork and equipment. Indicate location of dampers and items requiring maintenance or inspection. Submit as-built drawings for review prior to final inspection.

E. Operation and Maintenance Manuals: Submit eight (8) hard bound copies of the operating and maintenance manuals on all equipment and the system as a whole bound. The manual shall identify all equipment, the manufacturer's name, model, serial number, tag number, capacity, quantity, location and area served, operation and maintenance manual, and shall include the manufacturer's operation and maintenance manuals including control diagrams and source of service and replacement parts. Provide tabs separating each piece of equipment. When using published manuals covering several equipment models/options, identify which data and instructions apply to the equipment being provided. Submit complete manuals for review prior to final inspection.

1. Operating Instructions in manual shall include:
 - a. General description of the system and sequence of operations for all equipment.
 - b. Step by step procedure to follow in putting each piece of equipment in operation.
 - c. Provide schematic control diagrams for each separate fan system. Each diagram shall show locations of start-stop switches and correct operating settings for each control instrument shall be marked on this diagram.
 - d. Provide diagram for the electrical control system showing the wiring of all related electrical control items and interlocks.
 - e. Include all air balance and test reports.

- F. Provide a laminated copy of the control diagram for each component of the system. Diagrams shall be framed and hung in the Office.
- G. Certificates: Submit certificates as stipulated on item entitled "CERTIFICATES" hereinbelow.
- H. Guarantee: Submit guarantee as stipulated on item entitled "GUARANTEE" in PART 3 - EXECUTION hereinbelow.
- I. Maintenance Service Contract: Submit maintenance service contract as stipulated on item entitled "ONE YEAR MAINTENANCE SERVICE CONTRACT" in PART 3 - EXECUTION hereinbelow.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: For actual fabrication, installation and testing of work under this section use only thoroughly trained and experienced workmen completely familiar with items required and manufacturer's current recommended methods of installation. In acceptance or rejection of finished installation, no allowance will be made for lack of skill on part of the installer.
- B. The Mechanical Contractor shall provide an independent third party Testing and Balancing Contractor at their own expense to verify testing and balancing data provided under this section of the specifications. Selection of the third party Contractor shall be agreed on by both the Mechanical Contractor and the State.
- C. All equipment to be considered for this bid purposes must be of a manufacturer that has locally stocked spare parts, representative, and support of a service organization reasonably convenient to the site of installation which has serviced manufacturer's units of comparable type, size and capacity as those specified. The manufacture must have other units of comparable type, size and capacity installed and operating satisfactorily in the State of Hawaii for a minimum of two year prior to bid opening. The contractor shall provide a list of locations in Hawaii with addresses and telephone numbers when requested by the Engineer. All equipment with local manufacturer's representation shall be purchased through the local distributor.
- D. Laws, Regulations, and Permits
 - 1. Comply with all the requirements of the County of Maui, and the latest editions of SMACNA, ASHRAE and NFPA.
 - 2. Obtain and pay for all fees, permits, licenses, assessments, connection charges and inspections required for this work.
 - 3. At completion, submit certification from approving agencies that work meets above requirements.

- E. Substitution of another manufacturer's product specified hereinafter and for items with "or acceptable equal" after the brand name requires written permission by the Engineer prior to bidding. No substitution will be considered after the bid opening. Acceptable equal products of the following manufacturers are acceptable in lieu of those specified hereinafter by the manufacturer and model number.
1. Controls: Honeywell, Johnson Controls, Robert Shaw, Siebe (Ivensys), Automated Logic.
 2. VRF, Split system air conditioners: LG, Daikin, Fujitsu, Sanyo, Mitsubishi.
 3. Insulation: Certainteed, Owens-Corning, Pittsburgh Corning Corp, Pro-Tect-T-Kotes Fittings, Knauf.
 4. Exhaust and Supply Fans: Acme, Barry, Carnes, Chicago, Greenheck, Joy, L.C. Cook, Penn, Twin City Blower Company.
 5. Valves: Alco, DeZurick, Lukenheimer, Muessco, Nibco, Sporlan, Stockham, Superior, Walworth.
- F. Comply with the recommendations and requirement of the Codes and Standards listed hereinafter in addition to the detailed requirements of this specification.
1. American National Standards Institute Publications (ANSI):

A13.1	Scheme for Identification of Piping Standards
C 1	National Electrical Code
 2. National Fire Protection Association (NFPA) Standards:

90A	Air Conditioning and Ventilation System
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 3. Air Movement and Control Association (AMCA) Standards:

210	Test Code for Moving Devices
300	Test Code for Sound Rating Air Moving
 4. American Society of Heating, Refrigeration and Air Conditioning Architects (ASHRAE):

Handbook, Applications – latest edition
Handbook, Equipment – latest edition
 5. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

Manual for the Balancing and Adjusting of Air Distribution Systems
Low Velocity Duct Construction Standards – latest edition

6. Air Conditioning and Refrigeration Institute (ARI) Standards:

410	Forced Circulation Air Cooling and Heating Coils
520	Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units
550	Centrifugal and Rotary Water Chilling Packages

- G. Air conditioning equipment to be considered for bid purposes must be of manufacturer that has locally stocked spare parts, representation, and support of a service organization reasonably convenient to the site of installation which has serviced manufacturer's units of comparable type, size and capacity as those specified. 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 years prior to bid opening. The Contractor shall provide a list of locations in Hawaii with addresses and telephone numbers when requested by the Engineer. All equipment with local manufacturer's representative shall be purchased through the local distributor. Provide factory start-up with certified factory-trained personnel.

1.5 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials and equipment before, during, and after installation and to protect installed work and materials of all other trades. Under no circumstances shall any mechanical equipment be stored outside, unprotected.
- B. Replacements: In event of damage, immediately make all repairs and replacements necessary at no cost to the State.

1.6 CERTIFICATES

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. Contractor shall provide AHRI 550/590 factory certified test reports.

PART 2 – PRODUCTS

2.1 EQUIPMENT

- A. Capacities and characteristics of equipment are indicated on the drawings. See electrical drawing for all voltage and phase requirements of all equipment furnished under this work. Provide combination magnetic across-the-line starter, control voltage transformer and circuit breaker for each motor of mechanical equipment unless the equipment is factory-wired to a single power connection or unless otherwise indicated hereinafter. Provide disconnect switch for all mechanical equipment. All steel surfaces shall be hot-dipped galvanized. All steel exposed to weather shall be hot-dipped galvanized and shall have an additional two coats of zinc rich rust-proof paint. Provide vibration isolators as indicated hereinafter. All motors

shall be high efficiency type. All motors with variable speed drives shall have undervoltage, overvoltage, phase failure, phase reversal with automatic reset. All motors used with variable frequency drives shall be rated for variable speed usage.

<u>Equipment</u>	<u>Isolation Description*</u>	<u>Minimum Static Deflection</u>
Exhaust and Supply Fans	Rubber-in-shear with steel spring isolator	1"

*Isolator mounting shall be in accordance with manufacturer's dimensioned drawings. Isolators shall be sized specified static deflection from manufacturer's published loading information at each mounting point, based on operating weight. All springs shall be neoprene dipped with hot dipped galvanized housings. Provide additional layers of 3/4" thick insulation at factory or field install.

1. Ceiling Exhaust Fan: Ceiling fans shall have acoustically insulated housing. Air delivery shall be as indicated on the drawings and fan shall bear the AMCA certified ratings seal and the U/L label. Integral backdraft damper shall be totally shatterproof with no metal to metal contact. Fan shall have true centrifugal wheel with inlet perpendicular to or remote from inlet grille. Grille shall be of aerodynamic design of white molded plastic egg-crate shape and provide 85% free open area. Terminal box shall be provided on the housing with cord, plug, and receptacle inside the housing. Entire fan, motor, and wheel assembly shall be easily removable without disturbing the housing. Motor speed shall not exceed 1000 rpm and motor shall be suitably grounded and mounted on rubber-in-shear vibration isolators. Penn, Cook, Panasonic, Greenheck, Twin City, Broan, Nutone, or approved equal.
2. Inline Exhaust Fan: Forward centrifugal inline belt drive fans. Fan wheels shall be backward inclined and constructed of aluminum. The fan housing shall be of the square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components. Greenheck BSQ series or approved equal.
3. Split System Air Conditioner: Air Cooled Condensing unit shall be hermetic inverter driven scroll compressor with accumulator, charging valve, crankcase heater, timer circuit, internal vibration isolation and thermal overload protection. Non-ferrous copper condenser coil with lanced or corrugated plate fins. Direct drive, variable speed, propeller type condenser fan with permanently lubricated, totally enclosed and inherently protected motor. Factory applied Blue Fin corrosion protection coating on condenser fins and tubes. Galvanized steel unit casing, bonderized and finished with a powder coated baked enamel. The fan coil units shall be ceiling cassette, ducted or wall mounted as noted in equipment schedule. Split System AC shall be LG, Daikin, Fujitsu, Sanyo, Mitsubishi, or equal.
4. VRF Split-System Air Conditioners

- a. Air Cooled Condensing Unit: Hermetic inverter driven scroll compressor with accumulator, charging valve, crankcase heater, timer circuit, internal vibration isolation and thermal overload protection. Non-ferrous copper condenser coil with lanced or corrugated plate fins. Direct drive, variable speed, propeller type condenser fan with permanently lubricated, totally enclosed and inherently protected motor. Factory applied Blue Fin corrosion protection coating on condenser fins and tubes. Galvanized steel unit casing, bonderized and finished with a powder coated baked enamel.
- b. Fan Coil Unit: Unit shall be a ceiling concealed, ducted indoor fan coil unit installed above the ceiling with the return connection in rear and supply connection at the front. Filter boxes shall include 2" thick pleated MERV 13 filter. Mitsubishi Model PEFY-NMHU or approved equal.
- c. Fan Coil Unit: Unit shall be a ceiling cassette indoor fan coil that mounts at the ceiling with a fixed rear return center grille and directional supply vanes, with a modulating linear expansion device. MERV 8 filter minimum. Mitsubishi Model PLFY-NCMU or approved equal.
- d. Thermostat: Provide remote on-off switches and thermostats as indicated on drawings 48" above floor. The multi-zone fan coil units shall operate through an individual wired remote controller, Mitsubishi, model PAR21MAA or approved equal with auto off timer and operating lock. The controllers shall be programmed to operate the air conditioning units one hour before business hours, as set by the building engineer. Adjustments to the scheduling will be made on a case-by case basis based on the user's preference. The Contractor shall provide all necessary power wiring, conduits and connections for system which is provided.

2.2 DUCTWORK AND ASSOCIATED SHEETMETAL WORK

- A. All low pressure exhaust ducts shall be galvanized sheet metal steel with gages and construction in accordance with SMACNA Standards "Low Pressure Duct Construction Standards". Caulk/seal all joints/seams in ductwork airtight.
- B. Damper: Opposed blade type, all aluminum with exterior lever.
- C. Flexible Duct Connections: Neoprene coated glass fabric prefabricated connections, UL approved. Flexible duct connectors shall be provided at each inlet and discharge of exhaust fans.
- D. Deflectors: Provide fixed deflecting vanes at all branch take-offs and elbows. Shop fabricated blades; fit into side strips and screw or rivet to duct.

2.3 PIPE, FITTINGS AND VALVES

- A. Condensate Drain Piping (Aboveground): Type "L" hard drawn copper with copper or brass drainage fittings and 95-5 tin antimony (non-lead) solder joints. Use 45 degree elbows and cleanout plugs at all bends. Use non-corrosive flux.
- B. Refrigerant Piping: Type "L" hard drawn copper tube, ASTM B-88, with wrought copper or forged brass type fittings and silver brazing alloy.
- C. Valves: Ratings of not less than 125 psi working pressure. Provide chain wheel on valves in mechanical rooms if valves located at 8 feet above floor or higher. Provide epoxy coating on valves exposed to weather.
 - 1. Ball Valves 2-Inches and Smaller: Nibco T-560-BR-Y-20.
 - 2. Globe Valves 2-Inches and Smaller: Stockham B-22T (bronze).
 - 3. Check Valves 2-Inches and Smaller: Stockham B-319 (bronze).
 - 4. Check Valves 2-1/2 Inches and Larger: Stockham G-932 (iron body).
 - 5. Butterfly Valves: Lug type with iron body, bronze disc, 2-piece stainless steel stem, Buna-N seat with rigid phenolic liner backing, memory type locking infinite position throttling handle with position indicator and extended stem neck. Valves shall be capable of maintaining full pressure with downstream side removed. Valves 6" and larger shall have gear operator and handwheel.
 - 6. Gauges with 1/4" ball valves shall be provided as shown.
 - 7. Strainer: Muessco #758 with "Y" stainless steel screen 1/16 inch opening, iron body, flanged ends.
 - 8. Balancing Valves: Globe valve, iron body, bronze fitted with handwheel. Stockham G-512.
 - 9. Electric Valve Operator: Modulating low voltage electric motor with spring return and sufficient capacity to operate the control device under all conditions. Provide built-in transformer as required.

2.4 PIPE SLEEVES

Piping sleeves through walls and floors shall be steel pipe or 18-gauge galvanized metal. Piping through sleeves of fire rated walls or plenum chambers shall be caulked tight with fiberglass material. Sleeves installed through drilled holes through concrete shall be grouted and finished on both sides. Exterior sleeves shall be caulked watertight.

2.5 PIPE HANGERS AND SUPPORTS

- A. Horizontal piping shall be hung with Grinnell No. 260 hanger or equivalent; vertical piping shall be supported with Grinnell No. 261 riser clamps or approved equal.
- B. Uninsulated copper pipe shall be supported with copper plated hangers, Grinnell No. 97CP or approved equal.
- C. Under no circumstances shall piping be supported from ductwork, equipment or electrical.

2.6 FLEXIBLE CONNECTION

Provide flexible pipe connectors for all mechanical equipment connections rated at 150 psig working pressure, metal reinforced and with restraining rods. Multiple Victaulic joints may be used in lieu of flexible connections.

2.7 ACCESS PANELS

Provide access panels for all mechanical equipment requiring adjustment, servicing and routing maintenance. Access panels shall be 12 inch x 12 inch minimum size in walls and partitions, 24 inch x 36 inch minimum size for ceilings. Provide fire rated access panels to match rating of wall/ceiling where required.

2.8 INSULATION

- A. Apply in accordance with manufacturer's recommendations by skilled mechanics. Flame spread rating not to exceed 25 and a smoke development rating not to exceed 50.
 - 1. Condensate Drain Piping: Fiberglass insulation with all service jacket, Owens Corning or equal. Provide vapor barrier and all service jacket. Insulation thickness: 1-inch for pipe sizes 1 inch and smaller; 1-1/2 inches thick for larger pipes. Installation in accordance with manufacturer's latest recommendations.
 - 2. Refrigerant Piping: Armaflex insulation in accordance with manufacturer's recommendations. Insulation thickness: 1-inch for pipe sizes 1-1/2 inch and smaller; 1-1/2 inches thick for larger pipes.
 - 3. On pipe insulation throughout inside and outside of building, apply 16 mil embossed aluminum jacket with 2-inch overlap at longitudinal and circumferential joints, secured in place with 3/4 inch x 0.015 gauge aluminum bands on 18 inch centers. Apply humped aluminum ells or fabricated 16 mil aluminum to fittings and band in place.
 - 4. Saddles: Provide 180 degree galvanized sheet metal protective saddles at each hanger or support on insulated piping and shall be no less than 16 gauge and no less than 12 inches long. Insulation at saddles shall be 9 pcf density minimum.

5. Shields: An aluminum shield shall be fitted tightly around each piece of pipe covering where exposed to injury in mechanical rooms. On vertical pipes, shield shall extend a height of 6 feet. Longitudinal seams shall be palled 1 inch or more secured with sheet-metal screws spaced 4 inches apart, except on vapor sealed coverings, bands shall be used.

2.9 AUTOMATIC CONTROL SYSTEM

- A. Provide a complete DDC energy management control system (Automated logic, native Bacnet, Web-based system).
- B. Electric type, Barber-Coleman, Honeywell, Johnson, or approved equivalent. Provide all necessary accessories as required for a complete operable system.
- C. Control Panels
 1. All controllers, relays, switches, etc. for equipment located within equipment rooms shall be mounted in enclosed control panels with hinged locking doors. All control devices for equipment located exposed to weather shall be mounted inside NEMA 4X enclosures. Location of each panel is to be convenient for adjustment service. Nameplate shall be provided under each panel mounted control device describing the function of service. All electrical devices within the panel shall be pre-wired to terminal strips with all inter-device wiring within panel completed prior to installation of system.
 2. All electrical devices within the panel shall be prewired to terminal strips with all inter-device wiring within panel completed prior to installation of system.
- D. Electric control wiring, wiring connections and conduit required for installation of temperature control system as herein specified, shall be provided by temperature control contractor unless specifically shown on the drawings or called for in the specifications to be by the Electrical Contractor. All wiring shall comply with local and the National Electrical Codes. Provide control wiring for electric power of variable air box dampers and controls. All wiring shall be in conduit. Conduit exposed to weather shall be galvanized steel pipe conduit. No EMT is allowed outside building. Coordinate with Electrical Contractor, requirement and location of power connections for control voltage transformers where applicable at no extra cost to the State.
- E. Provide DDC controls and interlock with DDC system as indicated on plans for exhaust and supply fans. The Contractor shall provide all necessary power wiring, conduits and connections for system he provides.
- F. Temperature and Pressure Sensors/Transmitters: The temperature/pressure sensor type shall be as per manufactures recommendations and shall provide consistent and reliable operation. For wet sensors that are mounted in wells, the well and sensor shall be of the type that can be removed for calibration without wire connection removal. Similarly, the pressure transducer shall be of the type that the wiring pre-connector can be disconnected for device removal. Pressure transducers shall be fitting with a root ball valve and snubbers. Where pressure

transducers or pressure differential transmitters are required, provide for a Pete's plug with insulated extenders adjacent to the device.

2.10 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, furnish necessary tool with equipment as standard accessory.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Space reserved for ducts, piping and necessary lighting above furred ceilings are critical. Install ducts and piping through scissor frame. Location of light fixtures cannot be changed. If space allocated is too small for ducts and piping, make necessary move to fit into general pattern. All duct modifications shall be accomplished using 45 degree fittings; 90 degree fittings shall not be used unless prior approval from the Engineer is obtained. All changes shall be submitted to the Engineer for approval.
- B. Do not scale drawings. Check all measurements at building and adjust work to fit into space allotted. Close cooperation between trades will be required. Any work without regard for work of other trades shall be moved without extra charge, if necessary to permit proper installation of other work.
- C. Investigate the Contract Documents and make proper provisions to avoid interferences or construction delays. Determine the exact route of each duct and pipe. Make offsets and changes in direction required to maintain proper head room and pitch or to accommodate the structure and the work of other trades. When changing the size of ductwork, provide ducts having the same friction loss as the size of the duct shown on the Contract Documents. Furnish other trades with information to properly locate and size openings in the structure required for the work under this section. Furnish anchor bolts, sleeves, inserts and support required for the work under this section. Provide access panels for concealed items provided under this section that require maintenance, adjustment or inspection.

3.2 INSTALLATION

- A. 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 OSHA approved guard or rails all around exposed moving machinery parts, pulleys, belts and around high-temperature equipment and materials. No piping, electrical conduit, ceiling supports or similar items shall be supported from equipment or ductwork. Provide additional materials and labor for a complete, operable (including starting, testing, balancing and adjusting), and fully accepted system at no extra cost to the State.

- B. Equipment: 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 appurtenances. Provide equipment accessories necessary for proper operation and support. Concrete equipment bases and supports are under DIVISION 3 - CONCRETE. Direct trade providing concrete in the proper locations, dimensions, load carrying capacity and anchor bolt locations. Concrete pads shall be not less than four inches beyond the base of the equipment. Provide vibration isolators for all mechanical equipment as indicated hereinbefore. Secure floor mounted isolators to base and to equipment.
- C. Piping: Conform to recognized commercial standards. Inspect all pipes inside and outside. Remove interior obstructions and ream out pipe ends. 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 anchoring. Provide dielectric unions between dissimilar metals. Have piping tested, inspected and approved before it is furred in, buried or otherwise hidden. Provide 24 gauge galvanized steel sleeves where pipes pass through structure, sufficiently large to provide 1/4 inch clearance around pipe. Caulk watertight around pipes passing through sleeves. Wrap pipe with polyethylene tape where it passes through sleeve and when it contacts concrete and CMU (concrete masonry units). Provide non asbestos rope packing around all sleeves and seal with elastomeric caulk. All penetrations through the walls shall be packed with neoprene sponge, closed cell, conforming to ASTM Designation D01056 Grade SCE41. Provide chrome plated brass escutcheons, set tight on the pipe and to the wall where pipes are exposed in finished areas. Perform all welding using qualified welders in accordance with American National Standards Institute's Code B31.1 and American Welding Society Standard B31.0.
- D. Piping System: Pipe Supports Factory fabricated by Elcen, Fee and Mason, Grinnel or Unistrut; no chains or straps permitted. Provide concrete inserts, beam clamps, channel framing, hanger rods and accessories required for proper pipe support. Ramset or explosive type anchors are not permitted. Support vertical piping with hanger at base of riser and with pipe clamp at each floor. At each support point on insulated pipe provide Owens-Corning Kaylo pipe insulation (minimum 9 pcf density) or equal around pipe with 18 gauge sheet metal jacket, each two pipe diameters in length. Pipe Hanger Steel clevis hanger with adjustable hanger rod; 3/8" for pipe 2" and smaller, 1/2" for pipe 2 1/2" through 3 1/2" and 5/8" for pipe 4" and larger. Groups of lines may be supported from steel channel with pipe clamps.
1. Condensate Drain Piping System: Slope drain lines at 1/4 inch per foot unless otherwise directed. Provide a water seal (P trap) 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. See insulation specified hereinafter. Cleanouts at all changes in directions.
 2. Water Piping System: Provide unions or flanges at all connections to equipment and accessories. At all low points in the piping system, provide drain consisting of 1/2 inch gate valve with hose adaptor. Provide air vents at all high points in the piping

system; manual type unless otherwise indicated. Extend a discharge line to a drain from each vent. Provide chain wheel with guides on all valves in equipment rooms that are 8 feet or more in height. Provide chains extending to 5 feet above floor.

3. Electric Valve Operator: Modulating low voltage electric motor with spring return and sufficient capacity to operate the control device under all conditions. Provide built-in transformer as required.

3.3 ELECTRICAL WORK

- A. Conform to the requirements of NFPA-70, National Electrical Code, and to the requirements of DIVISION 16 - ELECTRICAL of these specifications. Obtain equipment manufacturer's control wiring diagrams for the equipment furnished. Prepare a control and interlock control diagram for the complete system. Indicate terminal connection points to factory wired equipment. Submit control diagram to the Engineer for review. Contractor shall supply and mount all motors and provide all control wiring with conduits and controls for equipment furnished by him except that shown on the Electrical Drawings. All power wiring, including final connection to the mechanical equipment shall be provided by the Electrical Contractor. Refer to DIVISION 16 - ELECTRICAL and to the electrical drawings as well as mechanical drawings for requirements and division of work for each application. Should any equipment supplied by the Mechanical Contractor require electrical service or wiring than as shown on the Electrical Drawings, advise the Electrical Contractor of such changes and pay all costs for any additions or alterations necessary in the wiring or controls. All control devices must be installed to operate within the manufacturer's rated load and voltage. All control circuits must be through the respective equipment disconnect to insure the control circuit being off when the equipment is off. Wiring materials and methods shall conform to DIVISION 16 - ELECTRICAL, to the applicable codes and to ANSI, National Electrical Code and NEMA Standards and Specifications.
- B. Electric Motor Characteristics and Drive: Motor voltages shall be as indicated, and to be verified with the Electrical Contractor and his drawings. Use high efficiency type motors. Service factor of 1.15 with wick oiled sleeve type bearings or grease packed ball bearings not to exceed 1800 RPM, unless otherwise indicated. V-belt drives designed for 150 percent of motor horsepower with provisions made to adjust belt tension. Where multiple V-belts are used, match the belts. 3/4 HP and larger motors shall have a minimum of two belts. Pulley diameters not smaller than 3 inches O.D. for A-belts, 5 inches for B-belts and 8 inches for C-belts. Drive ration shall not be greater than 1 to 7. All pulley cast iron or steel and properly aligned.
- C. Motor Starters and Wiring
 1. Furnish motor starters, enclosures, disconnect switches, necessary relays, and other devices, including remote push-button stations; deliver to Electrician for installation and wiring.
 2. Furnish, install, wire and interconnect panels, relays, timers, and other necessary control devices; integrate with motor starting equipment to produce a complete control system.

3.4 DUCTWORK

- A. Duct Connections: Flexible at both discharge and inlet of air moving equipment, applied in accordance with manufacturer's instructions. Allow 2-inches of free space between collars connected. Install 2 lb. density sheet lead band completely around collar at each end of connections and fasten to collars with screws through band and glass fabric, placed no more than 3-inches on centers.
- B. Keep ductwork openings closed with sheet metal during construction to prevent injury, and take all possible precautions to keep interior of ducts, air intake chambers and fan housings free from dirt and dust.
- C. Dampers and Deflectors: Provide splitter, butterfly and louver dampers, deflecting vanes for control of air volume and direction, and for balancing system where indicated, specified and directed.
 - 1. Dampers of galvanized steel, at least one gauge heavier than that for duct size in which damper is installed, reinforced where directed; with indicating quadrant in accessible location, and locking device for adjusting locking damper in position.
 - 2. Deflectors: Where fixed deflecting vanes are indicated, provide shop-fabricated blades; fit into side strips and screw or rivet to duct elbow in field.
- D. Duct Supports: Support horizontal ducts with hangers spaced not more than 8 feet apart; place hangers at changes in direction. Use strap hangers for ducts up to 30 inches wide; angle hangers for ducts over 30 inches wide. Strap hanger shall be one inch wide of 16 gauge galvanized sheet steel; extend down both sides of duct and turn under bottom at least 4 inches, fasten to side and bottom with sheet metal screws. Angle hangers may be formed by extending vertical bracing angles or by rods passing through bottom bracing angles.
- E. Erect all ducts with necessary elbows, dampers, etc. and all fans, air outlets, filters, dampers, etc., furnished under other articles of this section. Cross-break ducts exposed to weather to shed water.
- F. Provide sizes, runs and connections of ducts that adhere to drawings as closely as possible. Install to indicate heights as permitted by structure. Fabricate ductwork in workmanlike manner with air tight joints, presenting smooth surface on inside, neatly finished on outside; construct with curves and bends to ease flow of air.
- G. Openings through construction required for ductwork will be provided by others; shop drawings shall locate such duct openings. Obtain approval in ample time to meet building construction schedule. Ductwork shall have rectangular cross section unless otherwise indicated.

H. Low Pressure Ductwork

1. Details of construction and materials not specified herein shall be in accordance with ASHRAE Guide and SMACNA recommended and as approved.
2. Unless otherwise indicated, make inside radius of curves and bends not less than width of ducts. Where square elbows are used, provide fixed double radius turning vanes. Construct, brace and support ducts and air chambers so they will not sag or vibrate when fans are operating.
3. Fabricate, unless otherwise indicated or specified, in accordance with SMACNA "Low Velocity and Duct Construction Standards", latest edition. Ducts 18 inches wide and larger which are not insulated shall be cross broken. Distances between joints on any size duct shall not exceed 8 feet. Seal and caulk all ductwork airtight including all longitudinal seams and transverse joints. Conduct pressure tests for zero leakage at 2" water gage.

3.5 CORROSION PROTECTION

- A. Since the coatings specified herein are of a specialized nature, it is essential that only qualified and experienced applicators be acceptable for this type of work. Coat inside and outside of unit.
- B. A clean area, specialized equipment, techniques, including fog spray, are required to apply the coating properly, and without defects.
- C. Proper surface preparation is necessary. Surfaces shall be thoroughly cleaned and if there is evidence of rust or scaling on ferrous steel surfaces, they must be wire brushed, shot blasted or sandblasted, and primed with rust inhibitive primer. Non-ferrous surfaces shall be cleaned in preparation for the coating system.
- D. In order to coat effectively, the entire apparatus being coated should be disassembled to the maximum degree without disturbing wiring or piping. Upon completion of the coating, the apparatus should be reassembled with care so that the coating surface is not damaged.
- E. Surfaces to be coated shall have materials and application in strict accordance with manufacturer's recommendations.
- F. Corrosion protection coatings shall offer protection from all concentrations of salt solutions, fumes, splash, or spillage of dilute acids, alkalies, and other corrosive chemicals, as well as water, weathering, abrasion and radiation.
- G. The most critical area in coating this type of equipment is the non-ferrous, extended surface heat exchanger (finned coils). It is essential that the coatings be sprayed uniformly and completely over all surfaces of the fins and tubes. This will require several passes through each side of the coil in order to gain effective penetration through the inner coil rows without excessive build-up of fins edges. Care should be taken not to coat too quickly inasmuch as heat exchange will be impaired if the coating is not applied in the thicknesses specified

hereafter. Material viscosity must be adjusted to compensate for temperature and humidity conditions. Coat inside and outside of unit.

H. Cabinet Interior and Exterior Surfaces

1. Unit cabinet shall be coated with Ameron PSX 700 Engineered Siloxane. Metal preparation to provide a surface profile that shall include degreasing and etching.
2. The coating shall be applied to all exterior surfaces until a total of 6-8 mils D.F.T. is achieved. Coating shall be applied in strict accordance with coating manufacturer's recommendations.
3. After the coating has totally cured, the equipment shall be assembled using care not to damage the coating during assembly. Fasteners shall be stainless steel with bonderized rubber washer attached. Any touch up required shall be performed in accordance with the manufacturer's recommendations.
4. The coating shall be performed by a qualified and experienced applicator.

3.6 PIPE INSULATION SYSTEM

- A. Install insulation system in accordance with manufacturer's recommendations using tradesmen 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 Development of 50. Owens Corning, Johns Manville, Certaineed, Knauf, Armstrong, Pittsburgh Corning Corp, equal.
 1. Insulate condensate drain piping with 1" thick fiberglass with all service jacket for pipe sizes 1 inch and smaller and 1-1/2" thick for larger pipes. Seal all joints with insulation manufacturer's approved adhesive.
 2. On pipe insulation exposed to weather, apply 16 mil embossed aluminum jacket with 2" overlap at longitudinal and circumferential joints, secured in place with 3/4" x 0.015 aluminum bands on 18 inch centers. Apply humped aluminum ells or fabricated 16 mil aluminum to fittings and band in place.

3.7 AUTOMATIC CONTROL SYSTEM

- A. Automatic control system shall be electric and shall be furnished and installed by a qualified controls contractor specifically in this field. Controls contractor shall have proven experience in design, installation, calibration and service of equipment. Provide relays, control dampers, switches, control wiring and conduit and other items necessary to perform the functions specified or required for proper sequencing and operation of system. Direct the mechanical contractor in the proper location and installation of control dampers and similar items installed by that trade. Provide identifying labels on all controls. Provide waterproof enclosure around controls installed outdoors. Mount fan "on-off" switch 44 inches maximum above floor unless otherwise indicated in accordance with ADAAG requirements.

1. Control and Interlock Wiring: Provide all control and interlock wiring. Obtain wiring diagrams for all equipment and prepare a complete control-wiring shop drawing. Submit to Engineer for his comments. Conform to National Electrical Code requirements. All wiring shall be in pipe conduit: Galvanized pipe conduit for conduit for conduit exposed to weather, PVC for conduit below grade.
 2. Mount flow switches in upright position in a horizontal run of pipe; a minimum of ten pipe diameters from any fittings, valves or other obstruction. Locate switches in outlet piping of equipment.
 3. Set, test, calibrate, adjust and place in operation all equipment furnished by the control contractor. Upon completion of the operational test, inform the Engineer in writing that the system is installed in accordance with the drawings and specifications and that the system has been calibrated and tested and is ready for use. Correct deficiencies observed after the facility is occupied.
- B. Sequence of Operation: Air conditioning contractor shall provide all necessary controls sequence for new equipment as required for a complete and operating system. Exhaust Fans for Janitor and toilet shall be interlocked with DDC system. Supply Fans shall be interlocked with air conditioners.

3.8 BALANCE, ADJUST AND TESTING

- A. Scope: The Contractor shall obtain the services of an independent, qualified test and balance agency that specializes in, and whose business is the testing and balancing of ventilation systems, to test mechanical systems to determine quantitative performance. Compare observed quantities with design quantities. Adjust systems to produce observed quantities that will conform to design quantities within tolerances specified. Balance the flow to conform to design, lock and mark adjustments, and leave systems in balance. Complete balancing, adjusting and testing prior to final inspection by the Engineer and also after building is occupied if required.
- B. Job Conditions: Ventilation equipment shall have been completely installed and shall be put into continuous operation as required to accomplish the test adjustment and balance work specified.
- C. Certified Reports: Submit test reports on approved forms with certification by the testing Engineer that the methods used and the results are as specified. Reports shall be on forms as approved by the Engineer.
- D. Procedures: Air Systems - Test and balance new split system air conditioners, exhaust fans, and supply fans in accordance with SMACNA manual for the Balancing and Adjustment of Air Distribution Systems.
1. Preliminary: Size, type and manufacturer of air terminals and all tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations unless field tests show ratings to be impractical.

2. Verification: Prepare summation of readings of observed CFM for each system, compare with required CFM and verify that duct losses are within specified allowable range.
 3. Six copies of the complete test report shall be submitted to the State prior to final acceptance of the project.
 4. Balancing: Water piping systems shall be balanced to produce water quantities as indicated with all manual and automatic control valves open.
- E. Automatic Control System:
1. In accordance with the control manufacturer's representative, set and adjust automatically operated devices to achieve required sequence of operations. Testing organization shall verify all controls for proper calibration and list those controls requiring adjustment by control system installer. Permanently mark set-point.
 - a. Reports: Fill in test results on approved report forms. Submit three certified copies of required test reports to the Engineer for review.
 - b. Adjust factory set pressure controller for inlet guide vanes in accordance with design conditions.
- F. Test Data: The Contractor shall provide the State with 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 for the following items:
1. Pump (for each unit):
 - a. Manufacturer and Model.
 - b. Size.
 - c. Type Drive.
 - d. Motor H.P., Voltage, Phase, and Full Load Amps.
 - e. G.P.M.
 - f. Suction and discharge pressures.
 - g. R.P.M.
 - h. Motor Operating Amps during test.
- G. System Performance Report: After conclusion of balancing operations, make temporary installation of portable recorders and simultaneously record summer temperatures and

humidity at representative locations in each system and outdoors. Test location shall be as approved by the State. Recordings shall be made summer for a 5 day period, continuous over a weekend, and including at least one period of operation conditions within 2 F DB of maximum summer design condition.

3.9 CLEAN UP

Clean up the work provided under this section. Touch up with matching paint all damaged factory finishes. Adjust for quiet and effective operation.

3.10 PAINTING AND IDENTIFYING

A. The following items furnished under this section are to be painted and identified under Section 09900 - PAINTING. Do not paint over name plates or other identifying labels.

1. Painting of exposed bare metal surfaces in finished areas shall be provided herein if it is not specified under Section 09900 - PAINTING. Included in this work shall be bare metal registers, louvers, access panels for mechanical equipment, control covers and thermostat covers, sheet metal ductwork jacket, piping, hangers, etc. Prepare surface as required in paint schedule. Provide two final coats matching adjoining surface finish.
2. Provide piping identification and flow arrows. Stencil all exposed piping with painted black letters indicating the service and with an arrow indicating the direction of flow. Stencil where pipes enter and leave each area and at not over 30 ft. intervals within an area. Paint color band at stencils; green for water systems. 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.
3. Provide piping identification for abandoned piping with the existing stubouts on the condenser risers and indicates as "abandoned". Contractor shall coordinate with Engineer for the work. 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.

3.11 VALVE TAG AND VALVE LOCATION LOG

Provide identification tags on all valves. Contractor to provide a complete log of all valves to include: valve number, valve type, valve size, valve service and location.

3.12 INSTRUCTIONS

Instruct the State or State's representative in the proper operation and maintenance of the system. Review the maintenance manuals with the State's representative. Post starting and stopping instructions adjacent to the equipment, mounted in frame with glass cover plate. Submit a list of manufacturer's warranties for the equipment furnished.

3.13 GUARANTEE

Guarantee period and one-year maintenance service shall start only after 30 consecutive days of trouble-free operation after system acceptance. Both periods to run concurrent with same start and end dates. All work in this section shall be guaranteed for a period of one (1) year from the date of acceptance of the work as a whole by the State. Correction of undue noise or vibration is included in the guarantee. Should any equipment or material fail within this period, the Contractor shall replace or repair at no cost to the State. The Contractor shall be responsible for all damage to any part of the premises caused by leaks in piping or equipment for a period of one year after final acceptance of the work as a whole by the State.

3.14 ONE YEAR MAINTENANCE SERVICE CONTRACT

- A. In addition to the Guarantee on material and workmanship, the Installer shall submit seven (7) copies of the Maintenance Service Contract, countersigned by the General Contractor that will validate said Guarantee.
- B. The maintenance services shall extend for a period of one year commencing after 30 consecutive days of trouble free operation after date of acceptance of the work as a whole by the Engineer, and shall include all labor, materials, equipment and parts to necessary to service the complete system, in accordance with the attached Operation and Maintenance Manual (see ATTACHMENT NO. 1), so as to secure proper operation and function of the system. Filters shall be changed every month. Servicing of all equipment shall be done once a month. All costs for the periodic maintenance, including emergency calls, shall be borne by the Contractor. This maintenance period and the guarantee period shall run concurrently (same start and end dates). 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 require 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 parameters as measured during acceptance tests.
- C. The Installer shall include a listing of the following items along with the Maintenance Service Contract:
 - 1. Name of servicing contractor.
 - 2. Mechanical system acceptance date.
 - 3. Service contract expiration date.
 - 4. Monthly 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 serial number(s) and manufacturer's name(s).

D. 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
3 copies	DLNR Inspection Branch Engineers Files
3 copies	User

3.15 OPERATION AND MAINTENANCE MANUAL

Refer to paragraph entitled "SUBMITTALS", subparagraph "Operation and Maintenance Manuals" in PART 1 - GENERAL.

ATTACHMENT NO.1

OPERATION AND MAINTENANCE MANUAL

1.1 SCHEDULE OF MAINTENANCE SERVICE

A. All services performed by the Contractor shall include applicable items listed but shall not be limited to the following maintenance tasks.

B. ACCU

1. Monthly Service

- a. Check and record refrigerant compressor suction and discharge and oil pressures.
- b. Visual check for refrigerant and oil leakage; correct or repair as required. Check vibration isolator mounts.
- c. Check compressor, fan, and motor bearings for abnormal temperature and unusual noise; lubricate and/or replace as required.
- d. Check compressor oil level and add oil as required.
- e. Adjust alignment of bearings and sheaves for fans, motors, and compressors, and replace worn or noisy bearings or sheaves.
- f. Note and run system operation through complete operating cycle and adjust for proper operation. Certify performance of monthly maintenance service and correct and report all discrepancies.

2. Quarterly Service

- a. Review past log readings.
- b. Check response of unit at various load conditions for proper operation and calibration of capacity control system.
- c. Check safety controls and record settings.
- d. Check and clean all strainers.
- e. Lubricate fan motor bearings.
- f. Check fan belt tension. Replace frayed belts and always replace belts as a set.
- g. Check pulley tightness to shaft and pulley alignment.

- h. Check refrigerant and air temperature, and air flow rate.
3. Annual Service
- a. Test compressor crankcase oil and replace if contaminated or submit oil test results; clean or replace strainer and oil filter.
 - b. Megger (electrical test to measure wire insulation resistance, i.e. condition) compressor motor; check starter relay and control contacts and electrical connections for tightness and clean as required.
 - c. Test operate control switches, compressor unloading and safeties; calibrate and record settings. Adjust as required.
 - d. Submit and certify performance of annual maintenance service and correct and report in writing to Engineer all discrepancies.
 - e. Clean cooling coils of dirt accumulation using nitrogen, high pressure air/water, steam, or chemical coil cleaner solution.
 - f. Check pressure and temperature differential across cooling coils and log readings.
 - g. Clean supply and return air grilles, registers and diffusers and fresh air intake grille.

C. Fan Coil Unit

1. Monthly Service
- a. Clean and clear all drip pans and flush all related condensate drain lines with nitrogen. (Contractor may be liable for water damage due to clogged drains). Install pan tablets if necessary to control algae.
 - b. Wash permanent type filters with an approved detergent and spray coat with an approved filter treatment solution. Replace deteriorated permanent type filters that cannot be cleaned.
 - c. Lubricate and oil all fan and motor bearings and connections of dampers and vanes.
 - d. Check all drives for wear; adjust belt tension. Replace belt as required.
 - e. Operate equipment to check for proper operation, unusual noise and vibration; adjust or repair all equipment and controls as required; clean up all equipment.
 - f. Check time clock for proper operation and time settings.

- g. Certify performance of monthly services and that all discrepancies are reported and corrected.

2. Annual Service

- a. Adjust alignment of bearings and sheaves; lubricate fan and motor bearings. Replace worn or noisy bearings or sheaves.
- b. Clean cooling coils of dirt accumulation using nitrogen, high pressure air/water, steam or chemical coil cleaner.
- c. Clean supply and return grilles, registers and fresh air intake grilles and dampers and repair or replace deteriorated bird screens.
- d. Clean all fan wheels and interior and exterior of equipment housings.
- e. Secure all loose housing, seal leaks and touch-up paint after cleaning all rust.
- f. Check and calibrate all electric temperature controls.
- g. Certify performance of annual service and correct and report all discrepancies.

D. Exhaust and Supply Fan

1. Monthly Service

- a. Lubricate and oil all fan and motor bearings.
- b. Check all drives for wear; adjust belt tension. Replace belt as required.
- c. Operate equipment to check for proper operation, unusual noise and vibration; adjust or repair all equipment and controls as required; clean up all equipment.
- d. Certify performance of monthly services and that all discrepancies are reported and corrected.

2. Quarterly Service

- a. Lubricate fan and motor bearings.
- b. Check fan belt tension. Replace frayed belts and always replace belts as a set.
- c. Check pulley tightness to shaft and pulley alignment.

- d. Check motor controlled and backdraft dampers for proper operation; lubricate linkage for free movement.
 - e. Replace air filters where installed; remove and wash intake grilles.
 - f. Certify performance of quarterly fan maintenance service and correct and report all discrepancies.
3. Annual Service
- a. Adjust alignment of bearings and sheaves; lubricate fan and motor bearings.
 - b. Secure all loose housing, seal leaks and touch-up paint after cleaning all rust.
 - c. Remove and wash all intake grilles and dampers and repair or replace deteriorated bird screens.
 - d. Certify performance of annual service and correct and report all discrepancies.
- E. Air Distribution System
1. Monthly Service
- a. Check ductwork and air devices for noise and vibration.
 - b. Check ductwork and insulation for loose connections and damage.
2. Annual Service
- a. Clean all air devices.
 - b. Re-balance complete system.
- F. Building Automated Systems, Controls & Related Power
1. Monthly Service
- a. Check for proper setting of operating controls and sensors.
 - b. Check switches and contacts and clean or replace if required.
- G. Condensate Piping
1. Monthly Service
- a. Check all condensate drain piping and fittings for leaks.

- b. Check all insulated piping and fittings for leaks.
- c. Drain dirt leg.

1.2 WORK SCHEDULE

All maintenance work shall be performed between the hours of 7:30 a.m. and 4:00 p.m., on normal working days, Monday through Friday.

1.3 TROUBLE CALLS

- A. Emergency service and repairs required between regular service calls shall be rendered within 24 hours after the Contractor is notified, non-work days excluded.
- B. The Contractor shall call the Engineer the next working day after being notified of the problem and report the status of repairs.

1.4 MAINTENANCE REPORT/CHECKLIST

- A. The Contractor shall prepare and maintain a maintenance service report/checklist which shall include the following:
 - 1. Date maintenance service was performed.
 - 2. 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.
- B. 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 repair, and have the checklist available for inspection at the building site. The report shall be sufficiently detailed to properly reflect the past maintenance history of the equipment.
- C. Reports/Checklists shall be prepared on contractor furnished standardized forms and certified by a representative of the facility being served. A copy of the report/checklist shall be submitted after each visit to the Engineer.

1.5 CLEANUP AND WORK PRACTICES

- A. The Contractor shall keep the job site free of debris, litter, discarded parts, etc. and shall clean all oil drippings during the daily progress of work. The Contractor shall remove all tools, parts, and equipment from the service areas upon completion of the work.

- B. The Contractor shall exercise caution during the progress of his maintenance and repair work to prevent damage to 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.

END OF SECTION

SECTION 15950

HVAC TESTING/ADJUSTING/BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. The work includes testing, adjusting, and balancing (TAB) of new ventilating distribution systems including equipment, ducts, and piping which are located within, on, under, between, and adjacent to buildings.
- B. Related Work Described Elsewhere:
 - 1. Mechanical work as specified in Section 15000 - GENERAL MECHANICAL REQUIREMENTS unless specified otherwise in other sections of DIVISION 15.
 - 2. Air conditioning and ventilation equipment specified in Section 15800 - AIR CONDITIONING AND VENTILATION.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS. Also refer to Section 15000 - GENERAL MECHANICAL REQUIREMENTS.
- B. Statements: Submit the following in accordance with Section 15000 - GENERAL MECHANICAL REQUIREMENTS.
 - 1. Independent TAB agency personnel qualifications.
 - 2. Design review report.
 - 3. Pre-field TAB engineering report.
 - 4. Advanced notice TAB field work.
 - 5. Check out list.
- C. Independent TAB Agency Personnel Qualifications: For agency proposed for approval, submit information certifying that: the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract; the work to be performed by the TAB agency shall be limited to testing, adjusting, and balancing of HVAC air systems to satisfy the requirements of this specification section. Submit the following, for the agency, to the Engineer for approval in compliance with paragraph entitled "TAB Personnel Qualification Requirements."
 - 1. Independent AABC of/or NEBB certified TAB agency:

- a. TAB Agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification.
 - b. TAB Team Supervisor: Name and copy of AABC or NEBB TAB supervisor certificate and expiration date of current certification.
 - c. TAB team field leader: Name and documented evidence that the team field leader meets the qualification requirements.
 - d. TAB Team Field Technicians: Names and documented evidence that each field technician meets the qualification requirements.
 - e. Current Certificates: Registrations and certifications shall be current and valid for the duration of this contract. Certifications which expire prior to completion of the TAB work, shall be renewed in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification shall not perform TAB work on this contract.
 - f. Replacement of TAB Team Members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Engineer.
- D. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC and industrial ventilation system's design that would preclude the TAB team from accomplishing the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.
- E. Pre-Field TAB Engineering Report: Submit report containing the following information:
1. Step-By-Step TAB Procedure:
 - a. Strategy: Describe the method of approach to the TAB fieldwork from start to finish. Include in this description a complete methodology for accomplishing each TAB fieldwork session.
 - b. Procedural Steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system. Include intended procedural steps for TAB work for subsystems and system components.
 2. Pre-Field Data: Submit AABC or NEBB or SMACNA HVACTAB data report forms with the following pre-field information filled in:

- a. Design data obtained from system drawings, specifications, and approved submittals.
 - b. Notations detailing additional data to be obtained from the contract site by the TAB field team.
 - c. Designate the actual data to be measured in the TAB fieldwork.
 - d. Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB fieldwork. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to used, is to be made in the field, specify from which instruments the choice will be made. The instrument key number shall be placed in the blank space where the measured data would be entered.
3. Prerequisite HVAC and Industrial Ventilation System Work Checkout List: A list of inspections and work items which are to be completed by the Contractor, and submitted and approved by the Engineer prior to the TAB team coming to the contract site. At a minimum, a list of the applicable inspections and work items listed in the NEBB TABES, Section III, "Preliminary TAB Procedures" under paragraphs entitled "Air Distribution System Inspection" and "Hydronic Distribution System Inspection." Also, list as prerequisite work items, the deficiencies pointed out by the TAB engineer in his design review report.
- F. Advanced Notices: Submit "Advanced Notice for TAB Field Work" in writing.
- G. Completed Check Out Lists: Submit "Prerequisite HVAC and Industrial Ventilation Work Checkout List" and certify in writing that each item has been checked and is operating as designed.
- H. Field Test Reports: Certified TAB report.
- I. Submit certified reports in the specified format including the above data. Submit Certified TAB Report in the following manner:
1. Report Format: Submit the complete pre-field data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed and certified by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
 2. Design Review Report Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded.

3. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.
 4. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.
- J. TAB Submittal and Work Schedule: Compliance with the following schedule is the Contractor's responsibility.

TAB Field Work: At a minimum of 30 calendar days prior to start of field check, accomplish TAB fieldwork; submit certified TAB report; and conduct field check.

1.3 REFERENCES

- A. 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. ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(1989) Testing and Balancing Heating, Ventilating and Air Conditioning System
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2. AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE HA	(1991) Handbook, HVAC Applications
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3. NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB CMSV	(1993) Calculations and Measurements of Sound and Vibration
NEBB TABLES	(1991) Testing, Adjusting, Balancing of Environmental Systems
4. SHEET METAL & AIR CONDITONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA HVACADLTM	(1985) HVAC Air Duct Leakage Test Manual
SMACNA HVACTAB	(1993) HVAC Systems Testing, Adjusting and Balancing

1.4 QUALITY ASSURANCE

- A. Modifications of References: Accomplish work in accordance with referenced publications of AABC or NEBB except as modified by this section. In the references referred to herein, consider the advisory or recommended provisions to be mandatory, as though the word “shall” had been substituted for the words “should” or “could” or “may” wherever they appear. Interpret reference to the “authority having jurisdiction,” the “Administrative Authority,” the “Contracting Officer,” or the “Design Engineer” to mean the “Engineer.”
- B. TAB Personnel Qualification Requirements:
1. Independent AABC or NEBB Certified TAB Agency: Provide services of a TAB agency certified by AABC or NEBB to perform and manage TAB work on HVAC air systems. This TAB agency shall not be affiliated with any company participating in any other phase of this contract, including design, furnishing equipment or construction.
 2. TAB Team Personnel: TAB team approved to accomplish work on this contract shall be full-time employees of the TAB agency. No other personnel shall do TAB work on this contract.
 - a. TAB Team Supervisor: Supervisor shall be qualified by AABC or NEBB as a TAB supervisor or a TAB engineer.
 - b. TAB Team Field Leader: Leader shall have satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract’s bid opening date.
 - c. TAB Team Field Technician: Technician shall have satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract’s bid opening date.
 3. Responsibilities: The Contractor shall be responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule.
 - a. Contractor:
 - 1) TAB Personnel: Ensure that the TAB work is accomplished by a group meeting the requirements specified in paragraph entitled “TAB Personnel Qualification Requirements.”
 - 2) Pre-TAB Meeting: Attend the meeting with the TAB Supervisor, and ensure that a representative is present for the sheetmetal contractor, mechanical contractor, electrical contractor, and automatic temperature controls contractor.

- 3) HVAC and Industrial Ventilation System Documentation: Furnish one complete set of the following HVAC and industrial ventilation system-related documentation to the TAB Agency:
 - a) Contract drawings and specifications
 - b) Approved submittal data for equipment
 - c) Construction work schedule
 - d) Up-to-date revisions and change orders for the previously listed items
- 4) Submittal and Work Schedules: Ensure that the schedule for submittals and work required by this section are met.
- 5) Coordination of Supporting Personnel: Provide the technical personnel, such as factory representatives or HVAC controls installer required by the TAB field team to support the TAB field measurement work. Provide equipment mechanics to operate HVAC and industrial ventilation equipment to enable TAB field team to accomplish the TAB field measurement work. Ensure these support personnel are present at the times required by the TAB team, and cause no delay in the TAB fieldwork. Conversely, ensure that the HVAC controls installer has required support from the TAB team field leader to complete the controls check out.
- 6) Deficiencies: Ensure that equipment defects, installation deficiencies, and design deficiencies reported by the TAB team field leader are brought to the attention of the Engineer. Ensure that design deficiencies reported by the TAB field leader, or the TAB team supervisor, are transmitted to the Engineer within 7 calendar days from date of receipt from the TAB agency.
- 7) Prerequisite HVAC and Industrial Ventilation Work: Complete check out and debugging of HVAC and industrial ventilation equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC and industrial ventilation system installations, and verifying all adjustable devices are functioning as designed. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. List as prerequisite work items, the deficiencies, pointed out by the TAB team supervisor in the design review report. Ensure that the TAB Agency gets a copy of the prerequisite HVAC and industrial ventilation work checklist specified in the paragraph

entitled "Submittals." Do not allow the TAB team to commence TAB fieldwork until all of the following are completed:

- a) HVAC system installations are fully complete.
 - b) HVAC prerequisite checkout work lists have been completed, submitted, and approved.
 - c) HVAC system filters are clean for TAB fieldwork.
 - d) Industrial ventilation system installations are fully complete.
 - e) Control systems installations are fully complete.
- 8) Advance Notice: Furnish to the Engineer with advance written notice for each event, the commencement of the fieldwork and for the commencement of the TAB fieldwork.
- b. TAB Agency: Provide the services of a TAB team which complies with the requirements of paragraph entitled "TAB Personnel Qualification Requirements."
- 1) TAB Team Supervisor:
 - a) Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical TAB procedures and TAB team fieldwork.
 - b) Pre-TAB meeting: Attend meeting with Contractor. Design review report: Review project specifications and accompanying drawings to verify that the air systems systems are designed in such a way that the TAB Team Field Leader can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
 - c) Support required: Specify the technical support personnel required from the Contractor rather than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the pre-field engineering report or during the TAB fieldwork.

- d) Pre-field engineering report: Utilizing the following HVAC and industrial ventilation-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.
 - e) Prerequisite HVAC and industrial ventilation work checklist: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.
 - f) Technical assistance for TAB work: Provide immediate technical assistance to the TAB field team for the TAB work.
 - g) Certified TAB report: Certify the TAB report. This certification includes the following work:
 - (1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.
 - (2) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field engineering report and verify adherence to the procedures specified in this section.
 - h) Design deficiencies: Submit in writing as soon as possible, to the Contractor and the Engineer, each design deficiency reported by the TAB field team. Provide, in this submittal, a complete explanation including supporting documentation detailing the deficiency.
 - i) TAB field check: The TAB team supervisor shall attend and supervise TAB field check.
- 2) TAB Team Field Leader:
- a) Field manager: Manage, in the field, the accomplishment of the work specified in PART 3 - EXECUTION.
 - b) Full time: Be present at the contract site when TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
 - c) Prerequisite HVAC and industrial ventilation work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC and Industrial Ventilation Checklist, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

- C. Re-TAB Meeting: Meet with the State’s TAB representative and the designing engineer of the HVAC and industrial ventilation systems to develop a mutual understanding relative to the details of the TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TAB PROCEDURES

- A. TAB Field Work: Test, adjust, and balance the listed HVAC systems to the state of operation indicated on and specified in the contract design documents. Air systems shall be proportionately balanced and reported in the certified TAB report. Provide instruments and consumables required to accomplish the TAB work. Conduct TAB work on the listed HVAC and industrial ventilation systems in conformance with the AABC MN-1, or NEBB TABES, and NEBB CMSV, except as modified by this section:
 - 1. Maintenance and calibration of instruments.
 - 2. Accuracy of measurements.
 - 3. Preliminary Procedures: Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. Test ports required for testing by the TAB engineer shall be located in the field by the TAB engineer during TAB fieldwork. It shall be the responsibility of the sheetmetal contractor to provide and install test ports as required by the TAB supervisor.
 - 4. Air Distribution Systems TAB Work: Ventilating systems including fans, ducts, plenums, and registers, grilles, and louvers for outside air and exhaust air systems.
- B. Data From TAB Field Work: After completion of the TAB work, prepare a pre-final TAB report using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Engineer, the TAB work and the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled “Workmanship” of this section. Prepare the report neatly and legibly; the pre-final TAB report shall be the final TAB report minus the TAB supervisor’s review and certification. Obtain, at the contract site, the TAB supervisor’s review and certification of the TAB report. Verbally notify the Engineer’s TAB representative that the field check of the certified TAB Report data can commence; give this verbal notice 48 hours in advance of when the field checking shall commence. Do not schedule field check of the certified TAB report until the specified workmanship requirements have been met or written approval of the deviations from the requirements have been received from the Engineer.

C. Quality Assurance For TAB Field Work:

1. Field Check: Test shall be made to demonstrate that capacities and general performance of air systems comply with the contract requirements.
 - a. Recheck: During field check, the Contractor shall recheck, in the presence of the Engineer, random selections of data (water, air quantities, air motion, sound level readings) recorded in the certified report.
 - b. Areas of Recheck: Points and areas of recheck shall be selected by the Engineer.
 - c. Procedures: Measurement and test procedures shall be the same as approved for work for forming basis of the certified report.
 - d. Recheck Selections: Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the report.
 - e. Re-Tests: If random tests reveal a measured quantity which is out-of-tolerance, the report is subject to disapproval at the Engineers discretion. In the event the report is disapproved, all systems shall be readjusted and tested, new data recorded, new certified reports submitted, and a new field check conducted at no additional cost to the State.
2. Approval Prerequisite: Compliance with the field checking requirements of this section is a prerequisite to the final approval of the certified TAB report submitted.

D. Marking of Settings: Permanently mark the settings of HVAC adjustment devices including valves, splitters, and dampers so that adjustment can be restored if disturbed at any time. The permanent markings shall indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

E. Marking of Test Ports: The TAB team shall permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, these markings shall be made on the exterior side of the duct insulation. The location of test ports shall be shown on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

END OF SECTION

DIVISION 16 – ELECTRICAL

SECTION 16011

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The Contractor under this Division shall provide all labor, materials, equipment, supervision and services required for the construction of the electrical systems. The finished installations shall be complete, operable and shall include all work specified herein and shown on the Drawings.
- B. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All systems shall be properly adjusted and in working order at time of final acceptance.
- C. All concrete, steel reinforcement, miscellaneous metal-work, earthwork, painting, and grouting shall conform to the applicable requirements of the detailed equipment specifications as prescribed in appropriate sections.
- D. It is the intent of these Specifications and other Contract Documents to require an installation complete in every detail. Consequently, the Contractor will be responsible for minor details or for any special construction which may be found necessary to properly furnish, install, adjust, test, and place in successful and continuous operation, the entire electrical system.
- E. Related Sections include the following:
 - 1. Section 03300 – CAST-IN-PLACE CONCRETE.
 - 2. Section 09900 – PAINTING.
 - 3. Section 15800 – AIR CONDITIONING AND VENTILATION

1.2 DESCRIPTION OF WORK

- A. Work specified in this Division shall include, but not be limited to the following:
 - 1. Secondary electrical, telephone and cable television infrastructure.
 - 2. Electrical distribution system, including overcurrent protection devices and feeders.

3. Complete electrical system wiring including branch circuits, receptacles, luminaires, and switches.
4. Raceways for telephone/data/CATV system, including but not limited to, equipment racks and equipment backboards.
5. Complete lighting systems.
6. Include in the bid and pay for the permits, inspection fees and deliver the certificate of final inspection to Engineer.
7. Testing.
8. On as-built drawings, exterior electrical utility lines are required to be located by dimensions and azimuths from permanent reference points.

1.3 REFERENCES

- A. Comply with the applicable requirements of the following standards unless otherwise indicated:
 1. Comply with local ordinances; National Electrical Code; National Electrical Safety Code; applicable regulations of the National Board of Fire Underwriters; specifications of ANSI, NEMA, UL, IES, and IPCEA; and regulations of the County of Maui.
 2. In the event of conflict between pertinent codes and regulations, and the requirements of the referenced standards, or those indicated in Specifications and on drawings, the provisions of the more stringent shall govern.

1.4 PERMITS AND INSPECTION

- A. All permits required by local ordinances shall be obtained and paid for by the Contractor.
- B. Coordinate and arrange for inspections by Maui Electric Company (MECo) and Hawaiian Telcom, as necessary. Allow for adequate notification period, and all work in conformance with utility company requirements shall be corrected at no additional cost to the State.
- C. After completion of the work, the Engineer shall be furnished a certificate of final inspection and approval from the Electrical Inspection Department of local Authority Having Jurisdiction (AHJ).

1.5 COORDINATION

- A. Refer to all project Drawings and to all Sections of the project Specifications. Coordinate and fit all work accordingly so that all luminaires, switches, and equipment will be properly located and readily accessible. The Drawings indicate the relation of wiring and connections and must not be scaled for exact locations. Verify all construction dimensions at the

project and make changes necessary to conform to the building as constructed. Work improperly installed due to lack of construction verification shall be corrected at the Contractor's expense.

- B. Work shall be scheduled to avoid delays, interferences, and unnecessary work. If any conflicts occur necessitating departures from the Drawings and Specifications, details of departures and reasons therefore shall be submitted immediately for consideration by the Engineer.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Written certification that electrical systems are complete and operational.

1.7 DELIVERY, HANDLING AND STORAGE

- A. Deliver all materials of this Division in manufacturer's original unopened packages or containers with label intact and legible.
- B. Use means necessary to protect the materials of this section before, during and after installation; to protect the installed work and materials of all other trades; and to protect the original structure, work and materials of the State.
- C. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the State.

1.8 WARRANTY

- A. Installation shall be complete in every detail as specified and ready for use. Any items supplied by Contractor developing defects of design, construction, or quality within one year of final acceptance by Engineer shall be replaced by such new materials, apparatus or parts to make such defective portion of the complete system conform to the true intent and meaning of the Drawings and Specifications at no additional cost to the State. Lamps shall be warranted for 50 percent of rated lamp life. Electronic ballasts shall be guaranteed for 5 years.
- B. The warranty shall be countersigned by the General Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

- A. All materials shall conform to the latest issue of all applicable standards as established by NEMA, NFPA, ANSI, IEEE, IES, ASTM and Underwriters' Laboratories, and shall bear the manufacturer's name and trade name and when available, the Underwriters' Label.

- B. Neat appearances in the finished work will be required. Only experienced electrical workers shall be employed for the electrical installation.
- C. All work not installed and completed in accordance with the latest rules and regulations of the NEC, OSHA, NESC, and all local ordinances shall be removed and reinstalled correctly at the Contractor's expense.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all electrical materials and equipment in accordance with manufacturer's recommendations and as approved by the Engineer for the seismic zone classification at the project site.
- B. Cut, break, drill and patch as required to install electrical system. Repair any surface damage or marred by notching, drilling or any other process necessary for installation of electrical work. Patch any damaged surfaces to match the existing surface.
- C. All wiring and overcurrent devices for equipment furnished by other trades are sized for a contemplated equipment size. If equipment other than contemplated and indicated on the plan is provided, the Contractor shall be responsible for providing the required wiring, switches, and overcurrent devices at no cost to the State. The Contractor shall submit the proposed revisions to the electrical design to the Engineer for approval.
- D. The Electrical Contractor shall coordinate his work with other trades to avoid conflicts with civil, mechanical, structural, and architectural elements of this project.

3.2 JOBSITE CONDITIONS

- A. These specifications are accompanied by construction drawings including building and site plans of all trades, and show locations of all switches, feeder runs, luminaires, and other electrical equipment. The locations are approximate and before installing, study adjacent architectural details and make installation in most logical manner. Any device may be relocated within 10'-0" before installation at direction of Engineer without additional cost to State.
- B. Before installing, verify all dimensions and sizes of equipment.
- C. Verify that electrical system may be installed in strict accordance with the original design, the Drawings and Specifications and the manufacturer's recommendations.
- D. In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 CONNECTIONS TO MECHANICAL EQUIPMENT PROVIDED BY OTHER TRADES

- A. Electrical Contractor shall provide conduit, power wiring, and all electric connections from building wiring to equipment specified by other trades.
- B. Electrical Contractor shall ascertain from other trades furnishing equipment, the exact size and type of all equipment, the exact locations of such equipment and the proper point where electrical connections should be brought through the floors or walls, as the case may be. Locations shown are diagrammatic only; correct locations shall be the full responsibility of the Electrical Contractor.

3.4 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEMS

- A. Submit written certification that electrical systems are complete and operational. Submit certification with Contractor's request for final review.
- B. At the time of final review of electrical work, demonstrate the operation of electrical systems. Provide labor, apparatus and equipment for systems' demonstration. The various test shall be under the direction and supervision of the Engineer.
- C. The Contractor shall provide all test equipment, materials, labor, and temporary power hook-ups to perform start-up and all tests as required to obtain final field acceptance from the State. All tests shall be conducted in the presence of the Engineer or his representative. All test procedure shall conform to this specification and applicable standards the ANSI, IEEE, NEMA, OSHA, NFPA, etc.
- D. The Contractor shall be responsible for all tests and test record. Testing shall be performed by and under the immediate supervision of the Contractor. Test record shall be kept for each piece of equipment. Copies shall be furnished to the Engineer for his review and/or approval.
- E. A visual inspection of all electrical equipment, to check for foreign material, tightness of wiring and connection, proper grounding, matching nameplate charts with specification, etc., shall be made prior to actual testing.

END OF SECTION

SECTION 16100
ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor and materials required to complete all electrical work as indicated on the drawings and/or specified herein.
- B. Related Sections include the following:
 - 1. Section 16011 - GENERAL ELECTRICAL REQUIREMENTS applies to this section with additions and modifications specified herein.
 - 2. Section 09900 - PAINTING.

1.2 APPLICABLE PUBLICATIONS

The publications cited within this specification form a part of this specification to the extent referenced. Unless otherwise indicated, most recent edition of the publication with current revisions and amendments will be enforced.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Product Data
 - 1. Panelboards.
 - 2. Junction boxes 6 inches and larger.
 - 3. Safety switches.
 - 4. Overcurrent protection devices.
 - 5. Manual transfer switch.
 - 6. Metering equipment.
 - 7. Portable generator receptacle.
 - 8. Telecommunications equipment racks.
 - 9. Cable tray.

10. Floor outlet boxes.
11. Photovoltaic (PV) System
 - a. Photovoltaic modules. Include flash test data; temperature coefficients at STC, nominal operating cell temperature (NOCT), low irradiance conditions (LIC), high temperature conditions (HTC) and low temperature conditions (LTC).
 - b. Inverters.
 - c. Combiner boxes.
 - d. Photovoltaic racking system.
 - e. Materials and fasteners for structural support system and mounting hardware.

C. Shop Drawings

1. Submit shop drawings showing feeder 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.
2. Photovoltaic System
 - a. One-line diagram.
 - b. Three-Line Diagram: Show system details, devices, and circuiting.
 - c. Photovoltaic array string sizing calculations.
 - d. Manufacturer-recommended installation instructions and procedures including all equipment mounting support structures.
 - e. Provide photovoltaic installation details if proposed layout is different than as shown on drawings. Submit equipment layout, wiring requirements, panel and device locations, new equipment, etc. Structural support system and mounting hardware. Indicate assembly dimensions, locations of structural members, connections, general construction details, anchorages and methods of anchorage.
 - f. Estimated kWh production using PVWATTS software tool from National Renewable Energy Labs.

- g. Comprehensive engineering analysis for structural support system and mounting hardware to withstand wind and seismic loading indicated in the structural drawings. Provide structural calculations signed and sealed by a qualified structural engineer licensed in the State of Hawaii.
 - h. NABCEP certification of PV system contractor/installer.
- D. Operation and Maintenance Manuals: Photovoltaic system.
- E. Field Test Reports: Submit the following test results for approval in report form as stipulated in paragraph "FIELD QUALITY CONTROL" hereinbelow.
 - 1. 600 volt wiring test.
 - 2. Grounding system test.
 - 3. PV system tests.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials shall be new and those items listed by the Underwriters' Laboratories shall bear "UL" label of approval.
- B. Brand names, manufacturer's names and catalog numbers indicate standard of design and quality required. Acceptable manufacturers for electrical apparatus include General Electric, Siemens, Square D/Schneider, and Eaton. All apparatus supplied shall bear the name of the approved manufacturer on its nameplates. Substitute materials may be used if pre-qualified prior to bidding by the Engineer.
- C. Electrical apparatus shall be supplied through the manufacturer's designated representative by a local distributor.
- D. Proof of compliance shall be furnished when shop drawings are submitted.
- E. Where two or more similar type items are furnished, all shall be of the same manufacture.
- F. Where electrical apparatus is to be installed outdoors, NEMA 4X Type 316 stainless steel housings shall be provided.

2.2 RACEWAYS

- A. Rigid Steel Conduit: Rigid steel, zinc-coated inside and outside, for use with threaded fittings. ANSI C80.1.

- B. Flexible Metal Conduit: Flexible steel conduit; zinc-coated inside and outside, smooth inside walls, liquid-tight with factory fittings for liquid-tight installation. Provide bushings with bonding jumper lugs for flexible conduit in excess of six feet in length. UL 360.
- C. Electrical Metal Tubing (EMT): Thin walled steel tubing, zinc-coated. ANSI 80.3.
- D. Plastic Conduit: Polyvinyl chloride, Schedule 40 and Schedule 80. Provide a separate green equipment grounding conductor.

2.3 BOXES

- A. Outlet and Small Junction Boxes: Nominal 4 inches square for power and non-multi-media systems, 4-11/16 inches square for multi-media systems, 2-1/8 inches minimum depth exclusive of plaster ring, pressed steel, galvanized for corrosion protection. Exposed boxes and boxes exposed to the weather shall be cast steel, type FD.
- B. Extension Rings for Outlet Boxes: Pressed steel, zinc-coated for corrosion protection.
- C. Boxes Larger than 4 Inches Square: Fabricated from NEC grade steel, zinc-coated for corrosion protection, prime painted and finished to match adjacent architectural elements. 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.
- D. Multiple System Floor Outlet Boxes: Where power receptacles and media system outlets are grouped together, boxes shall be recessed activation, multi-service type, adjustable and concrete-tight. Each box shall contain four wiring compartments and consist of a cast-metal body with threaded openings for conduits, adjustable ring, flush trim ring with recessed activation access hatch. Provide gaskets where necessary to insure watertight installation. Four inches maximum depth.
 - 1. Walker RFB4-CI Series or approved equivalent.
 - 2. Provide accessories as required for recessed activation of receptacles and signal outlets as required.

2.4 CONDUCTORS

- A. Solid or stranded copper, sizes according to American Wire Gauge Wire, as shown on Drawings and #12 AWG minimum unless otherwise indicated. Stranded conductors only for #8 AWG and larger. All wiring shall be color coded.
- B. Branch Circuits: Type THWN.
- C. Luminaire Wires: Per NEC.
- D. Conductors Larger than #8 AWG: THWN or XHHW.

- E. Conductors for Equipment Connection: Stranded flexible type.

2.5 WIRING DEVICES

- A. General: Ratings and NEMA arrangement types as indicated. Drawings show minimum application ratings, specification describes nominal ratings.
- B. Switches: White, 20A, 120/277V, non-mercury quiet type, specification grade with nylon body. Provide double pole, three-way, and four-way switches as indicated.
- C. Duplex Convenience Receptacles: White unless otherwise indicated, 20A, 125V, specification grade, grounding type, unless otherwise noted.
- D. Other Receptacles: Specification grade, ratings and NEMA configurations as indicated. Provide twist lock receptacles where indicated.
- E. Ground Fault Circuit Interrupters: Receptacle type similar to duplex convenience receptacle except 20A and UL listed per UL 943 with 6 milliampere ground fault sensing circuit. Feed-through type with test and reset buttons.

2.6 DEVICE PLATES

- A. Nylon, high-impact resistant, white, gangs as required.
- B. For Exterior Installation: Weatherproof flip-open cover, cast aluminum, with cable opening and neoprene gaskets for plug-in equipment in outdoor or wet applications when receptacle is in use per NEC. Color to match adjacent finish. Cover shall be pad-lockable and capable of closing with a plug cap connected to the receptacle.

2.7 PANELBOARDS

- A. Mounting, enclosure type, voltage rating, main bus capacity, breaker complement and lugs as specified on drawings, complete with housing, door, trim, lock and typewritten circuit directory. Provide copper ground bus for all panels.
- B. Panelboards should have copper bussing with bolt-on, molded case circuit breakers. Provide 1-inch-per-pole breakers, half-size breakers not allowed. Circuit breaker complement short circuit ratings shall be fully rated. Use of series rated equipment will not be permitted. Toggle positions "ON", "OFF" and "TRIPPED" engraved or embossed on body and visible without removing enclosure cover.
- C. All locks shall be common-key type. Furnish 6 sets of keys to the Engineer.
- D. Panel housing and entire circuit breaker complement shall be of the same manufacture.
- E. Distribution panel shall be minimum 30 inches wide with an 8 inch minimum depth. Converted lighting panelboards with auxiliary gutters not acceptable.

2.8 CIRCUIT BREAKERS AND SAFETY SWITCHES

- A. Safety switches shall be heavy-duty grade, horsepower rated and sized as indicated or as to match branch circuit overcurrent device rating.
- B. Enclosures for switches shall be NEMA 1 for interior locations and NEMA 4X for exterior locations.
- C. Circuit breakers, unless otherwise shown, shall be molded case, toggle, mechanism operated, with no-fuse ambient-compensated thermal-magnetic overload automatic trip units for overcurrent and short-circuit protection, interchangeable trip units when available and contacts rated to interrupt short-circuit currents as specified on Drawings. Non-automatic breakers shall have short-circuit withstanding ratings as specified on Drawings. Multi-pole breakers shall have single, common operating handle for all poles unless otherwise shown. Toggle position “ON”, “OFF”, and “TRIPPED” and breaker rating engraved or embossed on body and visible without removing enclosure cover.

2.9 MANUAL TRANSFER SWITCHES

- A. Enclosure for manual transfer switch shall be NEMA 1.
- B. Switch shall be heavy-duty grade, double throw, horsepower rated, and sizes and indicated or as to match circuit overcurrent device rating. Shall be load make/break rated and be padlockable at “ON1”, “ON2”, and “OFF” position. UL listed as suitable for use as service equipment.

2.10 TELECOMMUNICATIONS EQUIPMENT RACK

- A. Provide in accordance with EIA/ECA-310E and UL 50.
- B. Seven-foot high floor mounted type, 12 gauge aluminum construction minimum, treated to resist corrosion. Provide with vehicle cable management channels. Ground lug. Rack shall be compatible with 19-inch rack mounted equipment.
- C. Rack shall be minimum 300 pound equipment load capacity and be black in color.

2.11 CABLE TRAYS

- A. NEMA VE 1. Cable trays shall form a wireway system, and shall be of nominal depth as indicated. Cable trays shall be constructed of aluminum. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than load-carrying ability of straight tray sections and shall have manufacturer’s minimum standard radius. Radius of bends shall be manufacturer recommended.
- B. Basket-Type Cable Trays: Provide size as indicated of nominal 12-inch wide and 6-inch deep, with maximum wire mesh spacing of 2 inches by 4 inches.

2.12 METERING EQUIPMENT

- A. Meter Socket: Conform to NEMA, EUSERC specifications and MECo requirements. 13 Jaw, test bypass, as approved by MECo for CT metering, for 3-phase, 4-wire system.
- B. Current Transformer Cabinet: Fabricated from code gauged steel, MECo sealable, screw attached covers, factory finished. Current transformer cabinet shall comply with MECo requirements.

2.13 CABINETS

- A. Fabricated from NEC grade steel with hinged door and lockable latch, galvanized for corrosion protection, finished to match panelboards for surface or flush mounting and size as shown on Drawings. Factory finished.
- B. Signal cabinets shall be equipped with 3/4-inch thick termite treated plywood backboards.
- C. All cabinets for power systems (i.e., panelboards, relay cabinets, etc.) shall be keyed alike. All cabinets for signal systems shall be key alike, but differently than power system cabinets.

2.14 PHOTOVOLTAIC SYSTEM

- A. General Requirements: Furnish all labor, materials (except as hereinafter noted), tools, equipment, and appliances required to provide and install all Electrical and Structural Work complete, as indicated on the drawings and/or as herein specified. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment furnished by the successful supplier. The work shall include, but not necessarily be limited to, the following:
 - 1. Complete photovoltaic system, including all necessary equipment, conduit, wiring, controls, and accessories. Any omission in specified equipment will not relieve the Contractor of the responsibility for providing a complete system, including all items required proper operation, except for such items which are specifically noted as being furnished by others.
 - 2. Provide a complete, programmable, utility-interactive, net energy metered solar photovoltaic (PV) system, including but not limited to solar photovoltaic modules, inverter assemblies, isolation transformers, PV array combiner enclosures, AC and DC disconnect switches, overcurrent protection devices and all other accessories and miscellaneous items required for a complete and operational system.
 - 3. The photovoltaic system shall have the capability to generate a web-based display showing the real-time performance of the photovoltaic system, including, but not limited to: ambient temperature; cell temperature; solar radiation; DC string level; power output of each inverter; system output voltage; total real-time power being produced; and total power produced to date.

4. The system layout on the drawings are conceptual and diagrammatic. Equipment, materials, installation, workmanship, inspection and testing shall be in strict accordance with local ordinances and Interconnection Standards of MECo. Assist the State to secure the Net Energy Metering/Interconnection agreement with MECo.
5. Provide proof of testing and certification with UL 1741 Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; UL 1703 Standard for Flat-Plate Photovoltaic Modules and Panels; and IEEE-929 Recommended Practice For Utility Interface of Photovoltaic (PV) Systems.
6. Prior to ordering equipment, the Contractor shall examine the drawings to verify the amount of space allocated for the electrical equipment and to determine if the materials proposed will fit within the allotted space. It shall be the Contractor's responsibility to provide equipment that will fit within the allotted space.
7. Installation shall be accomplished by an electrical contractor with a minimum of three year experience in the installation of utility-interactive solar photovoltaic systems in the State of Hawaii and NABCEP (North American Board of Certified Energy Practitioners) PV Installation Professional Certification . Submit data to indicate that the Contractor has successfully installed utility-interactive solar photovoltaic systems of the same type as specified herein, or that the Contractor has a firm contractual agreement with a subcontractor having such required experience. Include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. 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. Submit names and phone numbers of points of contacts for each installation.
8. The services of a technician or manufacturer's representative shall be acquired to supervise installation, adjustment and testing of the system. The manufacturer's representative shall currently maintain, a locally run and operated business in the State of Hawaii for at least five years and shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges. The manufacturer's representative shall show satisfactory evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The manufacturer's representative shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
9. All items of equipment, including wire and cable, shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. Codes, Regulations and Standard Specifications

1. AMSE PTC 50.
2. ANSI Z21.83.
3. NFPA 853.
4. NFPA 70.
5. IEEE 1547.
6. National Electrical Safety Code - ANSI C2.
7. See structural drawings for applicable criteria for structural support system and mounting hardware.

C. Materials and Workmanship

1. Photovoltaic Modules
 - a. High efficiency, polycrystalline modules, 15 percent minimum efficiency.
 - b. Modules must be of the same manufacturer and model number and consistent subcomponents.
 - c. Tempered glass low reflectance panel within a corrosion-resistant anodized aluminum frame. Panel frame shall be provided with pre-drilled mounting and grounding holes.
 - d. Each panel shall have ratings as indicated on drawings. 230 watt minimum PTC rating.
 - e. Nominal panel size shall not exceed 42 inches x 66 inches.
 - f. PV module bypass diodes must be inside the solar PV module's single conductor cable junction box.
 - g. Listed on the California Energy Commission's PTC list.
 - h. Modules shall be certified in accordance with UL 1703.
 - i. 25-year minimum power output warranty.
 - j. Sharp, Sunpower, Kyocera, or approved equivalent.

2. Inverters

- a. Utility-interactive, automatic sensing of AC input voltage. NEMA 3R enclosure. Nominal AC voltage, phase, and maximum output power ratings as indicated on drawings.
- b. Provide inverter with anti-islanding protection to prevent back-feeding inverter generated power to the grid in the event of a utility outage. Anti-islanding protection must be listed to UL 1741 and IEEE 1547.
- c. Overcurrent protection, ground fault protection, arc fault circuit interrupter and rapid shutdown must comply with the requirements of NFPA 70.
- d. Customizable AC voltage and frequency settings to address MECo specifications and criteria.
- e. Interval data meter to measure the AC output of the inverter.
- f. Provide inverter with self-diagnostic routines, and remote and local display of operating status and remote monitoring capabilities. Provide inverter compatible with monitoring system and metering system.
- g. Match inverter DC output to the design of the PV module array outputs and account for the following:
 - 1) The inverter low voltage is 50 percent of the maximum system voltage, to account for 25 year degradation.
 - 2) Voltage decrease due to high temperatures at the project site.
- h. Provide isolation transformer built into each inverter to provide safe galvanic separation between the AC side of the inverter and the grid.
- i. 96 percent minimum CEC efficiency rating.
- j. Maximum input open circuit voltage of 600 VDC.
- k. Minimum power tracking range of 220-480 VDC.
- l. RS-485 Modbus communication module and web-based monitoring functions.
- m. Emergency stop and enable/disable auxiliary contacts.
- n. Minimum warranty of 10 years. Specify warranty extension modalities.

- o. Must comply with the following requirements:
 - 1) IEEE 929.
 - 2) UL 1741.
 - 3) Listed on the CEC list of eligible inverters.
- 3. Combiner Boxes
 - a. UL 1741. Provide combiner box in wall mount, NEMA 4X enclosure and load-break disconnecting means. Provide overcurrent protection and output disconnecting means that comply with the requirements of NFPA 70.
 - b. Supply combiner boxes designed for use with the inverter supplied and coordinated to the specific PV source circuit design.
 - c. Rated for 600 VDC, integral fuse cover/puller, minimum 100A output current combiner box. 8-circuit with fuses rated for 15A and 20A, with provisions to incorporate blocking diodes in series with each circuit, and an integral or after-market lightning arrester. Integral string monitoring system.
- 4. Raceways
 - a. Conduits: Galvanized rigid steel, 3/4 inch minimum diameter unless otherwise indicated, for interior installations only. Aluminum conduits shall not be used.
 - b. Flexible Conduit: 3/4 inch minimum, zinc-coated inside and outside; PVC coated, lighted-tight with factory fittings.
- 5. Wires and Cables: Conductors shall be copper, No. 12 AWG minimum; No. 10 AWG and smaller, solid and round; No. 8 AWG and larger, 7 or 19 strands concentric. All conductors for photovoltaic direct current systems shall be Type USE-2.
- 6. Warning Signs: Engraved with lettering with red background, 1/2 inch high lettering minimum, stainless steel (Type 316) screw type fasteners.
- 7. Nameplates: Bakelite nameplates shall be black finish with white core and shall have 1/4 inch high engraved letters indicating the name of the equipment being served by the device on which the nameplate is to be installed or the name of the device, etc.
- 8. Photovoltaic Racking System: Photovoltaic rail system shall be aluminum with integral sliding panel clamps and suitable for use with standing seam metal roofing.

9. Conduit and Equipment Supports: Conduit and equipment supports shall be fabricated from stainless steel Type 316. All mounting hardware shall be stainless steel (Type 316).
10. Hardware, Supports, Backing, Etc.: All hardware, supports, backing, and other accessories necessary to install electrical equipment shall be provided. Iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze. Exterior materials shall be stainless steel (Type 316) with the exception of mounting brackets for the photovoltaic panels which shall not produce electrolysis with the metal framing, corrosion resistant aluminum or brass.

2.15 FIRESTOPPING MATERIALS

Provide firestopping at raceway penetrations through rated walls.

2.16 HARDWARE, SUPPORTS, BACKING, ETC.

- A. Provide all hardware, supports, backing and other accessories necessary to install electrical equipment. Wood materials shall be treated against termite, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze.
- B. Bolts, nuts, washers, and screws used for outside shall be high quality stainless steel or brass.
- C. Ground Rods: Ground rods shall be copper clad steel type, 3/4-inch diameter, 10 feet long, sectional type, and conform to UL 467.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.
- B. Underground Service: Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.2 RACEWAYS

- A. Use conduits with approved coupling and connectors. All cuts square, using saw. Ream the ends. Bends made with approved tools. Reject flattened or crushed conduit. No running thread. Bushing and two locknuts at connection to boxes and enclosures.
- B. Seal against water during construction. Risers must be closed, except when pulling conductors.

- C. All raceways shall be blown and swabbed after installation to remove any water then immediately sealed to prevent water infiltration during construction. Raceways must remain sealed except when pulling conductors. If water is discovered during the warranty period the Contractor shall remove water from raceways and associated boxes at no additional cost to the Owner.
- D. Exposed conduit runs to be parallel and/or perpendicular to architectural and structural elements. Galvanized rigid steel conduit or IMC up to 7'-0" above finished interior floor. EMT permitted for exposed installation indoors above 7'-0". EMT also permitted for exposed installation throughout dedicated electrical rooms, except where routed up through grade slab.
- E. Electrical Metallic Tubing (EMT): Acceptable for exposed, indoor installation as indicated above and for all concealed indoor installations with the following exceptions:
 - 1. EMT not permitted in/under grade slab.
 - 2. EMT not permitted in walls that are in contact with earth.
 - 3. Provide factory-made transitions between rigid conduit and EMT.
 - 4. Field-paint exposed tubing with corrosion-resistant paint.
- F. Non-metallic conduits only permitted for exterior ductlines and beneath grade slab at building; within retaining walls in contact with earth up to the first outlet box or conduit coupling above the height of earth being retained; and within walls anchored to grade slab and not in contact with earth up to height of first outlet box or conduit coupling. Exposed installation of non-metallic conduit not permitted. Installation of non-metallic conduits beneath areas with hazardous classifications not permitted.
- G. Minimum conduit diameter shall be 3/4-inch trade size.
- H. Provide nylon pullstring of 200 pound minimum tensile strength in all empty conduits in excess of 15 feet in length.
- I. Conceal all raceways unless otherwise noted on the drawings.
- J. Conduits crossing expansion joints shall be provided with appropriate couplings or flexible conduit jumpers as required to accommodate a 1-inch movement between structural elements in all horizontal directions from the static, design position.
- K. 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.
- L. Provide locknuts and bushings for all raceway terminations.
- M. Provide hubs for all raceway connections to boxes and enclosures exposed to weather.

3.3 BOXES

- A. Plumb and securely fasten. Flush boxes - exactly flush; apply form oil so that stray concrete can be removed readily. Remove all debris from interior.
- B. Install boxes serving opposite sides of walls a minimum of 6 inches apart to minimize noise transmission.
- C. Covers and Device Plates: Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates not permitted. Provide gasket for plates installed in wet locations.
- D. Electrical Penetrations: Opening around electrical penetrations (such as conduit penetrations of flush mounted equipment enclosures or junctions boxes) through fire resistance-rated walls, partitions, floors, or ceilings shall be sealed to maintain fire resistive integrity.

3.4 CONDUCTORS

- A. Lubricants: Non-wax type, chemically neutral to insulation and sheath. Mechanical means for pulling to be torque-limiting type and not be used to #2 AWG and smaller wires.
- B. No-solder pressure connectors or crimp connections for #8 AWG and larger wires. Remove all sharp points that can pierce tape. Reinsulate according to wire manufacturer's directions.
- C. Clean all raceways, boxes, and enclosures before pulling wires and cables. Form neatly in enclosures for minimum of cross-overs.
- D. Equipment Connections: Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.
- E. Seismic Bracing: Contractor shall provide seismic bracing for all electrical equipment, apparatus, and raceways. Bracing shall, as a minimum, comply with the County Building Code.
- F. Photovoltaic System
 - 1. General Requirements
 - a. Comply with IEEE 1262 Recommended Practice for Qualifications of Photovoltaic Modules.

- b. Power provided shall be compatible with the building's power distribution system.
- c. Power capacity shall be measured at the inverter AC output using the PVUSA Test Conditions (PTC).
- d. The System shall include all the hardware and appurtenances as needed for a complete solar photovoltaic system.
- e. System shall be installed in accordance with all applicable requirements of local electrical codes and the National Electrical Code (NEC), including but not limited to, Article 690 - "Solar Photovoltaic Systems" and Article 705 - "Interconnected Electrical Power Production Sources".
- f. Balance of system (wiring, component, conduits, and connections) must be suited for conditions for which they are to be installed.
- g. Interconnection must comply with MECo Net Energy Metering (NEM) and/or Interconnection standards. The Contractor shall provide the necessary 1-line and 3-line diagrams and inverter relay data as required by MECo and submit the completed NEM or Interconnection agreement to MECo.

2. Structural Supports

- a. All structures supporting photovoltaic and array systems shall be designed to resist dead load, live load, plus wind and seismic loads as indicated.
- b. Photovoltaic systems, including rail support system, shall be designed to support all loading specified based on spacing of structural steel support framing shown on the drawings. Coordinate all structural loading, connection points etc. for structural support system with mounting hardware with pre-engineered metal truss supplier prior to fabrication
- c. Thermal loads caused by fluctuations of component and ambient temperatures must be combined with all the above load combinations.
- d. All structural components, including array structures, shall be designed in a manner commensurate with attaining a minimum 30 year design life. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.

3. Label wiring at combiner boxes with circuit or string numbers.

4. Miscellaneous Details

- a. Provide permanent labels on the top frame of each photovoltaic panel identifying the string and panel numbers (i.e. "A-6/5" would identify string

6, panel 5, in array A). The labels shall be embossed or engraved to prevent fading and shall be permanently attached to the panels. The panels may be engraved with the information in lieu of providing permanent labels.

- b. Provide warning sign on the main building disconnect reading “WARNING: BUILDING IS FED BY PHOTOVOLTAIC GENERATING FACILITY”.
- c. Provide warning sign on photovoltaic system AC disconnect circuit breaker reading “ATTENTION: PHOTOVOLTAIC GENERATING FACILITY”.
- d. Provide warning signs on disconnecting means where all terminals may be energized in the open position reading “WARNING: ELECTRICAL SHOCK HAZARD, DO NOT TOUCH TERMINALS, TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION”.

3.5 MISCELLANEOUS DETAILS

- A. Provide necessary foundations, supports, backing, etc., for all raceways and equipment. Attach to wood and steel by screws or bolts. Attach to concrete by expansion anchors. Powder charge driven studs and anchors shall not be used.
- B. Clean all surfaces of enclosures and equipment.
- C. Close all unused knockout holes.

3.6 PAINTING

- A. Wipe clean of dirt, oil, grease, etc., with rag and solvent, prime and finish to match surrounding finish. Do not paint over nameplate. Paint as specified in Section 09900 - PAINTING.
- B. All surface-mounted boxes, enclosures, and exposed raceways shall be painted to match the color of surrounding.
- C. Do not field-paint circuit breakers.

3.7 IDENTIFICATION

- A. All panelboards, overcurrent protection devices, safety switches, switchbanks, junction boxes (6 inches and larger), and lighting contactors shall be provided with plastic plate identifying itself and its use.
 - 1. Identify all self-contained breakers and safety switches.
 - 2. Cabinets. (i.e. RELAY “2A”)

3. Switchbanks (e.g. identify function of each switch)
- B. In addition to the above, provide plastic plates within all distribution panels identifying main feeder breakers and sub-feed breakers.
- C. Plastic plate shall be laminated black and white, engraved 1/4-inch high lettering to expose black layer. Plate shall be riveted to the cover and located directly below device handle, or top side of door.
- D. CAUTION signs shall be provided by ordinances and/or Occupational Safety and Health Administration (OSHA).

3.8 GROUNDING

- A. Ground services, metallic enclosures, raceways and electrical equipment according to requirements of National Electrical Code, Article 250.
- B. 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 THWN, green insulation, unless indicated otherwise. Provide insulated ground wires to all receptacles and panels.
- C. All grounding wire runs where exposed and within building in raceways. Run equipment ground wires together with circuit conductors.

3.9 TESTING

- A. Upon completion of this portion of work, and prior to its acceptance by the State, make all required tests and secure all required approval from agencies having jurisdiction. Any deficiencies found shall be rectified and work affected by such deficiencies shall be completely retested at Contractor's expense.
- B. Perform an operational test after completion of the installation in the presence of the Engineer, to assure proper operation of all items of work. Remove all grounds and shorts. Balance feeder loads.

3.10 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Engineer 10 working days' notice prior to each test.

1. Devices Subject to Manual Operation: Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.
2. 600-Volt Wiring Test: Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of

approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms. Submit results to the Engineer.

3. Inspect conduit system for completeness, loose couplings and proper support.
4. Ground-Fault Receptacle Test: Test ground-fault receptacles with a “load” (such as a plug in light) to verify that the “line” and “load” leads are not reversed.
5. Grounding System Test: Test grounding system to ensure continuity and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Engineer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.
6. Testing of Photovoltaic System
 - a. Perform all inspections and tests using a NABCEP-certified professional and in accordance with NABCEP and IEC 62446 inspection procedures and manufacturer’s recommendations. Include the following visual and mechanical inspections and electrical tests and submit test results to the Engineer.
 - 1) PV Modules
 - a) PV module manufacturer, model and number of modules must match the approved shop drawings.
 - b) PV modules must be in good condition (including but not limited to no broken glass or cells, no discoloration, no damaged frames).
 - c) Verify output of PV modules according to manufacturer’s recommendations and NABCEP practices.
 - 2) Inverters
 - a) Inverter manufacturer, model and number of modules must match the approved shop drawings.
 - b) Test functionality of inverter anti-islanding.
 - c) Verify output of inverter according to manufacturer’s recommendations and NABCEP practices.

- b. Performance Verification
 - 1) Confirm that the system is supplying the predicted output under operation based on the irradiance, ambient and cell temperatures, AC and DC voltage drop and the inverter's efficiency.
 - 2) Make final adjustments to inverters and monitoring equipment. Adjustable parameters must be set to that the system will produce the maximum possible amount of energy on an annual basis and comply with MECo interconnection requirements.
- c. Conduct training and instruction for the operating and maintenance staff on the operation of and safety procedures for the system. Training session shall be conducted during normal business hours and shall last as long as necessary to properly instruct the staff, but not less than 2 hours.
- d. Submit a complete system documentation package depicting the as-built system design, major components and relevant information on safety, operations and maintenance. Operation and maintenance information shall include:
 - 1) Procedures for proper system operation and performance.
 - 2) Procedures for isolating/disconnecting equipment and emergency shutdown.
 - 3) Maintenance plan and intervals for all routine system maintenance including but not limited to array cleaning.
 - 4) Operating and maintenance guidelines shall differentiate which tasks can be performed by the State from those that require the services of a qualified technician, contractor or manufacturer's representative.
 - 5) Maintenance agreements, plans and recordkeeping forms to document maintenance activities over time.
 - 6) Copies of test reports and verification data.
 - 7) Copy of executed MECo interconnection agreement.

END OF SECTION

SECTION 16301

UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Related Work Described Elsewhere:

1. Laboratory Tests: Refer to DIVISION 2 - SITEWORK for all earthwork data.
2. Section 16011 - GENERAL ELECTRICAL REQUIREMENTS applies to this section with additions and modifications specified herein.

1.2 APPLICABLE PUBLICATIONS

The publications cited within this specification form a part of this specification to the extent referenced. Unless otherwise indicated, most recent edition of the publication with current revisions and amendments will be enforced.

1.3 SUBMITTALS

- A. Submit the following information in accordance with Section 01300 - SUBMITTALS:
- B. Manufacturer's Data and Shop Drawings
 1. Precast handholes and pullboxes.
 2. Handhole frame and cover.
- C. Test Reports: Submit test reports as stipulated in paragraph "TEST REPORTS" hereinbelow.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated.
 1. Conduit
 - a. Rigid Metal Conduit: UL 6, hot-dip galvanized, threaded type.
 - b. Rigid Plastic Conduit: UL 651, Schedule 40 and Schedule 80, PVC.

2. PVC Fittings: UL 651.
3. Tape: UL 510. Plastic insulating tape shall be capable of performing in a continuous temperature environment of 80 degrees C.
4. Power Wire and Cable
 - a. Wire and cable conductor sizes are designated by American Wire Gauge (AWG).
 - b. Feeder conductors shall be aluminum. Insulated conductors shall bear the date of manufacture imprinted on the wire insulation with other identification.
 - c. Provide conductor identification within each enclosure where a tap, a splice or a termination is made.
 - d. Use No. 10 minimum sized conductors, unless otherwise noted.
5. Wire Conformation: Cables shall be Type XHHW conforming to NEMA WC-7 and UL 44 or THWN.
6. Connector and Terminals: Wire connectors and terminals for use with copper conductors shall conform to UL 486A.
7. Pullstring
 - a. Pullstring shall be plastic rope having a minimum tensile strength of 200 lbs. in each empty duct except those intended for telephone cabling.
 - b. For empty ducts intended for telephone or cable television cabling, provide mule tape in conformance with telephone utility company standards.

2.2 UNDERGROUND STRUCTURES

Precast Handholes: Handholes, including metal frames and covers, shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated and required by reference company standard drawings. Top, walls, and bottom shall consist of reinforced concrete. Bottom shall be of monolithic concrete construction or gravel bed. Covers shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair their strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises.

2.3 WARNING TAPE

Preprinted polyethylene tape, marked with "CAUTION: BURIED ELECTRICAL LINE BELOW", 4 mil thick, detectable foil backed red color, 3-inch minimum width above power ductlines. Orange colored plastic warning tape per Hawaiian Telcom Standard 34028 above ductlines.

2.4 DUCT SEAL

Pliable, non-toxic material used for application around conductors in raceway and in empty conduits to minimize moisture and rodent/insect infiltration. Must be re-enterable material allowing for removal/reapplication after initial installation. Non-drying, non-cracking, non-corrosive material that will not adversely affect raceway and conductors. Provide duct seal at all duct entries in handholes, apparatus and risers to prevent water infiltration via duct system.

2.5 GROUNDING AND BONDING EQUIPMENT

Grounding and bonding equipment shall conform to UL 467.

2.6 GROUND RODS

Copperclad steel, single piece, 3/4-inch diameter by 10 feet long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Underground cable installation shall conform to NFPA 70 and ANSI C2.

1. Concrete: Concrete for electrical requirements shall be at least 3000 psi concrete with one-inch maximum aggregate conforming to the requirements of DIVISION 3 - CONCRETE.
2. Earthwork: Excavation, backfilling, and pavement for repairs for electrical requirements shall conform to the requirements of DIVISION 2 - SITEWORK.
3. Underground Duct with Concrete Encasement: Construct underground duct lines of individual conduits encased in concrete. The conduit shall be of PVC unless otherwise indicated on the plan. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 inches, except separate light and power conduits from control, signal, and telephone conduits by a minimum concrete thickness of 3 inches.
 - a. Duct lines shall have a continuous slope downward toward handholes and away from buildings with a pitch of not less than 3 inches in 100 feet.

Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger.

- b. Separators shall be of precast concrete, high impact polystyrene, steel, or any combination of these. Stagger the joints of the conduits by rows and layers so as to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs. Draw a brush through having the diameter of the duct, and having stiff bristles until the conduit is clear of all particles of earth, sand, and gravel; then immediately install conduit plugs.

4. Protection of Wire and Cable Ends

- a. The ends of wire and cables in handholes and in other wet locations as defined by the National Electrical Code that are not to be spliced or connected to equipment shall be protected from moisture and other damage.
- b. The ends of wires and cables shall be protected by means of not less than six half-lapped wraps of electrical insulating tape beginning 3 inches from the end of the wire or cable and continuing over the exposed conductor to form a watertight seal.
- c. Where the ends of wires and cables are to be left unspliced or unconnected temporarily during construction, they shall be protected as specified above to prevent moisture from getting into the cable.

5. Cable Tags: New cables provided in the handholes shall be provided with cable tags to identify the cables. Tags shall be fabricated of a plastic strip long enough to fit loosely around the cables after the tag ends have been fastened together. Data to be stamped or printed on the tags shall include feeder designation, voltage, quantity of conductors, conductor size and type of insulation and destination. Where two different sizes of cables are spliced together, separate markers shall be provided at each end of the splice.

6. Cable Pulling: Pull cables down grade with the feed-in point at the handhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through the handhole opening and into the duct runs. Cable slack shall be accumulated at each junction box where space permits by training the cable around the interior to form one complete loop. Minimum allowable bending radii shall be maintained in forming such loops.

- a. Lubricants for assisting in the pulling of jacketed cables shall be those specifically recommended by the cable manufacturer. The lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.
 - b. Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.
 - c. Secondary cable runs, 600 volts and less, shall include an insulated copper equipment grounding conductor sized as indicated.
7. When work in addition to that indicated or specified is directed in order to obtain the specified ground resistance, the provisions of the contract covering "Changes" shall apply.
- a. Grounding electrodes shall be cone pointed sectional driven ground rods driven full depth plus 6-inches, installed when indicated to provide an earth ground of the value before stated for the particular equipment being grounded.
 - b. Make grounding connections which are buried or otherwise normally inaccessible, and excepting specifically those connections for which access for periodic testing is required by exothermite type process. Make thermit welds strictly in accordance with the weld manufacturer's written recommendations. Welds which have "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. No mechanical connector is required at thermit weldments.
 - c. In lieu of an exothermic type process, a compression ground grid connector of a type which uses hydraulic compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire. In lieu of an exothermic type process, a compression ground grid connector of a type which uses hydraulic compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.
 - d. Grounding conductors shall be bare soft-drawn copper wire and sized as indicated or specified.
 - e. Connect copper-clad steel ground rods only to insulated XHHW or RHW copper ground conductor and weld the connection. Insulate the entire area of the rod in the vicinity of the weld and the connecting wire and seal against moisture penetration.
8. Cable Terminating: Protect terminations of insulated power and lighting cables from accidental contact, deterioration of coverings and moisture by the use of

terminating devices and materials. Install all terminations of insulated power and lighting cables and cable splices in accordance with the manufacturer's requirements. Make terminations using materials and methods as indicated or specified herein or as designated by the written instructions of the cable manufacturer and termination kit manufacturer.

9. Provide all empty conduits with a plastic pullstring or mule tape. Leave 48 inches of spare at each end of the pull.
10. Provide duct seal on all conduits after installation of pullstring, mule tape, or wiring.

3.2 FIELD TESTS

- A. Mandrel Test: After new ductline is complete, draw bristle brush through ductline and perform mandrel test. Mandrel shall be a wooden plug, 8 inch minimum length, with a diameter 1/2 inch less than duct inside diameter. Perform test on all new ducts 2 inches and larger.
- B. Distribution Conductors 600 Volt Class: Test all 600 volt class conductors to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts to provide a direct reading in resistance.
- C. Ground Rods: Test ground rods for ground resistance value. Use a portable ground testing megger to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one copy of the megger manufacturer's directions for use of the ground megger indicating the method to be used.
- D. Test Report: Provide three copies of each test report to the Engineer.
 1. 600 volt cables (identify each cable and test result).
 2. Grounding electrodes and systems (identify electrodes and systems, each test). Minimum ground resistance shall be 10 ohms.

END OF SECTION

SECTION 16510
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes, but is not limited to, interior luminaires, lamps, ballasts, drivers, emergency lighting units, lighting control, and all required components and accessories.
- B. Related Sections include the following:
 - 1. Section 16011 - GENERAL ELECTRICAL REQUIREMENTS applies to this section, with the additions and modifications specified herein.
 - 2. Section 16100 - ELECTRICAL WORK applies to this section, with additions and modifications specified herein.

1.2 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications may be referred to in the text by the basic designation only. Unless otherwise indicated, most recent edition of the publication with current revisions and amendments will be enforced.

1.3 DESCRIPTION OF WORK

The work includes providing luminaires, switches, time switches, and other control devices, contactors, and battery-powered units and systems for interior use, including luminaires and accessories mounted on the exterior surfaces of buildings. Materials not normally furnished by manufacturers of these devices are specified in Section 16100 - ELECTRICAL WORK.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Data, shop drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IES Lighting Handbook, as applicable, for the lighting system specified.
 - 1. Manufacturer's Data
 - a. Luminaires, including lamps and drivers.
 - b. Lighting contactors.

- c. Time switch.
 - d. Exit lights.
 - e. Emergency lighting equipment.
 - f. Occupancy sensors.
 - g. Wall box timer switch.
 - h. Electronic dimming ballast.
 - i. Dimming ballast controls.
 - j. Lighting control panels and low voltage control stations.
 - k. Modular dimming control panels and preset lighting control station.
2. Shop Drawings
- a. Luminaire assemblies.
 - b. Lighting control panels and control stations and project specific wiring/control diagrams.
3. Operations and Maintenance Manual: Submit operations and maintenance manual as stipulated in paragraph “OPERATIONS AND MAINTENANCE MANUAL” hereinbelow.
4. Qualifications of the lighting control system manufacturer as stipulated in paragraph “QUALITY ASSURANCE” hereinbelow.
5. Warranty: Provide as stipulated in paragraph “WARRANTY” hereinbelow.

1.5 OPERATIONS AND MAINTENANCE MANUAL

Submit operation and maintenance data showing all light fixtures, control modules, control zones, occupancy sensors, light level sensors, power packs, schematic diagrams and all interconnecting control wire, conduit, and associated hardware. Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project.

1.6 QUALITY ASSURANCE

- A. Lighting Control System Manufacturer: Minimum 10 years of experience in manufacture of architectural lighting controls.

- B. Lighting Control System Components: Listed by UL specifically for the required loads. Provide evidence of compliance upon request.

1.7 WARRANTY

- A. Provide manufacturer's warranty covering 5 years with factory commissioning on dimming system modules and drivers from date of purchase.
- B. Provide manufacturer's warranty covering 2-year parts and labor, and eight year limited warranty to repair and replace defective equipment applicable to daylight sensors, occupancy sensors, wall stations and bus supply.
- C. LED luminaires shall carry a minimum manufacturer's warranty of 5 years.

PART 2 - PRODUCTS

2.1 LED LUMINAIRES

- A. Provide lighting fixtures specifically engineered for LED light sources and drivers. Use of linear or screw-base retrofit LED light sources is not acceptable.
- B. LED Light Sources
 - 1. Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377: Nominal CCT: 4000 degrees K, unless otherwise specified.
 - 2. Color Rendering Index (CRI): Shall be greater than or equal to 80 unless otherwise indicated.
 - 3. Color Consistency: Manufacturer shall utilize a maximum 4-step MacAdam ellipse binning tolerance for color consistency of LEDs used in luminaires.
- C. Luminaire LED Power Supply Units (Drivers)
 - 1. LED Power Supply Units (Drivers): UL 1310. LED Power Supply Units (Drivers) shall meet the following requirements:
 - a. Minimum efficiency shall be 85 percent.
 - b. Shall be rated to operate between ambient temperatures of minus 22 degrees F and 104 degrees F.
 - c. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120V to 277V nominal.
 - d. Operating frequency shall be 60 Hz.

- e. Power Factor (PF) shall be greater than or equal to 0.90.
 - f. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.
 - g. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed unless noted.
 - h. Power supplies in luminaires shall be UL listed with a sound rating of "A".
 - i. Shall be dimmable, and compatible with a standard dimming control circuit of 0 - 10V or other approved dimming system as indicated.
 - j. Shall be equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.
2. Digital Control, Five Percent Dimming
- a. Dimming Range: 100 to 5 percent measured output current.
 - b. Typically dissipates 0.2 W standby power at 120V.
 - c. Complies with FCC requirements of CFR, Title 47, Part 15, for commercial applications at 120-277V.
 - d. Constant Current Reduction (CCR) dimming method.
 - e. Total Harmonic Distortion (THD): Less than 21 percent at full load; complies with ANSI C82.11.
 - f. Constant Current Drivers: Support for downlights and pendant fixtures in select currents from 350 mA to 1.4 A to ensure a compatible driver exists.
 - g. Support LED arrays up to 35 W.
 - h. Lutron EcoSystem 5-Series or approved equivalent.

2.2 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast or driver shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated. Delete thermal insulation immediately surrounding recessed luminaires.

2.3 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer to limit swinging with a 2-way bracing system. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 1/4 inch diameter.

2.4 LIGHTING CONTACTOR

NEMA ICS 2, electrically held contactor. Contacts shall be rated 600 volts, 20 amperes, and 4 poles. Coils shall be rated 120 volts. Provide in NEMA 1 enclosure conforming to NEMA ICS 6. Contactor shall have silver alloy double-break contacts. Provide contactor with hand-off-automatic selector switch.

2.5 TIME SWITCH

Astronomic dial type or electronic type, arranged to turn "ON" at sunset and turn "OFF" at predetermined time between 8:30 p.m. and 2:30 a.m. or sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Provide switch rated 120 or 277 volts, having automatically wound spring mechanism or capacitor, to maintain accurate time for a minimum of 15 hours following power failure. Provide time switch with a manual on-off bypass switch. Housing for the time switch shall be surface-mounted, NEMA 1 enclosure conforming to NEMA ICS 6.

2.6 LIGHTING CONTROL PANEL

Lighting control panels shall be UL listed, with surface mounted NEMA 1 enclosure. Door shall be hinged and lockable with internal barrier for separation of high voltage (Class 1) and low voltage (Class 2) wiring. It shall include intelligence boards, power supply and control relays. Clock display and keypad shall be mounted on interior cabinet door for easy user access and programming. The lighting control panel shall have the following features:

1. Panel shall accept up to 24 single pole relays. Relays shall be individual latching relays with 20 Amp load contacts for ballast (including HID, magnetic or electronic type ballasts), tungsten and general purpose loads. Relays shall use quick connectors and be individually replaceable to facilitate ease of use.
2. The lighting control panel shall provide a stagger up delay, override push buttons, and LED status light indicators for each relay or contactor control channel.
3. The clock shall have a backlight display, user keypad and shall provide 8 channels of time or astronomical control. Preprogrammed lighting control scenarios shall include: scheduled on/off, manual on/scheduled off, manual on/automatic switch

sweep off, astronomic on/off and astronomic control with scheduled on/off. Time clock shall provide up to 42 holidays, automatic daylight savings adjustment, astronomic coordinates by major cities, and help screens. Program memory shall be non-volatile and clock shall retain time keeping during power outages for at least 48 hours.

4. The panel shall have 8 universal switch inputs that are low voltage, self-configuring and shall not require programming to accept momentary on/momentary off switch, push button switch (cycling), maintained switch or 24 VDC signals from occupancy sensors and daylight sensors or other interfacing devices.
5. Time control shall be integrated to allow occupancy sensor control after hours with hold on of lighting during occupancy scheduled time. During occupied time, control scenarios shall be selectable for time schedule of lighting on initially and then hold on of lighting during occupied hours. Control shall provide adjustable occupancy sensor time delay from the time clock keypad.
6. Each panel shall support RS232 twisted pair and optional RS-485 connections. Either protocol may be used for programming, monitoring, and control. The dataline shall allow simultaneous operation of multiple communications access points to support multiple operator terminals. Each panel shall be capable of stand-alone automatic operation and the network shall achieve full distributed processing.

2.7 LOW VOLTAGE LIGHTING CONTROL STATIONS

Lighting control stations shall be compatible with lighting control panel, flush mounted, low voltage type, white color with matching faceplate. Provide number of zones indicated and engrave or provide permanent nameplates to identify function.

2.8 OCCUPANCY SENSORS

UL listed. Comply with GC-12. Occupancy sensors and power packs shall be designed to operate on the voltage indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator. Sensor shall have adjustable sensitivity and adjustable delayed-off time range of 5 minutes to 15 minutes. Wall mounted sensors shall be white, ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated.

1. Ultrasonic sensor shall be crystal controlled and shall not cause detection interference between adjacent sensors.
2. Infrared sensors shall have a daylight filter. Sensor shall have a fresnel lens that is applicable to space to be controlled.
3. Ultrasonic/Infrared Combination Sensor: Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection. Lights shall remain on if either the ultrasonic or infrared sensor detects movement. Infrared sensor shall have

lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Ultrasonic sensor frequency shall be crystal controlled. Provide on-off manual switch on cover and dual relay in private offices and small conference rooms. Sensors shall provide a nominal range of coverage of 500 square feet with ceiling heights of 8 to 12 feet.

4. Wallbox sensors shall provide a nominal range of coverage of 900 square feet when mounted at four feet above the floor with a 180 degree field of view. Sensor shall have minor motion coverage of 15 feet wide by 15 feet deep.

2.9 WALL BOX DIGITAL TIMER SWITCH

- A. The digital time switch shall be programmable to turn lights off after a preset time. Time switch shall be a completely self-contained control system that replaces the standard toggle switch. It shall have a ground wire and ground strap for safety. Switching mechanism shall be a latching air gap relay. Zero Crossing Circuitry shall be used to increase the relay life, protect from the effects of inrush current, and increase the switch's longevity.
- B. Time switch shall have the option for a one second light flash warning at five minutes before the timer runs out and twice when the countdown reaches one minute (when used to control lighting loads). Time switch shall have the option for a beep warning that shall sound every five seconds once the time switch countdown reaches one minute.
- C. Time switch shall have manual feature for timer reset where pressing the ON/OFF switch for more than 2 seconds resets the timer to the programmed time-out period.
- D. Time switch shall have an electroluminescent backlit Liquid Crystal Display that shows the timer's countdown.
- E. Time switch shall fit behind a decorator style faceplate. The calibration switch for setting time-out, time scroll, one second light flash, and beep warning shall be concealed to prevent tampering of adjustments and hardware.
- F. Time-out period shall be adjustable in increments of 5 minutes from 5 minutes to 1 hour, and in increments of 15 minutes from 1 hour to 12 hours.
- G. Time switch shall be capable of operating as an ON/OFF switch. White device and faceplate.
- H. Wattstopper TS-400 or approved equivalent.

2.13 EXIT LIGHTS

- A. UL 924, NFPA 70, and NFPA 101. Exit lights shall be self-powered type with low voltage disconnect. Exit lights shall use no more than 5 watts.
- B. Self-Powered LED Type Exit Lights (Battery Backup): 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. LED exit light shall have emergency run time of 1 1/2 hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).

2.14 EMERGENCY LIGHTING EQUIPMENT

- A. UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated. Provide accessories required for remote-mounted lamps where indicated. Remote-mounted lamps shall be as indicated.
- B. Emergency Lighting Unit: Provide as indicated. Emergency lighting units shall be rated for 12 volts, except units having no remote-mounted lamps and having no more than two unit-mounted lamps may be rated 6 volts. Equip units with brown-out sensitive circuit to activate battery when ac input falls to 75 percent of normal voltage.

2.15 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

- A. Wires: ASTM A641/A641M, galvanized regular coating, soft temper, 0.1055 inches in diameter (12 gage).
- B. Wires, for Humid Spaces: ASTM A580/A580M, composition 302 or 304, annealed stainless steel 0.1055 inches in diameter (12 gage).
- C. Rods: Threaded steel rods, 1/4 inch diameter, zinc or cadmium coated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.
- B. Lamps: Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the State if more than 15 percent of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. Provide 10 percent spare lamps of each type from the original manufacturer.
- C. Lighting Fixtures: Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where

applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four wires or threaded rods per fixture and located near each corner of each fixture. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires or threaded rods per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture. Provide wires or threaded rods for lighting fixture support in this section.

- D. **Suspended Fixtures:** Suspended fixtures shall be provided with 45 degree swivel hangers so that they hang plumb and shall be located with no obstructions within the 45 degree range in all directions. The stem, canopy and fixture shall be capable of 45 degree swing. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degree separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.
- E. **Exit Lights and Emergency Lighting Units:** Wire exit lights and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.
- F. **Lighting Controls**
1. All lighting control panels, dimming control equipment, switches, occupancy sensors, etc., shall be mounted as indicated in the Drawings and Specifications. All wiring shall be labeled clearly indicating which lighting control panel or device it connects to. All relays, contactors, and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the lighting control schedule for each panel. The relay panel shall be wired to control the power of each load as indicated on the Lighting Control Panel Schedules. All power wiring shall be identified with the circuit breaker number controlling the load.
 2. **Occupancy Sensor:** Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage shall provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid

nuisance activation and deactivation due to sudden temperature or airflow changes and usage. Set sensor “on” duration to 15 minutes. Sensors shall be connected to the unswitched phase legs of lighting circuits.

3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09900 - PAINTING.

3.3 GROUNDING

Ground noncurrent-carrying parts of equipment as specified in Section 16100 - ELECTRICAL WORK. Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.4 FIELD TESTS

- A. Operating Test: Upon completion of the installation, conduct an operating test to show that the equipment operates in accordance with the requirements of this section. Make adjustments and add and/or replace light fixtures and other equipment as required to correct deficiencies. Lighting level measurements shall be provided upon request and be made at intervals as directed by the Engineer and with a NIST calibrated cosine corrected photometer with a silicon photodiode.
- B. Lighting Control Test: Conduct operational control of installed and energized luminaires. Set time delays and aim as directed by Engineer.
- C. Ground Resistance Tests: Perform as specified in Section 16100 - ELECTRICAL WORK.
- D. Testing of Lighting Control System:
 - 1. Manufacturer's authorized service representative to conduct minimum of two site visits to ensure proper system installation and operation.
 - a. Conduct pre-installation visit to review system requirements with installer.
 - b. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation.
 - 2. Manufacturer's startup services will include:
 - a. Authorized service representative to verify daylight sensor locations, in accordance with layout provided by lighting control manufacturer; Lighting control manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 - b. Verify connection of power wiring and load circuits.

- c. Verify connection and location of controls.
 - d. Address digital devices.
 - e. Verify system operation control by control.
 - f. Verify proper operation of manufacturer's interfacing equipment.
 - g. Configure initial groupings of drivers for wall controls.
 - h. Provide initial rough calibration of sensors; fine-tuning of sensors is the responsibility of the Contractor.
- 3. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
 - 4. Manufacturer's authorized service representative shall conduct an on-site training course for operating staff and maintenance personnel on system capabilities, operation, adjustment and maintenance. The training period shall consist of a total of 8 hours of normal working time.
 - 5. Provide an additional post-start up site visit by the manufacturer or manufacturer's representative after system start up to evaluate system usage and discuss opportunities to make system adjustments. The post startup visit shall be scheduled at the discretion of the State within one year of initial operation and acceptance of the system.

END OF SECTION

SECTION 16530
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. The work includes providing lighting poles with brackets, luminaires, lamps, ballasts, and all other materials necessary for a complete exterior lighting system.
- B. Related Work Described Elsewhere:
 - 1. Section 03300 - CAST-IN-PLACE CONCRETE.
 - 2. Section 16011 - GENERAL ELECTRICAL REQUIREMENTS applies to this section, with the additions and modifications specified herein.
 - 3. Materials not considered to be lighting equipment or luminaire accessories are specified in Section 16100 –ELECTRICAL WORK and Section 16301 - UNDERGROUND ELECTRICAL WORK.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - SUBMITTALS.
- B. Data, shop drawings, and reports shall employ terminology, classifications, and methods prescribed by the IES Lighting Handbook.
- C. Manufacturer's Data: When data that describe more than one type, size, model, or item is submitted, clearly mark the data to indicate which type, size, model, or item is being provided. Data shall be sufficient to show conformance to specified requirements.
 - 1. Luminaires.
 - 2. Lamps.
 - 3. Poles and bracket arms.
- D. Shop Drawings
 - 1. Luminaires.
 - 2. Poles and Luminaire Mounting Brackets: Include dimensions, wind load determined in accordance with AASHTO LTS2 and as specified in "PRODUCTS" paragraph of this section, pole deflection, pole class, and other applicable information.

- E. Photometric Data and Illumination Calculations: Submit calculations for the parking areas using the proposed luminaires. The calculations shall be plotted on 11" x 17" or 24" x 36" paper and shall include summary tables. The summary tables shall include the luminaire description and calculation results. Calculations shall include maintained minimum, average and maximum footcandle levels. Calculations shall also include maximum/minimum and average/minimum uniformity ratios. Point-to-point footcandle values shall be provided at 10 feet on-center. Calculations shall utilize a 0.7 light loss factor.
- F. Field Test Reports: Submit test results as stated in paragraph entitled "FIELD QUALITY CONTROL" hereinbelow.

1.3 DELIVERY, STORAGE, AND HANDLING

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory applied pole wrappings until just before installing pole.

1.4 WARRANTIES, GUARANTEES AND INSTRUCTION SHEETS

Manufacturers' warranties and guarantees furnished for materials used in the work and instruction sheets and parts lists supplied with materials shall be delivered to the Engineer prior to acceptance of the project. All apparatus and workmanship shall be guaranteed for one year and, should any failure resulting from normal operation occur during that time, the Contractor shall replace the defective equipment or correct the workmanship at no cost to the State. An exception shall be made for LED luminaires which shall carry a minimum manufacturer's warranty of 5 years.

PART 2 - PRODUCTS

2.1 LED LUMINAIRES

- A. Provide lighting fixtures specifically engineered for LED light sources and drivers. Use of linear or screw-base retrofit LED light sources is not acceptable.
- B. LED Light Sources
 1. Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377: Nominal CCT: 4000 degrees K, unless otherwise specified.
 2. Color Rendering Index (CRI): Shall be greater than or equal to 80 unless otherwise indicated.
 3. Color Consistency: Manufacturer shall utilize a maximum 4-step MacAdam ellipse binning tolerance for color consistency of LEDs used in luminaires.

C. LED Power Supply Units (Drivers): UL 1310. LED Power Supply Units (Drivers) shall meet the following requirements:

1. Minimum efficiency shall be 85 percent.
2. Shall be rated to operate between ambient temperatures of minus 22 degrees F and 104 degrees F.
3. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120V to 277V nominal.
4. Operating frequency shall be: 60 Hz.
5. Power Factor (PF) shall be greater than or equal to 0.90.
6. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.
7. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed unless noted.
8. Power supplies in luminaires shall be UL listed with a sound rating of "A".
9. Shall be equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.

2.2 LIGHT POLE ASSEMBLIES

- A. Light pole assemblies shall conform to the requirements indicated on the drawings.
- B. Provide poles designed for wind loading of 105 miles per hour determined in accordance with AASHTO LTS while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole. Scratched, stained, chipped, or dented poles shall not be installed.
- C. Brackets and Supports: ANSI C136.3 and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted lights shall correctly position luminaire no lower than mounting height indicated. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

2.3 EQUIPMENT IDENTIFICATION

Manufacturer's Nameplate: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.4 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Light Pole Assemblies

1. Before trenching or excavating, structural outlines and center lines of ductlines and light pole foundations shall be clearly staked, and approval received from the Engineer. Staking shall be with steel or wood pegs or paint.
2. Light pole shafts shall be field adjusted for vertical alignment.
3. After pole is set, grease ends of all anchor bolts.
4. All tapped holes and stainless steel screws shall be sprayed with "Thread-Eze" by Chemsearch prior to assembling, shipping or installation. Grease all exposed screws and bolts.
5. Poles, base covers, luminaires, etc. shall be handled in a manner that will preserve the overall appearance and prevent damage to the coating. The use of chains, cables or unprotected forks is prohibited. Only non-abrasive nylon rope or equivalent nylon belting will be allowed (3/4-inch diameter minimum). Adequate hold-downs and appropriate blocking shall be utilized for shipping to prevent load movement and damage to the outer coating in transit.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 16100 - ELECTRICAL WORK. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.4 FIELD QUALITY CONTROL

- A. Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test after 100 hours of burn-in time to show that the equipment operates in accordance with the requirements of this section. Make adjustments and add and/or replace light fixtures and other equipment as required to correct deficiencies. Any deficiencies shall be rectified, and work affected shall be completely retested, at no additional cost to the State.
- B. Test for continuity of each circuit.
- C. Megger test each lighting circuit to certify that the circuits are free from short circuits and grounds. Submit results to the Engineer.
- D. A functional test in which it is demonstrated that each and every part of the system functions as specified or as intended herein. The Contractor shall test the system for 6 hours with all lights burning, then turn it off for one minute, then on again to check for faulty lights.

3.5 MISCELLANEOUS

All incidental parts which are not shown on the plans or called for in the proposal or specified herein or in the special provisions and which are necessary to complete the lighting system shall be furnished and installed by the Contractor as though such parts were shown on the plans and/or specified.

END OF SECTION