SPECIFICATIONS AND PROPOSAL

FOR

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

HONOLULU HARBOR, OAHU, HAWAII

JOB P10981

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HARBORS

2026

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

The receiving of bids for **HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET, HONOLULU HARBOR, OAHU, HAWAII, JOB P10981**, will begin as of the HIePRO Release Date. Bidders shall register and submit complete bids through HIePRO only. Refer to the following HIePRO link for important information on Vendor Registration: https://hiepro.ehawaii.gov/welcome.html.

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

HIePRO OFFER DUE DATE AND TIME is January 15, 2027, at 2:00 p.m., Hawaii Standard Time (HST). **Bidders shall submit and upload the complete proposal to HIePRO prior to the offer due date and time. Proposals received after said due date and time shall not be considered. Any additional support documents explicitly designated as confidential and/or proprietary shall be uploaded as a separate file to HIePRO. Bidders shall not include confidential and/or proprietary documents as part of their proposal. The record of each bidder and their respective proposal shall be open to public inspection. FAILURE TO UPLOAD THE PROPOSAL TO HIePRO SHALL BE GROUNDS FOR REJECTION.**

The scope of work consists of relocation of Oahu District Maintenance Baseyard along Auiki Street. The estimated cost of construction is $30,000,000.

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

The Hawaii Department of Transportation, Air and Water Transportation Facilities Division, 2016 GENERAL PROVISIONS FOR CONSTRUCTION PROJECTS, applicable to this

project are available on the internet at: http://hidot.hawaii.gov/administration/con/.

A virtual pre-bid conference is scheduled for December 10, 2026, at 9:00 a.m., HST. Interested bidders shall contact Mr. Jonathan Yee, Project Manager, directly at jonathan.sw.yee@hawaii.gov, no later than five working days prior to the scheduled pre-bid conference to receive the meeting invitation. All prospective bidders and/or their respective representatives are encouraged to attend, however, attendance is not mandatory. All information presented at the pre-bid conference shall be provided for clarification and information only. Any amendments to the solicitation shall be made by formal addendum and posted in HIePRO.

All Request for Information (RFI) questions and Substitution Requests shall be submitted in HIePRO **no later than December 17, 2026, at 2:00 p.m., HST.** RFI questions received after the stated deadline shall not be addressed. Substitution Requests received after the stated deadline shall not be considered. Verbal RFI(s) shall not receive a response. All responses to RFI questions shall be provided for clarification and information only and issued by formal addendum. Any amendments to the solicitation shall be made by formal addendum and posted in HIePRO.

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

Project Labor Agreement. The Project Labor Agreement (PLA) shall be binding on all contractors and subcontractors on the project through inclusion of the respective and appropriate PLA specifications in the solicitation documents. Following award of the contract for the project, the contractor shall be required to submit to the Department of Transportation Project Manager, a complete, fully executed Agreement To Be Bound – Attachment A (Agreement To Be Bound), within 14 calendar days of project award, or as soon thereafter as is practicable as determined by

the Department. The contractor shall obtain either a Letter of Assent or Attestation of Exemption, as appropriate, from each subcontractor, regardless of tier, who may be employed on the project and make copies of such respective documents available to the Department upon demand. The required form of the contractor's Agreement To Be Bound may be found in the PLA, included in the solicitation. Any Letter of Assent shall take the substantial form of the Agreement To Be Bound. **Failure to timely submit any required Agreement To Be Bound or to provide upon demand any required Letter of Assent or Attestation of Exemption shall be cause for the State, in its sole discretion, to rescind the subject award and to award the project to the responsive and responsible bidder with the next lowest bid price for solicitations made under HRS § 103D-302.**

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

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

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

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

Bidders are hereby notified that the Department of Transportation shall affirmatively ensure that contracts entered into pursuant to this advertisement are awarded to the lowest

responsible bidder without discrimination on the basis of race, color, national origin, sex, age, disability, or any other protected status recognized under applicable State and federal law.

For additional information, contact Mr. Jonathan Yee, Project Manager, by phone at 808-587-1956, or by email at jonathan.sw.yee@hawaii.gov.

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

DREANALEE K. KALILI
Deputy Director of Transportation for Harbors

HIePRO RELEASE DATE: November 4, 2026

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



PROJECT LABOR AGREEMENT
For the State of Hawaii
(Administrative Directive No. 24-01)

HRS § 103D-302 Competitive Sealed Bidding

The PROJECT LABOR AGREEMENT (PLA) shall be binding on all contractors and subcontractors on the project through inclusion of the respective and appropriate PLA specifications in the solicitation documents. The following shall be made a part of the solicitation:

- The definition of the terms "CONTRACTOR" and "SUBCONTRACTOR" for the purposes of this solicitation are those contained in the solicitation, in accordance with the Hawaii Department of Transportation (HDOT) General and/or Special Provisions for Construction, not as defined by the PLA.

- The required form of the contractor's AGREEMENT TO BE BOUND – ATTACHMENT "A" (Agreement To Be Bound) may be found in the Project Labor Agreement, included in the solicitation. Any LETTER OF ASSENT shall take the substantial form of the Agreement To Be Bound.

- Any subcontractor performing only trade work not represented by PLA signatories shall not be required to submit a Letter of Assent. However, any such subcontractor shall be required to timely provide to the awarded contractor, a written statement attesting that the subcontractor will be performing only work not subject to the PLA, which an ATTESTATION OF EXEMPTION shall be executed by a person authorized to bind the subcontractor. The awarded contractor shall provide any such Attestation of Exemption to HDOT upon demand.

- The contractor awarded the project shall:
    - Obtain either a Letter of Assent or Attestation of Exemption, as appropriate, from each subcontractor, regardless of tier, who may be employed on the project and make copies of such respective documents available to HDOT upon demand;

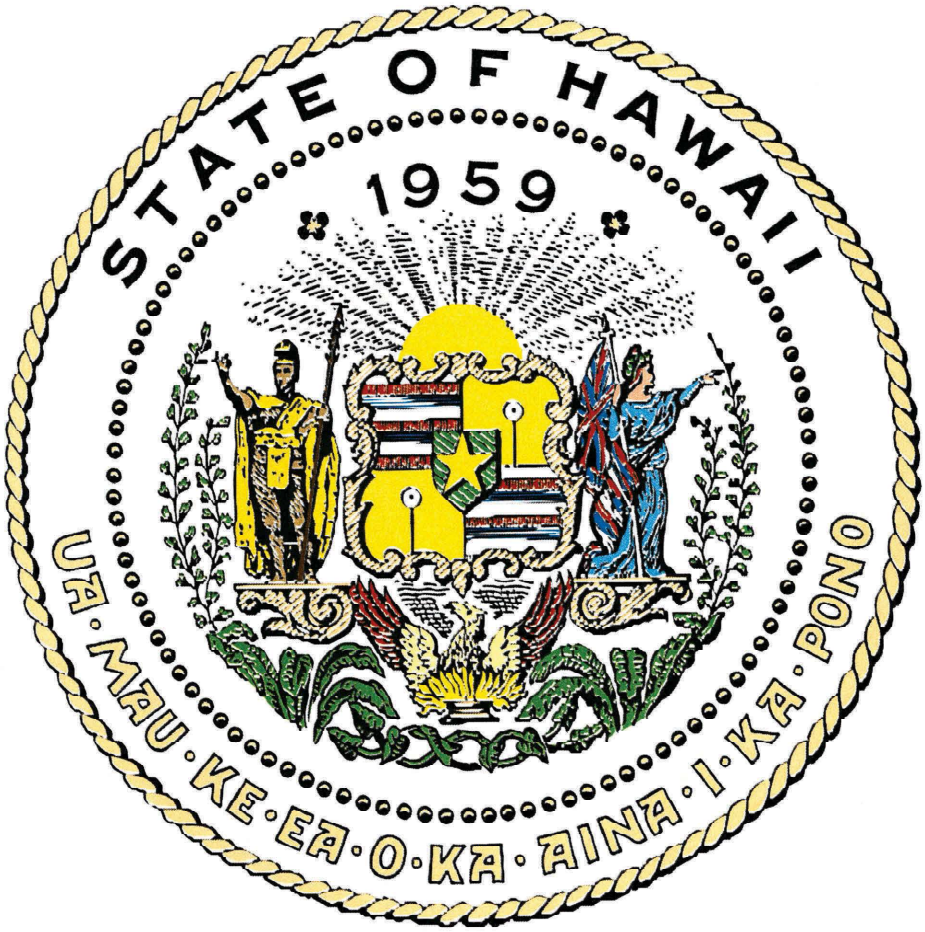
    - Execute the required Agreement To Be Bound; and

    - Submit to the HDOT Project Manager, a complete, fully executed Agreement To Be Bound, within fourteen (14) calendar days of project award, or as soon thereafter as is practicable as determined by the Department.

    - **Failure to timely submit any required Agreement to Be Bound or to provide upon demand any required Letter of Assent or Attestation of Exemption shall be cause for the State, in its sole discretion, to rescind the subject award and to award the project to the responsive and responsible bidder with the next lowest bid price for solicitations made under HRS § 103D-302, Competitive Sealed Bidding.**

    - By submitting an executed Agreement To Be Bound, the contractor shall be deemed to have certified that all required Letter(s) of Assent and Attestation(s) of Exemption have been received and will be made available to the Department of Transportation upon demand.

    - The contractor shall maintain in a current status throughout the life of the contract the Agreement To Be Bound, and all Letter(s) of Assent and Attestation(s) of Exemption from subcontractors of all tiers.



PROJECT LABOR AGREEMENT

For the State of Hawaii

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PROJECT LABOR AGREEMENT

This agreement is entered into by and between the State of Hawaii ("State"), the Hawaii Construction Alliance and its affiliated labor unions, and the Unions that become signatory to this Agreement for any construction project covered by this Agreement (hereinafter referred to as the "Union" or "Unions" individually or collectively, as the context may require).

ARTICLE I – Purpose and Findings

Public works projects involve numerous contractors and employees in different trades, have critical timelines for completion, and require skilled and properly trained workers to successfully complete the work in a safe and timely manner. To avoid delays and additional expense to the State of Hawaii, it is essential that the most critical public works projects proceed without labor disruptions, whether due to external labor relations factors or the frictions that can arise when a large number of contractors and their employees and subcontractors work in proximity to one another on a job site.

As the State grows in size and connects more communities via infrastructure development, the State has an overriding interest in maintaining the continuity of efficient construction work by using skilled and trained labor. In a complex environment such as the State of Hawaii, it is essential to avoid delay in completing critical public works projects so that public funds are utilized prudently and residents and visitors are not adversely impacted by interruption in public services or delay in the use of facilities that are important to the essential operations or infrastructure of the State.

A Project Labor Agreement ("PLA"), is a construction industry collective bargaining agreement applied to a particular public works project or set of projects. PLAs have been used for many years to achieve high-quality construction performance and the economic benefits that result from having a guaranteed source of skilled workers and avoiding work disruptions.

In the private sector, PLAs have been and are being used successfully on a variety of projects, such as the United States Navy's privatized military housing stabilization agreement, and other large and small private developments, including the retrofitting and remodeling of existing buildings and facilities. On public works projects, PLAs have been and are being used successfully by governmental entities, including the Honolulu Authority for Rapid Transportation.

PLAs on public works projects are open to both union and non-union contractors. A public agency awarding a project covered by a PLA may select any qualified bidder for the award, without regard to whether it is otherwise a signatory to a union collective bargaining agreement.

PLAs are effective mechanisms for controlling construction costs, ensuring efficient completion of projects, and establishing fair wages and benefits for all workers.

PLAs also help ensure worker health and safety protections while providing a unique opportunity for workforce development

PLAs on public works projects also promote government efficiency, thus lowering costs, in a number of ways. They prevent labor strikes or slowdowns during the life of the agreement; set work rules, schedules and conditions; build jobsite harmony by placing all contractors and workers on a level playing field; and provide for arbitration procedures to resolve grievances and jurisdictional disputes. They also increase public confidence in government procurement and improve transparency in the competitive bidding process.

The construction crafts needed on public works projects require a supply of new apprentices to perpetuate those crafts into the future. It is essential to train a local pool of skilled labor in the construction sector who will be able to competently and safely construct future public works projects. Through their apprenticeships, local construction unions provide genuine opportunities for long-term, well-paid careers in the construction industry. Entry into and employment through these apprenticeships can be facilitated by a formal understanding between the State and the local construction unions who fund and operate such apprenticeships.

In addition, veterans may be seeking employment on public works projects and training opportunities for entrance into the construction industry. Such training opportunities are available through programs such as "Helmets to Hardhats."

PLAs have proven to be a valuable mechanism across the United States in addressing many of these issues and have been a major factor in producing high quality construction work and projects that are completed on time, within budget, and without labor strife or disruptions. This PLA is intended to promote labor harmony, prevent labor disputes and slowdowns, achieve and promote efficient, high-quality construction that meets strict construction deadlines, improve State services, and ensure a steady local supply of skilled and trained labor on proprietary construction projects.

ARTICLE II – Definitions

As used in this Agreement:

"Agreement To Be Bound" means the acceptance agreement signed by each Contractor, agreeing to be bound by the terms of this PLA, in the form attached hereto as Attachment "A."

"Project Labor Agreement" or "PLA" means this multi-craft collective bargaining agreement between the State, the Hawaii Construction Alliance and its affiliated labor unions, and the Unions signatory to this Agreement, which shall be approved for use on Covered Projects by the Chief Procurement Officers of the State.

"Contractor" means any individual, firm, partnership, corporation, or other business entity (including but not limited to a general contractor, project manager,

construction manager, or primary employer, or combination thereof), including joint ventures, and any successors and assigns of the foregoing, that has entered into a contract to perform, assign, award, or subcontract any part of the construction work on a Covered Project, and all contractors and subcontractors of any tier.

"Covered Work" means on site construction work covered by each respective Master Agreements of the Unions signatory to this Agreement for a Covered Project., including facilities dedicated exclusively to supplying products to Covered Projects.

"Covered Project" means all large-scale public works projects in excess of one million five hundred thousand dollars ($1,500,000) for the building, erection, installation, or assembly of a structure, building, or facility, or infrastructure, including any such projects receiving funding from a bond issuance of the State, and any other public works project where the State has determined that delay in completing the project may lead to interruption or delay of services or use of facilities that are important to the essential operations or infrastructure of the State; provided, however, that the term does not include the routine operation or maintenance of a structure, building, or facility, or of new infrastructure.

"Maintenance" means the upkeep of a structure, building, or facility, or of infrastructure, to preserve the original functional and operational state of the structure, building, facility, or infrastructure, and includes any task that has been traditionally and historically performed by public workers in or upon structures, buildings, facilities, and infrastructure.

"Master Agreement" means the master collective bargaining agreement of each Union signatory to the Project Labor Agreement.

"Operation" means activities related to the normal performance of the functions for which a structure, building, facility, or infrastructure is intended to be used.

"Union" or "Unions" includes the Hawaii Construction Alliance ("HCA"), and their affiliated labor organizations, and the Unions signatory to this Agreement, acting on their own behalf and on behalf of their own respective affiliates and member organizations whose names are subscribed to the Project Labor Agreement. The parties to the Project Labor Agreement may mutually agree, in writing, to amend or modify the list of affiliated labor organizations in the event there is a change in affiliation. Nothing in this article is intended to imply that the state has the authority to approve which local unions may affiliate with the HCA.

"Work Disruption" means any strike, lockout, sympathy strike, slowdown, work stoppage, boycotting, picketing or similar activity that interferes with work on a Covered Project.

ARTICLE III – Scope of Agreement

The State shall require all Contractors to agree to be bound by this PLA by executing an Agreement To Be Bound as a condition of any future request for proposal issued on or after the effective date of this PLA for a Covered Project. The Unions agree that this PLA will be available to, and will fully apply to, any successful bidder for the project work for a Covered Project, without regard to whether the successful bidder performs work at other sites as either a union or non-union Contractor, and without regard to whether employees of such bidder are or are not members of any union.

It is understood that this PLA constitutes a stand-alone agreement, and by virtue of executing an Agreement To Be Bound, Contractor will not be obligated to sign any other collective bargaining agreement as a condition of performing work within the scope of this PLA.

All Contractors on all Covered Projects must execute an Agreement to be Bound by this PLA as a precondition of performing, assigning, awarding, or subcontracting work on the Covered Project.

It is understood that each party to this PLA acts independently of the other, and this PLA does not give rise to any joint and several liability between or amongst the parties. The Unions agree that this PLA does not have the effect of creating any joint employment status between and among the State and any Contractor.

ARTICLE IV – Appointment of Administrator

It is understood that the parties hereto support the active and effective administration and enforcement of the terms of this PLA by all signatory parties to ensure that the benefits envisioned from it flow to all intended parties. In furtherance thereof, the Joint Administrative Committee (as such term is defined in Article XVIII hereof) shall appoint the Director or Deputy Director of the Department of Labor and Industrial Relations, or its Interim Director if appropriate, as the administrator (the "Administrator"), to oversee the parties' compliance with this PLA and, subject to the provisions of Article XVIII hereof pertaining to the authority of the Joint Administrative Committee, to interpret, monitor and enforce the terms and conditions of this PLA. For such purposes, the Administrator shall be considered a party in interest in all matters related to this PLA, except the resolution of grievances and jurisdictional disputes.

ARTICLE V – Union Recognition

The Contractor recognizes the signatory Unions as the sole and exclusive bargaining representatives of all craft employees within their respective jurisdictions working on Covered Projects.

There shall be no discrimination against any Employee or applicant for employment because of his or her membership or non-membership in the Union or based upon race, creed, color, sex, age or national origin of such employee or applicant,

or any other factor prohibited by state or federal law.

The Contractor agrees to deduct dues and fees in the amount designated by a particular Union, subject to applicable law, provided that the Employee has executed a written assignment calling for such a deduction, which is provided to the Contractor, and provided further that the form of the written assignment is that form that is used for all operations by the particular Union for its members in the State of Hawaii. The Contractor will remit to the Union the dues and fees deducted in the manner set forth in the applicable Master Agreement. All Employees of Contractor who are not member of any Union shall pay dues and uniform assessments in accordance with the requirements of the applicable Union and applicable law. Such dues and assessments shall be limited to fees necessary for the performance for the Union's representation duties. Any employee failing to meet the above condition of employment shall upon written notice by the Union be discharged by the Contractor within five (5) working days, if permitted by existing law.

This PLA shall not unlawfully deprive, nor shall it be construed to unlawfully deprive, any non-union or union employee of his or her rights under federal and state laws.

Each Union shall have the right to designate a working craft employee as steward for each Contractor employing such craft on the Covered Project. Such designated steward shall be a qualified workman assigned to a crew and shall perform the work of the craft. The steward shall not perform supervisory duties. Under no circumstances shall there be a non-working steward. Stewards shall be permitted a reasonable amount of time during work hours to perform applicable Union duties related to the work being performed by the craft employees of his or her Contractor and not to the work being performed by the other Contractors or their employees.

Authorized representatives of the Union shall have access to the Project, provided that such representatives fully comply with the posted visitor, security, and safety rules and the environmental compliance requirements of the Project, provided they do not unnecessarily interfere with the employees or cause them to neglect their work. The Contractor recognizes the right of access set forth in this Section and such access will not unreasonably be withheld from an authorized representative of the Union.

To the extent this PLA addresses a subject, it represents the complete agreement of the parties on that subject. To the extent the PLA does not address a subject, the terms and conditions of the respective Master Agreement for the appropriate craft shall apply to that subject.

ARTICLE VI – Management Rights of Contractors

Contractors retain full and exclusive authority for the management of their respective operations except as specifically set forth in this PLA. The Contractors shall have the right to direct its work forces at their sole discretion, including, but not limited to, hiring, promotion, determining competency to perform work, transfer, lay-off, discipline or discharge for just cause; the selection of foreman and general foreman; the

assignment and scheduling of work; the requirement of overtime work; the determination of when work will be done; and the number and identity of employees engaged to perform such work.

The Contractor may, in its sole discretion, utilize the most effective method or techniques of construction, tools, or other labor-saving devices. Except as otherwise expressly stated in this PLA, there shall be no limitation or restriction upon the Contractor's choice of materials or design, nor upon the full use and installation and utilization of equipment, machinery, tools, or other labor- saving devices. If there is any disagreement between the Contractor and a Union concerning the manner or implementation of such device or methods of work, the implementation shall proceed as directed by the Contractor and the Union shall have the right to grieve and/or arbitrate the dispute as set forth in Article VIII of this PLA.

ARTICLE VII -- Hiring Procedures

Unless otherwise required by this PLA, Contractors shall utilize the job referral system of the appropriate signatory Union to acquire employees to work on the Project. The job referral system will be operated in a non-discriminatory manner and in full compliance with federal, State, and local laws and regulations which require equal employment opportunities and non- discrimination.

A probationary period of ten (10) working days shall be established for all new employees; during such time period such named employees may be summarily discharged and such discharge is not subject to the grievance and arbitration process. Notwithstanding the above, the Contractor may reject any referral for any lawful nondiscriminatory reason provided it complies with this Article. All disputes involving the discipline and/or discharge of an employee working on a Covered Project shall be resolved through the grievance and arbitration provisions. The Contractors shall have the right to reject any applicant referred by a Union, in accordance with the applicable Master Agreement.

In the event a Union is unable to fill a request for qualified employees within forty-eight (48) hours after such request is made by a Contractor (Saturdays, Sundays and Holidays excepted), the Contractor may employ applicants from any other available source. The Contractor shall inform the Union of the name and social security number of any applicant hired from the other sources and shall refer the applicant to the Union for dispatch to the Project within twenty-four (24) hours after hiring.

Except as required by law, the Unions shall not knowingly refer an employee currently employed by any Contractor working under this PLA to any other Contractor. This provision shall not be applicable in any case in which the Covered Employee has given notice to the Contractor- Employer of his or her intent to quit.

The selection of craft foremen and/or general foreman and the number of such foremen and/or general foreman required shall be entirely the responsibility of the Contractor, and Craft foremen shall be designated working foremen at the request of the Contractor and once so designated shall be allowed to perform work on the Project in

their respective crafts.

The parties recognize the State's interest in providing opportunities to participate on the Project to emerging Contractors, as well as other enterprises which may not have previously had a relationship with the Unions signatory to this PLA. To ensure that Contractors will have an opportunity to employ their "core" employees on this Project, all "core" employees must register with the appropriate Union prior to employment. The parties agree that such Contractor may request by name, and the Union will honor, referral of such persons who have registered with the appropriate Union for Project work and who demonstrate the following qualifications:

(a) possess any license required by State or federal law for the Project work to be performed;

(b) have worked a total of at least one thousand (1,000) hours in the construction craft during the prior three (3) years;

(c) were on the Contractor's active payroll for at least sixty (60) out of one hundred eighty (180) calendar days prior to the contract award; and

(d) have the ability to perform safely the basic functions of the applicable trade.

The Union will refer to such Contractor one journeyman employee from the hiring hall out-of-work list for the affected trade or craft and will then refer one of such Contractor's "core" employees as a journeyman and shall repeat the process, one and one, until such Contractor's crew requirements are met or until such Contractor has hired seven (7) "core" employees, whichever occurs first. Thereafter, all additional employees in the affected trade or craft shall be hired exclusively from the hiring hall out-of-work list(s), if available. For the duration of the Contractor's work, the ratio shall be maintained and when the Contractor's workforce is reduced, covered Employees shall be reduced in the same ratio of "core" covered Employees to hiring hall referrals as was applied in the initial hiring.

It is understood that Contractors that do not follow this process shall be subject to the Grievance Procedure of the PLA.

ARTICLE VIII – Work Stoppages

During the term of this PLA, there shall be no strikes, picketing, work stoppages, slow- downs, or other work disruption for any reason by the Union, its applicable Local Union or by an Employee, and there shall be no lockout by the Contractor. Failure of any Union, Local Union, or Employee to cross any picket line established at the Project site is a violation of this Article.

In the case of nonpayment of wages or benefits on a Covered Project, the Union shall give the State and the Contractor three (3) business days' notice should the Union intend to withhold labor from the Contractor's workforce, during which time the

Contractor or its upper tier contractor or the State may take action to correct the default. In this instance, a Union's withholding of labor (but not picketing) from a Contractor who has failed to pay wages or benefits shall not be considered a violation of this Article.

If the State or any Contractor contends that any Union signatory to this Agreement has violated this Article, it will so notify in writing the senior executive of th Union, setting forth the facts alleged to violate this Article. The HCA or the Union in violation of this Article and signatory to this Agreement will immediately use its best efforts to cause the cessation of any violation of this Article. The leadership of the Union will immediately inform the workers of their obligations under this Article. A Union complying with this obligation shall not be held responsible for the unauthorized acts of employees it represents.

ARTICLE IX – Grievance Procedure

This PLA is intended to provide close cooperation between management and labor. Each of the Unions will assign a representative to this Covered Project for the purpose of completing the construction of the project economically, efficiently, continuously, and without interruptions, delays, or work stoppages.

It is understood that the Contractors, the Unions, and the Contractors' Employees, collectively and individually, realize the importance to all parties to maintain continuous and uninterrupted performance of the work of the project and agree to resolve disputes in accordance with the grievance-arbitration provisions set forth in this Article.

Any question or dispute arising out of and during the term of this PLA (other than trade jurisdictional disputes) shall be considered a grievance and subject to resolution under the following procedures:

Step 1. (a) When any Contractor's Employee feels he or she is aggrieved by a violation of this PLA, he or she, through his or her local union business representative or job steward, shall, within ten (10) working days after becoming aware of the dispute, but in no event more than thirty
(30) business days after the Employee reasonably should have become aware of the event giving rise to the dispute, give notice to the work-site representative of the involved Contractor, stating the provision(s) alleged to have been violated. The business representative of the local Union or the job steward and the work-site representative of the involved Contractor shall meet and endeavor to adjust the matter within three (3) working days after timely notice has been given. The representative of the Contractor shall keep the meeting minutes and shall respond to the Union representative in writing at the conclusion of the meeting but not later than twenty-four (24) hours thereafter. If they fail to resolve the matter within the prescribed period, the grieving party may, within forty-eight (48) hours thereafter, pursue Step 2 of the Grievance Procedure, provided the grievance is reduced to writing, setting forth the relevant information

concerning the alleged grievance, including a short description thereof, the date on which the grievance occurred, and the provision(s) of the PLA alleged to have been violated.

(b) Should the Local Union(s) or the Contractor have a dispute with the other party and, if after conferring, a settlement is not reached within three (3) working days, the dispute may be reduced to writing and proceed to Step 2 in the same manner as outlined herein for the adjustment of an employee complaint.

Step 2. The Union Representative, and other representatives as needed, and the involved Contractor shall meet within seven (7) working days of the referral of a dispute to this second step to arrive at a satisfactory settlement thereof. Meeting minutes shall be kept by the Contractor. If the parties fail to reach an agreement, the dispute may be appealed in writing in accordance with the provisions of Step 3 within seven (7) calendar days thereafter.

Step 3. (a) If the grievance has been submitted but not adjusted under Step 2, either party may request in writing, within seven (7) calendar days thereafter, that the grievance be submitted to the appropriate Arbitrator from the list of the permanent panel of Arbitrators, as described herein. The decision of the Arbitrator shall be final and binding on all parties. The fee and expenses of such Arbitration shall be borne equally be the Contractor and the involved Local Union(s).

The Contractors and the Unions agree to the following permanent panel of five (5) arbitrators from which an Arbitrator shall be selected to hear and decide disputes arising under this Article. The members of the panel are:

Eden Hifo
Louis Chang
Lori Aquino
Ron Brown
James Duffy

In the event any panel member is no longer available to serve under this PLA, the State and the Unions collectively shall agree on a substitute panel member within thirty (30) calendar days of notification by the panel member of the member's unavailability to serve. If the parties cannot reach an agreement within the specified time, the remaining panel members shall establish a list of five (5) individuals from which the State and the Unions collectively shall select the substitute panel member by striking an individual from the list in an alternating and equal number of strikes. The remaining individual shall thereafter serve as the new panel member in substitution for the member who is no longer available to serve.

Selection of the Arbitrator from the panel shall be by mutual agreement of the Contractor and the Union(s) involved in the dispute. If an Arbitrator cannot mutually be agreed to by the parties, each party shall have an alternating and equal amount of strikes

from the panel of five (5) and the remaining panel member shall serve in the dispute. The Contractor or Union(s) invoking this procedure shall notify the Arbitrator selected. In the event that the selected Arbitrator is unavailable, the Contractor and Union(s) shall mutually agree upon another Arbitrator.

(b) Failure of the grieving party to adhere to the time limits established herein shall render the grievance null and void. The time limits established herein may be extended only by written consent of the parties involved at the particular step where the extension is agreed upon. The Arbitrator shall have the authority to make decisions only on issues presented to him or her, and he or she shall not have authority to change, amend, add to or detract from any of the provisions of this Agreement.

The Project Contractor shall be notified of all actions at Steps 2 and 3.

The time limits in this Article may be extended by mutual written agreement of the parties to the grievance.

Nothing in this Agreement shall be construed to interfere with or supersede the usual and customary legal remedies available to the Unions and/or employee benefit trust funds to collect delinquent wages or Trust Fund contributions from Contractors on the Project.

ARTICLE X – Pre-Job Conferences

The Contractor shall conduct a pre-job conference with the designated representatives for the HCA, and the Unions signatory to this agreement within thirty (30) days after the execution of the Contractor's contract with the State. The Contractor shall provide such representatives with a list of subcontractors seven (7) days prior to the pre-job conference.

ARTICLE XI – Jurisdictional Disputes

The Contractor performing the work shall be responsible for the assignment of work within the scope of work they will perform.

Should a jurisdictional dispute arise, including based on the assignment of work by the Contractor performing the work, there shall first be an attempt to resolve the dispute at the Project level by the Contractor and the Unions involved in the dispute by no later than seven (7) calendar days from the date a written notice of the dispute was received by the Contractor. If the dispute is not resolved within seven (7) calendar days, it shall be settled and adjudicated according to the following process. The decision rendered in the Plan proceeding described below or arbitration shall be final, binding and conclusive on the Contractor and Unions parties to the Plan proceeding or arbitration. A decision in any Plan proceeding or arbitration proceeding shall not create or be perceived to create a

precedent for future disputes. It is understood that the Joint Administrative Committee has no authority to rule on any issue involved in the jurisdictional dispute. Each signatory union to this PLA agrees to make a good faith effort to avoid jurisdictional disputes.

Jurisdictional disputes between Unions signatory to this Agreement who are members of the Hawaii Building and Construction Trades Council ("HBCTC") may be settled and adjudicated according to the current Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (the "Plan") established by the North America's Building Trades Unions ("NABTU") or any other dispute resolution plan or procedure that may be adopted in the future by the HBCTC if all such unions agree. If there is no mutual agreement, then the dispute shall be resolved as set forth below.

Unions that are not members of the HBCTC, or HBCTC members who are also members of the Hawaii Construction Alliance ("HCA") and decide not to use the procedure set forth in the immediately preceding paragraph or jurisdictional disputes between a member of HBCTC and a member of HCA shall utilize the following procedure. An arbitrator, based upon a review of Hawaii local industry standards and applying the other factors utilized by the National Labor Relations Board to resolve jurisdictional disputes, such as NLRB certification, collective bargaining agreements with the contractor, relative skills and training, past practice of employer, performance of employees, employer performance, and economy and efficiency of operations, shall determine the jurisdictional dispute.

(a) Either party may request, in writing, that the dispute be submitted to arbitration, before a single arbitrator, in accordance with the Arbitration Rules, Procedures and Protocols of Dispute Prevention & Resolution, Inc. ("DPR"), or its successors, then in effect, a current copy of which is attached hereto as Exhibit A, and the provisions of the Federal Arbitration Act, as amended (collectively, the "Required Arbitration Procedures").

(b) The arbitrator shall be selected in accordance with the Required Arbitration Procedures.

(c) The arbitration on the dispute shall be held at a mutually acceptable location in Honolulu, Hawaii. The decision of the arbitrator rendered in any such arbitration shall be final and binding upon the parties and judgment thereon may be entered in any court having jurisdiction thereof. The cost of the arbitration service and the fees of the arbitrator shall be shared equally and paid by the parties to the arbitration. Each party to the arbitration shall bear its own attorneys' fees and costs in the defense or prosecution thereof. Such arbitration award or decision shall not constitute a precedent for any future dispute.

All jurisdictional disputes between Unions signatory to this Agreement shall be resolved without the occurrence of any strike, work stoppage, or slow-down of any nature, and the Contractor's assignment shall be adhered to until the dispute is resolved by agreement, Plan proceeding or arbitration award covering all employees who are involved. The Arbitrator is not authorized to award back pay or any other damages for a misassignment of work, except that a party may seek back pay or damages for the period of non-compliance with an Arbitrator's decision from any party that fails to comply with such decision within seven (7) business days of the issuance of the Arbitrator's decision.

ARTICLE XII – General Work Rules: Obligations of Contractor and Unions

Slowdowns, standby crews, and featherbedding practices will not be tolerated.

It is understood that the Project Contractor may establish reasonable project rules that will be uniformly applied and adhered to by all Contractors, the Unions, and all employees. These rules will be provided to all Contractors for the Contractor's pre-job conference and made available in writing to their Covered Employees. These rules shall be provided to the Unions.

Security procedures for the control of tools, equipment, and materials are the responsibility of the Contractor. Covered Employees having in their possession without authorization any property of the Contractor or of another employee shall be subject to immediate discharge by the Contractor. The Contractor will be responsible for the establishment of reasonable security measures for the protection of personal, company, and Contractor property.

There shall be no restrictions on the use of any tools by any qualified employee in any emergency situation endangering life, limb, or property; or on the use of any tools or equipment for the performance of work within the Union's jurisdiction, provided the employee can safely use the tools and/or the equipment involved.

The selection of a craft foreman and general foreman and the number of same required shall be entirely the right and responsibility of the Contractor.

The Contractor has the sole and exclusive right to assign specific Covered Employees and/or crews to perform overtime work when such overtime work is necessary to accomplish the job. The overtime work shall be assigned to Covered Employees and/or crew(s), to the extent needed, who performed the work involved during the regular work day or work shift.

The Contractor shall provide a convenient and sanitary supply of drinking water and sanitary drinking cups.

The Contractor shall provide adequate sanitary toilet facilities, water, and clean up facilities to Covered Employees.

The Contractor shall provide a safe and secure place for storage of tools.

All required safety equipment will be provided by the Contractor.

ARTICLE XIII – Safety, Environmental and Health

It shall be the responsibility of the Contractor to ensure safe working conditions and employee compliance with any safety rules herein or established by the Contractor.

Covered Employees shall be bound by the safety, security and site access rules established by the Contractor for the Project. These rules will be published and given to each employee as part of their new-hire orientation, as well as posted throughout the Project.

The Contractor shall conduct safety meetings at least once a week for all Covered Employees. Such mandatory meetings will be conducted on paid time. Attendance at such meetings is mandatory and employees who do not attend may be subject to disciplinary action.

Covered Employees shall use, maintain, and care for personal protective equipment and other health and safety equipment issued or assigned them. Proper use of the equipment is mandatory, and failure to do so may result in disciplinary action up to and including discharge.

To further the health, safety and security of the workplace, the Contractor and Unions agree to implement the policy covering drugs and other controlled substances pursuant to Article XII.

ARTICLE XIV – Substance Abuse Policy and Drug and Alcohol Testing Procedure

The parties to this PLA acknowledge the prohibition of the use, sale, transfer, purchase, and/or possession of a controlled substance, alcohol, and/or firearms while on Project premises. Additionally, all parties to this PLA agree to a "drug free" workplace policy, which prohibits those working on this Project from having a level of alcohol which could indicate impairment, and/or any level of controlled substances (i.e., illegal drugs) in their system. No employee shall be permitted to work on the Project under the influence of intoxicants or drugs and shall be removed from the Project if found under the influence of intoxicants or drugs.

To that end, the parties agree that all employees performing work under this PLA shall be obligated and bound to their employer's drug and alcohol prevention policies and programs, whether those policies and procedures are contained in separate collective bargaining agreement between the Union and Contractor or policies and procedures of a contractor that has no separate collective bargaining agreement with the union. If a Contractor with no separate collective bargaining agreement with a union has drug and alcohol prevention policies and procedures, those policies and procedures shall be just as

effective in preventing drug and alcohol abuse as the policies and procedures contained in the corresponding collective bargaining agreement with the union, and shall have no lower testing standards than contained in that agreement. The Contractor shall provide a copy of those policies and procedures to the Union upon request. If a Contractor with no separate collective bargaining agreement with a union has no drug and alcohol prevention policies and procedures, those policies and procedures contained in the corresponding collective bargaining agreement with the union shall apply.

ARTICLE XV – Apprenticeship Program

All apprentices must be indentured in a State-approved apprenticeship program.

Contractors shall employ apprentices in their respective craft to perform work customarily performed by the craft in which they are apprenticed and within their capabilities.

To promote training and employment opportunities for military veterans who are interested in careers in the building and construction trades, the Contractor-Employer and Unions agree, when appropriate, to utilize the services of the Center for Military Recruitment, Assessment and Veterans Employment in the Center's "Helmets for Hardhats" program to serve as a resource for assessment for construction aptitude of the military veterans and for possible referral to apprenticeship programs.

Consistent with any restriction contained in applicable federal and state law and regulations, including those governing equal employment opportunity, prevailing wage and apprenticeship requirements and limitations, the Contractor may employ registered apprentices.

Apprentice pay scales and ratios shall be governed by the appropriate Union's joint apprenticeship program.

ARTICLE XVI – Wages, Hours, Etc.

The wages, hours, shift schedules, holidays, and other terms and conditions of employment will be governed by the master agreement of the applicable craft.

ARTICLE XVII – Subcontracting: Obligations of Contractors

Contractor agrees that it will not subcontract any Covered Work to be performed on a Covered Project, except to an individual firm, partnership, corporation, or any combination thereof or joint venture that signs an Agreement To Be Bound and thereby agrees to become a Contractor subject to this PLA.

ARTICLE XVIII – Joint Administrative Committee

The parties to this PLA shall establish a four (4) person Joint Administrative Committee (JAC). This JAC shall be comprised of a management party made up of two

(2) representatives selected by the State, including one Contractor who has signed the Agreement To Be Bound during the term of this PLA; and a labor party made up of two (2) representatives from the Unions signatory to this Agreement of which one representative shall be a member in good standing, officer or administrator of the Hawaii Construction Alliance. Each representative shall designate an alternate who shall serve in his or her absence for any purpose contemplated by this PLA.

The JAC shall not be involved in or rule upon any individual grievances or on any issue involved in a jurisdictional dispute. Outside of the context of an individual grievance or a jurisdictional dispute, the JAC will resolve any interpretations or clarifications of this PLA that may be required by the Unions and/or the Contractor by majority vote with such resolutions to be binding on all signatories of this PLA as provided herein. Any question regarding the meaning, interpretation, or application of the provisions of this PLA, shall be referred directly to the JAC for resolution prior to such question being referred to arbitration in the event the JAC is unable to resolve the question. Such resolutions or clarifications shall be reduced to writing, jointly signed by the JAC and distributed to the signatory parties to this PLA. If the JAC fails to resolve any questions regarding the meaning, interpretation, or application of the provisions of this PLA within its authority, the Administrator shall have the authority to resolve such question. Labor and management shall each have one equal vote at JAC meetings regardless of the number of attendees. Labor and management shall jointly chair the JAC. In addition to its charter to rule on interpretations or clarifications to this PLA, the JAC shall annually review the effectiveness of the PLA in meeting the PLA goals of:

a. No construction Work Disruption on this Project.

b. Reducing friction that may arise when union and open shop employees are working at a common jobsite.

c. High quality, cost effective construction work.

d. Providing training opportunities for local craft workers.

e. Ensuring compliance with health and safety policies and laws.

ARTICLE XIX – No Discrimination

The Contractor and Unions shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, age, disability, sexual orientation, marital status, ancestry, arrest or court record, or any other protected status pursuant to federal or state law or regulations.

All covered projects shall comply with and be in accordance with the right to organize for the purpose of collective bargaining guaranteed under Article XIII, Sections 1 and 2, of the State Constitution, and the operation and maintenance of facilities that are constructed pursuant to this PLA shall be consistent with the merit principle under Article XVI, Section 1, of the State Constitution.

Contractor agrees that it will not subcontract any Covered Work to be performed on a Covered Project, except to an individual firm, partnership, corporation, or any combination thereof or joint venture that signs an Agreement To Be Bound and thereby agrees to become a Contractor subject to this PLA. Any Contractor working on a Covered Project shall, as a condition to working on said Project, perform all work under the terms of Article XV – Subcontracting: Obligations of Contractors.

ARTICLE XX – Savings Clause

This document contains the entire agreement of the parties, and no party has made any representations to another party which are not contained herein. This PLA is intended to fully conform to all applicable statutes, regulations, and Executive Orders. Should any provision herein contained be rendered or declared invalid by reason of any existing legislation or by any decree of a court of competent jurisdiction, such invalidation of such part or portion of this PLA shall not invalidate the remaining portions thereof, and they shall remain in full force and effect. The parties shall immediately meet to renegotiate the portion or portions thereof rendered invalid.

ARTICLE XXI – Duration

The PLA shall become effective upon the execution by the State, the HCA, and the Unions signatory to this Agreement. The PLA shall remain in full force and effect until December 31, 2026 and, unless extended by the parties to the PLA, shall terminate thereafter. Amendments and modifications to the PLA must be made by mutual agreement of all the parties.

The PLA shall apply until the completion of any individual Covered Project regardless of the PLA term.

ARTICLE XXII – Execution in Counterparts

This Agreement may be executed in counterparts, such that original signatures may appear on separate pages and when bound together all necessary signatures shall constitute an original. Faxed or emailed signature pages transmitted to other parties to this Agreement shall be deemed the equivalent of original signatures.

ARTICLE XXIII – Annual Review upon Request

At each anniversary of the commencement date of the PLA, any signatory union (the "Requesting Party") may request a review of any issues of concern arising under the PLA to determine whether such issues can be resolved. If the Requesting Party is not satisfied with the outcome of the review process, the Requesting Party shall have the right to terminate its participation in the PLA upon thirty (30) days advance written notice to the Administrator.

This Project Labor Agreement is executed on this 22 day of December, 2023, Honolulu, Hawaii.

State of Hawaii

Governor

Hawaii Construction Alliance

UNION SIGNATURES

The undersigned Unions hereby agree to comply with all of the terms and conditions of Covered Projects.

It is understood that this signing shall be as binding on the undersigned Unions as though they signed the above-referenced Project Labor Agreement.

Iron Workers Local 625

12/13/23

Date

Ironworkers Local 625S

12/13/23

Date

United Union of Roofers, Waterproofers & Allied Workers Local 221

12.13.23

Date

International Union of Heat & Frost Insulators & Allied Workers Local 132

Douglas Fulp

Date 12/15/2023

IBUAC, AFL-CIO Local 1 Hawaii

12/13/2023

Date

Plumbers & Fitters UA Local 675

Valentino Ceria

Date 12/28/23

International Brotherhood of Electrical Workers Local 1186

Date 12/13/23

International Association of Sheet Metal, Air, Rail & Transportation Local 293

12/20/2023

Date

Hawaii Regional Council of Carpenters

12/14/23

Date

International Union of Operating Engineers Local 3

1/31/2024

Date

Laborers' International Union of North America Local 368

12/14/23

Date

Operative Plasterer's & Cement Masons International Association Local 630

Date

Hawaii Teamsters & Allied Workers Local 996

12/13/23

Date

International Union of Elevator Constructors Local 126

Date

International Brotherhood of
Boilermakers Local 627

December 13, 2023

Date

International Brotherhood of
Electrical Workers Local 1260

Date

District Council 50
International Union of
Painters & Allied Trades
Local 1791
Glaziers, Architectural
Metal & Glass Workers
Local 1889 Carpet,
Linoleum & Soft Tile
Local 1926
Drywall, Tapers &
Finishers Local 1944

Date

ATTACHMENT "A"
AGREEMENT TO BE
BOUND

This is to certify that the undersigned Contractor has examined a copy of the Project Labor Agreement between the State of Hawaii, the Hawaii Construction Alliance, and its Affiliated Labor Unions, and the Unions signatory to this Agreement ("PLA"). The undersigned Contractor hereby agrees to comply with all of the terms and conditions of the PLA on this Covered Project, entitled _[Name of Project]_.

It is understood that the signing of this Agreement To Be Bound shall be as binding on the undersigned Contractor as though the Contractor had signed the above-referenced PLA. The Contractor further agrees that all of its subcontractors, of whatever tier, shall execute this Agreement To Be Bound and agree to be bound by the PLA for all work within the scope of this Covered Project, entitled _[Name of Project]_.

The Contractor agrees to pay contributions to the bona fide fringe benefit trust funds established by the applicable Master Agreement(s) for each hour worked on the Covered Project, in the amounts designated in the applicable Master Agreement(s). By signing this Agreement To Be Bound, the Contractor adopts and agrees to be bound by the legally established trust agreements governing such trust funds, which may from time to time be amended. The Contractor authorizes the parties to such trust agreements to appoint trustees and successor trustees to administer the trust funds and hereby ratifies and accepts the trustees so appointed. The Contractor agrees to execute a separate subscription agreement in the event the trust funds so require.

CONTRACTOR/SUBCONTRACTOR:_____

Contractor State License # or Motor Carrier Permit #: _____

Name of Authorized Person (print): _____

Signature of Authorized Person: _____

Title of Authorized Person: _____

Telephone Number of Authorized Person:_____

Address of Authorized Person:_____

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HONOLULU, HAWAII

SPECIAL PROVISIONS

SPECIAL PROVISIONS

The "General Provisions" are amended as follows:

1.3 DEFINITIONS

1. Section 1.3 Definitions: The definition for "Subcontractor" is amended by deleting it and replacing it with the following:

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

2. Add the following to 1.3 Definitions.

   "HAWAII ePROCUREMENT SYSTEM (HIePRO) - The State of Hawaii eProcurement System for issuing solicitations, receiving proposals and responses, and issuing notices of award."

   "PROPOSAL (OR BID) - The offer of a Bidder, on the prescribed HDOT form, to perform the work and to furnish the labor and materials at the prices quoted."

2.7 REQUEST FOR SUBSTITUTION OF SPECIFIED MATERIALS AND EQUIPMENT BEFORE BIG OPENING is amended as follows:

1. The last sentence in the first paragraph (line 147 to 152) shall be replaced with the following:

"Where a bidder intends to use a material or equipment of an unspecified brand, make, or model, the bidder must submit a request to the Department for review and approval at the earliest date possible. As specified in the Notice to Bidders, all requests shall be posted as a question in HIePRO under the "Question and Answer" tab. Supporting documents for specific request shall be emailed to the Project Manager specified in the Notice to Bidders. Request must be posted in HIePRO and supporting documents received by the Project Manager via email no later than the RFI deadline in the Notice to Bidders."

2. The first sentence in the second paragraph (line 154 to 156) shall be replaced with the following:

"It shall be the responsibility of the bidder to submit sufficient evidence based upon which a determination can be made by the Department that the alternate brand is a qualified equivalent."

2.8 PREPARATION AND DELIVERY OF BID is amended as follows: Last Paragraph(line 189 to 192) shall be replaced with the following:

"**Bidders shall submit and upload the complete proposal to HIePRO prior to the bid opening date and time. Proposals received after said due date and time shall not be considered. Any additional support documents explicitly designated as confidential and/or proprietary shall be uploaded as a separate file to HIePRO. Bidders shall not include confidential and/or proprietary documents with the proposal. The record of each bidder and respective bid shall be open to public inspection.** Original (wet ink, hard copy) proposal documents are not required to be submitted. **Contract award shall be based on evaluation of proposals submitted and uploaded to HIePRO.**

FAILURE TO UPLOAD THE COMPLETE PROPOSAL TO HIePRO SHALL BE GROUNDS FOR REJECTION OF THE BID.

If there is a conflict between the specification document and the HIePRO solicitation, the specifications shall govern and control, unless otherwise specified."

2.11 BID SECURITY is amended by deleting (a) and replacing it with:

"(a) Unless directed otherwise in the invitation for bids, each bid shall be accompanied by bid security which is intended to protect the Department against the failure or refusal of a bidder to execute the contract for the work bid or to supply the required performance and payment bonds. Bid security shall be in an amount equal to at least five percent of the base bid and additive alternates. Bid security shall be in one of the following forms:

(1) A deposit of legal tender;
(2) A valid surety bid bond, underwritten by a company licensed to issue bonds in the State of Hawaii, in the form and composed, substantially, with the same language as provided herewith and signed by both parties; or
(3) A certificate of deposit; credit union share certificate; or cashier's, treasurer's, teller's, or official check drawn by or a certified check accepted by a bank, savings institution, or credit union insured by the Federal Deposit Insurance Corporation (FDIC) or the National Credit Union Administration (NCUA) and payable at sight or unconditionally assigned to the Department. These instruments may be utilized only to a maximum of one hundred thousand dollars ($100,000.00). If the required amount totals over one hundred thousand dollars ($100,000.00), more than one instrument not exceeding one hundred thousand dollars ($100,000.00) each and issued by different financial institutions shall be accepted.

If bidder elects options (1) or (3) above for its bid security, said bid security shall be in its original form and shall be submitted before the bid deadline to the Contract Office, Department of Transportation, Aliiaimoku Hale, 869 Punchbowl Street, Room 103, Honolulu, Hawaii 96813. Original surety bid bonds do not need to be

submitted to the Contracts Office. Bidders are reminded that a copy of its surety bid bond shall be <u>included with its bid</u> submitted and uploaded to HIePRO."

Delete 2.12 PRE-OPENING MODIFICATION OR WITHDRAWAL OF BIDS in its entirety and replace with the following:

"2.12 PRE-OPENING MODIFICATION OF WITHDRAWAL OF BIDS. Bids may be modified or withdrawn prior to the bid opening date and time. Withdrawal or revision of proposal shall be completed and submitted and uploaded to HIePRO prior to the bid opening date and time."

2.14 PUBLIC OPENING OF BIDS is amended by deleting 2.14 PUBLIC OPENING OF BIDS in its entirety.

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HONOLULU, HAWAII

SPECIFICATIONS

PART I

GENERAL PROVISIONS

The Hawaii Department of Transportation AIR and WATER Transportation Facilities Division General Provisions for Construction Projects dated 2016 is not physically included in these specifications. The General Provisions are available at

http://hidot.hawaii.gov/administration/con/

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HONOLULU, HAWAII

SPECIFICATIONS

PART II

TECHNICAL PROVISIONS

HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET.

JOB P10981

ARTICLE X – PROJECT DESCRIPTION

10.0 CONTENTS

The following file includes the following subsections:

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10.2 GENERAL REQUIREMENTS
10.3 WORK INCLUDED
10.4 DIRECTOR
10.5 ENGINEER
10.6 CONTRACTORS RESPONSIBILITY
10.7 STANDARD SPECIFICATIONS AND APPROVED EQUAL
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10.10 MODIFICATIONS TO PLANS AND SPECIFICATIONS
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10.13 HARBOR OPERATIONS
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10.15 AS-BUILT DRAWINGS
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10.21 HAWAII ONE CALL CENTER
10.22 PLAN APPROVALS: WORK WITHIN AUIKI STREET
10.23 CONSTRUCTION SITE SECURITY

10.1 GENERAL

A. The work to be done under this State of Hawaii contract shall include the furnishing of all labor, machinery, tools, apparatus and other means of construction, materials and equipment, and the supervision and services necessary to construct, complete in place, ready for use, all items of work in accordance with the intent of the Drawings and the Specifications for the proposal work consists of drawings titled “Honolulu Harbor, New Oahu District Baseyard Relocation at Auiki Street, HONOLULU HARBOR, OAHU, HAWAII, P10981”. The scope of work consists of relocation of warehouse structure, warehouse foundation, electrical systems, and plumbing systems; removal and disposal of contaminated and hazardous materials; and all incidental work necessary to complete construction as indicated on the construction drawings and within the Specifications.

10.2 GENERAL REQUIREMENTS

A. The provisions of Section 109 of the Standard Specifications shall apply except as herein modified.

10.3 WORK INCLUDED

A. Work consists of furnishing all transportation, labor, materials, tools, equipment, services, and incidentals necessary for work including, but not limited to, the following to accomplish The HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT

AUIKI STREET, OAHU, HAWAII, P10981, State of Hawaii, Department of Transportation, Harbors Division:

1. Supervision, coordination, and project staging.
2. Scheduling, including baseline schedule, work plan, and schedule updates. Required submittals.
3. Project sign and other miscellaneous signage. Mobilization and demobilization.
4. Environmental protection and pollution control. Environmental permits and control.
5. Coordination with contractors working within the project area.
6. Coordination with: the State of Hawaii Department of Transportation, Harbors Division; City and County of Honolulu, Department of Planning and Permitting and Board of Water Supply; Chevron; Island Energy Services; Hawaiian Electric Company; Oceanic Time Warner Cable; Hawaiian Telcom; Hawaii Fueling Facilities Corporation; and other public / government agencies and private entities.
7. Demolition, excavation, hauling, and disposal of existing debris; pavements; electrical utilities, and structures including, but not limited to, drainage structures, manholes, pipelines, conduits, and other debris; buildings, slabs and foundations; and appurtenances; and all other existing utilities and / or structures not required to remain in place to serve existing functions / facilities or specifically identified to be retained in place within the project area.
8. Handling, containment, hauling and disposal of hazardous and / or contaminated material including, but not limited to, substrates with lead-containing paint, asbestos-containing materials, soil containing hydrocarbons, PCBs, chlordane, etc.
9. Demolition and removal work. Earthwork and subgrade preparation.
10. All incidental work required to complete the work.

10.4 DIRECTOR

A. The term "Director" as used in these Specifications shall mean the Director of Transportation or his authorized representative.

10.5 ENGINEER

A. The term "Harbors Division Construction Engineer," "Harbors Construction Engineer," "Construction Engineer" or "Engineer," as used in these Specifications shall mean the Construction Engineer for Harbors Division, State Department of Transportation, or his authorized representative. The name and contact information for the Construction Engineer will be provided just prior to, or at, the Pre-Construction Meeting.

10.6 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall make direct application to the proper utility companies for water, electric power, and telephone service for use during construction of this project, and shall solely be responsible to pay for all connections, service charges, and all costs for construction and ultimate removal of all temporary service line extensions into the site.

The Contractor shall arrange for, coordinate and pay for utilities such as water, electricity, etc. that he will need for construction. Arrangements are to be made directly with the utility companies with separate meters installed to determine the Contractor's usage. This shall be performed at no additional cost to the Harbors Division.

The Contractor shall comply with all applicable Federal, State, and County laws, including Hawaii Public Health regulations, and all local laws and regulations concerning pollution control and abatement. No burning of debris and/or waste materials shall be permitted on the project site. The Contractor shall be responsible for all dust control. Dust shall be kept within acceptable levels at all times. Noise shall be kept within acceptable levels at all times.

The Contractor shall be responsible for any and all damages to harbor and adjacent facilities caused by his operations. The Contractor shall, at his own expense, make prompt restitution for damages to items caused by his operations or negligence. The Contractor shall hold the State and its consultants harmless for all claims from such loss or injury. The Contractor shall move/remove and replace existing items that may be an obstruction to performing the work, at no additional cost to the Harbors Division. In addition, the Contractor shall be responsible for care of these items with replacement, at no additional cost to the Harbors Division if he damages or destroys the items.
Documentation by the Contractor prior to moving/removing should be made to record the condition of the item for determination of damage.

The Contractor will prepare and obtain approval of site-specific Storm Water Pollution Prevention Plan (SWPPP) from the Department of Health at least 45 calendar days prior to the start of construction. The SWPPP shall be prepared in accordance with the City and County of Honolulu's Best Management Practice Manual for Construction, dated November 2011, and comply with the latest edition of the "Construction Site Runoff Control Program" of the Harbors Division. The SWPPP shall be submitted to the Harbors Division for review and comment prior to submittal to the Department of Health.

The Contractor shall ensure that construction dewatering effluent and hydrotest effluent is not allowed to enter State waters, or drainageways, or drainage systems, or MS4 that eventually discharge into State waters. Dewatering or hydrotest effluent, when required, may be done by back trenching (pit-to-pit discharge). The Contractor is prohibited from discharging dewatering effluent and hydrotest effluent, in any way, into State waters, or drainageways, or drainage systems, or MS4 that ultimately discharge into State waters.

The Contractor shall provide, erect, and maintain warning signs, lights, barricades, fences, and/or other means as necessary to prevent unauthorized persons and the general public from wandering onto the construction area where they may suffer injury or create a hazard to the construction operations or the work. The Contractor shall take all necessary precautions for safety in his operations and to prevent injury to his employees and to others having lawful access to the construction area. This work shall be done at no cost to the Harbors Division and shall be considered incidental to the various items of work.

The Contractor shall coordinate all work with the Engineer and the Harbors Division, Oahu District Manager, and shall conform to all harbor regulations affecting his operations.

The Contractor shall coordinate all work with Hawaii Fueling Facilities Corporation, and any other company or government agency impacted by this project.

B. Safety Requirements: The Contractor must be familiar with, and shall at all times conform to, all applicable health and safety regulations, including all OSHA standards. The Contractor shall submit to the Engineer a Health and Safety Plan within thirty (30) calendar days after the award of Contract for review and acceptance. The Contractor shall not be allowed to commence work until the Health and Safety Plan has been accepted by the Engineer.

The Contractor shall require its employees, subcontractors, and agents to comply with all applicable Federal, State, and local health and safety laws and regulations.

Acceptance of the Health and Safety Plan by the Harbors Construction Engineer shall not relieve the Contractor from its responsibility of complying with Federal, State, and local occupational health and safety laws and regulations. The Contractor is solely responsible for its compliance, and ensuring that its employees, subcontractors, and agents also comply, with all applicable Federal, State, and local occupational health and safety laws and regulations.

The Contractor shall be familiar with any and all Federal, State and local safety and drug-free workplace regulations and shall comply with all applicable provisions and amendments. Failure to do so will result in immediate discontinuation of any or all parts of the operation that are in violation until compliance is achieved.

1. Precautions at the Jobsite: The Contractor shall take all necessary precautions to protect the workers, invitees and the public, and shall provide, where reasonable and necessary, barriers, guards, temporary bridges, respiratory equipment, and lights. The Contractor shall require all personnel to wear hard hats, safety boots, and appropriate clothing while in any work area. In addition, personnel shall utilize safety harnesses, lines, and other restraint devices as required when working at either excessive heights or depths as defined by OSHA regulations.
   When working around existing piping or conduit, the Contractor shall first tone the area to determine underground line locations. Special care shall be taken during excavation to avoid all buried lines, cables, utilities, cathodic protection cables and conduit, and to maintain the minimum distance from existing cables, conduits, and pipe.

2. Fire Safety: The Contractor's personnel shall be familiar with the locations and use of firefighting equipment, including blankets, extinguishers, hoses, and dry powder agents. Smoking materials or other sources of flame or heat should be immediately extinguished in the event of any accident or equipment failure resulting in the release of flammable vapor or liquids. Fire safety equipment shall be provided by the Contractor as may be required by the local, State or Federal authorities.
   The Contractor shall not store equipment or park vehicles in a way that obstructs fire lanes nor blocks fire exits from office structures, equipment, buildings, or fenced areas.

3. Mechanical Safety: Dangerous parts of equipment shall be indicated by safety colors or warning signs. Extreme care shall be exercised in operating mobile or moving equipment.

4. First Aid: The Contractor shall ensure that all employees are aware of the locations and use of first aid equipment. Local emergency telephone numbers for ambulance, fire department, and law enforcement agencies shall be posted in prominent places. The Contractor shall provide all necessary first aid equipment, including a first aid kit in its vehicles.

5. Firearms and Alcohol: Absolutely, under no circumstances, shall unprescribed, controlled substances, alcohol, or firearms of any type be present or carried in vehicles by Contractor's personnel. Any of these items found in the possession of any person shall be grounds for immediate removal from the jobsite and/or dismissal of that person from the job.

6. Accidents: In the event that an accident or injury occurs at the jobsite, the Contractor shall immediately notify the State of the occurrence. A complete accident report, including photographs of the accident site, shall be provided to the State within two (2) weeks of the occurrence.

7. Jobsite Invitees: The Contractor shall be responsible for the safety of the personnel of any of its subcontractors, vendors, suppliers, agents or other invitees who enter the job site area and the Contractor shall require said invitees to comply with the requirements of this Section. The Contractor shall notify the Engineer of invitees in advance.

10.7 STANDARD SPECIFICATIONS AND APPROVED EQUAL

A. For work within the P10981 Honolulu Harbor, New Oahu District Baseyard Relocation at Auiki Street project(s) limits, the term "Standard Specifications," as used in these Technical Provisions of these Specifications, shall mean the "Hawaii Standard Specifications for Road and Bridge Construction, Department of Transportation Highways Division, Honolulu, Hawaii, 2005," and all subsequent amendments.

1. References to "roadway" or "highway" in the Standard Specifications shall mean "paved area."

2. References to "roadbed" in the Standard Specifications shall mean "pavement bed."

3. References to "highway right-of-way" in the Standard Specifications shall mean "project area."

The term "approved equal" as used in the Technical Provisions of these Specifications and Plans shall mean "an equal approved by the Director in writing."

10.8 PERMITS

A. The Contractor is responsible for complying with all permit requirements for the project and it has the sole responsibility of ensuring that all permits remain valid, and that all permits are renewed in a timely manner, throughout the duration of the project.

B. The Harbors Division has applied for the following permits and approvals and can be viewed by contractors at the contracting office..

1. NOI Form C: The National Pollutant Discharge Elimination System (NPDES) Permit for Discharges of Stormwater Associated with Construction Activity including the following:

C. Hot Work Permit: The Contractor shall obtain permits for all welding and burning operations on piers, wharves, and aboard vessels. The Contractor shall obtain the permits required for this work directly from the Harbors Division, Oahu District Manager. The Contractor shall pay for any filing fees and charges.

D. Noise Permit: That Contractor shall apply for, and obtain, a Community Noise Permit and/or Variance, for any work, or construction activities which emit noise in excess of the maximum permissible sound levels for any hour and/or day of the week/holidays, as specified in Hawaii Administrative Rule (HAR), Title II, Chapter 46, Section 7; whichever is required by the State of Hawaii Department of Health for such work, or means and methods, and the Contractor is solely responsible for providing any submittals and materials, and to undertake all efforts and

tasks, required by the Department of Health for the Noise Permit and/or Variance approval. The Contractor shall pay for any filing fees and charges.

E. Federal Aviation Administration (FAA) Height Hazard or Obstruction Determination (FAA 7460): The Contractor shall apply for, and obtain, a Determination of No Hazard to Air Navigation (or FAA 7460 clearance), or supply confirmation that such Determination is not required, for any construction equipment that it will deploy to do the work required by the contract and the Contractor is solely responsible for providing any submittals and materials, and to undertake all efforts and tasks, required by FAA for issuance of the Determination. The Contractor shall pay for any filing fees and charges.

F. The Contractor also shall consult applicable City, State, and other governmental agencies for required permits, charges and fees. The Contractor shall apply for, and obtain, any permits necessary for it to perform all work required under the contract and is responsible for preparing and furnishing any information needed to complete any permit or certification applications, as well as for paying any permit/certification filing fees and charges, imposed by the permitting agencies as conditions for approval. Permits, charges, and fees required for the Project may include, but not be limited to, the following:

1. Permits for work within City and County of Honolulu Streets including Trenching and Street Usage Permits
2. Grading, Grubbing or Stockpiling Permits if required for any work, beyond the limits of the project site, that the Contractor elects to do in support of the project. A permit for grading, grubbing, or stockpiling, within the project limits on State land, is not required.
3. Landfill Agreement
4. Fire Hydrant Use Permit
5. Department of Health, NDPES permit for discharges associated with construction activity dewatering.
6. Permit to Discharge into State Highways Drainage System.
7. Construction Dewatering Permit for Industrial Waste Discharge into the City and County Separate Storm Sewer System
8. Industrial Waste Discharge Permit (IWDP) for Temporary Discharge into the City Sewer System

The Contractor shall submit two (2) copies of all permits to the Harbors Construction Engineer no later than two working days after receipt of any approved permit.

10.9 SHOP DRAWINGS

A. The Contractor shall prepare shop drawings and submit eight (8) sets to the Harbors Construction Engineer for review and approval. Review of shop drawings is for general conformance with the design concept of the project Contract Documents and does not relieve the Contractor of his responsibility to provide all work in accordance with the Plans and Specifications.

10.10 MODIFICATIONS TO PLANS AND SPECIFICATIONS

A. The Contractor and his subcontractors must submit to the Engineer in writing any requests for modifications to the Plans and Specifications. Shop drawings that are submitted to the Engineer for review do not constitute "in writing" unless it is brought to the attention of the Engineer that specific changes are being suggested. In any event, changes to the Plans and Specifications by means of shop drawings become the responsibility of the person initiating the changes. The Contractor shall be responsible for coordinating and making all necessary revisions to the work of all trades to suit the modifications requested. Construction changes completed without written approval by the Harbors Construction Engineer will be at the Contractor's risk. All costs associated with unauthorized construction changes shall be the responsibility of the Contractor.

10.11 LAYOUT OF WORK

A. The Contractor shall layout his work from reference points and benchmarks indicated on the Plans and shall be responsible for all measurements in connection therewith. The Contractor shall furnish all equipment and materials required to establish and maintain all lines and grades as called for in the Plans or as required in the process of construction. The Contractor shall be responsible for the proper and accurate layout of the work and for the preservation of stakes and other marks. All survey work shall be performed by a Surveyor licensed, for a minimum of 20 years, in the State of Hawaii.

10.12 TESTING

A. The Contractor shall hire an independent certified testing agency to perform all testing required under these Specifications. Testing agency shall be subject to the approval of the Director. The Contractor shall be responsible for costs associated with testing, and for the submittal of test results.

B. Testing results shall be submitted for review by the Harbors Construction Engineer in a timely manner so as not to affect the construction schedule.

10.13 HARBOR OPERATIONS

A. All work shall be coordinated and scheduled with the Engineer. At least four weeks before work is started, the Contractor shall submit a work schedule and construction-phasing plan to the Engineer for review and approval.

B. The Contractor shall be aware that Harbor operations will always have first priority, are unpredictable, and subject to change. Interference from daily Harbor operations may occur and shall have no additional cost to the State.

C. The Contractor shall be responsible for coordination and protection of his work until final acceptance by the State.

D. The Contractor shall be responsible for providing any required temporary barricades or fencing for protection of his work to the satisfaction of the Engineer and at no additional cost to the State.

E. The Contractor shall conduct the work in a manner that will not interrupt nor otherwise interfere with full operation of the adjoining existing facilities. The Contractor shall, at his own expense, make prompt restitution for damages to these facilities, and payment for loss or injury suffered by users thereof, caused by the Contractor's operation or negligence, holding the State harmless therefrom.

10.14 WATERWAYS

A. The Contractor shall use all proper precautions and methods of procedure in his operations to ensure that no debris or other deleterious materials be allowed to fall, flow or otherwise enter the State waters, or drainage ways or drainage systems that discharge into State waters. The Contractor shall notify the State Department of Health and the Engineer of any petroleum, oil, or hazardous material spills immediately. Any petroleum, oil, or hazardous material spills shall be immediately removed to the satisfaction of the Engineer.

10.15 AS-BUILT DRAWINGS

A. Description

1. As-built drawings shall refer to those documents maintained and annotated by the Contractor during construction and shall be defined as (1) a neatly and legibly marked set of contract drawings showing the final location of piping, structures, equipment, electrical conduits, outlet boxes and cables; (2) additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the specifications; additional documents placed on reproducible vellum (post-contract drawings); and (3) Contractor layout and installation drawings

2. As-built drawings shall be full-sized and maintained in a clean, dry, and legible condition. As-built drawings shall not be used for construction purposes and shall be available for review by the Construction Engineer during normal working hours at the Contractor's field office

B. General

1. The Contractor shall keep a record of all field changes that occur during the project on two (2) full-sized sets of the contract plans to be kept at the job site. No partial payments will be allowed unless these changes are reflected on both sets of plans, and the plans must be current and kept up to date.

2. The Contractor shall be responsible for furnishing its own 100 percent (full) size as-built drawings set based on the latest Contract Documents. The Contractor shall incorporate any post contract drawings issued under Field Orders, responses to Requests for Information, or as part of Contract Change Orders, into both copies of the as-built plans.

3. Marking of the as-built drawings shall be kept current and annotations, to the as-built drawings, shall be done at the time the material and equipment are installed. These annotations shall be made with an erasable colored pencil conforming to the following color code:

   a) Additions and deletions shall be marked in red

   b) Comments, as well as dimensions, shall be marked in blue

4. All deviations from the contract drawings as a result of any and all Addenda, Field Orders, Requests for Information (RFIs) and approved Contract Change Orders shall be annotated on all affected drawings.

5. Annotations to the as-built drawings shall reference the specific Addendum number, Field Order number, Request for Information number, or the Contract Change Order number. Annotations without these reference numbers will not be considered complete

C. Submittals:

1. At the completion of the work, the Contractor shall transmit both copies of the as-built drawings to the Harbors Construction Engineer as a Submittal. The Contractor shall stamp both sets of drawings with the words "As-Built Drawings" and said stamp shall include a statement signed by the Contractor certifying that the drawings accurately and completely reflect the work as constructed. The stamp format and wording shall be submitted to the Construction Engineer for prior approval. No payment for Demobilization will be released until both copies of the As-Built Drawings are received by the Construction Engineer.

2. Record Drawings:

a) The State will prepare the Record Drawing by recording the changes, shown on the As-Built Drawings, onto original tracings. The Final Record Drawings will include an original tracing of the Title Sheet with a stamp containing the words "Record Drawings" as well as a signature line for the Contractor.

b) The Contractor shall review the Record Drawings prepared by the State and certify the Record Drawings by signing and dating the Record Drawing title sheet tracing where indicated. Any deviations from the plans determined by the Harbors Construction Engineer to be missing from, incomplete, or inaccurately drawn on the As-Built drawings shall be corrected on the Record Drawing tracings by the State and the Contractor shall be charged for the services. The State will keep a record of the associated cost impacts and deduct them from the contract price

c) Final payment, as well as full payment for Demobilization, will not be released until after the Record Drawing tracings have been signed and certified by the Contractor and returned back to the State.

D. Measurement and Payment: Separate measurement or payment will not be made for work required under this Article 10.16. All costs in connection with the work specified herein; furnishing, maintaining, producing and submitting as-built drawings, will be considered to be incidental to the various bid items in the Proposal Schedule

10.16 CONSTRUCTION ACCESS

A. General:

The Contractor and his subcontractors and suppliers shall conduct all business via the Auiki Street/Road 2 ingress/egress to the project area shown on the Contract Drawings.

The Contractor shall show all access routes to and from the construction site, including specific travel routes within the project area, in the Traffic Control Plan (TCP). The TCP shall be approved by the Harbors Construction Engineer prior to the start of construction.

Access for construction vehicles will be allowed at the primary entry of the project area. The Contractor shall be responsible for ensuring that access is controlled in such a manner as to allow the safe passage of construction vehicles to and from the site.

The access gate and driveway will not be measured or paid for separately but will be considered incidental to the various contract items in the Proposal Schedule.

B. Primary Site Access – Auiki Street/Road 2 Entrance: The primary access to the project site shall be from Road 2 entrance as indicated on the Plans. However, the Contractor shall coordinate and share this access with other contractors who are under separate contract with the State or with other parties.

C. The State does not warrant or guarantee that the Contractor will have sole, and unhindered ingress and egress, at all times through the Auiki Street/Road 2 entrance into the project site for the duration of the project. The Contractor is solely responsible for assessing its requirements for access and deliveries, and for scheduling, and coordinating ingress and egress for its access and deliveries with other contractors using the Road 2 entrance, in the context of the constraints described herein, and the conditions of General Provision 5.9 will apply.

D. Offsite Parking: The Contractor, and its sub-contractors and/or suppliers, shall not have any vehicles, inclusive of personal vehicles belonging to its personnel, or equipment and material, parked or stored on streets surrounding the project site, unless expressly required by the contract. Some of the streets surrounding the site and subject to this provision include:

- Auiki Street from Sand Island Access Road to Libby Street
- Mokauea Street from Auiki Street to Silva Street
- Mary, Hoe and Silva Streets in their entirety
- Kalihi Street from Auiki Street to Democrat Street
- Democrat Street from Kalihi Street to Libby Street
- Kahai Street from Mokauea Street to Libby Street
- Libby Street from Auiki Street to Nimitz Highway

The Contractor will be responsible for any costs associated with violating this provision, including but not limited to coordinating, holding and/or attending community or neighborhood meetings to address complaints pertaining to Contractor occupancy or use of these roads.

This restriction shall not apply in the event that the Contractor applies for, and obtains, a Street Usage Permit indicating City and County approval to use and occupy any of these areas. This restriction shall also not apply to the Contractor, or any sub-contractor or supplier, if its principal place of business is located on any of these road segments.

10.17 WORKING HOURS

A. The Contractor shall coordinate his work so as to minimize interferences with harbor operations. All work shall be coordinated and scheduled with the Harbors Construction Engineer who will be identified at the Pre-construction meeting. Four (4) weeks before work is started, the Contractor shall submit a work schedule and construction phasing plan to the Construction Engineer for review and approval.

B. Normal working hours within the project site are from 7:00 AM to 3:30 PM, Monday to Friday, except on State Holidays, unless otherwise authorized by the Construction Engineer. Working hours for construction within the City and County of Honolulu or Department of Transportation – Highways Division Rights-of-Way shall conform to the requirements of the authority having jurisdiction. Overtime, and Contractor payment Harbor's Inspector's overtime charges, are defined and described in the Special Provisions.

10.18 CONSTRUCTION SCHEDULE

A. The Contractor shall prepare, update, revise and submit project progress schedules, including the Project Schedule, Updated Project Schedule, Four-Week Work Plan Schedule, the Monthly Progress Status Report, and the Payment Schedule and Schedule of Cost Loading and Cash Flow.

The 4-week work plan needs to be updated weekly and include detail of the daily activities/phase/location, required tests and inspections. Other schedules to be updated

monthly or at the Construction Engineer/Construction Manager request. Construction Schedule shall comply with Section 8.6 of the General Provisions. A preliminary Construction schedule shall be submitted within 30 days of the contract transmittal. This schedule shall list all the required submittals, materials ETA, mobilization, construction activities, final inspection, and acceptance. An initial Construction Schedule shall be submitted 30 days prior to mobilization, and the baseline Construction Schedule shall be submitted at the first OAC meeting after construction mobilization. Schedule of Values shall be in compliance with Section 9.1 of the General Provisions.

10.19 HARBOR SECURITY

A. The Contractor shall submit required documentation of all Contractor's and sub-contractor's employees, their representatives, suppliers, manufacturers, and alike, and of all necessary vehicles needing access to the project site to the Engineer and Harbors Division, Oahu District Manager before starting work on the project. The documentation will include the following:

1. Authorized personnel's first name, middle initial(s), and last name by company name.
2. Vehicle(s) license plate number(s) by company name. All other requirements indicated shall be considered incidental to the project, for the life of the project, and shall be provided by the Contractor at no additional cost to the State.

B. At times additional security services maybe initiated and requested by the State. This request is not intended for security services required by the bidder for their work, materials, or equipment.

10.20 ALTERNATIVES AND SUBSTITUTIONS FOR EQUIPMENT, ARTICLES OR MATERIALS

A. These Specifications and/or Plans may specify equipment, articles, or materials under a trade name or the name of a manufacturer and his information catalog. The use of alternatives or substitutions of equal quality and characteristics for the purpose intended will be permitted, upon approval of the Director, in accordance with the requirements of the General Provisions, 2.7 and 6.13 and as amended by the Special Provisions.

Please note that these requirements include certain deadlines for requests on use of alternatives before bid opening and/or justification for substitutions after the bid opening. The Director also reserves the right to deny any request he deems irregular or not in the best interests of the State.

10.21 HAWAII ONE CALL CENTER

A. The Contractor shall comply with the Hawaii One Call law, HRS Section 269E-4. This includes, but is not limited to, coordination with the Hawaii One Call Center (HOCC) for any work involving excavation at least five (5) working days but not more than twenty-eight (28) calendar days prior to commencing excavation. The Contractor shall provide to HOCC a description of the excavation site that may include the count, place, address, and measurements as needed. Any additional required toning (not provided by Hawaii One Call Center) shall be completed at Contractor's expense.

HOCC contact information: telephone number 1-866-423-7287 or 811; website: http://www.callbeforeyoudig.org.

In the event that HOCC, its associated facility operators, and / or its contractors require access to Harbors secure areas, the Contractor shall assist with this access by providing TWIC-credentialed escort(s), as necessary. The Contractor shall contact the Harbors Division, Oahu

District Manager for the specific secure area requirements.

10.22 PLAN APPROVALS: WORK WITHIN AUIKI STREET

A. Work within Auiki Street and City and County Right-of-Way is not anticipated.

B. The Contractor shall not begin any work within the City right-of-way on Auiki Street unless authorization is received by the City and County of Honolulu and by the Engineer to proceed.

10.23 CONSTRUCTION SITE SECURITY

A. General Requirements: The Contractor is solely responsible for the security of the project site (i.e., within the limits of the P10981 project site) specifically required or identified for work under the contract, seven days a week and 24 hours a day, and shall provide any and all security measures, including security personnel, necessary to accomplish this as described in Article 10.19 above, as of the Notice to Proceed up through final acceptance of the project. Payment for security measures, and/or security guards or personnel, for this work will not be made separately but shall be considered incidental to the various contract items in the Proposal Schedule.

B. Dumping: Any and all abandoned vehicles, appliances, junk and trash, that become found, dumped or left within the project site, or areas within the project site specifically required or identified for work under the contract, after Notice to Proceed has been issued up through final acceptance of the project, shall be promptly and totally removed from the project site and disposed of in accordance with State and County requirements. The Contractor is solely responsible for preventing unauthorized access during working and non-working hours to eliminate illegal or illicit dumping within the project site for the duration of the contract under Article X. All work necessary to comply with this item will not be paid separately but shall be considered incidental to the various contract items and no separate payment will be made.

Item No.	Pay Item	Unit Price
1	Additional security services as described in Article X	ALLOWANCE

END OF ARTICLE

ARTICLE XI- REQUIRED SUBMITTALS

11.1 GENERAL

This Article describes the Contractor submittals that are required for this project. In general, they include, but are not necessarily limited to, shop drawings, product and material data sheets, material safety data sheets, work plans and schedules, samples, etc., as specified and required by the Plans and Specifications. As soon as possible after award of Contract, the Contractor shall submit for approval all required submittals to the Harbors Division Engineer at 79 S. Nimitz Highway, Honolulu, Hawaii 96813. After the State's approval of the submittals, the Contractor shall promptly and timely order the materials for the project so as to not delay the construction schedule and progression of work.

11.2 REQUIRED SUBMITTALS

The Contractor shall submit for review and approval eight (8) hard copy sets, unless otherwise specified, of each required submittal summarized below. Drawings and/or prints shall be full- sized unless indicated otherwise by the Engineer; electronic copies will not be accepted. To the best of the State's knowledge, this list is deemed to be complete, however, the Contractor shall consider this list to be the minimum required and shall be responsible for all submittals required by this Contract as may be specified elsewhere on the Plans and/or Specifications.

A. Environmental Protection, Permits, and Controls
   1. Contact information
   2. Stormwater Pollution Prevention Plan (SWPPP)
   3. Major Construction Activity Timetable
   4. Permit Applications and Forms
      a) All Test Results Required by Permits

B. Ambient Air Monitoring
   1. Ambient Air Sampling Plan

C. Demolition and Removal Work
   1. Proposed Demolition and Removal Procedures.
   2. Gas Free Certificate

D. Handling and Removal of Contaminated Materials
   1. Site Safety and Health Plan
   2. Construction - Environmental Hazard Management Plan (EHMP), including Sampling and Analysis Plan (SAP) and Dewatering Plan, where applicable.
   3. Detwatering Plan Working Training Certification
   4. Vehicle Decontamination Reports
   5. Completion Report

E. Removal of Asbestos-Containing Material

1. Copy of current C-19 License
2. Notification of Demolition and Renovation, in accordance with CFR Part 61.145 of Subpart M
3. Work Plan
4. Detailed Work Schedule using bar graph or Critical Path Method (CPM)
5. Manufacturer's Data
6. Material Samples:
    a) Plastic Sheeting
    b) Surfactant
    c) Tapes & Adhesives
    d) Warning Labels & Signs
    e) Protective Clothing
7. Respiratory Protection Program and Equipment
8. Documentation for Instruction
9. Documentation from Physician
10. Manufacturer's Certification for HEPA Vacuums
11. Notification of Intended Use for Rental Equipment (if used)
12. Work Area Entry Log
13. Certificate of Release
14. Waste Shipment/Disposal Record
15. Contractor's Qualifications, including insurance
16. Emergency Response and Evacuation Plan

F. Lead-Containing Paint Control Measures

1. Work Plan
2. Lead Training Documentation
3. Respiratory Protection Program and Training/Fit Documentation
4. Medical Examination Clearance
5. Qualified Consultant Qualifications
6. Testing Laboratory Qualifications
7. Proposed Disposal Landfill Waste Acceptance
8. Manufacturer's Data
9. Warning Labels and Signs
10. Emergency Response and Evacuation Plan
11. Final Clearance Report

G. Earthwork and Subgrade Preparation

1. Soils Testing of Fill and Subgrade
2. Field Density Test Results

H. Traffic Control

1. Traffic Control Plan (TCP)
2. Request(S) For Detours and Lane Closures
3. Shop Drawings
4. Notice to Motorists

11.3 See also, submittal requirements as described in the following Articles:

Article XV – Demolition, Removal, and Relocation
Article XVI – Earthwork and Subgrade Preparation
Article XVIII – Aggregate Base Course
Article XX – Portland-Cement concrete Pavement
Article XXII – Water System
Article XXIII – Sewer System
Article XXIV – Drainage System
Article XXVII – Fire Extinguishers and Cabinets
Article XXVIII – Fire Suppression Piping and Sprinklers
Article XXX – Unit Masonry Assemblies
Article XXXI – General Mechanical Requirements
Article XXXII – Mechanical Insulation
Article XXXIII – Plumbing
Article XXXIV – Low Pressure compressed Air System
Article XXXV – Fuel Dispensing
Article XXXVI – Unitary Air Conditioning Equipment
Article XXXVII – Ductwork and Ductwork Accessories
Article XXXVIII – Ceiling Fans
Article XXXIX – Industrial Ventilation and Exhaust Systems
Article XL – HVAC Testing, Adjusting, and Balancing
Article XLI – General Electrical Requirements
Article XLII – Electrical Work
Article XLIII – Low Voltage Switchboards
Article XLIV – Fire Alarm System
Article XLV – Lighting
Article XLVI – Underground Electrical Work
Article XLVII – Telecommunication Cabling System
Article XLVIII – Photovoltaic Collectors
Article XLIX – Video Surveillance System
Article L – Modular Battery Energy Storage System
Article LI – Metal Fabrication
Article LII – Metal Floor Plate Stairs
Article LIII – Pipe and Tube Railing
Article LIV – Rough Carpentry
Article LV – Sheating
Article LVI – Interior Finish Carpentry
Article LVII – Plastic-Laminate-Clad Architectural Cabinets
Article LVIII – Solid Surfacing Fabrications
Article LIX - Bentonite Waterproofing

Article LX - Thermal Insulation
ARTICLE LXI - Weather Barriers
ARTICLE LXII - Vapor Retarders
ARTICLE LXIII - Formed Metal Roof Panels
ARTICLE LXIV - Standing-Seam Metal Roofing Panels
ARTICLE LXV - Formed Metal Wall Panels
Article LXVI - Soffit Panels
Article LXVII - Sheet Metal Flashing and Trim
Article LXIX - penetration Firestopping
Article LXX - Joint Sealants
Article LXXI - Hollow Metal Doors and Frames
Article LXXII - Flush Wood Doors
Article LXXIII - Access Doors and Frames
Article LXXIV - Overhead Coiling Doors
Article LXXV - Aluminum-Framed Entrances and Storefront
Article LXXVI - Door Hardware
Article LXXVII - Glazing
Article LXXVIII - Fixed Louvers
Article LXXIX - Non-Structural Metal Framing
Article LXXX - Gypsum Board
Article LXXXI - Ceramic Tiling
Article LXXXII - Static-Control Resilient Flooring
Article LXXXIII - Resilient Base and Accessories
Article LXXXIV - Resilient Tile Flooring
Article LXXXV - Resinous Flooring/Static Control Resinous Flooring
Article LXXXVI - Tile Carpeting
Article LXXXVIII - Interior Painting
Article LXXXIX - High Performance Coatings
Article XC - Graffiti-Resistant
Article XCI - Room-Identification Panel Signage
Article XCIII - Plastic Toilet Compartments
Article XCIV - Wet Wall Panel System
Article XCV - Wall and Door Protection
Article XCVI - Toilet, Bath, and Laundry Accessories
Article XCVIX - Pallet & Cantilever Rack
Article C - Roller Window Shades
Article CI - Metal Building Systems
Article CII - Termite Control
Article CIII - Vehicle Lifts
Article CIV - Bridge Crane
Article CV - Bar Gratings
Article CVI - Metal Ladders

11.4 MEASUREMENT AND PAYMENT

Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XII– PROJECT SIGN

12.1 GENERAL

The Project Sign work shall consist of furnishing, constructing, placing, maintaining, and subsequently removing two Project Signs.

12.2 MATERIALS

The Contractor shall furnish and install all material necessary to complete this work.

12.3 CONSTRUCTION REQUIREMENTS

A. General: Furnish, construct, and erect two Project Signs, location to be determined by the Engineer, and as detailed in Appendix A, Project Sign Detail. The Contractor shall provide posts, brackets, braces, and appurtenances as required to mount the signs. The Contractor shall ensure that the Project Signs are structurally stable. Contractor shall install the signs prior to start of work and provide all required maintenance during construction. The contractor shall remove the signs after the Engineer has determined that the work is substantially complete.

B. Sign Specifications:

1. Letter Style – Project title shall be centered and set in a Helvetica Compact Bold. Other letters are set as shown and Helvetica Medium, with the exception of the initial capitals of "GOVERNOR JOSH GREEN, MD," which is set in Baskerville. Sign letters shall be set and spaced by a professional typesetter and enlarged photographically as indicated for photo stencil screen process.

2. Artwork – Constant elements of the sign layout-frame, stripe, and official State Information may be duplicated following working drawing measurements as specified on the Drawings. The "STATE OF HAWAII" masthead letters shall be Baskerville Bold, as indicated on the drawing layout.

3. Titles – The specific major work of the Project under construction is emphasized by using 3-1/2" and 3" type, all capitals. For other related information of lesser importance, use 1-1/2" or 1" type in initial caps and lower-case letters.

4. Materials – Panel shall be 3/4" exterior grade high density overlaid plywood, with resin-bonded surfaces on both sides.

5. Paints and Inks – Screen print inks shall be matte finish. Paints shall be satin finish, exterior grade. References to Ameritone color key paint are for color match only.

6. Color:

   a) Color 1: 1BL10A Bohemian Blue

   b) Color 2: 2H16P Softly (white)

   c) Color 3: 2VR2A Hot Tango (red)

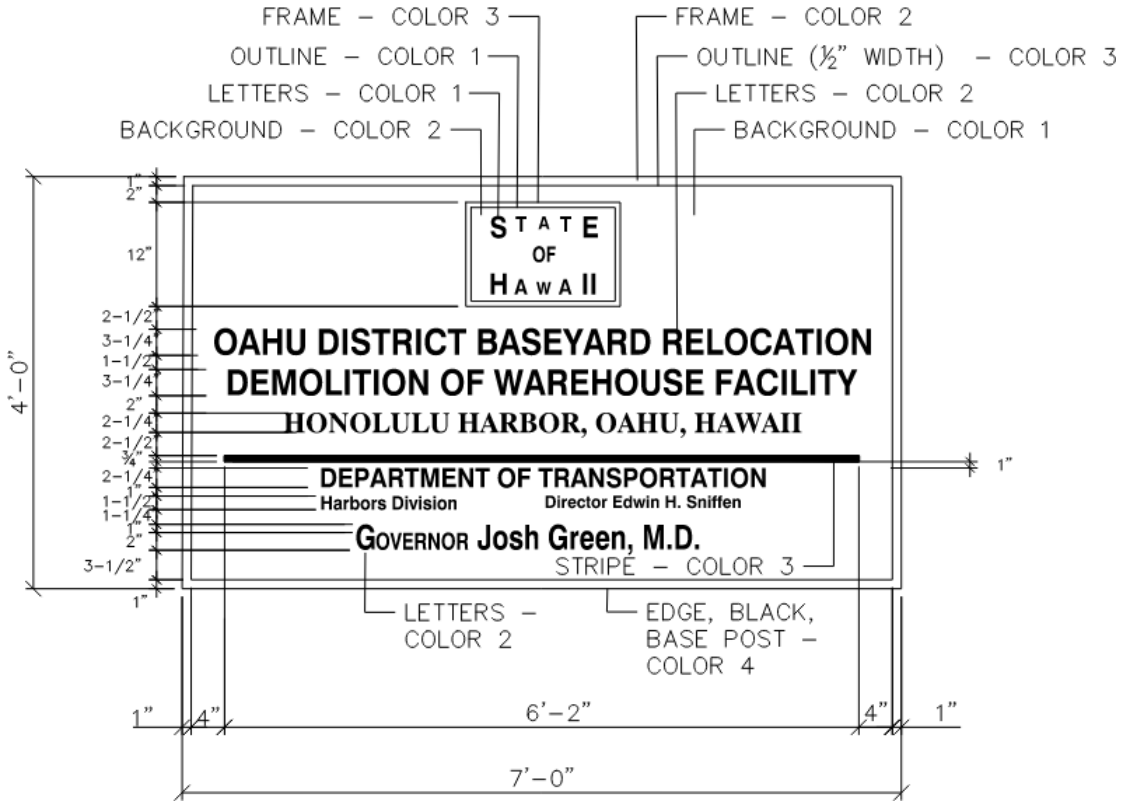
   d) Color 4: 1M52E Tokay (gray).

12.4 MEASUREMENT AND PAYMENT

Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

APPENDIX A: SAMPLE PROJECT SIGN DETAIL



ARTICLE XIII - MOBILIZATION AND DEMOBILIZATION

13.1 GENERAL

A. Mobilization and demobilization work shall consist of furnishing plant, materials, labor, and equipment to perform all work in conjunction with mobilization and demobilization for the job in accordance with this Article of the Specifications.

B. In general, the provision of Section 699 of the Standard Specifications shall apply except as hereinafter modified.

13.2 DESCRIPTION

A. Project Mobilization and Demobilization:

1. Mobilization shall include setting up, ready for use, of all plant, materials, and equipment at the jobsite.

2. Demobilization shall include the removal of all Contractor's plant, surplus materials, and equipment from the jobsite, for each part of the project, including project signs, as well as cleanup of the jobsite to the satisfaction of the Engineer.

13.3 EXECUTION

Delay in demobilizing completely from outside of the construction limits by the specified date will inconvenience Harbor users' operations. The Contractor shall pay the amount shown in the Schedule of Liquidated Damages, as amended by the Special Provisions, for each calendar day delayed in demobilizing completely from outside of the construction limits, which in this case shall be completing the Project Demobilization, whichever is later, by the specified date. The terms governing the assessment of liquidated damages, as specified in the General Provisions, and as amended by the Special Provisions, shall be applicable to the Contractor's delay in demobilizing from the site by the specified date.

13.4 MEASUREMENT AND PAYMENT

A. Project Mobilization and Demobilization

1. Maximum Bid Amount: The maximum bid amount allowed for Project Mobilization and Demobilization shall be limited to no more than six percent (6%) of the sum of all bid items with the exception of, and excluding, this item, and all allowance and force account items.

2. Payment: Project Mobilization and Demobilization, will be paid for at the lump sum bid price as shown in the Proposal Schedule

a) Sixty percent (60%) of the Project Mobilization and Demobilization lump sum bid price will be paid to the Contractor upon completion of mobilization, as described in Paragraph 13.2.A.1 above, at the work site. Partial payments will be made as follows:

i. When 2.5% of the original contract price is earned, but no sooner than after the Project Signs required under Article XII – Project Sign have been erected, up to a maximum of 30% of the Project Mobilization and Demobilization lump sum price in the Proposal shall be paid;

ii. When 5% of the original contract price is earned, up to maximum of 45% of the Project Mobilization and Demobilization lump sum price in the Proposal shall be paid;

iii. When 7.5% of the original contract price is earned, up to 60% of the Mobilization and Demobilization lump sum price in the Proposal shall be paid;

b) The remaining forty (40%) of the Project Mobilization and Demobilization lump sum bid shall be provided upon completion of demobilization from the work site, as described in Paragraph 13.2.A.2 above, and will be included in the final payment under this Contract. Refer also to Article 10.16.

Item No.	Pay Item	Unit Price
2	Mobilization and demobilization as described in Article XIII (not to exceed 6% of the sum of all items excluding the bid price of this item)	LS

END OF ARTICLE

ARTICLE XIV– TEMPORARY WATER POLLUTION, DUST, AND EROSION CONTROL
(For Project Subject to NPDES NOI-C Permit)

14.1 DESCRIPTION

This section is required for all work, including the Contractor's storage sites. It describes the following:

A. A detailed site-specific Best Management Practice (BMP) Plan including diagrams and narratives; constructing, maintaining, and repairing temporary stormwater pollution, dust, and erosion control measures at the project site including local material sources, work areas and access roads; removing and disposing of wastes and hazardous wastes; and control of fugitive dust (defined as uncontrolled emission of solid airborne particulate matter from any source other than combustion). Additionally, all projects at Honolulu and Kalaeloa Barbers Point Harbors are subject to State of Hawaii, Department of Transportation (HDOT) Harbors Division, Storm Water Management Plan (SWMP) requirements, unless exempted, and are subject to Harbors BMP inspections. If any requirement conflicts with those administered by State of Hawaii, Department of Health (HDOH), the contractor shall follow the more stringent requirement.

B. Compliance with applicable federal and other state permit conditions.

C. Work associated with dewatering and hydrotesting activities and compliance with conditions of the NPDES general permit coverage authorizing discharges associated with construction activity dewatering and hydrotesting.

14.2 GENERAL REQUIREMENTS

In order to provide for the control of water pollution, dust, and erosion arising from the construction activities of the Contractor and his subcontractors in the performance of this contract, the work performed shall comply with all applicable federal, state, and local laws and regulations concerning water pollution control including, but not limited to, the following regulations:

A. State of Hawaii, HDOH Hawaii Administrative Rules (HAR) Chapter 11-54 – Water Quality Standards and Chapter 11-55 – Water Pollution Control.

B. For Oahu projects ONLY, HDOT Harbors Division, Storm Water Management Plan.

C. For Oahu projects ONLY, City and County of Honolulu (CCH), Rules Relating to Water Quality.

D. For Oahu projects ONLY, CCH, Storm Water BMP Manual for Construction.

E. 40 CFR Part 110, Environmental Protection Agency (EPA) Discharge of Oil.

F. 40 CFR Part 117, EPA Determination of Reportable Quantities for Hazardous Substances.

G. 40 CFR Part 261, EPA Identification and Listing of Hazardous Waste.

H. 40 CFR Part 302, EPA Designation, Reportable Quantities, and Notification.

I. 49 CFR Part 171, U.S. Department of Transportation Hazardous Materials Regulations.

14.3 MATERIALS - Materials shall conform to the following when applicable:

A. Slope Drains. Slope drains may be constructed of pipe, fiber, mats, erosion control fabric, geotextiles, rubble, Portland cement concrete, bituminous concrete, plastic sheets, or other materials acceptable to the Construction Engineer.

B. Grass. Grass shall be quick growing species such as rye grass, Italian grass, or cereal grasses. Grass shall be suitable to the area and provide a temporary cover that will not compete later with permanent cover. Alternative grasses are allowable if acceptable to the Construction Engineer.

C. Fertilizer and Soil Conditions. Fertilizer and soil conditioners shall be a standard commercial grade acceptable to the Construction Engineer.

D. Silt Fences. Silt fences shall be synthetic filter fabric mounted on posts and embedded in compacted ground in compliance with American Society for Testing and Materials (ASTM) D6462, Standard Practice for Silt Fence Installation.

E. Berms. Berms shall be gravel or sand wrapped with geotextile material. Alternate materials are allowable if acceptable to the Construction Engineer.

F. Alternate materials or methods to control, prevent, remove, and dispose of pollution are allowable if acceptable to the Construction Engineer.

14.4 CONSTRUCTION

A. Preconstruction Requirements.

1. Temporary Water Pollution, Dust, and Erosion Control Meeting. The contractor shall be required to submit a site-specific BMP Plan to the Construction Engineer and address all comments by the Construction Engineer. After the Plan is accepted in writing by the Construction Engineer, the Contractor shall schedule a meeting with the Construction Engineer before the start of construction work to discuss the sequence of work, and plans and proposals for water pollution, dust, and erosion control.

2. Temporary Water Pollution, Dust, and Erosion Control Submittals. The Contractor shall submit the site-specific BMP Plan to the Construction Engineer prior to the start of work for review of compliance with this Article. A site-specific BMP Plan template is available online at https://hidot.hawaii.gov/harbors/malamakeawakai/, under HDOT Harbors Construction and Post-Construction Programs – Documents and Forms.

a) Written site-specific BMP Plan shall include the following as applicable:

i. Identification of potential pollutants and their sources and other factors that may cause water pollution, dust, and erosion.

ii. A list of all material and heavy equipment to be used during construction. Vehicles and equipment shall be well maintained and free from any type of fluid leaks.

iii. Construction schedule.

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

v. Descriptions of the methods and devices used to eliminate certain pollutants (e.g., wastewater, fuels, solvents, detergents, toxic or hazardous substances) from discharging into state waters and drainage systems and provide details of BMP to be installed or utilized. Indicate approximate dates when BMP will be installed and removed.

vi. Description of maintenance and subsequent removal of any erosion or siltation control devices.

vii. Method(s) of removal and disposal of solid and regulated hazardous wastes encountered or generated during construction. The Contractor is advised to procure regulated hazardous materials on an as-needed basis, as feasible. All excess regulated hazardous materials at the conclusion of this project shall remain the property of the Contractor and shall be removed from HDOT Harbors Division property upon the completion of the project.

viii. Method(s) of removing and disposing concrete and asphalt pavement cutting slurry, concrete curing water, and hydro demolition water.

ix. Method(s) of containing, removing and disposing of demolition dust and debris to minimize the discharge of these pollutants into state waters and drainage systems.

x. Spill kit contents and location.

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

xii. Method(s) of storing and handling of regulated hazardous materials (e.g. oils, paints) and other products used for the project. Safety Data Sheets (SDS) for all regulated hazardous materials used during construction activities shall be kept on- site throughout the duration of the project and readily available upon inspection. All containers of regulated hazardous materials should be provided with secondary containment during storage. Regulated hazardous materials not specifically needed in the execution of this project shall not be brought or stored on site. As feasible, the Contractor is encouraged to use products that do not contain any regulated constituents. The use of green products is encouraged.

xiii. Method(s) of concrete washout/waste control.

xiv. Method(s) of managing material stockpiles to minimize erosion and dust.

xv. Good housekeeping practices.

a. Minimize tracking of sediment offsite from project entrances and exits.

b. Litter management. The Contractor shall have a comprehensive housekeeping policy and shall actively enforce housekeeping requirements. Housekeeping items include, but are not limited to, cups, cans, bottles and other forms of lightweight litter, unattended containers of hazardous materials, concrete debris (e.g., dust, chips, and other sweepings), and discarded articles of disposable Personal Protective Equipment (e.g., earplugs, dust masks, and gloves). Employees who are specifically tasked with housekeeping duties shall be identified by name.

c. The Contractor should provide and maintain covered waste receptacles. No

construction debris or other refuse that is generated as a result of project activities is to be disposed in HDOT Harbors Division-owned waste receptacles.

xvi. Provide plan(s)/drawing(s) showing location of followings when applicable:

a. Boundaries of the property and the locations where construction activities will occur, including:
   i. Locations where earth-disturbing activities will occur (noting any sequencing of construction activities);
   ii. Approximate slopes and drainage patterns with flow arrows before and after the construction;
   iii. Locations where sediment, soil, or other construction materials will be stockpiled;
   iv. Locations of any contaminated soil or contaminated soil stockpiles;
   v. Locations of any crossings of state waters;
   vi. Designated points on the site where vehicle will exit onto paved roads;
   vii. Locations of structures and other impervious surfaces upon completion of construction; and
   viii. Locations of construction support activity areas.

b. Locations of all state waters, including wetlands and indicate which water bodies are listed as impaired.

c. The boundary lines of any natural buffers.

d. Topography of the site, existing vegetative cover, and features (e.g., forest, pasture, pavement, structures), and drainage pattern(s) of storm water onto, over, and from the site property before and after major grading activities.

e. Storm water discharge locations, including locations of any storm drain inlets on-site and in the immediate vicinity of the site to receive storm water runoff from the project; and locations where storm water will be discharging to state waters (including wetlands).

f. Locations of all potential pollutant-generating activities.

g. Locations of storm water control measures; and

h. Locations where chemicals will be used and stored.

xvii. Procedures for notification of appropriate facility personnel, emergency response agencies, and regulatory agencies where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Parts 110, 117, or 302, occurs during a 24-hour period. Contact information must be in locations that are readily accessible and available.

xviii. The Contractor shall date and sign the site-specific BMP Plan.

a. The Contractor shall keep the accepted Plan on-site or an easily accessible location throughout the duration of the project. Revisions to the Plan shall be included with the original plan. Modify contract documents to conform to

revisions. Include actual date of installation and removal of BMP. Obtain written acceptance by the Construction Engineer before revising BMP. An updated Plan shall be kept on-site throughout the remainder duration of the project.

b. The Contractor shall follow guidelines in the "*The City and County of Honolulu Storm Water Best Management Practice Manual – Construction*," (dated November 2011) in developing, installing, and maintaining BMP for the project. Additionally, the Contractor shall follow applicable City and County of Honolulu ***Rules Relating to Water Quality*** for all projects at Honolulu, Kalaeloa Barbers Point, and Kahului Harbors, and use respective Soil Erosion Guidelines for Maui, Kauai and Hawaii County projects. Information can be found at the respective County websites.

B. Construction Requirements are as follows.

1. No work shall be allowed to begin until submittals detailed in Subsection 14.4.A.2 - Temporary Water Pollution, Dust, and Erosion Control Submittals are completed and accepted in writing by the Construction Engineer. The Contractor shall prevent pollutants from entering state waters. These efforts shall address areas such as those that drain to water, are over water, or drain to storm drains in the area of the project site. The Contractor shall design, operate, implement, and maintain the Plan to ensure that storm water discharges associated with construction activities will not cause or contribute to a violation of applicable state water quality standards.
2. All projects at Honolulu Harbor are subject to HDOT Harbors Division SWMP requirements for construction at those harbors unless the project meets a specified exemption class. The requirements include, but are not limited to, construction site BMP initial, recurring (i.e. every two weeks from October through March and every two months otherwise), and final inspections at the frequencies outlined in the SWMP. No grading or land disturbance activities are allowed until the initial BMP inspection is completed and required BMPs are found to be properly installed.
3. Address all comments received from the Construction Engineer.
4. Modify and resubmit plans and construction schedules to correct conditions that develop during construction which were unforeseen during the design and pre-construction stages.
5. Coordinate temporary control provisions with permanent control features throughout the construction and post-construction period.
6. BMP shall be in place and operational until the construction is completed and accepted by Harbors.
7. Install and maintain either or both stabilized construction entrances and wheel washes to minimize tracking of dirt and mud onto roadways. Restrict traffic to stabilized construction areas only. Clean dirt, mud, or other material tracked onto the road immediately. Modify stabilized construction entrances to prevent mud from being tracked onto roadways.
8. Chemicals may be used as soil stabilizers for either or both erosion and dust control if acceptable to the Construction Engineer.
9. Cover exposed surface of materials completely with tarpaulin or similar device when

transporting aggregate, soil, excavated material or material that may be a source of fugitive dust.

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

11. Install or modify BMP due to change in the Contractor's means and methods, or for omitted condition that should have been allowed for in the accepted site-specific BMP Plan or a BMP that replaces an accepted site-specific BMP that is not satisfactorily performing.

12. Properly maintain BMP.

13. Remove, replace or relocate any BMP that must be removed, replaced or relocated due to potential or actual flooding, or potential danger or damage to the project or public.

14. The Contractor's designated representative specified in Subsection 14.4.A.2.a.(4) shall address any BMP concerns brought up by the Construction Engineer within 24 hours of notification, including weekends and holidays. Should the Contractor fail to satisfactorily address these concerns, the Construction Engineer reserves the right to employ outside assistance or use the Construction Engineer's own labor forces to provide necessary corrective measures. The Construction Engineer will charge the Contractor such incurred costs plus any associated project engineering costs. The Construction Engineer will make appropriate deductions from the Contractor's monthly progress estimate. Failure to apply BMP shall result in either or both the establishment and increase in the amount of retainage due to unsatisfactory progress or withholding of monthly progress payment. Continued failure to apply BMP may result in one or more of the following: The Contractor being fully responsible for all additional costs incurred by HDOT Harbors Division including any fines levied by HDOH, suspension of the Contract, or cancellation of the Contract.

C. Hydrotesting Activities. If work includes removing, relocation or installing waterlines, and the Contractor elects to flush waterline or discharge hydrotesting effluent into state waters or drainage systems, obtain a Notice of General Permit Coverage (NGPC) authorizing discharges associated with hydrotesting waters from the HDOH Clean Water Branch (CWB). If a permit is required, the Contractor must prepare and submit permit application (CWB-Notice of Intent (NOI) Form F) to the HDOH CWB.

Do not begin hydrotesting activities until the HDOH CWB has issued a NGPC. Hydrotesting operations shall be in accordance with conditions in the NGPC. Submit a copy of the NPDES Hydrotesting Waters Application and Permit to the Construction Engineer.

D. Dewatering Activities. If excavation of backfilling operations requires dewatering, and the Contractor elects to discharge dewatering effluent into state waters or existing drainage systems, obtain an NGPC authorizing discharges associated with construction activity dewatering from the HDOH CWB. If a permit is required, the Contractor must prepare and submit permit application (CWB-NOI Form G) to the HDOH CWB.

Do not begin dewatering activities until the HDOH-CWB has issued an NGPC. Conduct dewatering operations in accordance with the conditions in the NGPC. Submit a copy of the NPDES Dewatering Application and Permit to the Construction Engineer.

14.5 PAYMENT

Payment for Temporary Water Pollution, Dust and Erosion Control will not be measured and paid for separately but shall be incidental to applicable items in the Proposal Schedule.

No progress payment will be authorized until the Construction Engineer accepts in writing the

site- specific BMP Plan or when the Contractor fails to maintain the project site in accordance with the accepted BMP Plan.

The Contractor shall reimburse the State of Hawaii within 30-day for the full amount of all outstanding costs incurred by the State of Hawaii for all citations or fines received as a result of the Contractor's non-compliance with regulations.

END OF ARTICLE

ARTICLE XV - DEMOLITION, REMOVAL AND RELOCATION

15.1 DESCRIPTION

A. The work includes the following items:

1. Demolition and/or removal of utilities; gates; fencing; base course; and subbase as required; and all other obstructions within the project site as delineated on the drawings.
2. Backfilling resulting trenching, holes and pits.
3. Removal of organic material, junk, rubbish, and other objectionable material from the project site.
4. Disposal of designated material within the spoil area.
5. Disconnecting, capping or sealing site utilities.
6. Salvaging items for reuse by Owner.
7. Temporary relocation of utilities and other facilities, as required.

15.2 SUBMITTALS

A. Inventory: Submit a list of items to be removed and/or salvaged and deliver to Engineer prior to start of demolition.

15.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA/HDOH notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Pre-demolition Conference. The following items shall be discussed:

1. Review items to be salvaged and returned to Harbors District Office.

15.4 CONSTRUCTION REQUIREMENTS

A. Trenches, holes, depressions and pits left by the removal of such improvements shall be backfilled in accordance with these specifications.

B. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements

C. Protect adjacent buildings and facilities from damage due to demolition activities.

D. Protect existing site improvements, appurtenances, and landscaping to remain.

E. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

F. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

G. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

H. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.

I. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

J. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

15.5 DISPOSAL OF REMOVED MATERIAL

A. Material approved by the Director shall be deposited within the spoil area as determined by the Director. Placement of materials shall conform to Article XVI – EARTHWORK AND SUBGRADE PREPARATION.

B. All other material resulting from demolition and removal shall become the property of the Contractor and shall be removed from the project site and disposed of at County approved locations.

15.6 BASIS OF MEASUREMENT AND PAYMENT

A. Measurement and Payment for demolition, removal and relocation of the various items described in the Article shall be paid for at the Lump Sum price bid for Demolition, Removal and Relocation as shown in the Proposal Schedule.

Item No.	Pay Item	Unit Price
3	Demolition, removal, handling and disposal of items as described on the plans and technical provisions, inclusive of coordination with utility owners, environmental protection, and compliance with Federal, State, and County hauling and disposal regulations; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work in place	LS

END OF ARTICLE

ARTICLE XVI– EARTHWORK AND SUBGRADE PREPARATION

16.1 GENERAL

A. Earthwork shall consist of all excavation, embankment, pavement subgrade preparation, grading, and compaction.

Whenever a relative compaction requirement or sand equivalent value is specified in the Specifications in connection with Earthwork, the tests shall be made in accordance with the test methods specified in Section 106 of the Standard Specifications.

Suitable surplus material (as determined by the Engineer or his authorized representative) not required for fill shall be the property of the Contractor and shall be disposed of offsite.

B. Geotechnical Reports: The geotechnical reports that were prepared for the project by Geolabs, Inc. and dated November 08, 2024, which contractors can view at the contracting office. The analyses and recommendations included therein are based, in part, upon information obtained from field borings. Variations of subsoil conditions between and beyond the field borings may occur.

The field boring locations indicated in the geotechnical reports were plotted on the Topographic Survey Plan. Boring elevations were obtained by interpolating between the spot elevations shown on the same plan. The physical locations and field boring elevations should be considered accurate only to the degree implied by the method used.

The stratification lines shown on graphic representations of the borings in the geotechnical reports, and in the plans, depict the approximate boundaries between soil/rock types and, as such, may denote a gradual transition. Water level data from the borings were measured at the times shown on the graphic representations and/or presented in the text of this report. These data have been reviewed and interpretations made in the formulation of this report. However, it must be noted that fluctuation is expected due to tides, variation in rainfall, temperature, and other factors.

The geotechnical reports were prepared for the exclusive use of the Design Engineer for specific application to the project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied. Furthermore, the geotechnical reports were prepared solely for the purpose of assisting the Design Engineer in the preparation of the construction documents. Bidders are urged to retain a State of Hawaii licensed geotechnical engineer to assist in the interpretation of the geotechnical reports for bid estimating purposes.

The Contractor shall be aware that unanticipated soil/rock conditions may be encountered and unforeseen soil conditions, such as perched groundwater, soft deposits, hard layers, or cavities may occur in localized areas and may require additional probing or corrections in the field. In addition, the geotechnical engineering exploration conducted at the project site, on which the geotechnical reports are based on, excludes the investigation of the potential presence of existing hazardous materials.

The geotechnical reports are not contractual or construction documents. Differences may exist between the contents of the geotechnical reports and the contractual, or construction documents consisting of the construction drawings and specifications. In the event of a discrepancy between the construction documents and the geotechnical reports, the construction documents shall govern.

16.2 GENERAL REQUIREMENT

In general, the provision of Section 203 of the Standard Specifications shall apply except as hereinafter modified. References to "roadway" in this Article shall also mean "container terminal."

A. 203.02(B) - Materials, Selected Material is amended by adding the following after the first sentence:

"The excavated on-site base materials, sub-base materials, or granular materials may be re-used as select granular material for fill or backfill. Select granular material to be re-used as backfill shall be screened and/or processed to achieve a maximum particle size of 6 inches or less. Select granular material to be reused as backfill behind retaining structures shall be screened and/or processed to achieve well-graded with a maximum particle size of 3 inches or less. Due to the relatively shallow groundwater table, the excavated materials may require aeration to reduce the moisture content of the soils prior to being re-used as backfill. Furthermore, given highly variable ground stratums, the Contractor must anticipate that some of the onsite materials will not meet the requirements for fill and/or backfill."

B. 203.03(A)(4)(a)- Excavation, Sub-excavation is amended by adding the following after the first sentence:

"Soft and yielding areas encountered below areas to receive fill and/or future improvements shall be over-excavated to expose firm natural material. The excavated soft soils shall not be re-used as fill materials, and shall be disposed of offsite."

C. 203.03 (C) (l) - Embankment Construction, General is amended by adding the following:

"After the ground surface to receive fill has been cleared, it shall be scarified to a depth of 8 inches until it is uniform and free from ruts or other uneven features that may prevent uniform compaction. Bring scarified ground surface to optimum moisture, mix as required, and compact to a minimum of 95 percent relative compaction as determined by ASTM D1557 (AASHTO T 180). Prior to placing fill, the ground surface to receive fill shall be inspected by the Engineer.

Fill or backfill placed below water level shall consist of clean gravel, such as 3B Fine gravel (ASTM C33 No. 67 gradation), wrapped in a filter fabric, such as Mirafi 180N or approved equal fabric. The gravel shall extend to at least 12 inches above the water level. This backfill material is to reduce the compactive effort required and to facilitate backfill below the groundwater table or in a wet environment. Dewatering will not be required during placement. The top of the gravel layer should be compacted to a level surface before placing additional structural fill. Tensar TX-160 triaxial geogrid or approved equal fabric shall be placed over the gravel prior to placement of compacted fill.

Fill over the clean gravel and geotextile fabric should be well graded, non-expansive granular material of maximum particle size of 3 inches, with not more than 20 percent by weight passing a #200 sieve. The plasticity index (PI) of the soil passing the #40 sieve shall not be greater than 10. The imported fill shall have a minimum CBR value of 40 when tested in accordance with ASTM D1883.

The well graded granular fill and backfill should be placed in horizontal lifts of 8 inches in loose thickness and compacted to a minimum 95 percent compaction as determined by ASTM D1557."

D. 203.03(D)(1) - Subgrade Preparation, General is amended by adding the following:

"Subgrade Preparation in Non-Pavement Areas: After the existing ground surface has been cleared, the ground surface shall be proof-rolled with a 20-ton minimum vibratory proof-roller. The proof-rolled ground surface shall be scarified to a minimum depth of 8 inches until it is free from ruts or other uneven features which may prevent uniform compaction, moisture conditioned to above optimum moisture content, and compacted to a minimum of 90% relative compaction as determined by ASTM D1557."

E. 203.04 Method Of Measurement and 203.05 Basis Of Pavement are deleted

16.3 Submittals

Submit under provisions of Article XI – Required Submittals:

A. Soils Testing:

1. The compaction of all fill and the subgrade shall be tested by an independent testing agency retained by the Contractor. All test results shall be attested to by a Geotechnical Engineer licensed in the State of Hawaii and shall be submitted to the Engineer for approval. The cost of soils testing shall be borne by the Contractor.

2. Field density tests shall be made throughout the area for each 1500 sf of each compacted layer. All test results must be submitted to and approved by the Engineer before the Contractor can proceed with placing additional layers of fill or the placing of cushion fill or base course. Fill placed over untested areas, or areas with failed compaction tests, shall be removed at no cost to the State. The ground surface upon which such fill was removed shall be re-scarified, re-compacted, and re-tested in accordance with the requirements of the specifications.

16.4 MATERIALS

A. Onsite materials may be reused as compacted fill in accordance with 18.2 General Requirements and provided rock and coral fragments larger than 6 inches in maximum dimension are removed.

B. Fill and other construction material shall be clean, uncontaminated and be free of deleterious substances, including toxic chemicals, debris, and fine grained materials.

16.5 EXECUTION

All grading work shall be done in accordance with Chapter 23, Revised Ordinances of Honolulu, 1990, as amended (Ordinance No. 81-13), with the provisions of Section 203, Section 209 and the Soils Report by Geolabs Inc. dated November 08, 2024.

A. Fill Placement and Compaction:

Fills and backfills should be placed in level lifts not exceeding 8 inches in loose thickness, moisture conditioned to above the optimum moisture content, and compacted to a minimum of 95% relative compaction.

Relative compaction refers to the in-place density of soil expressed as a percentage of the maximum dry density as determined by ASTM D1557. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

Compaction shall be accomplished by sheepsfoot, vibratory rollers, or other types of compaction equipment deemed acceptable by the Engineer. Water tamping, jetting, or ponding are not acceptable methods for compacting the fill.

B. Ponds, Other Standing Water, and Endangered Wetland Birds

The project site is flat, and low-lying, with soil conditions that are conducive to the creation of standing water and ponds. Based on prior experience at the H.C. 10502 KCT Yard project, these conditions tend to attract endangered wetland bird species, that are protected by Federal and State laws, who will linger at the pond(s), or bodies of standing water, and they might build nests at these sites. This will trigger a State requirement to create buffer zones around such nests to safeguard the eggs and fledglings, which would need to remain in place for a few months, which will prevent and prohibit the contractor from working in the affected areas.

Therefore, the contractor shall implement actions to limit, and prevent, the formation of standing water and ponds, to make the project site less attractive to wetland birds, and the contractor shall also take measures to discourage wetland birds from lingering at any ponds that are intentionally created, and/or operated, as part of its means and methods.

The contractor shall schedule and sequence its work, and organize its means and methods, to ensure that there are no bodies of standing water or ponds, pooling on non- paved surfaces, with a surface area greater than or equal to 100 square feet, regardless of depth, remaining within the project site at the end of each work day, or during daylight hours throughout weekends and holidays. This requirement shall not apply to any ponds intentionally created by the contractor as part of its means and methods. For the specific purposes of the article only, the end of each work day shall be defined as either the end of working hours per General Provision Article 7.4, as amended by the Special Provisions, or sunset as calculated by the National Oceanic and Atmospheric Administration for Hawaii, whichever is earlier.

The contractor shall implement a bird control program at and for all ponds that it intentionally creates for its use, to discourage wetland birds from lingering there and to make them less attractive, that shall be in effect every day, inclusive of weekends and holidays, that the ponds remain active and filled with water. Such features of a bird control program might include, but are not limited to, covering the ponds with a membrane, physical barrier, or covered shelter, stationing personnel there to shy birds away, and installing static control devices such as visual deterrents, sonic devices or other physical bird deterrents. Static control devices lose their effectiveness within a short period of time, therefore, such measures should be accompanied by a program of adaptive management using a combination of devices and/or strategies.

The contractor shall submit its proposed bird control program for any ponds that it intends to create, to the Engineer for review and acceptance, before creating any pond for use on the project. It is recommended that the contractor consult with a biologist, specifically knowledgeable with native Hawaiian wetland bird species, in and for the preparation of the bird control program.

Payment for work to eliminate standing water, and ponds, by the end of each work day, and throughout weekend and holidays, to make the site less attractive to wetland birds, and for implementation of the bird control program to discourage wetland birds away from any intentionally created ponds, for every day that the ponds will remain active and filled with water, will not be paid for separately but shall be considered incidental to the various bid items.

The State recognizes that the complete elimination of the presence of wetland birds at the project site may not be entirely possible. Therefore, incidents involving the establishment of any protective buffer zone, associated with wetland birds and/or their nests, and the duration of the buffer zone presence, and their impact on work activities, will be considered a partial suspension in accordance with General Provision Article

8.10(b) as amended by the Special Provisions. Reimbursement to the contractor for impacts pertaining to any partial suspension, associated with wetland birds and/or their nests, will be governed by General Provision Article 8.10 (c) as amended by the Special Provisions. Time extension, if any, for impacts pertaining to any partial suspension, associated with wetland birds and/or their nests, will be in accordance with General Provision Article 8.5 (b)(5).

16.6 MEASUREMENT AND PAYMENT

Excavation and embankment for site grading, settlement, and surcharging, to the finished lines and grades indicated on the contract Drawings, shall be paid for on a lump sum basis in the Proposal Schedule. Payment shall be full compensation for backfill, hauling, removal, and relocation of material, equipment, tools, labor, materials, and incidentals necessary to complete the work.

Watering, subgrade preparation, soils compaction testing, and settlement monitoring (gauges and inspection) will be deemed a part of the work and additional compensation will not be allowed therefore.

Proof rolling, scarifying, and re-compacting of the subgrade materials will be deemed part of the work and additional compensation will not be allowed therefore.

Item No.	Pay Item	Pay Unit
4	Excavation and Embankment for site grading, inclusive of backfill, hauling, removal and relocation of materials, equipment, tools, labor, materials, and incidentals	LS

END OF ARTICLE

ARTICLE XVII - UTILITY EXCAVATION AND BACKFILL

17.1 GENERAL

A. The work consists of furnishing equipment, materials, labor and appliances to perform all work in connection with excavation, backfill and compaction necessary for the job in accordance with this Article of the specifications and the Hawaii Standard Specifications, Sections 204, 206, 703.20, and 703.21.

B. This section describes the following:

1. Excavating and backfilling trenches for utilities pipes (including but not limited to electric, water, drainage, sewer, telephone, oil, and gas lines) and conduits (including roadway and sign lighting, traffic signal, and other communications systems).
2. Excavating and backfilling for water, drainage and sewer structures and appurtenances.
3. Excavating and backfilling for utility structures and appurtenances.
4. Disposing of surplus uncontaminated material from excavations.
5. Excavating and backfilling for water pipes, manholes, and appurtenances are described further in Article XXII – Water System.
6. Provide and install asphalt primer, hot asphalt and fabric waterproofing membrane system where specified on the contract drawings

17.2 REFERENCES

A. Hawaii Standard Specifications for Road and Bridge Construction, State of Hawaii, 2005, as amended.

B. ARTICLE XV – DEMOLITION, REMOVAL AND RELOCATION

17.3 MATERIALS

Materials shall conform to the following sections of 2005 Hawaii Standard Specifications for Road and Bridge Construction when applicable:

1. Trench Backfill Material 703.21
2. Cullet and Cullet-Made Materials 717

Trench backfill material shall include mixture of aggregate and cullet. When cullet is not produced on the project island, or material unit price of cullet is greater than material unit price of structure backfill or greater than material unit price of trench backfill, cullet may be excluded for that backfill application. Before excluding cullet, submit availability and pricing documentation.

Trench gravel backfill material shall conform to AASHTO M 43, size number 67. When tested in accordance with AASHTO T 96, the LA abrasion shall not exceed 40 percent at 500 revolutions.

Controlled Low-Strength Material (CLSM) in accordance with Section 314 – Controlled Low-Strength Material (CLSM) for Utilities and Structures of 2005 Hawaii Standard Specifications for Road and Bridge Construction may be used in place of trench and structure backfill material, subject to the Engineer's acceptance. Where CLSM is allowed, provide drainage system to accommodate underground water seepage. CLSM will not be allowed as trench backfill when installing aluminum and aluminum-coated pipe conduits.

Provide plastic marking tape that is acid and alkali-resistant polyethylene film, 6- inches wide

with minimum thickness of 0.004 inch. Provide tape with minimum strength of 1,750 psi lengthwise and 1,500 psi crosswise. Manufacture tape with integral wires, foil backing, or other means to enable detection by a metal detector when tape is buried up to 3-feet deep. Manufacture tape specifically for marking and locating underground utilities. Provide metallic core of tape encased in a protective jacket or provided with other means to protect it from corrosion. Tape shall conform to the following colors and shall bear a continuous printed inscription describing the specific utility: Red: Electric; Yellow: Gas, Oil, Dangerous Materials; Orange: Telephone, Telegraph, Television, Police, and Fire Communications; Blue: Water System; Green: Sewer Systems.

Structural Backfill shall be per Subsection 703.20 of the standard specifications. Only Structural Backfill Material A is allowed for backfilling of drainage structures and light pole foundations.

17.4 EXECUTION

A. Structure and Trench Excavation

1. General: Notify the Engineer ten (10) working days before excavating for structures and trenches.

   The Contractor shall be responsible for the stability of temporary open cuts during construction of structures or trenches and shall take appropriate measures to meet OSHA requirements.

   Excavate in such a manner as to prevent damage to pavements, sidewalks, structures, landscaping, and other improvements. Excavate immediately before installation of conduit and other appurtenances. Stockpile excavated material in a location that shall not cause damage, obstruct vehicular and pedestrian traffic, or interfere with surface drainage.

   In excavation operations, do not disturb ground below elevations indicated in the contract documents. If ground below elevations indicated in the contract documents is disturbed, excavate disturbed ground until undisturbed ground is reached. Backfill this area with Class D concrete until required foundation elevation is reached.

   Keep foundation excavation dry by draining, bailing, pumping, or driving sheathings.

   Deposit remaining structure or trench excavation material that is not used as backfill, in roadway embankments in accordance with Subsection 203.03(B)(1) and Subsection 203.03(B)(3) of 2005 Hawaii Standard Specifications for Road and Bridge Construction.

   Excavation for structures shall be adequate to accommodate the new structure at the specified elevation. Excavation shall conform to Subsection 206.03(A) of the standard specifications.

   The contractor is responsible for design, construction and inspection of any shoring required for excavations in conformance with OSHA requirements and shall be sufficient in strength to prevent movement of the soil held in place by the shoring.

   Due to anticipated soft and/or loose subsurface soil conditions, some movement of soil around the underground structure excavations should be anticipated due to changes in the earth stresses during and after construction, especially during extraction of a sheet pile system, where utilized.

   The Hawaii One Call Center must be contacted prior to excavation, at telephone number: 1-866-423-7282 or at their website: http://callbeforeyoudig.org

B. Structure and Trench Backfill

Do not deposit fill material against back of foundations and manholes until test samples indicate that concrete has developed strength required in Subsection 503.03(E) of 2005 Hawaii Standard Specifications for Road and Bridge Construction.

Cure test samples under conditions similar to those affecting the structure. Continue backfilling so that excessive unbalanced loads are not introduced against the structure.

Place backfill material in uniform horizontal layers not exceeding 8-inches in loose thickness, before compaction. Moisten and compact each layer of backfill until relative compaction of not less than 95 percent is achieved in accordance with Subsection 203.03(C)(2) of 2005 Hawaii Standard Specifications for Road and Bridge Construction. The Engineer may reduce 95 percent compaction requirement in situations where such compaction is not feasible.

When the Engineer cannot use field density test, compact each layer of backfill with vibratory or other accepted equipment on granular backfill material.

Compaction of backfill material by ponding or jetting will not be allowed.

Where the bottom of the utility pipe is located within 12-inches or below normal ground water level, use trench gravel backfill material to at least 12- inches above pipe or to bottom of pavement structure. Gravel material shall be completely encapsulated by geotextile conforming to Subsection 716.03 of 2005 Hawaii Standard Specifications for Road, Bridge, and Public Works Construction.

When required, place sufficient fill at structures, utility pipes, and conduits ahead of other grading operations to permit public traffic to cross.

Compact backfill material in the following areas to a relative compaction of not less than 90 percent:

1. Footings not beneath surfacing.
2. Other locations where the documents indicate 90 percent relative compaction for structure or trench backfill.

Place plastic marking warning tapes for appropriate type of utility directly above pipe, within a depth of 3-feet from finish grade, unless otherwise indicated in the contract documents.

Backfill below and against structures shall be compacted to 95% relative compaction per Subsection 203.03(C)(2) and in conformance with Subsection 206.03(B) of the Standard Specifications.

Backfill to the elevation of the pavement aggregate subbase or the elevation where installation of CLSM is to occur as indicated on the contract documents.

CLSM shall be provided for backfill against structures where detailed. The Contractor shall get written approval to use CLSM backfill in a location not specifically specified in the project documents.

Contractor shall submit CLSM mix design for review at least two weeks prior to pouring.

Furnish batch/delivery tickets to the Construction Engineer at the time CLSM is poured or no later than when the truck leaves the work area where the CLSM was poured.

17.5 BASIS OF MEASUREMENT AND PAYMENT

A. Utility Excavation and Backfill will not be measured and paid for separately but shall be considered incidental to the various items in the Proposal Schedule.

B. Utility Backfill, including pipe cushion, gravel backfill, lightweight cellular concrete, CLSM, trench restoration, including asphalt concrete pavement, asphalt concrete base course, tack coat, prime coat, soil compaction testing, structural and all other work related to trench backfill will not be measured and paid for separately, but shall be considered incidental to the various items in the Proposal Schedule.

C. The Engineer will not pay for removal of material separately and will consider the cost for those items as included in the contract prices for the various contract pay items.

D. Except for those building structures included in ARTICLE XVII – UTILITY EXCAVATION AND BACKFILL, the Engineer will not pay for excavation and backfill for miscellaneous facilities separately and will consider the cost for those items as included in the contract prices for the various contract pay items. The cost is for the work prescribed in this section and the contract documents.

END OF ARTICLE

ARTICLE XVIII - AGGREGATE BASE COURSE

18.1 GENERAL

This work shall consist of constructing aggregate base course on a prepared subbase course in accordance with the requirements of the Contract or as established by the Engineer.

18.2 GENERAL REQUIREMENTS

The provisions of Section 304 - Aggregate Base Course of the Standard Specifications shall apply except as hereinafter modified:

1. Sections 304.04 Method of Measurement and 304.05 Basis of Payment are deleted.

18.3 SUBMITTALS

A. Submit certificate of compliance with these specifications and material data for the base course material.

B. Soils Testing: The compaction of the base course shall be tested by an independent testing agency. All test results shall be attested to by a Civil Engineer licensed in the State of Hawaii and shall be submitted to the Construction Engineer for approval. The cost of soils testing shall be borne by the Contractor. A field density test shall be made throughout the area for each 1,500 square feet of each compacted layer. However, at a minimum, one field density test shall be conducted within the auto storage area, and another at the new maintenance building location. All test results must be approved before the Contractor can proceed with placing additional layers of base course or pavement materials.

18.4 BASIS OF MEASUREMENT AND PAYMENT

Aggregate base course shall not be paid for separately but shall be incidental to concrete pavement and asphalt concrete pavement on land in the Proposal Schedule

END OF ARTICLE

ARTICLE XIX - ASPHALT CONCRETE PAVEMENT

19.1 DESCRIPTION

A. This work shall consist of constructing asphalt concrete pavement on a prepared base course, in accordance with the requirements of the contract.

19.2 GENERAL REQUIREMENTS

A. The provisions of Section 401 — Hot Mix Asphalt (HMA) Pavement of the "Standard Specifications" shall apply except as hereinafter modified:

1. 401.03 (A) Construction Requirements shall be amended to read as follows: Amend (A) Weather Limitations to read as follows:

   a) "(A) Weather Limitations. Do not place the bituminous plant mix: on wet surfaces, or

      i. when the air temperature is below 50° F., or

      ii. when weather conditions prevent the proper handling or finishing of the bituminous mixtures."

The Contractor shall notify the construction engineer, in writing, if concrete is to be furnished by a ready-mix supplier. The Contractor shall submit Delivery/Batch Ticket Documentation to the construction engineer when the ready-mix concrete is poured and no later than when the truck leaves the work area in which the concrete was poured.

B. 401.04 Measurement and 401.05 Payment are deleted.

19.3 BASIS OF MEASUREMENT AND PAYMENT

A. Asphalt concrete pavement, including bituminous material, and tack coat, will not be measured or paid for separately, but shall be considered incidental to the various contract items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XX PORTLAND - CEMENT CONCRETE PAVEMENT

20.1 GENERAL

A. The work consists of installation of Portland-Cement Concrete in areas located on the site where expected heavy load vehicles are expected. Area include but limited to trash enclosure, wash rack, fuel station, and material storage area.

20.2 REFERENCE

A. In general, the provisions of Section 411 – Portland Cement Concrete Pavement of the "Standard Specifications" shall apply except as hereinafter modified:

20.3 SUBMITTALS

A. Certified Test Reports: Before delivery of materials, submit eight copies of certified test reports for the following listed materials:

1. Aggregates
2. Admixtures
3. Materials for curing concrete

B. Contractor – Furnished Mix Design: At least 30 days prior to the mixing and placing of any concrete, submit for approval concrete mix design with test reports which show the results of tests for the specified materials and results of the 7-day and 28-day flexural strength tests of the concrete. The mix design shall be based on aggregate gradation and specific gravity results determined by a laboratory within the past 6 months. If test results are not available, aggregates shall be sampled and tested.

1. Mix Certification: At the expense of the Contractor, and before concrete is placed at the job site, each concrete mix design shall be evaluated and certified by an approved engineering testing laboratory. The laboratory's certification shall include but not be limited to the following:

a) Confirmation of aggregate test data.

b) Evaluation of Mix Designs: Check calculations. Report the following: cement factor, pounds-per-cubic-yard; standard deviation used in design of mix; maximum water, gallons per bag of cement; percentage of fine aggregate to total aggregate by weight; volume of admixture; and yield for one cubic yard of concrete.

c) Statement that the selected cement-factor and proposed water-cement ratio for field production of concrete will or will not provide the specified strength.

d) Statement of recommended approval or disapproval of mix design.

C. Aggregates

1. Alkali Reactivity: Aggregate shall be free of substances that are deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete. Acceptability of the aggregate shall be based upon satisfactory evidence furnished by the Contractor that the aggregate is free from such materials. Such evidence shall include service records of concrete of comparable properties under similar conditions of exposure and/or certified records of tests by an approved testing laboratory.

2. Fine Aggregates: Shall conform to ASTM C 33, except as otherwise modified herein. Fine aggregates from different sources of supply shall not be mixed or stored in the same stockpile nor used alternately in the same concrete mix. Grading shall conform to ASTM C 33. Aggregate which shows a variation in fineness modulus greater than 0.20 more or less than that of the value determined for the mix design will be rejected unless, at the option of the Engineer, suitable adjustments are made in concrete proportions to compensate for the difference in grading.

   a) The abrasion loss shall not exceed 40 percent for aggregates tested in accordance with ASTM C 131 or C 535.

   b) Aggregates shall be crushed

   c) Specific gravity not less than 2.55.

   d) For slip-form paving, the maximum aggregate size shall be 1-inch and will not require aggregate separation.

   e) Deleterious Substances: Requirements of Table 3 as given in ASTM C 33 apply, except the deleterious substances in coarse aggregate shall not exceed the following percentage by weight when tested in accordance with the tests designated in ASTM C 33:

	Maximum percent by weight of total sample
Clay lumps and friable particles	1.0 ±0.5

D. Admixtures: Where not shown or specified, the use of admixtures shall be subject to written approval of the Engineer. When more than one admixture is used in a mix, furnish satisfactory evidence to the Engineer that the admixtures to be used are compatible in combination with the cement and aggregates to be used for the project and will be suitable at the job temperatures.

1. Air-Entraining Admixtures: ASTM C 260.

2. Retarding Admixtures: Type B, D or G conforming to ASTM C 494. Submit for approval, test reports, from a laboratory approved by the Engineer certifying that the proposed admixtures, when combined with the cement and aggregates to be used, will produce the specified concrete having the desired properties with respect to retardation, water content, slump and strength.

3. Water-Reducing Admixtures: Type A, D, F or G conforming to ASTM C 494.

   Submit for approval test reports from a laboratory approved by the Engineer, certifying that the proposed admixture when combined with the cement and aggregates to be used, will produce the specified concrete having the desired properties with respect to time of set, water reduction, slump and strength.

E. Materials and Curing Concrete

1. Cotton Mats: Shall be free from any substances which may have a deleterious effect on fresh concrete.

2. Waterproof Paper: Shall conform to ASTM C 171, regular color.

3. Polyethylene Sheeting: Shall conform to ASTM C 171, white opaque color.

4. Polyethylene-Coated Waterproofing Paper Sheeting: Shall consist of white opaque polyethylene sheeting conforming to ASTM C 171 permanently bonded to waterproof paper conforming to ASTM C 171.

5. Polyethylene-coated Burlap: Shall conform to ASTM C 171

6. Liquid Chemical Curing Compound: The liquid curing compound shall be a clear styrene acrylate type, 30% solids content minimum which shall restrict the loss of moisture and properly cure the surface of the concrete. The chemical compounds shall be free of petroleum resins or waxes. The application of the chemical compounds shall be at the coverage recommended by the manufacturer, and the loss of moisture when determined in accordance with ASTM C 156 shall not exceed 0.030 gram-per-square-centimeter of surface when applied at a coverage rate of 300 square-feet-per-gallon.

7. Sealant and backer rod shall conform to Section 705 – Joint Materials of the Hawaii Standard Specifications for Road and Bridge Construction, 2005. References to Measurement and Payment shall be deleted.

20.4 EXECUTION

A. Subgrade Preparation: Soil shall be prepared and compacted according to ARTICLE XVI – EARTHWORK AND SUBGRADE PREPARATION. Before concrete is placed, the surface of the subgrade shall be brought to finish grade and elevations as shown. The fine grading equipment shall be equipped with adjustable steel cutting devices capable of accurately producing the required surface.

1. Side Form Construction:

a) Planer: A planer mounted on rollers riding the forms or on previously constructed slabs, or a power grader operating between forms shall be provided for shaping the final surface of the underlying material. The power grader or power equipment used to pull the planer shall not produce ruts or indentations in the material. Before forms are set, final surface grading may be completed with automatic planer controlled for both direction and grade. Subgrade surface shall not vary more than plus or minus 0.04-foot from the indicated elevations. When riding on previously constructed slabs, the planer shall be operated to prevent damage to surfaces or edges of the existing concrete.

b) Templates: Provide a scratch template for checking the contour of the underlying material. Mount a template of rigid construction on wheels that are supported on side forms or on concrete in adjacent lanes. Provide on the template adjustable rods projecting downward to the surface of the material and at maximum one-foot intervals. Adjust the rods to the required cross section at the bottom of the slab when the ends of the template are supported on the side forms or on concrete in the adjacent lanes. Check the template frequently during use to assure that the rods are in the correct position.

c) Grade Between Forms: Remove from the surface of the underlying material all foreign matter, waste concrete, cement, and debris. Finish the surface of the underlying material to the required section as shown on the drawings. Test the prepared surfaces with a template, after which maintain the surface in a smooth, compacted condition in conformity with the required section and established grade until concrete is placed. Wet the underlying material in advance of placing concrete to ensure a firm, moist condition at the time concrete is placed. Thoroughly wet fine-grained subgrade which has dried out. Add moisture the

previous night or not less than 6 hours before placing concrete. Do not permit equipment other than concrete delivery or paving equipment on the prepared underlying material located between forms.

2. Slip Form Construction (Contractor's Option):

   a) Planer: Provide a self-propelled planer automatically controlled for both direction and grade to shape the final surface of the underlying material.

      Accurately adjust the planer to the required cross section. When riding on previously constructed slabs, modify the planer to prevent damage to the surface and edges of the existing concrete.

   b) Subgrade Preparation: Finish the subgrade to the required section as shown. If the surface of the underlying material is to be used for grade and elevation control of the slip-form paver, the surface shall not vary more than plus or minus 0.02-foot from the elevations shown on the drawings. When the grade and elevation control of the slip form paver is established by a string line, the surface shall not vary more than plus or minus 0.04-foot. Remove from the surface of the underlying material, all foreign matter, waste concrete, cement, and debris. Wet the underlying material in advance of placing concrete to ensure a firm, moist condition at the time concrete is placed. Do not permit equipment other than concrete delivery or paving equipment on the prepared underlying material. Fill and recompact all ruts, holes, or other indentations of the surface. Confirm the final grade immediately before concrete is placed.

B. Proportioning and Mixing Concrete

1. Proportioning Concrete: Proportion concrete in accordance with the approved mix design. Except when failures of equipment or other unusual circumstances necessitate the temporary use of volumetric proportioning, all concrete shall be proportioned by weighing.

2. Volumetric Proportioning: When volumetric proportioning is required, the weight proportions in the mix design shall be adjusted into equivalent volumetric proportions by weighing representative samples of the aggregates in the conditions in which they will be measured and in accordance with ASTM C 29. In determining the true volume of the fine aggregate, allowance shall be made for the bulking effect from the moisture contained therein.

3. Concrete Equipment: In order to meet the plan and schedule of paving operations, select the number and sizes of units to accomplish the work. Maintain the concreting equipment in good condition. Assemble the equipment at a time sufficient to permit thorough inspection, calibration of weighing and measuring devices, adjustments of parts, and the making of any necessary repairs for satisfactory performance prior to the start of paving. Plant mixers, truck mixers, agitators, and non-agitating units shall conform to the applicable industry standards. On request by the Engineer, the Contractor shall submit a detailed check list for the inspection of the equipment.

   a) Batching Plant: Shall include batcher, bins, weighing hoppers, pollution control collectors, and other weighing equipment. Support the structure for the bins and scales on a firm foundation. Level and maintain the structure within the tolerances necessary for the proper operation of the weighing mechanism. Provide separate storage bins or compartments for fine aggregate and for each size of coarse aggregate with ample capacity and proper arrangement to preclude mixing of stored aggregates, under all working conditions. All weigh scales, remote

weighing systems and balances for separate and cumulative aggregate weighing shall conform to manufacturer's standard tolerances for separate aggregate batches.

i. Product Control: Design and arrange bins, discharge gates and conveyors to facilitate free flow and efficient control of materials entering the weigh hoppers. Construct weigh hoppers to provide for removing an overload of any one of the materials, also provide controls of the hopper so that as the aggregate approaches the level desired in the hopper, the rate of flow can be slowed and finally the flow shut off with precision, avoiding over-runs.

ii. Plant Inspection: Assemble the plant to facilitate inspection of all operations at all times and provide ready adjustment to compensate for varying moisture content of aggregate and for changing proportions of materials. Provide test weights or other equipment for calibrating and checking the measuring devices. The Contractor shall make all necessary corrections to secure satisfactory performance. Arrange the batching plant so that the weighing beam or dial and the aggregate discharge gates are in full view of the operator. Install glass windows to provide a view of mixer charging and discharging, truck loading positions, and water and additive gages. Scales shall be accurate within 1/2 of one percent. Design plant for capability of delivering quantities of aggregates within a limit of accuracy of 2 percent of the desired amount. Cement handled in bulk shall be transferred to separate weighing hopper capable of delivering quantities of bulk cement within a plus or minus tolerance of one percent. Provide canvas tremie or curtains attached to the discharge hopper to prevent loss of cement when discharging into batch trucks or mixers. Bulk cement shall be handled by pneumatic or screw conveyors. Bucket cement elevators shall not be used unless approved by the Engineer. Cement in standard packages (bags) need not be weighed, but fractional packages shall be weighed.

b) Mixers and Agitators: Attach to each mixer and agitator in a prominent place, a metal plate or plates showing clearly the use for which the equipment is designed, the capacity of the drum or container in terms of the volume of mixed concrete, and the manufacturer's recommended speed of rotation of the mixing drum or blades.

Examine mixers and agitators daily for changes in condition due to accumulations of hardened concrete or mortar or to wear of blades. Do not use mixer or agitator if the slumps of individual samples of concrete, taken from time to time at approximately the one-quarter and the three-quarter points of the load, differ by more than one-inch; the equipment may be used when operation with a longer mixing time or with a smaller load will permit the slump requirements to be met.

i. Mixers: Provide batch type mixers, whether field-operated pavers, central mix plants, or truck mixers. The mixing equipment shall be capable of combining the aggregates, cement, and water within the specified time into a thoroughly mixed and uniform mass, and of discharging the mixture without segregation. The mixer shall have a rated capacity of at least 27-cubic feet of mixed concrete and shall not be charged with batches greater than the manufacturer's rated capacity. Construct and operate mixer so that water or any part of the mixture will not be lost while unit is in operation. Concrete uniformity shall conform to the criteria stated in Annex A1, ASTM

C 94. Maintain concrete uniformity in rotating-drum mixers by replacing pick-up and throw-over blades which are worn with new blades.

ii. Stationary Mixers: When stationary mixers are approved for use, the central-plant mixers shall be single-drum or multiple-drum type. Equip mixers with a device for measuring and indicating the quantity of water entering the batch. The device shall prevent leakage of water when the valves are closed and be able to measure within a range of error of not more than one percent. Provide for each mixer a vertical tank for mixing water, equipped with a gage glass, graduated scale for reading in terms of weight, and a suitable overflow for regulating the filling of the tanks. Install a device for automatically measuring and indicating the time of mixing and an interlocking mechanism to prevent discharge of concrete before expiration of the required mixing time. Provide an automatic counter for indicating the number of batches handled. Install a sensor to verify the flow of admixture to the mechanical dispenser.

iii. Truck Mixers: Each truck mixer shall have a watertight drum suitably mounted and fitted with adequate blades capable of uniformly combining the mixture. Raise trailing dollies when not in use or when mixer load is being discharged. Provide a control switch for lowering or raising the booster axle to prevent lowering of the trailer after the load, or a partial load, has been discharged, unless a reset safety button is pushed. Provide a load adjustment control valve with a calibrated scale visible to the truck operator. Provide a revolution counter activator by the mixer drum. Provide truck mixers which will uniformly discharge low slump concrete. An inspection ladder shall be mounted on each mixer, to permit ready inspection of the consistency of the concrete before discharging from drums.

iv. Water Storage Tanks: Measuring tanks on truck mixers shall include outside taps and valves to facilitate checking the calibration of water tanks for providing water within one percent accuracy of the amount of water in the tank. Enclosed tanks operated by air pressure shall be visibly marked or labeled with the degree of accuracy for measuring the amount of water leaving the tank. Water meters if used shall be protected by pressure relief valves. Sight gages on tanks shall meet accuracy requirements of plus or minus one or 2 percent of the total quantity of mixing water in a batch. At the job site the Engineer may permit a small quantity of tempering water (not to exceed 2.5 gallons per cubic yard of concrete) to be added to the batch before discharging of the concrete provided the approved water-cement ratio is not exceeded. Locate water meters, gages, and other calibrated measuring devices on the pipelines between the water tank and the mixer drum.

v. Agitators: Agitators shall be truck mixers operated at a speed of rotation designated by the manufacturer as agitating speed, or truck agitators. Agitators, when loaded to capacity, shall be capable of maintaining the mixed concrete in thoroughly mixed and uniform mass and of discharging the concrete at the specified slump.

c) Transportation Equipment: Vehicles used for transporting mixed concrete from a central mixing plant shall provide slow agitation of the concrete during transit, except that non-agitating equipment which will deliver the mixture in an unsegregated condition of uniform consistency may be used as specified herein. Concrete mixed and delivered in truck mixers is specified elsewhere.

i. Non-Agitating Equipment: When non-agitating equipment is used to transport concrete, discharge shall be completed within 45 minutes after introduction of the mixing water to the cement and aggregates, except that when conditions contribute to quick stiffening of the concrete, the allowable time shall be reduced.

Deliver concrete to the site of work in a thoroughly mixed and uniform mass as determined in accordance with ASTM C 94 and discharged without segregation. Bodies of non-agitating equipment shall be metal, smooth, and watertight. If it rains or when the prevailing air temperature is 90˚ F or higher, protect concrete being hauled with watertight covers. Slump limitation shall be as specified.

d) Spreaders: Dump concrete into an approved spreader when non-agitating equipment is used for transportation. The spreader shall be capable of distributing concrete uniformly over the entire width of the lane being paved. Concrete may be discharged by end dumping directly on the compacted grade in front of the paving machine providing the surface of the grade is not damaged by haul units.

4. Measurement of Materials: The fine aggregate, each size of coarse aggregate, and the cement shall be weighed separately. Cement in standard packages (bags) need not be weighed, but bulk cement or fractional packages shall be weighed. The Contractor shall furnish the necessary equipment and shall establish accurate procedures for determining the quantities of free moisture in the aggregates, the true volume of the fine aggregate if volumetric proportioning is used, and the air content of the freshly mixed concrete if air-entrained concrete is used.

a) Chemical Admixtures: Measure the amount of chemical admixture by means of a device capable of ready adjustment to permit varying the quantity of admixture to be dispensed. Design and construct the device to accurately measure and dispense the required amount of admixture into the concrete mix. Keep different types of admixtures from intermixing prior to being mixed with other batch materials.

5. Mixing and Agitating:

a) Mixing: Mix all concrete with machines, except in emergencies the mixing may be by hand as approved. Mixing shall begin within 30 minutes after the cement has been added to the aggregate or water to the cement and aggregates. The total elapsed time for batching, mixing, conveying, discharging, and placing the concrete in final position shall not exceed 1-1/2-hours for ambient temperatures below 90˚ F, or 45 minutes for ambient temperatures above 90˚ F, unless specified otherwise. Only concrete which conforms to the specified requirements and the approved mix design shall be discharged on the subgrade. Once discharge has commenced, re-tempering the concrete with water will not be permitted. Excessive over-mixing which would require the addition of water to preserve the required consistency will not be permitted. The entire contents of the mixer shall be discharged before recharging. A discharge of separate aggregate at the end of the batch will be rejected and such material shall be removed from the site. Concrete shall be mixed by one of the following methods.

b) Central Plant Mixing: The minimum mixing time for central mixing plants when stationary mixers are approved for use, shall be 80 seconds after all solid materials are in the mixer drum, and with all the mixing water introduced before one-fourth of the mixing time has elapsed. This mixing time may be reduced if mixer performance tests (ASTM C 94) indicate that satisfactory mixes can be achieved at a reduced mixing time. The rate of rotation of the mixer drum shall be the manufacturer's specified speed. When a stationary mixer is approved for use for partial mixing of the concrete (shrink-mixed), the mixing time in the stationary mixer shall be as specified herein.

c) Truck Mixing: Mix and deliver concrete in a truck mixer. Charge the mixers with a ribbon-fed mixture of aggregates and cement, or in absence of facilities for ribbon feeding, charge the mixers with aggregates before the cement. Charge the truck mixer with a batch size equal to the rated capacity of the drum. When mixing is begun during or immediately after charging, a portion of the mixing water, not in excess of that required to produce the minimum acceptable slump, shall be added ahead of, or with, the other ingredients.

   i. Mixing: After all ingredients, including water, are in the drum, initially mix the materials for not less than 70 nor more than 100 revolutions of the drum. Control mixing speed to not less than 8 rpm and not more than 18 rpm. After the initial mixing or after 30 to 75 revolutions of the drum, test the slump. If necessary, add water only one time to produce the required slump; if additional water is added, from one to 2-1/2 gallons per cubic yard, continue the mixing for at least 30 more revolutions at drum speed of 10 rpm, or at least 5 to 10 more revolutions at drum speed of 16 to 18 rpm. Discharge of the concrete shall be completed within 1-1/2-hours or before the drum has revolved 300 revolutions, whichever comes first. Each batch of concrete delivered at the job site shall be accompanied by a time slip issued at the batching plant, bearing the time of departure therefrom and weight of aggregates, cement and water and the signature of the weighmaster.

d) Combination Central Plant and Truck Mixing (Shrink Mixing): Partially mix concrete in a central-plant mixer and complete the mixing in a truck mixer. In the central plant mixer select a minimum mixing time required to intermingle the ingredients, in any event, do not exceed 45 seconds. Complete the mixing in a truck mixer as specified above under truck mixing.

e) Agitating of Completely Mixed Concrete: Agitate completely mixed concrete from a central plant with an agitator or truck mixer operating at the speed of rotation designated by the manufacturer as agitating speed. Non-agitating equipment may be used when approved.

6. Ready-Mixed Concrete: For the purpose of this specification, ready-mixed concrete is defined as Portland-cement concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state. Ready-mixed concrete may be used provided that the plant has sufficient capacity and transportation equipment to deliver the concrete at the scheduled rate, however, the interval between batches shall not exceed 30 minutes; the plant meets the requirements specified herein for equipment, measurement of materials, mixing and agitation; and the plant has records which indicate an average plant coefficient of variation (ACI 214) of not greater than 15 percent. Ready-mixed concrete not specified otherwise shall be mixed and delivered by one of the methods specified in this section. Provide batch delivery tickets in accordance with ASTM C 94.

C. Forms

1. General Requirements: Construct forms of metal, except that flexible or curved forms may be metal or wood on curves having a radius of 150-feet or less and for fillets. Forms shall be of the full depth of the concrete and of a strength, when staked, sufficient to resist the pressure of the concrete and the loads resulting from the finishing operations without springing, settling, or losing their shape. All forms shall be free of bulge and warp and shall be cleaned thoroughly before being reused. Before placing the concrete, coat the contact surfaces of forms with a non-staining mineral oil.

   a) Side Forms: Place side forms only on underlying material that is at the proper grade. Set the side forms for full bearing on the foundation for the entire length and width and to the alignment of the edge of the finished pavement. Support the forms during the entire operation of placing, compaction, and finishing the pavement in such a manner that the forms will not deviate vertically more than 0.01-foot from the required grade and elevations indicated on the drawings. The maximum vertical deviation of the top of any side form, including joints, shall not exceed 0.01-foot from a 12-foot straightedge, nor shall the inside face vary more than 0.02-foot from a 12-foot straightedge. Stake sockets and interlocking devices shall be in such condition that they will prevent movement of the form.

2. Metal Forms: Use metal forms free from irregularities, dents, and sags. The top face of the form shall not vary from the plane of the face by more than one-eighth inch in 10-feet, and the lateral variation shall be not greater than one-fourth-inch in 10-feet.

3. Wood Forms: Use wood forms made of plywood or well-seasoned lumber. Planks shall have a nominal thickness of not less than 2-inches and shall not vary on their edges more than one-eighth inch in 5-feet from the plane of the curve indicated on the drawings. The top face of the form shall not vary from the plane of the face by more than one-eighth inch in 10-feet.

4. Setting and Removing Forms Not Specified Otherwise: The forms shall be joined neatly and tightly, staked securely to line and grade, and braced firmly throughout. Where practicable, set forms at least 500-feet in advance of the point where concrete is being placed. Oil forms thoroughly before concrete is placed against them. Forms shall remain in place for at least 12-hours after concrete has been placed against them. After form removal and until the end of the curing period, the sides of the pavement shall be protected with moist earth or by other approved methods. Remove forms in a manner to preclude damaging the concrete.

D. Slip-Form Construction (Contractor's Option)

1. Paving Equipment: Slip-form paving equipment shall be a self-propelled, automatically controlled, full tracked, concrete paving, finishing machine, capable of spreading and shaping the plastic concrete to the specified cross-section in one pass, and consolidating concrete mixtures as low as 0-inch slump. The paver shall screed and finish the freshly placed concrete in such a manner that a minimum of hand finishing is required.

2. Slip-Form Construction: Uniformly distribute concrete without delay into final position by a slip-form paver. For the full paving width consolidate the concrete by internal vibration with transverse vibrating units or a series of longitudinal vibrating units. If a series of longitudinal vibrating units are used, they shall be spaced at intervals not to exceed 2-1/2 feet, measured center to center.

a) Internal Vibration: The term "internal vibration" shall mean vibration by means of vibrating units located within the thickness of pavement section. The rate of vibration of each vibrating unit shall be not less than 8,000 vibrations per minute in the concrete, and the amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at least one-foot therefrom. The Contractor shall furnish a tachometer or suitable device for measuring and indicating the actual frequency of vibrations.

b) Equipment Support: When concrete is being placed adjacent to an existing pavement and part of the equipment is supported on the existing pavement, provide protection to prevent damage to the previously constructed pavement, such as, installing protective pads on crawler tracks or rubber-tire wheels and operating the equipment a sufficient distance from the pavement edge.

c) Alignment: No abrupt changes in longitudinal alignment of the pavement will be permitted. The horizontal deviation shall not exceed 0.10-foot from the established alignment of the pavement edge. Horizontal alignment shall be referenced to a taut string-line or the edge of a previously placed lane of concrete. Vertical alignment shall be referenced to a taut string-line or the surface of the underlying material.

3. Widths Less Than 40-Feet: Concrete required to be placed in widths less than 40-feet may be compacted and shaped by a powered mechanical compacting and shaping machine, except that a transverse tube (pipe) compactor shall be subject to approval of the Engineer. Consolidation shall be supplemented with vibratory compactors. Where hand compaction is performed, construct a tamper of heavy plank with length that exceeds the width of the pavement by a minimum of one-foot, shod with a heavy strip of metal for a tamping surface, and stiffened adequately to maintain the required shape during use. For concrete production in excess of 40-cubic yards per hour, and where all compaction is performed by hand methods, use at least two tampers.

4. Locations Inaccessible to Slip-Form Paving Equipment: Locations inaccessible to slip-form paving equipment shall be constructed as specified herein under "Conveying and Placing Concrete."

E. Conveying and Placing Concrete

1. Conveying: Convey concrete from the mixer to grade as rapidly as practicable. Use side discharge conveyors, bridge roller conveyors, or other similar conveyor systems which will not cause segregation or loss of ingredients. Deposit concrete as nearly as practicable in its final position to avoid re-handling. At any point in conveying, the free vertical drop of the concrete from one conveyor to another shall not exceed 3-feet. For short distances, chuting is permitted from the transportation equipment. When trucks are permitted to operate on the stabilized subgrade, concrete may be discharged in front of the paver. Clean conveying equipment before each run. Deposit concrete as soon as practicable after the forms have been oiled. Do not use concrete which has segregated in conveying or which was not protected from rainwater during a rainstorm or rainy weather.

2. Placing:

a) General: Concrete placement will not be permitted when weather conditions prevent proper placement and consolidation. Maintain drainage ditches, gutters and side drains to drain the subgrade during the construction of the pavement. In unreinforced pavement, place concrete in one continuous operation for the full depth and width of the section between longitudinal joints. If an emergency stop

occurs within 7-feet of a previously placed expansion or contraction joint, remove the concrete back to the joint. If an emergency stop occurs more than 7-feet from a previously placed expansion or contraction joint and if the concrete is not placed on a Portland cement stabilized base, install a keyed construction joint with approved tie-bars.

b) Concrete Placement: Deposit concrete in its final location within 45 minutes from the time all ingredients are charged into the mixer and before initial set. Deposit in a manner that will require a minimum of re-handling. At the Contractor's option concrete may be placed between stationary forms or constructed to the desired cross section using slip-form pavers. All work incidental to the handling and placing of concrete shall be done in a manner that will not damage the underlying surface. Dampen the underlying surface before placing concrete. Place concrete continuously at a uniform rate without unscheduled stops except for equipment failure or other emergencies. Care shall be exercised to avoid contamination of plastic concrete with foreign material on construction equipment or workman's footwear. Concrete spread by hand shall be done with shovels and not with rakes. Immediately fill with fresh concrete any holes left on removing any excess material or removing joint-forming devices. Thoroughly compact concrete adjacent to the forms and at joints.

3. Vibration: Immediately after spreading concrete, consolidate with internal vibrating equipment concrete adjacent to forms and joints regardless of slab thickness, and concrete slabs 8-inches or more in thickness. Limit the duration of vibration to that necessary to produce consolidation of the concrete. Excessive vibration will not be permitted and generally vibrators shall not be operated in the concrete at one location for more than 15 seconds. At the option of the Contractor, vibrating equipment of a type approved by the Engineer may be used to compact the concrete in unreinforced pavement slabs less than 8-inches thick.

   a) Vibrating Equipment: Operate equipment, except hand-manipulated equipment, ahead of the front of the finishing machine. Select the number of vibrating units and power of each unit to properly consolidate the concrete. Mount the units on a frame that is capable of vertical movement and, when necessary, radial movement, as the vibrators may be operated at any desired depth within the slab or be completely withdrawn from the concrete. The clear distance between frame-mounted vibrating units that have spuds that extend into the slab at intervals across the paving lane shall not exceed 30-inches. The distance between the end of the vibrating tube and the side form shall not exceed 2-inches. For pavements less than 10-inches thick, the vibrators shall be operated parallel with or at a slight angle to the subbase. For thicker pavements, the vibrators shall be angled toward the vertical, with the vibrator tip preferably about 2-inches from the subbase, and the top of the vibrator a few inches below the pavement surface. The vibrators may be pneumatic, gas driven, or the electric type, and shall be operated at frequencies within the concrete of not less than 8,000 vibrations per minute. The amplitude of vibration shall be such that noticeable vibrations occur at 1.5-foot radius when the vibrator is inserted in the concrete to the depth specified.

4. Placing Concrete in Hot Weather: Take extra care to reduce the temperature of the concrete being placed, and to prevent rapid drying of newly placed concrete. When the outdoor ambient temperature is more than 90˚ F, the temperature of the concrete shall not exceed 95˚ F; and curing shall be started as soon as the surface of the fresh concrete is sufficiently hard to permit it without damage. Concrete placement

temperatures shall be controlled by the Contractor at his expense and shall not be limited to: shading and cooling the aggregates; avoiding use of hot cement; cooling mixing water by additions of ice; insulating water supply lines and tanks; insulating mixer drums or cooling them with sprays or wet burlap coverings; working only at night; and addition of a retarder or water reducing retarder in the mix, if approved by the Engineer. Reduce the temperature of side forms by aerating the forms with wet burlap or similar covering materials. Cool underlying material by sprinkling lightly with water. Additional recommended practices may be found in ACI 305.

5. Protection Against Rain: All mixing and batching operations shall stop, and the surface of the unhardened concrete shall be covered with protective covering. The length of pavement to be protected shall extend back to a point where the rain is not indenting the pavement surface. When slip-form construction is used, install side forms in those areas of pavement where the edge cannot otherwise be protected to prevent edge erosion. After the rain ceases, install side forms as required to prevent excessive edge slump, and remove the protective covering without delay. Any water that remains on the pavement surface shall be removed. Areas of the surface where the texture has been damaged or exhibits a smooth sandy appearance shall be retextured and cured.

F. Finishing Concrete

1. General Requirements: Start finishing operations immediately after placement of concrete. Use finishing machine, except that hand finishing may be used in emergencies and for concrete slabs in inaccessible locations or of such shapes that machine finishing is impracticable. The surface of the pavement on both sides of a joint shall be finished to the same grade. Finish formed joints from a transverse bridge securely supported. Provide hand finishing equipment for use at all times. Maintain finishing equipment and tools in a clean condition and free from hardened concrete or grout. When ambient conditions are such as to cause rapid loss of moisture from pavement surface, a uniform fog spray of water to restore the surface sheen may be applied during finishing operations. Avoid application of excessive amounts of water to the surface.

2. Side Form Finishing: Strike off and screed the concrete to the required slope and cross-section by a power-driven transverse finishing machine. Transverse rotating tube or pipe shall not be permitted unless approved by the Engineer. The elevation of the concrete shall be such that, when consolidated and finished, the surface of the pavement will be adequately consolidated and at the required grade. Equip the finishing machine with two screeds readily and accurately adjustable for changes in pavement crown and compensation for wear and other causes. It shall make as many trips over each area of pavement and at such intervals as necessary to give the proper compaction, retain the coarse aggregate near the finished surface, and produce a surface of uniform texture, true to grade and crown. Excessive operation over an area,

   which results in an excess of mortar and water being brought to the surface, will not be permitted.

   a) Equipment Operation: Maintain the travel of machine on the forms without lifting, wobbling, or other variation of the machine which tend to affect the precision of concrete finish. Keep clean the tops of the forms by a device attached to the machine. During the first pass of the finishing machine, maintain a uniform ridge of concrete, 4-inches deep, ahead of the front screed for its entire length.

   b) Joint Finish: Before the concrete is hardened correct any edge slump of the

pavement, exclusive of edge rounding, in excess of 0.02-foot. Finish the concrete surface on each side of the construction joints to the same plane; correct all deviations before the newly placed concrete has hardened. Slip-form finishing is specified below.

3. Hand Finishing: Strike-off and screed the surface of the concrete to elevations slightly above finish grade so that when the concrete is consolidated and finished the surface of the pavement is at the indicated elevation. Vibrate the entire surface until the required compaction and reduction of surface voids is secured with a strike-off template.

4. Longitudinal Floating: After the initial finishing, further smooth and consolidate the concrete by means of hand-operated longitudinal floats. Use floats that are not less than 12 feet long and 6-inches wide and stiffened to prevent flexing and warping.

5. Slip-Form Finishing: After the concrete has been given a preliminary finish by means of finishing devices incorporated in the slip-form paving equipment, check the surface of fresh concrete with a straightedge device not less than 14 feet long. Remove high areas by the hand float method specified above. Finish the concrete surface on each side of the construction joints to the same plane. Correct all deviations before the newly placed concrete has hardened.

6. Straightedge Finishing: After completion of the longitudinal floating, any excess water or laitance shall be removed from the surface of the pavement transversely with a 10-foot straightedge or, where the use of a straightedge is not practicable, with a long-handled wood float having a blade not less than 5 feet in length and 6-inches in width. Do not use a wooden float to float the entire surface of the pavement in lieu of, or supplementing, the use of the longitudinal float, except as follows: when strike-off and consolidation is done by hand or if the slope of the pavement will not permit the use of a longitudinal float, the surface shall be floated transversely by means of the wood float.

7. Straightedge Testing: After the longitudinal floating has been completed and the excess water removed, but while the concrete is still plastic, test the slab surface with an accurate 10-foot straightedge swung from handles 3-feet longer than one-half the width of the slab. Hold the straightedge in successive positions to the centerline of the slab in contact with the surface of the concrete and go over the whole slab area from one side of the slab to the other as necessary. Advance along the centerline of the slab in successive stages of not more than one-half the length of the straightedge. Fill all depressions immediately with freshly mixed concrete, strike-off, consolidate, and refinish. Cut down all high places and refinish. Straightedge testing and surface correction shall continue until the entire surface is within the tolerance specified.

8. Texturing: Before the surface sheen has disappeared and before the concrete becomes non-plastic, the surface of the pavement shall be given a texture as specified below for Surface Finish.

9. Surface Finish:

   a) Burlap Drag Finish: Before the concrete becomes non-plastic, finish the surface of the slab by dragging on the surface a strip of clean, wet burlap measuring from 3 to 10-feet long and 2-feet wider than the width of the pavement. Select the dimension of the burlap drag so that at least 3-feet of the material is in contact with the pavement. Drag the surface so as to produce a finished surface with a fine granular or sandy texture without leaving disfiguring marks.

10. Edging: At the time the concrete has attained a f of hardness suitable for edging, carefully finish all slab edges, including the edges at formed joints, with an edge having a maximum radius of one-eighth-inch unless otherwise indicated. Clean by removing all loose fragments and soupy mortar from corners or edges of slabs which have crumbled and areas which lack sufficient mortar for proper finishing. Refill the voids solidly with a mixture of suitable proportions and consistency and refinish. Remove all unnecessary tool marks and edges. All remaining edges shall be smooth and true to line. Select tools, methods, and workmanship to produce joints having edges of the same quality as other parts of the pavement as approved by the Engineer. After removal of forms, repair all damaged and honeycombed areas with mortar composed of one-part Portland cement to two-parts sand.

G. Curing and Protection: Protect concrete from injurious action by the sun, rain, flowing water, or mechanical injury and prevent concrete from drying out from the time the concrete is placed until expiration of the minimum curing periods specified below. At the completion of the finishing and at the time the concrete surface has hardened enough to prevent the surface being marred by the curing material, cure the concrete by one of the following methods. Use fresh water for curing. Keep moist and at a temperature above 50˚ F, all portions of the pavement for the full curing periods specified below. Protect the pavement from damage during removal of form work or from injury resulting from storage or transportation of materials and equipment during construction. Protect exposed vertical faces of concrete with curing compound or by other suitable means.

1. Moist Curing:

a) Mats: Cover the entire surface of the pavement with two thicknesses of wet burlap weighing not less than 7 ounces-per-square-yard (dry weight), cotton mats, or other similar material having a high absorptive quality. Thoroughly wet the material when applied and keep continuously wet during the time the material remains on the pavement. Use mats made of clean material free from any substance which will have deleterious effect on the concrete. The minimum length of mats shall be the width of the pavement plus four times the thickness of the pavement. Place mats to completely cover the pavement surface and edges of the concrete with a slight overlap over adjacent mats. During application, avoid dragging the mats on the finished concrete or over mats already placed. Leave the mats in place not less than 8 hours, at that time remove the mats and continue curing by one of the other methods specified or leave the mats in place for a total of 7 days and keep continuously wet.

b) Waterproof Blanket: Wet the surface of the concrete with a fine spray of water and later cover the surface with waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Thoroughly saturate with water the burlap or polyethylene-coated burlap before placing. Select size of sheets that are at least one-foot longer than necessary to cover the entire width and edges of the slab. Place sheets with light-colored side up. Overlap adjacent sheets not less than 12-inches with the lapped edges securely weighted down or the sheets lapped 6-inches and cemented or tapered to form a continuous cover and a closed joint. Weight the cover down to prevent displacement or billowing from winds. Fold the coverings down over the exposed edges and secure the covering with a continuous bank of earth or other approved means. Use covers in good condition when placed; immediately repair tears and holes if they occur during the 7-day curing period.

c) Impervious-Sheeting Curing: Thoroughly wet the entire exposed surface of the concrete with a fine spray of water and then cover the surface with waterproofed

paper, polyethylene-bonded waterproof paper sheeting, polyethylene-coated burlap sheeting, or polyethylene sheeting conforming to the requirements specified above. Lay sheets directly on the concrete surface and overlap 12-inches at end of sheets. Select width of curing medium not less than 18-inches wider than the concrete surface to be cured. Place a bank of moist earth on edges just outside the forms or edges of concrete and cover the transverse laps to form closed joints. Repair or replace torn or otherwise damaged sheets during curing. Retain the curing medium on the concrete surface to be cured for not less than 7 days.

2. Liquid Chemical Curing Compound: Apply the compound specified elsewhere in this Section on the concrete surface to restrict evaporation of the mixing water. Seal all joint openings at the top by inserting moistened paper or fiber rope or cover joints with strips of waterproof material prior to application of the curing compound, in a manner to prevent the curing compound from entering the joint where a sealant is indicated to be installed. Seven days after the application of the curing compound, the joints may be exposed and prepared to receive the joint sealant materials.

   a) Application of Curing Compound: Immediately apply the compound after the surface loses its water sheen and has a dull appearance. Thoroughly agitate the curing compound by mechanical means during use and uniformly apply the compound in a two-coat for a total coverage of 200 square-feet-per-gallon of compound. If the compound lacks a uniform continuous, coherent film, or exhibits checks, cracks, peels, or pinholes, apply an additional cost of compound to areas where the film is defective. Have readily available impervious sheet curing for use to protect the freshly placed concrete in the event conditions occur to prevent correct application of the compound at the proper time. Respray with two coats of curing compound the concrete surfaces subjected to heavy rainfall. Before application of the compound, prepare the surface as specified for "Protection Against Rain." Apply the two coats at the same method and rate required above.

   b) Protection of Treated Surfaces: Protect concrete surfaces from all foot and vehicular traffic and all other sources of abrasion for not less than 72-hours. Maintain continuity of the applied liquid membrane-forming coating for the entire curing period and repair damage to the coating during the curing period.

3. Pavement Protection: Keep pavement closed to vehicular traffic until the concrete is not less than 6 days old and has attained a minimum flexural strength of 550 pounds-per-square-inch as determined by tests of the field-cured test beams. Prevent damage to edges of slabs if subgrade planer, concrete finishing machine, or similar equipment is supported on previously constructed slabs. After the concrete has reached the specified flexural strength as verified by the laboratory-cured test beams, the pavement may be put in service.

H. Field Sampling and Testing

1. Sampling:

   a) Aggregates: Sample at the source the fine and coarse aggregates prior to delivery of aggregates to the batch plant. During concrete placement sample coarse aggregates for each 1500-tons and fine aggregates for each 1000-tons. Use sampling methods in accordance with ASTM D 75. Identify each sample for conformance tests. When test results indicate that the fine aggregates consistently meet the specified gradation requirements, the rate of sampling may be reduced if approved.

b) Concrete: Obtain samples of plastic concrete in accordance with ASTM C 172. Quality Control samples may be taken at the concrete batch plant; however, samples for verification of concrete strength and slump for submittal to the State shall be taken at the job-site as the concrete is delivered in accordance with ASTM C 172. From each sample mold the required number of beams for each group of test specimens.

c) Sample Identification: Each sample shall be tagged for identification. The tag shall contain the following information:
Contract No.
Sample No.
Date of Sample
Sample
Source
Intended Use
For Testing

2. Testing:

a) Aggregate Testing: Without delay perform gradation tests on each sample. Make all other aggregate tests, except durability tests, on initial source samples, and repeat tests including durability tests whenever there is a change of source. During progress of concrete placement perform gradation tests for fine and coarse aggregates. Include sieve analysis for each fractional size and gradation analysis of the combined material representing the aggregate part of the concrete mix.

b) Cement Testing: Submit certificates as follows:

i. A report of the mill test results signed by the laboratory chemist.

ii. At the time of shipment from the mill or other storage point, a manufacturer's certificate that the cement was tested in accordance with the specified requirements.

iii. A statement that the concrete for the project will contain cement conforming to the specified requirements. The Contractor shall make all necessary arrangements with the cement supplier and carrier for the identification and transportation of the certified cement from the manufacturer to the concrete batch plant.

c) Concrete Testing: Perform all tests with aggregates and cement to be used in the project. During the course of construction, if there is a deficiency in strength of the concrete produced, perform additional tests at the Contractor's expense and make adjustment in the mix, as required, to obtain the specified strength.

i. Concrete Slump: Test consistency of concrete slump in accordance with ASTM C 143. Determine consistency of concrete at the start of each day's concrete placement and for each group of beam test specimens.

ii. Air Content: Determine air content at the start of concrete placement and for each group of beam test specimens. Record results with test specimens. Determine air content in accordance with ASTM C 173 or ASTM C 231.

a. Date concrete represented by core was placed

b. Date core was taken

c. Location of core – lane number, station number

d. Thickness of core

e. Condition of core – appearance, (honeycombed), concrete texture, condition of bottom of core

f. Disposition of cores – in Contractor possession

d) Tests for Flexural Strength: During the progress of the work verify the flexural strength by testing beams made from concrete taken from the forms at intervals indicated herein. Mold and cure beams in accordance with ASTM C 31. Perform tests in accordance with ASTM C 78. Mold one group of nine beams for each 1500 cubic yards or fraction thereof. Select one set of 3 beams taken at three locations: near the beginning, at midway, and near the end of concrete placement for a total of nine beams for each group. An approved laboratory shall furnish all necessary labor, concrete and facilities for molding, handling, and storing the beams at the site of the work and testing the beams. Perform tests at 7 days, 28 days and 90 days.

i. Flexural Strength: Concrete shall meet the following requirements:

ii. From each group of concrete beams, three beams tested at the end of 90 days shall have an average flexural strength equal to or greater than the specified strength.

iii. No individual beam tested at 28 days shall have a flexural strength less than 700 psi.

iv. The average strength specified above shall be at least 700 psi for first 20 beams molded. If the concrete strength is below the specified requirements, or does not meet other requirements of this specification, the Contractor shall make all necessary adjustments for conformance.

v. One beam of the group shall be tested at 7 days and one beam of the group shall be tested at 90 days. If the ratio of the 7-day and 28-day strength to the specified 90-day strength is less than 60 and 90 percent, respectively, or if the concrete strength does not meet other requirements of this specification, the Contractor shall make all necessary adjustments for conformations.

e) Control Charts: Provide control charts for concrete flexural strength in accordance with ACI 214, Appendix, except as otherwise modified herein. Post copies of charts at the job site. Submit weekly copies to Engineer. The charts shall indicate the specified strength and the average strength determined by the mix design. Each control chart shall consist of the following plots:

i. Test Results: At the same location, plot each individual test strength (the average result of three beams tested at 7, 28 and 90 days.

ii. Moving Average for Strength: Moving average of five consecutive tests (ACI 214).

iii. Moving Average for Range: The moving range is the difference between the highest and lowest of three test results: Points 1, 2 & 3; 2, 3 & 4; 3, 4 & 5; 4, 5 & 6; 5, 6 & 7; etc. Plot the moving average and compare with TABLE I, the selected average strength. If the range of test results fall below the selected average range, the Contractor shall make necessary adjustments to

the mix design to control the variation in the average strength results in order to assure that the specified strength is obtained.

f) Samples for strength tests shall be taken at random from each group of beams molded. All beams shall be numbered consecutively, marked as 7-day, 28-day and 90-day pairs, and identified as to each group sample.

20.5 BASIS OF MEASUREMENT AND PAYMENT

A. Measurement and Payment for concrete pavement shall be paid for at a Lump Sum Price for Portland Cement Concrete Pavement as shown in the Proposal Schedule and shall be full compensation for the work complete in place.

Item No.	Pay Item	Pay Unit
5	Portland – Cement Concrete Pavement	LS

END OF ARTICLE

ARTICLE XXII - WATER SYSTEM

22.1 GENERAL

A. The work consists of installation of equipment, materials, labor, and appliances to perform all work in connection with placing waterline system for the project in accordance with this Article of the specifications and the Hawaii Standards Specifications, Section 624, 703, 704, 707, 709, 712, and 717.

B. This section describes the follow:

1. Layout and install waterline alignment per plan to provide building and fire service.
2. Demolish and remove segment of existing waterline following relocation of existing waterline and backflow preventer servicing surrounded parcel.
3. See Article XVI – Earthwork and Subgrade Preparation
4. See Article XVII - Utility Excavation and Backfill
5. See Article XVIII – Aggregate Base Course
6. See Article XIX – Asphalt Concrete Pavement
7. See Article XX – Portland-Cement Concrete Pavement

22.2 REFERENCE

A. Hawaii Standard Specification for Road and Bridges Construction, State of Hawaii, 2005, as amended.

22.3 SUBMITTALS;

A. Submit in accordance per Standard provisions Section 624 of the Hawaii Standard Specifications for Road and Bridges Construction. 2005.

22.4 MATERIALS

A. In general, the provision of Section 624 – Water System of the "Hawaii Standard Specifications for Road and Bridge Construction", 2005, as amended, shall apply except as hereinafter modified and the State of Hawaii Water System Standards, 2002, as amended

1. 624.02 MATERIALS is amended by replacing the seventh paragraph with the following:

   "The Contractor shall furnish all materials, labor and equipment necessary to complete the water system in place, as detailed on the drawings."

2. 624.02 MATERIALS is amended by adding the following:

   "Unless otherwise specified or approved by the Director, distribution mains shall be ductile iron (D.I., Class 52). Ductile iron (D.I., Class 52) pressure pipe or galvanized iron (G.I. Schedule 40) pipe shall be used on the pier."

   All valves shall be 150 pounds unless otherwise shown on the drawings.

3. 624.04 METHOD OF MEASUREMENT and 624.05 BASIS OF PAYMENT shall be deleted.

22.5 BASIS OF MEASUREMENT AND PAYMENT

Measurement and Payment for WATER SYSTEM shall be measured and paid for at the Lump Sum Price Bid in the Proposal Schedule; including concrete blocks for water system, complete in place.

Work under this Article will not be measured for payment but will be paid for at the Contract Lump Sum Price.

Item No.	Pay Item	Pay Unit
6	Water System	LS

END OF ARTICLE

ARTICLE XXIII - SEWER SYSTEM

23.1 DESCRIPTION

A. This section describes constructing sewer systems and appurtenances.

23.2 SUBMITTALS;

A. Submit in accordance per Standard provisions Section 625 of the Hawaii Standard Specifications for Road and Bridges Construction, 2005.

23.3 MATERIALS (NOT USED)

23.4 CONSTRUCTION

A. Installation of Sewer Pipe.

1. General. Lay pipe starting from lowest point with spigots facing direction of flow. Fit and match pipe together to provide sewer true to line and grade with smooth and uniform invert.

   Do not use blocks and wedges to adjust pipe to proper line and grade, except as required for jackets and cradles. Uniformly support pipe for its entire length.

   Close exposed ends of sewers with accepted temporary covers at end of each work day. If water, mud or other foreign matter enters joints after pipe installation, open, clean, and replace affected joints.

   Check pipes that become submerged in water during the night each morning. Re-lay pipes that have floated from their proper positions at no increase in contract price or contract time. Before final inspection, visually inspect lines, and remove mud and other foreign matter within sewer line.

   Comply with requirements of Hawaii Occupational Safety and Health (HIOSH) Confined Space Standard §12-67.2-2.

2. Vitrified Clay Pipe. Install vitrified clay pipe with compression joints. Wipe or brush the pipe with lubricant or adhesive recommended by pipe manufacturer on contact surfaces of joints. Push spigot into bell until joint snaps into position.

   Do not use poured or formed joints using cement, sulfur compounds, bituminous materials, or other materials forming rigid joint.

   Use jointing compound recommended by pipe manufacturer for joining 6-inch by 4-inch extra heavy cast iron or ductile iron reducer to 6-inch vitrified clay sewer pipe and 4-inch house sewer.

3. Reinforced Concrete Pipe. Clean inside surface of concrete bell and concrete spigot end, including groove, before making joint. Lubricate rubber gasket and annular groove in spigot. Stretch and place gasket uniformly in annular groove in spigot. Lubricate inside bell surface 2 inches from end of pipe. Use soft vegetable soap compound lubricant recommended by manufacturer.

   Before assembling joint, place metal or wooden spacers against shoulder of bell and provide proper space between abutting ends of pipe.

   Telescope and seat spigot into bell. Do not mortar joints, inside or outside.

   Insert thin metal feeler gage between bell and spigot. Check position of rubber gasket around complete circumference of pipe. If gasket is not in proper position;

a) Withdraw pipe.

b) Check gasket for cuts and damages.

c) Re-lay pipe.

d) Recheck gasket position.

e) Provide joint openings:

f) Within tolerance recommended by manufacturer.

g) Consistent with design of pipe.

h) To not exceed 1/2 inch.

i) If joint opening exceeds any of above requirements, withdraw pipe, correct defect, and re-lay pipe.

4. PVC Pipe. Wipe clean and lubricate compression joints with lubricant provided by manufacturer before inserting spigot end of pipe into bell end.

   Handle, load, unload, and store PVC pipe with care. Store pipe and fittings under cover. Transport pipe and fittings in vehicle with bed long enough to allow length of pipe to lie flat.

   Place four inches of bedding material below pipe, plus additional bedding material above the bottom of pipe equal to 0.4 times outside diameter of pipe. If laying pipe in rock excavation, remove six inches of rock below pipe and place six inches of bedding below pipe.

   Cover pipe with minimum of 3 inches of accepted backfill material within 24 hours after placing pipe in trench.

   Provide special watertight manhole couplings for manhole connections. Cast couplings directly into cast-in-place manholes, or grout couplings into precast concrete manholes with non-shrink or expansion-type grout.

5. Leakage Tests

   a) General. Test sewers and sewer manholes for leakage in presence of the Engineer. Provide equipment and material necessary for tests including water and labor. Perform leakage test with results acceptable to the Engineer before placing backfill, concrete cradles, concrete jackets, or permanent resurfacing.

   b) Gravity Lines. Do not perform exfiltration leakage test if difference in elevation between inverts of adjacent manholes exceeds 10 feet.

      If ground water is above top of pipe, perform leakage (infiltration) tests as follows:

      i. After laying pipe and completing connections to manholes, backfill pipe trench to prevent floating of pipe.

      ii. Close end of sewer at upper structure to prevent entrance of water. Stop pumping of ground water for at least three days. Test the test portion for infiltration.

      c)

      iii. Use maximum quantity of infiltration of 200 gallons per day per inch of inside diameter per mile of pipe.

      iv. Reduce infiltration over limit specified above to within permissible limit before sewer is acceptable the Engineer. Repair visible leaks, despite limits

of leakage tests.

If ground water is below top of pipe laid, perform leakage (exfiltration) tests as follows:

i. Test each portion of sewer between successive manholes by closing the inlet of the lower manhole and closing the inlet of upper manhole with stoppers. Fill pipe and upper manhole with water:

   a. At least 4 feet above invert of upper manhole.

   b. Or, not less than 1 foot above high end of highest house connection on test portion.

ii. If construction of manhole is delayed, use barrel on bank to provide necessary pressure required for testing.

iii. Keep water present in trench below level of subgrade of sewer during test, and during patching or repairing required by test.

iv. Use maximum quantity of exfiltration 200 gallons per day per inch of inside diameter per mile of pipe.

v. Reduce exfiltration over limit specified above to within permissible limit before acceptance by the Engineer. Repair visible leaks, despite limits of leakage tests.

d) Low Pressure Air Test

i. Clean pipe to be tested.

ii. Plug pipe outlets with test plugs. Securely brace each plug.

iii. Add air until internal pressure of line reaches approximately 4 pounds per square inch. After reaching this pressure, allow pressure to stabilize. Pressure will normally drop as air temperature stabilizes, usually taking two to five minutes depending on pipe size. Reduce pressure to 3-1/2 pounds per square inch before starting test.

iv. Start test when pressure:

   a. Has stabilized.

   b. Is at or above starting test pressure of 3-1/2 pounds per square inch.

   If pressure does not drop more than 1 pound persquare inch during test time, line has passed test.

v. Ground water above pipe will reduce air loss. If section of line under test shows significant infiltration, perform infiltration test.

vi. Air test may be dangerous if line is prepared improperly. Install and brace plugs to prevent blowouts.

   Provide pressurizing equipment with regulator set at 10 pounds per square inch to avoid over-pressurizing and damaging acceptable line. Do not allow workers in manholes during testing.

TABLE 625.03-2 - MINIMUM AIR TEST TIME FOR VARIOUS PIPE SIZES			
Nominal Pipe Size, Inches	**T (Time) minutes / 100 feet**	**Nominal Pipe Size, Inches**	**T (Time) minutes / 100 feet**
3	**0.2**	**21**	**3.0**
4	**0.3**	**24**	**3.6**
6	**0.7**	**27**	**4.2**
8	**1.2**	**30**	**4.8**
10	**1.5**	**33**	**5.4**
12	**1.8**	**36**	**6.0**
15	**2.1**	**39**	**6.6**
18	**2.4**	**42**	**7.3**

6. Mandrel Test for Deflection of PVC Pipe. Perform mandrel test 30 days after completing trench backfill. In roadway areas, 30-day period begins after installation and compaction of bedding, backfill and subbase to within 2 feet of finished pavement grade.

   Pull rigid nine-sled mandrel through pipe by hand between adjacent manholes to measure for obstructions such as deflections, joint offsets, and lateral pipe intrusions. Use mandrel conforming to ASTM D 3033 and ASTM D 3034. Furnish material, equipment, and labor required for test, and perform test in presence of the Engineer.

   If mandrel fails to pass, pipe is considered overdeflected. If pipe is not damaged, uncover and reinstall pipe. Remove damaged pipe from work site. Do not reround or use other methods or processes to reduce or remedy overdeflections.

7. Connections to Existing Sewers

   a) General. Arrange with County Division of Sewers for making connections to existing sewers.

   b) Breaking into Existing Manholes. Connect to existing manholes and channelize inverts in presence of County Division of Sewers inspector. In making connection, place tight fitting false form on inside portion of manhole. Remove materials falling inside existing sewer pipe. Pay for damages to existing manhole and sewer pipe resulting from this work. After completing connection, work on required channelizing within existing manhole.

      i. Sewer Enclosed Within New Manhole. If building new manhole over existing sewer main, cut existing sewer line in presence of County Division of Sewers inspector. Clear new manhole of mud, debris, and standing water before cutting existing sewer line.

ii. Saddle Wye. If required to install new lateral from existing sewer main, provide saddle wye tap-in in presence of County Division of Sewers inspector.

c) Concrete Blocks. Provide concrete blocks next to each bell on both pipes and fittings.

d) Concrete Cradle. Provide concrete cradles under entire length of pipe as specified in contract documents. Before placing concrete, rest pipes firmly on concrete blocks. Keyway or curing is not required. Provide reinforcement as specified in contract documents.

e) Crushed Rock Cradle. Provide crushed rock cradle under entire length of pipe as specified in contract documents. Provide bed course material in layers not exceeding 8 inches in loose thickness and compact.

f) Concrete Jackets. Provide concrete jackets as specified in contract documents. Use small concrete blocks to support pipes, and provide reinforcement as specified in the contract documents. Cure reinforced concrete jackets for five days. Plain concrete jackets do not require curing.

g) House Sewer Connection. Arrange connections to cause least inconvenience for sewer user.

23.5 MEASUREMENT

A. Sewer systems will be paid on a lump sum basis. Measurement for payment will not apply.

23.6 PAYMENT

A. The Engineer will pay for accepted sewer systems on a contract lump sum basis. Payment will be full compensation the work prescribed in this section and contract documents.

The Engineer will not pay separately for concrete blocks, cutting and plugging of abandoned sewers, concrete plugs for ends of abandoned sewers, and vitrified clay caps at ends of existing sewers that will remain in use. Consider cost for these items as included in sewer system contract pay items.

Item No.	Pay Item	Pay Unit
7	Sewer System	LS

END OF ARTICLE

ARTICLE XXIV - DRAINAGE SYSTEM

24.1 GENERAL

A. The work consists of installation of equipment, materials, labor, and appliances to perform all work in connection with placing drainage system for the project in accordance with this Article of the specifications and the Hawaii Standards Specifications, Section 602, 603, 604, 703, 704, and 709.

B. This section describes the follow:

1. Layout and install drain line alignment, inlets, manholes and manufactured treatment devices to collect runoffs generated by the proposed site improvements.
2. Demolish and remove existing drain laterals following the demolition of the existing warehouse building.
3. See Article XVI - Earthwork and Subgrade Preparation
4. See Article XVII - Utility Excavation and Backfill
5. See Article XVIII – Aggregate Base Course
6. See Article XIX - Asphalt Concrete Pavement
7. See Article XX - Portland-Cement Concrete Pavement

24.2 REFERENCE

A. Hawaii Standard Specification for Road and Bridges Construction, State of Hawaii, 2005, as amended.

24.3 SUBMITTALS;

A. Submit in accordance per Standard provisions Section 624 of the Hawaii Standard Specifications for Road and Bridges Construction. 2005.

24.4 MATERIALS

A. Provide in accordance with following sections of Hawaii Standard Specification for Road and Bridges Construction

1. Culverts and Storm Drains Section 603.
2. Manholes, Inlets and Catch Basins Section 604.
3. Reinforcing Steel Section 602.
4. Aggregates Section 703.
5. Masonry Units Section 704.
6. Structural Concrete Section 601

B. Provide all other materials not specified herein as specified in references.

24.5 EXECUTION

A. EXAMINATION

1. Verify that field conditions are acceptable and are ready to receive work.
2. Verify invert elevations and slopes are correct.

3. Beginning of work means Contractor accepts existing conditions.

B. PREPARATIONS

1. Be responsible for precisely laying out storm drainage system. Locations shown on drawings of various existing utility fines were determined on basis of best information available. However, no assurance can be given that actual locations will be precisely as shown on drawings.

2. Exercise due care and caution necessary to avoid damage to impairment in use of existing utility lines. Repair and restore immediately damages inflicted on existing lines, as directed by Owner at no cost to Owner.

C. INSTALLATION

1. Install storm drainage System as per applicable "Hawaii Standard Specification for Road and Bridges Construction".

2. Connect to existing storm drain system as shown on drawings.

D. BACKFILLING

1. Backfilling is not permitted until lines have been tested and approved by Owner.

2. Backfilling see Excavation and Backfill for Drainage Facilities Section.

E. FIELD QUALITY CONTROL

1. Conduct field tests required by "Hawaii Standard Specification for Road and Bridges Construction" in presence of Owner.

F. PROTECTION OF FINISHED WORK

1. Protect finished installation.

2. Protect pipe from damage or displacement until backfill operation is in progress.

24.6 BASIS OF MEASUREMENT AND PAYMENT

A. The Engineer will pay for accepted Drainage systems on a contract lump sum basis. Payment will be full compensation the work prescribed in this section and contract documents.

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

Item No.	Pay Item	Pay Unit
8	Drainage System	LS

END OF ARTICLE

ARTICLE XXV - CHAIN LINK FENCE AND GATE

25.1 GENERAL

A. The work to be done under this Article consists of furnishing all labor, materials, equipment and other expenses necessary to replace and modify the existing chain link fencing and gates.

25.2 REFERENCES

A. Hawaii Standard Specification for Road and Bridges Construction, State of Hawaii, 2005, as amended.

25.3 SUBMITTALS;

A. Submit in accordance per Standard provisions of the Hawaii Standard Specifications for Road and Bridges Construction. 2005.

25.4 MATERIALS

A. All materials shall be new unless otherwise specified.

1. Chain Link Fence

a) Chain link fabric shall be an aluminum 6061-T94 alloy conforming to ASTM B-211. The wire shall-be 9-gage with a 0.148-inch nominal diameter. Mesh size shall be two inches and shall be woven with twisted and barbed sewage at both top and bottom.

b) Posts, top rails, braces shall be aluminum 6063-T6 alloy conforming to ASTM B-429. Pipes shall conform to size of ANSI Schedule 40.

c) Fittings such as eyetops, post caps, stretcher bars, stretcher bar bands, barbed wire arms and truss rods shall be fabricated from aluminum 6061-T6 alloy conforming to ASTM B-21 and ASTM B-211. All posts shall be fitted with approved eyetops and barbed wire anns designed to fit securely over the posts, and the top rails shall pass through the base of these eyetops. Bolts, washers and nuts shall be Type 316 stainless steel.

d) Barbed wires shall consist of three 12 1/2 - gage galvanized wire with 14-gage 4-point barbs spaced approximately five inches apart. Barbed wire shall conform to the requirements of ASTM A-121.

e) Tension wire shall be 7-gage aluminum alloy wire with a nominal 0.192-inch diameter.

f) Tie wire shall be 9-gage aluminum alloy wire with 0.148-inch nominal diameter.

g) Concrete for fence post footings shall be Class B, (2500 psi) in accordance with Section 601 of the Standard Specifications.

2. Chain Link Gate

a) Chain link fabric shall be an aluminum 6061-T94 alloy conforming to ASTM B-211. The wire shall-be 9-gage with a 0.148-inch nominal diameter. Mesh size shall be two inches and shall be woven with twisted and barbed selvage at both top and bottom.

b) Gate posts, frames and diagonals shall be fabricated from Schedule 40 galvanized steel pipe conforming to ASTM F-1083. Pretreatment for new galvanized surfaces to be painted shall be Galvaprep or approved equal. Epoxy paint shall be a high performance, two -component, high-solid epoxy polysiloxane paint, high gloss

finish, capable of being applied at a dry film thickness of five mils per coat, "PSX 700" as manufactured by Ameron Protective Coatings Division or approved equal. Gate posts color shall be OSHA safety yellow. Pipe frames and diagonals color shall be metallic gray.

c) Fittings such as stretcher bars, stretcher bar bands, truss rods and barbed wire arms shall be fabricated from aluminum 6061-T6 alloy conforming to ASTM B- 21 and ASTM B-211.

d) Barbed wires shall consist of four 9-gage galvanized wire with 14-gage 4-point barbs spaced approximately five inches apart. Strands shall be coated with a seven mil minimum thickness PVC coating, color shall be grey. Barbed wire shall conform to the requirements of ASTM A-121.

e) Tie wire shall be 9-gage aluminum alloy wire with 0.148-inch nominal diameter.

f) Concrete for gate post footings shall be Class B (2500 psi) in accordance with Section 601 of the Standard Specifications.

25.5 CONSTRUCTION

A. Any sand, dirt, rocks and other debris shall be removed from the fence line so that the fence can be installed level with the adjacent fence. Existing signs on the fence shall be carefully removed and stored for reinstallation on the new fence. The entire fence shall be removed to the limits shown in the plans. The existing fence posts for the fence shall be removed at least 3 inches below the top of the existing ground. The resulting holes shall be filled with grout. The existing fence posts for the gates and the existing fence posts in the breakwater shall be completely removed. Bushes and plants along the fence shall also be removed. All removed materials shall be properly disposed of by the Contractor away from the project site.

B. New holes shall be drilled for the new fence posts. The new line posts shall be offset from the existing post locations. The new gate posts, new corner posts and new end post near the breakwater shall be installed in the same location as the removed posts. The new concrete footings shall be constructed in accordance with Section 503 of the Standard Specifications except as modified in these specifications and on the project drawings. No live loads shall be permitted on the new concrete footings until the concrete has been allowed to properly cure for a minimum of seven (7) days. The project area shall remain barricaded from traffic for the duration of the curing period.

C. The new chain link fabric, tension wires, eye tops with barbed arms, and barbed wires shall be installed using new tie wires and new rails. Installation shall include new connecting hardware such as tension rods, tension bands, bolts, washers, nuts, etc.

D. The new chain link fence and gates shall be constructed in accordance with Section 607 of the Standard Specifications except as modified in these specifications and on the project drawings.

E. The removed signs shall be reinstalled in the original locations on the new fence with new hardware.

25.6 BASIS OF MEASUREMENT AND PAYMENT

Work under this Article will not be measured for payment but will be paid for at the Contract Lump Sum Price

Payment includes all costs associated with the removal and replacement of Gates, and the preparation and installation of all elements associated with the installation of the new pedestrian gate at Road No.2, in place, complete.

Item No.	Pay Item	Pay Unit
9	Chain Link Fence and Vehicle Gate and Pedestrian Gate	LS

END OF ARTICLE

ARTICLE XXVI - PAVEMENT MARKINGS

26.1 DESCRIPTION

The work shall consist of removing and installing temporary and permanent pavement markings in accordance with the requirements of the contract or as established by the Construction Engineer.

26.2 GENERAL REQUIREMENTS

In general, the provisions of Section 629 - Pavement Markings of the "Standard Specifications" shall apply except as hereinafter modified:

1. 629.04 Method of Measurement and 629.05 Basis of Payment are deleted. The Contractor shall provide thermoplastic markings.

26.3 SUBMITTALS;

A. Submit in accordance per Standard provisions Section 629 of the Hawaii Standard Specifications for Road and Bridges Construction. 2005.

26.4 MEASUREMENT AND PAYMENT

Pavement markings, inclusive of removal of existing markings in areas where existing pavement is to remain; temporary pavement markings; new pavement markings; and furnishing labors, materials, tools, equipment, and incidentals required to complete the work will not be measured or paid for separately but shall be considered incidental to the various items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXVII FIRE EXTINGUISHERS AND CABINETS

27.1. SUMMARY

A. This section includes providing portable fire extinguishers to afford 100 percent complete fire protection coverage throughout the indicated areas. The equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 10 except as modified herein.

B. The installation shall include all materials, accessories, and equipment necessary to provide each portable fire extinguisher ready for use. Install portable fire extinguishers to give full consideration to physical obstructions, furniture, and equipment. Portable fire extinguishers shall be listed by Underwriters Laboratories Industries (UL) or approved by Factory Mutual (FM). In the National Fire Protection Association (NFPA) publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears and reference to the "authority having jurisdiction" shall be interpreted to mean the Building Department and the Fire Department. Reference to the "Building Department" on the Contract Drawings and herein shall be interpreted to mean the City and County of Honolulu Department of Planning and Permitting. Reference to the Fire Department on the Contract Drawings and herein shall be interpreted to mean the Honolulu Fire Department. "Provide" shall mean "furnish and install" when used herein.

27.2. RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Signage specified in ARTICLE XII PROJECT SIGN.

27.3. DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

A. FM: Factory Mutual.

B. ICC: International Code Council.

C. NFPA: National Fire Protection Association.

D. UL: Underwriters Laboratories, Inc.

27.4. CODE, STANDARDS, AND REGULATIONS

A. The latest publications listed below form a part of this specification. The publications are referred to in the text by the basic designation only.

1. Factory Mutual (FM) Global:

FM AG	(Updated Online) FM Approval Guide
Data Sheet 4-5	Portable Extinguishers

2. International Code Council (ICC):

ICC/ANSI A117.7	American National Standard for Accessible and Usable Buildings and Facilities

3. National Fire Protection Association (NFPA):

NFPA 1	Uniform Fire Code
NFPA 10	Portable Fire Extinguishers

4. Underwriters Laboratories (UL), Inc:

UL FPED	(Updated Online) Fire Protection Equipment Directory
UL FRD	(Updated Online) Fire Resistance Directory.

B. Installation of all work in this Section shall be made in accordance with State Department of Health Regulations, the National Fire Protection Association, the International Building Code, and the Uniform Fire Code.

C. All applicable codes, regulations and ordinances of public bodies having jurisdiction are considered a part of these specifications. All work installed and materials provided must comply with the current edition of such codes, regulations, and ordinances.

27.5. CONTRACT DRAWINGS

A. Contract Drawings are essentially diagrammatic, indicating general layout and approximate locations toward establishing the scope for a uniform estimating basis for all bidders. They are not intended to be detailed construction working drawings.

B. See Contract Drawings for location, size, type, and quantity of fire extinguishers and cabinets.

C. Fire extinguisher and cabinets shall fit into space allotted. Reasonable modifications to indicated locations and arrangement to suit job conditions shall not constitute basis for requesting additional funds from the State.

D. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his or her work to the structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself or herself with all details of the work and notify the Contracting Officer of any discrepancy before performing any work.

27.6. SUBMITTALS

A. Manufacturer's Published Data:

1. As soon as practicable and before installation of any materials or equipment is begun, the Contractor shall submit a complete list of materials and equipment together with names and addresses of manufacturers, catalog numbers, and trade names to the Contracting Officer for approval.

2. Annotate descriptive data to show the specific model, type, quantity, and size of each item the Contractor proposes to furnish.

3. Approval of materials will be based on manufacturer's published rating. Any materials and equipment that are not in accordance with these specifications may be rejected.

27.7. OMISSIONS

A. It is the intent of the plans and specifications to provide a complete installation. Should there be omissions, the Contractor shall call the attention of the Contracting Officer to such omissions 15 days in advance of the date of bid opening so that the necessary corrections can be made

27.8. PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Furnish new equipment, 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 contract period after installation.

B. Pipe and fittings shall be stored on pallets or blocks a minimum 2 inches above the ground to prevent foreign material from entering piping prior to installation. Pipe ends shall be capped to prevent dirt, water, or other residue from entering.

27.9. MATERIALS AND EQUIPMENT

A. All materials shall be new, of equal or better quality of materials specified. For ease of maintenance and parts replacement, select equipment from a single manufacturer as much as possible.

B. All devices and equipment for fire protection service shall be UL listed or FM approved.

27.10. EQUIPMENT AND DEVICES

A. Portable Fire Extinguishers:

1. Multipurpose Dry Chemical Fire Extinguisher, Nominal 10 pound: Provide UL listed or FM approved, UL minimum rated 4A:80B:C fire extinguisher with steel or aluminum cylinder. Provide with complete inspection tags.

B. Fire Extinguisher Cabinets:

1. Interior-Mounted Semi-Recessed Cabinets: Provide flat trim semi-recessed cabinet with steel or aluminum body, white powder coated finish and clear tempered safety glass panel. Cabinet trim shall be flush to face of the wall. Cabinet shall have a minimum inside box dimension capable of holding specified fire extinguisher. Provide fire-rated cabinets installed in fire-rated walls. The rating of the cabinet shall be no less than the fire-resistance-rating of the wall.

2. Interior-Mounted Surface-Mounted Cabinets: Provide surface-mounted cabinet with steel or aluminum body, white powder coated finish and clear tempered safety glass panel. Cabinet shall have a minimum inside box dimension capable of holding specified fire extinguisher.

3. Exterior-Mounted Cabinets: Provide surface mounted cabinet with plastic or acrylic body, red finish, and clear or opaque front panel. Cabinet shall have brass lock, cover, and labels, and constructed of UV-resistant materials intended for outdoor use. Cabinet shall have a minimum inside box dimension capable of holding specified fire extinguisher.

C. Fire Extinguisher Bracket: Provide UL listed or FM approved fire extinguisher bracket with integral retaining strap and quick-release latch that protects against drops from accidental jarring. Bracket shall be listed for use with specified fire extinguisher.

27.11. SURFACE CONDITIONS

A. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of work. Do not proceed until unsatisfactory conditions are corrected.

27.12. INSTALLATION

A. Bracket-Mounted Fire Extinguishers:

1. Install fire extinguisher no more than 48 inches above finished floor measured to the top of the operating handle.
2. Clearance between bottom of fire extinguisher and finished floor shall be no less than 4 inches.
3. Install portable fire extinguisher with operating instructions and gauge facing outward.
4. A minimum of 36 inches in front and 12 inches on each side of the fire extinguisher shall be kept clear to provide access to the fire extinguisher.

B. Fire Extinguisher in Cabinet:

1. Install cabinets as indicated on Contract Drawings, except that fire extinguisher inside shall be not more than 48 inches above finished floor measured to the top of the operating handle.
2. Clearance between bottom of fire extinguisher cabinet and finished floor shall be no less than 4 inches.
3. Install portable fire extinguisher with operating instructions and gauge facing outward.
4. A minimum of 36 inches in front and 12 inches on each side of the fire extinguisher cabinet shall be kept clear to provide access to the fire extinguisher.

27.13. FIRE EXTINGUISHER SIGNAGE

A. Provide signage in accordance with NFPA 1, NFPA 10, and Contract Drawings.

B. Provide vertical signage on door of fire extinguishers cabinet with the words “FIRE EXTINGUISHER” in red letter decals.

C. Provide additional signage decal above fire extinguishers and cabinets installed in parking areas and in similar areas where visibility of the fire extinguisher or cabinet is routinely blocked. Identify bracket-mounted fire extinguisher or fire extinguisher cabinet with the words “FIRE EXTINGUISHER” in red letter decals applied to mounting surface above.

27.14. MEASUREMENT AND PAYMENT

A. Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXVIII FIRE SUPPRESSION PIPING AND SPRINKLERS

28.1. SUMMARY

A. The work includes installation of new automatic wet pipe sprinkler systems to afford 100 percent complete fire protection coverage throughout the indicated areas. The design, equipment, materials, installation, and workmanship of the sprinkler system shall be in strict accordance with the required and advisory provisions of NFPA 13, except as modified herein.

B. The sprinkler systems shall include all materials, accessories, and equipment necessary to provide a system complete and ready for use. Design and installation of the system shall be with full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage. Devices and equipment for fire protection service shall be listed by the Underwriters' Laboratories, Inc. (UL) or approved by FM Approvals (FM). In the National Fire Protection Association (NFPA) publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Reference to the "authority having jurisdiction" shall be interpreted to mean the Building Department and Fire Department. Reference to the "Building Department" on the drawings and herein shall be interpreted to mean the City and County of Honolulu Department of Planning and Permitting; reference to the "Fire Department" shall be interpreted to mean the Honolulu Fire Department. "Provide" shall mean "furnish and install" when used herein. The work shall begin at the points indicated.

28.2. RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Firestopping specified in ARTICLE LXIX PENETRATION FIRESTOPPING.

B. Painting work specified in ARTICLE LXXXIII INTERIOR PAINTING.

C. Signage specified in ARTICLE XII PROJECT SIGN.

D. Wet system specified in specified in ARTICLE XXII WATER SYSTEM.

28.3. DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

A. ASTM: American Society for Testing and Materials.

B. AWWA: American Water Works Association.

C. FM: Factory Mutual.

D. FPSI: Fire Protection Special Inspector.

E. NFPA: National Fire Protection Association.

F. PSI: Pounds per Square Inch.

G. UL: Underwriters Laboratories, Inc.

28.4. CODE, STANDARDS, AND REGULATIONS

A. The latest publications listed below form a part of this specification. The publications are referred to in the text by the basic designation only.

1. American Society for Testing and Materials (ASTM) International Publications:

ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	Electric-Resistance-Welded Steel Pipe

ASTM A 795	Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

2. American Water Works Association (AWWA) Publications:

AWWA C 105	Polyethylene Encasement for Ductile-Iron Pipe
AWWA C 110	Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. for Water
AWWA C 111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C 115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray Iron Threaded Flanges
AWWA C 151	Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C 153	Ductile-Iron Compact Fittings for Water Service
AWWA C 600	Ductile-Iron Water Mains and Their Appurtenances

3. FM Global:

FM AG	(Update Online) Approval Guide

4. National Fire Protection Association:

NFPA 1	Uniform Fire Code
NFPA 13	Installation of Sprinkler Systems
NFPA 24	Private Fire Service Mains and Their Appurtenances
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm and Signaling Code Handbook.

5. FM Global:

UL FPED	(Updated Online) Fire Protection Equipment Directory
UL FRD	(Updated Online) Fire Resistance Directory.

B. Installation of all work in this Section shall be made in accordance with State Department of Health Regulations, the National Fire Protection Association, the International Building Code, and the Uniform Fire Code.

C. All applicable codes, regulations and ordinances of public bodies having jurisdiction are considered a part of these specifications. All work installed and materials provided must comply with the current edition of such codes, regulations, and ordinances.

28.5. CONTRACT DRAWINGS

A. Contract Drawings are essentially diagrammatic, indicating general layout and approximate locations toward establishing the scope for a uniform estimating basis for all bidders. They are not intended to be detailed construction working drawings.

B. Piping arrangements shall fit into space allotted. Reasonable modifications to indicated locations and arrangement to suit job conditions shall not constitute basis for requesting additional funds from the State.

C. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his or her work to the structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself or herself with all details of the work and notify the Contracting Officer of any discrepancy before performing any work.

28.6. SUBMITTALS

A. Partial submittals will not be acceptable. The Contracting Officer will review and approve all submittals. Before work is commenced, submit for approval complete sets of Manufacturer's Product Data and Shop Drawings for the wet pipe fire sprinkler systems. Contractor shall check the submittals and shop drawings and certify that they are correct and in compliance with the Contract Drawings and Specifications. Submit 6 hard copies or an electronic copy of the following for approval.

B. Manufacturer's Product Data:

1. As soon as practicable and before installation of any materials or equipment has begun, the Contractor shall submit a complete list of materials and equipment together with names and addresses of manufacturers, catalog numbers, and trade names to the Contracting Officer for approval

2. Annotate descriptive data to show the specific model, type, and size of each item the Contractor proposes to furnish.

3. Approval of materials will be based on manufacturer's published rating. Any materials and equipment that are not in accordance with these specifications may be rejected.

C. Shop Drawings:

1. Provide shop drawings showing the wet pipe fire sprinkler systems to be installed by the Contractor. Prepare shop drawings on sheets 24 inches by 36 inches using a drawing scale not less than 1/8 inch = 1 foot. Shop drawings shall be prepared in accordance with NFPA 13 and include all data essential to the proper installation of the system. Do not commence work until the design of the systems and the various components have been approved.

2. Prior to start of any construction, required copies of to-scale shop drawings of fire sprinkler piping, sprinkler heads, valves, etc. shall be submitted for review. No work shall be started without approval of the Contracting Officer. Shop drawings shall be fully dimensioned to show that the equipment and connections thereto fit within the space provided.

3. Review of shop drawings is confined to arrangement of equipment only and does not relieve the Contractor from responsibility for proper fit, performance, and construction. Any deviation from the Contract Drawings and/or 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 a minimum and the Contracting Officer retains the right to judge the equality of any variation.

D. Calculations:

1. Submit required copies of calculations, together with shop drawings, for review prior to start of construction.

2. Hydraulic Calculations: Provide computer generated hydraulic calculations for the wet pipe fire sprinkler systems, prepared in accordance with this specification and standards referenced herein. Calculations shall be stamped by a Professional Engineer registered in the State of Hawaii.

3. Sway Bracing Calculations: Provide seismic bracing calculations prepared in accordance with NFPA 13.

E. Certificates of Compliance:

1. Contractor's material and test certificates for underground and aboveground piping per NFPA 13.

2. Pipe and fittings.

F. Field Posted As-Built Drawings: Upon completion of work, submit accurate as-built drawings to the Contracting Officer. As-built fire sprinkler shop drawings shall be stamped by a Professional Engineer registered in the State of Hawaii. Show exact locations and sizes, as actually installed, of the fire sprinkler systems on these record "as-built" drawings. Include a copy of the record drawings in each copy of the operation and maintenance manual described below.

G. Operational and Maintenance Instructions: Complete sets of bound instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the State. Each set shall be permanently bound and shall have a hard cover One complete set shall be furnished at the time the test procedure is submitted and the remaining sets shall be furnished before the contract is completed. The following identification shall be inscribed on the cover: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", the name and location of the building, the name of the Contractor. Flysheets shall be placed before instructions covering each subject. The instructions shall be on sheets approximately 8-1/2 inch by 11 inch with large sheets of drawings folded in. The instructions shall include, but shall not be limited to the following:

1. Table of Contents.

2. System layout showing sprinkler heads, piping, valves, and controls.

3. A control sequence describing start-up, operation, and shutdown..

4. Operating and maintenance instructions for each new piece of equipment, including lubrication instructions.

5. Manufacturer's bulletins, catalog cuts of new equipment, and descriptive data.

6. Equipment component lists and recommended spare parts.

7. All approved shop drawings, certificate of chlorination, certificate that the work conforms to all applicable codes.

8. Operation and maintenance bulletins.

9. Contractor and Manufacturer's warranty information.

H. Guarantee:

1. Contractor and Installer shall guarantee and certify in writing all work in this section for a period of 2 years. Contractor shall be responsible for all damages to any part of premises during equipment installation work under this section.

2. The entire fire protection installation described hereinafter shall be guaranteed as a complete working unit for a period of 2 years. In the event of failure due to faulty workmanship or materials during this period, all said failures shall be corrected to the satisfaction of the Contracting Officer at no additional cost to the State for labor and material.

3. The 2-year guarantee shall start at the end of 30 consecutive days of trouble-free operation after acceptance by the State.

4. The above guarantee shall not be interpreted as voiding, limiting, or reducing any equipment manufacturer's warranty or any guarantee permitted by law.

28.7. OMISSIONS

A. It is the intent of the plans and specifications to provide a complete installation. Should there be omissions, the Contractor shall call the attention of the Contracting Officer to such omissions 15 days in advance of the date of bid opening so that the necessary corrections can be made.

28.8. PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Furnish new equipment, 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 contract period after installation.

B. Pipe and fittings shall be stored on pallets or blocks a minimum 2 inches above the ground to prevent foreign material from entering piping prior to installation. Pipe ends shall be capped to prevent dirt, water, or other residue from entering.

28.9. MATERIALS AND EQUIPMENT

A. All materials shall be new, of equal or better quality of materials specified. For ease of maintenance and parts replacement, select equipment from a single manufacturer as much as possible.

B. All devices and equipment for fire protection service shall be UL listed or FM approved.

28.10. DESIGN OF SPRINKLER SYSTEM

A. Hazard Classification shall be in accordance with NFPA 13 and as indicated on Contract Drawings.

B. Location and spacing of sprinklers shall be in accordance with NFPA 13. Sprinklers shall be spaced uniformly on branch lines.

C. Distribution of water shall be essentially uniform throughout the hydraulically calculated most remote area.

D. Size pipe to provide the specified density when the system is discharging the specified total maximum required flow.

E. Design area shall be in accordance with NFPA 13. Minimum design area shall be as indicated on Contract Drawings. Reductions for quick response-type fire sprinklers below the minimum design area indicated on Contract Drawings will not be permitted. The sprinkler discharge design area shall be the hydraulically most remote area as defined in NFPA 13.

F. Hydraulic calculations shall include an outside hose allowance for hose streams as indicated on Contract Drawings.

G. Hydraulic calculations shall utilize the available water supply indicated on Contract Drawings.

H. Provide a design which is complete in all regards including, but not necessarily limited to.

1. Hydraulically designed, overhead wet pipe automatic sprinkler system including piping and sprinkler heads in accordance with NFPA 13.

2. Testing.

I. Arrangement: Conceal piping in areas with finished ceilings.

J. Friction losses in pipe shall be calculated in accordance with Hazen-Williams formula with coefficient "C" value of 120 for steel pipe in the wet-pipe system, and 140 for cement lined ductile iron underground piping. Friction loss for flexible pipe drops shall be based on manufacturer's literature.

28.11. EQUIPMENT AND DEVICES

A. Fire Sprinklers:

1. Provide automatic closed head sprinklers as indicated on Contract Drawings. New sprinklers shall not be equipped with O-ring seals. Sprinklers shall be UL listed or FM approved.

2. Provide a metal cabinet with spare sprinkler heads, 3 sprinkler stoppers, and one sprinkler head wrench adjacent to the main fire sprinkler risers of each building. The quantity and types of spare sprinkler heads shall be provided as specified in NFPA 13. Label spare cabinet with location(s) fire sprinklers are installed.

B. Fire Sprinkler Piping:

1. Aboveground Piping System: Provide equipment and devices in accordance with item entitled "ABOVEGROUND PIPING SYSTEMS" hereinbelow.

2. Underground Piping System: Provide equipment and devices in accordance with item entitled "UNDERGROUND PIPING SYSTEMS" hereinbelow.

C. Alarm Check Valve Assembly: Provide variable pressure type alarm check valve assemblies with retarding chamber, alarm test valve, alarm shutoff valve, pressure gauges, accessories, and appurtenances for the operation of the fire sprinkler system. UL listed or FM approved electronic pressurized operating switch with adjustable, instantly recycling pneumatic retard may be installed in lieu of retarding chamber and conventional pressure switch.

D. Floor Control Valve Assembly: Provide floor control valve assemblies to be used as individual floor isolation valves where indicated and install as shown on Contract Drawings. UL listed floor control valve assemblies will be permitted. Provide hand nut wheels for control valves. Provide butterfly control valves, check valve, tamper switch, water flow switch, test and drain connection, and valve signage for each floor control valve assembly.

E. Alarm Pressure Switch: Provide switches with opener or closer for the automatic transmittal of an alarm signal to the fire alarm control panel. Connect into the building fire alarm system unless otherwise indicated on Contract Drawings.

F. Valve Tamper Switch: Provide switches for butterfly valves with circuit opener for automatic transmittal of a supervisory signal to the fire alarm control panel. Connect to building fire alarm system unless otherwise indicated on Contract Drawings.

G. Valves: Provide valves of types approved for fire service. Provide butterfly valves as indicated on Contract Drawings. Valves shall open by counterclockwise rotation. Check valves shall be flanged or grooved, clear opening swing-check type with flanged inspection and access cover plate for sizes 4 inches and larger.

H. Water Motor Alarm: Provide alarm of the approved weatherproof and guarded type, which will sound locally upon the flow of water in the sprinkler system. Mount alarm on the exterior wall as indicated on Contract Drawings; water shall be discharged to a safe point outside the building.

I. Fire Department Connection: Provide 2-way flush type fire department connection with two 2-1/2 inch inlets and a 4-inch outlet. Provide cast brass or ductile iron body connections, NH threads, pin lug hose thread swivels, pin lug plugs with chain, and bronze nameplate lettered "AUTO SPKR FIRE DEPT CONN" and lettering indicating the building the fire department connection is serving, or similar wording.

J. Valve Seals, Tags, Signage, and Charts.

1. Seals: Provide brass cross-linked chain, all brass padlock, and 2 keys for each manually operated shutoff valve required to be sealed in the open position, unless provided with an electronic valve tamper switch.

2. Signs: Provide identification signs of standard design, fastened securely at designated locations in accordance with NFPA 13 and item entitled "SPRINKLER SYSTEM SIGNAGE" hereinbelow.

K. Sprinkler Guards: Sprinkler guards shall be UL listed or FM approved. Provide in the following locations.

1. As indicated on Contract Drawings.

2. Fire sprinkler bulb or link located less than 7 feet above finished floor.

3. Where sprinklers are subject to potential mechanical damage.

Fire sprinkler guards are permitted to be omitted on concealed-type fire sprinklers.

L. Automatic Air Release Vent: Provide in accordance with NFPA 13. Air release vent shall be automatic-type that does not require manual operation of valve. Maximum working pressure of air-release vent shall not be less than the fire sprinkler system maximum working pressure.

M. Hydraulic Design Data Nameplate: Provide permanently marked metal or rigid plastic hydraulic design data nameplate on the building main fire sprinkler riser. Nameplate shall display data including, but not limited to, the location of the design area, discharge density, water flow and residual pressure demand at the point where the sprinkler supply enters the building, occupancy classification or commodity classification and maximum permitted storage height and configuration, hose stream allowance, name of installing Contractor, and installation date.

N. Fire Protection Systems Document Box: Provide a fire sprinkler system record and document box. Box shall be a steel cabinet with red finish, designed to store fire sprinkler records, including a copy of the Operating and Maintenance Instructions manual. Install cabinet adjacent to the main fire sprinkler riser assembly and be prominently labeled "SYSTEM RECORD BOX" or as indicated in the Contract Drawings.

O. 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 Contracting Officer.

28.12. ABOVEGROUND PIPING SYSTEMS

A. Pipe: Provide in accordance with NFPA 13, except that all piping shall be black steel. Pipe sizes less than 2-1/2 inches in diameter shall be Schedule 40. Pipe sizes 2-1/2 inches and larger shall be Schedule 10. Plastic pipe and copper tubing shall not be permitted.

B. Fittings: Fittings shall be welded, threaded, or grooved-end type, UL listed or FM approved for use in sprinkler systems. Fittings for pipe sizes 1-1/4 inches in diameter and smaller shall be threaded. Make changes in pipe sizes through standard tapered reducing pipe fittings. Use of bushings will not be permitted. Press-fit fittings, snap-fit fittings, U-bolt style mechanical tees, and plain-end fittings that utilize steel gripping devices to bite into pipe when pressure is applied will not be permitted. Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape or pipe cement; apply on only on male threads. Welding shall be performed in the shop; field welding will not be permitted. All pipe and fittings aboveground and exposed to ambient air shall be painted.

C. Flexible Pipe Drops: Flexible piping assembly shall be stainless steel construction with braided hose, one-inch nominal diameter minimum, UL listed or FM approved. Provide flexible piping manufacturer's steel mounting bracket assembly compatible with suspended ceiling systems to be installed.

D. Pipe Hangers and Bracing: Provide hangers, supports, inserts, earthquake sway bracing, branch line restraint, and associated items to properly support fire sprinkler system piping in accordance with pertinent provisions of NFPA 13. Listed clamps shall be used to secure hanger, earthquake sway bracing, and restraint assemblies to metal building structural members, such as beams, trusses, and purlins; through bolts or other methods which require drilling or other means of removing portions of the metal structural element will not be permitted. Provide retaining straps for all beam clamps. Provide means to restrain the upward movement of piping at the last hanger, such as surge clips, on all branch lines and armovers for all sprinkler systems. Provide means to restrain the lateral movement of piping at the last hanger, such as sway bracing, on all branch lines and armovers for all sprinkler systems. Provide additional hangers to support the concentrated loads in piping between hangers, such as for flanged valves. All hangers, rods, bracing, and hanger components exposed to ambient air shall be painted.

E. Sway Bracing and Branch Line Restraints: Provide sway bracing on all new fire sprinkler piping in accordance with NFPA 13.

F. Drain Piping:

1. Drain piping shall discharge at a safe point outside the building.

2. Provide auxiliary drains as required by NFPA 13.

3. Drain piping and fittings shall be steel. Exterior exposed piping shall be painted to match exterior wall.

G. Pipe Penetrations: Where piping passes through walls, floors, roofs, and partitions, provide clearances in accordance with NFPA 13. Cores through concrete walls shall be ground smooth. Firmly pack annular space with insulation and caulk at both ends of sleeve with a flexible, waterproof cement. For penetrations through fire rated walls, floor/ceiling, or roof assemblies, fire stop penetration per UL listed firestop system.

H. Escutcheon Plates: Provide approved one piece or split hinge type plates for piping passing through floors, walls, and ceilings in exposed areas. Provide chromium plated metal plates where pipe passes through finished ceilings. Provide other plates of steel or cast iron with aluminum paint finish. Securely anchor plates in place with set screws or other approved positive means.

28.13. UNDERGROUND PIPING SYSTEMS

A. Pipe: Provide in accordance with NFPA 13. Provide Class 52 outside coated, cement-mortar lined, ductile iron pipe and fittings at base of riser. Provide thrust blocks at all changes in direction. Restrain pipe risers with steel rods extending from the underground elbow to the flange above grade. Minimum depth of cover shall be 36 inches at finished grade. Piping beyond base of riser shall comply with ARTICLE XXII WATER SYSTEM.

B. External Corrosion Protection: Provide 0.008 inch linear low-density polyethylene or 0.004 inch high-density cross-laminated polyethylene encasement for all underground piping and fittings.

28.14. SURFACE CONDITIONS

A. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of work. Do not proceed until unsatisfactory conditions are corrected.

28.15. INSTALLATION

A. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

B. Install the work of this section in strict accordance with the approved design drawings and the requirements of the Fire Department, Building Department, and applicable governmental agencies.

C. Equipment, material, installation, and workmanship shall be in accordance with NFPA 13 except as modified herein. Install piping straight and true to bear evenly on hangers. Keep the interior of new piping affected by the Contractor's operations thoroughly clean of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping and fittings so that water and foreign matter will not enter the pipes or fittings. Inspect piping before placing into position. Piping shall be inspected, tested, and approved before covering or concealing. Seal both ends of penetrations through fire rated walls, floor/ceiling assemblies, and roof assemblies to maintain fire resistive integrity with UL listed through-penetration fire stop assembly. Sprinkler piping shall be supported from the building structure; sprinkler piping shall not be supported from sprinkler piping.

D. Contractor shall center sprinkler heads in ceiling tiles as indicated on Contract Drawings.

E. Conceal all pipes in areas with finished ceilings.

F. Provide earthquake sway bracing and branch line restraint in accordance with NFPA 13.

28.16. FIELD PAINTING OF SPRINKLER SYSTEMS

A. Aboveground and exposed underground piping, valves, hangers, bracing, rods, drains, and other various fire sprinkler components which are not concealed in the ceiling space shall be painted. Factory-painted equipment is considered equivalent to the requirements below.

B. Clean, pretreat, prime, and paint parts of new sprinkler systems, including valves, piping, fittings, hangers, miscellaneous metalwork, and accessories. Apply coatings only to clean, dry surfaces using clean brushes. Clean surfaces to remove dust, dirt, rust, and loose mill scale in conformance with the paint manufacturer’s recommendations. Paints shall be free of cadmium, zinc-chromate, strontium-chromate, lead, and mercury. Paint shall be for ferrous metals suitable for corrosive environments.

C. Total paint thickness shall be 6 mil minimum dry film thickness (DFT) unless otherwise specified per manufacturer's instructions. Painting shall be at rates of application per layer in strict accordance with the manufacturer's direction to achieve the total dry film thickness specified.

D. Exercise care to avoid painting of sprinkler heads. Do not remove materials used to protect sprinkler heads while painting is in process. Upon completion of painting, remove the aforementioned protective materials. Replace sprinkler heads which are painted with new clean sprinkler heads of proper type.

28.17. SPRINKLER SYSTEM SIGNAGE

A. Provide pipe marking system consisting of 2 inch wide red self-adhering plastic tape bands lettered "FIRE SPRINKLER" for wet pipe fire sprinkler system main piping. Install pipe markers on exposed piping and piping within accessible portions of suspended ceilings including ceiling tiles and access panels in gypsum board ceilings. Install pipe markers at maximum 20 foot intervals. Install pipe markers on clean, dry surfaces.

B. All control, drain, venting, and test connection fire sprinkler system valves shall be identified with permanently marked metal or rigid plastic identification signage, secured with corrosion-resistant wire, chain, or other similar permanent means. Valve identification signage shall indicate its function and what it controls. Control valve signage shall identify the portion of the building served.

C. Hydraulic Design Data Nameplate: Provide embossed metal or rigid plastic hydraulic design data nameplate(s) on the every fire sprinkler riser.

28.18. FIELD TESTING OF FIRE SPRINKLER SYSTEMS

A. Preliminary Testing and Inspections: Testing shall be performed in accordance with NFPA 13 and this specification. Testing shall be considered successful when accepted by the Fire Protection Special Inspector (FPSI). Prior to start of work, the Fire Sprinkler Contractor shall coordinate with the FPSI to determine which tests are required to be witnessed by the FPSI. The FPSI shall be given a minimum one week's notice prior to required testing and inspections.

Contractor shall furnish appliances, equipment, instruments, connecting devices, 2-way radios, and personnel for tests. Fire Sprinkler Contractor shall furnish test results to the Contracting Officer. Fire Sprinkler Contractor shall be present for all testing and inspections

1. Underground Piping Visual Inspection: Fire sprinkler supply piping, fittings, thrust blocks, etc. will be visually inspected for conformance by the FPSI, when deemed required by the FPSI. Thrust blocks and fittings shall be uncovered during visual inspection. Items found in non-conformance with NFPA 13, this specification, approved manufacturer's published data, and approved shop drawings shall be corrected by the Contractor.

2. Underground Hydrostatic Testing: Hydrostatically test underground piping supplying wet pipe fire sprinkler systems at 200 PSI for a period of not less than 2 hours. Thrust blocking shall be installed and piping shall be center-loaded to prevent pipe uplift during testing. Pipe fittings shall remain uncovered and shall show no leakage in accordance with NFPA 13 or test gauge pressure shall not reduce below 200 PSI. The FPSI shall witness all hydrostatic testing, when deemed required by the FPSI. Fire Sprinkler Contractor shall furnish test results to the FPSI.

3. Underground Flushing: Flush new underground fire sprinkler supply between

connection to water main and fire sprinkler riser flange above grade. Underground fire sprinkler piping shall be flushed prior to connecting to aboveground fire sprinkler piping system. Provide pipe fittings, piping, restraints, hoses, etc. to discharge water during testing to a safe location. Pipe discharge diameter shall be a minimum 4 inches or two 2-1/2 inch hoses. The flushing test shall be considered successful when no debris is observed. The FPSI shall witness all underground flushing, when deemed required by the FPSI.

4. Aboveground Welded Piping Inspection: Welded piping shall be inspected for conformance with NFPA 13. The Fire Sprinkler Contractor will be responsible to check each welded outlet. Piping found to be in non-conformance with NFPA 13 shall be immediately removed from the job site.

5. Aboveground Piping Visual Inspection: Fire sprinklers, piping, hangers, sway bracing, branch line restraint, etc. will be visually inspected by the Fire Sprinkler Contractor and by the FPSI, when deemed required by the FPSI. Items found in non-conformance with NFPA 13, this specification, approved manufacturer's published data, and approved shop drawings shall be corrected by the Contractor.

6. Aboveground Hydrostatic Testing: Hydrostatically test aboveground piping of wet pipe fire sprinkler systems at 200 PSI for a period of not less than 2 hours. Piping shall show no leakage or reduction in pressure below 200 PSI. Piping above ceilings shall be tested before installation of ceilings. The FPSI shall witness all hydrostatic testing, when deemed required by the FPSI. Fire Sprinkler Contractor shall furnish test results to the FPSI.

7. Wet Pipe Fire Sprinkler System Operational Testing: Fire Sprinkler and Fire Alarm Contractor shall be present and conduct all testing. Operate all valves. Test alarms and other devices. Tests on equipment shall be performed and include visual equipment checks to ensure compliance with approved shop drawings. The FPSI shall witness testing, when deemed required by the FPSI. Fire Sprinkler Contractor shall furnish test results to the FPSI.

8. When tests have been completed and corrections made, submit signed and dated certificates, similar to those specified in NFPA 13 with a request for formal inspection and tests. Submit corrected as-builts to the FPSI in accordance with paragraph entitled "Field Posted As-Built Drawings" hereinabove.

B. Formal Inspection and Tests: The Building Department shall witness formal tests and approve the systems before they are accepted. The General Contractor shall submit the request for formal inspection at least 15 days prior to the date the formal inspection is to take place. Experienced technicians regularly employed by the Fire Sprinkler Contractor shall be present for the entire duration of the inspection. At this inspection, the installing Contractor shall repeat any or all of the required tests as directed. Correct defects in the work provided by the installing contractors and perform additional tests until it has been demonstrated that systems comply with all contract requirements. Contractor shall furnish appliances, equipment, instruments, connecting devices, 2-way radios, and personnel for tests.

C. Inspection Tags: Upon successful completion of formal inspection and testing, affix yellow inspection decal on fire department connection in accordance with Honolulu Fire Department requirements. Inspection decal shall be provided by a Contractor holding valid inspection, testing, and maintenance license(s) from the Honolulu Fire Department for the specific fire protection systems tested.

28.19. TRAINING REQUIREMENTS

A. Prior to final acceptance, the Contractor shall provide operation and maintenance training to the State. Each training session shall include emergency procedures, operational procedures, and unique maintenance and safety requirements. Dates and times of the training session shall be coordinated not less than 2 weeks prior to the session.

28.20. MEASUREMENT AND PAYMENT

A. Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXIX – CAST-IN-PLACE CONCRETE

29.1 GENERAL

The work shall include the furnishing of all labor, materials and equipment necessary to construct, complete in place, all cast-in-place concrete as shown on the plans and as specified herein.

29.2 MATERIALS

(A) Portland Cement - shall conform to "Standard Specifications for Portland Cement", ASTM C150, Type I/II.

(B) Blended Hydraulic Cement - shall conform to "Standard Specifications for Blended Hydraulic Cements", ASTM C595, Type IL(MS).

(C) Aggregates for Concrete - shall conform to "Standard Specifications for Concrete Aggregates" ASTM C33, except that local aggregates that have been shown by tests or actual service to produce concrete of required strength, durability and wearing qualities, may be used when approved by the Director.

(1) Fine Aggregate - Coral beach sand or basalt sand and No. 4 crushed rock of close grained, hard, bluish gray lava rock. Fine aggregate shall be clean, free from salt, vegetable loam, earth, elongated piece, disintegrated rock or other deleterious substances.

(2) Coarse Aggregate - Broken stone obtained from clean, hard, blue lava rock or other approved inert materials of similar characteristics, free from disintegrated stone and all adherent coatings. Size of aggregate shall be 3/4-inch maximum.

(D) Water – used in mixing concrete shall be clean salt-free, potable water.

(E) Admixture

(1) Water reducing and/or water reducing and set retarding admixture shall conform to ASTM C494, Type F or G, and shall be mixed in concrete in accordance with directions of manufacturer.

(2) Corrosion inhibiting admixture shall be calcium nitrite based , shall conform to ASTM C1582, and shall be mixed in concrete in accordance with directions of manufacturer.

(F) Reinforcing Steel - shall be deformed ASTM A615, Grade 60. Welded wire fabric shall conform to ASTM A1064 and shall be galvanized.

(G) Expansion Joint Filler - shall be pre-formed, non-extruding type, conforming to ASTM D1751, 1/2-inch thick.

(H) Joint Sealants - shall conform to ASTM D6690 or C920, Type M, Class 25, Use T for slopes 3 percent maximum, or ASTM C920, Type M, Grade NS, Class 25, Use T for slopes greater than 3 percent.

(I) Epoxy Grout and Epoxy Bonding Compound - shall be two component resins,

polysulfide free, high modulus, high strength epoxy adhesive..

(J) Vapor Retarder - shall be of polyethylene film, minimum 0.01" thick, conforming to ASTM E1745, Class A.

(K) Liquid Chemical Floor Hardeners and Sealers - Hardener must be colorless aqueous solution containing a blend of inorganic silicate or siliconate material and components combined with a wetting agent that penetrates, hardens, and densifies concrete surfaces. Submit manufacturer's instructions for placement of liquid chemical floor hardener. Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit manufacturers instructions for placement of sealers.

(1) Manufacturers / Approved Equals

(a) Basis of Design: Euclid Chemical Company Euco Diamond Hard Liquid Densifier Sealer (or approved equal).

- Approved Equal: Any manufacturer providing liquid chemical floor hardeners and sealers that meet the material, performance, and installation requirements.
- VOC Content: <5 g/L
- Abrasion/Wear Resistance: ASTM C779
- Coefficient of Friction: ASTM F609

(b) Basis of Design: Euclid Chemical Company UltraGuard Protectant and Densifier for Concrete Floors (or approved equal).

- Approved Equal: Any manufacturer providing liquid chemical floor hardeners and sealers that meet the material, performance, and installation requirements.
- Water based polymeric sealer
- Minimum 20% solids
- Contains stain resistant additive
- Densifying characteristics of lithium scale

29.3 TESTING AND INSPECTION

(A) Mill Laboratory Test, Reports and Affidavits - Furnished by the manufacturer, certifying that all materials delivered to the project conform to these specifications.

(B) Compressive Strength and Slump Tests: The Contractor shall obtain the services of an approved independent testing laboratory to make and test cylinder specimens for compressive strength in accordance with ASTM C39 and slump of concrete in accordance with ASTM C143.

Four test cylinders shall be taken for each compressive strength test at a frequency of one set for every 100 cubic yards of concrete, and as directed due to any apparent change of consistency or as deemed appropriate by the Director. One specimen shall be tested at 7 days, two at 28 days, and one shall be held in reserve in the event that additional testing is required. The concrete shall be considered acceptable if the average of both cylinders tests at 28 days meets or exceeds the specified design compressive strength (f'c) and neither test specimen falls more than 500 psi below that strength.

Should tests reveal that concrete is deficient in strength, additional testing of the

remaining cylinder and, if directed, testing of core samples of in-place concrete shall be accomplished at no additional cost to the State.

29.4 CONCRETE MIX DESIGN

(A) All concrete shall consist of cement, fine and coarse aggregate, admixture and water.

(B) All concrete shall have a 28 day compressive strength as follows: 4,000 psi for all facilities, including foundations, slabs, and deck topping; 3,000 psi for other minor miscellaneous concrete. All concrete shall have a maximum slump of 3-1/2" plus or minus 1/2". Slump may be increased to 6", provided the increase in slump is achieved by addition of admixtures rather than water. For 28 day compressive strengths, the cement content in bags of cement per cubic yard of concrete shall be 6.50 bags for 4,000 psi concrete and 5.50 bags for 3,000 psi concrete. Water cement ratio shall not exceed 0.45.

(C) Submit concrete mix design to the Engineer for approval. Note that concrete strength requirement is minimal only. No claim for extra compensation for the furnishing of concrete of greater strength in order to accomplish other requirements above specified will be considered by the Engineer.

29.5 CONSTRUCTION

(A) Concrete

(1) Concrete shall not segregate nor cause bleeding. It shall work readily into corner and angles of form and around reinforcement without segregation of materials or an excess of water on the surface. It shall produce exposed surfaces of uniform color and smooth appearance without honeycomb.

(2) Ready-Mix Concrete -shall conform to ASTM C94 with certificates furnished by the mixing plant that concrete has a 28 day compressive strength and maximum slump as specified above. Delivery tags with each load shall indicate yardage of concrete, amount of water and amount of cement. Plant shall have sufficient capacity so that the construction schedule can be maintained. The time elapsing between the introduction of the mixing water between the cement and the mixing aggregate and placing of the concrete in final position in the form shall not exceed 75 minutes.

(B) Forms

(1) Forms shall be constructed to slopes, lines, shapes and dimensions shown, installed and maintained plumb and straight and sufficiently tight to prevent leakage, and securely braced and shored to prevent displacement, and to safely support construction loads. Falsework shall be designed with adequate strength, rigidity and durability to successfully resist movement from wave action of the season; to safely carry the full load of fresh concrete and all construction loads without any settlement or deflection; to rigidly hold their shape and position

under internal vibration of fresh concrete.

(2) In no case shall the finished product deviate from established lines, grades and dimensions in excess of those tolerances listed in Section 203 of the ACI Guide to Formwork for Concrete (ACI 347-14). Any such deviation in excess of the allowable tolerance will be just cause for rejection of the finished product. Exposed concrete surfaces shall be formed with new sound Plywood or lined with "Form Ply" or approved equal. Plywood shall be commercial standard Douglas Fir, moisture resistant concrete form plywood not less than 5-ply and at least 5/8" thick. Forms shall be coated with a bond breaking material prior to the placement of reinforcing steel.

No construction loads exceeding the structural design loads shall be supported upon any unshored portion of the structure under construction

(C) Reinforcement

(1) Reinforcing steel bars and wire fabric shall be provided in sizes, lengths and configurations as indicated on the plans and shall be thoroughly cleaned before placing and again before placing of concrete to remove loose mill scale, rust, oil and all coatings that will destroy or reduce the bond. All items shall be accurately positioned and secured in place as indicated on the plans and as herein specified.

Annealed steel wire of not less than 16 gage shall be used to secure reinforcement. Reinforcement shall be placed in specified positions not exceeding the ACI Building Code (ACI 318-19). Unless otherwise noted, cleaning, bending and placing of reinforcement shall be done in accordance with the standard practice of the Concrete Reinforcing Steel Institute. Splicing of bars, except where shown, will not be permitted without the approval of the Director. Splices where permitted, shall be lapped as indicated on the drawings.

(2) Concrete cover over reinforcing shall be provided as indicated on the drawings.

(3) All reinforcement shall be observed by the Harbors Construction Engineer prior to closing of forms. This, however, shall not be construed to relieve the Contractor of his responsibility to place all reinforcing in accordance with the plans.

(D) Inserts -Provide and install all concrete anchors, bolts, pipe sleeves of polyvinyl chloride pipe, Class 150, and other fastening devices required and as shown on the plans. All anchors and bolts shall be hot dipped galvanized. Such embedment shall be securely fastened and rigidly held against movement during other work and the placing of concrete.

(E) Depositing Concrete

(1) No concrete shall be placed in the absence of the Harbors Construction Engineer who shall be given one day advance notice of placing of concrete.

(2) All sawdust, chips and other construction debris, extraneous matter and excessive water shall be removed from interior of forms. Surfaces shall be clean before placing of concrete.

(3) Concrete shall be deposited as nearly as practicable in its final position. In no case shall vibrators be used to transport concrete inside the forms. Concrete shall be thoroughly compacted by use of high frequency internal vibrators so that the concrete is thoroughly worked around the reinforcement, around embedded items and into corners of forms, eliminating all pockets which may cause honeycombing, pitting or planes of weakness.

(4) Use no concrete that has partially hardened or become contaminated by foreign materials or been retempered.

(5) Generally, carry on concreting as a continuous operation until placing of an individual section is completed.

(F) Curing and Protection -Concrete shall be cured for a period of not less than seven days by water curing or use of curing compounds.

(1) Water Curing -Concrete shall be kept wet by mechanical sprinklers, by ponding, or by any other approved method which will keep the surface continuously wet. Curing Compound -Concrete surfaces shall be sealed with liquid membrane compound conforming to ASTM C309. Curing compound shall not darken the concrete surface and shall be used in strict accordance with the manufacturer's recommendations.

(G) Finishing of Surface -After the concrete has been placed, struck off, consolidated and leveled, the concrete shall not be worked until ready for floating. Floating shall begin when the water sheen has disappeared. The surface shall then be consolidated with power driven floats of the impact type. The slab shall then be steel trowelled to light trowelled finish of uniform smooth texture. See Architectural drawings for additional finish and coating requirements and coordinate finishing with manufacturer’s requirements. Exterior slabs shall then be given a light broom finish.

(H) Finishing of Formed Surfaces -Surfaces shall have all exterior ties removed to a depth of at least one and one-half inches below the surface of the concrete and the resulting holes or depressions cleaned and filled with epoxy grout. Any rock pockets and honeycombing shall be cleaned and filled with epoxy grout. Joint marks and fins shall be smoothed off.

(I) Shrinkage, temperature, and all other cracks in concrete and cement materials in excess of 0.03” wide shall be repaired by the Contractor at no additional payment whether or not the cracks result from defective work of normal causes such as expansion, shrinkage, deflection, and settlement. Contractor shall submit his proposed methods and schedule of repairs for review before starting work.

(J) Crack repair shall restore the full structural integrity of the previously uncracked section. Repair methods shall include epoxy injection, epoxy patching, and other approved methods.

(K) Repair work shall be finished to match and blend with surrounding areas and shall be made to preclude recurrence of cracks at the repair or other locations.

Repair work shall include grooving and joint sealing, elastomeric paint and other methods.

(L) Contractor shall repair all cracks before the final acceptance of the project by the Owner. Contractor shall again repair all old, recurring, and new cracks one year after the date of final acceptance

(M) Installation of nonshrink grout under base plates:

(1) Inspection: The Contractor shall examine the areas and conditions under which nonshrink grout is 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 Contractor. Proceeding with work will imply acceptance of the conditions by the Contractor.

(2) Item to be grouted shall be set in its final position, shimmed and braced as required.

(3) Surfaces shall be clean and free of any loose parts.Installation shall be in accordance with the manufacturer's installation instructions leaving space to be completely grouted.

(4) Grout which has cracked or spalled shall be removed and item shall be re-grouted.

29.6 CONSTRUCTION JOINTS

(A) Construction joints shall be roughened to ¼" amplitude.Submit proposed construction joint locations for approval prior to construction..

29.7 CLEANUP

The Contractor shall clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work and upon completion of the entire concrete and related work.

29.8 BASIS OF MEASUREMENT AND PAYMENT

Concrete structures including pads and sidewalks and other minor concrete structures requiring ordinary reinforcing bars not epoxy coated rebars shall be considered as incidental to the various items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXX - UNIT MASONRY ASSEMBLIES

30.1 GENERAL

This section applies to all construction using CMU blocks for construction including, but not limited to, unit masonry assemblies consisting of the following:

A. Concrete masonry units.

B. Mortar and grout.

C. Reinforcing steel.

D. Ties and anchors.

E. Miscellaneous masonry accessories.

30.1.1 RELATED ARTICLES

Article LXXXVIII - “Interior Painting” testing for moisture and alkalinity.

30.1.2 DEFINITIONS

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

30.1.3 SUBMITTALS

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

B. 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.

C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

D. Each masonry unit weight classification required. List aggregate source.

E. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.

F. Each material and grade indicated for reinforcing bars.

G. Each type and size of anchor, tie, and metal accessory.

H. Test Reports:

1. Compressive Strength and Absorption: For each bearing masonry units.

a. From an independent testing agency, if specifically requested by Construction Engineer.

b. Tests shall be for conformance with the requirements of ASTM C90.

c. Frequency: Test at a minimum of one test per 1000 blocks delivered to Project.

2. Block salt content: If specifically requested by Construction Engineer.

a. From plant quality control division.

b. Test: Content analysis showing percentage of chloride.

c. Frequency: One test for Project if project block is cast from aggregates from a single quarry. Perform additional tests if block made from aggregate from additional sources.

I. Quality Control Inspection Documents: Comply with the following industry documents.

1. NCMA TEK 8-2 (2005): Removal of Stains from Concrete Masonry Walls

30.1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1093 to conduct the testing indicated.

B. 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.

1. Block plant shall maintain a quality control program to monitor and control block salt content.

C. 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.

30.1.5 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 preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, 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.

30.1.6 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.

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: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 90 deg 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.

30.2 PRODUCTS

30.2.1 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 walls and scheduled to be fully grouted.

B. Concrete Masonry Units: ASTM C90 and as follows:

1. Appearance: See Architectural drawings for textures and colors.

2. Unit Compressive Strength: Provide load bearing units with minimum average net-area compressive strength of 2000 psi.

3. Provide units, fully cured and free of cracks and chips on faces intended for exposure.

4. Composition: Manufacture from salt content controlled washed aggregate from a land source quarry.

5. Size (Width): Manufactured to the following dimensions within variations in dimensions only as permissible per ASTM C90:
   a. 8 inches nominal; 7-5/8 inches actual.

6. Weather Exposure: Provide concrete masonry units with water-repellent admixture added during manufacture where units will be exposed to weather.
   a. Manufacturers / Approved Equals
      - Basis of Design: Master Builders Solutions MasterPel 240 Water-Repellent and Efflorescence Control Admixture (or approved equal).
      - Approved Equal: Any manufacturer providing water-repellent and efflorescence control admixture that meet the material, performance, and installation requirements.

30.2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I/II. Provide natural color or white cement as required to produce mortar color indicated.

B. Blended Hydraulic Cement: ASTM C595, Type IL

C. Mortar Cement: ASTM C270, Type S or M.

D. Aggregate for Mortar: ASTM C144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C404.

F. Plasticizer Additive:

1. Acceptable for use in Mortar Cement with current International Code Council Evaluation Service (ICC-ES) acceptance 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 C1602. Clean and free from injurious amounts of oils, acids alkalis, salts, organic materials or other substances that may be deleterious to either mortar or reinforcement.

30.2.3 REINFORCING STEEL

A. ASTM A615/A615M, Grade 60 unless otherwise indicated on the drawings.

30.2.4 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 A82; with ASTM A153, Class B-2 coating.

30.2.5 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 ASTM A307, Grade A; with ASTM A563 (ASTM A563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153, 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 E488, conducted by a qualified independent testing agency.

1. Type: Chemical anchors.

2. Type: Expansion anchors.

3. Type: Undercut anchors.

4. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

5. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 for bolts and nuts; ASTM A666 or ASTM A276, Type 316, for anchors.

6. For Post-installed Anchors in Concrete Masonry: Capability to sustain, without failure, a load equal to four times the loads imposed.

30.2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. 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 0.187-inch steel wire, hot-dip galvanized after fabrication. Commercial plastic units are fabricated for the intended purpose.

1. Provide units with either two loops or four loops as needed for number of bars indicated.

30.2.7 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of ½-cup dry measure tetrasodium polyphosphate and ½-cup dry measure laundry detergent dissolved in 1-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.

30.2.8 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 or approved.

1. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry:

1. The mortar and grout shall be prepared in such manner that the specified properties can be met. 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. Place mortar within 2-1/2 hours after mixing. No materials which start to set shall be retempered.

3. Water-Repellent Mortar Admixture - Liquid water-repellent admixture added to mortar, intended for use with CMUs containing integral water repellent from same manufacturer.
   a. Manufacturers / Approved Equals
      - Basis of Design: Master Builders Solutions MasterPel 240MA Water-repellent and efflorescence-control masonry mortar, grout and stucco admixture (or approved equal).
      - Approved Equal: Any manufacturer providing water-repellent mortar admixture that meet the material, performance, and installation requirements.

C. 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.

1. Grout shall attain not less than 2,000 psi 28-day compressive strength per ASTM C1019 unless noted otherwise on drawings.

2. Conform to ASTMC476 for grout (coarse) mixed on-site. Conform to ASTM for grout designed by ready-mix suppliers.

30.3 EXECUTION

30.3.1 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.

30.3.2 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 laid shall be clean.

B. Masonry units shall not be wet at time of use. Dry units. Using damp units is acceptable.

C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

D. Leave openings for items to be installed before completing masonry. After installing items, 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.

30.3.3 CONSTRUCTION TOLERANCES

A. Comply with the tolerances in The Masonry Society Specification for Masonry Structures 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-inch in 20 feet, nor 1/2-inch maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, nor 1/2-inch maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4-inch in 20 feet, nor 1/2-inch maximum.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8- inch.

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch. Do not vary from adjacent bed-joint and head- joint thicknesses by more than 1/8-inch.

30.3.4 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-inch 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 4-inches horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below unless otherwise indicated on Drawings.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half 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.

E. 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.

F. Grout space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

1. Grout mix: Use one of the grout mixes specified in Part 2 above.

2. Gypsum board joint compound or other gypsum containing compounds are not permitted.

30.3.5 MORTAR MIXES

A. Unless indicated otherwise use the following mortars:

1. All walls: Type M or S (2500 psi) only.

30.3.6 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 3/8-inch thick joints.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

30.3.7 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 cured sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of Section 3.4 of TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements of Section 3.5 of TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height. Provide continuous special inspection for grout pour heights exceeding 5.33 feet.

30.3.8 FIELD QUALITY CONTROL

A. Engage a qualified independent testing agency to perform field quality-control testing indicated below.

1. Payment for these services will be made by Contractor.

2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq.ft. of wall area or portion thereof.

C. Mortar properties will be tested per ASTM C780.

D. Grout will be sampled and tested for compressive strength per ASTM C1019.

30.3.9 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 wall location as approved by Construction Engineer; leave adjacent wall uncleaned for comparison purposes. Obtain Construction Engineer’s approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent 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.

6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

30.3.10 MASONRY WASTE DISPOSAL

A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described below, and other masonry waste, and legally dispose of off State's property.

C. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than four (4) inches in each dimension.

2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Earthwork Section.

3. Do not dispose of masonry waste as fill within eighteen (18) inches of finished grade.

30.4 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS

31.1 GENERAL

A. These general mechanical requirements govern work specified under the following, unless specified otherwise in the individual articles:

1. ARTICLE XXXII – MECHANICAL INSULATION
2. ARTICLE XXXIII – PLUMBING
3. ARTICLE XXXIV – LOW PRESSURE COMPRESSED AIR SYSTEMS
4. ARTICLE XXXV – FUEL DISPENSING
5. ARTICLE XXXVI – UNITARY AIR CONDITIONING EQUIPMENT
6. ARTICLE XXXVII – DUCTWORK AND DUCTWORK ACCESSORIES
7. ARTICLE XXXVIII – CEILING FANS
8. ARTICLE XXXIX – INDUSTRIAL VENTILATION AND EXHASUT SYSTEMS
9. ARTICLE XL – HVAC TESTING, ADJUSTING, AND BALANCING

B. The organization of –these Mechanical Division specifications into sections and articles and arrangement on the drawings are not intended to divide the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. The Contractor is responsible for providing all Work specified in the specifications and indicated on the drawings

C. “Provide” shall mean “furnish and install”. Connect exterior utility systems to building systems 5 feet beyond the building line and as shown on drawings

31.2 QUALITY ASSURANCE

A. The Contractor must furnish all labor, materials, tools and equipment and perform all work and services necessary for a complete and properly operating mechanical system, including all work and equipment, as shown on drawings and as specified, in accordance with provisions of the Contract Documents and completely coordinated with work of all other trades.

B. The Contractor must completely examine the Contract Documents and must report to the Project Manager any error, inconsistency or omission he discovers.

C. Furnish and install all supplementary or miscellaneous items, hangers, supports, details, appurtenances and devices incidental to or necessary for a sound, secure and complete mechanical system where work required is not specifically indicated.

D. Drawings and specifications must be taken together. Provide work specified and not indicated or work indicated and not specified as though mentioned in both.

E. The Contractor must warrant that all materials and equipment furnished under this Contract will be new and that all work will be good quality, free from faults and defects and in conformance with Contract Documents for a guaranteed period of one year after acceptance of project. It must be the Contractor's responsibility to obtain extended warranties for use of all new equipment provided by the Contractor prior to project acceptance at no additional cost to the State.

F. The Contractor must maintain at the site one 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 Project Manager upon request.

G. The Contractor at all times must keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the work, the Contractor must 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 must clean all new equipment, material, items, and accessories.

H. The Contractor must give the Project Manager timely notice of its readiness for testing any work including the data arranged so the Project Manager may observe such testing. The Contractor must bear all cost of such tests.

I. The Project Manager will have the right to accept or reject material, equipment, and/or workmanship and determine when the Contractor has complied with the contract documents

31.3 INSPECTON OF SITE

A. This Contractor shall visit the site and examine the conditions affecting his work before submitting his proposal. The submission of the proposal will be considered evidence that the Contractor has visited the site and no extra payments will be allowed to the Contractor on account of extra work made necessary by his failure to visit the site.

31.4 SUBMITTALS

A. Submit in accordance with ARTICLE XI – REQUIRED SUBMITTALS.

B. Substitution Requests: Substitute materials or equipment may be used if qualified by written permission from the Project Manager. Submit a list of the substitutions with qualifying data for approval prior to bidding. See requirements in PART 1 – GENERAL PROVISIONS.

C. Equipment and Material Submittal: Submit for approval before preparation of shop drawings, 8 sets of submittal data showing manufacturer's name, trade name, catalog model or number, nameplate data, project specification and paragraph reference, performance specifications, certified dimensions, motor sizes and sound power levels by octave bands. See requirements in ARTICLE XI – REQUIRED SUBMITTALS.

D. Shop Drawings: Approval of shop drawings does not relieve the Contractor from responsibility of a complete installation or proper performance. No work shall commence until shop drawings are approved by the Project Manager. Shop drawing submittals must

conform to the requirements in ARTICLE XI – REQUIRED SUBMITTALS except as modified herein:

1. Minimum size of shop drawing sheet will be 22” x 34”.

2. All shop drawing must be to-scale, minimum scale must be the scale used in the Contract Drawings.

3. Shop drawings must include, as a minimum, bottom of duct dimensions, equipment locations, piping locations and heights, equipment bases, support details, wiring diagrams for control and interlock and locations and sizes of pipe sleeves and duct openings, and field verified structural items and ceiling.

4. Shop drawings must indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices and components. Coordinate drawings with other trades to avoid interferences.

5. 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.

6. At the time of submission, the Contractor must inform the Project Manager in writing of any deviations in the Shop Drawings from the requirements of the Contract Documents.

E. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories (UL), proof of such conformance must be submitted to the Project Manager for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual articles. In lieu of the label or listing, the Contractor must submit a certificate from an independent testing organization, which is competent to perform acceptable test and is approved by the Project Manager. The certificate must state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard. For materials and equipment whose compliance with organizational standards of specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer must be submitted for approval. The certificate must identify the manufacturer, the product and the referenced standard and shall simply state that the manufacturer certifies that the product conforms to all requirements of the project specification and of the referenced standards listed.

F. Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports specified in the individual articles must be submitted for approval.

G. Certificates of Conformance or Compliance: 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. Pre-printed certifications will not be acceptable; certifications must be in the original. The certification must 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.

H. Schedule of Work: In conjunction with the shop drawing submittal, submit 6 sets of a construction schedule indicating dates, times, and description of work. Submit with enough detail to evaluate outage periods and interferences with building operation.

I. "As-Built" Drawings: See additional requirements of ARTICLE XI – REQUIRED SUBMITTALS. Record changes from the contract drawings of all concealed piping. Show exact locations and sizes, as actually installed, of mechanical equipment, piping, isolating valves, and items requiring maintenance or inspection. Dimension underground piping from a visible point on structure. Keep at the job site a complete, accurate record of all approved deviations from the contract drawings, shop drawings and specifications. Keep these changes on reproducible prints of the drawings affected and submit to the Project Manager at the completion of the project.

J. Balancing Report and Maintenance Manuals: After installation, the new system must be tested, balanced and adjusted. Submit 8 copies of the balancing report and operating and maintenance manuals for approval before final inspection.

31.5 LAWS, REGULATIONS AND CODES

A. All work must be in accordance with government laws, ordinances, rules and regulations and orders.

B. The following shall govern where applicable; the Plumbing Code as adopted by the City and County of Honolulu, the Building Code as adopted by the City and County of Honolulu, State of Hawaii Department of Health Regulations, U.S. Department of Health and Human Services, applicable National Fire Protection Association Standards, 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 will apply.

31.6 PERMITS AND INSPECTIONS

A. The Contractor must apply and pay for all necessary inspections required by any public authority having jurisdiction.

31.7 DISCREPANCIES

A. The Drawings and Specifications are intended to be cooperative. Any materials, equipment, or system related to this article and exhibited on the Architectural, Structural, Electrical or Mechanical 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 will 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. Drawings and Specifications are intended to be fully cooperative and to agree, but should any discrepancy or apparent difference occur between Drawings and Specifications or should error occur in the work of others affecting the work, the Contractors must notify the Project Manager at once. If the Contractor proceeds with the work affected without instructions from the Project Manager, he must make good any resultant damage or defect. All interpretations of Drawings and Specifications must be clarified by the Project Manager.

31.8 WORKMANSHIP AND MATERIALS

A. Workmanship must be of the best quality and none but competent mechanical workers skilled in their trades and thoroughly familiar with the work involved must be employed. The Contractor must furnish the services of an experienced superintendent, who will be constantly in charge of the erection of the work, until completed and accepted.

B. Unless otherwise hereinafter specified, each article of its kind shall be the standard product of a single manufacturer.

C. 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 Project Manager that is referred to.

D. The Project Manager will have the right to accept or reject material, equipment and/or workmanship and determine when the Contractor has complied with the requirements herein specified.

E. All manufactured materials must be delivered and stored in their original containers. Equipment must be clearly marked or stamped with the manufacturer's name and rating. Equipment and materials must 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 Project Manager. Damaged or defective items, in the opinion of the Project Manager, must be replaced.

F. References to standards are intended to be the latest revision of the standard specified

31.9 MANUFACTURER’S RECOMMENDATIONS

A. Equipment installed under this Division of the Specifications must be installed according to manufacturer's recommendations, unless otherwise shown on the drawings or herein specified in this article. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations must be furnished to the Project Manager, prior to installation. Installation of the material will not be allowed to proceed until the

recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

31.10 OPENINGS, CUTTING AND REPAIRING

A. The Mechanical Contractor must cooperate with the work to be done under other articles in providing information as to openings required in walls and slabs for all piping including sleeves where required.

B. Any drilling or cutting required for the performance of work under this article is the responsibility of the Contractor and the cost there must be borne by him.

C. Holes in Concrete: The Mechanical Contractor must pay all costs for cutting holes. All holes through concrete shall be either core drilled or saw cut. All holes required must have the approval of the Project Manager prior to cutting and drilling. Cutting of holes through the concrete floor must require x-ray of proposed area to be cut to determine the extent of reinforcing bars, electrical conduit, etc. that is present. X-ray scans must be scheduled for after hours. Contractor is responsible for coordination of X-ray scan with the Project Manager and for protection of the required clear area for the scan. Contractor is responsible for protection of lower floors or adjacent spaces during core drilling or saw cutting, including protecting from water and slurry damage to existing surfaces and equipment.

D. It will be the responsibility of the Contractor to ascertain that all openings are properly located.

31.11 ELECTRICAL WORK

A. All power wiring, including final hookup to all mechanical equipment will be provided under the Electrical Division of this Specification. Control devices for mechanical systems required that are energized from the power system (i.e., 100 volts and higher) shall be provided by the Mechanical Subcontractor. The power wiring, conduits and appurtenant work including connection to the mechanical equipment and control devices shall be provided by the Electrical Subcontractor.

B. Electrical work under Electrical Division is based on the electrical rating of equipment indicated on the Mechanical Drawings. Additional electrical work caused by any deviation under the Mechanical Division must be paid for by the Mechanical Contractor.

C. All control wiring for communication, signals, and control power less than 100 volts are included under mechanical work and must be in accordance with Electrical Division requirements, except where specified otherwise in the Mechanical Division.

D. The Mechanical Contractor must furnish all starters, control transformers, motor controllers, any disconnect devices specified as part of the mechanical equipment and any other

electrically powered devices for installation by the Electrical Contractor. The Mechanical Contractor must turn over these items to the Electrical Contractor at the site after receipt of notice from the Electrical Contractor that he is ready to install said items

31.12 MATERIALS AND EQUIPMENT

A. As specified in all articles of following, unless specified otherwise in the individual articles:

1. ARTICLE XXXII – MECHANICAL INSULATION

2. ARTICLE XXXIII – PLUMBING

3. ARTICLE XXXIV – COMPRESSED AIR SYSTEMS

4. ARTICLE XXXV – FUEL DISPENSING

5. ARTICLE XXXVI – UNITARY AIR CONDITIONING EQUIPMENT

6. ARTICLE XXXVII – DUCTWORK AND DUCTWORK ACCESSORIES

7. ARTICLE XXXVIII – CEILING FANS

8. ARTICLE XXXIX – INDUSTRIAL VENTILATION AND EXHASUT SYSTEMS

9. ARTICLE XL – HVAC TESTING, ADJUSTING, AND BALANCING.

B. Materials and equipment must be cataloged products of manufacturers regularly engaged in production of such materials or equipment and must be manufacturer's latest design that complies with the specification requirements. Materials and equipment must duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two or more items of the same class of equipment are required, these items must 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 must have the manufacturer's name, address, model number, and serial number on the nameplate. Name of the distributing agent will not be acceptable.

C. All materials must 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.

31.13 NAMEPLATES

A. Each item of equipment must have manufacturer's nameplate of corrosion resisting metal attached in a conspicuous location. Nameplate data must include manufacturer's name,

address, model number, serial number, capacity, rating, and such other performance data as required to completely identify the item. In addition, the manufacturer must provide a separate corrosion resisting metal tag or plastic, unless specified otherwise, to carry the equipment designation as shown on drawings. Except as otherwise specified nameplate lettering must be stamped or engraved on the nameplate. Nameplates must be fastened by means of corrosion resisting metal screws, rivets or wire, 14-gage.

31.14 TOOLS AND SUPPLIES

A. Special tools and supplies must be provided if required to maintain equipment provided for this project. The items must be packaged or boxed to provide protection in storage and must be identified as to use. Tools and supplies must be accompanied by information as to source of supply.

31.15 VERIFICATION OF DIMENSIONS

A. The Contractor must check all dimensions at the site and must establish all lines and levels. The Contractor must be responsible for correctness of all dimensions and fitting of equipment, ductwork, fixtures, and piping into the available space. Should field measurements show conditions that require relocation of any work, such conditions must be reported to the Project Manager in advance of installation, and the work must proceed in accordance with his decisions.

31.16 PROTECTION OF WORK IN PROGRESS

A. Ducts, conduits (if provided by Mechanical technical specifications) and pipe openings must be closed with caps or plugs until connections are made. Equipment must 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 must be stored in weather-protected locations. Damage to materials or equipment due to the Contractor's neglect must be repaired or replaced to the satisfaction of the Project Manager by, and at the expense of the Contractor.

31.17 LOCAL TECHNICAL SUPPORT

A. The mechanical equipment suppliers that furnish equipment for this project must have a local Hawaii sales and service office, staffed with factory trained representatives fully capable of providing instruction, routine maintenance and emergency maintenance service on all system components supplied for this project. If the maintenance service is provided by a separate company, that company must be specifically trained by manufacturer and authorized to perform maintenance on the equipment furnished for this project.

31.18 PAINTING

A. Unless specified in other mechanical specification articles, the Contractor must be responsible for complete coverage in painting all exposed ferrous metal that has not been factory finish coated.

31.19 PIPING IDENTIFICATION

A. Identification of all new above grade pipe lines except sanitary, waste and vent plumbing pipes must be by means of colored, waterproof, all temperature, self-adhering labels, and directional arrow. Color coding must conform to ANSI/OSHA specifications.

B. At Contractor's option in lieu of the self-adhering labels, each and every system may be identified by painting with contrasting colors, using 3/4" high minimum stencil letters. Painting shall be done by the Mechanical Contractor.

C. All exposed pipes, whether insulated or not must be identified. Insulated pipes must be labeled on the outside of the insulation. Labels may be omitted from piping where the use is obvious, due to its connection to equipment and where the appearance would be objectionable in finished rooms, as approved by direction by the Project Manager.

D. Identification labels must be placed as follows:

1) Near each valve and branch connection.

2) Wherever piping merges or disappears from view from the floor of the room in which it is installed.

3) Labels must not be more than 50 feet apart.

31.20 VALVE IDENTIFICATION

A. Valves must be identified with brass tags where identification is required by other mechanical articles of these specifications.

B. Tag numbers must match identification numbers shown on as-built drawings.

C. Provide 1-1/2 inch diameter brass tags for all valves with identification numbers as indicated. Each tag must have stamped service designation and valve number designation in 1/4 inch black-filled letters over 1/2 inch black-filler numbers. Tags must be fastened to valves with brass jack chain. Index of all valves must be furnished by the Contractor and must include:

1) Valve I.D. number.

2) Location.

3) Purpose of system (Service).

4) Normally open or normally closed.

5) Type & Size of valve

31.21 IDENTIFICATION TAGS FOR MECHANICAL EQUIPMENT AND DEVICES

A. All mechanical equipment, panels, control devices such as temperature sensors, carbon dioxide sensors, pressure transmitters, pressure gauges and other devices must be provided with an identification tag that indicates the name of the item. The name must coincide with the Operations and Maintenance Manual and the as-built drawings.

B. The tag must be plastic nameplate, 1 inch x 3 inch minimum size, engraved laminated phenolic, white with black core. The tags must be fastened to the equipment or device with metal screws or fastened with a brass jack chain if it cannot be mounted with screws.

31.22 FIELD TEST

A. The Mechanical Contractor must perform all tests of the installed work and must provide all services, labor, equipment, materials and instruments needed for the tests. During pressure tests, all items in the system to be tested, not designed for test pressures must be removed or isolated from the system and must be reconnected or unblocked after tests are completed. Should operating tests require the presence of manufacturers' representatives, the Mechanical Contractor must cooperate with them and must place at their disposal all assistance, materials, and services required to perform such test. The Project Manager must be present and witness all field tests. Provide 5 working days advance notice. The Mechanical Contractor and the Project Manager must certify in writing that all work has passed all required tests. See requirements of individual Mechanical specifications articles and requirements of the drawings.

31.23 OPERATION AND MAINTENANCE MANUAL

A. Furnish an operation and maintenance, and troubleshooting manual for each item of equipment and the system as a whole. Unless otherwise indicated, furnish eight (8) copies of the manual bound in hardback binders or an approved equal. Furnish one 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 equipment or the building, the name of the Contractor, date, and the contract number. The manual must 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

manufacturer's brochures are used, adequately indicate (highlight, arrow, etc.) the project related information and delete (X or cross-out) the non-applicable information. Flysheet or divider sheet shall be placed before instructions covering each subject. The instruction sheets must be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. The manual must 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 must be legible and easily read, with large sheets of drawings folded in. The manual shall include:

1) Wiring and control diagrams with data to explain detailed operation and control of each item of equipment;

2) A control sequence describing start-up, operation, and shut-down;

3) Description of the function of each principal item of equipment;

4) The procedure for starting;

5) The procedure for operating;

6) Shut-down instructions;

7) Installation instructions;

8) Maintenance instructions;

9) Lubrication schedule including type, grade, temperature range and frequency;

10) Safety precautions, diagrams and illustrations; test procedures; performance data; start-up reports, and

11) Parts list. The parts lists for equipment must indicate the sources of supply, recommended spare parts and the service organization which is reasonably convenient to the project site.

B. The manual must be complete in all respects for equipment, controls, accessories and associated appurtenances provided.

C. The operation and maintenance manual must cover individual pieces of equipment and must include description of the operation of the complete system. This must include interlocks between equipment, sequences of equipment start-up and shut-down if required, shutdown interlocks, complete operating sequences of the system, system schematic diagrams, etc.

31.24 POSTED OPERATING INSTRUCTION

A. Furnish approved operation instructions for each principal item of equipment for the use of the operation and maintenance personnel. The operation instructions must include wiring diagrams, control diagrams and control sequence for each principal item of equipment. Operating instruction must be printed or engraved and must be framed under glass or in approved laminated plastic and posted where directed by the Project Manager. Operating instructions must be attached to or posted adjacent to each principal item of equipment including start up, procedure in the event of equipment failure and other items of instruction as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather must be made of weather-resistant materials or must be suitably enclosed to be weather protected. Operating instructions must not fade when exposed to sunlight and must be secured to prevent easy removal or peeling.

31.25 QUALITY ASSURANCE

A. The Mechanical Contractor must have a local Hawaii office, staffed with factory trained engineers fully capable of providing instruction, routine maintenance and emergency maintenance service on all system components. The Mechanical Contractor must have a three year experience record in the installation of mechanical systems similar in scope and performance to that specified herein, and must be prepared to provide evidence of this history as condition of acceptance and approval.

31.26 INSTRUCTION TO GOVERNEMNT PERSONNEL

A. The Contractor must furnish the services of competent instructors who will give full instruction to the State personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor must be thoroughly familiar with all parts of the installation and must be trained in operating theory as well as practical operation and maintenance work. Instruction must be given during the first regular work week after the equipment or system has been accepted and turned over to the State for regular operation. The number of man-days (8 hours) of instruction furnished must be as specified in other articles. When more than 4 man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other times must be used for instruction with the equipment or system. When significant changes or modifications in the equipment or systems are made under the term of the contract, additional instruction must be provided to acquaint the operating personnel with the changes or modifications.

B. Submit course outline, instructor’s name and an on-site training schedule two (2) weeks prior to training date. The training must include, in addition to information listed above, the following:

1) Provide overview and provide as-built plans, diagrams, operating and technical manuals for the system or equipment being addressed.

2) Identify, locate and explain the function of control devices at individual pieces of equipment.

3) Identify, locate and explain the operation and access of the control panels for each piece of equipment. Explain the sequence of operation and the control setpoints and how to change setpoints.

4) Instruction must be provided by an authorized service contractor.

C. Training sessions must be broken into maximum two (2) hour sessions per day whether classroom or field instruction.

D. Training sessions must only be scheduled after equipment to be trained is fully operational

31.27 SAFETY REQUIREMENTS

A. Belts, pulley, chains, gears, couplings, projecting set screws, keys and other rotating parts located so that any person can come in close proximity thereto must be fully enclosed or properly guarded. High temperature equipment and piping so located as to endanger personnel or create a fire hazard must be properly guarded or covered with insulation of a type as specified herein. Items such as catwalks, ladders, and guard rails must be provided where required for safe operation and maintenance of equipment.

31.28 FINAL INSPECTION

A. Final inspection must be requested by the Mechanical Contractor only after submittal of all required certificates. No final inspection will be made until all moving parts of equipment are properly guarded, all controls and safety devices tested and operative, all painting required is done and the site cleaned up.

31.29 GUARANTEE

A. The Mechanical Contractor to guarantee the installation as specified herein and PART 1 - GENERAL PROVISIONS.

31.30 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

31.31 WARRANTY AND MAITENANCE SERVICE CONTRACT

A. Contractor must attend a pre-maintenance meeting with the Project Manager to review the requirements and expectations of the Project Manager. The Contractor and Subcontractor(s) who are primarily in charge of maintenance must attend this meeting.

B. The installer must submit eight (8) copies of the Maintenance Service Contract, countersigned by the General Contractor that will validate the warranty.

C. The Warranty and maintenance service will extend for a period of one year commencing after 30 consecutive days of trouble-free operation after the Project Acceptance Date or as authorized by the Project Manager, if earlier than the Project Acceptance Date. The warranty and maintenance service must include all labor, materials, equipment, and parts necessary to service the complete system, in accordance with the attached Schedule of Maintenance Service, so as to assure proper operation and function of the system. All costs for the periodic maintenance, including emergency calls, will be borne by the Contractor. This maintenance period and the warranty period must run concurrently (same start and end dates). However, should the Contractor default on or delay the maintenance service contract and must restart or complete the service at a later time, then the warranty period will also extend to match the revised maintenance service period.

D. Contractor performing the maintenance services must have trained personnel with a minimum of five years of experience in the repair and maintenance of equipment similar to that listed herein.

E. Certification of Maintenance Work: All work done under this maintenance contract must be certified by a responsible employee of the Contractor who is in charge of or who performs the maintenance work. Service reports must be made out for all service periods, i.e., monthly, quarterly, semi-annual, annual, emergency, etc. Certification of work by the Contractor will be construed to mean that work has been performed in accordance with recommended and accepted maintenance procedures in conformance with the full intent of the service contract. Service report must include findings by the service personnel and description of work performed to maintain the systems in proper operating condition. All service reports must be reviewed with an authorized representative of the State who will acknowledge and sign reports.

F. Work Schedule/Advance Notification:

1) All maintenance work must be performed between the hours of 7:30 a.m. to 4:00 p.m., on normal working days, Monday through Friday, excluding State Holidays.

2) Monthly service will be defined as twelve service periods a year. Each service period must be approximately 30 days apart. Quarterly service will be defined as four service periods a year. Each period must be approximately three months apart. The first

service must occur three months after the start of the maintenance period. Semi-annual service will be defined as two services per year. Each period must be approximately six months apart. The first service must occur six months after the start of the maintenance period. Annual service will be defined as one service period a year. This service must be performed twelve months after the start of the maintenance period. Monthly, quarterly, semi-annual and annual services must all be performed independent of each other but, may be completed simultaneously. For example, quarterly service visits must not count as monthly service visits.

3) Contractor must submit a written maintenance work schedule to the Project Manager for approval prior to performing the maintenance service work. The schedule must identify all service tasks (i.e. monthly, quarterly, semi-annual, etc.) accurate to a specific week of each month. Any changes in the schedule that will affect subsequent scheduled services must be submitted in writing to the Project Manager prior to the next service and approved by the Project Manager.

4) Contractor must give the Project Manager a minimum of seven days prior to the notice to any maintenance and repair work. For any work that will require equipment outages, Contractor must inform the Project Manager on the estimated duration of the outage.

G. Trouble Calls: Emergency services and repairs required between regular service calls must be rendered within four hours after the Contractor is notified, non-working days included. The Contractor must call the Project Manager the next working day after being notified of the problem and report the status of repairs.

H. Maintenance Report/Checklist: The Contractor must prepare and maintain a maintenance service report/checklist for all regular and emergency services which must include the following:

1) Name of person making the service call.

2) Date of call.

3) Time in and out from project site.

4) Nature of call; if emergency, who contacted the service company.

5) Listing of equipment serviced including model and serial numbers.

6) Temperature and pressure readings from all available pressure gauges and thermometers. Readings from all other gauges, thermometers, level indicators, status indicators, sensors, ambient temperature and humidity at the site.

7) All items indicated to be recorded in the Schedule of Maintenance Service. The service Contractor must keep a separate log recording all regular and emergency maintenance calls to the project at his office. In addition, the Contractor must submit a signed copy of the written reports of maintenance and repair services performed within two working days after completion of the service. Reports must be signed by an authorized representative of the State.

I. Maintenance Log: The Contractor must provide a composition book to log all job site service visits. The log must include the date, name of mechanic, reason for the service visit, and notes on any discrepancies found and work performed. This composition book log must remain at the job site. In addition, the Contractor must provide a copy of the service reports, checklists, and any other pertinent documentation to be left at the job site in a Contractor provided binder.

J. Cleanup and Work Practices: The Contractor must keep the job site free of debris, litter, discarded parts and materials, etc. and must clean all oil drippings during the daily progress of work. The Contractor must remove all tools, parts, and equipment from service areas upon completion of the work. The Contractor must exercise caution during the progress of his maintenance and repair work to prevent damage to the ceilings, roofing and other building structure. The Contractor must restore all damages, caused by his negligence, to its original condition, at his own expense.

K. All periodic maintenance services performed by the Contractor must include applicable items listed but is not limited to the following maintenance tasks:

1) FAN COIL UNITS:

Monthly Service:

a. Clean and clear all drip pans and flush all related condensate drain lines with nitrogen. (Note: Contractor may be liable for water damage due to clogged drains.) Install pan tablets if necessary to control algae growth.

b. Change all disposable air filters at least once a month; use FARR 30/30 or approved equal.

c. Wash permanent type filters with an approved detergent and spray coat with an approved filter treatment solution. Replace deteriorated permanent type filters which cannot be cleaned.

d. Lubricate and oil all fan and motor bearings and connections of dampers and vanes.

e. Check all drives for wear; adjust belt tension. Replace belt as required.

f. Operate equipment to check for proper operation, unusual noise and vibration; adjust or repair all equipment and controls as required; clean-up all equipment.

g. Check time clock for proper operation and time settings.

h. Check operation of motor drives as applicable.

i. Certify performance of monthly service and correct and report all discrepancies.

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 solution.

c. Check pressure and temperature differential across cooling coils and log readings. Clean strainers, check vents and drains on chilled water coils.

d. Clean supply and return air grilles, registers and diffusers and fresh air intake grilles and dampers and repair or replace deteriorated bird screens.

e. Clean and adjust valves, clean strainers, and clean all fan wheels and interior and exterior of equipment housings.

f. Check and calibrate all electric and electronic temperature controls.

g. Verify operation of water detector where installed.

h. Certify performance of annual service and correct and report all discrepancies.

2) AIR COOLED CONDENSING UNITS:

Monthly Service:

a. Read and record refrigerant oil gauge pressures.

b. Read and record compressor motor voltage.

c. Read and record compressor motor current.

d. Check compressor bearing oil pressure, oil level. Add oil as required.

e. Check refrigerant charge. Add refrigerant as required.

f. Check and record findings or refrigerant moisture indicator.

g. Check and record findings of compressor capacity control.

h. Check and report findings for refrigerant, or oil leak and repair as required.

i. Check and record findings of operation of all operating and safety controls.

j. Check for undue noise and vibration and repair as required.

Quarterly Service:

a. Check setting of all operating and control electrical contacts and repair as required.

b. Clean all starter contacts and control electrical contacts and repair as required.

Semi-Annual Service:

a. Check compressor crankcase oil condition. Perform acid test.

b. Check for rust spots, clean and touch-up with paint.

Annual Service:

a. Change complete compressor oil and filters.

3) EXHAUST FANS:

Quarterly Service:

a. Check motor-controlled and back-draft dampers for proper operation; lubricate linkage for free movement.

b. Lubricate fan motors and bearings.

c. Check belt wear and tension; adjust or replace as needed.

d. Check sheaves for wear, replace as needed.

e. Check fan collar, bearings and shaft for wear, repair or replace as needed.

f. Certify performance of quarterly maintenance service and correct and report all discrepancies.

Semi-Annual Service:

a. Check and clean fan wheels and housings of dust, dirt and grease.

b. Remove and wash all intake grilles and dampers and repair or replace deteriorated bird screens.

c. Certify performance of quarterly maintenance service and correct and report all discrepancies.

4) AIR DISTRIBUTION SYSTEM:

Monthly Service:

a. Check ductwork for leakage, damage, and corrosion.

b. Check duct and devices for noise and vibration.

c. Check ductwork for loose connections and damage.

d. Certify performance of monthly maintenance service. Correct and report all discrepancies.

Semi-Annual Service:

a. Clean all air devices.

b. Re-balance and test complete system including adjustment of fan speeds and measurement of cooling coil performance to restore to the operating conditions from the test and balance report submitted during construction. Submit test and balance report after completion.

c. Paint damaged or weathered ductwork.

d. Certify performance of monthly maintenance service. Correct and report all discrepancies.

5) CONDENSATE DRAIN PIPING:

Monthly Service:

a. Clean and clear all drip pans and flush all related condensate drain lines with nitrogen. (Note: Contractor may be liable for water damage due to clogged drains.) Install pan tablets if necessary to control algae growth.

b. Check all condensate drain piping and fittings for leaks.

c. Check condition of insulation; re-insulate as necessary.

d. Drain dirt leg.

e. Certify performance of monthly maintenance service and that all discrepancies are reported and corrected.

6) CLEANING OF MECHANICAL EQUIPMENT ROOMS OR ENCLOSURES:

Monthly Service:

a. Vacuum or wipe clean all equipment surfaces and all related appurtenance.

b. Vacuum clean or sweep complete floor and platform areas. DO NOT wet floor and platform area where there is no waterproofing.

c. Wet wash complete floor area with tap water where allowed. Remove all used, deteriorated, replaced, discarded parts and related debris. DO NOT splash water onto electrical and mechanical equipment.

d. Notify Manager-in-Charge of any dangerous conditions, improper storage of furniture, materials and supplies which impacts your work within rooms and enclosures, including vandalism.

SERVICE MAINTENANCE REPORT

DATE: _____ SHEET NO. _____

Name of Facility and Location: _____

Submitted By: _____

Date of Service Call: _____

Time In, Time Out at Site: _____

Person(s) Contacted: _____

_____

Nature of Service Call: (Routine Maintenance, or Emergency, Explain)

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Equipment Readings and Maintenance Performed: (List all items serviced):

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Remarks: _____

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END OF ARTICLE

ARTICLE XXXII – MECHANICAL INSULATION

32.1 GENERAL

A. This article covers the furnishing, fabrication, delivery, and installation of the insulation for air conditioning, ventilation, plumbing and generator auxiliary systems complete, including but not limited to the following:

1. Sheetmetal duct insulation.

2. Pipe Insulation.

3. Equipment Insulation.

4. Manufacturer's literature, shop drawings and record drawings.

5. Inspection, test, and guarantee.

32.2 RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical work as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS unless specified otherwise in other articles of –the Mechanical Division.

B. Plumbing systems specified in ARTICLE XXXIII - PLUMBING.

C. Ductwork specified in ARTCILE XXXVII - DUCTWORK AND DUCTWORK ACCESSORIES

32.3 SUBMITTALS

A. Submit the following in accordance with ARTICLE XI – REQUIRED SUBMITTALS and ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Certificates of Conformance or Compliance:

1. Submit certificates of conformance for performance and characteristics specified, the listed standards and in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS for the following:

a. Duct Insulation
b. Pipe Insulation

C. Product Data: Submit product data for the following:

1. Duct insulation.

2. Pipe insulation.

3. Equipment insulation that is not factory installed.

4. Insulation accessories including vapor barrier, tape, and other items.

D. Listing: List of materials showing name and addresses of manufacturers; manufacturer's local supplier's name, address, and phone number; catalog numbers and trade names.

E. Guarantee and Certificate: Submit one-year guarantee and certificate in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

32.4 SUBMITTALS

A. Provide materials complying with NFPA Bulletin 90-A, as determined by UL method NFPA 225, ASTM E84 or UL 181, with flame spread rating 25 and under and smoke developed rating 50 and under.

B. Where vapor barriers are used, provide intact and continuous throughout.

32.5 DUCT INSULATION

A. All new interior air conditioning ducts and plenums must be insulated.

1. Insulate all supply, return, exhaust, transfer, and outside air ducts with 1-1/2 inch thick, 1.5 pounds per cubic foot density, FRK faced duct wrap. Provide Owens-Corning Fiberglass commercial grade faced duct wrap insulation Type 150, Owens Corning, Certainteed, Johns Manville, or approved equal.

2. Duct wrap insulation must conform to the requirements of Federal Specification HH-I-558B, Form B, Type I, Class 6, B-4 and NFPA 90 with the reinforced foil-Kraft vapor barrier facing conforming to Federal Specification HH-I-100B, Type II.

32.6 PIPE INSULATION

A. All above grade indoor domestic hot water supply, hot water return, tempered water supply, tempered water return piping must be insulated with Johns Manville Micro-Lok 650 with Vapor Barrier Jacket, Fiberglas heavy density pipe insulation with self-sealing, All Service Jacket (ASJ); Certainteed, Owens Corning, or approved equal, having minimum density of 3.5 lb. cu. ft. and a maximum "K" factor of 0.22 Btu-in/hr-SF-degrees-F at 50 degrees F mean. Thickness of insulation must be as follow:

Thickness	Pipe Size
One inch	Up to 2 inches
1-1/2 inches	2-1/2 inches and over

B. The insulation must be applied over clean, dry pipe with all joints firmly butted together. Longitudinal laps must be sealed with Schuller vapor barrier adhesive, Foster or approved equal. Butt joints must be wrapped with a 4 inch strip of the vapor barrier jacket cemented with vapor barrier adhesive. Each 3 feet section of insulation and each butt strip must be additionally secured with 3/4 inch wide Schuller No. 357 white tape, Foster or approved equal.

C. Valve fitting for pipe sizes smaller than 4 inch must be insulated with insulating cement by Schuller, Foster, or approved equal applied in one coat to a thickness equal to the adjoining tape insulation. Fittings for pipe sizes 4 inch and larger must be insulated with Micro-Lok insulation, Owens-Corning, Certainteed, or approved equal securely wired in place and finished with a leveling coat of Schuller No. 301 Insulating Cement, Foster, or approved equal. All fittings regardless of pipe size must be finished with PVC fitting covers and sealed to maintain vapor barrier.

D. Clamps or hangers in contact with pipe must be insulated separately in the same manner as fitting. The insulation must be applied upward along the vertical hanger rod to a point not less than 6 inches and sealed off.

E. Protect pipe insulation at all hanger and support points. Where one inch thick insulation is used, it must be protected by 12 inches long galvanized metal shield. Where 1-1/2 inch insulation is used, 12 inches long section of calcium silicate preformed pipe insulation with a vapor barrier jacket or cellular glass with vapor barrier jacket must be installed at the hanger point and protected with a 16 gauge galvanized metal shield on the outside of the jacket.

F. Condensate drain piping and plumbing drain pipes receiving condensate from the air conditioning system must be insulated with 3/4 inch thick flexible cellular insulation.

G. Refrigerant piping must be insulated with 3/4 inch thick flexible cellular insulation. Provide aluminum jacket for exterior installation

H. Aboveground outdoor pipe insulation must be finished with mastic and reinforcing fabric as recommended by the insulation manufacturer, covered with aluminum jacket, 0.106 inch thick and banded with stainless steel bands.

32.7 OTHER MECHANICAL EQUIPMENT REQUIRING INSULATION

A. Pipe hangers and supports for insulated pipes that contact the pipe surface directly must be insulated with same insulation system as the pipe insulation.

B. Strainers that are connected to insulated pipes. Insulate strainers with 1-1/2 inch thick cellular glass insulation. Finish insulation with ASJ vapor barrier.

C. Expansion tank that are connected to insulated piping. Insulate tank with 1-1/2 inch thick cellular glass insulation. Finish insulation with ASJ vapor barrier. Provide removable panels to allow disassembly of strainer (e.g., covers for basket strainers) for routine maintenance without damaging the insulation and vapor barrier.

D. Flow devices installed in insulated pipes. Insulate with same insulation system as adjacent pipe insulation. Provide removable insulation covers for test connections (e.g. connections to install portable flow meter) of the same material as the pipe insulation.

E. Parts of air handling equipment that are not factory insulated such as mixing boxes, return air plenums, etc. Insulate with same duct insulation system as connecting ductwork.

F. Equipment, pipes, and related appurtenances that are indicated or specified to be insulated but were not factory insulated such as duct mounted reheat coils.

G. Back of air devices and square to round adapters used to connect flexible ducts must be insulated with 1/2 inch thick flexible cellular insulation.

32.8 COOPERATION WITH OTHER TRADES AND CONFLICT IN WORK

A. Contractor must examine all drawings of proposed work and coordinate his work with other trades. Work conflicts must be brought to attention of the Project Manager and work rearranged or modified in accordance with his decision.

B. If changes in indicated locations or arrangements of work are required, they must be made by the Contractor without additional charge to the State provided that these changes were ordered before work is installed and no extra material or labor are required.

C. Should the Contractor determine that extra material and labor will be required to accommodate any rearrangement, he must first submit detailed estimate of cost for required changes and proceed with work only upon written authority of the Project Manager.

32.9 EQUIPMENT INSTALLATION

A. Equipment must be installed as indicated and in accordance with manufacturer's recommendations and instructions.

B. All necessary supports must be provided for equipment, appurtenances and duct as required. This work shall include any additional steel purlins, brackets, seismic restraints or supports.

32.10 WORKMANSHIP AND FABRICATION

A. Ductwork, plenums, casings, and accessories insulation:

1. Provide rigid type duct insulation on mechanical room walls and where indicated; provide blanket type insulation in all other locations. Provide field-applied insulation to exterior of supply ducts, return ducts, outside air intake ducts, duct plenums, and casings of HVAC units. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction with valve handles, damper handles, and other such items. Install insulation with jackets drawn tight and cement down on longitudinal and end laps. Do not use scrap pieces where a full-length section will fit.

2. Rigid Insulation: Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on

center and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors. Each pin or anchor must be capable of supporting a 20 pound load. Cut off protruding ends of pins, after clips are sealed with coating compound for inside work or manufacturer's recommended weatherproof coating for outside work, and reinforced with open weave glass membrane.

3. Flexible Blanket Insulation: Apply insulation with joints tightly butted. Secure insulation to ductwork with adhesive in 6 inch wide strips on 12 inch centers. Staple laps of jacket with outward clinching staples on 4 inch centers. Provide pins, washers, and clips at 18 inches on center and not more than 4 inches from duct edge for duct surfaces greater than 24 inches across except for top surfaces of horizontal ducts. For vertical ducts with surfaces less than 24 inches across, provide pins no more than 4 inches from duct edge at 18 inches on center. Carry insulation over standing seams and trapeze-type hangers. Install speed washers with pins and pin trimmed to washer. Sagging of flexible duct insulation is not be permitted. Cut off protruding ends of pins after securing and sealing clips with coating compound for inside work. In cold air ducts, vapor seal joints and staple as specified.

B. Pipe Insulation (Except Cellular and Calcium Silicate Insulation): Place sections of insulation around pipe and joints tightly butted into place. Draw jacket tight and smooth. Secure jacket with fire resistant adhesive, factory-applied self-sealing lap, or stainless steel outward clinching staples spaced not over 4 inches on center and 1/2 inch minimum from edge of lap. Cover circumferential joints with butt strips, not less than 3 inches wide, of material identical to jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. Adhesive used to secure butt strip must be same as that used to secure jacket laps. Apply staples to both edges of butt strips.

1. Vapor Barrier Jacket: When a vapor barrier jacket is required, as indicated in Table 1, on ends of sections of insulation that butt against flanges, unions, valves, fittings, and joints, provide a vapor barrier coating or manufacturer's weatherproof coating for outside service unless pipe is supplied with factory-applied self-seal lap. Apply vapor barrier coating at longitudinal and circumferential laps. Patch damaged jacket material by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as specified for butt strips. Extend patch not less than 1-1/2 inches past the break in both directions. At penetrations by pressure gauges and thermometers, fill voids with vapor barrier coating for outside service. Seal with a brush coat of the same coating.

2. Roof: Where pipe penetrates, insulate piping to a point flush with top of flashing and seal with vapor barrier coating. Butt top of flashing and interior insulation tightly to exterior insulation. Extend exterior metal jacket 2 inches to fold down beyond end of insulation. Seal flashing and counterflashing underneath with vapor barrier coating.

C. Flexible Cellular Insulation: Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90 degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheet-metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Apply two coats of finish as recommended by insulation manufacturers to flexible unicellular insulation in outside locations. Do not use vinyl lacquer finish or equivalent. Use metal jackets on cellular insulation located outside.

32.11 PAINTING AND IDENTIFYING OF PIPING

A. General: The following items furnished under this article are to be painted and identified under ARTICLE LXXXVIII – INTERIOR PAINTING. Do not paint over name plates or other identifying labels.

1. Exposed pipe insulation.

2. Exposed duct insulation.

3. Exposed equipment insulation that is unfinished.

32.12 ADJUSTING AND CLEANING

A. Pipes, equipment, and ducts must be cleaned free of scale and thoroughly flushed of all foreign matter prior to field insulation. Equipment must be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Pipe hangers and supports that were temporarily loosened to allow installation of the insulation, must be repositioned and adjusted to carry the load without crushing the insulation.

32.13 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXXIII – PLUMBING

33.1 GENERAL

A. Provide complete or modifications to interior plumbing and sanitary sewer systems. "Provide" shall mean "furnish and install" when used herein. Connect to utility systems at the 5 feet building line and as shown on drawings.

B. Connect to plumbing system all fixtures and equipment including any furnished by the State under another article of these specifications.

33.2 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Mechanical Materials and Methods are specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Painting of pipe hangers and supplementary steel is specified in ARTICLE LXXXVIII – INTERIOR PAINTING and ARTICLE LXXXIX – HIGH PERFORMANCE COATINGS.

C. All power wiring including disconnects and wiring to all motors as specified in –ARTICLE XLII – ELECTRICAL WORK.

D. Pipe insulation specified in ARTICLE XXXII – MECHANICAL INSULATION.

33.3 QUALITY ASSURANCE

A. Comply with all the requirements of the State of Hawaii, City and County of Honolulu and applicable utility companies.

B. Obtain and pay for all fees, permits, licenses, assessments, connection charges and inspections required for this work.

C. Accessible fixtures, other than those specified herein, require approval to ensure compliance with the Commission on Persons with Disabilities of the State of Hawaii.

D. 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 the ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS. No substitutions will be considered after the bid opening. 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, Stockham, or approved equal.

2. Drainage System Specialties: Josam, Zurn, J.R. Smith, or approved equal

3. Pipe Supports: Elcen, Fee and Mason, Grinnell, Unistrut, or approved equal.

4. Fixture Trim: Symmons, Speakman, Bradley, Chicago, Elkay, or approved equal.

E. 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 53	Pipe, Steel, Black and Hot Dipped Zinc-Coated Welded and Seamless
A 74	Cast Iron Soil Pipe and Fittings
B 88	Seamless Copper Water Tube
B 306	Copper Drainage Tube (DWV)
C 564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
D1785	Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120
D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings (Schedule 40)

2. AMERICAN NATIONAL STANDARDS INSTITUTE PUBLICATIONS (ANSI)

B16.18	Cast Copper Alloy Solder-Joint Pressure Fittings
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B16.23	Cast Copper Alloy Solder Joint Drainage Fittings - DWV
B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes

3. CAST-IRON SOIL PIPE INSTITUTE PUBLICATION (CISPI)

Standard No. 301	Hubless Cast-Iron Sanitary System with Cast-Iron No-Hub Pipe and Fittings
Pamphlet 100	Installation Suggestion for "No-Hub" Pipe and Fittings

4. PLUMBING AND DRAINAGE INSTITUTE (PDI) STANDARDS

PDI-WH-201	Water Hammer Arresters

33.4 SUBMITTALS

A. Submit in accordance with ARTICLE XI – REQUIRED SUBMITTALS and ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Equipment Submittal: Before beginning work, submit for review certified literature showing ratings and dimensions of equipment, of a list indicating manufacturer and model of fixtures and trim, and a list indicating all materials and items that are of a different manufacturer or model than those specified.

1. Spare Parts.

2. Equipment.

3. Plumbing Fixtures.

4. Pipe and Fittings.

5. Valves.

6. Specialties.

7. Strainer.

8. Reduced Pressure Backflow Preventer.

9. Piping Identification.

10. Valve Identification.

C. 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. At minimum, plan view and isometric piping diagrams of plumbing system piping and equipment including connection points to the site utilities. Inverts of buried piping shall be shown on the shop drawings. Submit shop drawings for the plumbing systems that conform to the general requirements in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

D. As-Built Drawings: Record changes from the Contract Documents of all concealed piping. Indicate location of isolating valves and items requiring maintenance or inspection. Dimension underground piping from a visible point on structure. Indicate invert and slope of drainage piping at sufficient location so that the invert can be calculated for any point in the system. Submit as-built drawings for review within two weeks after the final inspection. Submit as-built drawings for the plumbing systems that conform to the general requirements in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

E. Operation and Maintenance Manuals: Furnish operating and maintenance manuals on all equipment bound between hard covers. Include for all equipment the manufacturer's name,

model and serial number, operations and maintenance bulletins including control diagrams and source of service and replacement parts. Provide tabs separating each piece of equipment. When using publications covering several model options, identify which data and instructions apply to the equipment furnished for this project. Submit one copy of the complete manual for review by the Project Manager prior to final inspection. Provide eight (8) copies of the manual in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

33.5 CERTIFICATES

A. The Project Manager 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 must be furnished by the Contractor that the inspection or test was satisfactorily passed.

B. Certificates of Conformance or Compliance:

1. Chlorination Test Results.

2. Plumbing Inspection Completed.

33.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Furnish new equipment, fixtures, materials and accessories bearing the manufacturer's identification. Coordinate deliveries to avoid interferences or construction delays. Protect products during delivery, storage, installation, and the remainder of the construction period after installation

33.7 GUARANTEE

A. All work in this article must be guaranteed for a period of one year. Should any equipment, fixture or material fail within this period, the Contractor shall be responsible for all damage to any part of the premises caused by the failure and must repair or replace the defects at no cost to the State.

B. The one-year guarantee shall start at the end of thirty (30) consecutive days of trouble-free operation after acceptance by the Project Manager.

C. Refer to ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS and PART 1 - GENERAL PROVISIONS for additional guarantee requirements.

33.8 MATERIALS AND EQUIPMENT

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

B. Equipment: Requirements of manufacturer's equipment that is a component of a system provided under this work are included with the system's specifications hereinafter. Provide capacities and characteristics of the equipment shall be as indicated. See electrical drawings for all power wiring and disconnecting devices to all equipment requiring electrical power furnished under this article.

1. Electric Water Heater (Storage Type) - EWH: Provide heat input, recovery rates and capacities as indicated. The water heater shall conform to ASHRAE 90A and shall be UL listed. Tank shall be furnished with rigidly supported anode rods and designed for 150 psi working pressure. Tank shall be insulated with insulation having a minimum insulating factor of R-14. Water heater shall be equipped with immersion type screw-in elements, adjustable setpoint thermostat, over temperature protection device that can manually reset the internal electrical circuit and corrosion protection (FDA approved plastic or epoxy coating or glass lined with replaceable anode rod). Water heater shall be completely factory assembled, pre-wired and tested prior to shipment from the factory. Provide pressure-temperature relief valves and vacuum relief valves.

2. Instantaneous Water Heater - IWH: Provide heat input, recovery rates and capacities as indicated. Heater shall have temperature adjustment and flow control fitting. Heater shall have heating modules with replaceable filter in the inlet connector. Heating element shall be replaceable cartridge insert. Maximum operating pressure shall be 150 psi. Heater shall be surface mount, thermostatic control, UL listed. Provide a UL listed disconnect switch with heater.

3. Tempered Water Return Pumps - TWRP: Pumps shall be in-line, centrifugal type, wet rotor type, electric motor driven, suitable for the intended service. Service temperature shall be 140 degrees Fahrenheit. Pump capacities shall be as indicated, and the speed shall not exceed 3,600 rpm. Suction and discharge connections shall be flanged. Impeller shall be non-overloading, 304 stainless steel, statically and dynamically balanced to eliminate vibration. The case shall be silicon bronze. Equal performing pumps with external electric motor shall be provided with high temperature mechanical seal for hot water application and metal coupling guard shall be submitted for approval as substitutions. Provide connections and isolation valves for priming, vent, drain, and pressure gauges.

4. Insulate pump with 2-inch thick cellular glass insulation formed in a removable enclosure around each pump. Provide water resistant, vapor barrier covering. Pump nameplate shall be readable without having to remove the insulation

C. Plumbing Fixtures: Accessible fixtures, other than those specified herein, require pre-bid approval to ensure compliance with the Commission on Persons with Disabilities of the State of Hawaii. Provide chrome plated brass angle stops, tube risers, chrome plated brass P-traps, trap arms, adapters, escutcheons and cover plates. Provide connecting fittings, china bolt caps, wall support brackets as required. Provide flow restrictors or other approved flow control devices to limit flow for all lavatory faucets to maximum 0.35 gpm and showers and sink faucets to a maximum of 1.75 gpm. Urinals shall be limited to maximum 0.125 gallons per flush. Toilets shall be limited to maximum 1.28 gallons per flush. All strainers shall be provided with holes not larger than 1/4-inch diameter. Wall mounted fixtures shall include floor mounted wall carriers for that fixture. Wall carriers included in the following specifications are for single fixtures.

1. Accessible Water Closet - Floor Mounted - Flush Valve Style - A-WC: Floor mounted, elongated bowl, flush valve, 4 bolt base, vitreous china, white, 16-1/8-inch-17-1/2-inch high. Provide American Standard, Kohler "Highcliff Ultra" No. K-96057 or approved equal. Total height from finish floor to top of seat shall not be less than 17-inch, nor higher than 19-inch.

    a. Provide Sloan Royal 111-1.28, Delany S402-1.28, American Standard Ultima, or approved equal flush valve, 1.28 gallon per flush, 1-1/2 inch exposed top spud, chrome plated, one-inch screwdriver angle stop, adjustable tailpiece, integral vacuum breaker, spud coupling, wall and spud flanges. Force to activate flush valve shall be less than 5 pound.

    b. Provide Olsonite No. 95, Church No. 9500C, Kohler No. K-4666C or approved equal 1-inch thick maximum, heavy duty solid white plastic open front seat with check hinge.

2. Water Closet - Floor Mounted - Flush Valve Style - WC: Floor mounted, elongated bowl, flush valve, 4 bolt base, vitreous china, white, 16-1/8-inch-17-1/2-inch high. Provide American Standard, Kohler "Highcliff Ultra" No. K-96057 or approved equal.

    a. Provide Sloan Royal 111-1.28, Delany S402-1.28, American Standard Ultima, or approved equal flush valve, 1.28 gallon per flush, 1-1/2 inch exposed top spud, chrome plated, one-inch screwdriver angle stop, adjustable tailpiece, integral vacuum breaker, spud coupling, wall and spud flanges. Force to activate flush valve shall be less than 5 pound.

    b. Provide Olsonite No. 95, Church No. 9500C, Kohler No. K-4666C or approved equal 1-inch thick maximum, heavy duty solid white plastic open front seat with check hinge.

3. Accessible Urinal - A-UR: Wall mounted, washout action, vitreous china, white, 3/4-inch top spud inlet, 2-inch outlet, removable stainless steel, beehive-style strainer. Provide American Standard "Washbrook" No. 6590.001, Kohler "Bardon" K-4904-ET, Sloan SU-1009, or approved equal.

    a. Provide Sloan Royal 186-0.125, Delany S451-0.125, American Standard Ultim, or approved equal flush valve, 3/4-inch exposed top spud, chrome plated, 3/4-inch screwdriver angle stop, adjustable tailpiece, integral vacuum breaker, spud coupling, wall and spud flanges, with ADA VARIATION flush valve handle assembly. Force to activate flush valve shall be less than 5 pound. Total height from finish floor to flush valve handle shall not exceed 44-inches. Provide floor mounted wall carrier with bearing plate, Smith, Josam, Zurn, or approved equal.

4. Accessible Lavatory - Wall Hung - Cold Water - A-LAV: 19 inch x 17 inch nominal overall dimensions, 4-inch centers, vitreous china, front overflow, faucet ledge, contoured back and side splash shields, white. Provide American Standard "Lucerne" No. 0355.012, Kohler "Kingston" No. K-2005 or approved equal. Depth of lavatory bowl shall not exceed 6-1/2 inches. Provide soap dispenser hole.

a. Provide Smith No. 700, Josam No. 17100 or approved equal floor mounted concealed arm wall carrier.

b. Faucet shall be single lever handle, three hole, 4-inch centers, ceramic cartridge, 0.5 GPM aerator, American Standard Monterrey, Moen 8413F03, Chicago 2200-4E39VPABCP, or approved equal. Provide chrome plated brass grid strainer, chrome plated drain fittings, 1-1/2 inch tailpiece and trap. Provide chrome plated angle supplies with loose key stops. Force to activate faucet shall be less than 5 lb. Provide solid tube connection between supply stop and faucet. Flex hoses shall not be provided.

c. Provide Plumberex Handy-Shield, Truebro or approved equal closed cell foam or vinyl insulated safety covers for supplies and drain, including the trap.

5. Accessible Sink - Single Compartment - Hot and Cold Water - A-SK: Single compartment, 18 or 20 gauge, type 304 stainless steel, self-rimming, faucet ledge with 3 faucet holes 4-inch on center, 20-inch by 21-inch overall dimensions. Underside of sink shall be fully undercoated. Provide American Standard, Elkay, or approved equal. Depth of sink shall not exceed 6-1/2 inches.

   a. Provide Chicago 201-AG8AE35-317VAB, American Standard 7074.550, or approved equal hot and cold water double lever faucet with 8-inch swing spout, 1.5 gpm, 4 inch wrist blade handles, compression cartridge. Provide chrome plated brass basket strainer, chrome plated drain fittings, 1-1/2-inch tailpiece and trap. Provide chrome plated angle supplies with loose key stops. Force to activate faucet shall be less than 5 lb. Provide solid tube connection between supply stop and faucet. Flex hoses shall not be provided.

   b. Provide Plumberex Handy-Shield, Truebro, or accepted equivalent closed cell foam or vinyl insulated safety covers for supplies and drain, including the trap.

6. Accessible Shower - Flush Mounted - A-SHO: Provide triple chrome plated, brass single lever handle, pressure balanced mixing valve with concealed temperature limiting stops, Kohler "Forte" K-22177-G, American Standard TU662.211, Delta 51361, or approved equal. Sprayhead shall be 1.75 gpm multi-function hand spray, non-positive shut-off, 60-inch stainless steel flex hose. 30-inch stainless steel slide rail, individual water supply check stops, wall supply elbow, adjustable bracket. Provide chrome plated in-line vacuum breaker for shower hose and diverting valve. Force to activate shower valve shall be less than 5 pound.

7. Shower - Flush Mounted - SHO: Provide triple chrome plated, brass single lever handle, pressure balanced mixing valve with concealed temperature limiting stops, Kohler "Rally" K-R21498-G, American Standard “Spectra” 1660.771, Delta 75536, or approved equal. Sprayhead shall be 1.75 gpm multi-function hand spray, non-positive shut-off, 60-inch stainless steel flex hose. Individual water supply check stops, wall supply elbow, adjustable bracket. Provide chrome plated in-line vacuum breaker for shower hose and diverting valve.

8. Mop Sink - MS: Precast terrazzo, 24-inch by 24-inch by 12-inch high overall dimensions, square with 6-inch dropped front, one-inch tiling flange on 2 sides, one-

piece construction, with stainless steel integral cast drain body for a caulked connection not less than one-inch deep to a 3-inch pipe. 3,000 psi terrazzo (strength after 7 days) composed of grey Portland cement and marble chips, with all air holes and pits grouted and all surfaces ground and polished. Provide with stainless steel protective cap. Provide angled front side where indicated. Florestone No. 96, Acorn Engineering TNC-24-TF2, Fiat TSB series, or approved equal.

a. Provide Chicago 540-LD897SCP, American Standard 8344.012, Kohler K 8907, or approved equal utility faucet, with vacuum breaker, 3/4-inch hose thread on spout, integral stops, adjustable wall support and pail hook. Faucet shall be chrome plated, all brass construction with brass valve bodies on 8-inch centers. Faucet shall have replaceable, brass washerless valve cartridges with indexed brass cross handles.

D. Pipe and Fittings

1. Drainage, Waste and Vent Piping Below Grade: Service weight cast-iron soil pipe and fittings, conforming to ASTM A74, "Standard Specification for Cast Iron Soil Pipe and Fittings," no-hub cast iron soil pipe conforming to CISPI 301, "Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications," with cast iron mechanical couplings, stainless steel bolts and nuts, and neoprene gaskets or heavy duty stainless bands with 4 or more adjusting screws. Provide MG coupling, Husky Series 4000 Anaheim Foundry Company or approved equal.

2. Drain, Waste and Vent Piping Above Grade: Service weight cast-iron soil pipe and fittings, conforming to ASTM A74, "Standard Specification for Cast Iron Soil Pipe and Fittings," no-hub cast iron soil pipe conforming to CISPI 301, "Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications," with stainless steel bands and neoprene gaskets.

3. Potable Water Piping: Type L hard drawn copper tube, conforming to ASTM B88, A Standard Specification for Seamless Copper Water Tube, with soldered (95-5) joint wrought copper pressure fittings. Use long radius elbows wherever possible. Use Type K hard drawn copper tube with brazing alloy on joints and pipes below grade.

4. Storm Water or Storm Drain Piping Below Grade: Same specification as the Drain, Waste and Vent Piping Below Grade.

5. Pipe Sleeves: Schedule 40 steel pipe, ASTM A53

E. Valves:

1. Gate Valves 3 Inches and Smaller: 125-lb. S.W.P., bronze body and trim, rising stem, inside screw, solid bronze wedge disc, screw-in bronze bonnet, threaded ends, aluminum handwheel. Lead Free. Provide NIBCO T-111, Crane or pre-approved equal.

2. Ball Valves 3 Inches and Smaller: 600 psi W.O.G., bronze, two piece body, 316 stainless steel ball, reinforced TFE seat and seals, full port, threaded ends, 316 stainless steel stem, lever handle with integral stop. Lead free. Provide NIBCO T-585-70-66, Crane or approved equal.

3. Check Valves 1-1/2 Inches and Smaller: 200-lb. S.W.P., bronze body and trim, swing check valve, bronze disc, bronze hinge pin, Buna-N resilient seat, threaded ends. Provide NIBCO T-413, Crane or approved equal.

4. Check Valves 2 Inches and Larger: 200-lb. S.W.P., double door check valve, steel or cast iron body, aluminum bronze doors, stainless steel spring and pins, Buna-N resilient seat, non-slam closure, lug body style. Provide APCO 9000-L, NIBCO or approved equal.

5. Thermostatic Mixing Valve - TMV: Provide tempering valve assembly complete with thermostatic mixing valves to maintain constant outlet tempered water temperature from the minimum to the rated capacity of the assembly. The valve shall maintain the selected discharge temperature as well as an adjustment knob to allow selecting the discharge temperature. Provide a low flow valve and a high flow valve to meet all flow requirements. Provide all bronze or stainless steel construction, shut off valves or check stop valves, 20 to 240 degrees Fahrenheit bimetal thermometer on discharge pipe, adjustable pressure regulating valve, pressure gauge and minimum 18 gage painted steel or stainless steel surface mounted or recessed cabinet with minimum 16 gage hinged door or cover to enclose the assembly. Large-flow parallel side shall have thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet. Small-flow parallel side shall have a thermostatic water mixing valve. Thermostatic mixing valves shall comply with ASSE 1017 and to include check stops on hot- and cold-water inlets and shut-off valve on outlet. Water regulator shall comply with ASSE 1003 and include pressure gage on inlet and outlet. Component pressure ratings shall be 125 psig minimum, unless otherwise indicated. Provide Symmons Temptrol or approved equal.

F. Plumbing System Specialties

1. Cleanouts:

a. Cleanout - CO: Provide Smith No. 4470 or approved equal, countersunk bronze plug.

b. Cleanout to Grade - COTG: Provide Smith No. 4470 or approved equal installed with concrete collar, flush with grade.

c. Floor Cleanout - FCO: Provide Smith No. 4103 or approved equal cast iron cleanout with round heavy duty scoriated nickel-bronze top and flashing flange. Provide with adjustable top and frame. Strainer shall be adjustable to floor thickness.

d. Wall Cleanout - WCO: Provide Smith No. 4472 or approved equal with polished stainless steel access plate and screw.

2. Access Panels - AP: Provide Milcor or approved equal access doors with Allen wrench lock and concealed hinges; style K for plaster walls, style A for acoustical tile surfaces, style M for masonry and other surfaces. 8-inch x 8-inch minimum size in walls and partitions for single items (e.g. WHA), 12-inch x 12-inch for more than one item (e.g. two adjacent valves) and either 12-inch x 12-inch or 24-inch x 24-inch for ceiling access and as indicated. For access panels in fire rated walls and ceilings, provide fire rated access panels to match or exceed the rating of the wall or ceiling. Unless otherwise indicated, provide access panels with primer painted surfaces and field painted to match the color of the adjacent surface.

3. Floor Drain - FD: Provide Smith No. 2005-A, Josam or approved equal with Duco cast iron body and flashing collar, 5-inch round nickel-bronze strainer with square, 1/4 inch by 1/4 inch square heelproof openings, vandal proof screws and No-Hub outlet. Provide trap primer connections as indicated.

4. Floor Sink - FS: Provide Smith No. 3003NB-Y, Josam, or approved equal with cast iron body, acid resisting porcelain enameled interior, nickel bronze rim, domed bottom strainer, flashing flange, 2 open grate unless otherwise indicated, 12-inch square, 8-inch deep, No-Hub outlet. Provide trap primer connections as indicated.

5. Automatic Trap Primer: Provide Smith No. 2699A1, PPP or approved equal, cast bronze valve with sweat connections. Provide drain lines with trap priming fitting. Provide access panel as required for maintenance.

6. Electronic Trap Priming Manifold - ETP: Provide pre-assembled manifold in surface mounted, factory coated, steel cabinet, with integral vacuum breaker, manual override switch, solenoid valve, and internal timeclock. Number of outlets shall be coordinated with the contract drawings. Provide with a UL listed disconnect switch. PPP, Mifab, J R Smith, or approved equal.

7. Interior Hose Bibb - HB-1: Provide Chicago No. 952, T&S B-2301, or approved equal, chrome plated, vacuum breaker spout with integral 3/4-inch hose thread outlet and loose key handle. Provide with Chicago No. 1771 chrome plated, in-line, concealed wall mounted stop, Arrowhead, or approved equal.

8. Exterior Hose Bibb - HB-2: Provide Smith 5673, rough brass finish, removable wheel handle and vacuum breaker spout with integral 3/4-inch hose thread outlet.

9. Strainer: Provide "Y" type strainers ahead of all flow control valves and as indicated with bronze strainer baskets with no larger than 1/32-inch perforations, lead free. Provide 3/4-inch ball valve and flushing lines from bottom of each strainer. Provide Watts Series LF777, Mueller LF352, or accepted equivalent

10. Water Hammer Arresters - WHA: Provide Smith Series 5000 or approved equal. Provide on water supplies and locate as close as practical to each faucet, control valve or flush valve except hose faucets. Air chambers shall consist of a 12-inch length of pipe of the same diameter as the branch supply, capped on one end. Commercial type arresters, tested and certified in accordance with PDI WH-201, "Water Hammer Arresters," shall be provided where indicated. Installation of these arresters shall be accessible and include access panels when concealed. Size of the arresters shall

conform to the PDI symbols and shall be selected in accordance with the recommendations of PDI:

PDI Symbol	Fixture Unit Rating
A	1-11
B	12-32
C	33-60
D	61-113

11. Temperature and Pressure Relief Valve: Bronze body, ASME rated, stainless steel spring, automatic temperature and pressure relief, tamper-resistant bonnet screws, Watts or approved equal, 3/4-inch inlet, ANSI Z21.22. Unit shall be rated for the device it is to protect.

12. Vacuum Relief Valve: Conform to ANSI Z21.11 with brass body construction, protective cap. Watts or approved equal. Unit shall be rated for the device it is to protect.

13. Pressure Reducing Valves - PRV: Provide bronze body water pressure reducing valves for domestic water supply systems conforming to American Society of Sanitary Engineering (ASSE) 1003. Provide Watts Series U5B, 223, Febco, Conbraco, or approved equal with strainer. Provide additional pressure reducing valve in parallel to accommodate stable water flow over the entire range of flow demand. Provide a permanently installed downstream pressure gauge for each PRV to allow adjusting of the setpoint.

14. Ice Maker Box: Specialty Products, Sioux Chief, LSP, Oatey, or approved equal metal ice maker box, nailing tabs with angle valve.

15. Air Gap Fitting for Standpipe: Provide Smith No. 3951, Josam, or approved equal, cast-iron body, threaded outlet with set screw on inlet.

16. Downspout Boot: Provide inlet size to match size of gutter downspout. No-hub 4-inch outlet for connection with 4-inch pipe. Cast iron body and securing strap. Smith Fig. 1786, Zurn Z191, Watts RD-970, or approved equal.

G. Thermometers:

1. Blue spirit filled lens tube type with separable socket. Adjustable, with 2 degree F maximum scale divisions, enameled die-cast aluminum adjustable angle case. Provide stainless steel wells for steel pipes and brass wells for copper pipe and of suitable length to accommodate pipe size and thickness of insulation. Select scale such that normal system operating temperature is at 50 percent of thermometer range.

H. Pressure Gauges:

1. Pressure gauges shall be Grade A, accurate within 1 percent of full scale, phosphor bronze Bourdon tube, spring type, with 4-1/2-inch diameter dials unless otherwise indicated, with recalibrating screws. Socket shall be 1/4 inch NPT forged brass, bottom

outlet. Gauges shall have plain cast aluminum cases with screwed rings finished in black enamel or chromed and shall be installed with necessary piping, including heavy duty needle valve.

2. Pressure gauges ranges shall be such that the position of the pointer during normal operation will be 50 percent of dial range.

I. Calibrated Balancing Valves:

1. Copper or brass alloy body up to 2-inch size, 125 psi working pressure, differential pressure read out ports across valve seat, memory stop, calibrated nameplate, soldered end, lead free, leak tight full rated working pressure and portable meter and hoses to read flowrate or differential pressure and flowrate calibration curve. Manual flow control valve shall be Watts LFCSM-61-S, Nibco S-1810-LF, or approved equal.

J. Expansion Tank:

1. Hot Water Expansion Tank - Steel tank with flexible butyl rubber diaphragm separating the air chamber from the water, lead free construction, designed to absorb water volume increase in potable hot water system due to thermal expansion. Inlet connector shall be stainless steel, materials for diaphragm shall be FDA approved, tank shall be listed by IAPMO and certified by ANSI/NSF61. Pre-charge tank with air to 20 psi or as recommended by the manufacturer. Maximum pressure 150 psi or higher. Maximum temperature 200° F or higher.

K. Insulation:

1. See ARTICLE XXXII – MECHANICAL INSULATION.

L. Wash Rack System:

1. Wash Rack Platform: Galvanized heavy duty steel construction capable of supporting up to 50,000 lbs. Platform shall be elevated 8-inch off the ground with one 16-foot ramp provided for vehicular access. Drive-on and back-off configuration with 6-foot high side and rear walls. Stainless steel control panel.

2. Conveyor System: Conveyor with wear flights and 2-foot trench assembly integrated into the wash rack platform. Auto and manual control with emergency stop, and warning light and audible alarm. Provide factory supplied hopper assembly.

3. Water Cannon: 25 GPM at 100 PSIG, stainless steel cannon pump, 50-foot hose with fire nozzle.

4. Settling Tanks: Provide two 1,490-gallon, 45-degree cone bottom tanks with automatic air actuated pinch valve. Dark green colored exterior. Stainless steel tank stands.

5. Water Treatment System: Provide nominal 20-foot ISO equipment container package including pre-plumbed and pre-wired equipment and lighting from factory. Treatment system to consist of water pump, oil-water separator, air compressor, media filter,

polishing filter, and holding tank with ozone injection system. Required electrical distribution and climate control systems for the treatment system must also be provided. Container walls to be insulated and have and ventilation and heater systems for climate control. NEMA 4X disconnect for electrical power connection. Maximum 1 inch potable water source connection and waste minimum 3-inch drainage connection.

33.9 PREPARATION

A. Visit the worksite and become fully aware of all existing conditions. Investigate the Contract Documents and make proper provisions to avoid interferences 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.

33.10 INSTALLATION AND REQUIREMENTS

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 guard around high-temperature equipment and materials. When exposed to weather, provide a weather protected enclosure around electrical equipment, controls and other items that are not satisfactorily protected. Provide all extra materials and labor for a complete operable system at no extra cost to the State.

33.11 CUTTING AND PATCHING

A. Place sleeves for piping penetrating through poured concrete prior to pouring of concrete.

B. Do not cut any openings in any structural member until location is approved by Structural Engineer.

C. Cut all holes necessary for installation of work under this article.

D. Cutting of holes in concrete is not permitted except by approval of Project Manager which will be on an individual basis and require the use of coring tools, power saws and drills.

E. Cutting of reinforcing bars is not permitted. Splay bars to clear or move hole as required.

F. Install pipe sleeves through holes cut in slabs. In concrete slab install sleeves to clear reinforcing bars and tightly pack non-shrink grout around sleeve for full thickness of walls.

33.12 ACCESS TO EQUIPMENT

A. Install all control devices, specialties, valves and related items to provide easy access for operation, inspection, adjustment, repair and maintenance. If these items are concealed

behind walls or ceilings of non-removable type construction, provide access panels where indicated or required of size shown or necessary.

33.13 EQUIPMENT INSTALLATION

A. Install equipment, piping and appurtenances in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS. Provide equipment accessories necessary for proper operation and support.

33.14 FIXTURE INSTALLATION

A. Set fixtures in an approved workmanlike manner. Point up all edges against building structure with white grout. Provide adequate wall carriers or supports for all wall-mounted fixtures. Provide water supplies for all fixtures; compression joint type with chromium plated brass escutcheon and cover tube, loose-key angle stop valve and drawn copper tube riser even if details are not shown on the plans. Provide chromium plated brass P-trap, waste fittings, wax rings, gaskets, fasteners and escutcheon as required for all fixtures even if not detailed on the drawings. Exposed metal including pipe shall be polished chromium plated. Provide a 1/4-inch x 6-inch x 32-inch steel plate for support of wall-hung lavatories if carriers are not specified. Secure plate to studs and bolt to fixtures. Point-of-connections indicated are suggested locations. Contractor may, at his option, relocate the point-of-connection (POC) to a more convenient location if the existing piping is deemed to be inaccessible. All extra piping, fittings and valves for relocated POC's shall be provided at no additional cost to the State. Sinks with multiple compartments and trough sinks, provide multiple faucets, angle supplies and stops to match the number of faucet locations specified or indicated at no additional cost to the State.

33.15 PIPING INSTALLATION

A. Conform to the requirements of the Uniform Plumbing Code as adopted by the City and County of Honolulu. Inspect all pipe 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-plated brass escutcheons, set tight on the pipe and to the wall where pipes are exposed in finished areas. Provide clamping collar or 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.

33.16 DRAINAGE, WASTE AND VENT PIPE SYSTEMS

A. 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, extended collar up vent and turn in at top. Install hubless cast-iron pipe in accordance with CISPI pamphlet 100-1972. Provide cast-iron and neoprene gasketed no-hub coupling below grade. MG stainless steel clamps and cast-iron no-hub couplings shall be installed in accordance with manufacturer's written instructions.

33.17 WATER PIPING SYSTEM

A. Coordinate point of connection locations and material compatibility with the site utilities contractor's work and schedule. Secure each water line where it penetrates partitions to serve fixtures, and similar items. Wrap all lines passing through concrete with polyethylene tape. Install unions or flanges at all valves, equipment and system specialties. Install dielectric unions at connections of copper and ferrous pipe.

33.18 PIPING SYSTEM SUPPORTS

A. Pipe Supports: For above ground piping, strap to permanent structure or support with pipe hangers unless indicated otherwise. Support underground piping on firm soil along its entire length. Where rocks are encountered, have trench excavated to minimum over-depth of 4 inches and backfilled with granular moist earth, thoroughly tamped. Materials used for backfilling over piping shall be granular earth, free from debris and stones. The Project Manager may reject any materials which he considers unsuitable for fill. Provide a minimum of one foot of cover for all pipes. 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".

B. Provide Supports for Hubless Piping:

1. Provide hangers or anchors on the piping at each side of, and within 6" of hubless pipe coupling, so coupling will bear no weight.

2. Do not provide hangers on couplings.

3. Provide hangers adequate to maintain alignment and to prevent sagging of the pipe.

C. 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. Groups of lines shall be supported as detailed on drawings. Hangers in contact with copper tubing or pipe shall be copper or plastic coated to minimize dissimilar metal corrosion.

D. Trapeze Hangers: Support multiple pipe runs on trapeze type hangers with galvanized finish. Provide all necessary supporting steel rollers to keep pipe in alignment and allow for expansion.

33.19 FIELD QUALITY CONTROL

A. Test plumbing systems in accordance with the Uniform Plumbing Code as adopted by the City and County of Honolulu. Perform tests in the presence of, and to the satisfaction of inspectors having jurisdiction over the work. Ask for final inspection by the Project Manager after all tests, adjustments and balancing have been performed.

B. Test drainage systems in accordance with Section 712 of the Plumbing Code.

C. Hydrostatically test the domestic water piping system at 100 psi. Inspect the entire system while under pressure and correct all deficiencies.

D. Test equipment to demonstrate its operations and compliance with the specification.

E. All drainage piping systems which show signs of obstructed flow, no flow or slow flow shall be thoroughly snaked until all obstructions are cleared and water drains freely.

33.20 TESTING AND INSPECTION

A. Contractor shall furnish all equipment for tests and any required retests and pay for all cost of repairing any damage resulting from such tests. Contractor shall adjust systems until they are approved. Tests must be performed in presence of, and to satisfaction of, inspector of official agency involved.

B. Defective Work: If inspection or test shows defects, such defective work or material must be replaced and inspection and tests repeated. Repairs to piping must be made with new material. No caulking of screwed joints or holes will be accepted.

C. Protection to Fixtures, Materials, and Equipment: Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury. Upon completion of all work, fixtures, materials, and equipment must be thoroughly cleaned, repainted as required, adjusted, and operated.

D. Removal and capping of existing plumbing lines as required is included in this article.

E. Chlorination: Domestic water lines must be sterilized with chlorine before acceptance of work. Dosage of chlorine shall be not less than 50 ppm. After contact period of not less than 8 hours, system shall be flushed with clean water until residual chlorine content is not greater than 0.2 ppm. All valves in lines being sterilized shall be opened and closed several times during contact period. Certificate must be furnished to Engineer evidencing proper performance of sterilizations.

33.21 ADJUSTING AND CLEANING

A. Clean up work areas and fixtures. Adjust system for proper operation, ready for use. Touch up with matching paint all damaged factory finishes.

33.22 PAINTING AND IDENTIFYING

A. The following items furnished under this article are to be painted under ARTICLE LXXXVIII – INTERIOR PAINTING and ARTICLE LXXXIX – HIGH PERFORMANCE COATINGS.

1. Do not paint over name plates or other identifying labels. Paint exposed black iron work including pipe, fittings, iron body valves, pipe hangers, etc., with two coats of zinc rich paint.

B. Provide piping and valve identification per the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

33.23 INSTRUCTIONS

A. Provide instructions to Project Manager for plumbing system operation in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

33.24 MAINTENANCE SERVICE CONTRACT

A. Provide maintenance service for all plumbing system components as specified in and in accordance with the requirements and schedule of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

33.25 OPERATION AND MAINTENANCE MANUAL

A. Must be provided as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

33.26 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXXIV – COMPRESSED AIR SYSTEM

34.1 GENERAL

A. This section covers the furnishing, fabrication, delivery and installation of the compressed air system complete, including but not limited to the following:

1. Packaged air compressor with receiver.
2. Pipe and fittings.
3. Valves.
4. Instrumentation and controls.
5. Condensate traps.
6. Filters.
7. Hangers and supports.
8. Strainers.
9. Flexible connections.
10. Identification for piping.
11. Operation and maintenance instructions and manuals.
12. Manufacturer's literature, shop drawings and record drawings.
13. Inspection, test and guarantee.
14. Hose Reels.

B. Provide complete interior compressed air system. “Provide” shall mean “furnish and install” when used herein.

34.2 RELATED WORK SPECIFIED ELSEWHERE

A. General mechanical work as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Concrete work specified in –ARTICLE XXIX – CAST-IN-PLACE CONCRETE.

C. Painting work specified in ARTICLE LXXXVIII – INTERIOR PAINTING and ARTICLE LXXXIX – HIGH PERFORMANCE COATINGS.

D. Electrical work specified in ARTICLE XLII – ELECTRICAL WORK.

34.3 QUALITY ASSURANCE

A. Comply with all the requirements of the State of Hawaii, City and County of Honolulu and applicable utility companies.

B. Obtain and pay for all fees, permits, licenses, assessments, connection charges and inspections required for this work including scheduling and coordinating the State Boiler inspector to inspect the air compressor and receiver installation.

C. Present to the State certificates of inspection and approval from proper authorities.

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 National Standards Institute Publications (ANSI):

B1.20.1-83	Pipe Threads, General Purpose (Inch)
B16.3-92	Malleable Iron Threaded Fittings
B16.39-86	Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

2. American Society of Mechanical Engineers (ASME):

BPVC SEC VIII	Boiler and Pressure Vessel Code: Section
D1-92	VIII Pressure Vessels, Division 1
BPVC SEC IX-92	Boiler and Pressure Vessel Code, Section IX

3. American Society for Testing and Materials (ASTM) Publications:

A 53 83	Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless

4. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

MSS-SP-58-93	Pipe Hangers and Supports - Materials, Design and Manufacturer
MSS-SP-69-91	Pipe Hangers and Supports - Selection and Application

5. National Electrical Manufacturers Association (NEMA):

ICS 1-93	Industrial Control and Systems General Requirements

ICS 2-93	Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC

34.4 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 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, and accessories as may be required to meet such conditions.

C. Nameplate: Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment.

D. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the State of any discrepancy before performing any work.

34.5 SUBMITTALS

A. Submit the following documents in conformance with the requirements for submittals from ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Shop Drawings: At minimum, plan view of compressed air system including piping, valves and equipment. Elevations of piping shall be shown on the shop drawings.

C. Product Data:

1. Compressed air piping and fittings.

2. Valves.

3. Pressure regulators, filters and other hardware

4. Hose reels, hoses and fittings.

D. Certificates of Conformance or Compliance:

1. List of manufacturer's warranties for the equipment and material furnished.

E. As-Built Drawings:

1. Submit drawings that show the plan view of the locations and sizes of the piping and equipment provided by this article.

F. Guarantee and Certificate

1. Submit one year guarantee in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

G. Operating and Maintenance Instructions

1. Submit Operations and Maintenance Manuals for all compressed air system equipment that conform to the general requirements in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

34.6 MATERIALS AND EQUIPMENT

A. All materials shall be new, of equal or better quality of materials specified, and approved by the State. For ease of maintenance and parts replacement, select equipment from a single manufacturer as much as possible. Substitutions require pre-bid approval.

34.7 RECIPROCATING AIR COMPRESSOR

A. Up to 175 PSIG System: Two-stage, oil-less, air cooled reciprocating, belt driven type, suitable for supplying compressed air at pressures indicated. Provide compressor with ball type bearing, pressure lubricated, thermal overload protection as required by NEMA, pressure switch, inlet filter-mufflers, vibration isolators, intercoolers, aftercooler, and flexible connectors. Provide safety control for shutdown and alarm on high discharge air temperature. Capacity as indicated on drawings. Mount compressor and motor on a base plate and set on the receiver. Design receiver for additional load of compressor and motor.

B. Receiver: Provide horizontal receiver (tank) of welded steel, ASME labeled, in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Unfired Pressure Vessels, complete with pressure gage, safety valve, check valve, shut-off valve on tank outlet, and automatic tank drain on tank. Lining shall be a factory applied 5 mil minimum vinyl coating per BOR VR-3. Exterior finish shall be two (2) coats of rust inhibitor primer and one (1) coat epoxy enamel. Provide tank with steel supports and bolt to a concrete foundation. Capacity as indicated.

C. Motor: Provide motor with 40 degrees C, ambient temperature rise, continuous duty, TEFC type motor, ball bearings, for operation with current of voltage, phase, and cycle indicated on the electrical drawings. Motor of such capacity that brake horsepower required by driven equipment at normal rated capacity will not exceed nameplate rating of motor.

D. Motor Controllers: NEMA ICS1, "Industrial Control and Systems General Requirements", and NEMA ICS2, "Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC". Controllers shall have thermal overload protection in each phase. Magnetic-type motor controllers shall have

undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure or similar automatic-type or maintained-contact switch, the controller shall have hand/off/automatic selector switch. Connections to the selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor control circuit shall be maintained in the "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. Selector switch shall have means for locking in all positions. For each motor not in sight of controller or where controller disconnection means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. Place non-fused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall give adequate protection to the motor windings; be thermal inverse, time limit-type; and include manual reset-type pushbutton on outside of motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in the "OFF" position. Minimum short circuit to withstand rating of combination motor controller and type enclosure shall be as indicated on the electrical drawings.

E. Start-and-Stop Control: When set for start-and-stop (hand) control, motor shall stop automatically when discharge pressure reaches maximum pressure setting and start automatically when discharge pressure falls to minimum setting. Cylinders shall unload during periods of motor shutdown.

F. Intercoolers and Aftercooler: Intercoolers shall be supplied between all intermediate stages of all multi-stage compressors and after-coolers shall be supplied with all compressors. Intercoolers for air-cooled compressors shall be the tube-and-fin type. Aftercoolers shall be of the air-cooled tube-and-fin type. Air-cooled intercoolers and aftercoolers shall have sufficient capacity to cool the compressed air to within 20 degrees F of the ambient temperature under the atmospheric conditions indicated. The pressure drop of compressed air through the cooler shall not exceed one PSI. All intercoolers and aftercoolers shall be provided with a moisture separator and drain trap to remove the condensed moisture from the air leaving the cooler.

1. Tube-and-Fin: Tube-and-fin coolers shall be copper, aluminum, copper-aluminum, or copper-alloy construction. Fins shall be securely bonded to the tubing. Tube-and-fin coolers shall be provided with a fan for circulation of the cooling air. The fan shall be adequately guarded for safety and be driven either from the compressor crankshaft or by an independent electric motor

34.8 COMPRESSED AIR PIPING AND ACCESSORIES

A. Piping: Provide ASTM A53, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless", Schedule 40, seamless carbon steel pipe, galvanized. Piping system shall be threaded.

B. Fittings - 2” and Smaller: ASME B16.3 galvanized malleable iron threaded fittings, Class 150.

C. Valves:

1. Gate Valves 2 Inches and smaller: Class 150, bronze body and trim, rising stem, inside screw, solid bronze wedge disc, screw-in bronze bonnet, threaded ends, aluminum handwheel. Provide NIBCO T-131 or approved equal.

2. Ball Valves 2 Inches and Smaller: 600 PSI W.O.G., bronze, two piece body, 316 stainless steel ball, reinforced TFE seat and seals, full port, threaded ends, 316 stainless steel stem, lever handle with integral stop. Provide NIBCO T-585-70-66 or approved equal.

D. Specialties:

1. Filter and Water Trap: Provide zinc body, polycarbonate plastic bowl with aluminum bowl guard, fiber filter element, Nitrile seal, manual drain valve, 150 PSIG maximum working pressure, 3/4" threaded ends. Provide Wilkerson F30-06-000 or approved equal.

2. Pressure Regulator: Provide relieving type regulator of zinc body, bonnet and piston, Nitrile seals, 0-125 PSIG operating pressure range, 300 PSIG maximum working pressure, 3/4" threaded ends. Provide Wilkerson R30-06-000 or approved equal.

3. Pressure Gauge: Provide with aluminum case with stainless steel retaining ring, non-shatterable safety Plexiglas lens, threaded brass socket, brass movement and safety pressure relief plug to prevent lens from flying out in case of an explosion. Gauge shall have a 3-1/2-inch minimum diameter dial and a dial range of approximately twice the working pressure. Provide Trerice 600C series or approved equal. Provide Trerice type FFG No. 735 needle valve for isolation.

4. Quick Coupling Connection: Provide steel construction, Buna-N seal, female threaded end, push to connect, 360 degree swivel, with a maximum working pressure of 300 PSIG. Provide Aeroquip or approved equal. Verify actual coupler size with the State.

5. Wye-Strainers: 150-lb. S.W.P., bronze body and trim, 20 mesh stainless steel screen, threaded ends. Provide Watts or approved equal.

6. Traps: Provide traps to drain water and other liquids from system. Rated working pressure shall not be less than system operating pressure. Traps shall be of the automatic type, float actuated, stainless steel construction.

7. Flexible Connections: Provide vibration isolation, wire braid reinforced corrugated metal hose type, line-sized, with bronze threaded end connections, suitable for the pressure indicated. Length as recommended by manufacturer, but not less than 18 inches.

8. Unions: Provide dielectric unions where indicated.

9. Polytetrafluoroethylene Tape: Provide for screw-jointed pipe.

E. Coalescing Cartridge Type Filters: Provide filter housing of cast aluminum alloy suitable for operating pressures up to 300 PSIG. Provide glass fiber cartridge filters capable of removing liquids and solids of 0.3 microns and larger. Filter capacity shall be compatible with rated flow of equipment. Provide each filter with differential inlet-outlet pressure indicator and manual drain valve. Provide Zeks Model 140LT or approved equal.

F. Pipe Hangers and Supports: MSS-SP-58, "Pipe Hangers and Supports - Materials, Design and Manufacturer", MSS-SP-69, "Pipe Hangers and Supports - Selection and Application", and ANSI B31.1, "Power Piping", except as specified or indicated otherwise. Provide zinc plated pipe hangers and supports. Provide tubing supports of U-shaped steel bolts and nuts firmly secured to adequately support structures such as walls, columns, floors, or brackets. Clips shall fit closely around piping but shall have sufficient clearance to permit longitudinal movement of piping during normal expansion and contraction. Provide supports at valves, fittings, branch lines, outlets, changes in direction, equipment, and accessories.

34.9 SLEEVES

A. Floor slabs, roof and walls above and below grade: Galvanized-steel pipe having an inside diameter at least 1/2 inch larger than the outside diameter of the pipe passing through it. Provide sufficient sleeve length to extend completely through floors, roofs, and walls, so that sleeve ends are flush with finished surfaces except that ends of sleeves for floor slabs shall extend 1/2 inch above finished floor surface. Sleeves located in waterproofed construction shall include flange and clamping ring.

34.10 FRESH WATER

A. Fresh water for cleaning, flushing, and testing shall be clean and potable.

34.11 COOPERATION WITH OTHER TRADES AND CONFLICT IN WORK

A. Contractor shall examine all drawings of proposed work and coordinate his work with other trades. Work conflicts shall be brought to attention of the State and work rearranged or modified in accordance with their decision.

B. If changes in indicated locations or arrangements of work are required, they shall be made by Contractor without additional charge to the State provided that these changes were ordered before work is installed and no extra material or labor are required.

C. Should Contractor determine that extra material and labor will be required to accommodate any rearrangement, he shall first submit estimate of cost for required changes and proceed with work only upon written authority of State.

34.12 EQUIPMENT INSTALLATION

A. Before installation of any equipment is begun, Contractor shall notify the State, a minimum of two (2) weeks prior to installation, of his intended installation procedures.

B. Install and test the packaged air compressor and controls in accordance with the manufacturer's instructions and under the direct supervision of a certified representative of

the manufacturer of each equipment. Submit qualifications and manufacturer's certification of competence of the certified manufacturer's representative.

C. Necessary supports shall be provided for equipment, appurtenances and pipe, as required. These include frames or supports for air compressors and other similar type items requiring supports.

34.13 WORKMANSHIP AND FABRICATION

A. Pipe Installation:

1. Piping: Piping shall follow the general arrangement shown. Cut piping accurately to measurements established for the work. Work piping into place without springing or forcing, except where cold-springing is specified. Piping and equipment within buildings shall be entirely out of the way of lighting fixtures and doors, windows, and other openings. Do not conceal piping until it has been inspected, tested, and approved. Where pipe passes through building structure, pipe joints shall not be concealed, but shall be located where they may be readily inspected and building structure shall not be weakened. Avoid interference with other piping, conduit, or equipment. Except where specifically shown otherwise, vertical piping shall run plumb and straight and parallel to walls. Piping connected to equipment shall be installed to provide flexible for vibration. Adequately support and anchor piping so that strain from weight of piping is not imposed on the equipment.

2. Fittings: Use long radius ells where appropriate to reduce pressure drops. Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used. Make branch connections with tees fittings.

3. Cleaning: Before jointing and erection of piping or tubing, thoroughly clean interiors of pipe sections, tube, and components. In steel pipe, loosen scale and other foreign matter by rapping sharply and expel by wire brush and swab. Blow out pipe and components with compressed air at 100 psig or more. Maintain cleanliness by closure of pipe openings with caps or plugs. Before making final terminal connections, blow out complete system with compressed air at 100 psig or more.

4. Changes in Pipe Size: Use reducing fittings for changes in pipe size. The use of bushings will not be permitted.

5. Drainage and Flexibility: Compressed air piping shall be free of unnecessary pockets and pitched approximately 3 inches per 100 feet in the direction of flow to low points. Where pipes must be sloped so that condensate flows in opposite direction to air flow, slope 6 inches per 100 feet or greater. Provide flexibility by use of fittings, loops, and offsets in piping. Install branches at top of a main to prevent carryover of condensate and foreign matter.

6. Threaded Joints: Where possible use pipe with factory cut threads, otherwise cut pipe ends square, remove all fins and burrs, and cut taper pipe threads per ANSI B1.20.1, “Pipe Threads, General Purpose”. Threads shall be smooth, clean, and full cut. Apply thread tape to male threads only. Work piping into place without springing or forcing.

Backing off to permit alignment of threaded joints will not be permitted. Engage threads so that not more than three threads remain exposed.

7. Valves: Install valves at the locations indicated and elsewhere as required for the proper functioning of the system. Gate or ball valves shall be used unless otherwise directed. Valves shall be installed in positions accessible for operation and repair. Install valve with stem horizontal or above.

8. Pressure-Reducing Valves: Each pressure-reducing valve shall be provided with an inlet strainer. Each pressure-reducing valve unit shall be provided with two block valves and with a globe or angle bypass valve and bypass pipe. A bypass around a reducing valve shall be of reduced size to restrict its capacity to approximately that of the reducing valve. Each pressure-reducing valve unit shall be provided with an indicating gage to show the reduced pressure, and safety valve on the low pressure side. These requirements do not apply to small pressure regulating valves used to adjust pressure for pneumatic equipment.

B. Hangers and Supports: Selection, fabrication and installation of piping hangers and supports shall conform to MSS-SP-58, "Pipe Hangers and Supports - Materials, Design and Manufacturer", MSS-SP-69, "Pipe Hangers and Supports - Selection and Application", except that spacing of the hangers and supports shall be as per Table I.

TABLE I. MAXIMUM SPAN FOR PIPE

DIAMETER INCHES	STD. WT. STEEL PIPE SCHEDULE 40	EX. STRONG STEEL PIPE SCHEDULE 80
1/2	5'-0"	5'-0"
3/4	5'-9"	5'-9"
1	6'-6"	6'-6"
1-1/2	7'-6"	7'-9"
2	8'-6"	8'-6"

C. Pressure Gauges: Pressure gauges shall have a shut-off valve or petcock installed between the gage and the line.

D. Strainers: Strainers with meshes suitable for the services shall be provided where indicated, or where dirt might interfere with the proper operation of valve parts, orifices, or moving parts of equipment.

E. Equipment Foundations: Equipment foundations shall be of sufficient size and weight and of proper design to preclude shifting of equipment under operating conditions or under any abnormal conditions which could be imposed upon the equipment. Foundation shall meet the requirements of the equipment manufacturer. Equipment vibration shall be maintained within acceptable limits, and shall be suitable dampened and isolated.

F. Equipment Installation: Equipment installation shall be strictly in accordance with this specification, and the installation instructions of the manufacturers. Equipment mounted on concrete foundations shall be grouted before piping is installed. All piping shall be installed in such a manner as not to place a strain on any of the equipment. Flanged joints shall not

be bolted tight unless they match adequately. Expansion bends shall adequately extended before installation. All piping shall be graded, anchored, guided and supported without low pockets.

G. Cleaning of System: As installations of the various system components are completed, they shall be adequately cleaned before final closing. All foreign matter shall be removed from equipment and surrounding areas. Preliminary of final test will not be permitted until the cleaning is approved the State.

H. Pipe Sleeves: Pipe sleeves shall be provided where pipes and tubing pass through masonry of concrete walls, floors, roofs, and partitions. Sleeves shall be held securely in proper position and location before and during construction. All sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Space between the pipe or tubing and the sleeve shall be firmly packed with oakum and caulked on both ends of the sleeve with elastic cement.

I. Floor, Wall, and Ceiling Plates: Plates on pipes passing through floors and partitions of finished rooms shall be chromium-plated steel or nickel-plated cast iron; all other plates shall be painted cast-iron, malleable iron, or steel.

J. Flashing for Buildings: Where pipes pass through building roofs and outside walls, provide flashing.

K. Union and Flanges: Unions and flanges shall be placed where necessary to permit easy disconnection of piping and apparatus, and as indicated. Each connection having a screwed-end valve shall have a union. Unions shall be used on piping under 2 inches in diameter, and flanges shall be used on piping 2 inches and over in diameter. Dielectric unions or flanges shall be installed between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous to non-ferrous connections.

34.14 PAINTING AND IDENTIFYING OF PIPING

A. General:

1. The following items furnished under this article are to be painted and identified under ARTICLE LXXXVIII – INTERIOR PAINTING and ARTICLE LXXXIX – HIGH PERFORMANCE COATINGS. Do not paint over name plates or other identifying labels.

2. Paint exposed black iron work including pipe, fittings, iron body valves, pipe hangers, etc., with two coats of zinc rich paint.

B. Identification of Piping: Provide identification of all new pipe lines in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

C. Identification of Valves: Provide identification tags for all valves in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

34.15 TESTING

A. General Requirements, Testing: Perform testing after cleaning and acceptance of cleanness. Contractor shall furnish equipment and apparatus necessary for tests. Tests shall be subject to the approval of the State. Pressurize each piping system individually and check to assure that there are no cross-connections between different systems prior to operational tests.

B. Factory Tests: Test air compressors at the factory to assure proper operation. Contractor shall certify satisfactory accomplishment of tests.

C. Hydrostatic and Leak Tightness Tests:

1. Remove or isolate from the system the compressor, filters, instruments, and equipment which would be damaged by water during hydrostatic tests and reinstall after successful completion of tests.

2. Hydrostatically test piping systems for 30 minutes with water at one and one-half times design working pressure.

3. After satisfactory completion of hydrostatic pressure test, blow systems dry with clean, oil-free compressed air, and test with clean, dry air at design working pressure. Brush joints with soapy water solution to check for leaks. Install a calibrated test pressure gage in piping system to observe any loss in pressure. Calibrate the test pressure gage with a dead weight tester within 15 days before use certify by initial and date on a sticker applied to dial face. Maintain required test pressure for a sufficient length of time to enable an inspection of joints and connections.

D. Operational Tests: Test equipment as in service to determine compliance with contract requirements and warranty. During the test, test equipment under every condition of operation. Test safety controls to demonstrate performance of their required function. Completely test system for compliance with specifications.

E. Defective Work: If inspection or test shows defects, such defective work or material shall be replaced and inspection and tests repeated. Repairs to piping shall be made with new material. No caulking of screwed joints or holes will be accepted.

34.16 POSTED OPERATING INSTRUCTIONS

A. Furnish approved operation instructions for each principal item of equipment for the use of the operation and maintenance personnel. The operation instructions shall include wiring diagrams, control diagrams and control sequence for each principal item of equipment. Operating instruction shall be printed or engraved and shall be framed under glass or in approved laminated plastic and posted where directed by the State. Operating instruction shall be attached to or posted adjacent to each principal item of equipment including start-up, procedure in the event of equipment failure and other items of instruction as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather shall be made of weather-resistant materials or shall be suitably enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

34.17 FIELD INSTRUCTIONS

A. Upon completion of the work and at a time designated, the services of one or more qualified personnel shall be provided by the Contractor for a period of not less than 8 hours to instruct the representatives of the State in the operation and maintenance of the compressed air system. These field instructions shall cover all the items contained in the bound instructions.

34.18 MAINTENANCE AND SERVICE CONTRACT

A. Provide maintenance service for all compressed air system components as specified in accordance with the requirements and schedule of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

34.19 OPERATION AND MAINTENANCE MANUAL

A. Submit the Operating and Maintenance Manual for all compressed air system equipment and the system as a whole in accordance with the requirements and schedule of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

34.20 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXXV – FUEL DISPENSING

35.1. GENERAL

A. This article covers the furnishing, fabrication, delivery and installation of the fuel storage and piping system complete, including but not limited to the following:

1. Aboveground gasoline fuel storage tank
2. Aboveground diesel fuel storage tank
3. Transfer pumps.
4. Fuel and vent piping system.
5. Leak detection and monitoring system
6. Pipe, valves and fittings
7. Electrical conduits, wiring and components pertaining to the monitoring and control system
8. Operation and maintenance instruction manuals
9. Manufacturer's literature, shop drawings and record drawings
10. Inspection, test and guarantee

35.2. RELATED WORK SPECIFIED ELSEWHERE

A. Exterior excavation and backfill specified in ARTICLE XVII – UTILITY EXCAVATION AND BACKFILL.

B. Mechanical work specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

C. Electrical work specified in ARTICLE XLII – ELECTRICAL WORK.

35.3. CODE, STANDARDS, REGULATIONS

A. Installation of all work in this article shall be made in accordance with State Department of Health Regulations, National Fire Protection Association, and the International Building Code.

B. All applicable codes, regulations and ordinances of public bodies having jurisdiction are considered a part of these specifications; all work installed and materials provided must comply with the current edition of such codes, regulations and ordinances.

C. Present to the State certificates of inspection and approval from proper authorities.

35.4. 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, 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 University.

B. Capacities of all equipment and materials shall be not less than those indicated.

C. Nameplate: Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment.

D. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the State of any discrepancy before performing any work.

35.5. SUBMITTALS

A. Submit in accordance with ARTICLE XI – REQUIRED SUBMITTALS and ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Manufacturer's Catalog Data.

1. Aboveground gasoline fuel storage tank
2. Aboveground diesel fuel storage tank
3. Tank fittings and attachments
4. Leak detection monitoring system
5. Tank level probes
6. Tank interstitial sensors
7. Overfill alarms
8. Pipe, valves and fittings
9. Electrical components and control system
10. Fuel transfer pump set
11. Transfer pump

C. Shop Drawings: Show the general arrangement of all components, clearances and principal dimensions including overall length, width and height, controls and electrical schematic drawings. Include weight of components, capacities and clearances. Submit shop drawings, "as-built" drawings and control diagrams showing new system equipment arrangement for the fuel systems.

D. Statements:

1. Permits
2. Personnel license/certifications

E. Field Test Reports:

1. Pneumatic tests
2. Leak detection monitoring system operational tests
3. Operational test of fuel system

F. Certificates:

1. Tank fittings and attachments
2. Pipe and fittings
3. Valves

G. Operation and Maintenance Manuals: Operations and Maintenance manuals shall be provided for each major system including but not limited to:

1. Aboveground gasoline fuel storage tanks
2. Aboveground diesel fuel storage tanks
3. Leak detection monitoring system
4. Tank level probes
5. Overfill alarms
6. Tank interstitial sensors
7. Emergency shutoff valve system
8. Secondary containment system (if needed)

35.6. QUALITY ASSURANCE

A. Standard Products: Materials shall be resistant to diesel fuel and other petroleum based products conforming to requirements of FS VV-F-800, "Fuel Oil, Diesel". Completed installation shall conform to applicable requirements of NFPA 30, "Flammable and Combustible Liquids Code".

B. Permitting: Contractor shall obtain necessary permits in conjunction with installation of underground petroleum piping as may be required by federal, state, or local authority. Submit copy of permits to the State.

C. Licensed Personnel: Personnel required to install underground petroleum piping shall be licensed/certified by the State of Hawaii. Submit copy of license/certification to the State.

D. Safety: Ensure employees are trained in requirements of 29 CFR 1910.1200, "Hazard Communication", and understand information contained in material safety data sheets for their protection against toxic and hazardous chemical effects.

E. Experience: Contractor shall be experienced in the construction of fuel system.

35.7. OMISSIONS

It is the intent of the plans and specifications to provide a complete installation. Should there be omissions, the Contractor shall call the attention of the State to such omissions prior to the deadline for inquiries so that the necessary corrections can be made

35.8. GUARANTEE AND CERTIFICATE

A. In general, the provision of Section 699 of the Standard Specifications shall apply except as hereinafter modified.

1. All equipment, fixtures, piping, accessories and material furnished for a period of one (1) year commencing after 30 consecutive days of trouble-free operation from the date of final acceptance against all defects in material and workmanship. If any equipment, fixture, 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, fixture, piping and materials to provide the results specified or shown.
3. All equipment to be properly installed in strict accordance with manufacturer’s recommendations and to be free of vibration or objectionable noise.

4. All piping to be drip free and properly installed to be free of vibration, pounding or objectionable noise.

B. The above guarantee shall not be interpreted as voiding, limiting or reducing any equipment manufacturer's warranty or any guarantee permitted by law.

C. The Project Manager shall have the right to require a written certificate, dated and signed by a responsible employee of this Contractor, evidencing the performance of any portion of the work, or any testing; as a condition precedent to the acceptance of any work or the result of any test. Whenever a regulatory agency performs inspections or tests of any portion of the work, a certificate shall be furnished by the Contractor that the inspection or test was satisfactorily passed.

35.9. PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Furnish new equipment, 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 contract period after installation.

35.10. QUALITY ASSURANCE

A. Standard Products: Materials shall be resistant to diesel fuel and other petroleum based products conforming to requirements of FS VV-F-800, "Fuel Oil, Diesel". Completed installation shall conform to applicable requirements of NFPA 30, "Flammable and Combustible Liquids Code".

B. Permitting: Contractor shall obtain necessary permits in conjunction with installation of the aboveground storage tank system as may be required by federal, state, or local authority. Submit copy of permits to the Project Manager.

C. Licensed Personnel: Personnel required to install the aboveground storage tank system shall be licensed/certified by the State of Hawaii. Submit copy of license/certification to the Project Manager.

D. Safety: Ensure employees are trained in requirements of 29 CFR 1910.1200, "Hazard Communication", and understand information contained in material safety data sheets for their protection against toxic and hazardous chemical effects.

35.11. MATERIALS AND EQUIPMENT

A. All materials shall be new, of equal or better quality of materials specified, and approved by the State. For ease of maintenance and parts replacement, select equipment from a single manufacturer as much as possible. Substitutions require pre-bid approval.

B. All materials shall be suitable for the service intended. Service will gasoline or diesel fuel as indicated.

35.12. ABOVEGROUND FUEL STORAGE TANK

A. General: Tanks provided shall be as specified. Each provided AST shall be UL listed for compliance with UL 2085, as an insulated, secondary containment aboveground storage tank, protected type. Each tank shall bear the UL label in compliance with UL 2085.

B. Concrete Encased Aboveground Storage Tank: Tank system shall include a primary storage tank and an integral fully-enclosed secondary containment reservoir. Tank system shall be in accordance with NFPA 30 and NFPA 30A. Tank system shall be designed and manufactured for horizontal installation. Primary storage tank shall be constructed of single wall stainless steel in accordance with UL 142. The secondary containment must be a minimum of 30 mil thick high density polyethylene (HDPE) liner encased in concrete that fully-encloses the primary storage tank. Concrete must have a minimum 4000 psi strength, be monolithically poured, and properly reinforced for the application. The primary storage tank and insulation must be isolated from the exterior concrete encasement. The volume of the containment reservoir shall be greater than or equal to 110 percent of the primary tank volume. The primary storage tank shall be supported within the containment reservoir with steel tank saddles, or other similar supports, fabricated and attached by the tank manufacturer. Tank system shall bear the UL 2085 label. The containment reservoir shall verifiable for leaks. Provided with lifting lugs which allow tank system relocation. Provide a minimum smooth flat mounting surface of 12 by 12 inches for attaching nameplates.

C. Tank Exterior Protective Coating: Protect the exterior surfaces of each aboveground tank with the manufacturer's standard coating system. Finish paint shall be white.

D. Tank Interior Protective Coating: Tank shall be provided with an interior protective coating in accordance with manufacturer's recommendations.

E. Tank Piping Penetrations: The number and size of tank piping penetrations shall be provided as indicated. Dielectric bushings shall be provided on all pipe connections to a tank. Pipe connections to a tank shall be through welded-in-place double tapered NPT couplings. The termination of fill lines within a tank shall be provided with an anti-splash deflector.

F. Tank Signage.

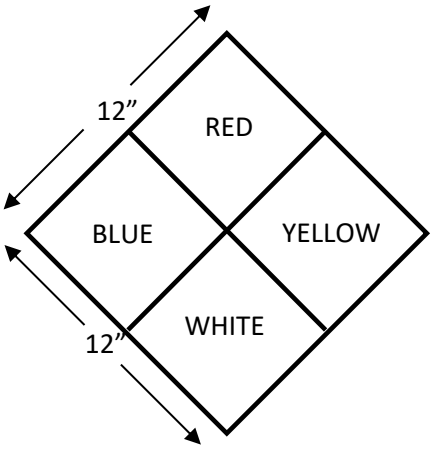
1. The tank shall be provided with signs affixed to the tank exterior in a visible location. The signs shall be red letters on white background with minimum size 3" high, 1/2" stroke. The signs shall indicate the following:

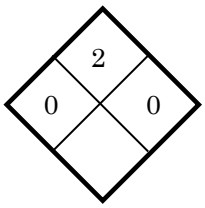
    a. "NO SMOKING OR OPEN FLAMES WITHIN 25 FEET" on all approachable sides and dispensing area within 25 feet.
    b. "DANGER-FLAMMABLE LIQUID" on all approachable sides, 3" high, 1/2" stroke, red letters on white background.
    c. Warning labels conforming to NFPA 704 Hazard Labeling System on all approachable sides (12" square, NFPA standard style and colors).
    d. The tank shall be provided with a label indicating its empty lifting weight (1" high, 3/16" stroke)

2. The tanks shall be provided with labels affixed to the tank exterior indicating the following information:

    a. "CAUTION: This tank to contain only petroleum products" at the fill port (3/4" high, 1/8" stroke).
    b. "No. 2 DIESEL" or “GASOLINE” on the dispenser (1" high, 3/16" stroke, red letters on white).
    c. "xxxx GALLONS" is the actual compartment xxxx capacity near the fill port.
    d. "FILL" at the fill port.
    e. "VENT" at the vent riser.
    f. "EMERGENCY VENT" at the emergency vent fitting.
    g. "Owner/Operator: “State of Hawaii" 1" H x 1/8" stroke letters, red on white, on or under the dispenser on tank.

h. NFPA 704 identification of the fire hazards of material placards. On all approachable side of tank.





Reflective white lettering
on the blue and red diamonds

i. "IN CASE OF FIRE OR SPILL
(1) Use emergency pump shutoff
(2) Report the accident:
Fire Department No._____
Facility Address:_____"
1" H x 3/16" stroke, red on white, on or under the dispenser on tank.

j. "PRODUCT I.D. GASOLINE" or "PRODUCT I.D. No.2 DIESEL" on dispenser. 1" H x 3/16" stroke, red on white.

k. "PRODUCT I.D." tag on fill pipe. 3/4" H letters, red on white.

G. Tank Fittings and Attachments: Provide tank with the following fittings and attachments as indicated or required:

1. Fill limiting valve to restrict flow to 2 gallons per minute when tank reaches approximately 90 percent of capacity.
2. Overspill containment with drain back to tank, UL listed
3. Aluminum drop tube in fill connection. Size as indicated.
4. Tank suction fitting for transfer pump.
5. Tank level gauge fitting.
6. Manual gage stick.
7. Normal vent, free flow type and riser. Overall riser height as indicated.
8. Emergency primary and secondary vent. Size as indicated.
9. Grounding lug attached to steel tank shell.
10. Interstitial leak detection connection with lockable cap, clearly marked.
11. Tank level probe fitting.

35.13. STORAGE TANK ACCESSORIES

A. Storage Tank Fill Automatic Shutoff Valve: Provide with OPW 633-T, Morrison or approved substitute aluminum 4" fill adapter. Shutoff valve shall restrict flow to 2 gallons per minute when tank reaches approximately 90% of capacity. Provide overfill alarm panel which shall include an alarm light, an audible alarm, and reset capabilities. The alarm panel shall be mounted adjacent to the tank as indicated. The alarm panel shall initiate a minimum 70 decibel audible alarm when the liquid level within a tank reaches the 90 percent full level. The alarm system shall conform to the requirements of paragraph MONITORING SYSTEM. Provide Morrison Bros 9095AA, OPW overfill prevention valve or approved equal for above ground storage tank with drop tube.

B. Storage Tank Emergency Vent: Provide primary and secondary tank emergency pressure relief vent for all storage tanks, with aluminum body and lid, carbon graphite shear pin designed to break at 2.5 psi, spring loaded lid, stainless steel link designed to break at 3.5 psi and cast iron bar designed to break at 6.5 psi, and 8" connection. Provide OPW 202-F, Morrison Brothers or approved substitute. Provide aluminum emergency vent adapter for emergency vent tank connections less than 8".

C. Storage Tank Vent: Provide primary tank vents for all storage tanks, Morrison Bros 749 pressure/vacuum vent, OPW or approved substitute. Provide vent riser with height as indicated.

D. Tank Gauges:

1. Stick Gauge: Tank shall be provided with 2 stick gauges graduated in feet and inches. Stick gauge shall be of wood and treated after graduating to prevent swelling or damage from the fuel being stored.

2. Tank Calibration Charts: Tank shall be furnished with 2 copies of calibrated charts which indicate the liquid contents in gallons for each 1/8 inch of tank depth.

3. Analog Tank Gauge: Each storage tank shall be provided with an automatic analog reading gauge which is directly mounted to a tank fitting as indicated. Gauge shall be a level sensing, mechanically actuated device. Gauge shall be accurate to plus or minus 1/4 inch and be capable of measuring the liquid level over the full range of a tank's height. Gauge shall have vapor tight seals to prevent condensate from fogging the viewing glass. Provide Morrison 818 clock gauge with stainless steel float and cable or approved substitute. Provide clock face to match fuel tank provided.

35.14. LEAK DETECTION MONITORING SYSTEM

A. The system shall be UL and FM approved, intrinsically safe for use in hazardous locations. The system shall include the probes, sensors, alarm annunciators, sensor and control wiring, transformers, and connectors, supplied by a single manufacturer. Electrical connections below grade shall be buried service wire splice encapsulation kits. Provide PVC conduit with sweep elbows for all buried cable incidental to the monitoring and leak detection system. Monitor panel and devices shall be Veeder-Root leak detection panel or approved equal.

1. Monitor Panel: Provide a microprocessor-based wall-mounted monitoring panel capable of interfacing with the sensors, probes, and alarms specified hereinafter. The monitor shall be housed in a NEMA 1 enclosure with visual indicators for power, alarm, and warning conditions. A liquid crystal display with function keys, numeric keypad and an integral printer capable of providing a hard copy record of the amount of fuel dispensed in understandable English shall be provided. The monitoring system shall be suitable for continuous operation, reporting both normal operating conditions

and system malfunctions or failures. The monitor panel shall be provided with all interfacing components to permit communication and data transfer with computers, central station alarms, and external printing devices. The monitor panel shall include alarm capabilities for the following minimum conditions: tank high liquid level, tank low liquid level, overfill, tank leak, and piping leak. The monitor shall be capable of handling multiple sensors. Provide cables, sensor/input/output/communications modules, connectors, battery back-up, and mounting and installation hardware. Monitor panel shall include printer and network card for remote access. Provide Veeder-Root TLS-350 or approved equal.

2. Tank Interstitial Sensor: Provide a sensor which shall function in the leak detector tube of the interstitial space for the storage tank as indicated. The sensor shall meet NFPA 30, "National Electrical Code", Class I, Division 1, Group D for hazardous location. The sensor shall have the ability to detect the presence of liquid in the interstitial space and provide an alarm condition. The monitoring system shall have the ability to continuously monitor the integrity of the sensor for an open condition, alarm condition, or normal operating condition. Sensor shall be compatible with the fluid which it is monitoring.

3. Tank Level Probe: Provide an electronic, magnetostrictive wire probe which shall have the ability to collect in-tank fluid height and temperature data. The probe shall interface with the monitoring panel which in turn shall be capable of providing on-demand inventory reports, which shall include fluid volume, fluid height, fluid temperature, date, and time. After a delivery of fuel to the tank has been completed, the system shall be capable of providing an inventory report on the monitor panel, which shall include the starting volume in the tank, ending volume in the tank, net increase in volume, date, and time. Probe shall be compatible with the fluid which it is monitoring.

4. Overfill Alarm Panel: Provide an alarm capable of providing both audible and visual warnings of a potential overfill to the operator making a fluid delivery to the tank. The alarm shall interface with the monitoring panel. The alarm panel shall be equipped with a push button to provide the operator with the ability to acknowledge the alarm and silence the audible indicator. The alarm and acknowledgment switch shall be designed to operate in an outdoor environment. The system shall have a programmable alarm limit.

5. Input/Output Modules: Provide input/output modules for switch inputs from external devices and relay outputs to overfill alarms, external audible and visual warning devices, and pump control functions as indicated or required.

35.15. TANK MOUNTED FUEL DISPENSER

A. Provide a new fuel dispensing unit complete with pump, dispenser, hose, nozzle and controller.

B. Provide fuel dispensing unit with integral UL labeled suction pump as supplied by the tank manufacturer. Unit must include all necessary appurtenances for operation. Unit must include a visible register to indicate individual deliveries up to 99.9 gallons with a reset meter. Pump must have a delivery capacity of 15 gpm. Hose must be a minimum 3/4 inch inside diameter, 15 ft long, and fuel resistant. The dispensing nozzle must be of the automatic shutoff type with graduated notches for various delivery speeds. Dispensing unit must provide a means for locking of the nozzle to the pump when the pump is shutoff. Diesel fuel dispensing unit cabinet must be painted yellow from the manufacturer. Gasoline dispensing unit must be painted red from the manufacturer. Units must be clearly marked for the fuel they are dispensing.

35.16. SPECIAL WIRING

A. All factory assembled, package type equipment shall be provided with integral control panel to which all motors in each unit shall be factory wired. Control panel shall contain all relays, starters, and other control devices, all arranged so as to be accessible for maintenance, testing, and inspection. Control panel on each unit shall contain 120 volt control transformer installed so that all control circuits extending to remote control devices, etc., will be 120 volts maximum.

B. Any wiring not shown and required to properly connect equipment, including connections to special safety control or apparatus not shown, shall be included under this article.

C. All electrical conduit and wiring between the control panel, tank, emergency alarm panel and packaged pump set shall be provided by the contractor in accordance with all manufacturer's recommendations and the National Electric Code. Wiring, equipment, and fittings shall be explosion-proof in conformance with applicable requirements of UL 698 and UL 886 for Class I, Division 1, Group C and D hazardous locations.

35.17. MISCELLANEOUS SIGNS

A. Provide a "NO SMOKING" sign within 15 feet of point of transfer while filling operations are in progress at container or vehicles (i.e. at aboveground fuel tank, fuel dispenser). Sign shall be made from aluminum with plastic laminate to protect the printed message from the weather, minimum size 10 inches high by 7 inches wide.

B. All signs shall be conform to the requirements of ANSI Z535. Provide fasteners for wall mounting or galvanized steel U-channel or square tubing sign posts with concrete footing for free standing locations.

C. Provide "EMERGENCY SHUTOFF" sign at emergency shutoff switch for fuel dispensers. Signs shall be made from fiberglass, ultraviolet, weather and impact resistant, reflective, projecting type and conform to the requirements of 29CFR 1910.145.

D. Provide signage for dispensing area in accordance with NFPA 1, Section 42.7.2.6.4 as amended by the State Fire Code. Sign shall be conspicuously posted in the dispensing area and shall have the following or equivalent wording:

"WARNING: it is unlawful and dangerous to dispense fuel into unapproved containers.

No Smoking.

Stop Motor.

No filling of portable containers in or on a motor vehicle.

Place container on ground before filling.

Discharge your static electricity before fueling by touching a metal surface away from the nozzle.

Do not Re-enter your vehicle while fuel is pumping.

If a fire starts, do not remove nozzle – back away immediately.

Do not allow individuals under the age of 15 to use the pump.

The placement of foreign object(s) that allows the fuel dispensing lever to remain in the open position is prohibited at all times."

35.18. PREPARATION

A. Visit the worksite and become fully aware of all existing conditions. Investigate the Contract Documents and make proper provisions to avoid interferences and construction delays. Determine the exact route of each pipe. Make offsets and changes in direction required to maintain proper headroom and pitch or to accommodate the structure and the work of other trades. Furnish other trades with information to properly locate and size openings in the structure required for this work. Furnish anchor bolts, sleeves, inserts and supports required for this work.

35.19. INSTALLATION AND REQUIREMENTS

A. Perform work using personnel skilled in the trade involved. Provide competent supervision. Furnish new equipment, materials and accessories bearing the manufacturer's identification and conforming to recognized commercial standards. All required demolition, including saw cutting and chipping of concrete and masonry to remove or install fixtures and piping shall be provided as well as patching, repair and painting at no additional cost to the State. Provide all extra materials and labor for a complete operable system at no additional cost to the State.

35.20. ACCESS TO EQUIPMENT

A. Install all control devices, specialties, valves and related items to provide easy access for operation, inspection, repair and maintenance. If these items are concealed behind walls or ceilings of non-removable type construction, provide access panels of proper size for easy access at no additional cost to the State.

35.21. EQUIPMENT INSTALLATION

A. Install equipment in the space allotted with sufficient clearance for proper operation and maintenance. Where equipment differs in arrangement or connections from those shown, provide all required changes in piping, supports and appurtenances and cost of work of any other trades affected. Provide equipment accessories necessary for proper operation and support.

35.22. STORAGE TANK INSTALLATION

A. When moving, handling or working around the storage tank ensure no damage occurs to the tank or separator, its fittings and attachments, concrete pad, piping, or the leak detection monitoring system components. Cap all unused fittings to prevent the introduction of foreign matter into the tank or separator.

B. Installation: Install storage tank as indicated and in accordance with manufacturer's instructions. Tank shall be anchored to the concrete pad. Provide grout between the concrete pad and tank supports as necessary. Coordinate work among trades to prevent conflicts or delays. Verify proper locations for piping and conduit penetrations through the concrete pad and anchor bolt locations prior to pouring concrete. Install all tank and separator fittings after tank or separator is anchored. Fittings shall be properly protected from damage during installation.

35.23. PIPING INSTALLATION

A. Piping connections to equipment shall be as required by equipment manufacturer. Clean pipe interior of foreign matter. When work is not in progress, close open ends of pipe and fittings so that water, earth, or other substances cannot enter. Replace pipe, fittings, or appurtenances found defective after installation. Make threaded joints with tapered threads and make tight with joint compound; compatible with intended petroleum products, applied to male threads only. Install in accordance with the pipe manufacturer’s recommendations.

35.24. LEAK DETECTION MONITORING SYSTEM

A. General: Provide all wiring, conduit, junction boxes, and other devices required for the leak detection monitoring system. Wiring, equipment, and fittings shall be explosion-proof in conformance with applicable requirements of UL 698 and UL 886 for Class I, Division 1, Group C and D hazardous locations. Submit proof of such conformance for approval. Installation shall conform to requirements of NFPA 70. Store and handle all leak detection monitoring system components to ensure sound, undamaged condition. Do not drop, strike, or otherwise mishandle the components, which could result in loss of calibration or damage. All damaged equipment shall be replaced with new equipment at no additional cost to the State.

B. Monitor Panel: Mount the monitor panel as indicated and in accordance with the manufacturer's instructions. Provide necessary mounting hardware. Provide power to the monitor panel.

C. Probes and Sensors: Install probes and sensors as indicated and in accordance with the manufacturer's instructions. Pre-test probes and sensors prior to installation. Do not allow foreign matter to enter the storage tank or interstitial space during installation. Probes and sensors shall not be damaged during installation.

D. Overfill Alarms: Mount the remote overfill alarm and acknowledgment switch as indicated and in accordance with the manufacturer's instructions. Provide necessary mounting hardware.

35.25. ELECTRICAL WORK

A. Provide wiring, conduits, switches and devices required for controlling electrical equipment. Wiring, equipment, and fittings shall be explosion-proof in conformance with applicable requirements of UL 698 and UL 886 for Class I, Division 1, Group C and D hazardous locations. Submit proof of such conformance. Electrical installations shall conform to requirements of NFPA 70.

35.26. TESTS

A. Piping Pneumatic Test: Test product carrier piping under pneumatic pressure of at least 1-1/4 times designed working pressure of the particular piping system, but not less than 50 psig. Test secondary piping under pneumatic pressure of 5 psig. Provide filtered, oil-free air for tests. Joints in secondary piping shall not be made until product carrier pipe is successfully pressure tested. Take care not to exceed pressure rating of various fittings. Maintain pressure in product carrier piping for at least 2 hours during which there shall be no drop in pressure in each line greater than that allowed for thermal expansion and contraction. Maintain a pressure in secondary piping for at least one hour. To facilitate this test, various sections of each piping system may be isolated to test each separately. Furnish tapped test adapter fittings that can be attached to each end of the section of line being tested that will permit direct connection to the piping from air compressor. No taps in line will be permitted. Furnish necessary equipment for testing. Gauges shall be subject to testing and approval. In the event leaks are detected, repair and repeat tests. Upon satisfactory completion of tests, relieve pressure and seal line. Make provisions to prevent displacement of piping during testing. Keep personnel clear of piping during pneumatic testing. Isolate equipment such as pumps, tanks, and meters from piping system during tests.

B. Aboveground Piping Pneumatic and Hydrostatic Tests: Testing shall comply with the applicable requirements of ASME B31.3, NFPA 30, and the requirements specified herein. Care shall be taken not to exceed pressure rating of various fittings. Hydrostatic testing shall be performed using fuel as the liquid. Water shall not be introduced into the system for testing. To facilitate the pneumatic and hydrostatic tests, various sections of the piping system may be isolated and tested separately. Where such sections terminate at flanged valve points, the line shall be closed by means of blind flanges in lieu of relying on the valve. Tapped flanges shall be provided to allow a direct connection between the piping and the air compressor and/or pressurizing pump. Tapped flanges shall also be used for gauge connections. Taps in the permanent line will not be permitted. Gauges shall be subject to testing and approval. In the event leaks are detected, the pipe shall be repaired and the test repeated. Following satisfactory completion of each pneumatic and hydrostatic test, the pressure shall be relieved and the pipe immediately sealed. Provision shall be made to prevent displacement of the piping during testing. Personnel shall be kept clear of the piping during pneumatic testing. Equipment such as pumps, tanks, and meters shall be isolated from the piping system during the testing.

C. Aboveground Storage Tank Tightness Tests: A tightness test shall be performed on each aboveground storage tank. The tests shall be performed prior to making piping connections. Tests shall be capable of detecting a 0.1 gph leak rate from any portion of the tank while accounting for effects of thermal expansion or contraction. Gauges used in the tightness tests shall have a scale with a maximum limit of 10 psig. Each storage tank shall be pressurized with air to 5 psig and monitored for a drop in pressure over a 2-hour period during which there shall be no drop in pressure in the tank greater than that allowed for pressure variations due to thermal effects.

D. Manufacturer's Tank Tests: Following the tank tightness test, each storage tank shall be leak tested in accordance with the manufacturer's written test procedure if the manufacturer's test procedure is different from the tightness tests already performed. Any test failure shall require corrective action and retest.

E. Fuel System Flushing and Operational Test: Install temporary piping or hose equipped with a strainer having not less than 40-mesh screen between supply pipe and tank fill connection on tank from which fuel is being pumped. Furnish temporary pump for flushing. Clean means absence of sediment or emulsion; bright refers to fluorescent appearance of fuel that has no cloud or haze. Test system to demonstrate performance requirements for which it was designed. Test shall include unloading fuel trucks to demonstrate effectiveness of overfill and overspill protection system. When a portion of each system or a piece of equipment fails to pass tests, make repairs or adjustments and repeat test until satisfactory performance is achieved. Tests shall be witnessed by the Project Manager, and the Contractor shall notify the Project Manager a minimum of 14 days before testing. Furnish calibrated instruments and equipment, as well as the fuel, required to clean and flush each system and to conduct tests. Upon completion of tests replace filters.

F. Leak Detection Monitoring System Test: Activate leak detection monitoring system and test in accordance with manufacturer's instructions and witnessed by the Engineer. All deficiencies shall be corrected and the system re-tested.

1. High Liquid Level Alarm Test: Each storage tank shall be initially overfilled with the appropriate product in order to verify the high liquid level alarms in the remote alarm panel function as designed. The initial overfill shall also verify that the storage tank overfill protection device functions as designed. Tank overfill shall stop immediately once the overfill device operates. The Contractor shall not overfill any storage more than 98 percent level even if the leak detection and liquid level electronic panel and the overfill device do not function as designed. Any problems with the electronic panel or the overfill device shall be corrected and retested. The system shall be drained below the high liquid levels following all tests.

35.27. EQUIPMENT TEST, INSPECTION, AND OPERATION

A. Test and Inspection: Perform all field tests and trial operations, and conduct all field inspections. Provide all labor, equipment, and incidentals required for the tests. State shall witness all field tests and trial operations and shall conduct final field inspections. Give the State ample notice of the dates and times scheduled for tests, trial operations, and inspections which require the presence of the State. All deficiencies found shall be rectified and work affected by such deficiencies shall be completely retested at the Contractor's expense.

B. Operation: Place into operation all equipment provided and installed, except as specifically noted otherwise. Make all necessary adjustments to equipment to assure proper operation as instructed by the manufacturers of the equipment. Lubricate equipment prior to operation in accordance with the manufacturer's instructions. Dry out all motors before operation as required to develop and maintain proper and constant insulation resistance.

35.28. TANK FUEL LEVEL AT TURNOVER

A. At the end of all testing and inspections, the tank shall be turned over to the State with a full tank of fuel, grade to be coordinated with the State.

35.29. PAINTING AND IDENTIFYING

A. The items furnished under this article are to be painted and identified under ARTICLE LXXXIX – HIGH-PERFORMANCE COATINGS. Do not paint over name plates or other identifying labels. Paint all unfinished, exposed pipes, nipples, fittings and other ferrous items.

35.30. PIPING IDENTIFICATION

A. As specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

35.31. IDENTIFICATION OF VALVES

A. As specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

35.32. CLEANING AND ADJUSTING

A. Equipment and piping shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Pumps shall be adjusted to the flow indicated by the manufacturer to meet specified conditions.

35.33. FIELD INSTRUCTON

A. As specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. The Contractor shall provide the services of a certified representative of the fuel storage and dispensing system and waste product transfer system for a period of one (1) working days of training for the State. Instruction shall include operation and maintenance.

35.34. MAINTENANCE SERVICE CONTRACT

A. Comply with all the requirements specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

35.35. OPERATION AND MAINTENANCE MANUAL

A. Comply with all the requirements specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

35.36. SCHEDULE OF MAINTENANCE SERVICE

A. Comply with all the requirements specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

35.37. MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXXVI – UNITARY AIR CONDITIONING EQUIPMENT

36.1 GENERAL

A. This article covers the furnishing, fabrication, delivery and installation of the air conditioning system complete, including but not limited to the following:

1. Variable Refrigerant Flow system.

2. Operation and maintenance instructions and manuals.

3. Manufacturer's literature, shop drawings and record drawings.

4. Inspection, test and guarantee.

36.2 RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical work as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS unless specified otherwise in the Mechanical Division.

B. Painting work specified in ARTICLE LXXXVIII – INTERIOR PAINTING.

C. Electrical work specified in ARTICLE XLII – ELECTRICAL WORK.

D. Pipe, duct and equipment insulation and related appurtenances specified in ARTICLE XXXII – MECHANICAL INSULATION.

E. Ductwork and ductwork accessories specified in ARTICLE XXXVII – DUCTWORK AND DUCTWORK ACCESSORIES.

F. Testing, adjusting and balancing of air conditioning systems specified in ARTICLE XL – HVAC TESTING, ADJUSTING, AND BALANCING.

36.3 SUBMITTALS

A. Submit in accordance with ARTICLE XI – REQUIRED SUBMITTALS and ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Shop Drawings: Submit shop drawings of plans, performance data and details showing locations and installation including but not limited to the following (Note: shop drawing of these items can be combined with the shop drawing for the air conditioning equipment shop drawings.):

1. Fan coil unit.

2. Air cooled condensing unit.

C. Certificates of Conformance or Compliance: Submit certificates of conformance for performance and characteristics specified, the listed standards and in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS for the following:

1. Fan coil unit per ARI Standard 210/240 or 360.

2. Air cooled condensing unit per ARI Standard 365.

D. Product Data: Submit product data for the following:

1. Fan coil unit.

2. Air cooled condensing unit.

E. Operations and Maintenance Manuals: Submit manuals in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

F. Equipment Listing: Listing of equipment showing name and addresses of manufacturers; manufacturer's local supplier's name, address and phone number; catalog numbers and trade names in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

G. Maintenance service contract and schedule: Submit maintenance service contract and schedule in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

H. As-Built Drawings: Submit drawings in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

I. Guarantee and Certificate: Submit one year guarantee and certificate in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

J. Warranty: Submit three year written warranty for coatings on finned tube coils in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

36.4 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.

1. AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 210/240	Unitary Air-Conditioning and Air-Source Heat Pump Equipment
ARI 360	Commercial and Industrial Unitary Air Conditioning Equipment

2. AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

ASHRAE 15	Safety Code for Mechanical Refrigeration

3. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME/ANSI B31.5	Refrigeration Piping

4. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 653/A 653M	Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
ASTM B 117	Operating Salt Spray (Fog) Apparatus
ASTM C 534	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM D 1654	Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM E 84	Surface Burning Characteristics of Building Materials

5. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58	Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	Pipe Hangers and Supports - Selection and Application

6. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA ICS 1	Industrial Control and Systems
NEMA ICS 2	Industrial Control and Systems Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC 1
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA MG 1	Motors and Generators

7. UNDERWRITERS LABORATORIES INC. (UL)

UL 873	Temperature-Indicating and Regulating Equipment
UL 900	Air Filter Units

36.5 QUALITY ASSURANCE

A. Modification of References: Accomplish work in accordance with the referenced publications, except as modified by this article. 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 Owner," or "the Design Engineer" to mean the Project Manager.

B. Safety: Design, manufacture, and installation of unitary air conditioning equipment shall conform to ASHRAE 15

36.6 WARRANTY

A. Manufacturer's Warranty: Submit manufacturer's 3 year written warranty for coatings on finned tube coils in accordance with item entitled "CORROSION PROTECTION" and with the requirements in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

36.7 VARIABLE REFRIGERANT FLOW SPLIT SYSTEM

A. The variable refrigerant flow (VRF) air conditioning system shall be cooling only split system. The system shall include an air cooled condensing unit, indoor unit, and system controls.

B. Air Cooled Condensing Unit: VRF system with a single, dual or triple frame outdoor unit connected to indoor units with a single refrigerant piping system connectable using factory designed and supplied Y-branches and Headers, and having integrated controls.

1. Casing / Frame shall be constructed with galvanized steel, bonderized and finished with powder coat baked enamel paint or epoxy coating. Each frame shall have removable inspection panels to allow access to service tool connection, dip switches, auto addressing and error codes.

2. Outdoor unit frames shall be completely factory assembled, piped and wired. Dual and triple frame outdoor units may be field piped with factory designed and supplied Y-branch kits to manifold them together into a single refrigerant circuit.

3. Refrigerant System consists of a single refrigeration circuit and use refrigerant as indicated. The outdoor unit shall be provided with factory installed components, including a refrigerant strainer, check valves, oil separator, accumulator, hot gas bypass valve, liquid injection valve, four-way reversing valve, electronic controlled expansion valve high and low side charging ports, high pressure safety switch, service valves, and interconnecting piping. An integral subcooler assembly and electronic controlled expansion valve shall be provided. Both refrigerant lines from the outdoor unit to indoor units shall be insulated.

4. Refrigeration Oil Control: Outdoor units shall have a centrifugal oil separator for each compressor and controls to ensure sufficient oil supply is maintained, and that oil does not travel with the refrigerant.

5. Compressors: 3-phase outdoor unit frames less than or equal to 80,000 btuh shall be equipped with one hermetic digitally controlled inverter driven compressor to modulate capacity. 3-phase outdoor unit frames greater than 80,000 btuh nominal capacity shall be equipped with one digitally controlled inverter driven hermetic compressor to modulate capacity, and one constant speed hermetic scroll compressor. An internal thermal overload and a factory-mounted crankcase heater shall be provided on each compressor.

6. Outdoor Unit Coil: Outdoor unit coils shall be of a nonferrous construction with louvered fins on copper tubing, and are protected with an integral metal guard. Coil fins have a factory applied corrosion resistant coating.

7. Fans and Motors: Outdoor unit frames less than 80,000 btuh shall include one direct drive, variable speed propeller type fan. Outdoor unit frames greater than 80,000 btuh shall include at least two direct drives, variable speed propeller type fans. Fan motors shall have inherent protection, permanently lubricated bearings, and are variable speed. The fan motor shall be mounted for quiet operation. Raised guards are provided to limit contact with moving parts.

8. Controls: Outdoor units shall be factory wired with necessary electrical control components, integral microprocessors, printed circuit boards, thermistors, sensors, terminal blocks, and lugs for power wiring. The control circuit between the indoor units and the outdoor unit shall be a 24 volt direct current completed using a two-conductor, stranded, and shielded cable for the RS-485 daisy chain communication. Microprocessor-based algorithms shall provide component protection, soft-start capability, refrigeration system pressure, temperature, defrost, and ambient control.

C. Fan Coil Unit:

1. Casing: The casing shall be designed to mount concealed above a finished ceiling. The unit is manufactured with coated metal. Cold surfaces are covered with an insulating material. The cold surface areas of the case are covered externally with sheet insulation conforming to ASTM Standard D-1418. Provide hanger brackets to support the unit weight on four corners.

2. Fan Assembly and Control: Fans are directly driven and mounted on a common shaft. Fans shall be statically and dynamically balanced. The fan motor is a Brushless Digitally-Controlled design with permanently lubricated and sealed ball bearings. The fan/motor assembly is mounted on vibration attenuating rubber grommets. The fan speed is controlled using a microprocessor based, direct digital control algorithm that provides a minimum of three pre-programmed fan speeds. Fan settings are high, medium, and low. Each setting can be field adjusted from the factory setting.

3. Air Filter: Return air is filtered with a removable, disposable filter.

4. Coil: The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed and the coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

5. Microprocessor Controls: The unit is provided with an integrated microprocessor-based controller. The controller is capable of performing functions necessary to operate the system without the use of a wall-mounted controller. A temperature thermistor is factory-mounted in the return air stream. All unit operation parameters, excluding the unit operating schedule, are stored in non-volatile memory resident on the unit microprocessor. The field supplied communication cable between the indoor unit(s) and outdoor unit is to be a minimum of 18 AWG, 2-conductor, stranded, and shielded cable (RS485), terminated via screw terminals on the control boards. The microprocessor control provides the following functions: self-diagnostics, auto restart following power restoration, test run, and will operate the indoor unit using one of three operating modes:

   a. Cooling

   b. Dry

   c. Fan Only

D. Wall Mounted Fan Coil Unit:

1. General: The fan coil unit shall be wall-mounted and shall have a modulating linear expansion device. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

2. Casing: The casing shall have a white finish, multi directional drain and refrigerant piping with a separate back plate for mounting to the wall.

3. Fan: The indoor fan shall be an assembly with one line-flow fan direct driven by a single motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right). A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

4. Air Filter: Return air shall be filtered by a removable, washable filter.

5. Coil: The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed and the coils shall be pressure tested at the factory. A

condensate pan and drain shall be provided under the coil. Provide factory condensate pump when indicated.

E. Master Control Panel: Provide centralized control panel with minimum 12 inch backlite, color, touch panel display. Panel shall be capable of connecting up to 50 indoor units. Panel shall monitor each indoor unit temperature and humidity, with yearly scheduling function.

36.8 CORROSION PROTECTION

A. Provide corrosion protection coating of the air cooled condensing unit cabinet and condenser coil.

B. The coil shall be protected with a polyurethane based, metal impregnated coating. The coating product shall be performed by an applicator qualified by the coating manufacturer to apply the product. Prior to coating, the coil shall be rinsed using a high pressure warm water spray. Any bent fins shall be properly adjusted. The coil shall then be degreased with a pH neutral detergent and rinsed with a high pressure warm water spray. Ensure the coil is completely dry prior to coating. A chromate free conversion layer shall be applied, achieving total coverage and penetration. The coil shall be completely dry prior to the next step. A metal impregnated polyurethane topcoat shall be applied. Ensure total penetration and coverage without bridging. The total DFT of the topcoat shall be 20 to 25 microns or as recommended by the coating manufacturer. The coating shall provide protection against ultraviolet radiation and shall be temperature resistant to 365 degrees F. The coating shall be documented to a minimum of 3,000 hours in both ASTM B117 salt spray test and ASTM B287 acetic salt spray test. The coating manufacturer shall provide a 3 year warranty. Blygold, Thermoguard Finguard or approved equal.

C. The cabinet and exterior surfaces shall be coated with Ameron PSX 700 Engineered Siloxane, Thermoguard Casing Guard or accepted equivalent. Metal preparation shall include degreasing and etching. The coating shall be applied to all exterior surfaces until a total DFT of 6-8 mils. Coating shall be applied in accordance with the manufacturer's recommendations. After the coating has cured, the equipment shall be assembled using care not to damage the coating during assembly. Fasteners shall be stainless steel with bonderized rubber washer. Any touch up required shall be performed in accordance with the manufacturer's recommendations.

36.9 MOTORS

A. Provide motors designed for the supply voltages made available for this portion of the Work, and with the following attributes:

1. Sized to develop the required brake horsepower and to operate satisfactorily with a voltage variation of plus or minus 10%;

2. Conforming to NEMA motor standards;

3. Dynamically balanced, and held to commercial tolerance;

4. Selected so that, when ambient temperature reaches 120°F for a period of two hours or more, the motor will operate satisfactorily without failure.

5. With squirrel-cage type drip-proof enclosure, unless otherwise indicated, constant speed, across-the-line normal starting torque designed for quiet operation;

6. Each motor of ample size to operate its unit at proper full load and speed continuously, without heating in any part more than 40°C above the temperature of the surrounding atmosphere.

B. Where motor is used with V-belt drive, equip with a sliding base and belt guard, and motor sheave.

C. Furnish motor starters for all equipment with electrical motors furnished under this article. Unless factory installed, installation of starters and power wiring shall be provided by ARTICLE XLII – ELECTRICAL WORK.

36.10 MOTOR CONTROLLERS

A. NEMA ICS1 and NEMA ICS2. All controllers shall have thermal overload protection in each phase. Overload protective devices shall give adequate protection to the motor windings, be of the thermal inverse-time-limit type.

B. Provide full voltage, magnetic-type motor controllers with under voltage release and maintained contact push-button stations or switches. Provide each controller with a hand-off-automatic selector switch. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the "hand" position. All safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in the motor control circuit in both the "hand" and the "automatic" positions. Control circuit connections to any hand-off-automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with an indicated, or a manufacturer's approved, wiring diagram.

C. For each motor not in sight of the controller, provide a controller disconnecting means capable of being locked in the open position or a manually operated, nonfused switch in sight of the motor.

D. Enclosures shall be NEMA 1 for indoor locations and NEMA 4X non-metallic for outdoor locations.

E. Provide each with a "hand-off-auto" switch, overload reset button, and indicating lights mounted on the hinged front cover with door interlock and manual defeater mechanism. Provide indicating lights (green for "Running" and red for "Overload"), phase failure and reversal relay for all three phase starters, auxiliary contacts for contactors (1-N.O. and 1-N.C. unless noted otherwise), engraved plastic nameplates (e.g. “FCU-1”, “ACCU-1”, “Running”, HAND-OFF-AUTO”, etc.), control transformer, and fuses.

36.11 SPECIAL WIRING AND DEVICES

A. All factory assembled, package type equipment shall be provided with integral control panel to which all motors in each unit shall be factory wired. Control panel shall contain all relays, starters, and other control devices, all arranged so as to be accessible for maintenance, testing, and inspection. Control panel on each unit shall contain control transformer installed so that all control circuits extending to remote control devices, thermostats, etc., will be 120 volts maximum.

B. Any wiring not shown and required for air conditioning and ventilation equipment and controls to properly connect equipment, including connections to special safety control or apparatus not shown, shall be included under this article. All control wiring shall meet the requirements of the National Electric Code and be installed in metal conduit.

C. Provide all control devices to meet the specified sequence of operations including but not limited to relays, contactors, controllers, enclosures, transformers, wiring, conduits, junction boxes, indicating lights, and other devices.

36.12 PIPING AND FITTINGS

A. General: All pipe and pipe fittings shall be suitable for 125 psi minimum working pressure, in accordance with the latest edition of ASTM and ANSI specifications as indicated.

B. Refrigerant Piping: Seamless copper tubing, hard drawn, Type "K", conforming to ASTM B88 with wrought copper fittings and solder joints.

C. Service: Condensate drain, hard drawn copper tubing, type "L", conforming to ASTM B 88 with cast bronze soldered joint ANSI B16.18 fittings, 95-5 tin-antimony solder.

36.13 REFRIGERANT VALVES AND PIPING ACCESSORIES

A. Provide valves designed, manufactured, and tested specifically for refrigerant service. Internal parts shall be removable for inspection or replacement without applying heat or breaking pipe connections. Threaded ends of valves shall conform to ANSI B2.1. Valves shall open when turned counterclockwise.

B. Shutoff Valve Box: Provide factory refrigerant shutoff valve box with indoor units. Valve shall close in the event a refrigerant leak piping system is detected. Box to support connection to up to eight indoor units with a total combined cooling capacity of less than 71 MBH.

C. Globe and Angle Valves: Forged brass, bronze alloy, forged steel, steel alloy, or ductile iron body with packed stem and seal cap. Packless type with handwheels and forged brass or bronze alloy bodies with brazing ends may be used in sizes up to and including 7/8 inch O.D. 1-1/4 inches and larger valves shall be tongue and groove flanged and shall have bolted bonnets. Valves one inch and smaller shall have brazed or soldered ends. Refrigerant valves shall be of the backseating type making it possible to repack the valves under pressure without removal from the line.

D. Solenoid Valves: Solenoid valves shall be bronze or brass body, packless type, with stainless steel trim, rated for continuous-duty service, direct or pilot operated, provided with manual lift stem and designed for use with the type of refrigerant used. Valves shall have a safe working pressure of 400 psi and a maximum operating pressure differential of at least 200 psi at 85 percent rated voltage. Valves shall have an operating pressure differential suitable for the refrigerant used. Valves shall have adequate capacity for the installation at a pressure drop suitable for the refrigerant used. The solenoid coil shall have moisture proof insulation and shall be UL approved and shall conform to ARI 760.

E. Filter-Driers: Filter-driers shall conform to ARI 710. Sizes 1/2 inch and larger shall be the full flow, replaceable core type. Sizes smaller than 1/2 inch shall be the sealed type. Cores shall be a desiccant that will not plug, cake, dust, channel, or break down, and shall remove water, acid, and foreign material from the refrigerant. A strainer shall be an integral part of the unit and the assembly shall be fabricated of steel with copper solder end connections. The dryer shall be constructed so that none of the desiccant will pass into the refrigerant lines. The minimum bursting pressure shall be 1500 psi.

F. Moisture Indicator Sight Glass: Moisture indicator sight glasses shall be provided where indicated or specified. The sight glass and moisture indicating element shall be removable. The moisture indicator shall have a reversible color indicator which has an easily distinguished color change. The sight glass shall be provided with a protective cover.

36.14 PIPE HANGERS AND SUPPORTS

A. Hangers and supports shall be of manufacturer and type specified or as indicated or accepted equivalent. Pipe supports and hangers in contact with copper piping shall be copper or plastic coated. Provide hot dipped galvanized pipe hangers and supports.

B. Shields: Provide protection shields at hanger points of insulated piping.

C. Supports:

1. Piping shall be supported from structural steel, grouted CMU walls, or concrete slab only; piping shall not be supported in any manner from the roofing.

2. Drilled-In Threaded Inserts: Where supports in slabs are required after concrete has been poured, Phillips "Redhead" drilled in threaded inserts shall be provided, installed in accordance with manufacturer's recommendations.

3. Expansion Anchors and Power-Actuated Fasteners and Devices: Install lead shield anchors or power actuated sleeves, fasteners and devices in accordance with manufacturer's recommendations. Powder actuated pins are not allowed to be "shot" into the concrete structure.

D. Schedules: Pipe support spacing and sizes of pipe hanging suspension rods shall conform to the following table, except support spacing for copper tubing shall not exceed 6 feet on centers:

PIPE SIZE	SUPPORT SPACING

1/2-inch & 3/4-inch	Not over 6-ft.-6-inch
1-inch & 1-1/4-inch	Not over 8-ft.-6-inch
1-1/2-inch	Not over 10-ft.-0-inch
2-inch & 2-1/2-inch	Not over 12-ft.-0-inch
3-inch	Not over 12-ft.-0-inch
4-inch	Not over 14-ft.-0-inch
6-inch	Not over 17-ft.-0-inch
8-inch to 12-inch	Not over 21-ft.-0-inch
14-inch to 18-inch	Not over 25-ft.-0-inch

PIPE SIZE	ROD SIZE
Up to 2-inch	3/8-inch
2-1/2-inch	1/2-inch
4-inch to 5-inch	5/8-inch
6-inch	3/4-inch
8-inch to 12-inch	7/8-inch
14-inch to 18-inch	1-inch

E. Supplementary Steel: Provide all necessary supplementary steel for proper support or attachment of hangers. Steel shall be painted with one coat of rust inhibiting primer.

F. Single Hangers: Unless otherwise indicated, support single pipe runs as follows:

1. Pipe 2-1/2 inch and smaller: Split ring type hanger, Grinnell Fig. 104, Crawford Fig. 104, Fee and Mason Fig. 199, Elcen Fig. 92 or adjustable clevis hanger, or accepted equivalent.

2. Pipe 3 inch and larger: Clevis hanger conforming to MSS SP-69, Type 1.

G. Riser Clamps: Carbon steel conforming to MSS SP-69 Type 8. Grinnell Fig. 261, Fee and Mason Fig. 241 or accepted equivalent.

36.15 INSULATION

A. Provide as specified in ARTICLE XXXII – MECHANICAL INSULATION.

36.16 CONTROL DEVICES AND ACCESSORIES

A. Provide transformers, relays, software etc. as required for a complete and operable control system.

B. Electric wiring and wiring connections required for installation or relocation of temperature control system, as herein specified, shall be provided by temperature control contractor unless specifically shown on the drawings or called for in specification to be by the Electrical Contractor. All wiring shall comply with requirements of local and national electrical codes.

C. Ancillary Equipment:

1. Wiring and Accessories: Provide all required interconnecting wiring to complete the system. Provide transformers as required. Electrical work shall comply with local codes and the electrical section of this specification. Wires and cable shall comply with all codes and be in accordance with the manufacturer's recommendations for interconnection of direct digital control equipment.

36.17 COOOPERATION WITH OTHER TRADES

A. Contractor shall examine all drawings of proposed work and coordinate his work with other trades. Work conflicts shall be brought to attention of the Project Manager and work rearranged or modified in accordance with his decision.

B. If changes in indicated locations or arrangements of work are required, they shall be made by Contractor without additional charge to the State provided that these changes were ordered before work is installed and no extra material or labor are required.

C. Should Contractor determine that extra material and labor will be required to accommodate any rearrangement, he shall first submit detailed estimate of cost for required changes and proceed with work only upon written authority of the Project Manager.

36.18 CUTTING AND PATCHING

A. Cut all holes necessary for installation of work under this article.

B. Patching of all holes, etc., will be done under other articles of specification. Patch any holes cut unnecessarily.

36.19 EQUIPMENT IDENTIFICATION

A. Label water heaters, reheat coils, storage tank, circulation pumps and other equipment as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

36.20 ACCESS TO EQUIPMENT

A. Install all control devices, specialties, valves and related items to provide easy access for operation, inspection, repair and maintenance. If these items are concealed behind walls or ceilings of non-removable type construction, provide access panels of proper size for easy access at no additional cost to the State.

36.21 EQUIPMENT INSTALLATION

A. Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this article, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end

embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a non-shrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

36.22 PIPING INSTALLATION

A. Pipe shall be cut accurately to measurements established at the jobsite and worked into place without springing or forcing, properly clearing all windows, doors, and other opening. Cutting or other weakening of the building structure to facilitate piping installation will not be permitted without written approval.

B. Pipes shall be cut square, shall have burs removed by reaming, and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Install special swing and expansion joints in pipe lines where required. Filings, dust, or dirt shall be wiped from interior of the pipe before connections are made.

C. Changes in direction shall be made with fittings. All piping shall be installed with sufficient pitch to insure adequate drainage.

D. Screw joints shall be made with tapered threads properly cut conforming to requirements of NBS handbook H28. Joints shall be made perfectly tight with a stiff mixture of litharge and glycerin or other approved threaded joint compound applied with a brush to the male threads only. Not more than three threads shall show after the joint is made up.

E. Flanges shall be suitable for the required operating pressures and temperature conditions. Gaskets shall be fiber plastic or other synthetic material suitable for water service. All nuts, bolts and washers used shall be galvanized for ferrous flanges and brass for copper or bronze flanges.

F. Pipes passing through walls above and below grade or concrete floors shall be provided with pipe sleeves fitted into place at time of construction. Sleeves shall not be installed in structural members. Each sleeve shall extend through its respective wall or floor and shall be cut flush with each surface. Unless otherwise indicated, sleeves shall be of such size as to provide a minimum of 1/4 inch all around clearance between jacket over insulation and sleeves. Space between sleeve and piping shall be packed with twisted jute packing and then sealed with waterproof sealant. Penetrations through fire rated walls shall be sealed with approved fire stopping material.

G. All piping systems shall be thoroughly tested for leaks prior to insulating pipe and closing up ceilings, walls and floors. Piping system shall be pressure tested to maximum allowable working pressure. Correct all leaks at no cost to the State.

36.23 UNITARY AIR CONDITIONING SYSTEM INSTALLION

A. Install as indicated, in accordance with requirements of ASHRAE 15, and the manufacturer's installation and operational instructions.

36.24 EQUIPMENT SUPPORT

A. Refer to structural drawings and as-built drawings for type of construction from which equipment is to be suspended.

B. Drilled in Threaded Inserts: Where supports in beams and joints are required after concrete has been poured, drilled in threaded inserts shall be provided, installed in accordance with manufacturer's recommendations.

36.25 PIPE HANGERS AND SUPPORT INSTALLATION

A. Provide adjustable hangers, clamps, supplementary structural members, etc., as required for proper support of all piping. Hangers shall be of adequate size to permit covering to run continuously through hangers. Coordinate location of hangers with light fixtures as shown on Electrical drawings. Hangers provided under other articles shall not be used for support of piping or equipment provided under this article unless permission is granted in writing.

B. Supports shall secure pipes or conduits in place, shall prevent pipe vibration, maintain required grading by proper adjustment, provide for expansion and contraction, and shall make neat appearance.

C. Design supports of strength and rigidity to suit loading, service, and in a manner which will not stress unduly the building construction.

D. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing.

E. Vertical risers shall be secure at each floor level and additional supported at bottom of riser to prevent slipping or falling of piping.

36.26 VIBRATION ISOLATION

A. Vibration transmission from all reciprocating and/or rotating equipment shall be effectively isolated, by use of vibration mountings or hangers. Mounting and hanger sizes shall be determined by the manufacturer to assure adequate deflection and vibration isolation, and shall be installed in accordance with manufacturer's recommendations to provide not less than 90 percent isolation efficiency.

B. All pipe connections to reciprocating and/or rotating equipment shall be made with flexible pipe connections.

36.27 PAINTING

A. All ferrous metal shall be given one shop coat of red lead or other approved rust resisting paint. Where zinc coated metal is furnished, it shall not be shop primed unless specifically called for, but all abraded places and welds shall be touched up with Galvalloy or accepted equivalent.

B. Pipe hangers, supports and other iron work in concealed spaces shall be thoroughly cleaned and painted with one coat of asphalt varnish. Finish painting of exposed items is specified in ARTICLE LXXXVIII – INTERIOR PAINTING.

36.28 ACCESS PANELS

A. Provide access panels for concealed valves, controls, dampers, filters and other fittings requiring inspection and maintenance.

B. Access panels are required in the ductwork to clean the condenser coils of AC units. Access panels to be hinged, gasketed, tool less operation.

36.29 AIR FILTERS INSTALLATION

A. Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air.

36.30 IDENTIFICATION OF PIPING

A. As specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

36.31 IDENTIFICATION OF VALVES

A. As specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

36.32 FIELD TEST OF REFRIGERANT PIPING SYSTEM

A. Refrigerant Piping System: After completion of the piping installation and prior to initial operation, conduct tests on the piping system. Furnish materials and equipment required for tests. Correct defects disclosed by the test. Test the system for tightness after installation and before insulation is applied. Temporarily remove controls and other apparatus that may be damaged by the test pressure or make inoperative before the tests are made and plug, or cap openings. Correct threaded, soldered, or brazed joints that leak by remaking the joints. Repair all joints that leak. Test charging, evacuation, and initial charging is not necessary for fully precharged refrigeration machinery. Provide leak testing of connections and add only enough additional refrigerant to obtain full charge.

B. Test Pressures: Refrigerant system test pressures for tightness shall not be less than ANSI 15 or ANSI B31.5 test pressures specified.

C. Charging the System for Test: Charge the low and high pressure side of the system with a dry, inert gas, such as nitrogen or anhydrous carbon dioxide using a small amount of the

refrigerant gas to act as a tracer. Use a pressure limiting or reducing valve with pressure gauge on the high pressure gas tank to limit the pressure in the system to the specified test pressure for the respective refrigerant.

D. Leakage Test: With the system charged to the desire pressure, tightly shutoff the gas supply and hold the system for 30 minutes, during which time there shall be no loss of pressure. If a pressure drop, not attributable to temperature changes occurs during this period, check the entire system with a halide torch or an electronic leak detector. When leaks are found, make repairs and provide another 30 minute period at the test pressure. Testing and repair shall continue until there is no loss of pressure.

E. Evacuation: After completion of testing of refrigerant system for leaks remove all air and moisture from the system by using a high vacuum pump. The pump shall be capable of reducing the absolute pressure in the system to a point where any water present in the lines will vaporize at a temperature appreciably below the ambient temperature and will be withdrawn from the system. Before conducting the evacuation test, inspect the vacuum pump oil for purity and provide new oil charge if existing charge is contaminated. Evacuate the system to a maximum absolute pressure of 0.020 inches of Mercury (500 microns) or lower. During the evacuation, the ambient temperature shall not drop below 35 degrees F. Use pressure gauges for measurement of pressure. Upon achieving evacuation of system, valve off the vacuum pump from the system for a period of at least 12 hours. Consider the system tight and dry and free of air, if the absolute pressure has not increased by more than 0.002 inches of Mercury (50 microns) at the expiration of this period. Repeat the pressure test if the pressure rise exceeds 0.02 inches of Mercury, indicating a leak in the system or presence of moisture. If no leaks are found, resume the evacuation test and continue until dryness of system is achieved. When a satisfactory vacuum has been obtained, break the vacuum by introducing vapor (no liquid) and subsequently seal off the system.

F. Charging: Provide the initial charge of refrigerant. Charge by connecting the drums of refrigerant to the system charging connection, to feed the liquid refrigerant into the low side of the system where it will be evaporated. Note the gross and net weights of the drum, and place the drum on a scale to determine when empty. Loosely connect the charging connection to the system connection, so that the initial flow of refrigerant will expel air from the connection, and then tighten the loose joint. When the system vacuum has been broken by the refrigerant, start and operate the compressor while charging continues. Exercise the following procedures and precautions during the charging operation:

1. Place the refrigerant condensing system in operation.

2. Place the fluid circulation system of the evaporator fans of a direct expansion system in operation.

3. Do not permit the compressor discharge pressure from becoming excessive.

36.33 FIELD QUALITY CONTROL

A. Leak Testing: Upon completion of installation of air conditioning equipment, test factory- and field-installed refrigerant piping with an electronic-type leak detector. Use same type of refrigerant to be provided in the system for leak testing. When nitrogen is used to boost system pressure for testing, ensure that it is eliminated from the system before charging.

Minimum refrigerant leak field test pressure shall be as specified in ASHRAE 15, except that test pressure shall not exceed 150 PSIG on hermetic compressors unless otherwise specified as a low side test pressure on the equipment nameplate. If leaks are detected at time of installation or during warranty period, remove the entire refrigerant charge from the system, correct leaks, and retest system.

B. Evacuation, Dehydration, and Charging: After field charged refrigerant system is found to be without leaks or after leaks have been repaired on field-charged and factory-charged systems, evacuate the system using a reliable gage and a vacuum pump capable of pulling a vacuum of at least one mm Hg absolute. Evacuate system in accordance with the triple-evacuation and blotter method or in accordance with equipment manufacturer's printed instructions and recharge system.

36.34 START-UP AND INITIAL OPERATIONAL TEST

A. Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

36.35 TSTING ADJUSTING AND BALANCING

A. Test, adjust and balance each piece of equipment as required to assure proper operation. Testing, adjusting and balancing is specified in ARTICLE XL – HVAC TESTING, ADJUSTING, AND BALANCING.

36.36 FILED INSTRUCTIONS

A. Provide field instructions as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS. Upon completion of the work and at a time designated, the services of one or more qualified personnel shall be provided by the Contractor for a period of not less than eight (8) hours to instruct the representatives of the Project Manager in the operation and maintenance of the air conditioning system. These field instructions shall cover all the items contained in the bound instructions.

36.37 PERFORMANCE TESTS

A. Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, test the systems to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, record readings hourly. At the end of the test period, average the readings, and the average shall be considered to be the system performance. Record the following readings:

1. Room Temperature in degrees F for each air conditioned room.

36.38 MAINTENANCE SERVICE CONTRACT

A. Provide maintenance service for all laboratory service piping system components as specified in and in accordance with the requirements and schedule of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

36.39 OPERATION AND MAINTENANCE MANUAL

A. Shall be provided as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

36.40 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXXVII – DUCTWORK AND DUCTWORK ACCESSORIES

37.1 GENERAL

A. This article covers the furnishing, fabrication, delivery and installation of the air conditioning and ventilation system complete, including but not limited to the following:

1. Sheetmetal ducts

2. Operation and maintenance instructions and manuals

3. Manufacturer's literature, shop drawings and record drawings

4. Inspection, test and guarantee

37.2 RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical work as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS unless specified otherwise in the Mechanical Division.

B. Insulation for air conditioning and ventilation specified in ARTICLE XXXII – MECHANICAL INSULATION.

C. Testing, adjusting, and balancing of air conditioning systems specified in ARTICLE XL – HVAC TESTING, ADJUSTING, AND BALANCING.

D. Access panels specified in ARTICLE LXXIII – ACCESS DOORS AND FRAMES.

E. Painting work specified in ARTICLE LXXXVIII – INTERIOR PAINTING.

F. Electrical work specified in ARTICLE XLII – ELECTRICAL WORK.

37.3 SUBMITTALS

A. Submit in accordance with ARTICLE XI – REQUIRED SUBMITTALS and ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Shop Drawings: After review of equipment, submit for review shop drawings of plans to scale, performance data and details showing locations and installation including but not limited to the following (Note: shop drawing of the items in this article shall be combined with the mechanical shop drawings that depict the equipment and ductwork required by other articles of the Mechanical Division):

1. Ductwork

2. Air Devices

3. Equipment

4. Duct Accessories

5. Airflow

C. Product Data: Submit product data for the following:

1. Air Devices

2. Equipment

3. Duct Accessories

D. Operations and Maintenance Manuals: Submit manuals in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

E. Equipment Listing: List of equipment showing name and addresses of manufacturers; manufacturer's local supplier's name, address and phone number; catalog numbers and trade names in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

F. Maintenance service contract and schedule: Submit maintenance service contract and schedule in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

G. As-Built Drawings: Submit drawings in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

H. Guarantee and Certificate: Submit one year guarantee and certificate in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

37.4 EXHAUST FAN

A. Provide centrifugal, belt driven, inline fan as indicated on the drawings. Fan shall be provided with a totally enclosed fan cooled (TEFC), high efficiency motor with minimum 1.15 SF, single speed with speed as indicated and adjustable pitch motor pulley for speed adjustment. Fans shall be licensed to bear the AMCA Certified Ratings Seals for sound and air performance and shall be and U.L. Listed. Air delivery shall be as indicated on drawings. Motor speed shall not exceed 1,800 RPM and motor shall be suitably grounded and mounted on rubber-in-shear vibration isolator.

B. Backward inclined aluminum wheel shall be sparking resistant and non-overloading. Housing shall be of spun aluminum construction.

C. Provide the following accessories:

1. Disconnecting device with NEMA, non-metallic enclosure for fan motor, accessible without removing the fan housing.

2. Motor starter

3. Hinged access cover.

4. Auto belt tensioner.

37.5 AIR DEVICES

A. NC ratings for all air devices shall not exceed 26.

B. Supply Air Diffuser - SAD: Provide Titus Model R-OMNI series, Metalaire, or approved equal. Diffuser shall be duct mounted, louvered face, steel, with adjustable pattern, in sizes, capacities and patterns as indicated. Provide removable center core with aluminum opposed blade volume damper, square or round neck as indicated, and standard white finish or as indicated. Sliding radial blade dampers are not acceptable.

C. Supply Air Diffuser – SAD-1: Provide Titus Model TDC series, Metalaire, or approved equal. Diffuser shall be surface mounted, louvered face, aluminum, with adjustable pattern, in sizes, capacities and patterns as indicated. Provide removable center core with aluminum opposed blade volume damper, square or round neck as indicated, and standard white finish or as indicated. Sliding radial blade dampers are not acceptable

D. Supply Air Register - SAR: Provide Titus Model 300FL series, Metalaire, or approved equal. Register shall be louvered, aluminum, surface mounted, 3/4 inch louver spacing, adjustable deflection angle, double deflection with front blades parallel to long dimension and in sizes and capacities as indicated. Provide opposed blade damper and standard white finish or as indicated.

E. Return, Transfer and Exhaust Air Register - TAR, EAR, and RAR: Provide Titus Model 350FL series, Metalaire, or approved equal. Register shall be louvered, aluminum, surface mount, 3/4 inch louver spacing, 35 or 45 degree fixed deflection angle with blades parallel to long dimension and in sizes and capacities as indicated. Provide opposed blade damper and standard white finish or as indicated.

F. Provide sponge rubber under all flanges.

G. Contractor shall coordinate finish of all air devices with the Project Manager.

37.6 DUCTWORK MATERIALS

A. All ductwork must be galvanized metal installed of gauges and with bracing and joints in accordance with the latest edition of ASHRAE Guide and Data Book and SMACNA Duct Construction Standards.

B. For air conditioning and general ventilation systems, the thickness of the sheet metal and size and spacing of the stiffeners used shall be in accordance with the requirements of the latest edition of the ASHRAE Guide and Data Book and SMACNA Duct Construction Standards, +2 inch W.G. static pressure class. Connections to plenum shall be airtight. All ducts shall be sealed to Seal Class B requirements. No polysulfide sealant shall be used. Polyurethane sealant is acceptable. Branch take-off connections shall be made with 45 degree angle take-off.

C. Plenums must be braced with 1 1/2 inch x 1 1/2 inch x 1/8 inch angles. Hangers shall be one inch x 18 gauge or as required by SMACNA. Brace ducts in accordance with SMACNA recommendations for seismic loads.

D. Provide duct access doors in accordance with SMACNA Duct Construction Standards and NFPA 90A and 96. Duct access doors in insulated ducts must be of the insulated type.

37.7 DUCT INSULATION

A. See ARTICLE XXXII – MECHANICAL INSULATION for requirements of duct insulation.

37.8 VOLUME DAMPERS

A. Volume dampers shall be installed where shown and as required for air balancing. Dampers shall be 2 gauges heavier than the duct in which they are installed and shall be reinforced to prevent vibration and noise. Provide locking quadrants with hat-channel or standouts for exterior insulated ductwork. Unless otherwise indicated, all volume dampers in ductwork 10 inches or greater, in either width or height, shall be opposed blade type. Provide Ruskin, Pottorff, or approved equal.

B. Balancing Dampers: Balancing dampers for branches and mains shall be equipped with Young Regulator No. 1, Dura Dyne, or approved equal.

C. Concealed Operators: Where damper operators must be placed in remote or concealed locations, provide Young Regulator No. 914, Dura Dyne, or approved equal, miter gear or cable operator with Young Regulator No. 315, Dura Dyne, or approved equal, concealed regulator with flush mount, chrome plated, adjustable access cover.

D. Backdraft Dampers: Backdraft dampers shall be adjustable, counterbalanced type, heavy duty extruded aluminum, minimum 0.125 inch wall thickness frame, minimum 0.070 inch wall thickness blades with vinyl edge seals, maximum allowed spot velocity of 3500 fpm and maximum air temperature of 200 degrees. Provide front flange. Provide Ruskin CBD6, Pottorff, or approved equal.

37.9 ACCCESS PANELS

A. Furnish access panels for dampers, coils, fans, filters and all equipment requiring access for operation, inspection, adjustment, repair and maintenance, where indicated or required of size shown or necessary. Access panels shall be provided in accordance with ARTICLE LXXIII – ACCESS DOORS AND FRAMES.

37.10 FLEXIBLE CONNECTION FOR DUCTWORK

A. At ducts to equipment, provide vent-fabric flexible connections with a minimum of 9 inch full length.

37.11 SPECIAL WIRING

A. All factory assembled, package type equipment shall be provided with integral control panel to which all motors in each unit shall be factory wired. Control panel shall contain all relays, starters, and other control devices, all arranged so as to be accessible for maintenance, testing, and inspection. Control panel on each unit shall contain control transformer installed so that all control circuits extending to remote control devices, thermostats, etc., will be 120 volts maximum.

B. Any wiring not shown and required for air conditioning to properly connect equipment, including connections to special safety control or apparatus not shown, shall be included under this article. All control wiring must meet the requirements of the National Electrical Code (NEC) and be installed in metal conduit.

37.12 COOPERATION WITH OTHER TRADES

A. Contractor must examine all drawings of proposed work and coordinate his work with other trades. Work conflicts must be brought to attention of Project Manager and work rearranged or modified in accordance with his decision.

B. If changes in indicated locations or arrangements of work are required, they must be made by Contractor without additional charge to the State provided that these changes were ordered before work is installed and no extra material or labor is required.

C. Should the Contractor determine that extra material and labor will be required to accommodate any rearrangement, he must first submit detailed estimate of cost for required changes and proceed with work only upon written authority of the Project Manager.

37.13 CUTTING AND PATCHING

A. Do not cut any openings in any structural member until location is approved by Structural Engineer.

B. Cut all holes necessary for installation of work under this article.

C. Cutting of holes in concrete is not permitted except by approval of Project Manager which will be on an individual basis and require the use of coring tools, power saws and drills.

D. Patching of all holes, etc., will be done under other articles of specification. Patch any holes cut unnecessarily.

37.14 EQUIPMENT INSTALLATION

A. Equipment must be installed as indicated and in accordance with manufacturer's recommendations and instructions.

B. All necessary supports must be provided for equipment, appurtenances and duct as required. This work shall include any additional steel purlins, brackets, seismic restraints or supports.

C. Provide controls as indicated for proper operation of the equipment. Provide all necessary relays, contactors, enclosures and transformers to ensure proper system operation.

37.15 WOKRMANSHIP AND FABRICATION

A. Ductwork:

1. Fabricate all ductwork and related work to highest industry standards and recommendations of ASHRAE and SMACNA. Provide all necessary supplementary steel structure supports, purlins or brackets to support duct properly from structure. Provide seismic restraints as required by the Building Code as adopted by the City and County of Honolulu.

2. Sides of ductwork must be cross broken. Long seams must be Pittsburgh lock groove, hammered flat or double seamed. Ducts must also have supplemental stiffening as required to prevent drumming and to provide structurally sound assembly.

3. Center line radius of curves, bends, offsets for branch and connections must be equal to 1-1/4 times duct width or larger. Duct turns in all square elbows must be accomplished by using prefabricated turning vanes such as Tuttle & Bailey “Ducturn” or other approved equal. Double thickness turning vanes in ducts deeper than 16 inches may be used in lieu of “Ducturn” provided prior approval of design is given by the Project Manager.

4. Volume and splitter dampers must be installed where required and must be provided with extension rods for adjusting and locking. Dampers must be made of not lighter than 18 gauge steel for dimensions up to 10 inches, and multi-louvered, opposed blade type on ducts over 10 inches high. All dampers must have Young Regulator No. 401 locking quadrants or approved equal.

5. Paint inside of all supply, return, exhaust and transfer air ducts with one coat of flat black paint wherever duct is visible through register or grille opening.

6. Ducts passing through outside walls must be suitably and properly flashed and counter-flashed to prevent leaks.

7. Exterior ductwork must have tops sloped to prevent water from pooling on the ducts and to drain water.

37.16 EQUIPMENT SUPPORT

A. Refer to drawings for type of construction from which equipment is to be supported. Structural metal supports shall be provided as indicated.

37.17 DUCT HANGER AND SUPPORTS

A. Provide hangers, clamps, supplementary steel, etc., as required for proper support of all piping.

B. Supports must secure ducts in place, must prevent vibration, sway, provide for expansion and contraction, and must make neat appearance.

C. Design supports of strength and rigidity to suit loading, service, and in a manner which will not stress unduly the building construction.

D. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing.

37.18 PAINTING AND IDENTIFYING OF DUCTWORK

A. The following items furnished under this article are to be painted and identified under ARTICLE LXXXVIII – INTERIOR PAINTING. Do not paint over name plates or other identifying labels.

1. Exposed ducts and insulated ducts.

2. Exposed duct hangers and supports.

B. Paint exposed black iron work including duct, fittings, structural steel members used for equipment, and other supports, hangers, etc., with two coats of zinc rich paint.

37.19 TESTING AND BALANCING

A. Test, adjust and balance each piece of equipment as required to assure proper operation. Testing, adjusting and balancing is specified in ARTICLE XL – HVAC TESTING, ADJUSTING, AND BALANCING.

37.20 CALIBRATION AND ADJUSTMENTS

A. After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the unit control panels under warranty.

37.21 ADJUSTING AND CLEANING

A. All equipment and ducts must be cleaned free of scale and thoroughly flushed of all foreign matter prior to field insulation. Equipment must be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Hangers and supports that were temporarily loosened to allow installation of the insulation, must be repositioned and adjusted to carry the load without crushing the insulation.

37.22 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXXVIII – CEILING FANS

38.1 DESCRIPTION

A. This article covers the providing of ceiling fans, controls and all related appurtenances including, but not limited to the following:

1. High volume, low speed ceiling fan.

2. Controls.

3. Operation and maintenance instructions and manuals.

4. Manufacturer's literature, shop drawings and record drawings.

5. Inspection, test and guarantee

38.2 RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical work as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS unless specified otherwise in the Mechanical Division.

B. Electrical work specified in ARTICLE XLII – ELECTRICAL WORK.

38.3 SUBMITTALS

A. Submit the following for approval and in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS:

1. Shop Drawings: Shop drawings shall show location of all fans in plan and elevation views, controls, dimensions showing all clearances and shall include electrical power and control diagrams.

2. Product Data: Submit data for ceiling fans and controls.

3. Schedule: Submit schedule of ceiling fans listing name and address of manufacturer, catalog numbers, and trade names.

4. Certificates of Conformance or Compliance:

   a. Submit certified sound data in compliance with sound criteria.
   b. Warranty on fan motor and VFD.
   c. Warranty on fan flywheel.

5. As-Built Drawings: Submit as-built drawings in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

6. Guarantee and Certificate: Submit guarantee and certificate in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS and as modified in paragraph 38.5 of this article.

38.4 QUALITY ASSURANCE

A. Fans shall be provided with metal identification plates or adhesive labels permanently affixed in a conspicuous location identifying manufacturer, model and number.

B. Fans shall be UL listed. The UL label shall be firmly affixed to the fan.

C. Fans shall either be assembled and/or manufactured or distributed in the U.S.A. Imported fans and parts are acceptable provided they comply with the requirements of this specification and are distributed through an American based distributing/manufacturing company who shall be responsible for the execution of the fan's guaranty/warranty agreement.

D. The manufacturer or the American based distributing/manufacturing company shall be an established company who has regularly engaged in the manufacture and/or distribution of ceiling fans for the past 10 years.

E. The fan distributor/manufacturer shall maintain an Authorized Service Center in the State of Hawaii. In addition, the service center shall maintain a local inventory of replacement and service parts.

F. 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. National Electrical Manufacturers Association (NEMA):

ICS 1-93	Industrial Control and Systems General Requirements
ICS 2-93	Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC

2. Underwriters Laboratories, Inc. (UL) Publications:

507-94	Safety Electric Fans, Eighth Edition
1917-94	Safety Solid-State Fan Speed Controls, Second Edition

38.5 ADDITIONAL GUARANTEE AND CERTIFICATE

A. In addition to the guarantee requirements stipulated in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS, the Contractor shall guarantee and certify in writing the following:

1. Manufacturer's standard warranty on the fan motor and VFD.

2. Manufacturer's standard warranty on the flywheel.

38.6 CEILING FAN

A. General: High volume, low speed (HVLS) ceiling fan shall be constructed with the following requirements and accessories:

1. 5-blade type with minimum 52-inch sweep which will provide quiet operation.

2. All metal construction.

3. The fan body and switch cup/cap shall be die-cast or stamped heavy gage steel. The switch cup/cap shall be removable for ease of service.

4. Blades shall be interlocked with one another and the impeller hub with a heavy-duty steel retaining ring for safety. Impeller hub shall also be connected to the building structure with a safety restraint cable and hub retaining ring.

5. The support assembly (two-piece canopy with cross-bar mounting bracket or single piece canopy with mounting bracket) with a ball and socket hanging system (Cathedral Hanging) shall be UL listed. The locking system shall be by cross pin and set screw. Where a two-piece canopy is used, it shall be made of either die-cast or stamped heavy gage galvanized steel or stainless steel. Aluminum or zinc is not acceptable. Where a mounting bracket is used as the support assembly beneath a single piece canopy, it shall be made of high quality non-recycled die cast zinc. Fasteners used to secure the support assembly to the substrate shall be electroplated steel or stainless steel.

6. Non-rotating stationary hanger pipe of either galvanized steel or stainless steel, nominal 3/4-inch (minimum 0.824-inch inside diameter), fastened directly to the motor housing. Electrical Metal Tubing (EMT) or aluminum tubing is not acceptable.

7. Fan control wiring shall be located within the hanger pipe, protected from rotating parts.

8. Extension lead wires shall be of sufficient length to accommodate the required length of extension poles. Rewiring of the fan unit or splicing of the wires to increase its length is not acceptable.

9. Fans shall include a braided galvanized steel safety retention cable. The safety retention cable shall be factory installed on the fan motor, and be secured around the building structure with a minimum of two U-bolt steel cable clamps.

10. Guy wires shall be included for fans with drop lengths equal to or greater than 4 feet in length. Guy wires shall be constructed of braided galvanized steel and designed to prevent lateral movement of the fan when installed.

B. Motor:

1. The motor shall be manufactured in accordance with NEMA, UL or CSA Standards.

2. The motor shall be direct drive, brushless, reversible, with 100 percent copper windings.

3. The motor shall be of the high torque, low speed direct drive type. High speed motors provided with a gearbox to reduce the operating speed of the fan shall not be permitted

4. Electrical windings shall be insulated in accordance with UL Standards. Paper insulation is not acceptable.

C. Variable Frequency Drive (VFD):

1. The VFD shall be manufactured in accordance with NEMA, UL or CSA Standards.

2. The VFD shall include protection systems with sensors for continuous monitoring of temperatures, voltage and current to prevent failures caused by over/under-voltage, over-current, over-temperature, over-speed, and fan impact.

D. Bearings:

1. Bearing shall be corrosion resistant, stainless steel, permanently lubricated, sealed, no-oil type, requiring no maintenance.

2. Where spinner type motors are used, the bearings provided shall be high quality double shielded bearings of the type described above.

E. Control Switch:

1. Triple capacitor speed control.

2. Single switch controlling each fan unit:

a. Provide one switch per fan. Grouping of fan switches shall be fully coordinated to ensure fit in rough openings and walls and coordinated with the junction box and switch plates.
b. Provide wall mounted infinitely variable speed control switch with reversible air flow direction to pull the air up or push it down.
c. Each switch shall be handicapped accessible with a linear slide control device or other controlling mechanism that allows selection of the fan speed from “OFF” to “HIGH” speed with a closed fist and without any rotary motion to meet the requirements of ADAAG.
d. Speed range shall be approximately 20 RPM to 210 RPM.
e. Switches shall be mounted in a metal box in the wall, no higher than 48 inches above the finished floor.
f. Circuiting shall match the bank of fans as shown on the electrical drawings, and shall meet the manufacturer’s recommendations for satisfactory operation over all fan speeds without humming. Provide additional relays, contactors, circuit breakers and other devices and accessories as required for controlling each fan from a single control switch station.
g. The control switch shall have sufficient amperage to supply power the fan connected to the switch, as indicated on the drawings.

F. Fan Blades and Fan Blade Holders:

1. Fan blades shall be manufactured from extruded aluminum into an airfoil shape, and internally reinforced to minimize blade deflection. Individual blade weight shall not exceed 10 pounds.

2. Blade holders shall be UL listed, rigid, manufactured from die-cast steel or non-recycled zinc alloy. Stamped steel is not acceptable.

3. The angle or "Pitch" of the holder shall be factory calibrated to be no more than 16 degrees and no less than 13 degrees.

4. Each set of fan blades and holders (for each individual fan) shall be balanced to within one gram of each other.

5. Where stator motors are used, noise-reducing components such as isolation rings and rubber cushions shall be provided.

G. Flywheels:

1. Where provided, flywheels shall be manufactured of butyl, neoprene or EPDM (ethylene propylene diene monomer) modified rubber and shall be warranted for a minimum of 5 years against deterioration and sagging. Plastic flywheels are not acceptable.

H. Finish:

1. Electroplated, epoxy or baked-on paint coating finishes shall provide a uniform smooth finish that is tarnish, rust and scratch resistant.

2. The fan body, blade and pipe extension finish (color) shall be selected by the Architect from manufacturer's standard available colors after award of bid.

   a. Brass finishes shall be electroplated and finished with a clear acrylic lacquer.
   b. Painted color finishes shall be an electrostatically applied, baked-on powder coat system.

38.7 COOPERATION WITH OTHER TRADES AND CONFLICT IN WORK

A. Contractor shall examine all drawings of proposed work and coordinate his work with other trades. Work conflicts shall be brought to the attention of the State and work rearranged or modified in accordance with their decision.

B. If changes in indicated locations or arrangements of work are required, they shall be made by Contractor without additional charge to the State provided that these changes were ordered before work is installed and no extra material or labor are required.

C. Should Contractor determine that extra material and labor will be required to accommodate any rearrangement, he shall first submit estimate of cost for required changes and proceed with work only upon written authority of State.

D. The Contractor and the Installer shall examine the areas and conditions under which the ceiling fans are to be installed.

E. Should any condition be found unsuitable, no work shall be done until the unsatisfactory conditions have corrected and are acceptable to the Installer. Proceeding with work will imply acceptance of the conditions by the Installer.

38.8 EQUIPMENT INSTALLATION

A. Verify the existing roof/ceiling deck slope and mounting conditions. Install mounting plates as required to provide a solid, level and plumb surface for mounting of outlet box. Mounting plates and outlet box shall be securely mounted and capable of supporting a minimum of 40 pounds. Only UL listed outlet boxes labeled "For Fan Support" shall be used.

B. Fan motor shall be properly grounded.

C. Assemble and install the fans in accordance with the manufacturer's instructions and recommendations, complete and ready for use.

D. Fans shall be installed at a height as noted on the plans, but in no case shall a fan be mounted with the bottom of its blades lower than 7 feet 6 inches above the finished floor surface. In addition, fans shall be installed so that fan blades are no closer than 18 inches to adjacent walls, finishes, and suspended light fixtures to prevent a "strobing" effect.

E. Fan blades shall be uniformly balanced and tightly fastened to the blade holders. Blade holders shall be tightly fastened to the flywheel or motor casing.

F. Fans shall be well balanced and shall not wobble or shake when running at all speeds. A maximum of 1/8 inch horizontal movement (at the end of the fan blades) is acceptable

38.9 TESTING

A. General Requirements, Testing: Perform testing after cleaning and acceptance of cleanness. Contractor shall furnish equipment and apparatus necessary for tests. Tests shall be subject to the approval of the State.

B. Operational Tests: Test equipment as in service to determine compliance with contract requirements and warranty. During the test, test equipment under every condition of operation. Test safety controls to demonstrate performance of their required function. Completely test system for compliance with specifications. Each fan unit shall be operated at low, medium and high speeds and shall not wobble or shake excessively. Rebalance or replace fan to correct problem.

38.10 ADJUST AND CLEAN

A. Prior to acceptance of the work, thoroughly clean the fan unit and the surrounding area. Adjust system for proper operation. Patch and/or paint any surface marred or damaged as a result of the fan installation as required to restore the surface to its original conditions. Touch up with matching paint all damaged factory finishes.

38.11 FIELD INSTRUCTIONS

A. Upon completion of the work and at a time designated, the services of one or more qualified personnel shall be provided by the Contractor for a period of not less than 4 hours to instruct the representative of the State in the operation and maintenance of the ceiling fans. These field instructions shall cover all the items contained in the bound instructions.

38.12 MAINTENANCE AND SERVICE CONTRACT

A. A maintenance and service contract shall be provided in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

38.13 OPERATION AND MAINTENANCE MANUAL

A. See requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

38.14 SCHEDULE OF MAINTENANCE SERVICE

A. Shall be as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS, including work schedule, trouble calls, maintenance report/checklist and cleanup, and work practices.

38.15 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XXXIX – INDUSTRIAL VENTILATION AND EXHAUST SYSTEMS

39.1. GENERAL

A. This article covers the furnishing, fabrication, delivery and installation of the dust collection and exhaust system complete, including but not limited to the following:

1. Laboratory fume hood exhaust fans.
2. Dust collector, blower, drives and supports.
3. Laboratory exhaust ductwork.
4. Dust collection ductwork.
5. Motors and motor starters.
6. Controls, devices, wiring and accessories.
7. Operation and maintenance instructions and manuals.
8. Manufacturer's literature, shop drawings and record drawings.
9. Inspection, test and guarantee.

39.2. RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical work as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS unless specified otherwise in the Mechanical Division.

B. Concrete work specified in ARTICLE XXIX – CAST-IN-PLACE CONCRETE.

C. Painting work specified in ARTICLE LXXXVIII – INTERIOR PAINTING.

D. Electrical work specified in ARTICLE XLII – ELECTRICAL WORK.

39.3. QUALITY ASSURANCE

A. Comply with all the requirements of the State of Hawaii, City and County of Honolulu and applicable utility companies.

B. Obtain and pay for all fees, permits, licenses, assessments, connection charges and inspections required for this work.

C. Present to the State certificates of inspection and approval from proper authorities.

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 Conference of Governmental Industrial Hygienists (ACGIH):

2090-95	Industrial Ventilation

2. Air Movement and Control Association, Inc. (AMCA):

99-86	Standards Handbook
99-0401-66	Classification for Spark Resistant Construction
201-90	Fan Application Manual - Fans and Systems
211-87	Certified Ratings Program for Air Moving Devices
261-92	Directory of Products Licensed to Use the AMCA Seal.

3. American National Standards Institute Publications (ANSI):

IP-20-88	Drives Using Classical V-Belts and Sheaves Cross Sections, A, B, C, and D
IP-22-91	Drives Using Narrow V-Belts and Sheaves.

4. American Society for Testing and Materials (ASTM) Publications:

A 53 83	Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.

5. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

MSS-SP-58-93	Pipe Hangers and Supports - Materials, Design and Manufacturer
MSS-SP-69-91	Pipe Hangers and Supports - Selection and Application.

6. National Electrical Manufacturers Association (NEMA):

ICS 1-93	Industrial Control and Systems General Requirements
ICS 2-93	Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.

39.4. 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 and ductwork 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 ductwork, fittings and accessories as may be required to meet such conditions.

C. Nameplate: Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment.

D. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the State of any discrepancy before performing any work.

39.5. SUBMITTALS

Submit the following in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

A. Equipment Submittal: Submit product data for the following:

1. Dust Collector Assembly
2. Exhaust Fans

B. Shop Drawings: Submit shop drawing of plans, performance data and details showing locations and installation including but not limited to the following:

1. Dust Collector
2. Exhaust Ducts
3. Exhaust Fans

C. As-Built Drawings: Submit drawings in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

D. Operating And Maintenance Manuals: Submit in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

E. Guarantee and Certificate: Submit one year guarantee and certificate in accordance with ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

F. Test Reports: Submit 6 copies of the final test report for the dust collection system and laboratory exhaust systems tested.

39.6. MATERIALS AND EQUIPMENT

A. All materials shall be new, of equal or better quality than of materials specified. For ease of maintenance and parts replacement, select equipment from a single manufacturer as much as possible. Substitutions require pre-bid approval:

39.7. DUST COLLECTOR ASSEMBLY

A. General: Automatic, shaker type, self-contained fabric dust collector using "shaking" action to periodically clean the filter bag type filter media and designed for use in a wood dust collection system. Unit shall be complete, self-supporting, factory fabricated of welded steel construction but partially disassembled for shipping. Dust hopper shall be located below the collector section and include at least two 55 gallon steel drums to store the saw dust. Provide complete with flanged connections, slide gate, connecting duct or tubing to collection drums and 45 degree sloped sides. Unit shall be constructed of minimum 12 gauge, welded, hot rolled steel (ASTM A 570/A 570M) braced for minimum 16 inches water gauge pressure at maximum of 150 degrees F with inspection and maintenance hinged steel access doors including side access door for sliding out tube sheet header and filters during replacement, explosion vent, and steel leg braces. Entire assembly shall be factory prepared and finished in manufacturer's standard epoxy point. Provide one set of bag filters for initial installation and one complete set of spare filters. Design access doors and hopper clearance for dimensions shown. Provide factory trained technician to supervise field assembly installation and startup of the dust collector. Startup services shall include but not limited to operation, testing, adjustment and training of the State's representatives in the operating and maintenance procedures.

B. Fan: Fan and motor shall be integral with the dust collector assembly. Provide backward inclined type for non-overloading operation. Fan shall be non-sparking, constructed from aluminum and statically and dynamically balanced with the motor. Provide control panels and magnetic starters with NEMA 9 enclosure and explosion proof motor with NEMA 9 enclosure. Provide discharge elbow or hood and sound attenuator on fan discharge to decrease sound level by at least 7 dbA with pressure drop no higher than 0.6 inches water gauge at the specified air flow rate.

C. Provide grounded, replaceable, spring mounted, 8.2 ounces fire retardant cotton bag filters designed for wood dust filtration with a collection efficiency of over 99 percent. The filters shall be arranged in assemblies with minimum filter area specified and are removable as an assembly by unlocking a lever mechanism and sliding the bag out. The number of assemblies provided shall be sized for the flow rate indicated and an air flowrate to filter area ratio of 10 or lower.

D. Controls shall be solid state, micro-electronics based and includes shaker motors, eccentric shaker assembly, starters, adjustable timers, timing circuit for adjustable pulse duration and other control devices for automatic or manual "Start-stop" switch or push buttons and enclosure. Control panel shall be NEMA 9 enclosure factory pre-wired and terminated for mounting as indicated. Provide factory installed sprinkler system with connection to field installed pipe at exterior of collector housing. Controls shall be all electric, electro-mechanical electronic or solid state and designed for external source of control power at 115/1/60. All control transformers required if voltage are less that the source values shall be provided as part of the collector assembly. Provide a differential pressure gauge to measure pressure drop across the filters. Motor starters and controls shall be integrated and coordinated to meet the sequence of operation.

39.8. BASIC MATERIALS

A. Coated and Uncoated Carbon Steel Sheets, Plates, and Shapes:

1. Mill Galvanized Steel Sheet: ASTM A 527/A 527M, lock forming quality, Coating G-90.

2. Mill Galvanized Steel Shapes: ASTM A 36/A 36M galvanized in accordance with ASTM A 123.

3. Uncoated (Black) Carbon Steel Sheet: ASTM A 569/A 569M.

4. Uncoated (Black) Carbon Steel Plates and Shapes: ASTM A 36/A 36M.

B. Corrosion Protection: Equipment fabricated from ferrous metals that do not have a zinc coating conforming to ASTM A 123 shall be treated for prevention of corrosion with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test except that equipment located outdoors shall withstand 500 hours. The salt-spray fog test shall be in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8 inch). The rating of the unscribed area shall be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimen with respect to materials, conditions of application, and dry-film thickness.

39.9. MISCELLANEOUS MATERIALS

A. Filler Metal, Welding: AWS filler metal specification and grade compatible with base materials to develop full joint strength.

B. Flashing Materials: Mill galvanized, phosphatized, steel sheet with minimum spangle, conforming to ASTM A 525, Coating G90, 24-gauge minimum thickness.

C. Gaskets:

1. Elastomer Buna-N: Sheet, 1/8-inch (3-mm) thick, conforming to ASTM D 2000, Type 2BG410B14.

2. Rubber: Sheet, 1/8-inch (3-mm) thick red or black, natural, reclaimed, synthetic rubber or mixture hereof, conforming to ASTM D 1330.

D. Protective Coating Materials:

1. Baked Unmodified Phenolic: Mil. Spec. MIL-V-12276, Type II.

2. Epoxy Coating: Conform to Mil. Spec. DOD-P-23236, Type I, Class 1 or Mil. Spec. MIL-P-24441 system, Formula 150 green primer 3 mils, Formula 151 haze gray 3 mils, and Formula 152 white 3 mils.

3. Inorganic Zinc Coating: SSPC Paint 20, Type I-C (Self-cure type).

4. Galvanizing Repair Paint: Conform to Mil. Spec. DOD-P-21035.

E. Sealant:

1. Elastomeric: Sealant specified in this specification or referenced standards as elastomeric or without further qualification, shall be silicone, polyurethane, polysulfide, polyisobutylene, or acrylic terpolymer suitable for the service. For sealing of non-gasketed duct joints during fabrication or assembly, sealant shall be polyurethane, acrylic terpolymer or polysulfide. Sealant shall conform to the following:

Silicone: Conforming to Fed. Spec. TT-S-001543, single component type, not requiring primed substrate, with manufacturer published estimated life of 30 years and a maximum 5 percent shrinkage when cured.

2. Caulking of Building Surface Penetration: Foamed silicones, two-component, fire-resistant, low-exothermic, room temperature vulcanizing silicone.

39.10. MOTORS

A. Provide high efficiency motors designed for the supply voltages made available for this portion of the work, and with the following attributes:

1. Sized to develop the required brake horsepower and to operate satisfactorily with a voltage variation of plus or minus 10%;

2. Conforming to NEMA motor standards;

3. Dynamically balanced, and held to commercial tolerance;

4. Selected so that, when ambient temperature reaches 120□F for a period of two (2) hours or more, the motor will operate satisfactorily without failure.

5. Unless otherwise indicated or specified, provide totally enclosed fan cooled (TEFC) enclosure cast iron frame, constant speed, across-the-line normal starting torque, designed for quiet operation;

6. Each motor of ample size to operate its unit at proper full load and speed continuously, without heating in any part more than 40□C above the temperature of the surrounding atmosphere.

B. Where motor is used with V-belt drive, equip with a sliding base and belt guard, and motor sheave.

C. Furnish motor starters for all equipment with electrical motors furnished under this article. Unless factory installed, installation of starters and power wiring shall be provided by ARTICLE XLII – ELECTRICAL WORK.

39.11. SPECIAL WIRING

A. All factory assembled, package type equipment shall be provided with integral control panel to which all motors in each unit shall be factory wired. Control panel shall contain all relays, starters, and other control devices, all arranged so as to be accessible for maintenance, testing, and inspection. Control panel on each unit shall contain control transformer installed so that all control circuits extending to remote control devices, thermostats, etc., will be 120 volts maximum.

B. Any wiring not shown and required for the exhaust system to properly control equipment, including connections to special safety control or apparatus not shown, shall be included under this article. All control wiring for control power to actuate the control device and the communication signal to initiate or terminate the control operation, shall meet the requirements of the NEC and shall be installed in metal conduit.

39.12. MOTOR CONTROLLERS

A. NEMA ICS1, “Industrial Control and Systems General Requirements” and NEMA ICS2, “Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC”. All controllers shall have thermal overload protection in each phase. Overload protective devices shall give adequate protection to the motor windings and be of the thermal inverse-time-limit type.

B. Where factory installed starters are not furnished, provide full voltage, magnetic-type motor controllers with under voltage release and maintained contact push-button stations or switches. Provide each controller with a hand-off-automatic selector switch, unless otherwise indicted. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the "hand" position. All safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in the motor control circuit in both the "hand" and the "automatic" positions. Control circuit connections to any hand-off-automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with an indicated, or a manufacturer's approved, wiring diagram.

C. For each motor not in sight of the controller, provide a controller disconnecting means capable of being locked in the open position or a manually operated, non-fused switch in sight of the motor.

D. Enclosures shall be NEMA Type 1 for indoor locations, NEMA Type 4X for outdoor locations or locations exposed to corrosive conditions, NEMA Type 9 for indoor hazardous and other classified locations, or as indicated.

E. Provide each with a "hand-off-auto" switch, overload reset button, and indicating lights mounted on the hinged front cover with door interlock and manual defeater mechanism or as indicated. Provide indicating lights (green for "Running" and red for "Overload"), phase failure and reversal relay, auxiliary contacts for contactors (1-N.O. and 1-N.C. unless noted otherwise), engraved plastic nameplates (e.g. "EF-1, 2, 3, 4 and 5", "DC-1", etc.), control transformer and fuses.

F. Provide three phase, reduced voltage soft start controller between the motor and the starter for the dust collection fan motor to allow adjustable startup time in addition to the magnetic starter that is provided with the equipment. Provide controller with energy saver feature which provides the motor with the required voltage for a particular load and a line voltage limiter and external reset button. Start time adjustment shall be field adjustable from ½ to 30 seconds. Provide NEMA Type 9 enclosure. Provide controller for voltage and horsepower indicated. Controller shall be Nordic, Square D, Cutler Hammer, Reliance, Magnetek or approved equal.

G. Power Transmission Components:

1. Blower Drives: V-belt type as indicated. V-belt drives shall conform to MPTA and RMA Stateing Standards for Drives Using Classical and Stateing Standards for Drives Using Narrow Multiple V-belts. Drives shall be applied in accordance with the manufacturer's published recommendations, unless specified otherwise. Horsepower rating of a V-belt drive shall be based on maximum pitch diameter of sheaves.

2. Sheaves: Statically and dynamically balanced, machined cast ferrous metal or machined carbon steel, bushing type, secured by key and keyway. Pitch diameter or fixed sheaves and adjustable sheaves, when adjusted to specified limits, shall not be less than that recommended by NEMA MG 1. Select adjustable sheaves that provide the required operating speed with the sheave set at midpoint of its adjustment range. The adjustment range for various size and type belts shall be: 16 percent, minimum for Classical section belts; 12 percent, minimum for Narrow section belts. Belt deflection in adjustable sheave drives shall not exceed 1-1/2 degrees. Companion sheaves for adjustable sheave drives shall have wide groove spacing to match driving sheaves, except that standard fixed pitch spacing may be used for all two-through-four groove drives whose center-to-center dimensions exceed the following: "A" and "B" Section 16 inches; "C" Section 25 inches; "D" Section 36 inches. Belts shall be endless, static dissipating, oil-resistant, synthetic cloth or filament reinforced elastomer construction.

39.13. DUCTWORK, DUST COLLECTION

A. General Requirements for Dust Collection Ductwork: Where specified or indicated, fabricate system ductwork from galvanized steel, with welded seams and flanged and gasketed joints. Construction shall be suitable for handling wood dust particulate with an influent loading of 7,000 grains per standard cubic feet per minute (scfm). Ductwork shall be provided in accordance with best practice recommendations and requirements of SMACNA Round Industrial Duct Construction Standards for Class II duct and requirements specified or indicated.

B. Fabrication of Dust Collection Ductwork: Provide indicated sizes, lengths, and configuration without deviation unless otherwise approved. Installation shall be airtight as defined under paragraph entitled, "Ductwork Structural Integrity and Leakage Testing," in this section and shall include all necessary reinforcements, bracing, supports, framing, gasketing and fastening to guarantee rigid construction and freedom from vibration, airflow induced motion, and excessive deflection. For dust collection system, provide SMACNA Class 2 construction with welded duct and fitting seams and welded companion angle or Van-Stone flanges. Welding shall conform to requirements specified herein. Provide flanges where necessary for ease of access to equipment or maintenance disassembly, and where indicated. Elbows and fittings shall be a minimum 2 gauges heavier than straight ducts of equal diameter.

C. Radius Elbows: Fabricated from butt welded specified piece gore sections or from formed welded or seamless tubing to a minimum centerline radius of 1.5 diameters. Assemble, weld, and finish ground gore sections to eliminate internal projections. Die-stamped elbows may be used for duct sizes 8 inches diameter or less, with a minimum centerline radius of 1.5 diameters. Gored elbow construction shall be in accordance with the following:

16 inches diameter and less	Over 16 inches diameter
90 degree - 5 piece minimum	90 degree - 7 piece minimum
60 degree - 4 piece minimum	60 degree - 6 piece minimum
45 degree - 3 piece minimum	45 degree - 5 piece minimum
30 degree - 3 piece minimum	30 degree - 4 piece minimum
15 degree - 2 piece minimum	15 degree - 3 piece minimum

D. Flanged Joints: Gasketed with full face gaskets. Gasket material shall be 1/8-inch (3-mm) thick red or black rubber.

E. Access Doors: Access doors shall be hinged, gasketed, and fitted with snap-action closures. Access door gaskets shall be weather-stripping type, neoprene. Provide cleanout adjacent to every bend and vertical riser. In horizontal duct runs, maximum cleanout door spacing shall be 10 feet.

39.14. SPECIALTIES

Provide steel, iron, stainless steel, nonferrous metal, or plastic to match duct construction, or as indicated.

A. Access Ports, Test: With gasketed screw cap and flange, to suit exhaust service, one-inch nominal pipe size.

B. Blast Gates: Provide means for locking in adjusted position with bolt and nut. Gates shall be of heavy duty industrial grade construction. Gate frame shall be of fabricated steel. Provide positive seal.

C. Access Doors: Hinged and gasketed door, 6 inches by 9 inches minimum size.

D. Floor Sweeps: Provide floor sweeps with hinged doors as indicated. Provide heavy duty magnetic strip to trap ferrous material. Riser section shall be equipped with a vacuum cleaning fitting with spring-tension closed caps. Provide two lengths of 1-1/2" diameter 50-foot hoses with assorted hose attachments for sweeping floors and crevices.

E. Special Hoods: Fabricate special hoods for those woodworking equipment not provided with dust collection provisions. Hoods shall be fabricated to dimensions recommended by the ACGIH Ventilation Manual. Hoods shall be of galvanized steel, minimum 18 gauge.

F. Flexible Duct: Provide heavy duty flexible duct from steel duct riser to equipment as indicated. Provide 50' of spare flexible duct for future use.

39.15. SUPPORTING ELEMENTS

A. General Requirements for Supporting Elements: Provide ducting systems and equipment supporting elements including but not limited to building structure attachments, supplementary steel, hanger rods, stanchions and fixtures, vertical duct attachments, horizontal duct attachments, anchors and supports. Supporting elements shall be suitable for stresses imposed by systems, with a minimum safety factor of 4.0 based on duct being 50 percent full of particulate conveyed. Supporting elements shall conform to SMACNA Accepted Industry Practice for Industrial Duct Construction, SMACNA Round Industrial Duct Construction Standards, SMACNA Rectangular Industrial Duct Construction Standards, and NFPA 91, as applicable, and modified and supplementary requirements specified herein. Do not use weld studs and powder actuated anchoring devices to support mechanical systems components without prior approval.

B. Vertical Attachments: Unless otherwise indicated, provide in accordance with SMACNA Standards, except mill galvanized steel straps shall be a minimum of one-inch wide, 16-gauge thick.

C. Horizontal Attachments: Provide as indicated and in accordance with SMACNA Standards:

D. Supplementary Steel: Provide where required to frame structural members between existing members. Such supplementary steel shall be fabricated in accordance with the AISC S 326, and shall be hot-dipped after fabrication.

E. Vibration Isolators: Vibration isolators shall be devices with in-series, contained, steel springs, chloroprene elastomer elements, and fasteners for connecting to building structure attachments. Devices shall be loaded by support system in operating condition to produce required static spring deflection without exceeding 75 percent of device maximum load rating.

39.16. SAFETY PRECAUTIONS

A. Guards and Screens: Provide metal personnel safety guards for normally accessible moving power transmission components in accordance with OSHA 29 CFR 1910.219. Construct guards and screens to provide, as applicable: required strength and clearance with ease of sectional disassembly for maintenance and inspection functions where guard total weight exceeds 50 pounds; weather protection where components are weather exposed. Installed guards and screens shall not negate noise control and vibration isolation provisions.

B. Welding: Conform to ANSI Z49.1 for safety in welding and cutting.

39.17. COOPERATION WITH OTHER TRADES AND CONFLICT IN WORK

A. Contractor shall examine all drawings of proposed work and coordinate his work with other trades. Work conflicts shall be brought to the attention of the State and work rearranged or modified in accordance with their decision.

B. If changes in indicated locations or arrangements of work are required, they shall be made by Contractor without additional charge to the State provided that these changes were ordered before work is installed and no extra material or labor are required.

C. Should the Contractor determine that extra material and labor will be required to accommodate any rearrangement, he shall first submit detailed estimate of cost for the required changes and proceed with work only upon written authority of the State.

39.18. INSTALLATION REQUIREMENTS

Installation shall conform to NFPA 91, SMACNA Round Industrial Duct Construction Standards and SMACNA Rectangular Industrial Duct Construction Standards. Provide mounting and supports for equipment, ductwork, and accessories, including structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors, blast gates, and dampers. Install accessories in accordance with the manufacturer's instructions. Positive pressure duct inside buildings shall be constructed airtight. Install dust collector equipment in accordance with manufacturer's instructions and recommendations.

A. For woodworking facilities, conform to NFPA 664.

B. Electrical Ground Continuity: Where electrical ground continuity is required, provide brazed connection insulated, multi-strand, copper wire jumpers across points of discontinuity. Connection to ground and continuity testing shall be provided as part of the work of ARTICLE XLII – ELECTRICAL WORK.

C. Miscellaneous Sheet Metal Work: Provide flashings fabricated from mill galvanized steel, as indicated. Sheet metal thickness, reinforcement and fabrication, where not indicated, shall conform to SMACNA Accepted Practice for Industrial Duct Construction.

D. Building Penetrations:

1. General Penetration Requirements: Provide properly sized, fabricated, located, and traded coordinated sleeves and prepared openings, for duct mains, branches, and other item penetrations, during the construction of the surface to be penetrated.

2. Framed Opening: Provide framed openings in accordance with approved shop drawings.

3. Clearances: Provide a minimum one inch clearance between penetrating and penetrated surfaces.

4. Tightness: Penetration shall be weathertight.

5. Sealant: Sealant shall be elastomeric type or foamed silicone type, as specified under paragraph entitled "Sealants," in this article. Apply to oil free surfaces to a minimum 3/8-inch (10-mm) depth.

E. Installation of Supports:

1. Selection: Selection of duct and equipment support system shall take into account the best practice recommendations and requirements of SMACNA Round Industrial Duct Construction Standards, SMACNA Rectangular Industrial Duct Construction Standards, and NFPA 91; location and precedence of work under other sections; interference’s of electrical work; facility equipment; building configuration; structural and safety factor requirements; vibration and imposed loads under normal and abnormal service conditions. Indicated support sizes, configurations, and spacing are the minimal type of supporting component required for normal loads. Where installed loads are excessive for the normal support spacing, provide heavier duty components or reduce the element spacing. After system start-up, replace or correct support elements which vibrate and cause noise or possible fatigue failure. Exercise special care to prevent cascading failure.

2. General Requirements for Supports: Securely attach supporting elements to building structural steel or structural slabs. Where supports are required between building structural members provide supplementary structural steel as specified for work under this article. On submittals show location of supports and anchors and loads imposed

on each point of support or anchor. Do not hang ductwork or equipment from piping, or other ducts or equipment. Attach supports only to structural framing member and concrete slab. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required, between structural framing members, provide suitable intermediate metal framing. C-clamps shall not be used. A maximum span of 10 feet shall exist between any two points, with lesser spans as specified or as required by duct assemblies, interference's, and loads imposed or permitted. Provide a minimum one (1) set of two vertical support elements for each point of support and each length of duct, except as otherwise specified. Install supports on both sides of all duct turns, branch fittings, and transitions. Cross-brace hangers sufficiently to eliminate sway. Perforated strap hangers are prohibited. Where ductwork system contains heavy equipment, hang such equipment independently of the ductwork. The location of supporting elements shall be limited by the allowable load on the purlin which shall be limited to that no greater than the moment produced by one Kip load at mid-span of purlin. When the hanger load exceeds these limits, provide reinforcing of purlin or additional support beams. When an additional beam is used, the beam shall bear on the top chord of the roof trusses and bearing shall be over gusset plates of top chord. Stabilize beam by connection to roof purlin along bottom flange.

3. Methods of Attachment: Attachment to building structural steel shall be by clamping and when approved, by welding, in accordance with AWS D1.1. Masonry anchors selected for overhead applications shall be constructed of ferrous materials only. Install masonry anchors in rotary, non-percussion, electric drilled holes. Self-drilling anchors may be used provided masonry drilling is performed with electric hammers selected and applied in such a manner as to prevent concrete spalling or cracking. Pneumatic tools are prohibited.

F. Welding: Welding shall be done in accordance with the applicable provisions of AWS D1.1 and AWS D1.3.

G. Test Ports: Provide test access ports at points required for work under paragraph entitled "Testing, Adjusting, and Balancing", in this article. Locate test ports in straight duct as far as practical downstream of blower, change of direction fittings, takeoffs, interior to duct accessories, and like turbulent flow areas.

H. Ductwork Cleaning: Protect duct openings from construction debris using temporary caps, flanges, or other approved means. Clean dirty duct interior with high velocity water and oil-free air streams or by vacuum cleaning as required by project conditions. After construction is complete but accessible and prior to acceptance, remove all construction debris from exterior surfaces. Do not close duct inspection ports until inspected by the State.

I. Protective Coating Work: Provide protective coating on interior and exterior surfaces of the dust collection system as specified hereafter. Prime coat exterior surfaces as part of work under ARTICLE LXXXVIII – INTERIOR PAINTING. Brush primer, or provide protective coating where no primer is specified, onto corners and into crevices and welds, working the material into irregular surfaces for a holiday free finish.

J. Factory and Field Painting and Finishing:

1. Factory Work: Factory finish interior ferrous metal and other specified metallic equipment and component surfaces with manufacturer's standard surface preparation, primer, and finish coating. Factory finish exterior to building space ferrous metal surfaces and other exterior to building and interior to building metallic or nonmetallic

surfaces with specified protective coating system in accordance with the paragraph entitled "Protective Coating Material", in this article.

2. Field Work: Touch-up or if necessary, repaint factory applied finishes which are marred, damaged, or degraded during shipping, storage, handling, or installation to match the original finish. Field or shop fabricated ferrous metals required for installation specified under this article shall be cleaned and primed in accordance with ARTICLE LXXXVIII – INTERIOR PAINTING. Painting of surfaces not otherwise specified and finish painting of items primed at the factory or elsewhere, are specified as part of the work under ARTICLE LXXXVIII – INTERIOR PAINTING. Finish paint all exposed ductwork and supports.

39.19. TESTING, ADJUSTING, AND BALANCING

A. Ductwork Structural Integrity and Leakage Testing: Inspect and test systems pressure rated higher than 2 inches water gauge for structural integrity and leakage as systems or sections during construction but after erection, as work progresses, in system or section lengths not exceeding 100 feet. Test for structural integrity at 50 percent in excess of system blower positive or negative total pressure. Test for leakage at 10 percent in excess of system blower positive or negative total pressure. Leakage test procedure and apparatus shall be in accordance with SMACNA High Pressure Duct Construction Standards. Total leakage, prorated to length of duct under test, shall not exceed one percent (1%) of system capacity.

B. Power Transmission Component Adjustment: Test and adjust V-belts an sheaves for proper alignment and tension preliminary to operation and after 72 hours of operation at final speed.

C. Preliminary Tests: Conduct an operational test on the entire exhaust duct systems, components, and equipment for a period of not less than 6 hours after power transmission components are adjusted. Replace filters, if any, after preliminary tests and prior to conducting final acceptance tests.

D. Testing, Adjusting, and Balancing Work: Perform work in accordance with the applicable and recommended procedures of: ACGIH Industrial Ventilation Manual. Provide apparatus, certified, calibrated, instrumentation including that to measure sound levels, motor current, and power factor. Unless approved otherwise, instruments shall be limited to manometers and approved aneroid type gauges (such as a Magnehelic). Velometers may be used for low velocity measurements if approved by the State. A detailed agenda of the proposed work shall be submitted to and approved by the State prior to starting any work.

E. System Volume Acceptance Criteria: Systems final volume shall be within the following limits:

Fan	Plus 10 percent, minus zero percent of design volume at design temperature
Hood or Equipment	Plus or minus 10 percent of design volume at design temperature

Note: Tolerances shall be taken with clean conditions:

F. Sound Level Criteria: Sound levels higher than 80 dba at hoods or at workers' normal operating positions at equipment shall be reported to the State in writing in addition to being included in the required test reports.

G. Test Reports: Provide 6 copies of final test report for the system tested, describing all test apparatus, instrumentation calculations, factors, flow coefficients, sound levels, and equipment data based on ACGIH recommended forms or reasonable facsimiles thereof to suit project conditions. Final adjustment and settings shall be permanently marked, drilled, and pinned as an integral part of device. Adjustment and setting data shall be included in test report.

39.20. SYSTEM OPERATION DEMONSTRATION

A. After systems and equipment testing, adjusting, and balancing has been completed and accepted, demonstrate the complete and correct functioning of systems, equipment and controls by operation through normal ranges and sequences, and by simulation of abnormal conditions. Manually and automatically cause every device to function as intended. Readjust, as necessary, any settings and after sufficient operating time, but not less than 6 hours, verify ability of equipment and controls to establish and maintain stable and accurate operation and required system performance. Note any abnormal deviations, such as excessive vibration, noise, and heat, binding damper mechanisms, and incorrect blower rotation. Make any necessary repairs, replacements or adjustments. Submit a written report documenting the tests performed and the results of the tests.

39.21. POSTED OPERATING INSTRUCTIONS

A. Furnish approved operation instructions for each principal item of equipment for the use of the operation and maintenance personnel. The operation instructions shall include wiring diagrams, control diagrams and control sequence for each principal item of equipment. Operating instruction shall be printed or engraved and shall be framed under glass or in approved laminated plastic and posted where directed by the State. Operating instruction shall be attached to or posted adjacent to each principal item of equipment including start-up, procedure in the event of equipment failure and other items of instruction as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather shall be made of weather-resistant materials or shall be suitably enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

39.22. FIELD INSTRUCTIONS

A. Upon completion of the work and at a time designated, the services of one or more qualified personnel shall be provided by the Contractor for a period of not less than 2 days to instruct the representative of the State in the operation and maintenance of the exhaust system. These field instructions shall cover all the items contained in the bound instructions.

39.23. ONE YEAR MAINTENANCE AND SERVICE CONTRACT

A. Shall be provided as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

39.24. OPERATION AND MAINTENANCE MANUAL

A. Provide hard bound copies of the Operating and maintenance Manual on all equipment and the systems as a whole. Provide manuals in accordance with the requirements of ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

39.25. MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XL – HVAC TESTING, ADJUSTING, AND BALANCING

40.1 SUMMARY

A. The work includes testing, adjusting, and balancing (TAB) of new air conditioning system, including equipment and ducts, which are located within the building.

B. Refer to notes on the drawings for additional requirements for work under this article.

40.2 RELATED WORK SPECIFIED ELSEWHERE

A. Mechanical work as specified in ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS unless specified otherwise in the Mechanical Division.

B. Air conditioning and ventilation equipment specified in ARTICLE XXXVI – UNITARY AIR CONDITIONING EQUIPMENT.

C. Ductwork for air conditioning and ventilation specified in ARTICLE XXXVII – DUCTWORK AND DUCTWORK ACCESSORIES.

40.3 SUBMITTALS

A. Submit in accordance with ARTICLE XI – REQUIRED SUBMITTALS and ARTICLE XXXI – GENERAL MECHANICAL REQUIREMENTS.

B. Certificates:

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 perform by the TAB agency must be limited to testing, adjusting, and balancing of HVAC air and water systems to satisfy the requirements of this specification article. Submit the following, for the agency, to the Project Manager for approval in compliance with subparagraph entitled "TAB Personnel Qualification Requirements" herein below.

1. Independent AABC 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 must be current, and valid for the duration of this contract. Certifications which expire prior to completion of the TAB work, must 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 must 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 Project Manager.

D. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this article. 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 field work from start to finish. Include in this description a complete methodology for accomplishing the TAB field work 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 and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

2. Pre-Field Data: Submit AABC or NEBB or SMACNA HVAC TAB 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 field work.

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 field work. 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 use, 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 Work Checkout List: A list of inspections and work items which are to be completed by the Contractor and submitted and approved by the Project Manager 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 Subcontractor 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 Work Checkout List" and certify in writing that each item has been checked and is operating as designed.

H. Field Test Reports:

1. Certified TAB report.

2. Field Test Reports: Submit certified reports in the specified format including the above data.

Certified TAB Reports:

a. Report Format: 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 must be typewritten. Handwritten report forms or report data are not acceptable.

b. 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.

c. 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.

d. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

3. TAB Submittal and Work Schedule: Compliance with the following schedule is the

Contractor's responsibility.

a. TAB Field Work: At a minimum of 30 calendar days prior to start of field check, accomplish TAB field work; submit certified TAB report; and conduct field check.

40.4 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.

1. ASSOCIATED AIR BALANCE COUNCIL (AABC):

   AABC MN-1 Testing and Balancing Heating, Ventilating and Air Conditioning Systems

2. NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB):

   NEBB TABES Testing, Adjusting, Balancing of Environmental Systems

3. SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA): SMACNA HVACTAB HVAC Systems Testing, Adjusting and Balancing

40.5 QUALITY ASSURANCE

A. Modifications of References: Accomplish work in accordance with referenced publications of AABC or NEBB except as modified by this article. 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" or “must” wherever they appear.

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: The 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.

C. Responsibilities: The Contractor shall be responsible for ensuring compliance with the

requirements of this article. 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.

1. Contractor:

    a. TAB Personnel: Ensure that the TAB work is accomplished by a group meeting the requirements specified in subparagraph entitled "TAB Personnel Qualification Requirements" herein above.

    b. Pre-TAB Meeting: Attend the meeting with the TAB Team Supervisor and ensure that a representative is present for the Sheetmetal Contractor, Mechanical Contractor, and Electrical Contractor.

    c. HVAC Documentation: Furnish one complete set of the following HVAC-related documentation to the TAB Agency:

        1) Contract drawings and specifications.

        2) Approved submittal data for equipment.

        3) Construction work schedule.

        4) Up-to-date revisions and change orders for the previously listed items.

    d. Submittal and Work Schedules: Ensure that the schedule for submittals and work required by this article are met.

    e. 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 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 field work. Conversely, ensure that the HVAC controls installer has required support from the TAB team field leader to complete the controls check out.

    f. Deficiencies: Ensure that equipment defects, installation deficiencies, and design deficiencies reported by the TAB team field leader are brought to the attention of the Project Manager. Ensure that design deficiencies reported by the TAB team field leader, or the TAB team supervisor, are transmitted to the Project Manager within 4 calendar days from date of receipt from the TAB agency.

    g. Prerequisite HVAC Work: Complete check out and debugging of HVAC 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 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 TAB 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 work checkout list specified in the item entitled "SUBMITTALS" herein above. Do not allow the TAB team to commence TAB field work until all of the following are completed.

        1) HVAC system installations are fully complete.

2) HVAC prerequisite checkout work lists have been completed, submitted, and approved.

3) HVAC system filters are clean for TAB field work.

h. Advance Notice: Furnish to the Project Manager with advance written notice for each event, the commencement of the field work and for the commencement of the TAB field work.

2. TAB Agency: Provide the services of a TAB team which complies with the requirements of subparagraph entitled "TAB Personnel Qualification Requirements" herein above.

a. TAB Team Supervisor:

1) Overall Management: Supervise and manage the overall TAB team work effort, including preliminary and technical TAB procedures and TAB team field work.

2) Pre-TAB Meeting: Attend meeting with Contractor.

3) Design Review Report: Review project specifications and accompanying drawings to verify that the air systems and water systems are designed in such a way that the TAB Team Field Leader can accomplish the work in compliance with the requirements of this article. 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.

4) Support Required: Specify the technical support personnel required from the Contractor other 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 TAB engineering report or during the TAB field work.

5) Pre-Field TAB Engineering Report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.

6) Prerequisite HVAC Work Checkout List: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.

7) Technical Assistance for TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.

8) Certified TAB Report: Certify the TAB report. This certification includes the following work:

a) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.

b) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field TAB engineering report and verify adherence to the procedures specified in this article.

9) Design Deficiencies: Submit in writing as soon as possible, to the Contractor and the Project Manager, each design deficiency reported by the TAB field team. Provide, in this submittal, a complete explanation including supporting documentation detailing the deficiency.

10) TAB Field Check: The TAB team supervisor shall attend and supervise TAB field check.

b. TAB Team Field Leader:

1) Field Manager: Manage, in the field, the accomplishment of the work specified in PART 3 - EXECUTION.

2) 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 article.

3) Prerequisite HVAC Work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work checkout list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

D. Re-TAB Meeting: Meet with the Project Manager's TAB representative and the Designing Engineer of the HVAC 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

40.6 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 and water systems must be proportionately balanced and reported in the TAB report. Provide instruments and consumables required to accomplish the TAB work. Conduct TAB work on the listed HVAC systems in conformance with the AABC MN-1, or NEBB TABES, except as modified by this article:

1. Maintenance and calibration of instruments.
2. Accuracy of measurements.
3. Preliminary Procedures: Test ports required for testing by the TAB Engineer must be located in the field by the TAB Engineer during TAB field work. It must be the responsibility of the Sheetmetal Contractor to provide and install test ports as required by the TAB Engineer.
4. Air Distribution Systems TAB Work: Air handling units, fan coil units and fans including coils, ducts, plenums, mixing boxes, and air distribution devices for supply air, return air, and outside air.
5. Water Distribution Systems TAB Work: Chilled water, condenser water, reheat water, heat recovery water systems including chillers, condensers, cooling towers, pumps, coils, system balance valves and flow measuring devices.

B. TAB Work on Performance Tests:

1. Performance Tests: In addition to the TAB proportionate balancing work on the air distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the cooling systems.

2. Ambient Temperatures: On each TAB report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. That is, record these temperatures at beginning and at the end of data taking

40.7 WORKMANSHIP

A. Conduct TAB work on specified HVAC systems until measured parameters are within plus or minus 10 percent of the design values, that is, the values specified or indicated on the contract documents. To minimize the possibility of noise at the air device, "coarse" balancing must be performed at the duct branch and "fine" balancing must be performed at the face of the air device.

40.8 DEFICIENCIES

A. Strive to meet the intent of this article to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the item entitled "Workmanship" herein above, provide written notice as soon as possible to the Contractor and the Project Manager describing the deficiency and recommended correction. Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor’s

40.9 QUALITY ASSURANCE FOR TAB FIELD WORK

A. Field Check: Test must be made to demonstrate that capacities and general performance of air and water systems comply with the contract requirements.

1. Recheck: During field check, the Contractor must recheck, in the presence of the Project Manager, random selections of data (water, air quantities, air motion, sound level readings) recorded in the certified report.

2. Areas of Recheck: Points and areas of recheck must be selected by the Project Manager.

3. Procedures: Measurement and test procedures must be the same as approved for work for forming basis of the certified report.

4. Recheck Selections: Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the report.

5. Retests: If random tests reveal a measured quantity which is out-of-tolerance, the report is subject to disapproval at the Project Manager's discretion. In the event the report is disapproved, all systems must be readjusted and tested, new data recorded, new certified reports submitted, and a new field check conducted at no additional cost to theState.

B. Approval Prerequisite: Compliance with the field checking requirements of this article is a prerequisite to the final approval of the certified TAB report submitted.

40.10 MARKING OF SETTINGS

A. 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 must indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

40.11 MARKING OF TEST PORTS

A. The TAB team must permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, these markings must be made on the exterior side of the duct insulation. The location of test ports must be shown on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

40.12 MEASUREMENT AND PAYMENT

A. Measurement and payment for work under this Article shall not be made separately and shall be considered incidental to and included in the amount bid for various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLI-GENERAL ELECTRICAL REQUIREMENTS

41.1 GENERAL

A. This article specifies the general electrical requirements for all labor, materials, equipment, and services under the following:

1. Article XLII - Electrical Work.
2. Article XLIII - Low Voltage Switchboards.
3. Article XLIV - Fire Alarm System.
4. Article XLV - Lighting.
5. Article XLVI - Underground Electrical Work.
6. Article XLVII - Telecommunication Cabling System.
7. Article XLVIII - Photovoltaic Collectors.
8. Article XLXI - Video Surveillance System

B. Related Work Specified Elsewhere: Article X - Project Description.

41.2 WORK INCLUDED

A. The Contractor 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 the 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 articles.

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 and the cost of same shall be included in the contract price.

41.3 DESCRIPTION OF WORK

A. Work shall include, but not be limited to, the following:

1. Underground infrastructure for primary electrical, secondary electrical and telecommunications utility services.
2. Distribution system, including metering equipment, switchboards, panelboards, overcurrent protection devices, and feeders.
3. Complete electrical system wiring including branch circuits, luminaires, switches, receptacles, outlets and control devices.
4. Complete lighting and control systems, including photocells, lighting contactors, and control stations.

5. Power wiring for electrically-operated equipment and appliances.
6. Telecommunications system infrastructure.
7. Fire alarm system.
8. Video surveillance system.
9. Utility interactive photovoltaic system.
10. Testing.

B. Electrical wiring system shall have sufficient capacity to accommodate all equipment, appliances and other electrical loads as specified herein and shown on the drawings and as required per National Electrical Code and other applicable codes, standards and requirements plus spare capacity to accommodate any planned future facilities and additions and minimum 25 percent spare capacity for future growth.

41.4 REFERENCES

A. 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 City and County of Honolulu.

B. Comply with requirements and regulations of electric and telecommunications utilities.

C. 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.

41.5 COORDINATION

A. Refer to all project Drawings and to all Sections of the project Specifications. Coordinate and fit all work accordingly so that all electrical outlets 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 Harbors Construction Engineer.

41.6 SUBMITTALS

A. Submit in accordance with Article XI - Required Submittals.

B. Shop drawings and catalog cuts of the equipment and products identified in technical section for approval.

C. Each submittal shall be prepared with a summary sheet attached to each copy identifying all items included in the submittal.

D. Incomplete submittals and those without summary sheets will be returned without review. Review and acceptance of shop drawings by Harbors Construction Engineer shall not relieve the Contractor of responsibility to provide for a complete and proper installation.

41.7 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 acceptance of the Harbors Construction Engineer and at no additional cost to the State.

41.8 WARRANTY

A. Installation shall be complete in every detail as specified and ready for use. Unless otherwise indicated, any items supplied by Contractor developing defects of design, construction, or quality within one (1) year of final acceptance by Harbors Construction 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.

B. The warranty shall be countersigned by the General Contractor.

41.9 DRAWINGS AND SPECIFICATIONS

A. Electrical system drawings are diagrammatic and symbolic. Locations of outlets, devices, raceways, apparatus, etc., shown are approximate and shall be installed with the required maintenance and code clearances and to avoid conflict with other systems and trades. Visit site and verify lineal footages required and check scales and dimensions shown on architectural drawings prior to bidding to verify locations, routing and lineal footages of electrical work required for inclusion into bid. Study adjacent civil, architectural, structural and mechanical details and make installation in most logical manner for eye appeal and coordination with other systems and trades. Unless dimensioned or noted otherwise, orderly configuration and visual composition are fully intended.

B. Include additional components and wiring which are not shown or specified herein but are required for proper control and operation to provide for a complete and operable system within intent indicated on the drawings and specifications.

C. Study civil, architectural, structural and mechanical drawings and specifications prior to bidding and provide additional wiring including apparatus and devices for equipment furnished by the State or other trades without additional cost.

D. Relocate devices, apparatus and associated wiring including raceways, from locations shown, without additional cost, for code compliance and to avoid conflict with other systems or trades, structures, utilities and when directed before installation.

E. Equipment ratings or wire sizes that are missing or shown in error shall have adequate capacity to serve the required and future loads plus minimum 25 percent spare capacity and be in compliance with NEC.

F. Verify voltages and other ratings of energy conversion, transformation and electrical utilization equipment prior to placing order with factory. Input voltages of equipment shall match serving utility or system voltage available.

41.10 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, 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.

41.11 INSTALLATION

A. Install all electrical materials and equipment in accordance with manufacturer's recommendations and as accepted by the Harbors Construction 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 damaged or marred by notching, drilling or any other process necessary for installation of electrical work. Patch any damaged surfaces to match the existing surface.

41.12 JOBSITE CONDITIONS

A. These specifications are accompanied by construction drawings including building and site plans of all trades showing locations of all outlets, switches, service runs, feeder runs, devices, 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 Harbors Construction 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 Harbors Construction Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

41.13 CONNECTIONS TO EQUIPMENT PROVIDED BY OTHER TRADES

A. Electrical Contractor shall provide conduit, wiring and all electrical connections from building wiring to motors for ventilation, air conditioning, and other equipment, including all switches, motor protection devices, as specified by other trades.

B. Electrical Contractor shall ascertain from other trades furnishing motor-driven equipment, the exact size and type of all motors, 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.

C. Examine mechanical, architectural, and other Drawings and Specifications for information concerning motors and control apparatus and diagrams.

D. Install individually mounted starters furnished for motors under other Divisions. Provide and install safety switches as necessary for each such motor.

E. All control devices and control wiring shall be provided as described in the installation manuals of equipment and/or the Drawings and Specifications of other trades and disciplines.

41.14 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 tests shall be under the direction and supervision of the Harbors Construction 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 Harbors Construction Engineer or his representative. All test procedure shall conform to this specification and applicable standards. (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 Harbors Construction Engineer for his review and/or acceptance.

E. A visual inspection of all electrical equipment, to check for foreign material, tightness or wiring and connection, proper grounding, matching nameplate charts with specification, etc., shall be made prior to actual testing.

F. After demonstration of systems, submit to the Harbors Construction Engineer six (6) sets of keys for electrical equipment locks.

41.15 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLII-ELECTRICAL WORK

42.1 GENERAL

A. This article includes, but is not limited to, electrical systems as indicated in the drawings.

B. Related Work Specified Elsewhere: Article XLI - General Electrical Requirements applies to this article with additions and modifications specified herein.

C. 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.

42.2 SUBMITTALS

A. Submit for Review:

1. Panelboards.
2. Dry transformers.
3. Overcurrent protection devices.
4. Safety switches.
5. Cord reels.
6. Manual transfer switch.
7. Wiring devices and device plates.
8. Overhead cable reels.
9. Automatic control devices.
10. Cabinets.
11. Junction boxes larger than 6-inch square.
12. Grounding busbar.

B. 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.

C. Field Test Reports: Submit the following test results for approval in report form as stipulated in item "FIELD QUALITY CONTROL" hereinbelow.

1. 600-volt wiring test.
2. Grounding system test.
3. Written Notification: Submit written notification of all tests as noted under item entitled "TESTING" hereinbelow.

D. Submit written notification of all tests and test results as stipulated in paragraph entitled "TESTING" hereinbelow.

42.3 MATERIALS AND EQUIPMENT

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 ABB, Square D/Schneider, Siemens, and Eaton. Acceptable manufacturers for telecommunications apparatus include B-Line, Chatsworth, Hoffman, Hubbell, Leviton and Siemon. 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 Harbors Construction Engineer.

C. Electrical equipment 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, e.g., safety switches shall be of the same manufacturer unless otherwise noted.

F. Where electrical apparatus is to be installed outdoors, NEMA 4X stainless steel Type 316 housings shall be provided, unless noted otherwise.

42.4 RACEWAYS

A. Rigid Steel Conduit: Rigid steel, zinc-coated inside and outside, for use with threaded fittings. ANSI C80.1.

B. Electrical Metal Tubing (EMT): Thin walled steel tubing, zinc-coated. ANSI C80.3.

C. 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.

D. Plastic Conduit: Polyvinyl chloride, Schedule 40. Provide a separate green equipment grounding conductor.

E. Fittings for Metal Conduit and EMT: UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

1. Rigid Metal Conduit: Threaded-type. Split couplings unacceptable. Provide explosionproof sealing fittings where indicated.

2. EMT: Steel compression type.

F. Fittings for Rigid Nonmetallic Conduit: NEMA TC 3 for PVC and UL 514B.

42.5 BOXES

A. Outlet and Small Junction Boxes: Nominal 4 inches square, 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 aluminum, type FD, prime painted and enamel finished, with neoprene gasketed covers, threaded hubs for conduit connections and stainless steel screws.

B. Extension Rings for Outlet Boxes: Pressed steel, zinc-coated for corrosion protection.

C. Boxes and Wireways 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 stainless steel, NEMA 4X, Type 316 with matching neoprene gasketed covers, threaded hubs for conduit connections and Type 316 stainless steel screws. Boxes with any dimension larger than 12-inches shall have a hinged cover.

D. Floor Outlet Boxes: Recessed activation, multi-service type, adjustable and concrete-tight. Each box shall contain 4 wiring compartments with threaded openings for conduits, adjustable ring, flush trim ring with recessed activation access hatch and carpet insert. Cast metal body. Provide gaskets where necessary to ensure watertight installation. Evolution RFBA series or approved equivalent.

42.6 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. For exterior and wet locations, cabinets shall be stainless steel, NEMA 4X, Type 316 stainless steel, with matching neoprene gasketed trim and doors, threaded hubs for conduit connections, stainless steel screws and hardware and external means for mounting.

B. All cabinets for power systems (i.e., panelboards, relay cabinets, etc.) shall be keyed alike. All cabinets for signal systems shall be keyed alike, but differently than power system cabinets.

42.7 CONDUCTORS

A. Solid or stranded copper, sizes according to American Wire Gauge 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: XHHW.

E. Conductors for Equipment Connection: Stranded flexible type.

F. Cabling: Not acceptable.

G. Color Coding: Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

1. 208/120 Volt, 3-Phase or 240 volt, 3-Phase:
    a. Phase A - black.
    b. Phase B - red.
    c. Phase C - blue.
2. 480/277 Volt, 3-Phase:
    a. Phase A - brown.
    b. Phase B - orange.
    c. Phase C - yellow.

H. Fire Alarm Conductors: As specified in Article XLIV - Fire Alarm System.

42.8 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

42.9 WIRING DEVICES

A. General: Ratings and NEMA arrangement types as indicated. Drawings show minimum application ratings, specification describes nominal ratings.

B. Switches: Ivory, 20A, 120/277V, non-mercury quiet type, specification grade with nylon body. Provide double pole, keyed, three way and four way switches, as indicated.

C. Duplex Convenience Receptacles: Ivory unless otherwise indicated, 20A, 125V, specification grade, grounding type, unless otherwise noted. Provide tamperproof, safety covers, where indicated.

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.

F. Pin and Sleeve Receptacles: Cast outlet box and spring loaded cover. Ampere rating and pin configuration as indicated.

42.10 DEVICE PLATES

A. Stainless steel Type 304. Gangs are required.

B. For Exterior Use: Weatherproof flip-open cover, high-grain non-metallic, plastic or fiberglass, 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.

42.11 CORD REELS

Industrial grade, steel housing, yellow powder coat finish, retractable 3/C #12 Type SJ cord, positive-latch mechanism to maintain desired cord length, NEMA 5-20R GFCI receptacle connector.

42.12 PORTABLE GENERATOR TAP BOX/MANUAL TRANSFER SWITCH

A. UL 1008. Completely factory assembled, wired and tested. Molded case breaker type. Knife switch or fused switches not acceptable

B. Manual transfer switch manufacturer shall provide a complete factory assembled, wired and tested manual transfer switch.

C. Manual transfer switch shall be factory Hi-pot tested for a period of not less than 60 seconds.

D. Manual transfer switch shall consist of (2) mechanically-interlocked molded case circuit breakers, male cam-style inlet connectors, power distribution blocks and grounding terminals, all housed within a pad-lockable enclosure.

E. Transfer switch enclosure shall be Type 316 stainless steel, NEMA Type 3R. The main access shall be through an interlocked hinged door that extends the full height of the enclosure. Access for portable generator cables with male cam-style plugs shall be via drawn flange cable entry openings in the bottom of the enclosure. A hinged flap door shall allow cable entry only after the main access door has been opened.

F. Cam-style male connectors shall be UL listed, single-pole separable type and rated 400 amps at 600 VAC. All cam-style connectors shall be color coded. Cam-style connectors shall be provided for each phase, neutral and ground. Each of the phase cam-style connectors shall be factory wired to a molded case circuit breaker. The ground cam-style connector shall be bonded to the enclosure and a ground lug shall be provided for connection of the facility ground conductors. None of the cam-style connectors shall be accessible unless all three (3) molded case circuit breakers are in the "OFF" position and the main access door is open.

G. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the molded case circuit breakers.

H. Molded case circuit breakers shall be UL listed with AIC ratings as indicated.

1. One molded case circuit breaker shall control the connection between the normal/utility source and the manual transfer switch.

2. A second circuit breaker shall control the connection between the portable generator (via male cam-style connectors) and the manual transfer switch.

3. Molded case circuit breakers shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless all breakers are in the "OFF" position. All molded case circuit breakers shall be mounted behind a deadfront panel. The load-side of the molded case circuit breakers shall not be energizable unless the main access door is closed and one of the molded case circuit breakers is in the "ON" position. The molded case circuit breakers shall be safety interlocked by mechanical means to ensure that only one of these breakers can be closed at any given time.

I. ESL Storm Switch or approved equivalent.

42.13 CONTROL EQUIPMENT

A. Contactors: Contact ratings as specified, electrically-held, coil voltage to match lighting circuit voltage, NEMA 1 enclosure, number of poles as required.

B. Manual Motor Starters: HP rated toggle operated mechanism with appropriate overload heater elements, NEMA 1 enclosure. (NEMA 4 cast iron or ferrous alloy with neoprene gaskets for outdoor applications or where exposed to damp atmosphere or as indicated.) Toggle positions "ON", "OFF" and "TRIPPED" engraved or embossed on body and visible without removing enclosure cover.

42.14 PANELBOARDS

A. Mounting, voltage rating, main bus capacity, breaker complement, and lugs as specified on drawings, complete with housing, door, trim, lock and typewritten circuit directory. Provide 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 Harbors Construction Engineer.

D. Panel housing and entire circuit breaker complement shall be of the same manufacture.

E. Distribution panels shall be a minimum 30 inches wide with an 8-inch minimum depth. Converted lighting panelboards will not be accepted.

F. NEMA rating of panelboard enclosures shall be as specified.

42.15 CIRCUIT BREAKERS AND SAFETY SWITCHES

A. 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 withstand ratings as specified on Drawings. Multi-pole breakers shall have single, common operating handle for all poles. Toggle positions "ON", "OFF" and "TRIPPED" and breaker rating engraved or embossed on body and visible without removing enclosure cover.

B. Safety switches shall be heavy-duty grade, horsepower rated and sized as indicated or as to match branch circuit overcurrent device rating.

C. Enclosures for breakers and switches to be NEMA 1, for interior locations and NEMA 4X stainless steel for exterior locations.

42.16 DRY TRANSFORMERS

A. General: Dry transformers shall be totally metal enclosed ventilated 2 winding type, with six 2-1/2 percent taps, 2-FCAN, 4-FCBN unless otherwise noted. Temperature shall be 115 degrees C on a 220 degree C insulation system, and the transformer shall be rated and labeled for 10 percent continuous overload. Oversize or derated transformers not acceptable. Sound ratings shall not exceed NEMA ST 20 for nominal size indicated.

B. Transformers shall meet 2016 Department of Energy efficiency standards for low-voltage dry-type transformers.

C. Vibration Mounts: All transformers shall be provided with internal vibration isolators. Transformers rated 30 kVA and larger shall be provided with external double-deflection neoprene vibration isolators with 0.4 inch static deflection between the transformer and mounting surface.

D. Transformer Connections: Provide flexible conduit connections to transformer casing for primary and secondary feeders.

E. NEMA 1 enclosures unless otherwise indicated.

42.17 DUCT SEAL

Pliable, non-toxic material used for application around 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 apparatus and risers.

42.18 HARDWARE, SUPPORTS, BACKING, ETC.

A. Provide all hardware, supports, backing and other accessories necessary to install electrical equipment. Wood materials shall be treated against termites, 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 exterior use 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.

42.19 TELECOMMUNICATIONS GROUNDING AND BONDING EQUIPMENT

A. Grounding Busbar: Provide corrosion-resistant copper grounding busbar suitable for indoor installation in accordance with ANSI-J-STD-607-A. Busbars shall be electro-plated for reduced contact resistance. If not plated, the busbar shall be cleaned prior to fastening the conductors to the busbar, and an anti-oxidant shall be applied to the contact area to control corrosion and reduce contact resistance. Provide a telecommunications grounding busbar at backboards as shown on the drawings. Provide telecommunications grounding busbar with the following:

1. Pre-drilled copper busbar provided with holes for use with standard sized lugs.
2. Minimum dimensions of 0.25-inch thick by 4-inches wide by 12-inches long.
3. Listed by a nationally recognized testing laboratory.

B. Telecommunications Bonding Conductor: ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 6, Class B stranded bare copper wire for sizes No. 6 and larger diameter. Provide a copper conductor in accordance with ANSI-J-STD-607-A or as otherwise indicated on the drawings.

42.20 TELECOMMUNICATIONS SUPPORT INFRASTRUCTURE

A. Wire Basket Cable Tray: NEMA VE1. Wire basket cable tray shall form a wireway system consisting of sizes indicated complete with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars.

1. Construct units with rounded edges and smooth surfaces in compliance with applicable standards. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
2. Wire basket cable tray shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
3. Straight sections and accessories shall be constructed of steel that has been zinc-coated after fabrication.
4. Fittings shall have the same load-carrying ability of straight sections and shall have manufacturer's minimum standard bend radius.

B. Telecommunications Backboard: Void-free, fire rated interior grade (A/C grade minimum) plywood, 3/4-inch thick, 4-feet by 8-feet. Do not cover stamp on backboard.

42.21 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.

42.22 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards and panelboards that are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

42.23 HARDWARE, SUPPORTS, BACKING, ETC.

A. Provide all hardware, supports, backing and other accessories necessary to install electrical equipment. Wood materials shall be treated against termites, 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 at exterior locations shall be Type 316 stainless steel.

42.24 EXECUTION

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.

C. Service Entrance Identification:

1. Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

2. Labels: Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to item entitled "IDENTIFICATION" hereinbelow. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

D. Raceways:

1. Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits under floor slab as if exposed. 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.

2. 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 State.

3. Exposed conduit runs to be parallel and/or perpendicular to architectural and structural elements. Galvanized rigid steel conduit or IMC up to 7-feet above finished interior floor. EMT permitted for exposed installation indoors above 7 feet.

4. Electrical Metallic Tubing (EMT): Acceptable for exposed, indoor installation as indicated above and for all concealed indoor installations with the following exceptions:

    a. EMT not permitted in/under grade slab.

    b. EMT not permitted in walls that are in contact with earth.

    c. Provide factory-made transitions between rigid conduit and EMT. Use only compression type, concrete tight couplings.

    d. Surface mounted EMT is not permitted within the maintenance building.

    e. Field-paint exposed tubing with corrosion-resistant paint.

5. 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.

6. Restrictions Applicable to Flexible Conduit: Provide flexible steel conduit between 3 and 6 feet in length for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Flexible conduit not allowed for all other installations. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquid-tight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement, or motors. Provide separate ground conductor across flexible connections.

7. Underground Conduit Other Than Service Entrance: Schedule 40 PVC. Convert nonmetallic conduit to steel conduit before rising through floor slab. Plastic coating shall extend minimum 6 inches above floor.

8. Conduit Installed Under Floor Slabs: Conduit run under floor slab shall be located a minimum of 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

9. Conduit through Floor Slabs: Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

10. Conduit Installed in Concrete Floor Slabs: Schedule 40 PVC. Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab. Do not stack conduits. Space conduits horizontally not closer than 3 diameters, except at cabinet locations. Curved portions of bends shall not be visible above finish slab. Conduit larger than one inch trade size shall be parallel with or at right angles to main reinforcement; when at right angles to reinforcement, conduit shall be close to one of supports of slab.

11. Stub-Ups: Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

12. Conduit Support: Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed 1/4 proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. For conduits greater than 2-1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

13. Directional Changes in Conduit Runs: Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

14. Locknuts and Bushings: Fasten conduits to sheet metal boxes and cabinets with 2 locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits and provide insulating type where required by NFPA 70. Provide threaded, weatherproof hubs for all raceway connections to boxes and enclosures exposed to the weather.

15. Minimum conduit diameter shall be 3/4-inch trade size except that 1/2-inch conduit will be permitted for branch circuit (non-signal) raceways with a maximum of two current carrying conductors #10 AWG and smaller.

16. Provide nylon pullstring of 200 pound minimum tensile strength in all empty conduits in excess of 15 feet in length.

17. 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.

18. Provide locknuts and bushings for all raceway terminations.

19. Provide hubs for all raceway connections to boxes and enclosures exposed to weather.

E. Boxes:

1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided.

2. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3. Install boxes serving opposite sides of walls a minimum of 6 inches apart to minimize noise transmission.

F. Conductors:

1. Lubricants: Non-wax type, chemically neutral to insulation and sheath. Mechanical means for pulling to be torque-limiting type and not be used for #2 AWG and smaller wires.

2. 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. Make splices within boxes in accessible locations.

3. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways.

4. Clean all raceways, boxes, and enclosures before pulling wires and cables. Form neatly in enclosures for minimum of cross-overs.

G. Conductor Identification: Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with manufacturer's recommendations.

H. 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.

I. 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.

J. Miscellaneous Details:

1. 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.

2. Clean all surfaces of enclosures and equipment.
3. Close all unused knockout holes.

K. Painting:

1. 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 Article LXXXVIII - Interior Painting.
2. All surface-mounted boxes, enclosures, and exposed raceways shall be painted to match the color of surrounding areas. Exposed raceways with dedicated utility spaces are not required to be painted.
3. Do Not field-paint circuit breakers, panelboards, and safety switches.

L. Identification:

1. All overcurrent protection devices, switchbanks, enclosures, and cabinets shall be provided with plastic plate identifying itself and its use.
    a. Identify all panelboards, meters, breakers and safety switches.
    b. Cabinets, Junction Boxes and Wireways. (i.e. RELAY "2A").
    c. Switchbanks (e.g. identify function of each switch).
2. 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.
3. CAUTION SIGNS shall be provided as required by Ordinances and/or by OSHA.

M. Grounding:

1. Ground services, metallic enclosures, raceways and electrical equipment according to requirements of National Electrical Code, Article 250. Install 3/4 inch x 10 feet copperclad ground rod, Copperweld Steel Co. or approved equal, with top 12-inches below finished grade. Provide additional ground rods spaced minimum six feet apart as required. Bond together with No. 1/0 bare copper wire buried 12-inches below finished grade or as indicated to obtain a ground resistance of 25 ohms or less as measured by three point fall of potential method with electric ground megger. Connect ground rods to building entrance equipment and nearest cold water pipe with grounding electrode conductor per N.E.C. At water meter, install pipe clamps, Thomas & Betts Co, No. 3900 series or approved equal, on both sides of meter and bond together. Connection shall not interfere with installation or removal of water meter.
2. Ground connections to equipment, raceways, motors, grounding type receptacles and other metallic parts directly exposed to ungrounded conductors by insulated conductors, No. 12 minimum, AWG copper, N.E.C. Type TW, green insulation, or continuous approved metal raceways unless indicated otherwise. Provide insulated ground wires to all receptacles, panels, transformers and switchboards.
3. All grounding wire runs where exposed and within building in raceways. Run equipment ground wires together with circuit conductors.
4. All telecommunications infrastructure shall be grounded in accordance with ANSI-J-STD-607-E.

N. 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.

42.25 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. Written notification of all proposed tests shall be provided to the Harbors Construction Engineer a minimum of 14 days prior to the date of the test.

B. Perform an operational test after completion of the installation in the presence of the Harbors Construction Engineer, to assure proper operation of all items of work. Remove all grounds and shorts. Balance feeder loads.

C. Furnish test equipment and personnel and submit written copies of test results.

D. Inspect conduit system for completeness, loose couplings, and proper support.

E. Devices Subject to Manual Operation: Each device subject to manual operation shall be operated at least 5 times, demonstrating satisfactory operation each time.

F. 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 Harbors Construction Engineer.

G. 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.

H. 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 the Harbors Construction Engineer and indicate location of rods as well as resistance and soil conditions at time measurements were made.

42.26 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLIII-LOW VOLTAGE SWITCHBOARDS

43.1 GENERAL

A. Section Includes: Low-voltage switchboards, circuit breakers, and utility company metering equipment.

B. Related Work Specified Elsewhere: Article XLI - General Electrical Requirements applies to this section with additions and modifications specified herein.

C. Applicable Publications: The publications cited within this specification form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Unless otherwise indicated, most recent edition of the publication with current revisions and amendments will be enforced.

43.2 SUBMITTALS

A. Submit in accordance with Article XI - Required Submittals.

B. Manufacturer's Data:

1. Switchboards.
2. Circuit breakers.
3. Surge protective devices.

C. Shop Drawings: Furnish drawings for switchboard including, but not limited to, the following:

1. Overall dimensions and front view.
2. Ampere ratings of bus bars.
3. Maximum short circuit bracing.
4. Circuit breaker type, interrupting rating, and recommended settings for all adjustable breaker parameters.
5. Provisions for utility company metering.
6. Elementary diagrams and wiring diagrams with terminals identified and indicating interconnections between items of equipment.
7. One-line diagram.

D. Operation and Maintenance Manuals:

1. Switchboards.
2. Circuit breakers.
3. Surge protective devices.

E. Seismic Certification.

F. Field Test Reports: Submit field test report on results on field testing.

G. Obtain utility company approval for all service and utility company metering equipment.

43.3 PRODUCTS

A. Switchboard:

1. NEMA PB 2 and UL 891.

2. Manufacturers: Square D, Eaton, Siemens, and ABB shall be acceptable.

3. Ratings: The voltage rating of the switchboards shall be as indicated. The continuous current rating of the main bus shall be as indicated. The short-circuit current rating shall be as indicated. The switchboard shall be UL listed and labeled as service entrance equipment and qualified to withstand seismic forces as required for the site conditions.

4. Construction: Switchboard shall consist of vertical sections bolted together to form a rigid assembly and shall be aligned as indicated. All circuit breakers shall be front accessible. Where indicated, "provision for future breaker" or "PFB" shall mean to include bus, device supports, and connections. Provide insulating barriers in accordance with NEMA LI 1, Type GPO-3, 0.25 inch minimum thickness. Apply moisture resistant coating to all rough-cut edges of barriers. Switchboard shall be completely factory engineered and assembled, including protective devices and equipment indicated with necessary interconnections, instrumentation, and control wiring.

    a. Enclosure: The switchboard enclosure shall be a NEMA ICS 6 Type 1. Enclosure shall be bolted together with removable bolt-on side and rear covers. Bases, frames and channels of enclosure shall be corrosion resistant and shall be fabricated of galvanized steel. Base shall include any part of enclosure that is within 3 inches of concrete pad. Paint enclosure, including bases, ASTM D1535 light gray No. 61 or No. 49.

    b. Bus Bars: Bus bars shall be copper with silver-plated contact surfaces. Make bus connections and joints with hardened steel bolts. The through-bus shall be rated at the full ampacity of the main throughout the switchboard and arranged for future extensions. Provide minimum 6 one-quarter by 2 inch copper ground bus secured to each vertical section along the entire length of the switchboard. The neutral bus shall be rated 100 percent of the main bus continuous current rating.

    c. Main Section: The main section shall consist of and insulated-case circuit breaker and utility transformer compartment.

        i. Pull section and utility metering compartment shall comply with EUSERC and Hawaiian Electric Company (HECO) requirements.

        ii. Pull section and utility sections shall be barriered from the rest of the compartments, have a hinged lockable front cover, removable bus links with provisions for mounting current transformers. Current transformers shall be supplied and installed by HECO.

    d. Distribution Sections: The distribution sections shall consist of molded-case circuit breakers as indicated.

5. Protective Devices:

    a. Main Device: Main device shall be an individually mounted, manually operated, stationary mounted, insulated case circuit breaker.

    b. Feeder Devices:

        i. Feeder devices 1200 amps and smaller shall be group mount molded case circuit breakers with bolted connections.

        ii. Feeder devices larger than 1200 amps shall be individually mounted insulated breakers. All circuit protective devices shall have the following minimum symmetrical current interrupting capacity: 65kA or as listed on the contract drawings.

c. Insulated Case Circuit Breakers:

i. Breakers shall be constructed of a high dielectric strength, glass reinforced insulating case. The interrupting mechanism shall be arc chutes. Steel vent grids shall be used to suppress arcs and cool vented gases. Interphase barriers shall isolate completely each pole.

ii. Breakers shall contain a true 2-step stored energy operating mechanism which shall provide quick make, quick break operation with a maximum 5 cycle closing time. Breakers shall be trip free at all times. Common tripping of all poles shall be standard.

iii. Insulated case circuit breakers shall be rated to carry 100 percent of their frame ampacity continuously.

iv. A charging handle, close push-button, open push-button, and Off/On/Charge indicator shall be located on the breaker escutcheon and shall be visible with the breaker compartment door closed.

v. Each insulated case breaker shall be equipped with a digital electronic trip unit. The trip unit shall provide protection from overloads, short circuits and ground faults. The protective trip unit shall consist of a solid state, microprocessor based programmer; tripping means; current sensors; power supply and other devices as required for proper operation.

vi. As a minimum, the trip unit shall have the following protective functions unless otherwise indicated on the drawings:

a) Adjustable current setting or long time pickup

b) Adjustable long time delay

c) Switchable, adjustable short time pickup and delay

d) Adjustable instantaneous pickup

e) Adjustable ground fault pickup and delay.As a minimum, the trip unit shall include the following features:

f) Long time and short time protective functions shall have true RMS sensing technology and thermal long time memory.

g) Ground fault protective function shall contain a memory circuit to integrate low level arcing fault currents with time, to sum the intermittent ground fault spikes.

h) High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.

i) Multi-button keypad to provide local setup and readout of all trip settings on the LCD.

j) UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug.

k) An integral test jack for testing via a portable test set and connection to a battery source.

l) A mechanism for sealing the rating plug and the trip unit.

m) Noise immunity shall meet the requirements of IEEE C37.90.2.

n) Display trip targets for long time, short time, and ground fault, if included.

o) The trip unit shall keep a log of the last 10 events including overcurrent trips, protective relay trips. The log shall store RMS currents, phase, type of trip, trip counter, time and date for each event.

p) Instantaneous trip shall utilize filtering which permits fully selective operation with downstream current limiting devices up to the short time rating of the circuit breaker, when the instantaneous pickup is set above the current limiting threshold.

q) The trip unit shall include Modbus RTU communication capability. The trip unit, through dedicated secondary terminals on the breaker, shall provide a communication port for communication with and access to a remote computer. All metering, setpoints, protective trip counts, and other event signaling shall be retrievable by the remote computer.

r) The trip unit shall meter current, RMS, each phase, which shall be displayed on the LCD (if the manufacturers trip unit can not incorporate the specified functions, separate device(s) with equal function shall be provided for each breaker).

d. Molded Case Circuit Breakers:

i. Group mounted breakers shall be connected to the vertical bus by bolted connections. Individually mounted molded case circuit breakers shall be stationary mounted.

ii. Circuit breaker frames shall be constructed of a high-strength, molded, glass-reinforced polyester case and cover. Breakers shall have an overcenter, toggle handle-operated, trip free mechanism with quick make, quick break action independent of the speed of the toggle handle operation. The design shall provide common tripping of all poles. Breakers shall be suitable for reverse feeding.

iii. Breakers shall have ON and OFF position clearly marked on escutcheon. Breakers shall include a trip-to-test means on the escutcheon for manually tripping the breaker and exercising the mechanism and trip latch.

iv. Breakers shall include factory installed mechanical lugs. Breakers shall be standard, or 80 percent rated.

v. Breakers shall use digital true RMS sensing trip units and a rating plug to determine the breaker trip rating.

vi. Each feeder circuit breaker shall be equipped with a digital electronic trip unit. The trip unit shall provide protection from overloads, short circuits and ground faults. The protective trip unit shall consist of a solid state, microprocessor based programmer; tripping means; current sensors; power supply and other devices as required for proper operation.

vii. The protective trip unit shall consist of a solid state, microprocessor based programmer; tripping means; current sensors; power supply and other devices as required for proper operation.

viii. Long time and short time protective functions shall have true RMS sensing technology for harmonic rich currents including up to the 19th harmonic.

ix. High contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.

x. A multi-button keypad shall provide local setup and readout of all trip settings on the LCD.

xi. UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug. Rating plugs shall be available in sizes from 40 percent to 100 percent of the breaker sensor rating

xii. The trip unit shall have an integral test jack for testing via a portable test set and connection to a battery source.

xiii. Noise immunity shall meet the requirements of IEEE C37.90.

xiv. The trip unit shall display trip targets for long time, short time, and ground fault, if included.

xv. Provide visual illuminated indication of the trip unit (normal, pickup, trip, error).

xvi. The trip unit shall be provided with a 10 event trip history log. Each trip event shall be recorded with type, phase and magnitude of fault that caused the trip

xvii. As a minimum, the trip unit shall have the following protective functions:

a) Current setting or long time pickup, adjustable from 50 percent to 100 percent of the rating plug value.

b) Adjustable long time delay with typical inverse time characteristics.

c) Instantaneous pickup, adjustable from 2.0 to 10 times the rating plug in 0.5 increments

d) Short time pickup and delay. Short time pickup shall be adjustable from 1.5 to 9 times the long time pickup setting in 0.5 increments with an OFF option. Provide minimum of 12 short time delay bands with 3 selectable I^2t bands.

e) Adjustable ground fault pickup and delay. Ground fault pickup shall be adjustable from 0.4 to 1.0 times the breaker sensor rating in 0.05 increments. Provide a minimum of 15 ground fault delay bands with 3 selectable I^2t bands.

f) The trip unit shall display RMS current, each phase, on the LCD.

6. Multi-Function Power Monitor:

a. The main of the switchboard shall be provided with a UL listed and digital multifunction power monitor, GE EPM 7000 or approved equivalent that complies with all of the following requirements.

b. The meter shall be designed for multifunction electrical measurement on 3 phase power systems. The meter shall perform to spec in harsh electrical applications in high and low voltage power systems.

i. The meter's surge withstand shall conform to IEEE C37.90.1.

ii. The meter shall have a phasor diagram that clearly shows wiring status.

c. The meter shall have an accuracy of +/- 0.1 percent or better for Volts and Amps, and 0.2 percent for power and energy functions. The meter shall meet the accuracy requirements of IEC62053-22 (Class 0.2 percent) and ANSI C12.20 (Class 0.2

percent). The meter shall have a Frequency measurement accuracy of not less than 0.001 Hz.

i. The meter shall provide true RMS measurements of voltage, phase- to-neutral and phase-to-phase; and current, per phase and neutral.

ii. The meter shall calculate RMS readings, sampling at over 400 samples per cycle on all channels measured readings continuously with no cycle blind spots.

iii. The meter shall utilize 24 bit Analog to Digital conversion.

iv. The meter shall provide %THD (% of Total Harmonic Distortion). Harmonic magnitude recording to the 40th order shall be available for voltage and current harmonics.

d. The meter shall provide a simultaneous voltage and current waveform recorder.

i. The meter shall be capable of recording 512 samples per cycle for a voltage sag or swell or a current fault event.

ii. The meter shall provide pre- and post-event recording capability.

iii. The meter shall have a programmable sampling rate for the waveform recorder.

iv. The meter shall have an advanced DSP design that allows power quality triggers to be based on a one cycle updated RMS.

v. The meter shall allow up to 170 events to be recorded.

vi. The meter shall store waveform data in a first-in, first-out circular buffer to insure that data is always being recorded.

e. The meter shall include a 3-line, bright red, .56-inch LED display. The meter must display a % of Load Bar on the front panel to provide an analog feel. The % Load bar shall have not less than 10 segments.

f. The meter shall provide user configured fixed window or rolling window demand. This shall allow the user to set up the particular utility demand profile.

i. Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.

ii. All other parameters shall offer max and min capability over the user selectable averaging period.

iii. Voltage shall provide an instantaneous max and min reading displaying the highest surge and lowest sag seen by the meter.

iv. The meter shall provide an update rate of every 6 cycles for Watts, VAR and VA. All other parameters shall be every 60 cycles.

g. The meter shall provide Limits Alarms and Control Capability as follows:

i. Limits can be set for any measured parameter.

ii. Up to 16 limits can be set.

iii. Limits shall be based on % of Full Scale settings.

iv. Manual Relay Control shall be available through software.

v. Relay set delays and reset delays shall be available.

vi. Relay control shall be available through DNP over Ethernet with the Ethernet Option card.

h. The meter shall have data-logging capability with the 4 Megabyte memory.

i. The meter shall have a real-time clock that allows for time stamping of all the data in the meter when log events are created. The meter shall have 6 logs; and shall also have a waveform log:

   i. The meter shall have 3 historical logs for trending profiles. Each log shall be capable of being programmed with up to 64 parameters. The user shall have the ability to allocate memory between the 3 historical logs in order to increase or decrease the memory allotted to each of the logs.

   ii. The meter shall have a log for Limits Alarms. The Limits log shall provide magnitude and duration of an event, time-stamp, and log value. The log must be capable of recording to 2048 events.

   iii. The meter shall have a log for System Events. The System Events log shall record the following occurrences with a time-stamp: Demand Resets, Password Requests, System Startup, Energy Resets, Log Resets, Log Reads and Programmable Settings Changes.

   iv. The meter shall have a log for I/O changes. The I/O Change log shall provide a time-stamped record of any Relay Outputs and any Input Status changes. The log must be capable of recording up to 2048 events.

   v. The meter shall have a log which is capable of recording a waveform both when a user-programmed value goes out of limit and when the value returns to within limit.

j. The meter shall be provded with 100BaseT Ethernet functionality.

   i. The meter shall speak with 12 simultaneous sockets of Modbus TCP, so that multiple requests for data can be received simultaneously.

   ii. The meter shall speak with 5 simultaneous sockets of DNP over TCP/IP so that multiple requests can be handled simultaneously.

   iii. The meter shall speak with both Modbus TCP and DNP over Ethernet simultaneously.

   iv. Provide an embedded Web server that allows access to metered readings through the Internet, using any standard Web browser from a PC, smart phone, or tablet PC.

k. The Pulse Output/Digital Input Card shall provide the following features:

   i. 4 KYZ pulse/4 Status inputs.

   ii. Programmable to any energy parameter and pulse value.

   iii. Programmable to End of Interval pulse.

   iv. Can function for manual relay control and limit based control.

   v. 120mA continuous load current.

   vi. DNP input.

l. The meter and options shall have a standard 10 Year warranty.

7. Surge Protective Device (SPD):
    a. Electrical Requirements:
        i. Maximum Single Impulse Surge Current Rating: Based on the testing of a complete SPD including fuses and all components that make up the SPD assembly using an IEEE C62.41, 8x20us current wave applied at the maximum, per mode rated value of the SPD. Devices that derive a per mode rating by adding test results of individual components are not acceptable.
        ii. Surge Life Rating: Determined by the application of an 8x20us, 10kA short circuit Category C High test waveform across the SPD as defined by ANSI/IEEE C62.41.2-2002. The test wave shall be injected at one-minute intervals until the conclusion of the test or device failure. A failure is defined as either performance degradation or more than 10 percent deviation of clamping voltage at the specified surge current.
        iii. Surge Current Rating for Service Entrance Equipment:
            a) Maximum Single Impulse Surge Current Rating: 150 kA per mode.
            b) UL 1449 Nominal Discharge Current Rating (In): 20kA.
            c) Minimum Surge Life Rating: 20,000 IEEE C62.41 C-High (C3) impulses.
        iv. The UL assigned Voltage Protection Rating (VPR) shall be tested in accordance with UL 1449, 3rd Edition. The VPR shall not exceed the following values for an SPD with a 480/277V, wye rating with an integral disconnect:
        v. Line to Neutral: 900V
        vi. Line to Line: 1200V
        vii. SPD shall be UL witness tested to a fault current rating equal to or greater than the fault current rating of the distribution equipment. The SPD short-circuit current (SCCR) rating shall be marked on the SPD in accordance with the requirements of UL 1449 and NEC Article 285.
        viii. The use of smaller, electronic grade (<40mm) MOVs is not acceptable. SPDs that use gas tubes, silicon avalanche diodes or selenium rectifiers or combinations of these components along with MOVs are not acceptable.
        ix. SPDs shall provide protection in each of the following modes: L-N, L-G, N-G, and L-L.
        x. The Maximum Continuous Operating Voltage (MCOV) for all voltage configurations shall be at least 115 percent of nominal.
        xi. EMI/RFI Noise Suppression: -50 dB attenuation at 100 kHz, tested per MIL-STD 220B.
        xii. The SPD fusing system shall be capable of allowing the rated Maximum Single Impulse Surge Current to pass without premature fuse operation. SPDs utilizing a fusing system that opens at or below the Maximum Single Impulse Surge Current rating are unacceptable.
        xiii. SPDs shall include integral fusing for each suppression component. Designs that rely solely on an electrical panel's main breaker to interrupt fault currents resulting from a shorted suppression component are not allowed.

xiv. The use of plug-in type suppression modules is not allowed.

xv. SPDs shall have an integral non-fused disconnect, independently tested to the maximum surge current rating of the device.

xvi. Standard Monitoring Features:

a) Green LED operational status indicator per each protected phase.

b) Audible alarm with Red LED alarm status indicator and test / silence switch, enabled via a front panel pushbutton switch.

c) Dry contacts for remote monitoring purposes, 1NO & 1NC contact. Change in state indicated on MOV failure.

d) Six-Digit Digital Surge Event Counter with battery backup.

b. SPDs shall be factory-mounted integral to the electrical distribution equipment and shall not violate the equipment manufacturer's UL label.

8. Heaters: Provide 120-volt heaters in each switchboard section. Heaters shall be of sufficient capacity to control moisture condensation in the section, shall be 250 watts minimum, and shall be controlled by a thermostat located in the section. Thermostat shall be industrial type, high limit, to maintain sections within the range of 60 to 90 degrees F. Supply voltage for the heaters shall be obtained from a control power transformer within the switchboard. If heater voltage is different than switchboard voltage, provide transformer rated to carry 125 percent of heater full load rating. Transformer shall have 220 degrees C insulation system with a temperature rise not exceeding 115 degrees C and shall conform to NEMA ST 20. Energize electric heaters in switchboard assemblies while the equipment is in storage or in place prior to being placed in service. Provide method for easy connection of heater to external power source. Provide temporary, reliable external power source if commercial power at rated voltage is not available on site.

9. Terminal Boards: Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Terminal boards associated with current transformers shall be short-circuiting type. Terminate conductors for current transformers with ring-tongue lugs. Terminal board identification shall be identical in similar units. External wiring shall be color coded consistently for similar terminal boards.

B. 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. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

C. Protective Device Coordination:

1. All protective devices, including circuit breakers, fuses, overload and protective relays shall have short circuit withstand ratings and time current characteristics to protect equipment and conductors against fault currents and sustained overload conditions and coordinated for fault isolation with minimum impact to system operation.

2. Protective device requirements shall be coordinated with the utility company's system. Protective devices shall be set, adjusted, tested and calibrated as required and per manufacturer's recommendations for proper coordination prior to energization of the electrical system.

43.4 EXECUTION

A. Installation: Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

B. Grounding: NFPA 70 and IEEE C2, except that grounds and grounding systems shall have a resistance to solid earth ground not exceeding 25 ohms.

1. Grounding Electrodes: Provide driven ground rods as specified in Article XLII - ELECTRICAL WORK. Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

2. Equipment Grounding: Provide bare copper conductors not smaller than No. 4/0 AWG and not less than 24 inches below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3. Connections: Make joints in grounding conductors and loops by exothermic weld or compression connector.

4. Grounding and Bonding Equipment: UL 467, except as indicated or specified otherwise.

C. Installation of Equipment and Assemblies: Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

1. Switchboard: ANSI/NEMA PB 2.1.

2. Field Applied Painting: Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3. Galvanizing Repair: Repair damage to galvanized coatings using ASTM A780/A780M, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

D. Identification:

1. Mark conductors at each end. Provide factory-installed white plastic tubing heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide white preprinted polyvinyl chloride sleeves, heat stamped with black block type letters. Each sleeve shall contain a single letter or number, elliptically shaped to securely grip the wire and keyed in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Each wire marker shall indicate the device or equipment, including specific terminal number to which the remote end of the wire is attached.

2. Provide engraved laminated nameplates for all breakers, compartments and check meters.

E. Foundation for Equipment and Assemblies:

1. Mount switchboard on 4 inch concrete pad.

2. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 inches above slab surface.

F. Field Quality Control:

1. Performance of Acceptance Checks, Settings, and Tests: Perform in accordance with the manufacturer's recommendations, NFPA 70B, and referenced ANSI standards. Perform tests to obtain information about the performance of the breakers, meters, wiring, and instrument transformers together as a unit as well as separately. Tests shall include but not be limited to the following:

   a. Compare actual connections with wiring diagrams. If differences are found, determine if error is in diagram or in actual wiring; correct as necessary.

   b. Inspect devices and equipment for damage or maladjustment caused by shipment or installation.

   c. Use calibrated torque wrench to assure that tightness of bolted bus joints is in accordance with manufacturer's recommendations.

   d. Check electrical continuity of current, potential and control circuits in accordance with wiring diagrams.

   e. Perform insulation resistance test at 500 volts DC on field- installed control wiring. Disconnect field-installed control wiring from equipment and from factory-installed wiring before testing. Minimum insulation resistance shall be 1,000,000 ohms.

   f. Verify type, range, and connections of instrument transformers. Confirm correct polarity of current transformers electrically.

   g. Remove short-circuiting links from current transformers after checking that secondary circuits are complete.

   h. Verify meter connections and ensure calibration.

   i. Remove wedges, ties, and blocks installed by the manufacturer to prevent damage during shipment.

   j. Check low-voltage circuit breakers in accordance with the manufacturer's instructions. Set trip devices in accordance with vendor-recommended settings.

   k. Grounding System:

      i. Visual and Mechanical Inspection: Inspect ground system for compliance with contract plans and specifications.

      ii. Electrical Tests: Perform in accordance with Article XLII - Electrical Work.

2. Follow-Up Verification: Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Circuit breakers shall be tripped by operation of each protective device. Test shall require each item to perform its function not less than 3 times. As an exception to requirements stated elsewhere in the contract, the Construction Manager shall be given 10 working days advance notice of the dates and times for checks, settings, and tests.

43.5 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLIV-FIRE ALARM SYSTEM

44.1 GENERAL

A. This work includes designing and providing a new, complete, addressable programmable fire alarm system as described herein and on the contract drawings. The system shall include all wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and supervisory signal initiating devices, alarm notification appliances, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. The system layout on the drawings is conceptual. A single fire alarm control panel is indicated. Equipment, materials, installation, workmanship, inspection, and testing shall be in strict accordance with the required and advisory provisions of NFPA 72.

B. Related Work Specified Elsewhere:

1. Article XLII - Electrical Work: All raceways, power wiring including wiring to disconnect switches and breakers, and wiring to all equipment.
2. Article XXVIII - Fire Suppression Piping and Sprinklers: Alarm initiating devices shall be installed with the sprinkler system.
3. Article XXXVIII - Ceiling Fans.
4. Permits, Tests and Inspections: Apply, secure and pay for all required permits, fees, licenses, tests, inspections and royalties necessary to accomplish the work. Schedule and coordinate required tests and inspections.

44.2 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. Code of Federal Regulations (CFR):

47 CFR 90	Private Land Mobile Radio Service
29 CFR 1910.36	Occupational Safety and Health Standards, Subpart E - Means of Egress, General Requirements
29 CFR 1910.37	Occupational Safety and Health Standards, Subpart E, Means of Egress, General

B. Factory Mutual Engineering and Research Corporation (FM):

FM P7825	Approval Guide

C. National Electrical Manufacturers Association (NEMA):

NEMA ICS 1	Industrial Control and Systems

D. National Fire Protection Association (NFPA):

NFPA 1	(2021) Uniform Fire Code
NFPA 70	(2020) National Electrical Code
NFPA 72	(2019) National Fire Alarm Code

E. Underwriters Laboratories Inc. (UL):

UL 464	Audible Signal Appliances

UL 864	Control Units for Fire-Protective Signaling Systems
UL 1449	Transient Voltage Surge Suppressors
UL FPED	Fire Protection Equipment Directory

F. American Electricians Handbook by Croft (latest edition), McGraw-Hill.

G. Practical Electrical Wiring by Herbert P. Richter and W. Creighton Schwan, McGraw-Hill.

H. Copper Development, Inc.'s "Copper Building Wire Handbook".

I. National Electrical Safety Code.

J. Local ordinances and regulations of the City and County of Honolulu.

K. International Municipal Signal Association Inc. Specification No. 19-1, polyethylene insulated, polyvinyl chloride jacket signal cable; and

L. Applicable instructions of the manufacturer for equipment and materials supplied for the project.

44.3 SUBMITTALS

A. Submit in accordance with Article XI - Required Submittals.

B. Partial submittals will not be acceptable. Annotate descriptive data to show the specific model, type, and size of each item the Contractor proposes to furnish. Do not commence work until the design of the system and the various components have been approved. The Harbors Construction Engineer will review and approve all submittals. Before work is commenced the shop drawings must be approved.

1. Manufacturer's Catalog Data:
    a. Fire alarm control panel (FACP)
    b. Fire alarm power extender panels
    c. Manual fire alarm stations
    d. Batteries
    e. Battery charger
    f. Smoke sensors
    g. Audiovisual alarms
    h. Visual alarms
    i. Horns
    j. Addressable interface modules
    k. Wire and cables
2. Shop (Working) Drawings:
    a. Point-To-Point Wiring Diagrams: Drawings shall be job-specific. "Typical" or "generic" drawings are not acceptable. The diagrams shall include but not be limited to the following:
        i. Locations of All System's Elements: Indicate all devices, junction boxes, and pass-through devices and entities where the cables and conductors can be accessed by personnel. Indicate the number of devices provided. Also indicate the locations of

all cable and conductor terminations and intermediate connections showing where they pass through without terminations/connections from and to equipment panels and/or devices.

ii. Labeling of All Elements: All devices junction boxes, etc. shall be labeled by functional designations, locations and numbers such as building alphabet, room function and room number.

iii. Fire Alarm Wiring and Color Codes: All cable and conductor color codes, the wire marking system and marker designation as specified herein shall be shown.

b. Equipment and/or Modular Systems Wiring Diagram: Wiring diagrams showing all equipment modules, components and key internal cabinet wiring that should be accessed for tests and maintenance. Drawings shall include but not be limited to the following:

i. Equipment Modules and Components: The equipment modules and components layout (relative locations in proportion to the modules, components, and cabinet/enclosure sizes) including the fire alarm control panel(s), battery cabinets, etc. The drawings shall also show the arrangement of modules, components, wiring and expansion space within the FACP cabinet.

ii. Input and Output Circuits Labeling: Label the input and output circuits by circuit designations specified herein.

iii. Internal - External Circuits Interface Information: Only information that interfaces with external circuits and internal equipment wiring need be shown. All external wiring and circuits shall be shown in the riser diagram and the Contractor furnished Point-To-Point Wiring Diagrams.

iv. Changes in or deletion of the modular system wiring diagrams shall not require changes to the riser diagrams and the Contractor furnished Point-To-Point Wiring Diagrams and vice versa except for the panel deletion or change.

v. Provide a complete description of the system sequence of operation for all initiating, notification, and control devices via a sequence of operation matrix diagram.

c. Design Data:

i. Standby battery capacity calculations shall list the type of devices and modules, quantities, unit amperage draw for standby and alarm conditions, total amperage draw and battery amp/hour rating.

ii. Provide detailed voltage drop calculations for all notification appliance circuits.

iii. Provide data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances, and 25 percent spare capacity for initiating devices.

3. Guaranty.

4. Operations and Maintenance Manual: Provide a copy of the Operations and Maintenance Manuals a minimum of two (2) weeks prior to the final test.

a. The manual may be provided in several volumes if so approved by the Harbors Construction Engineer.

b. The manual shall contain the following:

i. Manufacturer's Printed Equipment/System Operations and Maintenance Manual, and Devices Brochures:

a) Start-up, operating, preventative maintenance, adjustment and troubleshooting procedures, and parts list.

b) System Control Diagrams.

c) Internal equipment wiring diagrams.

ii. Manufacturer's Representatives: The names, addresses and phone numbers of the fire alarm system manufacturer, the nearest manufacturer's representative, and the nearest supplier of the manufacturer's equipment and parts.

iii. Fire Alarm System Test Results: Provide completed test data sheets with the recorded measured data obtained during pre-final testing in the designated spaces and a printout of the equipment program. The test plan shall be developed in accordance with NFPA 72, Chapter 7. Submit the following information.

a) Test information applicable for the project.

b) Standard attendance signature sheets.

iv. Approved fire alarm shop drawings.

5. As-Built Drawings: Drawings shall provide a detailed description of system operation during alarm, supervisory, and trouble modes and shall include a complete list of all system addresses including input/output logic. Upon completion and before final acceptance of the work, submit complete set of as-built drawings of the system for record purposes. Drawings shall include all components and circuit diagrams complete with conductor color codes and a listing of initiating devices.

6. Qualifications of the fire alarm system installer and technician as stipulated in paragraph "QUALITY ASSURANCE" hereinbelow.

7. Guaranty and Certificate: Submit guaranty as stipulated in paragraph "GUARANTY AND CERTIFICATE" hereinbelow.

8. Maintenance Service Contract: Provide as stipulated in paragraph "MAINTENANCE SERVICE CONTRACT" hereinbelow.

9. Written notification of all tests and test results as specified in paragraph "TESTING" hereinbelow.

44.4 QUALITY ASSURANCE

A. Qualification of Installer: Installation shall be accomplished by an electrical contractor with a minimum of five years' experience in the installation of fire alarm systems in the State of Hawaii. The services of a technician provided by the control equipment manufacturer shall be provided to supervise installation, adjustments, and tests of the system. Prior to installation, submit data for approval by the Harbors Construction Engineer showing that the Contractor has successfully installed interior fire alarm 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 contact at each site.

B. Qualifications of System Technician: Installation drawings, shop drawings, and "as-built" drawings shall be prepared by, or under the supervision of, a qualified technician. Qualified technician shall be an individual who is experienced with the types of work specified herein, and is currently certified by the National Institute for Certification in Engineering Technologies (NICET) as an engineering technician with minimum Level-III certification in Fire Alarm Systems program. Contractor shall submit data showing the name and certification of the technician at or prior to submittal of drawings.

C. Regulatory Requirements: Devices and equipment for fire alarm service shall be listed by Underwriters Laboratories, Inc. or approved by the Factory Mutual System or listed by other nationally recognized testing laboratories.

D. Requirements for Fire Protection Service: Equipment and material shall have been tested by Underwriters Laboratories, Inc. and listed in UL FPED or approved by Factory Mutual and listed in FM P7825. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL FPED or FM P7825. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement.

E. Standard Products: Materials and equipment shall be standard new products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least one year prior to bid opening. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials.

F. Modification of References: In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the County Building and Fire Departments.

44.5 GUARANTY AND CERTIFICATE

A. The Contractor shall guaranty and certify in writing all work in this section for period of one (1) year. Should any equipment or material fail due to defective equipment, material or workmanship within this period, the Contractor shall replace the item at no cost to the State.

B. The one (1) year guaranty shall start at the end of thirty (30) consecutive days of trouble free operation after certification by the Fire Department and acceptance by the State whichever date is the latest.

44.6 MAINTENANCE SERVICE CONTRACT

A. During the fire alarm system's one (1) year guaranty period, the Contractor shall supply complete maintenance and testing services for the entire fire alarm system in accordance with the manufacturer's instructions and NFPA 72. The system shall be tested and serviced every three (3) months for a minimum of four (4) times during the guaranty period. Reports prepared on Contractor-furnished standardized forms similar to the form in NFPA 72 shall be submitted to the Harbors Construction Engineer.

B. During the one (1) year guaranty period, the Contractor shall, upon the receipt of notice from the State's representative, promptly make all repairs arising out of defective material, workmanship or equipment. The Contractor shall respond to such notices within 12 hours after receipt of the notice.

C. The local representative or supplier shall have direct access to replacement parts and a fire alarm repairman, either on his own staff or in a manufacturer's service center, to ensure the system can be restored to normal operation within two (2) days of system failure. All costs including air-fare, car rental, travel time, etc. shall be borne by the contractor.

D. It is understood that the State will undertake repairs if, following two (2) working days after receipt of such notice, the Contractor fails to make or undertake the repairs with due diligence. The expense in connection therewith shall be charged to the Contractor.

44.7 MANUFACTURER QUALIFICATIONS

All components of each new system shall be furnished by a single manufacturer, shall be of current design and shall be in regular and recurrent production. Provide design, materials and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

44.8 SYSTEM DESIGN

A. System Operation: System shall be a complete, supervised, non-coded, addressable fire alarm system conforming to NFPA 72. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until all initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. The system shall provide the following functions and operating features:

1. The FACP shall provide power, annunciation, supervision and control for the system.
2. Provide Class B, Style 4 signaling line circuits.
3. Provide Class B, Style Y, notification appliance circuits.
4. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel, and any extender panel(s).
5. Provide an audible and visual trouble signal to activate upon a single break or open condition, or ground fault which prevents the required operation of the system. The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature which will silence the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, the trouble signal shall again sound until the trouble is acknowledged. A smoke sensor in the process of being verified for the actual presence of smoke shall not initiate a trouble condition.
6. Provide a notification appliance silencing switch which, when activated, will cause the notification appliances to cease operating, but not affect the liquid crystal display. This switch shall be overridden upon activation of a subsequent alarm.
7. Provide alarm verification capability for smoke sensors.
8. Provide switches in a locked portion of the FACP to bypass the automatic notification appliance circuits. Operation of a switch shall indicate a trouble condition on the FACP display.
9. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.
10. The system shall be field programmable. All programmed information shall be stored in non-volatile memory.

11. An alarm signal shall automatically initiate the following functions:
    a. Visual indication of the device operated on the fire alarm control panel (FACP).
    b. Continuous actuation of all alarm notification appliances
12. A trouble condition shall automatically initiate the visual indication of the system trouble and sound the audible alarm on the FACP .
13. A supervisory signal shall automatically initiate a visual indication of the device operated and sound the audible alarm on the FACP.

B. System Monitoring:
    1. Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, and sprinkler service entrance valve, whether supplied under this contract or existing, shall be monitored to ensure its proper position.
    2. Provide Internal Digital Alarm Communicating Transmitter (DACT) module for remote monitoring of fire sprinkler system. DACT module shall be capable of reporting alarm, supervisory, trouble and AC failure. Dual lie operation with automatic 24-hour test and programmable power fail report delay.

C. Overvoltage and Surge Protection:
    1. Provide a factory approved surge suppressor at power inputs to control panels conforming to UL 1449. Suppressor shall be hybrid MOV type providing a maximum clamping voltage of 500 volts and a 150 joule minimum energy dissipation capacity.
    2. Signaling Line Circuit Surge Protection: For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of IEEE C62.41.1 and IEEE C62.41.2. Cables and conductors, which serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform:
    3. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

D. Fire Alarm Control Panel (FACP): Provide a complete control panel fully enclosed in a single lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the enclosure. Control unit shall provide power, supervision, control and logic for the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Control unit shall be suitable for operation on a 120 volt, 60 hertz, normal building power supply. Provide panel with supervisory functions for power failure, internal component placement, and operation. Visual indication of alarm, supervisory, or trouble initiation on the fire alarm control panel shall be a 2 inch by 4 3/4 inch backlight LCD display capable of displaying graphics and a 6-line text display. FACP shall be manufactured by Edwards, Simplex, Siemens or Notifier.
    1. Cabinet: Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say "FIRE ALARM CONTROL PANEL" and shall not be less than 0.75 inch high. Provide prominent rigid plastic or metal identification plates for all lamps, circuits, meters, fuses and switches. The cabinet shall be provided in a sturdy steel housing, complete with backbox, hinged steel door with cylinder lock, and semi-flush mounting provisions.

2. Control Panel Modules: Provide power and control modules to perform all functions of the FACP. Provide audible signals to indicate any alarm, supervisory or trouble condition. The alarm signals shall be different from the trouble signal. Connect all circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and relays, if any, on screw terminals in the FACP.

3. Silencing Switches: Provide an alarm silence switch at the FACP which will silence the audible signal but not affect the visual alarm indicator. Provide trouble and supervisory silencing switch which will silence the audible trouble and supervisory signal, but not extinguish the visual indicator. This switch shall be overridden upon activation of a subsequent alarm.

4. Memory: Provide each control unit with non-volatile memory and logic for all functions. The use of long life batteries, capacitors or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMS or EPROMS. The control panel shall have the ability to store a minimum of two hundred (2000) events in a log stored in a battery-protected memory.

5. Service Mode: The FACP shall have a service mode to permit the arming and disarming of individual detection or output devices as well as manually operating output devices. Status of these devices shall be displayed upon command or printed on a printer. FACP shall remain 100 percent operational and capable of responding to an alarm condition while in the routine maintenance mode. The FACP shall automatically return to the normal mode after a predetermined time (1 hour) in the event the panel remains unattended in the service mode.

6. Field Programmability: Provide control units and control panels that are fully field programmable for control, initiation, notification, supervisory and trouble functions of both input and output. The system program configuration shall be menu driven. All system changes shall be password protected.

7. Input/Output Modifications: The FACP shall contain features which allow the bypassing of input devices from the system or the modification of system outputs. These control features shall consist of a panel mounted keypad. Any bypass or modification to the system shall indicate a trouble condition on the FACP.

8. Resetting: Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory or trouble condition on the system still exists.

9. FACP shall include two 250-point signaling line circuit (SLC) addressable modules and 8-notification appliance circuits (NACs) at 3 amperes each.

10. Walk Test: The FACP shall have a walk test feature. When using this feature, operation of initiating devices shall result in limited system outputs, so that the notification appliances operate for only a few seconds, but no other outputs occur.

11. Digital Alarm Communicator Transmitter (DACT): Provide a DACT at the FACP compatible with the fire alarm system supervising station selected by Harbors Division. Transmitter shall have a means to transmit alarm, supervisory and trouble conditions via a single transmitter. Transmitter shall have a source of power for operation which conforms to NFPA 72. Transmitter shall be capable of initiating a test signal daily at any selected time. Transmitter shall be arranged to seize telephone circuits in accordance with NFPA 72.

E. Electric Power:

1. Primary Power: Provide primary power for the FACP from the normal AC service to the building where shown on the drawings. Power shall be 120 VAC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all circuits and devices. Make the service connection for the FACP at the location indicated. Provide a red and white engraved plastic sign indicating "FIRE ALARM SYSTEM" permanently affixed to the FACP identifying the power service location, panel, and breaker.

2. Emergency Power Supply: Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

   a. Batteries: Provide rechargeable, maintenance-free, lead-calcium or sealed lead acid batteries as the source for emergency power to the FACP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power. Batteries shall have lead bolt-on or wing-nut-type terminals. Batteries with fast-tab terminals are unacceptable. House batteries within the control panel. Separate cells to prevent contact between terminals of adjacent cells and between terminals and other metal parts. Batteries shall have a clear or transparent battery shell which clearly displays the liquid level within the battery.

   b. Capacity: Provide the batteries with sufficient capacity to operate the system under supervisory and trouble conditions, including audible trouble signal devices for 24 hours and audible and visual signal devices under alarm conditions for an additional 5 minutes.

   c. Battery Charger: Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged the charger shall recharge them back to full charge within 48 hours. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

F. Photoelectric Smoke Sensors:

1. Provide addressable photoelectric smoke sensors utilizing the photoelectric light scattering principle for operation. Smoke sensors shall be listed for use with the fire alarm control panel.

2. All components shall be rust and corrosion resistant. Vibration shall have no effect on the detector's operation. Protect the detector chamber with a fine mesh metallic screen which prevents the entrance of insects or air born materials. The screen shall not inhibit the movement of smoke particles into the chamber.

3. Provide twist lock bases for the sensors. The sensors shall maintain contact with their bases without the use of springs. Provide companion mounting base with fixed wiring terminals. Terminate field wiring on the fixed terminals.

4. Where device is surface mounted, provide manufacturer's surface mounting backbox or device skirt.

5. Sensors shall be equipped with screw terminals for each conductor.

6. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting.

7. Sensors shall include alarm LED which flashes under normal conditions, indicating that the sensor is operational and in regular communication with the control panel. LED to be placed into steady illumination by the control panel when the sensor is in alarm.

G. Manual Stations:

1. Provide metal or plastic, semi-flush mounted, single action, addressable manual pull stations, which are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations which require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station.

2. Break-glass front stations and pull-lever break-glass rod types are not acceptable.

3. Provide manufacturer's backboxes for surface mounted manual stations.

4. Provide clear weatherproof, gasketed manual station covers where indicated.

H. Addressable Interface Devices: The addressable interface device shall provide an addressable input interface to the FACP for monitoring normally open or normally closed contact devices such as waterflow switches, valve supervisory switches, relays for output function actuation, etc.

1. Addressable Monitor Modules: Addressable Monitor Module shall be provided to connect supervised conventional initiating device or zone of supervised conventional initiating devices, including but not limited to water flow and alarm pressure switches, valve tamper switches and other such devices to one of the 2 wire intelligent analog loop cards. Monitor module shall mount in a 4 inch square, 2-1/8 inch deep electrical box and shall be capable of Style B supervised wiring to the initiating device. Monitor module shall provide address setting means switches and store an internal identifying code which the control panel shall use to identify the type of devices.

2. Addressable Control Modules: Addressable Control Module shall be provided to connect supervised conventional notification device or zone of notification devices that require an external power supply, such as audio-visual alarms, to one of the (2) wire analog loop cards in a Style Z configuration. The control module shall be capable of operating as a relay (dry contact Form C), to control auxiliary functions. The module shall mount in a 4 inch square, 2-1/8 inch deep electrical box and shall be capable of Style B supervised wiring to the indicating or control device. The module shall provide address setting means switches and store an internal identifying code which the control panel shall use to identify the type of devices.

3. Isolation Modules: Provide isolation modules to isolate wire-to-wire short circuits on a loop and limit the number of other modules or sensors that are incapacitated by the short circuit fault. Place isolator modules at signaling line circuit T-taps where the T-tap will contain more than 5 addressable devices and located such that not more than 30 addressable devices are connected between isolation modules. If a wire-to-wire short occurs, the module shall automatically open the circuit. On repair of the short, the module shall automatically reconnect the isolated section of the signaling line circuit. The module shall mount in a 4 inch square, 2-1/8 inch deep electrical box. Module shall contain an integral LED that flashes each time the module is polled and illuminates steadily to indicate that a short has been detected and isolated.

I. Notification Appliances:

1. Horns: Provide electronic horns suitable for use in an electronically-supervised circuit. Horns shall have a minimum rating of 90 dBA at 10 feet. Output from the horn shall be a three-pulse temporal pattern. All audible alarms shall be synchronized.

2. Visual Alarm Signals: Provide lamp assembly suitable for use in an electronically-supervised circuit. Provide lamps of the flashing stroboscopic type, powered from the control panel alarm circuit. Lamps shall produce selectable 15, 30, 75 and 100 candela strobe settings, or as indicated on the drawings. Lamp color shall be clear or nominal white (i.e. unfiltered or clear filtered white light). Flash rate shal be minimum of one Hz and maximum of 3 Hz, and maximum pulse duration of 0.2 of one second with a minimum duty cycle of 40 percent. All visual alarms shall be synchronized.

3. Notification appliances and mounting plates shall have a red finish.

4. Provide fire alarm manufacturer's backboxes for surface mounted devices. Provide gasketed, weatherproof devices where indicated.

5. Provide combination type audio/visual appliances where indicated.

6. Connections: Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

J. Fire Alarm Power Extender Panels: Provide fire alarm power extender panels as required. Fire alarm power extender panel shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface-mounted steel cabinet with hinged door and cylinder lock. The extender panel(s) shall have the necessary components and equipment required to provide a minimum of 4 supervised, Class B, Style Y, notification appliance circuits. Each appliance circuit shall be rated for 1.5 amperes minimum at 24 volts DC. An alarm signal from the FACP will initiate the notification appliance circuits to extend the alarm. Primary power for the panel shall be 3 amperes at 120 volts AC, nominal. Standby power shall be same as FACP and charger shall be housed integrally within the cabinet. The trouble open and fault alarm signals shall be monitored by addressable monitor modules. NAC triggers shall not be used.

K. System Wiring: Provide wiring materials under this section as specified in Article XLII - Electrical Work with the additions and modifications specified herein.

1. Wiring within Cabinets, Enclosures, Boxes, Etc.: Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure or cabinet. All conductors which are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make all connections with approved pressure type terminal blocks, which are securely mounted.

2. Above Grade Alarm Wiring: Notification appliance circuit conductors shall be Type THHN/THWN, 14 AWG minimum. Type TW is not permitted. Signaling line circuits and initiating device circuit field wiring shall be copper, No. 16 AWG size conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, which shall be in or adjacent to the FACP. Color coding is required for circuits and shall be maintained throughout the circuit. T-taps are permitted where allowed by the fire alarm system manufacturer. Minimum conduit size shall be 3/4 inch diameter.

3. Below Grade Direct Burial Type Cables:

    a. Below grade fire alarm wiring shall be direct burial, unshielded multi-conductor type, PVC-jacketed cable with #14 AWG and/or larger Type XHHW.

    b. Multi-conductor cable shall be UL listed, Type TC cable conforming to National Electrical Code Article 340.

        i. Copper conductors shall be concentric stranded, class B (7 strands).

        ii. Insulation shall be PVC or nylon with an overall PVC jacket.

        iii. Cable conductor number shall be as shown on the plans.

        iv. Green, white, and gray colored conductors shall not be used.

    c. Below grade twisted pair or twisted shielded pair cable shall be direct burial, Type TC, with minimum #16 AWG conductors.

4. Conductor Terminations: Color coding is specified under paragraph INSTALLATION hereinbelow. Labeling of any circuit at terminal blocks in terminal cabinets, FACP, and remote fire alarm control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. FACP shall contain a laminated drawing which indicates each conductor, its label, circuit and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel or unit so that it does not interfere with the wiring or terminals.

5. Cable and Conductor Ties: One-piece, self-locking nylon ties having a minimum loop tensile strength of 175 pounds and resistance to the same conditions as cable marker.

6. Nameplates: Provide metallic and/or phenolic noncorrosive and non-heat sensitive nameplates for:

    a. Fire Alarm Control Panel:

        i. Manufacturer's name and address.

        ii. Model Number.

        iii. Serial Number.

        iv. Date of Manufacture.

        v. Manufacturer's drawing number (if available).

    b. Fire alarm power extender panels.

    c. The nameplates shall be factory installed, securely mounted inside the fire alarm panel with machine screws or glue and shall also be accessible and visible. Information on the nameplates shall be 1/8-inch or larger lettering stamped or engraved with the following:

7. Corrosion and Fungus Protection: Metallic equipment shall be coated with a rust-inhibiting treatment and standard finish per the manufacturer's standard. Components shall be protected against corrosion and fungus (e.g., circuit boards shall be epoxy coated).

44.9 EXECUTION

A. Examination of the Drawings and Specifications: Confirm and coordinate voltages and requirements of equipment furnished by other trades which will be connected to the fire alarm

system. They include sensors and dampers, and any other equipment connected to the fire alarm system. Include the above information on the field-posted as-built drawings.

B. Examination of Site Conditions:

1. Cabinets, panels, outlets, pull stations, audio / visual devices and other equipment and devices shall be installed in the locations and heights shown on the drawings and/or as specified herein.

2. The location of the equipment and devices shown on the plans are approximate. Before installing, the Contractor shall study adjacent construction, verify all dimensions and sizes of equipment at the job site and perform installation in what he considers the most logical manner.

   a. Any changes from the locations shown on the drawings must be approved by the Harbors Construction Engineer and shown on the "field-posted as-built" drawings.

   b. Any device may be relocated within 10'-0" before installation at the direction of Harbors Construction Engineer without additional charge to State.

C. Installation:

1. Protect dissimilar metals with approved fittings and treatment.

2. All metallic conduits and boxes shall be grounded with a green wire ground conductor.

3. Equipment Installation: Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with NFPA 70, NFPA 72, and as modified herein.

   a. Panels: Locate the FACP and power extender panels where indicated on the drawings. Mount the enclosure with the top of the cabinet 6 feet above the finished floor. All conductor terminations shall be labeled and a drawing containing all conductors, their labels, their circuits and their interconnection shall be permanently mounted in the FACP.

   b. Manual Stations: Locate manual stations where shown on the drawings. Mount stations so that their operating handles are 4 feet above the finished floor.

   c. Notification Appliances: Locate notification appliance devices where shown on the drawings. Mount assemblies on walls 80 inches above the finished floor or 6 inches below the ceiling whichever is lower.

   d. Smoke Sensors: Locate sensors as shown on the drawings. Sensors located on the ceiling shall be installed not less than 4 inches from a side wall to the near edge. Those located on the wall shall have the top of the detector at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. In the case of solid joist construction, the sensors shall be mounted on the bottom of the joists. On smooth ceilings, sensors shall be installed not over 25 feet apart in any direction. Closer spacing shall be used when recommended by the detector manufacturer or required by NFPA 72. Install smoke sensors no closer than 3 feet from air handling supply outlets.

D. Cables and Conductors:

1. Below Grade Cable Installation: Cable shall be installed as indicated on the drawings.

   a. Cables shall not be installed in the same ducts, conduits, handholes, etc. with non-fire alarm circuits.

   b. Align and clean ducts and conduits before cable installation using mandrels, and scrapers and wire brushes.

c. Properly sized tensiometer and pulling devices shall be used for cable installation. Jerking of cables during the pulling installation process shall not be allowed.

i. At the request of the Harbors Construction Engineer, the Contractor shall provide proof and date of calibration of the tensiometer and cable pulling devices used.

ii. Cable pulling tensions shall not exceed manufacturer`s recommended pulling tensions.

iii. Use cable lubricants and compounds that will neither change the physical characteristics nor increase the conductor insulation dielectric constants of the cable sheath.

d. Should the Contractor proceed with conduit cleaning and cable installation without having notified the Harbors Construction Engineer, if directed by the Harbors Construction Engineer, the Contractor shall remove the cable(s) for inspection and reinstall at no additional cost to the State.

i. The Contractor may reinstall the removed cable if inspection and/or tests show no cable damage.

ii. If the cable is damaged, the Contractor shall install a new replacement cable at no additional cost to the State.

2. Above Grade Conductor Installation:

a. Conductors shall not be installed in the same conduits, ducts, junction boxes, etc. with non-fire alarm circuits. 120 volt AC fire alarm circuit conductors shall not be contained within the same multi-conductor cable nor installed with cables and other conductors in the same conduits, ducts, enclosures, junction boxes, etc. with 24 volt DC fire alarm circuits.

b. Conductors shall be installed in continuous lengths. Splices shall be made in above ground junction boxes by terminating wires with wirenut connections.

c. Cable pulling tensions shall not exceed manufacturers' recommended pulling tensions.

d. Wire-nut connectors: Permitted for connections in above grade locations only, in junction boxes and equipment and to devices that are not available or manufactured with screw-type connections.

E. Cable and Conductor Terminations and Dress: The following requirements shall apply to terminal cabinets, junction, and outlet boxes larger than 12" x 12":

1. Electric equipment shall be installed in a neat and workmanlike manner.

2. Cable conductors or individual conductors shall be bundled, dressed, and held together with cable straps, ties or lace and fanned in a manner that equipment terminals are visible and accessible, and allow the connections to be removed and reconnected without moving a large number of wires.

a. Conductors to screw type connectors shall be terminated with wire lugs or with approved cable termination connectors compatible with the specific termination.

b. A minimum of 6 inch excess length shall be provided for conductors from the bundles to the connectors using a vibration loop as described by NEC 300-14.

c. Conductors shall be labeled as specified herein.

3. Cross-connected conductor pairs in junction and device outlet boxes or cabinets will not require bundling and cable straps, ties or lace but shall be neatly installed with a minimum of 6 inches of excess length so conductors can be easily traced between terminals. Label all conductors as specified herein.

4. Cabinets, junction boxes, outlet boxes, other boxes, shall have sufficient space to accommodate all conductors installed in them without crowding.

5. Completed work shall be uncrowded and uncluttered and shall allow accessibility without cutting and/or removing of any straps, ties, laces, cables, components, devices, brackets, modules, equipment and like items.

6. Cables shall be secured to junction boxes, equipment cabinet backboards, console members or to other system components using cable clamps and wraps. Provide cable support posts as required to facilitate system installation.

F. Cable and Conductor Identification System:

1. Signaling Line Circuits: Signaling line circuits shall be labeled by circuit number as shown on the drawings. Conductors shall be labeled in the fire alarm panel(s), the building's main fire alarm junction box and other enclosures larger than 4 inches in any dimension.

2. Audible and Visual Notification Appliance Circuits: Notification appliance circuits shall be labeled by signaling circuit number as shown on the drawings. Conductors shall be labeled in the fire alarm panel(s) and in other enclosures larger than 4 inches in any dimension.

G. Framed Operating Instructions: A framed set of operating instruction printed on a white background or engraved Main Fire Alarm Panel Operating Instructions shall be provided. The framed instructions shall be permanently mounted adjacent to the main fire alarm annunciator-control panel.

H. Field Touch-up Painting: Touch-up painted surfaces and fire alarm system components damaged during installation to match the existing or specified paint and color.

44.10 TESTING

A. Testing of the New Fire Alarm System:

1. After completion of the fire alarm system's installation, turn on and leave the system on for a minimum of 2 consecutive weeks to demonstrate that contract work operates, meets the requirements of the specifications, and does not affect the operation of the entire fire alarm system.

2. Upon successful completion of the 2 week operational period, arrange with the Harbors Construction Engineer for a pre-final fire alarm system test and inspection. The test and inspection shall demonstrate that all the Contractor installed fire alarm system equipment, devices cables and conductors are operating acceptably and have been installed in accordance with this specification.

a. Accordingly, the test demonstrates that the system is ready for a final test of the overall fire alarm system.

b. Representatives at the prefinal test shall include the Contractor, fire alarm system manufacturer's representative, user, the user's facility maintenance agency personnel and Harbors Construction Engineer.

3. Preliminary Test Results: Include the control panel and initiating and indicating devices, a unique identifier for each device with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include a hard copy of printer output information from preliminary testing, i.e. download historical file so that all test data is available for State review.

    a. Tests:

        i. Ground Resistance Tests: Measure the resistance of each connection to ground. Ground resistance shall not exceed 5 ohms. The tests shall be witnessed by the State Inspector and test results recorded for use at the final acceptance test.

        ii. Smoke Detector Tests: Prior to formal inspection and tests, clean and perform sensitivity tests on each smoke detector. Clean the smoke sensors in accordance with the manufacturer's recommended procedures. Present recorded data at the formal inspection for verification. Approved copies shall become part of the operations and maintenance manual for the fire alarm system.

        iii. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests" of this section. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable to the State a minimum of 7 calendar days before the formal acceptance test date required in the paragraph below. Without the submission of this report, the final acceptance test is automatically canceled.

    b. Formal Acceptance Testing: Notify the State in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. A final acceptance test will not be scheduled until the O&M Manuals are submitted and the following are provided at the job site:

        i. Marked-up red line drawings of the system as actually installed

        ii. Dielectric strength and insulation resistance test results

        iii. Loop resistance test results

        iv. Complete program printout including all input/output addresses

        v. A list of passwords permitting access by designated State employees to all levels of the system.

    c. The final tests shall be witnessed by the County Fire Department or Authority Having Jurisdiction (AHJ). At this time, any and all required tests shall be repeated according to AHJ. Following acceptance of the system, as-built drawings and Operation and Maintenance (O&M) Manuals shall be submitted for review and acceptance. In existing buildings, the transfer of devices from the existing system to the new system and the permission to begin demolition of the old fire alarm system will not be permitted until the as-built drawings and O&M Manuals are received.

    d. Minimum System Tests: Test the system in accordance with the procedures outlined in NFPA 72. The required tests are as follows:

        i. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.

ii. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

iii. Test each initiating and indicating device and circuit for proper operation and response at the control unit.

iv. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.

v. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

vi. Determine that the system is operable under trouble conditions as specified.

vii. Visually inspect all wiring.

viii. Test the battery charger and batteries.

ix. Verify that all software control and data files have been entered or programmed into the FACP. Hard copy records and electronic files in PDF-A format shall be provided to the Harbors Construction Engineer.

x. Verify that red-line drawings are accurate.

xi. Measure the current in circuits to assure there is the calculated spare capacity for the circuits.

xii. Measure voltage readings for circuits to assure that voltage drop is not excessive.

xiii. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke or test gas needed to activate the detector.

xiv. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

4. Audio Tests:

a. Provide test equipment and conduct audio test for the fire alarm system in and around the building and in areas where new audio alarm devices have been installed.

b. Audio measurements shall be made in rooms and buildings with the doors in the open and closed position.

c. An audio test plan and proposed test equipment shall be submitted for review and approval with the test plans submittal in accordance with NFPA 72, Chapter 7.

d. The measured data shall be recorded on data sheets provided by the Contractor and shall be part of the test plan submission and records.

e. At the request of the Harbors Construction Engineer, the Contractor shall provide proof of instrument calibration and date of calibration.

f. Contractor shall be responsible for notifying the AHJ or Fire Department of formal acceptance testing.

B. Concealed Work: Concealed work re-opened and re-closed at random during the formal inspection as requested by the Harbors Construction Engineer shall be done at no additional cost to the State.

C. Testing Tools and Equipment: The Contractor shall provide the tools and equipment, including handheld radios, etc. necessary to accomplish the testing.

44.11 TRAINING

A. Conduct training and instruction for the operating and maintenance staff, as designated by the Harbors Construction Engineer, on the operation of the fire alarm panel and system.

B. The training session shall be conducted during normal business hours and shall consist of a total of 8 hours of instruction.

C. The initial training session shall be 4 hours in duration and shall start after the system is functionally completed, but prior to final acceptance tests. The remaining 4 hours of instruction time shall be scheduled at the discretion of the Owner and within one year of initial operation and acceptance of the system.

D. Instruction shall include operations and query of system status, etc.; and hands-on training in the procedures and process for operations and obtaining system status, trouble and other functional information to determine when to call for repairs and how to report the type of trouble encountered. Provide all passwords necessary to reprogram the system.

44.12 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLV-LIGHTING

45.1 GENERAL

A. This article includes, but is not limited to luminaires, lamps, and emergency lighting units.

B. Related Work Specified Elsewhere:

1. Article XLI - General Electrical Requirements applies to this section, with the additions and modifications specified herein.

2. Article XLII - Electrical Work applies to this section, with additions and modifications specified herein.

C. Applicable Publications: The publications listed within this specification form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Unless otherwise indicated, most recent edition of publication with current revisions and amendments will be enforced.

45.2 DESCRIPTION OF WORK

The work includes providing luminaires 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 Article XLII - Electrical Work.

45.3 SUBMITTALS

A. Submit in accordance with Article XI - Required Submittals.

B. Manufacturer's Data:

1. Luminaires.

2. Exit signs.

3. Emergency lighting equipment.

4. Lighting control panels.

5. Room controllers.

6. Occupancy sensors.

7. Occupancy sensor/switches.

8. Wall mounted lighting control stations.

C. Shop Drawings:

1. Luminaire assemblies.

2. Emergency lighting systems.

3. Lighting control schematic wiring diagrams.

D. Operations and Maintenance Manual: Submit operations and maintenance manual as stipulated in paragraph "OPERATIONS AND MAINTENANCE MANUAL" hereinbelow.

1. Qualifications of the lighting control system manufacturer as stipulated in paragraph "QUALITY ASSURANCE" hereinbelow.

2. Warranty: Provide as stipulated in paragraph "WARRANTY" hereinbelow.

45.4 OPERATIONS AND MAINTENANCE MANUAL

Submit operation and maintenance data showing all light fixtures, control modules, control zones, occupancy sensors, power supplies, 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.

45.5 QUALITY ASSURANCE

A. Lighting Control System Manufacturer: Minimum 10 years' 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.

45.6 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 8-year limited warranty to repair and replace defective equipment applicable to daylight sensors, occupancy sensors, wall stations and bus supply.

C. LED luminaire manufacturer's warranty shall be as stipulated in paragraph "LED LUMINAIRES" hereinbelow.

45.7 LED LUMINAIRES

A. Provide luminaires specifically engineered for LED light sources and drivers. Use of linear or screw-base retrofit LED light sources is not acceptable. LED luminaires shall carry a minimum warranty of five years.

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 for 4000 degree K light sources.

3. Color Consistency: Manufacturer shall utilize a maximum 4-step MacAdam ellipse binning tolerance for color consistency of LEDs used in luminaires.

C. LED Luminaire Power Supply Units (Drivers): UL 1310. LED power supply units (drivers) shall meet the following requirements:

1. Minimum efficiency shall be 85 percent.

2. Rated to operate between ambient temperature of minus 22 degrees F and 104 degrees F.

3. Designed to operate on the voltage system indicated.

4. 60 Hz operating frequency.

5. Power factor 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. Drivers shall be mounted integral to the luminaire. Remote mounting of driver is not allowed.

8. UL listed with sound rating of A.
9. Equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.
10. Shall be dimmable, and compatible with a standard dimming control circuit of 0 - 10V or other approved dimming system as indicated.

45.8 RECESS- AND FLUSH-MOUNTED LUMINAIRES

Provide type that can be relamped from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be finished as indicated.

45.9 SUSPENDED LUMINAIRES

Provide hangers capable of supporting twice the combined weight of the adjoining luminaires, and shall sustain a steady pull of not less than 500 pounds (1000 pounds for security type fixtures). Provide with swivel hangers to ensure a plumb installation. Hangers shall be zinc-plated steel with swivel-ball tapped for the conduit size indicated. Hangers shall allow luminaires to swing within an angle of 45 degrees. Single-unit suspended luminaires shall have twin-stem hangers. Multiple-unit or continuous row luminaires 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.

45.10 LIGHTING CONTROL PANEL

A. 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.

B. Lighting Control Panel:

1. Panel shall accept up to 24 single pole relays. Relays shall be individual latching relays with 20 Amp load contacts for LED 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. Wattstopper LMCP 24 Series or approved equal.

45.11 LOW VOLTAGE LIGHTING CONTROL STATIONS

Lighting control stations shall be compatible with lighting control panel or room controller, flush mounted, low voltage type, white color with matching faceplate. Provide number of zones indicated and engrave or provide permanent nameplates to identify function.

45.12 LIGHTING CONTROL SYSTEM ROOM CONTROLLERS

A. On/Off Room Controllers:

1. Shall provide on/off control of lighting in response to digital lighting system communication devices.
2. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load, plenum rated.
3. One, two or three relay configuration as indicated.
4. Class 2 power to sensors and switches via a free topology Cat 5e digital lighting management local network.
5. Three RJ-45 Digital Lighting Management (DLM) local network ports with integral strain relief and dust cover.

B. Dimming Room Controllers:

1. Shall provide dimming control of lighting in response to digital lighting system communication devices.
2. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load, plenum rated.
3. High efficiency switching power supply with 0-10 volt output per relay for control of dimmable loads.
4. One, two or three relay configuration as indicated.
5. Class 2 dimming control signal at 0-10VDC, sinks up to 100 mA per channel of control of compatible drivers.
6. Class 2 power to sensors and switches via a free topology Cat 5e digital lighting management local network.
7. Four RJ-45 Digital Lighting Management (DLM) local network ports with integral strain relief and dust cover.

45.13 OCCUPANCY SENSORS

A. UL listed. 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.

B. Ultrasonic sensor shall be crystal controlled and shall not cause detection interference between adjacent sensors.

C. Infrared sensors shall have a daylight filter. Sensor shall have a fresnel lens that is applicable to space to be controlled.

D. 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.

E. Wallbox sensors shall provide a nominal range of coverage of 900 square feet when mounted at 4 feet above the floor with a 180 degree field of view.

45.14 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be type as indicated.

45.15 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

45.16 INSTALLATION

A. Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires, and secure in accordance with manufacturers' directions and accepted shop drawings. The installation shall meet with the requirements of NFPA 70. Mounting heights specified or indicated shall be to bottom of luminaire for ceiling-mounted luminaires and to center of luminaire for wall-mounted luminaires. Obtain approval of the exact mounting for each luminaire on the job before installation is commenced and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed luminaires may be supported from suspended ceiling support system ceiling tees if the ceiling system support rods or wires are provided at a minimum of four rods or wires per luminaire and located not more than 6 inches from each corner of each luminaire. Do not support fixtures by ceiling acoustical panels. Where luminaires of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such luminaires independently or with at least one 3/4-inch metal channel spanning, and secured to, the ceiling tees. Provide rods or wires for luminaire support under this section of the specifications. Rods or wires shall conform to the requirements of Division 9 of these specifications. Additionally, for recessed luminaires, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each luminaire.

B. Supports for fixtures shall sustain a steady pull of not less than 2-1/2 times weight of fixtures and accessories.

C. Provide unswitched circuits for emergency lighting equipment to prevent unnecessary battery operation when utility power is available. Wire exit lights and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.

D. Provide for local control of lights unless indicated otherwise. Provide relay and contactor-controlled lighting circuits where remote switching is required.

E. Where specifically recommended by the manufacturer of specialty electrical items, work performed shall be done by factory trained technicians.

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, work bays, 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.

45.17 GROUNDING

Ground noncurrent-carrying parts of equipment as specified in Article XLII - 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.

45.18 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 Harbors Construction 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 the Harbors Construction Engineer

45.19 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLVI-UNDERGROUND ELECTRICAL WORK

46.1 GENERAL

A. The work under this article consists of the furnishing and installation of all labor and materials required to complete all electrical work as indicated on the drawings and/or specified herein. The work includes but is not limited to the following:

1. Hawaiian Electric Company (HECO) and telecommunications underground infrastructure and services.
2. Provision of new underground electrical distribution system, including ductlines, handholes and conductors.

B. Related Work Specified Elsewhere: Article XLI - General Electrical Requirements applies to this article with the additions and modifications specified herein.

C. Coordination with Other Trades: During pricing and construction, Contractor shall coordinate his work with other trades to avoid omissions and overlapping of responsibilities.

D. Special Conditions:

1. Contractor shall arrange for Harbors and utility company inspections and acceptance of new work, as applicable.
2. The Harbors Construction Engineer shall witness all tests. The Contractor shall schedule all testing, in writing, with the Harbors Construction Engineer, a minimum of two (2) weeks prior to testing.

E. Rules and Permits:

1. The entire installation shall be done in strict accordance with the latest rules and regulations of the National Electrical Code (NEC), National Electrical Safety Code (NESC) and any applicable local electrical ordinances.
2. The Contractor shall arrange for periodic inspections by the local authorities and shall deliver certificates of completion and inspection to the Harbors Construction Engineer.
3. All work shall be inspected by the proper local authorities as it progresses.
4. Comply with requirements and regulations of the electric and telecommunications utilities.

F. Symbols: The standard electrical symbols, together with the special symbols, notes and instructions indicated on the drawings, describe the work required and are to be included as a part of these specifications.

G. Drawings and Coordination of Work: These specifications are accompanied by drawings indicating the location of work to be performed.

1. The drawings and these specifications are complementary, each to the other, and what is called for by one shall be as binding as if called for by both.
2. Every effort has been made to indicate clearly and specifically all work required to be performed by the Contractor; however, any item of material, equipment or work not specifically called for herein or on the drawings but which is required to complete the installation so that it will conform to the NEC, NESC, local laws, and the intent and meaning of the plans and specifications, shall be furnished and installed by the Contractor at no additional cost to the State.

3. Locations of equipment unless shown on detail drawings or specifically described as to location, are to be considered approximate only.

4. Check the drawings and details, and locate equipment in a neat and symmetrical arrangement.

5. Before work is started, any equipment may be relocated within ten (10) feet of the designated locations shown on the plans at no additional cost to the State, when so ordered by the Harbors Construction Engineer.

6. Before installing, verify all dimensions and sizes of equipment at job site. Conduit routing is typical and may be altered in any logical manner. However, all changes shall be approved by the Harbors Construction Engineer and shown on "as-built" drawings.

46.2 SUBMITTALS

A. Submit in accordance with Article XI - Required Submittals.

B. Handholes including frame and cover. Submit handhole butterfly diagrams with dimensioned duct penetration points and miscellaneous support hardware (i.e. cable racking, pulling irons, sumps, etc.)

C. Warning Tape.

D. Submit results of 600V cable test as stipulated in paragraph entitled "TESTING AND INSPECTION" hereinbelow.

E. Shop drawings and catalog cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Approval of shop drawings and catalog cuts shall not release Contractor from complying with intent of specifications and drawings. Any deviations from approved shop drawings shall have prior approval by the Harbors Construction Engineer.

46.3 MATERIALS AND EQUIPMENT

A. General:

1. Materials and equipment shall be new (unless otherwise specified herein) and shall bear the inspection label of the Underwriters' Laboratories, Inc. where such inspection and labeling service is rendered for the materials and equipment in question.

2. Brand names and catalog numbers used herein to specify materials and equipment (unless otherwise noted) are to indicate the standards of design and quality required. Materials and equipment of equal quality of other manufacturers will be accepted subject to the approval of the Harbors Construction Engineer.

B. Precast Handholes: Handholes, including metal frames and covers, shall be the type noted on the drawings and shall be constructed in accordance with applicable details as indicated and required by reference utility company standard drawings. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be monolithic construction. 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. Provide all necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. A pulling-in iron shall be installed in the wall opposite each ductline entrance.

C. Raceways:

1. Rigid Steel Conduit: Rigid steel, zinc-coated inside and outside, for use with threaded fittings. Minimum 3/4-inch diameter. All exposed rigid steel conduits shall be painted to match surrounding finishes. Refer to Article LXXXIX - High Performance Coatings for requirements.

2. Plastic Conduit: Polyvinyl chloride (PVC) Schedule 40. All underground ductlines shall be concrete encased.

D. Wire and Cable:

1. Conductors: All conductors shall be copper, No. 12 AWG minimum. No. 8 AWG and larger diameter shall be stranded; No. 10 AWG and smaller shall be solid. Do not provide wires and cables manufactured more than 12 months prior to the date of delivery to the site. Aluminum conductors shall not be provided.

2. Color Coding: Provide for feeder and branch circuit conductors. Color shall be green for grounding conductors and white for neutral conductor.

3. Insulation: Type XHHW or RHW-2 unless otherwise specified.

4. Bonding Conductors: Solid bare copper wire for sizes No. 8 AWG and smaller diameter; Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

E. Splices: Any splices necessary shall be compression type, mechanically firm and made only in wireway, pull boxes or handholes. Splices shall be sufficiently taped and coated to provide a completely waterproof permanent joint. An approved plastic electrical tape and waterproof coating shall be used. A minimum of two layers of tape shall be applied.

F. Electrical Tape:

1. Insulating Tape: UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2. Other Tapes: Tapes shall be UL listed for electrical insulation and other purposes in wire and cable splices. Terminations, repairs and miscellaneous purposes, electrical tapes shall comply with UL 510.

G. Pullstring:

1. Pullstring shall be plastic rope having a minimum tensile strength of 200 lbs. in each empty duct except those intended for HT cabling.

2. For empty ducts intended for HT cabling, provide muletape in accordance with telephone utility company standards.

H. Warning Tape: Pre-printed polyethylene tape marked with "CAUTION BURIED ELECTRICAL LINE BELOW," 4 mil thick, detectable foil backed, 3" minimum width. Warning tape for utility company ductlines shall be provided in accordance with utility company requirements.

I. Duct Seal: Pliable, non-toxic material used for application around and in conduits and to minimize moisture and rodent/insect infiltration. Must be re-enterable material allowing form removal/reapplication after initial installation. Non-drying, non-cracking, non-corrosive material that will not adversely affect raceways and conductors. Provide duct seal at all duct entries in handholes, apparatus and risers.

J. Ground Rods: Copper clad steel, 3/4" x 10' long minimum.

K. Hardware, Supports, Backing, Etc.: All hardware, supports, backing and other accessories necessary to install electrical equipment shall be provided. Steel materials shall be stainless steel Type 316, where available. Where stainless steel is not available, materials shall be galvanized and coated with a three-coat epoxy-polyamide system for corrosion protection. Touch up paint after installation. Channel irons shall be stainless steel Type 316, unless otherwise indicated.

46.4 CONSTRUCTION METHODS

A. Underground cable installation shall conform to NFPA 70 and ANSI C2.

B. Concrete: Concrete for electrical requirements shall be at least 3000 psi concrete with one-inch maximum aggregate conforming to the requirements of Article XXIX - Cast-In-Place Concrete.

C. Earthwork: Excavation, backfilling, and pavement for repairs for electrical requirements shall conform to the requirements of Article XVII - Utility Excavation and Backfill.

D. Underground Duct with Concrete Encasement:

1. Construct underground duct lines of individual conduits encased in concrete. The conduit shall be of PVC. 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.

2. 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.

3. 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. After ductline is installed, pull a mandrel not less than 12" long having diameter 1/4" less than inside diameter of conduit through each conduit. As each section of duct line is completed from handhole to handhole, draw a brush through having the same 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.

E. Cable Pulling:

1. 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 handhole or 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.

2. 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.

3. Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.

4. Secondary cable runs, 600 volts and less, shall include an insulated copper equipment grounding conductor sized as indicated.

5. Installation of Cables in Handholes: Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form all cables to closely parallel walls and not to interfere with duct entrances.

F. Cable Terminating:

1. 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.

2. Splices for 600 Volt Class Cables:

a. Make splices in underground systems only in accessible locations such as handholes, using a compression connector on the conductor and by insulating and waterproofing by one of the following methods suitable for continuous submersion in water.

b. Provide cast-type splice insulation by means of molded casting process employing a thermosetting epoxy resin insulating material and apply by a gravity poured method or by a pressure injected method. The component materials of the resin insulation shall be in a packaged form ready for convenient mixing without removing from the package. Do not allow the cables to be removed until after the splicing material has completely set.

c. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for cables to be spliced. When the mold is in place around the joined conductors, prepare the resin mix and pour into the mold. Do not allow cables to be moved until after the splicing materials have completely set.

d. Heat shrinkable method shall employ materials and equipment contained in an approved commercial splicing kit.

G. Grounding:

1. Provide grounding for entire electrical installation as required by Article 250 of the National Electrical Code.

2. All grounding wire runs shall be routed together with circuit conductors.

3. Install green-insulated equipment grounding conductor in all conduits. Conductor sizes per Article 250 of the National Electrical Code.

4. Grounding electrodes shall be cone pointed driven ground rods driven full depth less 6 inches, installed when indicated to provide an earth ground of the value before stated for the particular equipment being grounded.

5. 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.

6. 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.

7. Grounding conductors shall be bare soft-drawn copper wire No. 6 AWG minimum unless otherwise indicated or specified.

H. Provide all empty conduits with a plastic pullstring or mule tape. Leave 48 inches of spare at each end of the pull.

I. Finishing:

1. All cutting that may be required for the complete installation of the electrical work shall be carefully performed and all patching shall be finished to match existing conditions.

2. Close unused knockouts in boxes or enclosures with metal cap.

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

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

46.5 TESTING AND INSPECTION

A. General: All testing shall be witnessed by the Harbors Construction Engineer. The Contractor shall schedule all testing with the Harbors Construction Engineer, in writing, a minimum of two (2) weeks prior to testing.

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

C. The Contractor shall show by demonstration in service that all circuits and devices are in operating condition. Tests shall be such that each item of control equipment will function not less than five times.

D. Wherever test or inspection reveals faulty materials or installation, the Contractor shall take corrective action, at his own expense, repairing or replacing materials or installation as directed. The materials or installation shall then be retested.

E. Test all 600V class feeder cables. Perform the following test prior to connecting to equipment:

1. All feeder wiring to light poles shall be tested to insure proper operation according of functions specified.

2. Measure insulation resistance of all 600V conductors to ensure that no accidental shorts or grounds exist. All feeder cables, #10 or larger shall have insulation resistance of 1.5 megohms or higher. Insulation resistance shall be measured by 500 volts megger. Resistance of feeder cables shall be recorded and turned over in four copies to the Harbors Construction Engineer during final inspection. Proper operation of all electrical devices shall be demonstrated at request of the Harbors Construction Engineer during final inspection.

3. Balance loading on each feeder.

F. Ground Rods: Test ground rods for ground resistance value before any wire is connected. 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.

G. Performance of Acceptance Checks, Settings, and Tests: Perform in accordance with the manufacturer's recommendations, NFPA 70B, and referenced ANSI standards. Perform tests to obtain information about the performance of the breakers and wiring, as a unit as well as separately. Tests shall include but not be limited to the following:

1. Compare actual connections with wiring diagrams. If differences are found, determine if error is in diagram or in actual wiring; correct as necessary.

2. Inspect devices and equipment for damage or maladjustment caused by shipment or installation.

3. Use calibrated torque wrench to assure that tightness of bolted bus joints are in accordance with manufacturer's recommendations.

4. Remove wedges, ties, and blocks installed by the manufacturer to prevent damage during shipment.

5. Verify maximum resistance to ground of grounding systems.

46.6 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLVII-TELECOMMUNICATION CABLING SYSTEM

47.1 GENERAL

A. Work in this article includes the structured cabling system for the telecommunication systems which shall be provided for this project. Work includes, but is not limited to, the passive cabling infrastructure, pathways and spaces to support the telecommunication systems specified herein. Structured cabling system will be utilized to support voice (telephone) and data connections within the facility. The structured cabling system shall consist of entrance facilities for utility services, telecommunication rooms, backbone distribution and horizontal distribution system to support the facility. Materials not normally furnished by manufacturers of these devices are specified in Article XLII - Electrical Work.

B. 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.

47.2 SUBMITTALS

A. Submit in accordance with Article XI - Required Submittals.

B. Telecommunication Shop Drawings: Contractor shall provide RCDD approved shop drawings in accordance with ANSI/TIA/EIA-606-A. As a minimum, the Contractor shall provide the following drawings:

1. Building Floorplans with Building Area/Serving Zone Boundaries and Entrance Facilities: Drawing shall indicate the location of the entrance facilities, telecommunication spaces, access points, pathways, grounding system and other systems that need to be viewed from the complete building perspective.

2. Typical Detail Drawings: Detailed drawings of symbols and typical details for faceplate labeling/identification, faceplate types, faceplate population installation procedures, detail racking and raceways.

C. Manufacturer's Data:

1. Telecommunications Cabling and Connectors.

2. Termination Equipment, including patch panels and termination blocks.

3. Telecommunication Outlets, including outlet box, faceplates, and jacks.

4. Equipment Cabinets/Racks.

5. Cable Supports.

D. Qualifications: Telecommunications Contractor

E. Test Reports: Telecommunication system cabling test reports.

F. Record Documentation.

G. Labeling: Telecommunications system infrastructure administration/ identification scheme.

H. Warranty: Submit warranty as stipulated in paragraph entitled "WARRANTY" hereinbelow.

47.3 MANUFACTURER'S STANDARD OF QUALITY

A. It is the intent of these specifications and applicable drawings to identify the essential requirements related to the telecommunications wiring system and the quality of materials, construction, design, and overall workmanship. All manufacturers shall meet these minimum requirements.

B. All products referenced in this article may be substituted with a product of the same or better operating specifications if substitution is submitted and approved in accordance with the requirements of the Special Provisions. Contractor shall list all apparatus or materials substitutions, and provide sufficient product information or specifications, to illustrate product is equivalent to those specified herein.

47.4 QUALITY ASSURANCE

A. Brand names, manufacturer's names and catalog numbers indicate a standard of design and quality required. Acceptable manufacturers for telecommunication apparatus include ADC, Belden, Blonder Tongue, Corning, CommScope/Systimax, Leviton, Pass & Seymour, Siemen, and Suttle or approved equal. All apparatus supplied shall bear the name of the approved manufacturer of its nameplates.

B. Cabling, equipment, and hardware manufactures shall have a minimum of three (3) years experience in the manufacturing, assembly, and factory testing of components which comply with the latest ANSI/TIA 568 standards.

C. Preparation of shop drawings and submittals shall be done under the supervision of a BICSI Registered Communications Distribution Designer (RCDD). RCDD shall be currently employed as a member of the Contractor's staff. Sub-contracting personnel with RCDD accreditation is not acceptable.

D. All Contractor personnel shall be fully trained and qualified to perform tasks associated with the installation, termination and testing of UTP.

E. Supervisors and installers assigned to the installation of this system or any of its components shall be BICSI Registered Cabling Installers, Technician Level. In lieu of BISCI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of three (3) years experience in the installation of the specified copper components. They shall have factory or factory approved certification indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three (3) and a maximum of five (5) successful system installations provided that are equivalent in system size and in construction complexity to the telecommunication system proposed for this project. Include specific experience in installing and testing telecommunication systems and provide names and locations of at least two project installations successfully completed using optical fiber and copper telecommunication cabling systems. Contractor shall submit a list of personnel qualified to perform such activities for bid evaluation.

47.5 RECORD DOCUMENTATION

A. In addition to the standard close out documentation, Contractor shall provide T5 drawings including documentation on installed cables and termination hardware in accordance with ANSI/TIA 606-C. T5 drawings shall include schedules to show information for cutovers and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. Provide hard copy documentation for the following T5 drawings as a minimum:

B. Cables: A record of installed cables shall be provided in accordance with ANSI/TIA-606-C. The cable records shall include only the required data fields in accordance with ANSI/TIA-606-C. Included manufacture date of cable with submittal.

C. Termination Hardware: A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with ANSI/TIA-606-C. Documentation shall include the required data fields, as a minimum, in accordance with ANSI/TIA-606-C.

47.6 DEFINITION OF TERMS

A. Apparatus: Generally used herein to include the information outlets and faceplates, designation strips, materials, supplies or whatsoever that may be purchased, together with the usual appropriate fittings, attachments, appurtenances, and appliances required for the intended operation.

B. Work Specification: The technical specification describing the Scope of Work, including the engineering, furnishing, delivery, installation and testing of the telecommunication wiring system.

C. Intra-Building Wiring System: A wiring system, which includes necessary apparatus, providing communications within a building.

D. Horizontal Distribution System: The part of the premise distribution system that provides connection between the horizontal cross connect point within the equipment and/or telecommunications room and the work area.

47.7 WARRANTY

A. Contractor shall warrant the installation and provide an application/ manufacturer's warranty in addition to the standard Installation, Workmanship, and Equipment Warranty.

1. Application/Manufacturer's Warranty: Contractor shall extend an Application/Manufacturer's warranty to the State. This warranty guarantees that any application up to 1 Gbps will run on this wiring system for a period of at least 20 years. As an example, Commscope (Systimax Solutions) offers the SYSTIMAX product's exclusive SYSTIMAX 20-year product and applications warranty. Contractor shall register the installation with the manufacturer to secure such extended warranties and assurances.

2. Installation Warranty: Contractor shall warrant to the State that the installation, workmanship, equipment, and/or material to be furnished herein shall be new and free from defects in material and workmanship for a period of no less than two (2) years from the date of project acceptance; and will be of the kind and quality designated or described herein and shall perform in the manner set forth in the Contract. At time of acceptance, Contractor shall guarantee that the State shall be in sole ownership and title to all materials and equipment, which shall be free of any encumbrance or claims imposed by a third party.

B. If it appears within two years from the date of project acceptance, and/or title passage that the installation, workmanship, equipment and/or material furnished hereunder does not meet the warranties specified above and the State notifies the Contractor promptly, the Contractor shall thereupon correct any defect, including non-conformance with the Contract, without delay and expense to the State.

C. If Contractor is obliged to correct defects as specified above, the warranty period for the repaired or replacement part shall be warranted for the remaining warranty term, as determined by the original date of acceptance.

D. The State shall also be entitled to all manufacturer's warranties and guarantees associated with the apparatus or materials provided by the Contractor.

47.8 COMPONENTS

UL or third party certified. Provide a complete system of the telecommunications cabling and pathway components using a hierarchical star topology and support structures, pathways and spaces complete with conduits, cable trays, pull wires, terminal boxes, outlets, cables, junction boxes, and backboards. Fixed cables and pathway systems for telecommunication systems shall be UL listed or third party independent testing laboratory certified and shall comply with NFPA 70.

47.9 PATHWAYS (BACKBONE AND HORIZONTAL)

A. ANSI/TIA-569-E and Addenda: Pathways shall consist of cable tray and conduit installations as specified in Article XLII - Electrical Work. Provide grounding and bonding as required by the National Electrical Code (NFPA 70) and ANSI J-STD-607-E.

B. Work Area Pathways: Provide minimum one 1"C between each information outlet location and horizontal distribution cable tray or comm room. Comply with the National Electrical Code (NFPA 70) and ANSI/TIA-569-E and Addenda.

47.10 TELECOMMUNICATIONS CABLING INFRASTRUCTURE

A. Cabling shall be UL listed for the application and shall comply with ANSI/TIA-568 standards and NFPA 70. Provide a labeling system for cabling as required by ANSI/TIA-606-C and UL 969. Cabling manufactured more than 12 months prior to date of installation shall not be used.

B. Backbone Optical Fiber Cabling:

1. Type OFNP, Designation OS2, Inside-Outside Plant, Single-Mode Optical Fiber Cable:
    a. Construction: TIA-492CAAB; 9 μm core diameter, 125 μm cladding diameter, with low water peak.
    b. Minimum Overfilled Modal Bandwidth-Length Product: 500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.
    c. Configuration Options:
        i. Tight buffered, plenum, optical cable. Strand count as indicated
        ii. Stranded loose tube, optical fiber cable. Strand count as indicated
    d. Maximum Attenuation: 0.5 dB/kmat 1310 nm wavelength; 0.5 dB/kmat 1550 nm wavelength.
    e. Jacket Color: Per State’s requirements
2. Type OFNP, Designation OS2, Inside Plant, Single-Mode Optical Fiber Cable:
    a. Construction: TIA-492CAAB; 9 μm core diameter, 125 μm cladding diameter, with low water peak.
    b. Minimum Overfilled Modal Bandwidth-Length Product: 500 MHz-km at 850 nm wavelength; 500 MHz-km at 1300 nm wavelength.
    c. Maximum Attenuation: 0.5 dB/kmat 1310 nm wavelength; 0.5 dB/kmat 1550 nm wavelength.
    d. Jacket Color: Per State’s requirements.

C. Horizontal Cabling:

1. Horizontal Voice/Data Cabling: Comply with NFPA 70, NEMA WC 63.1, ICEA S-90-661 and performance characteristics in ANSI/TIA-568. Horizontal UTP cabling shall not exceed 295-feet of cabling distance between the horizontal cross-connect point and the communications outlet at work area.

2. UTP (unshielded twisted pair), 100-ohm. Provide four each individually twisted pair, minimum 24 AWG conductors, Category-6, plenum (CMP) rated with a green PVC jacket.

3. Patch Cords: Factory-made, four-pair cables in 12-inch lengths; terminated with an eight-position modular plug at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.

D. TELECOMMUNICATIONS OUTLET BOXES

1. As specified in Article XCI - Electrical Work and as clarified herein.

2. Flush Mounted Outlet Boxes: Standard type 4 11/16-inches square by 2 1/8-inches deep with reducer ring. Mount flush in finished walls at height specified for outlet receptacles. Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend radii.

3. Surface Mounted Outlet Boxes: Two-gang, extra deep device box, modified to accept 1-inch conduit with double gang faceplate. Provide entrance end fitting as required to accept 1-inch conduit. Paint to match surrounding finishes. Wiremold #v2444-2 or approved equivalent.

47.11 OPTICAL FIBER HARDWARE

A. Fiber Optic Connector Intermateability Standard (FOCIS) specifications of TIA-604 series.

B. TIA-568.3.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

D. Number of Connectors per Field: Two for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

E. Patch Cords: Factory-made, dual-fiber cables in 36 inch lengths.

F. Connector Type: Type LC complying with TIA-604-10, connectors.

47.12 UTP OUTLET/CONNECTOR ASSEMBLIES

A. Outlet/Connector UTP Copper: Outlet/connectors shall comply with FCC Part 68.5 and ANSI/TIA-568.

B. Outlet/connectors shall be UL1863 listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with ANSI/TIA-568 Category-6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired T568B. UTP outlet/connectors shall comply with ANSI/TIA-568 for 200 mating cycles.

C. Connectors Serving Outdoor Access Points: Same as above. Provide shuttered jacks.

D. Cover Plates: Telecommunications cover plates shall comply with UL 514C and ANSI/TIA-568; flush design constructed of stainless steel. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process.

E. 110 Connector Blocks: Provide insulation displacement connector (IDC) Type 110 for Category 5e and higher systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare. Terminal blocks shall meet or exceed the requirements for the cable provided.

F. UTP Copper Patch Panels: Provide in accordance with ANSI/TIA-568. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Panels shall be constructed of 0.09-inch minimum aluminum and shall be rack mounted and compatible an EIA compliant 19-inch equipment rack. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568B. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port. Patch panel shall meet or exceed the requirements for the cable provided.

47.13 EQUIPMENT CABINETS/RACKS

A. Provide in accordance with EIA-310-D and UL 50.

B. Equipment Racks: 7 foot high, floor mounted modular type, 16-gauge steel or 11 gauge aluminum construction minimum, treated to resist corrosion. Provide vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug and a horizontal power strip with a minimum of six (6) duplex 120-volt 20-amp receptacles. Rack shall be compatible with standard EIA 19-inch rack mounted equipment.

47.14 BACKBOARDS

Provide void-free, interior A/C grade plywood 3/4 inch thick and sized as noted on the drawings. Backboards shall be fire rated or covered with two coats of gray or a lighter color, nonconductive, fire-retardant paint. Do not cover the fire stamp on the backboard.

47.15 GROUNDING AND BONDING PRODUCTS

Comply with UL 467, ANSI J-STD-607-E, and NFPA 70. Components shall be identified as required by ANSI/TIA-606-C.

47.16 IDENTIFICATION

Provide equipment nameplates in accordance with Article XLII - Electrical Work. Passive telecommunications infrastructure components and cabling shall be labeled and identified as indicated on drawings and in accordance with ANSI/TIA-606-E.

47.17 INSTALLATION

A. Telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware shall be installed in accordance with the latest ANSI/TIA-568, ANSI/TIA-569-E, NFPA 70, and UL standards as applicable. Cabling shall be connected in a hierarchical star topology network. Daisy chaining cables between outlets is not acceptable. Metal raceway

bases, covers, and dividers shall be bonded and grounded in accordance with ANSI J-STD-607-E.

B. Optical Fiber Cabling:

1. Comply with TIA-568.1 and TIA-568.3.
2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
3. Terminate all cables; no cable may contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. In communications equipment room, provide 10 ft long service loop on each end of cable.
9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
10. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. UTP Cabling:

1. Install UTP cabling and pathway system as detailed in the ANSI/TIA-568 standards. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, minimum 10-feet unless otherwise noted, at each backboard location and in the electrical/telecommunications closet. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable bend radii shall not be less than six times the cable diameter.
2. Horizontal Cabling: Install horizontal cabling and pathways between electrical/ telecommunications closet and telecommunications outlet assemblies in accordance with project requirements and ANSI/TIA wiring standards.

D. Pathway Installations: Comply with ANSI/TIA-569-E and associated addenda. Conceal conduit within finished walls and ceilings, where possible. Keep conduit minimum 6 inches away from parallel runs of electrical power equipment, flues, steam, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project.

E. Work Area Outlets:

1. Terminations: Terminate UTP cable in accordance with ANSI/TIA-568 standards, and wiring configuration as specified.

2. Faceplates: As a minimum, each jack shall be labeled as to its function and a unique number to identify cable link.

3. Cables: Unshielded twisted pair shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

4. Pull Cords: Pull cords shall be installed in all conduits which do not initially have cable installed.

F. Telecommunications Closet Termination: Install termination hardware required for copper system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

G. Grounding and Bonding: In accordance with ANSI J-STD-607-E and NFPA 70.

47.18 LABELING

A. Labels: All labels shall be in accordance with ANSI/TIA-606-C. Handwritten labeling unacceptable. Stenciled lettering for voice and data cables shall be provided using either thermal ink transfer process or laser printer.

B. Cable: All cables shall be labeled using color labels on both ends with identifiers as indicated on the drawings.

C. Termination Hardware: All communication outlets and patch panel connections shall be labeled using color coded labels with identifiers as indicated on the drawings.

47.19 TESTING

A. Telecommunications Cabling Testing: Perform telecommunications cabling inspection, verification, and performance tests in accordance with the latest ANSI/TIA-568 standards.

B. Optical Fiber Cable Testing:

1. Visually inspect optical fiber jacket materials for qualified electrical testing laboratory certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test instruments must meet or exceed applicable requirements in TIA-568.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. Link End-to-End Attenuation Tests:

a. Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction in accordance with TIA-526-14, Method B, One Reference Jumper.

b. Attenuation test results for backbone links must be less than 2.0 dB. Attenuation test results must be less than those calculated in accordance with equation in TIA-568.1.

5. Optical fiber optic cables shall be Tier 1 and Tier 2 tested in accordance with TIA-568.3-D.

C. UTP Cable Tests:

1. Visually inspect cabling jacket materials for UL or third party certification markings. Visually inspect UTP jacket materials for UL or third party certification markings. Inspect cabling terminations at backboards and at outlets to confirm color code for tip and ring pin assignments, and inspect cabling connections to confirm compliance with ANSI/TIA-568 standards. Visually confirm marking of outlets, wallplates, outlet/connectors, and patch panels.

2. Verification Tests:

a. Telephone cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connected.

b. Final Verification Tests: Perform verification tests for UTP systems after the complete telecommunications cabling and workstation outlet/connectors are installed. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local and long distance telephone call.

47.20 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLVIII-PHOTOVOLTAIC COLLECTORS

48.1 GENERAL

Section Includes:

A. PV system description.

B. Manufactured PV units.

C. PV module framing.

D. Inverters.

48.2 DEFINITIONS

A. ETFE: Ethylene tetrafluoroethylene.

B. FEP: Fluorinated ethylene propylene.

C. IP Code: Required ingress protection to comply with IEC 60529.

D. MPPT: Maximum power point tracking.

E. PTC: PVUSA Test Condition. Commonly regarded as a "real-world" measure of PV output. See below for definition of "PVUSA."

F. PV: Photovoltaic.

G. PVUSA: Photovoltaics for Utility Systems Applications.

H. STC: Standard Test Conditions defined in IEC 61215.

48.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for PV panels.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For PV modules.

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Detail fabrication and assembly.

4. Include diagrams for power, signal, and control wiring.

48.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special materials and workmanship warranty and minimum power output warranty.

48.5 HAWAIIAN ELECTRIC COMPANY APPROVAL

A. 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 standards of Hawaiian Electric Company (HECO).

B. Submit the interconnection application and obtain the interconnection agreement with HECO on behalf of the State.

48.6 CLOSEOUT SUBMITTALS

Operation and Maintenance Data: For PV modules to include in operation and maintenance manuals.

48.7 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of PV modules that fail in materials or workmanship within specified warranty period.

1. Manufacturer's materials and workmanship warranties include, but are not limited to, the following:

a. Faulty operation of PV modules.

2. Warranty Period: Fifteen years from date of Substantial Completion.

B. Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace components of PV modules that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.

1. Manufacturer's minimum power output warranties include, but are not limited to, the following warranty periods, from date of Substantial Completion:

a. Specified minimum power output to 86 percent or more, for a period of 25 years.

48.8 PRODUCTS

A. Performance Requirements: Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. PV System Description and Components:

1. System Description: A 664 module carport canopy to generate a total nominal rated output of 322 kWDC and 248kW AC. Inverters and modules compliant with BAA.

2. System Components:

a. PV modules.

b. Array frame.

c. Utility-interactive inverter.

d. Overcurrent protection, disconnect, and rapid shutdown devices.

e. Mounting structure.

f. Utility meter.

C. PV Module Characteristics:

1. PV Module Electrical Characteristics:
    a. Rated Open-Circuit Voltage (Voc): 53.63 V dc.
    b. Voltage at Pmax (Vmpp): 45.63 V dc.
    c. Rated Short-Circuit Current (Isc): 11.16 A.
    d. Current at Pmax (Impp): 10.63 A.
    e. Maximum Power at STC (Pmpp): 485 W.
    f. Temperature Coefficient of Voc: -0.27%/C.
    g. Short-Circuit Temperature Coefficient: 0.04%/C.
    h. Pmax Temperature Coefficient: -0.34%/C.
    i. PTC Rating: 365 W.
    j. Module Efficiency: 20.9 percent.
    k. Series Fuse Rating: 30 A.
2. PV Module Physical Characteristics:
    a. BAA Compliant.
    b. Cell Type: Mono-crystalline PERC cells, bifacial.
    c. Module Construction:
        i. Nominal Size: 44.1 inches wide by 87.2 inches long.
        ii. Weight: 64.2 lb.
        iii. 2.0 mm fully tempered, high-transmission, PV solar glass with anti-reflective coating
        iv. Framed Glass: Backsheet
    d. Bypass Diode Protection: 3 bypass diodes.
    e. Junction Box:
        i. Weatherproof.
        ii. IP Code: IP67
        iii. IEC certified (UL listed).
    f. Output Cabling:
        i. 12AWG, 11.81 inch symmetrical cables
        ii. MC4 genuine connector
3. PV Module Framing: Double Webbed 15-Micron Anodized Aluminum Alloy.
    a. Entire assembly UL listed for electrical and fire safety, UL 61730, and complying with IEC 61215.
        i. Frame strength exceeding requirements of certifying agencies in subparagraph above.

D. Inverter:
    1. Compliant with BAA.
    2. Inverter Type: String.
    3. Control Type: Maximum power point tracker control.
    4. Inverter Electrical Characteristics:
        a. Maximum Recommended PV Input Power: 62 kW
        b. Maximum DC Input Voltage: 1000 V dc.
        c. Start-up DC Input Voltage: 188 V dc.
        d. MPPT Voltage Range: 550-800 V dc.
        e. Maximum PV Short-Circuit Current: 32A.
        f. Number of String Inputs: 12 inputs.
        g. Number of Independent MPPT Circuits: 6 MPPT.
        h. Rated Output Voltage: 480 V AC.
        i. Maximum Output Current: 80 A.
        j. Peak Efficiency: 97.5 percent.
        k. DC Terminal Range (AWG): #14 - #8 AWG CU
        l. AC Terminal Range (AWG): #4 - #4/0 AWG CU
        m. Modbus Protocol: Proprietary / SunSpec
        n. Utility Interface: Utility-interactive inverter.
    5. Operating Conditions:
        a. Operating Ambient Temperatures: Minus 13 to plus 140 deg F.
        b. Storage Temperature: Minus 40 to plus 158 deg F.
        c. Relative Humidity: Zero to 100 percent.
    6. Enclosure: NEMA Type 4X, C3 corrosivity classification.
        a. Cooling Methods: Forced convection, variable speed fans.
        b. Protective Functions:
            i. AC over voltage protection.
            ii. AC Surge Protection.
            iii. Integral AC Disconnect.
            iv. DC over voltage protection.
            v. DC Fuse.
            vi. DC Surge Protection.
            vii. Integral DC Disconnect.
    7. Disconnects: Rated for system voltage and conductor.
    8. Regulatory Approvals:

a. IEEE 1547.

b. UL 1699B.

c. UL 1741.

d. UL 1998.

9. Characteristics:

a. Inverter Dimensions: 24.2 x 28.8 x 22.4 inches

b. Inverter Weight: 184 lbs.

48.9 EXECUTION

A. Examination:

1. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

2. Do not begin installation until mounting surfaces have been properly prepared.

3. If preparation of mounting surfaces is the responsibility of another installer, notify Harbors Construction Engineer of unsatisfactory preparation before proceeding.

4. Examine modules and array frame before installation. Reject modules and arrays that are wet, moisture damaged, or mold damaged.

5. Examine roofs, supports, and supporting structures for suitable conditions where PV system will be installed.

6. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation:

1. Comply with NECA 1.

2. Coordinate layout and installation of PV panels with roof and support assembly and other construction.

3. Support PV panel assemblies independent of supports for other elements such as roof and support assemblies, enclosures, vents, pipes, and conduits. Support assembly to prevent twisting from eccentric loading.

4. Install PV inverters, and rapid shutdown in locations indicated on Drawings.

5. Install weatherseal fittings and flanges where PV panel assemblies penetrate exterior elements such as walls or roofs. Seal around openings to make weathertight.

6. Wiring Method: Install cables in raceways.

7. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

C. Connections:

1. Coordinate PV panel cabling to equipment enclosures to ensure proper connections.

2. Coordinate installation of utility-interactive meter with utility.

3. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
4. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

48.10 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE XLIX-VIDEO SURVEILLANCE SYSTEM

49.1 GENERAL

Section includes a video surveillance system consisting of cameras, digital video recorder, data transmission wiring, and a control station with its associated equipment.

49.2 DEFINITIONS

A. AGC: Automatic gain control.

B. BNC: Bayonet Neill-Concelman - type of connector.

C. B/W: Black and white.

D. CCD: Charge-coupled device.

E. FTP: File transfer protocol.

F. IP: Internet protocol.

G. LAN: Local area network.

H. MPEG: Moving picture experts group.

I. NTSC: National Television System Committee.

J. PC: Personal computer.

K. PTZ: Pan-tilt-zoom.

L. RAID: Redundant array of independent disks.

M. TCP: Transmission control protocol - connects hosts on the Internet.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network.

49.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work. Provide CCTV coverage maps.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.

3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.

4. UPS: Sizing calculations.

5. Server.

6. Wiring Diagrams: For power, signal, and control wiring.

C. Design Data: Include an equipment list consisting of every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

49.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for cameras, camera-supporting equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

C. Product Warranty: Sample of special warranty.

49.5 CLOSEOUT SUBMITTALS

Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition, include the following:

A. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

49.6 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

B. Control Station: Rated for continuous operation in ambient temperatures of 40 to 95 degrees F and a relative humidity of 20 to 90 percent, noncondensing.

C. Interior, Controlled Environment: System components, except central-station control unit, installed in air-conditioned interior environments shall be rated for continuous operation in ambient temperatures of 40 to 100 degrees F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 1 enclosures.

D. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of 40 to 95 degrees F dry bulb and 20 to 100 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph. Use NEMA 250, Type 4X enclosures.

E. Corrosive Environment: System components subject to corrosive fumes, vapors, and wind-driven salt spray in coastal zones. Use NEMA 250, Type 4X enclosures.

49.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Three years from date of Substantial Completion.

49.8 PRODUCTS

A. System Requirements:

1. Manufacturer/Model:

a. Video Management System: Genetec Omnicast Enterprise or approved equivalent

b. Server: Streamvault SV-2040E-R12-108T-12-410 or approved equivalent, 45-day retention, 20 percent overprovision

c. Cameras:

i. 90 Degrees: Dome; Axis P3267-LVE or approved equivalent

ii. 180 Degrees:

a) Indoors: Panoramic Dome; Axis P4707-PLVE or approved equivalent

b) Outdoors: Weatherproof Panoramic Dome; Axis P3818-PVE or approved equivalent

iii. 360 Degrees: PTRZ; P3747-PLE or approved equivalent

2. Video-signal format shall comply with NTSC standard, composite interlaced video. Composite video-signal termination shall be 75 ohms.

3. Tamper Protection: Built-in tamper protection with alerts.

B. Main Distribution Frame Rack: Schneider Electric/APC NetShelter SX Model AR3104, 24U Half-Height or approved equivalent.

C. Automatic Color Dome Camera: Assembled and tested as a manufactured unit, containing dome assembly, color camera, motorized pan and tilt, zoom lens, and receiver/driver.

1. Comply with UL 639.

2. Pickup Device: CMOS.

3. Signal-to-Noise Ratio: Not less than 50 dB, with camera AGC off.

4. With AGC, manually selectable on or off.

5. Sensitivity: Camera shall provide usable images in low-light conditions, delivering an image at a scene illumination of 0 lux at 50 IRE.

6. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. Illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with camera AGC off.

7. Manually selectable modes for backlight compensation or normal lighting.

8. Pan and Tilt: Direct-drive motor, pan and tilt as indicated on plans. Pan-and-tilt speed shall be controlled by operator. Movement from preset positions shall be not less than 300 degrees per second.

9. White Balance: Auto-tracing white balance, with manually settable fixed balance option.

10. Motion Detector: Built-in digital.

11. Dome shall support multiplexed control communications using coaxial cable recommended by manufacturer.

D. Lenses: Optical-quality coated lens, designed specifically for video-surveillance applications and matched to specified camera. Provide color-corrected lenses with color cameras.

1. Auto-Iris Lens: Electrically controlled iris with circuit set to maintain a constant video level in varying lighting conditions.
2. Fixed Lens: With calibrated focus ring.
3. Zoom Lens: Motorized, remote-controlled unit, rated as "quiet operating." Features include the following:
    a. Electrical Leads: Filtered to minimize video signal interference.
    b. Motor Speed: Variable.
    c. Lens shall be available with preset positioning capability to recall the position of specific scenes.

E. Power Supplies: Low-voltage power supplies matched for voltage and current requirements of cameras and accessories, and of type as recommended by manufacturer of camera and lens.

1. Enclosure: NEMA 250, Type 4X.

F. Camera-Supporting Equipment:

1. Minimum Load Rating: Rated for load in excess of the total weight supported times a minimum safety factor of two.
2. Mounting Brackets: Type matched to items supported and mounting conditions.
3. Protective Housings for Fixed and Movable Cameras: NEMA 4X enclosures with internal camera mounting and connecting provisions that are matched to camera/lens combination and mounting and installing arrangement of camera to be housed.
    a. Tamper switch on access cover sounds an alarm signal when unit is opened or partially disassembled. Central-control unit shall identify tamper alarms and indicate location in alarm display.
    b. Camera Viewing Window: Polycarbonate window, aligned with camera lens.
    c. Duplex Receptacle: Internally mounted.
    d. Alignment Provisions: Camera mounting shall provide for field aiming of camera and permit removal and reinstallation of camera lens without disturbing camera alignment.
    e. Sun shield shall not interfere with normal airflow around the housing.
    f. Mounting bracket and hardware for wall or ceiling mounting of the housing. Bracket shall be of same material as the housing; mounting hardware shall be stainless steel.
    g. Finish: Housing and mounting bracket shall be factory finished using manufacturer's standard finishing process suitable for the environment.

G. Network Video Recorders: External storage or internal 250-1, 500-GB hard disk drive.

1. Video and audio recording over TCP/IP network.
2. Video recording of MPEG-2 and MPEG-4 streams.
3. Video recording up to 48 Mbps for internal storage and up to 100 Mbps for external storage.
4. Duplex Operation: Simultaneous recording and playback.
5. Continuous and alarm-based recording.

6. Full-Featured Search Capabilities: Search based on camera, time, or date.
7. Automatic data replenishment to ensure recording even if network is down.
8. Digital certification by watermarking.
9. Minimum 72TB needed for continuous recording at full camera resolution at 15 fps with 45 day retention, 20 percent overprovision.
10. Full integration with LAN, Intranet, or Internet through standard Web browser or video management software.

H. IP Video Systems:

1. System shall provide high-quality delivery and processing of IP-based video, audio, and control data using standard Ethernet-based networks.
2. System shall have seamless integration of all video surveillance and control functions.
3. Graphical user interface software shall manage all IP-based video matrix switching and camera control functions, two-way audio communication, alarm monitoring and control, and recording and archive/retrieval management. IP system shall also be capable of integrating into larger system environments.
4. System design shall include all necessary compression software for high-performance, dual-stream, MPEG-2/MPEG-4 video. Unit shall provide connections for all video cameras, camera PTZ control data, bidirectional audio, discreet sensor inputs, and control system outputs.
5. All camera signals shall be compressed, encoded, and delivered onto the network for processing and control by the IP video-management software.
6. Camera system units shall be ruggedly built and designed for extreme adverse environments, complying with NEMA Type environmental standards.
7. Encoder/decoder combinations shall place video, audio, and data network stream that can be managed from multiple workstations on the user's LAN or WAN.
8. All system interconnect cables, workstation PCs, PTZ joysticks, and network intermediate devices shall be provided for full performance of specified system.

I. Control Stations:

1. Heavy-duty, freestanding, modular, metal furniture units arranged to house electronic equipment. Coordinate component arrangement and wiring with components and wiring of other systems.
2. Normal System Power Supply: 120 V, 60 Hz, through a locked disconnect device and an isolation transformer in central-station control unit. Central-station control unit shall supply power to all components connected to it unless otherwise indicated.
3. Power Continuity for Control Station: Batteries in power supplies of central-station control units and individual system components shall maintain continuous system operation during outages of both normal and backup ac system supply.
    a. Batteries: Rechargeable, valve-regulated, recombinant, sealed, lead-acid or lithium ion type with nominal 10-year life expectancy. Capacity adequate to operate portions of system served including audible trouble signal devices for up to four hours and audible and visual alarm devices under alarm conditions for an additional 10 minutes.

b. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Charger shall recharge fully discharged battery within 24 hours.

4. Annunciation: Indicate change in system condition and switching of system or component to backup power.

J. Signal Transmission Components: Cable - CAT6 PoE.

49.9 EXECUTION

A. Examination:

1. Examine pathway elements intended for cables. Check raceways and other elements for compliance with space allocations, installation tolerance, hazards to camera installation, and other conditions affecting installation.

2. Examine roughing-in for LAN, WAN, and IP network before device installation.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Wiring:

1. Wiring Method: Install cables in raceways unless otherwise indicated.

a. Except raceways are not required in accessible indoor ceiling spaces and attics.

b. Except raceways are not required in hollow gypsum board partitions.

c. Conceal raceways and wiring except in unfinished spaces.

2. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

4. Communications cabling shall be in accordance with Article XLVII - Telecommunications Cabling System.

5. Grounding: Provide independent-signal circuit grounding recommended in writing by manufacturer.

C. Video Surveillance System Installation:

1. Install cameras and infrared illuminators level and plumb.

2. Install cameras with 84-inch- minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

3. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms and adjust.

4. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

5. Install tamper switches on components indicated to receive tamper switches, arranged to detect unauthorized entry into system-component enclosures and mounted in self-protected, inconspicuous positions.

6. Avoid ground loops by making ground connections only at the control station.
    a. For 12- and 24-V dc cameras, connect the coaxial cable shields only at the monitor end.
7. Identify system components, wiring, cabling, and terminals in accordance with Article XLVII - Telecommunications Cabling System.

D. Field Quality Control:
1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
3. Perform Tests and Inspections:
    a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
4. Tests and Inspections:
    a. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
    b. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
        i. Prepare equipment list.
        ii. Verify operation of auto-iris lenses.
        iii. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
        iv. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet (17 to 23 m) away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
        v. Set and name all preset positions; coordinate with the Harbors IT Security and IT Specialists.
        vi. Set sensitivity of motion detection.
        vii. Connect and verify responses to alarms.
        viii. Verify operation of control-station equipment.
    c. Test Schedule: Schedule tests after pretesting has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

d. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

5. Video surveillance system will be considered defective if it does not pass tests and inspections.

6. Prepare test and inspection reports.

E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.

2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.

3. Adjust all preset positions; consult State's personnel.

4. Recommend changes to cameras, lenses, and associated equipment to improve State's use of video surveillance system.

5. Provide a written report of adjustments and recommendations.

F. Cleaning:

1. Clean installed items using methods and materials recommended in writing by manufacturer.

2. Clean video-surveillance-system components, including camera-housing windows, lenses, and monitor screens.

G. Demonstration: Train State's maintenance personnel to adjust, operate, and maintain video-surveillance equipment.

49.10 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE L - MODULAR BATTERY ENERGY STORAGE SYSTEM

50.1 GENERAL

A. This Article describes the operation and functionality of a Battery Energy Storage System (BESS) that shall operate as an integrated solution, providing capabilities necessary for deployment as described herein. All work connected with the supply of the BESS shall be in accordance with the requirements of the appropriate UL/ IEEE/NFPA standards.

B. BESS Sizing and Connection:

1. KVA and kWh values as depicted on design drawings.

2. 480V, 3-Phase, 60Hz.

C. Project Elevation for Spec Compliance:

1. Up to 1000m (3300ft) above sea level.

2. Incorporate any necessary derating factor needed to maintain the required project kW and kWh capabilities in this specification.

D. The BESS shall have the following key features

1. Modular and scalable up to the size depicted on the design drawing

2. Islanding mode capable with the manufacturer's reference design for micro grid applications (specification to be provided with information submittals), where the requirements are described, with a description of which parts and services are provided by the BESS manufacturer and which are provided by the customer. The BESS shall be suitable for implementation of the following mode: Islanding Mode 2: Resilience – Energy Storage + PV.

E. Power Module

1. Rack-mounted, scalable power block architecture.

2. User replaceable power modules.

F. Battery Technology: Lithium-Iron-Phosphate or other, similar District approved technology

G. Battery Cabinet: Delivered complete to site pre-wired, assembled and tested in enclosure.

H. Battery Warranty:

1. Backed by the battery cell manufacturer, not a system integrator.

2. Highly flexible usage application agnostic based on average daily discharge - not limited to a specific customer project or usage profile.

3. 10 years term with 1 average daily full-cycle discharge, without rest period restrictions between charging and discharging.

I. Over-the-air (OTA) firmware/software updates for feature enhancements & service when enabled by customer.

J. Native Outdoor design – not an indoor product in an outdoor enclosure or container.

50.2 STANDARDS

Equipment furnished shall meet the guidelines defined in the applicable sections of the standards and codes listed below.

A. IEEE Standard 1547.1-2020: IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

B. IEEE 1547-2018 – IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.

C. EMC: FCC part 15 Class A.

D. UL 9540-2020; Energy Storage Systems and Equipment.

E. UL 9540A Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.

F. UL 1973: Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Application.

G. UN38.3: Test and Certification for the transportation of Lithium Batteries.

H. RoHS: Restriction of Hazardous Substances in Electrical and Electronic Equipment.

I. Communications protocols: Modbus TCP; SunSpec 2.0 (or similar).

J. Grid code: UL1741 / IEEE 1547- 2018; IEEE 1547.1-2020.

K. CA Rule 21.

L. UL 1741 – Standard for Safety Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources..

M. California Energy Commission approved equipment list.

N. California Self Generation Incentive Program approved list of equipment.

O. ANSI//NETA ATS-2021: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, latest edition.

P. NFPA 70 – National Electrical Code.

50.3 SUBMITTALS

A. Submit System Data: Include dimensions, manufacturers' technical data on features, components, ratings, finishes and performance for each sub-system indicated.

B. Shop Drawings: All drawings included in the User Manual, attached. Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly and location and size of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement. Include the following:

1. Include dimensioned plans, elevations, sections and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Wiring Diagrams: interconnecting wiring; and power, signal, and control wiring.
4. System configuration with conceptual single-line diagrams.
5. Submit scaled plan layout with minimum clearances with required overlay on site/building plans for spaces where the equipment is to be installed.

C. BESS Data:

1. Nameplate legends.
2. AC bus configuration with size and number of conductors, including phase,neutral, and ground conductors of main and auxiliaries buses.
3. Nominal current ratings of buses.
4. Overload and short-circuit ratings of the BESS system.
5. Control power wiring drawing for external interfaces (EMS / Site controller / …).
6. Prior to fabrication of BESS, submit the following data for approval:
    a. Complete electrical features.
    b. Provide features, characteristics and ratings of individual protection devices sizes.
    c. Safety features.
    d. Accessories and nameplate data.
    e. One line diagram of the primary distribution system.
    f. Elementary and detailed point-to-point interconnection wiring diagrams for power, signal and control systems
    g. Technical data for each major sub-system (Converter and Battery). System must provide a single computing device to connect to the converters and batteries
    h. Dimensioned exterior and section views of the BESS.
    i. Floor plan.
    j. Foundation guide plan.
    k. Provisions and required locations for external conduit and wiring entrances.
    l. Dimensions and approximate design weights.
    m. Detail equipment assemblies and indicate dimensions of enclosures, weights, loadings, required clearances, method of field assembly of switchboard and its housing components.

n. Step-by-step operating instructions.

o. Narrative description of operation of BESS system.

p. Generic plan drawings indicating battery layout, BESS system, cabinetmonitoring, etc.

q. Conceptual single line diagram between BESS and building electrical system for sensing, relaying,electrically 0perated devices for resiliency application.

D. Informational Submittals:

1. Certificates & Listing: For each product and for the system, from manufacturer.

2. Seismic: Anchorage seismic generic study to be supplied.

3. Documents demonstrating compliance with specification:

a. Battery Cell Manufacturer.

b. Battery System Manufacturer.

c. BESS System Manufacturer.

4. Qualifications of the BESS installer. The installer must be licensed and demonstrate experience to perform the work.

E. Closeout Submittals:

1. Manuals: For BESS and associated equipment.

a. Submit companion copies of complete maintenance and operating manuals, including technical data sheets, single line diagrams.

b. Lists of spare parts and replacement components recommended being stored at project site for ready access.

2. Supplier must provide Material Safety Data Sheets (MSDS) specific to their particular product to facilitate customer personnel training and communications with emergency response and environmental agencies.

3. Include wiring diagrams needed for installation, maintenance and operation.

4. The diagrams shall identify the terminals to facilitate in the installation, maintenance and operation.

5. Testing and commissioning reports.

F. Installation, Operation and Maintenance Manua:

1. Includes step-by-step installation instructions for properly installing the system.

2. For preparing, operating, and maintaining the BESS, equipment wiring connection outlines.

3. Includes catalog sheets and technical data sheets indicating physical data and electrical performance and electrical characteristics.

4. Recommended Spare Parts List.

    a. List of required spare parts to be furnished with the BESS.

    b. Each spare part shall be interchangeable with, and shall be made of the same material and workmanship as, the corresponding part included with the product furnished under these specifications.

    c. Special tools required for ongoing maintenance.

5. Provide Modbus registers map for external control system interfacing.

6. Maintenance Plan Options for routine and preventative maintenance required to keep the warranty in effect.

7. Detailed Standard and Extended Warranty options.

8. Manufacturer's reference design for Microgrid applications including SLD, operating modes and bill of material.

9. Detailed communication diagram for all devices (with transmission lines, carrier type, protocols, ID#'s, baud rate, parity, IP/TCP #'s per device, etc.)

10. Any required Material Safety Data Sheets (MSDS).

50.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer shall be well established company regularly engaged in the application, engineering, manufacturing, integration and testing of BESS systems.

B. Factory Testing:

1. Products and sub-systems are tested and shown to conform to Manufacturer's Quality Standards.

2. Production Tests.

C. Field Testing and Commissioning

1. Performed by factory authorized personnel.

2. Follow manufacturer's instructions and demonstrate compliance according to operation sequence.

3. Provide documentation that the equipment has been properly installed, adjusted, and tested.

50.5 WARRANTY

A. Battery Performance Guarantee.

1. Backed by the battery cell manufacturer, not a system assembler or integrator.

2. Application agnostic based on average daily discharge - not limited to a specific customer project or usage profile

3. Average Daily Cycle Definition: Total energy discharged over a year divided by DC residual energy (declining kWh capacity of the battery system) divided by 365.

4. 10-year term available with up to one average daily cycle, with no rest period restrictions between charging and discharging.\

B. Other Products/Sub-System Warranty:

1. Standard Warranty Term: 2 years from the commissioning date.

2. The warranty shall cover all mechanical and electrical devices contained within the converter sub-system.

3. For the warranty to remain in effect, both regular and preventive maintenance need to be performed per manufacturer's requirements for the environmental conditions of the project site, with supporting documentation. Maintenance plan shall include evaluation and replacement of power modules, power module fan, thermal sensors, corrosion remediation and touch paint on the BESS enclosure.

4. In addition to the warranty term above, terms of up to 10 years shall be available for the system. Warranty shall be extendable while existing warranty remains in force.

50.6 ISO CERTIFICATIONS

A. ISO 9001 – Quality Management System

B. ISO 14001 – Environmental Management System

C. ISO 50001 – Energy Management

50.7 MAINTENANCE

A. Routine Maintenance: More frequent, less demanding maintenance that can be carried out by trained customer personnel, should the customer decide to take on this responsibility.

B. Preventative Maintenance: Less frequent but more comprehensive maintenance that must be performed by factory trained and authorized personnel.

C. Time intervals and scopes of work for routine and preventative maintenance shall be described in the manufacturer's documentation.

D. Supporting documentation that regular and preventative maintenance have been performed per manufacturer's requirements, using parts and supplies defined by the manufacturer, is necessary for the product warranty to remain in effect.

50.8 TRAINING

A. Factory-trained personnel shall provide training for customer-designated personnel that includes safety procedures, BESS operational theory, sub-assembly identification and operation, preventative maintenance, and troubleshooting.

B. During commissioning, a factory-trained technician shall provide on-site operational training for designated personnel. An additional remote training session can be provided to the customer upon request.

50.9 PRODUCTS

A. Basis of Design: SUNSYS HES-L, by Socomec Inc. or approved equal.

B. Alternate manufacturers wishing to have products evaluated for acceptability and conformance with the performance requirements of this specification as alternates to the basis of design shall provide compliance and/or exception statements and all items requested in the submittals section above.

C. Assemblies and Materials: All materials and parts shall be new, of current manufacture, and shall not have been used in a prior service, except as required during factory testing. The system manufacturer shall conduct inspections on incoming parts, assemblies and final products.

D. Availability of Service Personnel: Manufacturer shall have a North American service organization with factory-trained service personnel.

E. Availability of Spare Parts: Manufacturer shall have a reliable supply chain, with component and system distribution, ensuring availability of replacement parts from manufacturer.

F. BESS Attributes:

1. Modular and scalable up to the size depicted on the design drawing.

    a. Power in 50kVA blocks, minimum.

    b. Battery energy storage in modular blocks.

2. Grid forming functionality.

G. Manufacturer to provide reference design for microgrid implementation.

H. System is comprised modular Units depending on system size that include the following items:

1. Controls (Outdoor):

    a. Houses the Power Conversion System (PCS).

    b. AC/DC distribution protection.

    c. Battery Management System (BMS).

    d. IoT Equipment for remote monitoring.

2. Batteries (Outdoor)

    a. Capacity as indicated on design drawings.

    b. C-RATE 0,5C.

3. All relevant wiring and interconnections between the controls and batteries.

4. Total scalable kVA/kW shall be based on design indicated on Drawings and shall be configured using power modules in accordance with manufacturer’s standard system.

I. Power Modules:

1. Power module ratings vary by manufacturer, but scalable size shall not exceed 50 kVA blocks.

2. Replaceable, continuous duty, rack-mounted power modules.

3. Should one or more of the power modules fail, the system shall continue to operate at reduced power output,

J. Battery Configuration:

1. Battery configurations shall be scalable.

2. Battery racks shall be effectively cooled.

K. BESS Enclosures:

1. Native outdoor modular design and construction. Container-based products are not compliant with this specification and will be rejected.

2. Components shall be contained within a weatherproof, moisture-sealed, tamper-resistant, metal enclosure with a minimum IP55 or equivalent rating suitable for outdoor installation on a concrete pad, in accordance with the manufacturer's requirements.

3. Compartment doors on the enclosure must have a locking provision suitable for a padlock with a 3/8 inch shackle.

4. Doors must have provisions to withstand strong wind gusts when in the open position

5. The battery enclosures shall be equipped with a fire detection/suppression system.

6. Cabinet interconnections shall not require conduit in concrete

50.10 GENERAL OPERATION

A. The BESS shall be designed to operate under the following electrical grid conditions: Rated voltage 480V, 3-phase + Neutral (4W).

B. In normal operation (On Grid mode), BESS shall operate in current-source mode, using four-quadrant control.

C. The BESS AC system equipment shall have a Basic Insulation Level in accordance with relevant standards.

D. Start/Stop Characteristics: The BESS can be started and stopped by the following methods:

Receiving control commands from a local interface (HMI) such as a touchscreen display, a Microgrid Controller (MGC), or a 3rd party system such as the Energy Management System, or the local electric utility.

50.11 POWER CONVERSION SYSTEM (PCS)

A. Thermal Management: Controlled heating elements shall provide additional temperature and humidity support as required to maintain suitable operating temperature during system operation.

B. Air Filtration: The air-handling systems shall include filtering that is adequate to keep dust from the interior of the PCS system. Replacement of filter shall not require special tools or involve more than two hours of labor at the site.

C. The PCS shall be bi-directional converter, with four-quadrant control, that can be operated in inverting mode for battery discharging and rectifying mode for battery charging.

D. Operation During Normal Conditions:

1. Both grid-connected and islanded (off grid) modes.

2. Optional Blackstart Capability.

3. The following operation modes shall be provided:

a. Active and reactive power control.

b. Voltage and frequency control.

c. The PCS shall not create harmonic levels that cause the facility to exceed IEEE-519 recommended limits at the Point of Common Coupling (PCC) or elsewhere within the facility.

d. Control parameter setting and charge/discharge instructions shall be from a local interface (HMI) option such as a touchscreen display, a Microgrid Controller (MGC), or a 3rd party system such as the Energy Management System (EMS), or the local electric utility, and shall be SUNSPEC compliant.

e. Load following.

f. PV smoothing.

g. Voltage shall be maintained per IEEE-1547-2018.

h. UL 1741 PCS CRD function, import only.

4. Operation During Abnormal Condition:

a. The PCS stops automatically when serious abnormal conditions (Alarms) are detected.

b. When non-serious errors (Warnings) are detected, the PCS continues operation with error signals which shall be reported.

5. PCS Electrical Protection:

a. The PCS shall be protected against thermal overload, over-current and over-voltage.

b. Insulation monitoring and ground fault detection shall be provided.

c. The following protective functions shall be provided:

i. DC over-voltage, under-voltage, over-current.

ii. AC over-voltage, under-voltage, over-current.

iii. Anti-Islanding.

iv. Battery protection.

v. Internal fault (over temperature, logic failure, etc.)

50.12 PCS TECHNICAL SPECIFICATION

Details	Technical requirement
AC ratings	
Power Module Rating	50kVA Max
Power module replacement	Replaceable
Voltage range	480V, +/- 20%
Type of connection	AC three-phase, 3-wire + Neutral (4W)
Rated Frequency	60 Hz ± 5%
Real and reactive power control accuracy	±1%
VAR production	Full VAR production at rated voltage
Harmonics	Less than 5% current distortion @ 100% load
Environmental ratings	
Operating temperature	-20°C to +45°C* without derating
Storage Temperature	-20°C to +60 °C
Humidity	0 – 95% non-condensing
Impact of Altitude on Available Capacity	1000 m : No derating Greater than 1000m per IEC62040-3
Enclosure type	IP 55 / NEMA 3R (Outdoor)

Functions/Features	
Power flow operation	Supports four-quadrant control
Real power control	Positive and negative
Reactive power control	Capacitive and inductive
Combination of real and reactive power control	Real power taking priority
Load following (renewable smoothing)	Allowing renewable smoothing
Low-voltage ride through	Supporting transition from grid connected to islanded operation
Over-The-Air updates	Over-the-air (OTA) firmware/software updates for feature enhancements & service
Operation modes	
Black start	External authorization
Commanded power	External command
Commanded VAR	External command
Frequency regulation	External command
Frequency response	Automatic
Islanding	PCS supports islanding operation and transition from On-Grid to Island mode and optional seamless reconnection to the grid.
Renewable smoothing	External command
Scheduled power	Preconfigured time/date of work power profiles
Voltage regulation	External command
Response time of PCS to the command received	< 100 ms

Communications	
Communications with 3rd party controller	ModBus TCP and/or SUNSPEC Protocol

Battery technologies	
Battery technology supported by PCS	Li-ion, Lithium Iron Phosphate (LFP)
Physical systems	
Protection class	IP55 for outdoor installation
Monitoring and control	
Interface, status and control panel	Yes
Voltage (AC/DC)	Yes
Current (AC/DC)	Yes
Active power (AC/DC)	Yes
Reactive power	Yes
Energy (AC/DC)	Yes
Capacity (Ah)	Yes
Power factor	Yes
Fault	Yes
Battery information	Yes
Battery temperature (average/extreme)	Yes
State of Charge & Health (SOC / SOH)	Yes
Alarm &-Warning messages	Yes

Efficiency	
Round-trip efficiency	≥ 90%
Protection system	
Under/over voltage (DC and AC)	Yes
Under/over frequency	Yes
Over current protection	Yes
Ground fault protection	Yes
Overheating protection	Yes
Smoke detection (Trip/Alarm)	Yes
Surge protection (DC and AC)	Yes
Automatic AC & DC open circuit when fault detection	Yes
Insulation monitoring	Yes
Function Features	
Symmetrical Overload capability	110% during 60 min 125% during 20min (Off-grid option) 150% during 60s (Off-grid option)
Audible Noise	
Noise level	Less than 70 dBA at 1 meter

50.13 BATTERY SYSTEM

A. The battery system shall be tested according to UL 9540A.

B. Battery type and Chemistry: Li-Ion, Lithium Iron Phosphate (LFP).

C. Battery cabinet system shall be delivered complete to the job site pre-wired, assembled and tested in its enclosure at the factory prior to shipment.

D. C-Rate: 0.5 C.

E. Fire Protection: Smoke and heat detectors, effective fire suppression systems.

F. Battery Rack Assembly:

1. Native Outdoor design – not an indoor product in an outdoor rated enclosure or container.
2. IP-66 rated.
3. Cabinet interconnection does not require conduit in concrete.
4. Design minimizes footprint with back-to-back or in-line configuration capability.
5. Effective cooling system to maintain suitable operating temperature.
6. Resistive Heating system to maintain suitable operating temperature.
7. Integrated rack-level Battery Monitoring System (BMS).

G. Battery Module/Tray:

1. Module/tray battery management system (BMS) shall be provided.
2. Automatic module balancing shall be provided.
3. Module/tray cooling system shall be provided.
4. Protective devices should include for DC-side protection:
    a. Battery fuse for each battery cell and module.
    b. DC contactor for each battery rack.

H. Battery Management System (BMS):

1. The BMS design shall protect the battery and interconnected power system from malfunction and component failure.
2. BMS is used to monitor, protect, maintain safety and optimal operation of each battery cell, module and rack. BMS consist of: Module/tray BEMS, rack BMS and system BMS.
3. The BMS shall communicate to higher level supervisory and automatic control systems. The BMS shall handle battery fire detection, battery tripping, battery disconnect, and related PCS commands and shall communicate fire alarms and signals to the suppression system.
4. The BESS shall communicate with the BMS and report the peak temperature in all battery modules and monitor the operating temperature in all battery modules, as well as the state of health (SOH) calculation as determined by the BMS. The BESS shall utilize battery temperature and SOH data reported by the BMS to annunciate alarms and respond to fault conditions.
5. Metering and monitoring:
    a. Battery cell voltage (all cells).
    b. Battery module temperature (8 sensors per module).
    c. Cell Balancing.

d. Battery system voltage.

e. Battery system current.

f. Battery rack voltage.

g. Battery rack current.

h. Battery SOC of each rack and battery system.

i. Battery SOH (state of health) of each rack.

6. Battery Protection:

a. Over-charge.

b. Over-discharge.

c. Over/under temperature.

d. Over/under voltage.

e. Overcurrent.

f. Short circuit current.

g. Internal battery fault detection.

h. Cell balancing.

7. BMS Data Communications: All metering items and contactor status shall be provided for PCS control and monitoring system by a standard protocol.

I. Alarms and Resets:

1. Alarms.

a. Informational Notification - Indicates the status of the unit.

b. Warning Alarm indicates a problem with the converter requiring attention (not affecting proper operation).

c. Converter Inhibit indicates a problem with the converter affecting proper operation. The converter will stop operation.

d. Trip Offline Alarm indicates a severe problem with the converter. The system will not operate.

e. Isolate Alarm indicates a problem affecting proper operation of the system.

f. The system will operate with limited functionality.

g. Alarms shall be available to external monitoring and/or control such as the HMI of BESS system.

2. Resets - Energy storage unit alarms shall be reset by any of the following means

a. Via a personal computer-connected to the control panel Ethernet port.

b. External Reset can be performed by 3rd party controller,

50.14 COMMUNICATIONS

A. The BESS shall be capable of communicating over Modbus TCP, furnished and installed by the system manufacturer, which shall permit communication to the microgrid controller (MGC) or Energy Management System (EMS) to allow monitoring of such parameters as battery voltage, current, temperature, state of charge and state of health at the cell/module/tray and rack levels; as well as allow to control charging, discharging and other functions of BESS, as necessary.

B. Local Connection for management and servicing of the BESs: The BESS shall have a maintenance port (serial, WiFi, Bluetooth, etc.)

C. Remote Connection and Monitoring:

1. Integrated IoT devices that make it possible to:

a. Upload operational data to the cloud.

b. Upload data required to satisfy battery warranty.

c. Provide firmware updates over the air,

d. Remote diagnostics.

D. Access to necessary software tools and associated licenses for PCS/BMS configuration and system parameter setting.

E. Information Security: Supplier shall design the BESS to be hardened against willful attack or human negligence.

50.15 ENERGY MANAGEMENT SYSTEM (EMS)

A. Shall be by Energy Toolbase or other approved supplier,

B. Operates the system for maximize economic returns.

C. Monitor for remote system monitoring.

D. The BESS shall provide a standard SunSpec interface for other EMS providers (or similar).

50.16 EXECUTION

A. Installation is the responsibility of the installing contractor.

B. Contractor shall follow all applicable national, state and local codes.

C. Inspect equipment for any signs of damage and coordinate with factory for returns.

D. Follow all national, state and local codes with respect to installation of this product.

E. Follow manufacturer’s installation manual.

F. Verify all dimensions in the field. Check for damage, loose connections, and other potential deficiencies. Document findings and follow corrective action as required under the direction of the manufacturer.

G. Install Markings and Signage: The BESS shall be equipped with appropriate marking and signs notifying electrical workers and the general public of potential personal injury hazards.

50.17 START-UP AND COMMISSIONING

A. Shall be factory assisted.

B. Installing Contractor shall perform the start-up work under the supervision of factory trained personnel.

C. Perform visual and mechanical inspections and electrical tests identified in NETA ATS, and in manufacturer's documentation.

D. Perform commissioning per manufacturer's procedures.

E. Identify and correct any issues.

F. Factory-trained technician shall provide operational on-site training for customer-designated personnel.

G. Provide report documenting tests and certifying successful compliance.

50.18 MEASUREMENT AND PAYMENT

Work under this Article will not be measured nor paid for separately but shall be considered incidental to and included in the amount bid for the various bid items in the Proposal Schedule.

END OF ARTICLE

ARTICLE LI - METAL FABRICATIONS

51.1 SUMMARY

A. Article Includes:

1. Metal bollards.

2. Pipe and downspout guards.

51.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

51.3 ACTION SUBMITTALS

A. Product Data:

1. Fasteners.

2. Shop primers.

3. Shrinkage-resisting grout.

4. Metal bollards.

5. Pipe and downspout guards.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Metal bollards.

51.4 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

C. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

51.5 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dipped galvanized per ASTM F2329/F2329M.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

51.6 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in ARTICLE XXIX CAST-IN-PLACE CONCRETE.

51.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlapping.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flathead (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

51.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Articles as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

51.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation

with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with primer specified in ARTICLE LXXXIX HIGH-PERFORMANCE COATINGS.

51.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 galvanized steel pipe steel shapes, as indicated.

B. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- thick, galvanized steel or stainless-steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

C. Prime steel bollards with primer specified in ARTICLE LXXXIX HIGH-PERFORMANCE COATINGS.

51.11 PIPE AND DOWNSPOUT GUARDS

A. Fabricate pipe and downspout guards from 3/8-inch- thick by 12-inch- wide, steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

B. Galvanize and prime steel pipe and downspout guards.

C. Prime steel pipe and downspout guards with primer specified in ARTICLE LXXXIX HIGH-PERFORMANCE COATINGS.

51.12 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

51.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dipped galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be

embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

51.14 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dipped galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlapping.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

51.15 INSTALLATION OF METAL BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

51.16 INSTALLATION OF PIPE AND DOWNSPOUT GUARDS

A. Provide pipe guards at exposed vertical pipes in where not protected by curbs or other

barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

51.17 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

51.18 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LII - METAL FLOOR PLATE STAIRS

52.1 SUMMARY

A. Article Includes:

1. Industrial Class stairs with steel floor plate treads.

2. Steel railings and guards attached to metal stairs.

3. Steel handrails attached to walls adjacent to metal stairs.

52.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs, railings, and guards.

1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

2. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

D. Schedule installation of railings and guards so wall attachments are made only to completed walls.

1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

52.3 ACTION SUBMITTALS

A. Product Data: For metal floor plate stairs and the following:

1. Metal floor plate treads.

2. Shop primer products.

3. Grout.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.

2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.

3. Include plan at each level.

4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

C. Delegated Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

52.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Welding certificates.

52.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

52.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.

2. Protect steel members and packaged materials from corrosion and deterioration.

3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

a. Repair or replace damaged materials or structures as directed.

52.7 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design stairs, railings, and guards, including attachment to building construction.

B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq ft.

2. Concentrated Load: 300 lbf applied on an area of 4 sq in.

3. Uniform and concentrated loads need not be assumed to act concurrently.

4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.

5. Limit deflection of treads, platforms, and framing members to L/360.

C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally to an area of 1 sq ft.
b. Infill load and other loads need not be assumed to act concurrently.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to ASCE/SEI 7.

52.8 METALS

A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

D. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed).

1. Provide galvanized finish for exterior installations and where indicated.

E. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

52.9 FASTENERS

A. General: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 where built into exterior walls.

1. Select fasteners for type, grade, and class required.

B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.

C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.

52.10 MISCELLANEOUS MATERIALS

A. Welding Electrodes: Comply with AWS requirements.

B. Shop Primers: Provide primers that comply with ARTICLE LXXXIX "High-Performance Coatings."

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint compatible with paints specified to be used over it.

E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

52.11 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.

2. Use connections that maintain structural value of joined pieces.

B. Assemble stairs, railings, and guards in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.

2. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless

otherwise indicated.

2. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlapping.

3. Remove welding flux immediately.

4. Weld exposed corners and seams continuously unless otherwise indicated.

5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish # 3 - Partially dressed weld with spatter removed.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flathead (countersunk) screws or bolts unless otherwise indicated.

2. Locate joints where least conspicuous.

3. Fabricate joints that will be exposed to weather in a manner to exclude water.

4. Provide weep holes where water may accumulate internally.

52.12 FABRICATION OF STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Stringers: Fabricate of steel plates or steel channels.

a. Stringer Size: As required to comply with "Performance Requirements" Article.
b. Provide closures for exposed ends of channel stringers.
c. Finish: Shop primed Galvanized.

2. Platforms and Tread Supports: Construct of steel plate or steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.

a. Provide closures for exposed ends of channel framing.
b. Finish: Shop primed Galvanized.

3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers.

4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Floor Plate Stairs: Form treads and platforms to configurations shown from diamond plate floor plate of thickness needed to comply with performance requirements, but not less than 1/8 inch.

1. Form treads with integral safety nosing and back edge stiffener. Form risers of same material as treads.

2. Weld steel supporting brackets to stringers and weld treads to brackets.

3. Fabricate platforms with integral nosings matching treads and weld to platform framing.

D. Risers: Solid.

52.13 FABRICATION OF STAIR RAILINGS AND GUARDS

A. Comply with applicable requirements in ARTICLE LIII PIPE AND TUBE RAILINGS.

B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: As indicated in drawings.

2. Picket Infill: As indicated in drawings. Pickets must spaced to prohibit the passage of a 4-inch diameter sphere.

C. Welded Connections: Fabricate railings and guards with welded connections.

1. Fabricate connections that are exposed to weather in a manner that excludes water.

a. Provide weep holes where water may accumulate internally.

2. Cope components at connections to provide close fit or use fittings designed for this purpose.

3. Weld all around at connections, including at fittings.

4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

5. Obtain fusion without undercut or overlapping.

6. Remove flux immediately.

D. Form changes in direction of railings and guards as follows:

1. By inserting prefabricated elbow fittings.

E. Close exposed ends of railing and guard members with prefabricated end fittings.

F. Connect posts to stair framing by direct welding unless otherwise indicated.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.

52.14 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dipped galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Interior Stairs:

a. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

52.15 EXAMINATION

A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.

1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

52.16 INSTALLATION OF METAL STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces.

a. Clean bottom surface of baseplates.
b. Set steel stair baseplates on wedges, shims, or leveling nuts.
c. After stairs have been positioned and aligned, tighten anchor bolts.
d. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

1) Neatly finish exposed surfaces; protect grout and allow to cure.

2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dipped galvanized after fabrication and are for bolted or screwed field connections.

3. Comply with requirements for welding in "Fabrication, General" Article.

52.17 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.

2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.

3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.

4. Secure posts, rail ends, and guard ends to building construction as follows:

a. Anchor posts to steel by welding to steel supporting members.
b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

52.18 REPAIR

A. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

52.19 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LIII - PIPE AND TUBE RAILINGS

53.1 SUMMARY

A. Article Includes:

1. Steel railings.

53.2 COORDINATION

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

53.3 ACTION SUBMITTALS

A. Product Data:

1. Metal finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

53.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

53.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

53.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

53.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

53.8 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

53.9 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

53.10 STEEL RAILINGS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

D. Plates, Shapes, and Bars: ASTM A36/A36M.

53.11 FASTENERS

A. Fastener Materials:

1. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dipped zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.

53.12 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

53.13 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.

2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.

2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.

2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlapping.

3. Remove flux immediately.

4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

J. Form changes in direction as follows:

1. As detailed.

2. by inserting prefabricated elbow fittings.

K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise

indicated.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.

2. Coordinate anchorage devices with supporting structure.

53.14 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dipped galvanized steel railings, including hardware, after fabrication.

2. Comply with ASTM A123/A123M for hot-dipped galvanized railings.

3. Comply with ASTM A153/A153M for hot-dipped galvanized hardware.

4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

53.15 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.

2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.

3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.

4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

53.16 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

53.17 CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

53.18 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

53.19 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LIV - ROUGH CARPENTRY

54.1 SUMMARY

A. Article Includes:

1. Wood products.

2. Wood-preservative-treated lumber.

3. Fire-retardant-treated lumber.

4. Miscellaneous lumber.

5. Plywood backing panels.

B. Related Requirements:

1. ARTICLE LVII PLASTIC LAMINATE-CLAD ARCHITECTURAL CABINETS for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

54.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.

2. NLGA: National Lumber Grades Authority.

3. SPIB: The Southern Pine Inspection Bureau.

4. WCLIB: West Coast Lumber Inspection Bureau.

5. WWPA: Western Wood Products Association.

54.3 ACTION SUBMITTALS

A. 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.

4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

54.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. 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 ALSC Board of Review.

2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

54.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering them with waterproof sheeting, securely anchored. Provide air circulation around stacks and under coverings.

54.6 WOOD PRODUCTS

A. Lumber: Comply with 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.

3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.

2. Dimension Lumber: 15 percent unless otherwise indicated.

54.7 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:

1. UC1: Interior construction not in contact with ground or subject to moisture. Include the following items:

    a. Wood furniture or casework framework.
    b. Wood trim installed above floor level in dry conditions.

2. UC2: Interior construction not in contact with ground but may be subject to moisture. Include the following items:

    a. Wood sills, blocking, and similar concealed members in contact with masonry or concrete.

3. UC3A: Coated sawn products in exterior construction not in contact with ground but exposed to all weather cycles including intermittent wetting. Include the following items:

    a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

5. After treatment, redry boards and dimension lumber to 19 percent maximum moisture content.

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.

54.8 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment is not to promote corrosion of metal fasteners.

2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for

exterior locations and where indicated.

3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.

C. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

E. Application: Treat all rough carpentry unless otherwise indicated.

54.9 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.

2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.

3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

54.10 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

54.11 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide screws, in sufficient length,

to penetrate not less than 1-1/2 inches into substrate.

1. 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 A153/A153M or ASTM F2329.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

54.12 MISCELLANEOUS MATERIALS

A. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

54.13 INSTALLATION

A. Set work 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.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. 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.

E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.

3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.

F. 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.

G. Comply with AWPA 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.

H. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

54.14 INSTALLATION OF WOOD BLOCKING AND NAILERS

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 wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

D. 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.

54.15 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.

54.16 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LV - SHEATHING

55.1 SUMMARY

A. Article Includes:

1. Wall sheathing.

B. Related Requirements:

1. ARTICLE LXI WEATHER BARRIERS for water-resistive barrier applied over wall sheathing.

55.2 ACTION SUBMITTALS

A. Product Data:

1. Wall sheathing.

2. Sheathing joint-and-penetration treatment materials.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

55.3 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. 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.

55.4 DELIVERY, STORAGE, AND HANDLING

A. 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 air circulation around stacks and under coverings.

55.5 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

55.6 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.

1. Type and Thickness: Type X, 5/8 inch thick.

2. Size: 48 by 96 inches for vertical installation.

55.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall sheathing, provide fasteners of Type 304 stainless steel.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

55.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

55.9 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 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.

2. ICC-ES evaluation report for fastener.

D. Coordinate wall 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.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. 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.

55.10 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.

2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.

3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

E. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.

1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

55.11 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LVI - INTERIOR FINISH CARPENTRY

56.1 SUMMARY

A. Article Includes:

1. Interior trim.

B. Related Requirements:

1. ARTICLE LIV ROUGH CARPENTRY for furring, blocking, and other carpentry work not exposed to view.

2. ARTICLE LXXXVIII INTERIOR PAINTING for priming and back priming of interior finish carpentry.

56.2 ACTION SUBMITTALS

A. Product Data:

1. Interior trim.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors 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. Include chemical-treatment manufacturer's written instructions for finishing treated material.

2. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

56.3 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.

2. Provide air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

56.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until

building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

56.5 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's 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. For exposed lumber, mark grade stamp on end or back of each piece.

56.6 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.

2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.

4. Do not use material that is warped or does not comply with requirements for untreated material.

5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.

6. Application: Where indicated on Drawings.

56.7 INTERIOR TRIM

A. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: Verify local availability before retaining species and grades listed below.

a. Eastern white pine; NeLMA or NLGA D Select.
b. Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NLGA or WWPA D Select (Quality).
c. Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NeLMA, NLGA, or WWPA D Select (Quality).
d. White woods; WWPA D Select.
e. Douglas fir-larch or Douglas fir south; NLGA, WCLIB, or WWPA Superior or C & Btr finish.
f. Spruce-pine-fir; NeLMA, NLGA, WCLIB, or WWPA 1 Common.
g. Alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; NHLA A Finish.

2. Maximum Moisture Content for Softwoods: 15 percent with at least 85 percent of shipment at 12 percent or less.

3. Maximum Moisture Content for Hardwoods: 10 percent.

4. Finger Jointing: Not allowed.

5. Face Surface: Surfaced (smooth).

56.8 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

56.9 FABRICATION

A. Back out or kerf backs of the following members, except those with ends exposed in finished work:

1. Interior standing and running trim, except shoe and crown molds.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

56.10 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

56.11 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

56.12 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and align with adjacent materials.

1. Use concealed shims where necessary for alignment.

2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

56.13 INSTALLATION OF INTERIOR TRIM

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.

1. Do not use pieces less than 24 inches long, except where necessary.

2. Stagger joints in adjacent and related standing and running trim.

3. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.

4. Use scarf joints for end-to-end joints.

5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

6. Install trim after gypsum-board joint finishing operations are completed.

7. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.

8. Fasten to prevent movement or warping.

9. Countersink fastener heads on exposed carpentry work and fill holes.

56.14 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements.

1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

56.15 CLEANING

A. Clean interior finish carpentry on exposed and semi exposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

56.16 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

56.17 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LVII - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

57.1 SUMMARY

A. Article Includes:

1. Plastic-laminate-clad architectural cabinets.

2. Cabinet hardware and accessories.

3. Miscellaneous materials.

B. Related Requirements:

1. ARTICLE LIV ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

2. ARTICLE LVIII SOLID SURFACING FABRICATIONS for countertops.

57.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Articles to support loads imposed by installed and fully loaded cabinets.

57.3 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad architectural cabinets.

2. Cabinet hardware and accessories.

3. Miscellaneous materials.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.

2. Show large-scale details.

3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Articles.

4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

D. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.

a. Provide one sample applied to core material with specified edge material applied to one edge.

57.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For the following:

1. Composite wood products.

2. High-pressure decorative laminate.

3. Adhesives.

57.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

57.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

57.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

57.8 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

57.9 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork and installation comply with requirements of grades specified.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Face frame.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

F. Exposed Surfaces:

1. Plastic-Laminate Grade: VGS.

2. Edges: Grade VGS.

3. Pattern Direction: Horizontally for drawer fronts, doors, and fixed panels.

G. Semi exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, ISO 4586-3.

a. For semi exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.

2. Drawer Sides and Backs: Hardwood plywood .

3. Drawer Bottoms: Hardwood plywood.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.

I. Drawer Construction: Fabricate with exposed fronts fastened to sub-front with mounting screws from interior of body.

1. Join sub-fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated on the drawings by laminate manufacturer's designations.

57.10 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Softwood Plywood: DOC PS 1, medium-density overlay.

57.11 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Butt Hinges: 2-3/4-inch, five-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:

1. Semi concealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.

C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

D. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.

E. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

F. Drawer Slides: ANSI/BHMA A156.9.

1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.

a. Type: Full extension.
b. Material: Aluminum slides.

G. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

H. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: As selected by Architect from manufacturer's full range.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Brass, Blackened, Bright Relieved, Clear Coated: ANSI/BHMA 610 for brass base; ANSI/BHMA 636 for steel base.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

57.12 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dipped galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.

57.13 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

57.14 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

57.15 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

57.16 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi exposed surfaces.

57.17 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LVIII - SOLID SURFACING FABRICATIONS

58.1 SUMMARY

A. Article Includes:

1. Solid surface material countertops, including:

a. Solid surface material backsplashes.
b. Solid surface material end splashes.
c. Solid surface material apron fronts.

2. Solid Surface door threshold.

B. Related Requirements:

1. ARTICLE XXXIII PLUMBING for sinks and plumbing fittings.

58.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: Provide detail fabrication drawings.

1. For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

a. Show locations and details of joints.
b. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. Solid Surface Material, 6 inches square.

58.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

58.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

58.5 QUALITY ASSURANCE

A. To ensure warranty coverage, provide manufacturer certified solid surfacing fabricators to fabricate the solid surfacing material being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Minimum of 5 years of experience working with solid surfacing materials is required of fabricators. Submit solid surfacing material manufacturer's certification attesting to fabricator qualification approval.

B. Installer Qualifications: Fabricator of countertops.

58.6 FIELD CONDITIONS

A. Field Measurements:

1. Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

58.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

58.8 WARRANTY

A. Provide manufacturer's warranty to repair or replace defective materials, excluding damages caused by physical or chemical abuse or excessive heat, and workmanship for a period of 10 years from date of final acceptance of the work.

58.9 SOLID SURFACE MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Type: Provide Standard type unless Special Purpose type is indicated.

2. Colors and Patterns: Provide pattern and color for all solid surfacing material components and fabrications as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers. Provide products with consistent patterned color throughout thickness of the product.

3. Surface Finish: Provide a uniform appearance on exposed finished surfaces and edges. Exposed surface finish is:

a. Countertop: Semigloss; gloss rating of 25-50.
b. Door Threshold: Matte; gloss rating of 5-20.

58.10 FABRICATION - SOLID SURFACE COUNTERTOPS

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: Radius edge with apron, 1-1/2 inches high with slightly eased edges.

2. Backsplash: Straight, slightly eased at corner.

3. End Splash: Matching backsplash.

C. Countertops:

1. 1/2-inch- thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints:

1. Fabricate countertops without joints where possible.

2. If needed, fabricate countertops in sections for joining in field.

a. Joint Locations: Not within 18 inches of a sink and not where a countertop section less than 36 inches long would result, unless unavoidable.
b. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
c. Form joints and seams between solid surfacing material components using manufacturer’s approved seam adhesive. Provide inconspicuous joints in appearance without voids to create a monolithic appearance.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

58.11 FABRICATION – SOLID SURFACE DOOR THRESHOLD

A. Fabricate solid surface door threshold in thickness and profile as indicated in the drawings.

58.12 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Provide silicone sealant, mildew-resistant, single-component, non-sag, plus 25 percent and minus 25 percent movement capability, acid-curing; ASTM C920, Type S, Grade NS, Class 25, Use NT; clear formulation; approved for use by the solid surfacing material manufacturer.

C. Mounting Hardware: Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

58.13 EXAMINATION

A. Examine substrates to receive solid surface material and conditions under which the solid surface component will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops. Install all components and fabricated units plumb, level, and rigid.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

58.14 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten sub-tops to cabinets by screwing through sub-tops into corner blocks of base cabinets. Shim as needed to align sub-tops in a level plane.

C. Secure countertops to sub-tops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

G. Use specified silicone sealant to seal all expansion joints between solid surfacing material components and all joints between solid surfacing material components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Provide sealant bead smooth and uniform in appearance and minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Provide continuous bead and run the entire length of the joint being sealed.

H. Door Threshold: Set door threshold over a bed of adhesive as recommended by solid surface manufacturer.

I. Make plumbing connections to sinks and lavatories in accordance with ARTICLE XXXIII PLUMBING.

58.15 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LIX - BENTONITE WATERPROOFING

59.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D3776/D3776M	(2020) Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
ASTM D4833/D4833M	(2007; R 2020) Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
ASTM D5084	(2016a) Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D5385/D5385M	(2025) Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
ASTM D5891/D5891M	(2025) Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners

59.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, manufacturer’s instructions, protection, and correction procedures.

59.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle bentonite waterproofing materials in original manufacturer's packaging and in strict accordance with manufacturer's printed instructions. Do not place or store bentonite materials in wet areas or during precipitation. Protect materials and accessories from moisture. Remove and replace products that show evidence of exposure to moisture prior to completion of installation. Remove materials which show evidence of damage, deterioration, or contamination.

B. Provide bentonite products and containers with manufacturer's labels intact and identifying all materials.

59.4 WARRANTY

A. Special Manufacturer Warranty: Manufacturer's standard form in which waterproofing manufacturer agrees to furnish waterproofing material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within a period of 5 years from date of acceptance of work by the Government.

B. Source Limitations: Provide waterproofing system materials and accessory products from single source from single manufacturer.

59.5 PERFORMANCE REQUIREMENTS

A. General: Waterproofing system must be capable of performing as a continuous watertight installation and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Waterproofing must accommodate normal substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without resultant moisture deterioration.

B. Compatibility: Provide waterproofing system materials that are compatible with one another and with adjacent materials under conditions of service and application required, as demonstrated by waterproofing manufacturer based on testing and field experience.

59.6 HDPE/BENTONITE WATERPROOFING SYSTEM

A. Composite, High Density Polyethylene (HDPE) / Bentonite Membrane: Provide composite membrane consisting of 20-mil thick, HDPE geomembrane liner bonded to up to 1.0 psf layer of bentonite clay granules, with a spun high-density polyethylene facing.

B. Composite HDPE/Bentonite Membrane Performance Requirements

1. Puncture Resistance, ASTM E154/E154M: 155 lbf minimum;
2. Tensile Strength, ASTM D412: 500 percent minimum;
3. Elongation, ASTM D412: 500 percent minimum;
4. Vapor Permeance, ASTM E96/E96M: 0.029 perms maximum;
5. Resistance to Hydrostatic Head, ASTM D5385/D5385M: 25 ft of water
6. Color: Gray/Black

C. Accessory Materials

1. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 sieve.
2. Bentonite Mastic: Trowelable consistency, bentonite compound, containing not less than 55 percent high swelling Wyoming sodium bentonite, specifically formulated for application at joints and penetrations.
3. Termination Bar: Extruded aluminum or formed stainless steel bars with upper flange to receive sealant.
4. Plastic Protection Sheet: Polyethylene sheeting complying with ASTM D4397; thickness recommended by waterproofing manufacturer to suit application but at least 6 mils thick.
5. Cement Grout Patching Material: manufacturer’s recommended grout mix compatible with substrate being patched.
6. Masonry Fasteners: Case-hardened, nails or hardeneed0steel, powder0actuated fasteners, Depending on manufacturer’s written requirements, provide ½ or 1 inch diameter washers under fastener heads.
7. Tapes: Waterproofing manufacturer's recommended tape for joints between sheets, membranes, or panels. Use with recommended adhesive bonding primer.
8. Reinforced Overlap Seam Tape: Reinforced, rubberized-asphaltic waterproofing seam

tape 4-inch wide by 60 mils thick for sealing membrane overlaps where flood testing is required.

9. Non-Reinforced Overlap Tape: Non-reinforced, adhesive tape of partially cross-linked polymeric elastomers 2 inch by 1/8 inch for molding form-fit seals around contours and for taping seams within overlaps.

10. Double-Sided Bentonite Laminate Tape: Pressure sensitive, double-sided tape laminate of bentonite sandwiched between a netting and non-woven fabric for wrapping through-concrete imbeds and other detailing.

11. Water stops: Flexible, reinforced, bentonite-laminate water stop strips 1/2 inch by 1 inch with pressure-sensitive adhesive backing for sealing static cold joints in concrete.

12. Joint Sealants: Single component, high performance, medium-modulus, low-VOC, UV-stable, non-sag polyurethane sealant.

13. Primer: Adhesive bonding agent primer formulated for use with tapes and pressure sensitive waterproofing accessories.

D. Waterproofing Protection: Provide protection course as indicated in the drawings. Provide protection board products recommended in writing by waterproofing manufacturer to suit project conditions. Protection board must be 1/4 inch thick semirigid board with mineral-reinforced asphaltic core laminated between an asphalt-saturated felt liner on one side and a weather-coated, glass-mat liner covered with a bond-breaking film on the other.

59.7 SURFACE PREPARATION

A. Examine surfaces prior to treatment, eliminate irregularities and remove loose and foreign material. Remove form tie rods. Point cracks and honeycombs in concrete surfaces. Make surfaces of finished patches flush with adjacent concrete surfaces. Allow cement mortar to dry for minimum of 72 hours prior to application of bentonite membrane.

59.8 APPLICATION

A. Apply bentonite waterproofing on exterior surfaces of below grade concrete walls and under elevator pits where indicated, in accordance with manufacturer's printed instructions. Securely fasten panels over all construction joints and all expansion joints. Thoroughly pack all through-wall openings and penetrations with bentonite gel, granular bentonite, or both, prior to placement of bentonite membrane.

59.9 GENERAL INSTALLATION

A. Install a continuous layer of waterproofing membrane with ends and edges lapped a minimum of 5 inches. Stagger end joints between membranes. Seal joints with seam tape. Treat fastener penetrations. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane according to manufacturer's details. Apply bentonite mastic at changes of plane, construction joints in substrate, projections and penetrations. Provide all necessary details and materials to properly seal any penetrations to the bentonite membrane (i.e. boots, gaskets, and clamps).

59.10 BELOW-SLAB WATERPROOFING

A. Apply waterproofing membrane with HDPE side down. Install membrane sheets bentonite-side up with edges overlapped 4-inch minimum over substrate. Staple ends and edges where subject to displacement during concrete placement. Position membrane to stagger end laps 12 inches. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls and extend a minimum of 12 inches. Install under slabs

starting at lowest point, install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches. Protect waterproofing from damage caused by reinforcing supports with sharp edges.

59.11 INSTALLATION OVER BACKFILLED CONCRETE WALL

A. Install bentonite membrane with the bentonite side in direct contact with concrete or wall. Install membrane with a minimum 4-inch sheet edge overlap. Tack membrane to highest point of wall. Install 2-inch-wide non-reinforced adhesive tape inside the seam and 4-inch wide reinforced overleap seam tape over all seam edges of the HDPE sheet using a hand roller to ensure tape is securely bonded. Detail all waterproofing system penetrations in accordance with manufacturer's current procedures and details; contact manufacturer for procedures and details for project conditions not provided in application instructions. Inspect finished membrane installation and repair any damaged waterproofing materials prior to backfill material placement. Assure that membrane is not displaced during backfill material placement. Install a continuous layer of protection board over bentonite membrane. Treat joints per manufacturer's recommendations.

59.12 PROTECTION

A. Protect bentonite membrane during backfilling and compaction in accordance with manufacturer's printed instructions. If backfill is not immediately applied, protect panels from precipitation by completely covering exposed panels with polyethylene; remove polyethylene immediately prior to backfilling. Replace damaged panels with new panels before and during backfilling and compaction.

59.13 BACKFILL

A. Backfill with smooth and uniform material with no sharp projections. Compact backfill to at least 85 percent of ASTM D1557 maximum density. Ensure backfill material is not contaminated with salt or other materials that could prevent bentonite from hydrating.

59.14 CORRECTIONS

A. Repair leaks and defective areas in accordance with manufacturer's printed instructions.

59.15 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LX - THERMAL INSULATION

60.1 SUMMARY

A. Article Includes:

1. Polyisocyanurate foam-plastic board insulation.

2. Mineral-wool blanket insulation.

60.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Polyisocyanurate foam-plastic board insulation

2. Mineral-wool blanket insulation

60.3 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

60.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

60.5 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

60.6 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.

1. Minimum R-value

a. Exterior walls: Must have a minimum R value of 6.5.

60.7 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; complying with ASTM E136 for combustion characteristics.

1. Exterior walls: Must have a minimum R-value of 13.

2. Minimum R-value

a. Exterior walls: Must have a minimum R-value of 13.
b. Roof: Must have a layer of minimum R-value 11LS over a layer of minimum R-value 19.

3. Minimum Thickness

a. Exterior walls: 10 inches minimum
b. Roof: 3 ½ inches (R-11LS) over 6 inches (R-19)

60.8 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

D. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

60.9 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-

spread and smoke-developed indexes of 5, per ASTM E84.

2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Miscellaneous Application Accessories:

1. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.

2. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.

3. Clip-and-Pin Components:

a. Beam/Bar Joist Clips: For beams, bar joists, and Z-type purlins.
b. C-Purlin Clips: For C-type purlins.
c. Tube Clips: For wood beams and metal tubular framing.

4. Insulation Support Banding

a. Material: Stainless steel.

60.10 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

60.11 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

60.12 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

5. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install unfaced blanket insulation over ceiling area in thickness indicated. Where partitions occur, extend insulation up either side of partition.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

2. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

60.13 INSTALLATION OF BOARD INSULATION

A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

60.14 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

60.15 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXI - WEATHER BARRIERS

61.1 SUMMARY

A. Article Includes:

1. Fluid applied, vapor permeable air barrier assembly

B. Related Requirements:

1. ARTICLE LV SHEATHING.

2. ARTICLE LX THERMAL INSULATION.

3. ARTICLE LXX JOINT SEALANTS.

61.2 ACTION SUBMITTALS

A. Product Data:

1. Fluid applied vapor permeable air barrier assembly

B. Product Data Submittals: Include manufacturer’s written instructions for evaluating, preparing, and treating substrate; safety data sheets; standard details; technical data; and tested physical and performance properties of weather barrier.

C. Shop Drawings: Show locations and extend of weather barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

61.3 INFORMATIONAL SUBMITTALS

A. Tests and Evaluation Reports: For water-resistive barrier, from ICC-ES.

61.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer must have minimum five (5) years experience with installation of similar weather barrier assemblies under similar conditions.

2. Installation must be in accordance with manufacturer’s installation guidelines and recommendations.

3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

61.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver weather barrier materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for mixing with other components.

B. Store weather barrier materials as recommended by the manufacturer in a protected area and out of direct sunlight. Protect materials from rain and physical damage.

61.6 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit weather barrier system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

61.7 WARRANTY

A. Warranty Period: 10 years from date of Substantial Completion.

61.8 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: Henry Air-Bloc All Weather STPE (or approved equal)

B. Approved Equal: Any manufacturer providing weather barriers that meet the material, application, performance, and color requirements.

61.9 WEATHER BARRIERS

A. Fluid Applied Vapor Permeable Air Barrier:

1. UV-resistant, moisture cure, single-component STPE water-resistive air-barrier

a. Water Vapor Permeance: ASTM E96
b. Air Leakage: ASTM E2357
c. Elongation (ASTM D412): 350 percent
d. Flame spread and smoke development (ASTM E84): Class A
e. UV Resistance: Accelerated weathering (ASTM G154): greater than 5000 hours; UV resistance during construction: 12 months; Allowed under
f. VOC content, max (EPA Method 24): 25g/L
g. Color: Black

61.10 ACCESSORY MATERIALS

A. Requirement: Provide primers, flashing, thru-wall flashing, sealants, adhesives, and other accessory materials that are recommended in writing by weather barrier manufacturer to produce a complete weather barrier assembly and that are compatible with primary weather barrier material and adjacent construction to which they may seal.

61.11 INSTALLATION OF WEATHER BARRIERS

A. Weather Barriers:

1. Fluid applied vapor permeable air barrier: Comply with manufacturer's written instructions and warranty requirements.

2. Verify the substrate is in accordance with Air Barrier Manufacturer requirements and as specified in this Article prior to air barrier installation.

3. Install weather barrier accessories for complete installation with weather barriers in

accordance with manufacturers written instructions.

4. Fastener Penetrations:

   a. It is the responsibility of the post-applied fastening component installer to preserve the integrity of the air barrier.
   b. Supplemental sealant may be required at the point of fastener penetration depending on fastened component profiles, substrate type, and fastener installation workmanship.
   c. Contact the Air Barrier Manufacturer for project specific recommendations.

61.12 PROTECTION

A. Protect air barrier from damage by other trades.

B. Install cladding as soon as practical after application. Refer to product specific technical data sheet for product limitations.

61.13 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXII - VAPOR RETARDERS

62.1 SUMMARY

A. Article Includes:

1. Reinforced polypropylene vapor retarder.

62.2 ACTION SUBMITTALS

A. Product Data:

1. Reinforced polypropylene vapor retarder.

62.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

62.4 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: Lamtec WMP-50 (or approved equal)

B. Approved Equal: Any manufacturer providing vapor retarders that mee the material, performance, color, and installation requirements,

62.5 REINFORCED POLYPROPYLENE VAPOR RETARDERS

A. Polypropylene Vapor Retarders

1. Puncture Resistance: ASTM C1136
2. Tensile Strength: ASTM C1136
3. Thickness: 10-mil thick sheet
4. Permeance: ASTM E96, with maximum permeance rating of 0.02 perm.
5. Bursting Strength: ASTM D774
6. Mold Resistance: ASTM C665 / C1338
7. Dimensional Stability: ASTM D1204
8. Light Reflectance: ASTM C523
9. Flame Spread: UL-723
10. Surface Burning Characteristics: ASTM E84

B. Color:

1. Admin Building: Black coated polypropylene

2. Maintenance Shop: White coated polypropylene

62.6 ACCESSORIES

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

62.7 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

62.8 INSTALLATION OF VAPOR RETARDERS ON FRAMING

A. Place vapor retarders on side of construction indicated on Drawings.

B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

62.9 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction.

62.10 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXIII - FORMED METAL ROOF PANELS

63.1 SUMMARY

A. Article Includes:

1. Tapered-rib-profile, exposed-fastener metal roof panels.

B. Related Requirements:

1. ARTICLE LX THERMAL INSULATION for insulation installed under metal panels

2. ARTICLE LXV FORMED METAL WALL PANELS for factory-formed metal wall panels.

3. ARTICLE LXVII SHEET METAL FLASHING AND TRIM for formed sheet metal flashings and roof drainage items.

63.2 ACTION SUBMITTALS

A. Product Data:

1. For formed metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: Actual sample of finished products for each type of exposed finish for metal panels, clips, fasteners, closures, and other metal panel accessories.

1. Size: Manufacturers' standard size.

63.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For formed metal roof panels, for tests performed by a qualified testing agency.

B. Qualification Statements: For roof installers.

C. Sample warranties.

63.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels.

63.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this Article with minimum five years experience in manufacture of similar products in successful use in similar applications.

B. Installer Qualifications: Experienced installer with minimum of five years experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic, able to communicate with Owner, Architect, and installers, supervising work on site whenever work is underway.

63.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

63.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written installation instructions and warranty requirements.

63.8 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

63.9 WARRANTY

A. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

63.10 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: MBCI Metal Roof and Wall Systems 7.2 Panel (or approved equal)

B. Approved Equal: Any manufacturer providing panels that meet the material, coating, profile, structural, performance, and installation requirements.

63.11 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:

1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.

3. Deflection Limits: As indicated on Drawings.

B. Air Infiltration: Air leakage of not more than 0.04 cfm/sq. ft. when tested in accordance with ASTM E1680 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

63.12 TAPERED-RIB-PROFILE, EXPOSED-FASTENER METAL ROOF PANELS

A. Panels: Formed with raised, trapezoidal ribs spaced at regular intervals.

1. Structural Support: Over open framing.

2. Material: Aluminum.

3. Panel Profile: Flat pan between major ribs.

4. Rib Spacing: 7.2 inches o.c.

5. Panel Coverage: 36 inches.

6. Panel Height: 1.5 inches.

7. Fasteners: Manufacturer's standard screw fasteners.

8. Color: Pacific Blue

63.13 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Sheet pre-painted by coil-coating process to comply with ASTM A755/A755M.

1. Nominal Thickness: 0.028 inch.

63.14 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub-framing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system, including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness in accordance with manufacturer's recommendations. Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with manufacturer's recommendations. Finish downspouts to match gutters.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

G. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

63.15 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's recommendations.

5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by metal panel manufacturer for application, but not less than thickness of metal being secured.

63.16 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

63.17 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

63.18 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written recommendations.

63.19 INSTALLATION OF VAPOR RETARDER

A. Loosely lay vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.

2. Continuously seal side and end laps with per manufacturer’s recommendation.

63.20 INSTALLATION OF ROOF INSULATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, in accordance with manufacturer's written installation instructions.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.

63.21 INSTALLATION OF METAL ROOF PANELS

A. Install metal panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that are concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel Work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to exterior; use galvanized-steel fasteners for surfaces exposed to interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Exposed-Fastener, Metal Roof Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.

2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.

3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.

4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

5. Flash and seal panels with weather closures at perimeter of all openings.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that are without buckling and tool marks, and that are true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft., with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c., using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

H. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.

I. Pipe and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.

63.22 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal panel installation, including accessories. Report results in writing.

B. Remove and replace applications where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

63.23 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

63.24 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXIV - STANDING-SEAM METAL ROOF PANELS

64.1 SUMMARY

A. Article Includes:

1. Vertical-rib, seamed-joint, standing-seam metal roof panels.

B. Related Requirements:

1. ARTICLE LX THERMAL INSULATION for insulation located in the roof assembly.

2. ARTICLE LXII VAPOR RETARDERS for vapor retarders located under roof insulation.

64.2 ACTION SUBMITTALS

A. Product Data:

1. For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: Actual sample of finished products for each type of exposed finish for metal panels and metal panel accessories.

1. Size: Manufacturers' standard size.

64.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For standing-seam metal roof panels, for tests performed by a qualified testing agency.

B. Qualification Statements: For roof installers.

C. Sample warranties.

64.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels.

64.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage a single firm to assume undivided responsibility for installing all components of the Roofing System including all related sheet metal flashings and all of the components. The installer must be authorized or licensed by the panel manufacturer to install manufacturer's products and that is eligible to receive manufacturer's warranty. The actual work must be supervised by personnel trained by the manufacturer in proper application of the product. The installer must have capability for preparing shop details and fabrication of all flashings not furnished by the panel manufacturer. Installer must execute 100% of metal roof system installation with installer's' own forces.

64.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

64.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written installation instructions and warranty requirements.

64.8 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

64.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including rupturing, cracking, or puncturing.
    b. Deterioration of metal and other materials beyond normal weathering.

2. Warranty Period: One year from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 25 years from date of Substantial Completion.

64.10 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: MCBI SuperLok Metal Roof Panels (or approved equal)

B. Approved Equal: Any manufacturer providing panels that meet the material, coating, profile, structural, performance, and installation requirements.

64.11 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:

1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.

3. Deflection Limits: As indicated on Drawings.

B. Air Infiltration: Air leakage of not more than 0.09 cfm/sq. ft. when tested in accordance with ASTM E1680 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646 at the following test-pressure difference:

D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

F. FM Approvals Listing: Provide metal roof panels and component materials that comply with requirements in FM Approvals 4471 as part of a panel roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

H. Energy Performance:

64.12 STANDING-SEAM METAL ROOF PANELS, GENERAL

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed fasteners in side laps. Include all accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

64.13 VERTICAL-RIB, SEAMED-JOINT, STANDING-SEAM METAL ROOF PANELS

A. Panels: Formed with vertical ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

1. Structural Support: Over open framing.

2. Material: Metallic-coated steel.

3. Seam Type: Manufacturer's standard.

4. Panel Profile: Smooth striated.

5. Panel Coverage: 16 inches.

6. Panel Height: 2.0 inches.

7. Clips: Two pieces, floating, designed to accommodate thermal movement.

a. Steel Clips: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, in thickness indicated on shop drawings.
b. Clip Spacing: As indicated on approved Shop Drawings.

8. Color: Bone White

64.14 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Pre-painted by the coil-coating process to comply with ASTM A755/A755M.

1. Nominal Thickness: 0.028 inch.

2. Surface: Smooth with striations finish.

64.15 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub-framing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 coating designation. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, fasteners, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness in accordance with manufacturer's recommendations. Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10 ft. long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with manufacturer's recommendations. Finish downspouts to match gutters.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

64.16 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.

64.17 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

64.18 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

64.19 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written installation instructions.

64.20 INSTALLATION OF VAPOR RETARDER

A. Loosely lay vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.

2. Continuously seal side and end laps per manufacturer’s recommendation.

64.21 INSTALLATION OF ROOF INSULATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, in accordance with manufacturer's written installation instructions.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.

64.22 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

A. Install metal panels in accordance with manufacturer's written installation instructions and approved Shop Drawings in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Concealed Clip, Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.

2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

4. Watertight Installation:

a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommended in writing by manufacturer as needed to make panels watertight.
b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

F. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

H. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.

I. Pipe and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.

64.23 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

64.24 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair

by finish touchup or similar minor repair procedures.

64.25 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXV - FORMED METAL WALL PANELS

65.1 SUMMARY

A. Article Includes:

1. Concealed-fastener, lap-seam metal wall panels.

B. Related Requirements:

65.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

1. Concealed-fastener, lap-seam metal wall panels.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

65.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For concealed-fastener, lap-seam metal wall panels, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

65.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to be included in maintenance manuals.

65.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

65.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for

drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

65.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

65.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

65.9 WARRANTY

A. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

65.10 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: PAC-CLAD Precision Series Wall Panel System (or approved equal).

B. Approved Equal: Any manufacturer providing panels that meet the material, coating, profile, structural, color, performance, and installation requirements.

65.11 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: As indicated on Drawings.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature

changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

65.12 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weather tight installation.

B. Creased-Rib-Profile, Concealed-Fastener Metal Wall Panels MTL-1: Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.

1. Basis of Design: PAC-CLAD Precision Series Wall Panel – Highline S1 (or approved equal)

2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

a. Thickness: 0.032 inches.
b. Surface: Smooth, flat finish.
c. Exterior Finish: Two-coat fluoropolymer.
d. Color: Pacific Blue (or approved equal).

3. Panel Coverage: 12 inches.

4. Panel Height: 1-3/8".

C. Box-Rib-Profile, Concealed-Fastener Metal Wall Panels MTL-2: Formed with raised, center-creased, square major ribs; with reveal joint between panels.

1. Basis of Design: PAC-CLAD Precision Series Wall Panel – Box Rib 1 (or approved equal)

2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

a. Thickness: 0.032 inches.
b. Surface: Smooth, flat finish.
c. Exterior Finish: Two-coat fluoropolymer.
d. Color: Musket Gray (or approved equal).

3. Panel Coverage: 12 inches.

4. Panel Height: 1-3/8".

D. Creased-Rib-Profile, Concealed-Fastener Metal Wall Panels MTL-3: Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.

1. PAC-CLAD Precision Series Wall Panel – Highline B1 (or approved equal)

2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

   a. Thickness: 0.032 inches.
   b. Surface: Smooth, flat finish.
   c. Exterior Finish: Two-coat fluoropolymer.
   d. Color: Granite (or approved equal).

3. Panel Coverage: 12 inches.

4. Panel Height: 1-3/8".

65.13 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub-framing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

   1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.

   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

65.14 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

65.15 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

65.16 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or

blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

65.17 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

65.18 INSTALLATION OF METAL PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

C. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
2. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
3. Stainless Steel Panels: Use stainless steel fasteners.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint

at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

65.19 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

65.20 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXVI - SOFFIT PANELS

66.1 SUMMARY

A. Article Includes:

1. Aluminum-faced composite architectural panels.

66.2 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-faced composite architectural panels.

B. Product Data Submittals:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar trim samples and accessories involving color selection.

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

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

66.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, tests must be performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

66.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to be included in maintenance manuals.

66.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

66.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

66.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

66.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

66.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including rupturing, cracking, or puncturing.
    b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: 15 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

66.10 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: AL13 Architectural Panels (or approved equal)

B. Approved Equal: Any manufacturer providing resinous flooring that meets the material, coating, structure, finish, performance, and installation requirements.

66.11 ALUMINUM-FACED COMPOSITE ARCHITECTURAL PANELS

A. Panel Size: 4 feet x 8 feet

B. Panel Thickness: 0.157 inch (4mm)

C. Core Material: Polyethylene

D. Panel Weight: 1.17 lb/sf

E. Aluminum face sheets: AA A3003-H24 alloy aluminum sheet with nominal thickness of 0.020 inches.

F. Finish: fluorocarbon coating per AAMA 2605.

G. Color: Acorn Grey (or approved equal)

H. Accessories: Attachment framing, fasteners, tapes, gaskets, etc. as required by the manufacturer.

66.12 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide aluminum-faced composite architectural panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.

3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

66.13 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub-framing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

66.14 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal

Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

66.15 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

66.16 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.

2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel

manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

66.17 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

66.18 INSTALLATION OF METAL SOFFIT PANELS

A. Install panel system according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.

2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.

3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.

4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.

2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.

3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

66.19 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

D. Leave panels clean and free of residue. Where required, clean exposed surfaces per manufacturer’s recommendation.

66.20 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXVII - SHEET METAL FLASHING AND TRIM

67.1 SUMMARY

A. Article Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.

2. Underlayment.

3. Miscellaneous materials.

B. Related Requirements:

1. ARTICLE LIV ROUGH CARPENTRY for wood nailers, curbs, and blocking.

2. ARTICLE LXIII FORMED METAL ROOF PANELS for exposed fastener metal roof panels and accessories.

3. ARTICLE LXIV STANDING SEAM METALL ROOF PANELS for concealed fastener metal roof panels and accessories.

4. ARTICLE LXV FORMED METAL WALL PANELS for factory formed aluminum wall panels with concealed fasteners and accessories.

5. ARTICLE LXX JOINT SEALANTS for exterior joints.

6. ARTICLE LXXI HOLLOW METAL DOORS AND FRAMES for exterior standard steel doors and frames.

7. ARTICLE LXXIII OVERHEAD COILING DOORS.

8. ARTICLE LXXV ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

9. ARTICLE LXXVIII FIXED LOUVERS.

67.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.

2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.

3. Identification of material, thickness, weight, and finish for each item and location in Project.

4. Details for forming, including profiles, shapes, seams, and dimensions.

5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.

6. Details of termination points and assemblies.

7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.

8. Details of roof-penetration flashing.

9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counter flashings.

10. Details of special conditions.

11. Details of connections to adjoining work.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

67.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

67.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

67.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

67.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

67.7 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

67.8 WARRANTY

A. The Contractor must execute to the Owner a 5-year written warranty that the installation will be watertight and that any leaks which develop during that the period which are not due to improper use or willful damage will be repaired at no cost to the Owner.

B. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

67.9 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

67.10 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with

minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Pre-painted by the coil-coating process to comply with ASTM A755/A755M.

1. Nominal Thickness: 0.034 inch.

2. Surface: Smooth, flat.

3. Exposed Coil-Coated Finish:

   a. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Color: As selected by Architect from manufacturer's full range.

67.11 UNDERLAYMENT

A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

67.12 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, soldier, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

67.13 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.

4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with SMACNA recommendations.

E. Fabricate cleats and attachment devices from same material as accessories being anchored or from compatible, noncorrosive metal.

F. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

G. Do not use graphite pencils to mark metal surfaces.

67.14 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.

2. Fabricate in minimum 96-inch- long sections.

3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.

4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

5. Gutter Profile: as indicated.

6. Expansion Joints: Butt type with cover plate.

7. Accessories: Stainless steel wire-ball downspout strainer.

8. Gutters: Fabricate from the following materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.040-inch thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows.

1. Hanger Style: As detailed, or if not details per SMACNA figure designation 1-35D.

2. Fabricate from the following materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.063-inch thick.

67.15 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing and Fascia Cap: Fabricate in minimum 96-inch- long but not exceeding 12 ft. long sections. Furnish with 6-inch- wide, joint cover plates.

1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.

2. Fabricate from the following materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.040-inch thick.

B. Expansion-Joint Cover: Fabricate expansion-joint cover from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.040-inches thick.

C. Base Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.040-inches thick.

D. Counterflashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.040-inch thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.040-inch thick.

67.16 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. At Windows and Doors:

a. Aluminum Window and Doors: Fabricate from 0.062-inch aluminum sheet.
b. Steel Doors: Fabricate from 0.034-inch aluminum-zinc coated steel sheet.

2. Color to match color of window or door trim.

67.17 EXAMINATION

A. Examine substrates, areas, and conditions with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

67.18 INSTALLATION OF UNDERLAYMENT

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.

1. Install in shingle fashion to shed water.

2. Lap joints not less than 2 inches.

67.19 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.

3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.

4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.

5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.

6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.

7. Do not field cut sheet metal flashing and trim by torch.

8. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.

2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate, not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

2. Prepare joints and apply sealants to comply with requirements in ARTICLE LXX JOINT SEALANTS.

67.20 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with joints sealed with sealant.

2. Provide for thermal expansion.

3. Attach gutters at eave or fascia to firmly anchor them in position.

4. Provide end closures and seal watertight with sealant.

5. Slope to downspouts.

6. Fasten gutter spacers to front and back of gutter.

7. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.

8. Anchor gutter with gutter brackets spaced not more than 24 inches apart to roof deck unless otherwise indicated and loosely lock to front gutter bead.

9. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft. apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.

2. Provide hangers with fasteners designed to hold downspouts securely 1 inch away from walls.

3. Locate hangers at top and bottom and at approximately 60 inches o.c.

4. Provide elbows at base of downspout to direct water away from building.

D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

67.21 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.

2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.

2. Extend counterflashing 4 inches over base flashing.

3. Lap counterflashing joints at a minimum of 4 inches.

4. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

67.22 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

67.23 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

67.24 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

67.25 BASIS OF MEASUREMENT AND PAYMENT

A. Work under this Article will not be measured nor paid for separately but should be considered incidental to and included in the prices bid for the various items of work in this

project.

END OF ARTICLE

ARTICLE LXIX - PENETRATION FIRESTOPPING

69.1 SUMMARY

A. Article Includes:

1. Penetration firestopping systems.

2. Penetrations in fire-resistance-rated walls.

3. Exposed penetration firestopping systems.

B. Related Requirements:

1. ARTICLE LXX JOINT SEALANTS for non-fire-resistance-rated joint sealants.

69.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

69.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

69.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

69.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

69.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other

causes.

B. Install and cure penetration firestopping system materials in accordance with manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

69.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be accessed and installed in accordance with specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

69.8 SOURCE LIMITATIONS

A. Obtain penetration firestopping systems for each type of opening indicated by a single manufacturer.

69.9 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform penetration firestopping system tests.

2. Test in accordance with testing standards referenced in ARTICLE LXIX PENTRATION FIRESTOPPING. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems installed with products bearing the classification marking of a qualified testing agency.

- UL in its online directory "Product iQ."
- Intertek Group in its "Directory of Building Products."

B. Provide components for each penetration firestopping system that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.

C. Provide components for each penetration firestopping system that do not contain ethylene glycol.

D. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.

E. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.

69.10 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems must be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.

1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.

2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

C. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 723.

69.11 ACCESSORIES

A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain the required ratings. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated, including but not limited to:

1. Permanent forming/damming/backing materials.

2. Substrate primers.

3. Collars.

4. Steel sleeves.

69.12 FILL MATERIALS

A. Cast-in-Place Firestopping Devices: Factory-assembled devices for use in cast-in-place concrete floors consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestopping Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

H. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, and when required by a listed system, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed or dislodged.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

K. Thermal and Endothermic Wraps: Flexible, insulating, and fire-resistant protective wraps tested and listed for up to 2-hour fire ratings in accordance with ASTM E814 or UL 1479; for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines, and for thermal barrier and circuit integrity protection in accordance with ASTM E1725 or UL 1724.

L. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.

M. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.

1. Fire-rated cable pathway devices are the preferred product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:

    a. Capable of retrofit around existing cables.
    b. Designed so that two or more devices can be ganged together.
    c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.

2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re-enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.

N. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.

O. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

P. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestopping gasket for use around rectangular steel HVAC ducts without fire dampers.

Q. Firestopping Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

R. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch in diameter.

S. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

69.13 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

69.14 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

69.15 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings in accordance with manufacturer's written instructions and with the following requirements:

1. Remove foreign materials from substrate surfaces that could interfere with adhesion of penetration firestopping materials.

2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

69.16 INSTALLATION

A. General: Install penetration firestopping systems in accordance with manufacturer's written

installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

69.17 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."

2. Contractor's name, address, and phone number.

3. Designation of applicable testing and inspecting agency.

4. Date of installation.

5. Manufacturer's name.

6. Installer's name.

69.18 FIELD QUALITY CONTROL

A. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

B. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

69.19 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

69.20 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXX - JOINT SEALANTS

70.1 SUMMARY

A. Provide all sealants to completely close all joints indicated on the drawings or specified to be sealed to a watertight condition, including the following.

1. Exterior joints.
2. Interior joints.
3. Horizontal traffic-bearing joints.
4. Silicone sealant.
5. Acoustical sealant.

B. Related Work Specified Elsewhere:

1. ARTICLE LVI INTERIOR FINISH CARPENTRY
2. ARTICLE LXVII SHEET METAL FLASHING AND TRIM
3. ARTICLE LXXXVIII INTERIOR PAINTING
4. Where noted in the drawings.

70.2 SUBMITTALS

A. Submit under the provisions of ARTICLE XI REQUIRED SUBMITTALS.

B. Product Data: Submit manufacturer's product data and specifications for type of sealant required for approval.

C. Safety Data Sheets (SDS): Submit SDS for each product.

D. Samples: Submit color finish samples of each sealant for approval.

E. Warranty: Submit warranty as noted under item entitled "WARRANTY"

70.3 WARRANTY

A. The Contractor must submit a written warranty on the sealant for a Two (2) year period after the Date of Project Acceptance. The warranty must provide for the repair of all leaks as well as repair and replacement of sealant and damage to the building and/or its finishes at no cost to the State.

70.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who specializes in installing joint sealants

similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Use manufacturers standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

70.5 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

70.6 PRODUCT 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: Store and handle materials in compliance with manufacturers' written instructions to prevent their deterioration or damage due to moisture, high temperatures, contaminants, or other causes.

70.7 PROJECT CONDITIONS

A. Inspection: Examine joint surfaces and backing, and their anchorage to the structure, and conditions, under which joint sealer work is to be performed, and notify the General 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.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.

70.8 MATERIALS

A. Preformed Foam Sealants: Provide manufacturer's standard preformed, pre-compressed, impregnated, open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; factory produced in pre-compressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following:

1. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

2. Impregnating Agent: Manufacturer's standard.

B. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene-jacketed

polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, nonabsorptive material as recommended for compatibility with sealant by the sealant manufacturer to control the joint depth for sealant placement, to break bond of sealant at bottom of joint, to form optimum shape of sealant bead on back side, and to provide a highly compressible backer which will minimize the possibility of sealant extrusion when joint is compressed.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure.

D. Primer for Sealants: Non-staining, as recommended by the sealant manufacturer.

E. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

F. Sealants:

1. Sealant No. 1, At Exterior Vertical and Overhead Joints: One-part polyurethane-based sealant, conforming to ASTM C 920, Type S, Grade NS, Use NT, Class 25 as applicable.

    a. Chern-Calk 900; Bostik Inc.
    b. Dymonic; Tremco.
    c. Dynatrol I; Pecora Corp.
    d. Or approved equal.

2. Sealant No. 2, At Interior Vertical and Overhead Joints: Non-Elastomeric Sealant; acrylic-emulsion type, conforming to ASTM C 834.

    a. AC-20 Acrylic Latex; Pecora Corp.
    b. Chem-Calk 600; Bostik Inc.
    c. Tremflex 834; Tremco.
    d. Or approved equal.

3. Sealant No. 3, At all Horizontal Traffic-Bearing Joints: Two-part polyurethane-based sealant, conforming to ASTM C 920, Type M, Grade P, Use T, Class 25.

    a. Chem-Calk 550; Bostik Inc.
    b. Urexpan NR-200; Pecora Corp.
    c. SL 2: Sonneborn
    d. Or approved equal.

4. Sealant No. 4, Silicone Sealant: Mildew-resistant, conforming to ASTM C 920; Type S; Grade NS; Class 25; Use NT, formulated with fungicide; intended for sealing interior joints between plumbing fixtures and wall surfaces.

    a. 786 Mildew Resistant; Dow Corning Corp.
    b. 898 Silicone Sanitary Sealant; Pecora Corp.
    c. Trernsil600 White; Tremco.
    d. Or approved equal.

5. Sealant No. 5, Acoustical Sealant: Resilient, non-staining, non-shrinking, non-hardening, non-skinning, nondrying, non-sag interior sealant complying with ASTM C 834.

    a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
    b. SHEETROCK Acoustical Sealant; USG Corp.
    c. Tremflex 834; Tremco.
    d. Or approved equal.

G. Bituminous Joint Filler:

1. Provide resilient and non-extruding type pre-molded 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:

    a. "Elastite"; Celotex.
    b. "Tex-Mastic"; J.P. Petroleum Products.
    c. "Corkfill"; W.R. Meadows.
    d. Or approved equal.

70.9 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

70.10 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that 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.

70.11 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets;

and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

4. Provide flush joint profile in accordance with Figure 8B in ASTM C1193, where indicated on drawings.

70.12 JOINT SEALANT SCHEDULE

A. Sealant and Location: lnstall sealants indicated in joints fitting descriptions and locations as well as in locations where sealant is typically applied and as shown on the drawings, including but limited to, the following locations.

B. Sealant No. 1:

1. Exterior joints and recesses formed where frames of windows and doors adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.

2. Metal-to-metal joints where sealant is required, indicated, or specified.

3. Exterior locations, not otherwise indicated or specified.

C. Sealant No. 2:

1. Small voids between walls or partitions and adjacent casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.

2. Perimeter of frames at doors and windows which adjoin exposed interior concrete and masonry surfaces.

3. lnterior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.

D. Sealant No. 3:

1. Seats of metal thresholds for exterior doors.

2. Control and expansion joints in floors, slabs, flooring, and walkways.

E. Sealant No. 4:

1. 1. Joints between plumbing fixtures and adjoining surfaces.

2. Joints occurring where substrates change.

F. Sealant No. 5:

1. lnterior sealing of exposed joints.

2. Interior sealing of concealed construction joints.

70.13 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

70.14 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

70.15 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXI - HOLLOW METAL DOORS AND FRAMES

71.1 SUMMARY

A. Article Includes:

1. Interior standard steel doors and frames.

2. Exterior standard steel doors and frames.

B. Related Requirements:

1. ARTICLE LXXVI DOOR HARDWARE for door hardware for hollow-metal doors.

71.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

71.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

71.4 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel doors and frames.

2. Exterior standard steel doors and frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, and finishes.

C. Shop Drawings: Include the following:

1. Elevations of each door type.

2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening conditions.

6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.

7. Details of anchorages, joints, field splices, and connections.

8. Details of accessories.

9. Details of moldings, removable stops, and glazing.

D. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

E. Product Schedule: For hollow metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

71.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of windborne-debris impact resistance door for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Field quality-control reports.

71.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

71.7 PERFORMANCE REQUIREMENTS

A. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for basic protection.

1. Large-Missile Test: For glazed openings located within 30 feet of grade.

B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than U-0.61 when tested in accordance with ASTM C1363 or ASTM E1423.

71.8 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule on Drawings.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Polyurethane or Polyisocyanurate with Vertical steel stiffener.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum A60 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Factory Prime. Field paint finish as indicated.

71.9 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door Schedule on Drawings.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Polyurethane or Polyisocyanurate with Vertical steel stiffener.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
b. Side lite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Slip-on drywall.

3. Exposed Finish: Factory Prime. Field paint finish as indicated.

C. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule on Drawings.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Polyurethane or Polyisocyanurate with Vertical steel stiffener.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch.
b. Side lite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Slip-on drywall.

3. Exposed Finish: Factory Prime. Field paint finish as indicated.

71.10 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.

2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

3. Post Installed Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dipped galvanized in accordance with ASTM A153/A153M, Class B.

71.11 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dipped galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in ARTICLE LXXVII GLAZING.

71.12 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Side Lite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.

2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.

3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

71.13 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

71.14 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

71.15 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth,

flush, and invisible on exposed faces. Touch-up finishes.

b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with post installed expansion anchors.

3. Solidly pack mineral-fiber insulation inside frames.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

5. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

D. Glazing: Comply with installation requirements in ARTICLE LXXVII GLAZING and with hollow-metal manufacturer's written instructions.

71.16 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

71.17 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Articles.

71.18 BASIS OF MEASUREMENT AND PAYMENT

A. Work under this Article will not be measured nor paid for separately but should be considered incidental to and included in the prices bid for the various items of work in this

project.

END OF ARTICLE

ARTICLE LXXII - FLUSH WOOD DOORS

72.1 SUMMARY

A. Article Includes:

1. Solid-core flush wood doors with plastic-laminate-faces.

a. Vision panels with impact-resistant glazing.

B. Related Requirements:

1. ARTICLE LXXI HOLLOW METAL DOORS AND FRAMES for door frames.

2. ARTICLE LXXVII GLAZING for glass view panels in flush wood doors.

72.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-core flush wood doors and transom panels with plastic-laminate-faces.

B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.

2. Door edge construction

3. Door face type and characteristics.

4. Door frame construction.

5. Factory-machining criteria.

6. Factory- finishing specifications.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.

2. Door elevations, dimension and locations of hardware, lite cutouts, and glazing thickness.

3. Dimensions and locations of blocking for hardware attachment.

4. Dimensions and locations of mortises and holes for hardware.

5. Clearances and undercuts.

6. Doors to be factory finished and application requirements.

D. Samples for Verification:

1. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.

2. Frames for light openings, 6 inches long, for each material, type, and finish required.

72.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

72.4 CLOSEOUT SUBMITTALS

A. Special warranties.

72.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

72.6 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during remainder of construction period.

72.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of plastic laminate faces.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

72.8 SOURCE LIMITATIONS

A. Obtain flush wood doors from single manufacturer.

72.9 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

72.10 SOLID-CORE FLUSH WOOD DOORS AND VISION PANELS WITH PLASTIC-

LAMINATE FACES

A. Interior Doors, Solid Core with Plastic-Laminate Faces:

1. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.

2. ANSI/WDMA I.S. 1A Quality Grade: Custom.

3. Plastic-Laminate Faces: High-pressure decorative laminates complying with ISO 4586-3, Grade HGS.

4. Colors, Patterns, and Finishes: As indicated.

5. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.

a. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors:

a. Glued wood stave.

7. Construction:

a. Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces and crossbands are applied.

72.11 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads with plastic laminate finish to match door finish unless otherwise indicated.

1. Wood Species: Species compatible with door faces.

2. Profile: Flush rectangular beads.

72.12 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.

2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.

3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in ARTICLE LXXVII - "Glazing".

72.13 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

2. Finish faces, all four edges, edges of cutouts, and mortises.

B. Factory finish doors.

72.14 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

72.15 INSTALLATION

A. Hardware: For installation, see ARTICLE LXXVI - "Door Hardware".

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.

3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

4. Clearances:

   a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
   b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
   c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

72.16 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

72.17 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXIII - ACCESS DOORS AND FRAMES

73.1 SUMMARY

A. Section Includes:

1. Access doors and frames.

B. Related Requirements:

1. Mechanical for heating and air-conditioning duct access doors.

73.2 ALLOWANCES

A. Access doors and frames are part of an access door and frame allowance.

73.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames.

73.4 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Description: Face of door flush with frame, with exposed flange and concealed hinge.

2. Locations: Wall and ceiling.

3. Door Size: As indicated in drawings.

4. Metallic-Coated Steel Sheet for Door: Nominal 0.064-inch, 16 gage, factory finished.

5. Frame Material: Same material, thickness, and finish as door.

6. Latch and Lock: Cam latch, screwdriver operated.

73.5 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS),

exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

73.6 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2. Keys: Furnish two keys per lock and key all locks alike.

73.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.

a. Color: As selected by Architect from full range of industry colors.

73.8 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

73.9 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

73.10 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

73.11 BASIS OF MEASUREMENT AND PAYMENT

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

END OF SECTION

ARTICLE LXXIV - OVERHEAD COILING DOORS

74.1 SUMMARY

A. Article Includes:

1. Insulated service doors.

B. Related Requirements:

1. ARTICLE LI METAL FABRICATIONS for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

74.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.

5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.

2. Bottom bar with sensor edge.

3. Guides.

4. Brackets.

5. Hood.

6. Locking device(s).

7. Include similar Samples of accessories involving color selection.

74.3 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to be included in maintenance manuals.

74.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

74.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

74.6 MANUFACTURERS

A. Basis of Design: Wayne Dalton ThermoTite 800C Rolling Service Door (or approved equal)

B. Approve Equal: Any manufacturer providing insulated overhead coiling doors that meet the material, coating, profile, structural, performance, and installation requirements.

C. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

74.7 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

2. Testing: According to ASTM E330/E330M or DASMA 108 for garage doors and complying with acceptance criteria of DASMA 108.

3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Windborne-Debris Impact Resistance: Provide impact-protective overhead coiling doors that pass ASTM E1886 missile-impact and cyclic-pressure tests according to ASTM E1996 for Wind Zone 1 for basic protection.

1. Large-Missile Test: For overhead coiling doors located within 30 ft. of grade.

D. Seismic Performance: Overhead coiling doors are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.0.

74.8 DOOR ASSEMBLY

A. Service Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

B. Operation Cycles: Door components and operators capable of operating for not less than 200,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Insulated Door Curtain R-Value: R-7.7.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 3-inch center-to-center height.

F. Bottom Bar: Two angles; fabricated from stainless steel.

G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

H. Hood: Galvanized steel.

1. Shape: Round.

2. Mounting: As indicated on Drawings.

I. Locking Devices: Equip door with slide bolt for padlock and chain lock keeper.

J. Electric Door Operator:

1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.

2. Operator Location: Front of hood.

3. Motor Exposure: Interior.

4. Motor Electrical Characteristics:

   a. Horsepower: ½ HP, 120V, single-phase.

5. Emergency Manual Operation: Chain type.

6. Obstruction-Detection Device: NEMA 4 Photo Eyes.

7. Control Station(s): Interior mounted.

8. Other Equipment: Audible and visual signals.

K. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

74.9 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

74.10 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.

2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.

3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding wind locks.

74.11 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

74.12 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Chain Lock Keeper: Suitable for padlock.

C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

74.13 CURTAIN ACCESSORIES

A. Weather Seals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.

2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

74.14 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel

plate.

74.15 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.

2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.

1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.

2. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.

74.16 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

74.17 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

74.18 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

74.19 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

D. Power-Operated Doors: Install according to UL 325.

74.20 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

74.21 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup check according to manufacturer's written instructions.

2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.

3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

74.22 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

74.23 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

74.24 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXV - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

75.1 SUMMARY

A. Article Includes:

1. Aluminum-framed fixed window system.

75.2 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-framed fixed window system.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Operating characteristics, electrical characteristics, and furnished accessories.

C. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.

2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.

3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

E. Samples for Verification: Actual sample of finished products for each type of exposed finish.

1. Size: Manufacturers' standard size.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.

2. Anchorage.

3. Expansion provisions.

4. Glazing.

5. Flashing and drainage.

75.3 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront system.

B. Product Test Reports: For aluminum-framed entrance and storefront systems, for tests performed by a qualified testing agency.

C. Sample Warranties: For aluminum-framed entrance and storefront systems.

75.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.

75.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Ensure that manufacturers meet the requirements specified in this Article and project drawings.

2. Ensure that the manufacturer can provide field service representation during construction, approving acceptable installers and approving application methods.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

75.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

75.7 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: Arcadia AG451T Thermal Center Glazed System for 1" Glass (or approved equal)

B. Approved Equal: Any manufacturer providing glazed aluminum systems that meet the material, finish, profile, structural, and performance requirements.

75.8 SOURCE LIMITATIONS

A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

75.9 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.

C. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

D. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.50 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

   a. Fixed Glazing and Framing Areas: SHGC for the system of not more than <**0.28**.

3. Air Leakage:

   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.

E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.

75.10 ALUMINUM-FRAMED FIXED WINDOWS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.

2. Glazing System: Retained mechanically with gaskets on four sides.

3. Glazing Plane: Center.

4. Finish: Color anodic finish.

5. Fabrication Method: Field-fabricated stick system.

6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

7. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

75.11 GLAZING

A. Glazing: Comply with ARTICLE LXXVII GLAZING.

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

75.12 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.

2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.

3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.

75.13 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

2. Reinforce members as required to receive fastener threads.

B. Anchors: As recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

75.14 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.

3. Physical and thermal isolation of glazing from framing members.

4. Accommodation for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Storefront Framing: Fabricate components for assembly using screw-spline system.

E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

75.15 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Light bronze Medium bronze Dark bronze Champagne Match Architect's sample As selected by Architect from full range of industry colors and color densities Insert color.

75.16 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

75.17 INSTALLATION OF ALUMINUM-FRAMED FIXED WINDOWS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.

2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in ARTICLE LXX JOINT SEALANTS, to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

K. Install glazing as specified in ARTICLE LXXVII GLAZING.

75.18 ERECTION TOLERANCES

A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.

2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.

3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

75.19 FIELD QUALITY CONTROL

A. Testing: Glazed Aluminum Systems must receive a minimum of 3 water penetration tests and 3 air leakage tests in the field during construction. Area and time of tests must be per the direction of the Architect, Owner or their representative.

B. Tests: Perform the following tests on representative areas of aluminum-framed entrance and storefront systems.

1. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

a. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

2. Water Penetration: ASTM E1105 at a minimum static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and to not evidence water penetration.

C. Aluminum-framed entrance and storefront systems will be considered defective if they do

not pass tests and inspections.

D. Prepare test and inspection reports.

75.20 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXVI - DOOR HARDWARE

76.1 SUMMARY

A. Provide all finishing hardware required for all doors and cabinet work, complete as specified.

B. It is the intent of this Specification to cover in general the class and character of all finish hardware required.

C. 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 must be fitted with appropriate hardware of the same standards as the hardware described throughout these specifications. Contractor must furnish hardware schedule as specified.

D. Suppliers proposing substitutes of equivalent products of other than the manufacturers named must submit schedules listing the product and manufacturer specified and the product and manufacturer of proposed substitute.

E. Related Work:

1. Door silencers are provided under ARTICLE LXXI HOLLOW METAL DOORS AND FRAMES.

2. Provide cylinders for doors provided under ARTICLE LXXV ALUMINUM-FRAMED ENTRANCES AND STOREFRONT.

3. Coordinate the work with other directly affected Articles involving manufacturer or fabrication of internal reinforcement for door hardware.

76.2 SUBMITTALS

A. Door Hardware Schedule: Furnish copies of the hardware schedule in compliance with specifications and Drawings. Schedule format must be vertical type as listed in DHI document “Sequence and Format for the Hardware Schedule”. List each opening using same door numbers as shown and hardware to be applied. State materials finish, and manufacturer’s number for each item. Required types are listed. Double space entries and number and date each page. Include the following information:

1. Identification number, location, hand, fire rating and material of each door and frame.

2. Type, style, function, size, quantity and finish of each door hardware item.

3. Complete designations of every item required for each door opening including name and manufacturer.

4. Fastenings and other pertinent information.

5. Location of each door hardware set, cross referenced to the Drawings, both on floor

plans and in door schedules.

6. Explanation of abbreviations, symbols, and codes contained in the schedule.

7. Mounting locations for door hardware.

8. Door and frame sizes and materials

9. List of related door devices specified in other Articles for each door and frame.

B. Manufacturer's Data: Submit manufacturer's descriptive literature along with schedule.

C. Keying Schedule: Submit a keying schedule prepared by or under the supervision of the Architectural Hardware Consultant detailing State's final keying instructions for locks for approval by the Contracting Officer; using keying nomenclature as listed in DHI document "Keying Terminology". Door designation listed in the Keying Schedule must be same as those used on Drawings and Hardware Schedule. Include schematic keying diagram. Keying of locks must be as directed by the Contracting Officer.

D. Tools and Maintenance Instructions: Furnish a complete set of special wrenches, tools, maintenance instructions applicable to each different or special hardware component, but not less than the number supplied with the finish hardware materials.

E. Warranty: Submit written warranty as specified in paragraph entitled "WARRANTY" herein below.

76.3 QUALITY ASSURANCE

A. Perform work in accordance with current ICBO UBC, as amended, NFPA 80 for fire doors, and NFPA 101 for exit doors as applicable. Required hardware must bear the label of Underwriters Laboratories, Inc. and be listed in the current UL Building Materials Directory or labeled and listed by another testing laboratory acceptable to the Contracting Officer.

B. Manufacturer: Company specializing in manufacturing the Products specified in this Article with minimum 3 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.

D. Hardware Supplier Personnel: Employ an experienced Architectural Hardware Consultant (AHC), or Contracting Officer accepted equal, who is available at reasonable times during the course of the Work, to the Contracting Officer 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. Existing Openings:

1. Where patching of existing doors and frames is necessary, patching must be done as directed by the Contracting Officer.

2. Where new hardware components are scheduled for application to existing

construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

F. Manufacturer's Warranty Response Time: Complete repair or replacement within 36 hours after being notified by the user. If repair at the site is not possible because the exact make and model replacement is not available within the specified response time, a temporary substitute of equal quality must be provided within the specified response time. If a temporary replacement is provided, the permanent repair/replacement response time will be extended to 7 calendar days.

76.4 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 Article as door and door frame.

76.5 DELIVERY, STORAGE AND HANDLING

A. Delivery, store, protect and handle products to prevent damage of any kind and to maintain security to 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 as directed by Contracting Officer.

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.

76.6 WARRANTY

A. Locks must have a minimum 5-year manufacturer's warranty.

B. Door closers must have a minimum 10-year manufacturer's warranty.

C. Panic exit devices must have a minimum 5-year manufacturer's warranty.

D. The Surety must not be liable for manufacturer's warranty beyond 1 year of the project acceptance date.

E. Procedure for providing manufacturer warranty is described in General Conditions, article 7.35.3. Contractor must complete the manufacturer's forms in the name of the Department and submit such forms to the manufacturer within such time as required to validate the warranty/guaranty and submit the forms to the Contracting Officer.

76.7 PROJECT RECORD DOCUMENTS

A. Record actual locations of installed cylinders and their master key code.

76.8 OPERATION AND MAINTENANCE DATA

A. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

B. The manufacturer's representative must instruct the User's staff on the hardware's maintenance procedures (type of lubricant needed and frequency of maintenance

76.9 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in HARDWARE GROUPS at end of this Article. 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.

C. Products listed hereinafter are pre-approved as equals to those products listed in the HARDWARE GROUPS.

76.10 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 A156 series standard for each type of hardware item and with ANSI A156.18 for finish designations indicated.

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 must 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 to the 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. 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.

F. Expansion shields in concrete or masonry must fill the depth and diameter of drilled holes.

G. Bring to the attention of the Contracting Officer any discrepancy between the Hardware Groups and door schedule prior to ordering.

76.11 HINGES

A. General: Hinges must conform to ANSI/BHMA A156.1, Grade 1 as a certified product by BHMA and the requirements of this specification.

1. The following hinges will be considered equal subject to project conditions:

a. Hager:

Type 1: BB1279
Type 2: BB1191
Type 3: BB1168
Type 4: BB1199

b. McKinney:
Type 1: TA2714
Type 2: TA2314
Type 3: T4A3786
Type 4: T4A3386

c. Stanley:
Type 1: FBB179
Type 2: FBB191
Type 3: FBB168
Type 4: FBB199

d. Or, approved equal

2. Hinge Application Requirements:

a. Exterior Outswing Doors: Type 4 x NRP.
b. Exterior Inswing Doors and Vestibule Doors: Type 3 or 4.
c. Interior Doors with Closers: Type 1 or 3.
d. Interior Doors Over 36 Inches Wide. Type 4.
e. Interior Doors 36 Inches or Less Without Closer: Type 1.

B. Templates: Except for hinges to be installed entirely (both leaves) into wood doors and frames, provide only template producing units.

C. Screws: 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: Non-rising pins.

4. Tips: Flat button and matching plug, finished to match leaves.

5. Oil impregnated or ball bearing hinges are acceptable products.

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 must be as follows:

Door Thickness/Width	Hinge Height	Hinge Width
1-3/4 inches to 36-inches	4-1/2 inches	4-1/2 inches extra heavy ball bearing
1-3/4 inches over 36-inches	5-inches	4-1/2 inches extra heavy ball bearing
1-3/4 inches over 48-inches	5-inches	4-1/2 inches extra heavy ball bearing

Note: Hinge width must be of sufficient size to clear frame and trim when door swings 180 degrees.

76.12 LOCK CYLINDERS AND KEYING

A. All work, whether new or modification to existing to remain, must be in compliance with requirements of this Article. Cylinders and cores must have 6 pin tumblers unless scheduled otherwise. The contractor has the option of replacing the existing lock cylinders, at no additional cost to the State, if needed to create a new master keying system.

B. Provide the number of individual keys equal to not less than 4 times the number of cylinders provided. The number of keys cut to each key cut must be as directed by the Contracting Officer. All remaining keys must be blank. All locks must be master keyed and Grandmaster keyed to a single lock system. During period of construction, all locks must be operated by a special construction master key. Regular day and master keys are to be retained by the Contractor so they cannot be obtained or duplicated by unauthorized persons. All keys must be stamped “DO NOT DUPLICATE” at the point of manufacture. The special construction master key must become inoperative when regular keys are turned over to the Contracting Officer. Proper certification of factory assembly of all locks and cylinders and master keying of all locks and cylinders must be furnished by the Contractor

prior to final acceptance of this portion of the work. Certificate must then be given to the Contracting Officer. Provide 20 construction master keys, 6 grand master keys, and 6 master keys per set.

C. Removable Core Locks: This project requires that all locks be provided with removable core locks and construction removable cores. Provide 4 control keys for removable cores and 20% extra cores for the State's use.

D. Keying for cabinetry must be provided by manufacturer of hardware.

E. Upon acceptance of the project, the Contractor must arrange for temporary keys, obtained from custodian if further access is required.

76.13 LOCKS, LATCHES AND BOLTS

A. General: Mortise locks and latches must conform to ANSI/BHMA A156.13, Series 1000, Grade 1 unless Grade 2 is listed; bored locks and latches must conform to ANSI/BHMA A156.2, Series 4000, Grade 1 unless Grade 2 is listed; auxiliary locks must conform to ANSI/BHMA A156.5, Grade 1; bolts must conform to ANSI/BHMA A156.16, Grade 1; ADAAG and the requirements of this specification.

1. The following mortise locksets and deadbolts will be considered equal:

   a. Best 38H series, 40H Series.
   b. Sargent 4800 series, 8200 series.
   c. Schlage L400 series, L9000 series.
   d. Or, approved equal.

2. The following cylindrical locksets and deadbolts will be considered equal:

   a. Best 93K series, 83T Series.
   b. Sargent 10 series, 480 series.
   c. Sargent 11 series, 480 series.
   d. Schlage "ND" series, B600 series.
   e. Or, approved equal.

B. Mortise locksets must be manufactured in a single sized case formed from 12-gauge minimum steel. The case must be closed on all sides and back. The lockset must have a field-adjustable, beveled armored front, with a 0.125-inch minimum thickness.

C. Mortise locksets must have freewheeling or breakaway vandal resistant design outside levers on all exterior doors. The freewheeling lever design must 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 matching hardware set. Provide dustproof recessed floor strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolts.

E. Lock Throw:

1. Provide 3/4-inch minimum throw of latch and one-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-feet 6-inches in height.

F. Provide locksets, latches, and cylinders equal in all respects to those specified in the Hardware Groups.

76.14 PANIC EXIT DEVICES

A. General: Panic exit devices must conform to ANSI/BHMA A156.3, Grade 1 and the requirements of this Article. Exit device vertical rods must be one piece construction. No splicing will be allowed. Provide recessed floor strikes.

1. The following panic hardware will be considered equal:

a. Corbin Russwin ED5000, ED4000 series.
b. Monarch 18,17 series.
c. Sargent 80 series.
d. Von Duprin 98, 35 Series.
e. Yale 7000 series.
f. Or, approved equal.

B. All exit devices must be heavy duty push rail and cast chassis construction.

C. Exit devices must have freewheeling or breakaway vandal resistant design outside levers on all exterior doors. The freewheeling lever design must 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 must be mounted with theft resistant through bolts.

76.15 CLOSERS AND DOOR CONTROL DEVICES

A. General: Closers must conform to ANSI/BHMA A156.4, Series C02000, Grade 1, with features necessary for the particular application, UL10C listed for fire rated doors, ADAAG, and the requirements of this specification.

1. The following closers will be considered equal for heavy use on exterior doors:

a. Corbin Russwin DC6000 series.
b. Doromatic SC71 series.
c. LCN 4041 Series, 4011/4111 Series.
d. Norton 7500 series.
e. Sargent 351 Series, 281 Series.
f. Or, approved equal.

2. The following closers will be considered equal for medium use on interior doors:

a. Corbin Russwin DC3000 series.
b. Doromatic SC81 series
c. LCN 1461 series.
d. Norton 8501 series.
e. Sargent 1431 series.
f. Or, approved equal.

B. Size of Units: Provide non-sized closers, adjustable to meet maximum opening force requirements of ADA. 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. Closers must have adjustment operating valves for closing speed, latching speed, and backcheck control as a standard feature

D. Provide parallel arm or regular arm closer as required to mount closer on door face least exposed to public traffic.

E. Provide drop plates, brackets, or adapters for arms as required to suit details or conditions.

F. Closer covers must be rectangular, full cover type, high impact non-corrosive, and flame retardant.

G. Closer must not require removal for adjustments to be made.

H. Provide hold-open arms where indicated.

76.16 FLAT GOODS

A. General: Flat goods must conform to ANSI/BHMA A156.6 and the types listed in the HARDWARE GROUPS.

1. The products of the following manufacturers will be considered equal subject to project conditions:

a. Baldwin Hardware Corporation
b. Burns Manufacturing Incorporated
c. Hager Companies
d. Ives Hardware
e. Rockwood Manufacturing Company
f. Trimco
g. Or, approved equal.

B. Door plates for single doors must be 2-inches less than door width. Door plates for double doors must be 1-inch less than door width. Height of plate should be as listed but 1-inch less than bottom rail for panel doors.

76.17 STOPS AND HOLDERS

A. General: Stops and holders must conform to ANSI/BHMA A156.16 and the types listed in the HARDWARE GROUPS.

1. The products of the following manufacturers will be considered equal subject to project conditions:

a. Architectural Builders Hardware MFG., Inc.
b. Baldwin Hardware Corporation
c. Burns Manufacturing Incorporated

d. Hager Companies
e. Ives Hardware
f. Trimco
g. Or, approved equal.

76.18 THRESHOLDS

A. General: Thresholds must conform to ANSI/BHMA A156.21 and ADAAG. Provide size, thickness, and profile as listed in the HARDWARE GROUPS.

1. The products of the following manufacturers will be considered equal subject to project conditions:

a. Hager Companies
b. National Guard Products
c. Pemko Manufacturing Co.
d. Reese Enterprises
e. Zero International
f. Or, approved equal.

76.19 WEATHERSTRIPPING AND GASKETING

A. General: Weather-stripping and smoke gasketing must conform to ANSI A156.22 and the types listed in the HARDWARE GROUPS.

1. The products of the following weatherstripping and gasketing manufacturers will be considered equal subject to project conditions:

a. Hager Companies
b. National Guard Products
c. Pemko Manufacturing Co.
d. Reese Enterprises
e. Zero International
f. Or, approved equal.

76.20 CABINET HARDWARE

A. General: Cabinet hardware must conform to ANSI/ANSI A156.9 and the types listed in the HARDWARE GROUPS.

1. The products of the following cabinet hardware manufacturers will be considered equal subject to project conditions:

a. Accuride
b. Grass
c. Julius Blum Hardware
d. Ives
e. Knap & Vogt Manufacturing Co.
f. Trimco
g. Or, approved equal.

76.21 FINISHES

A. Finishes: Identified in schedule at end of Article.

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 finishes are 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.

76.22 EXAMINATION

A. Pre-Installation Meeting: Before the start of work under this contract, the Contractor, hardware installer, hardware manufacturer’s representative or supplier, the Contracting Officer, and a user representative should meet to review the keying system, hardware installation instructions, and installation conditions.

B. Verify that doors and frames are ready to receive Work and dimensions are as indicated.

76.23 INSTALLATION

A. Install each hardware item in compliance with manufacturer’s instructions and recommendations.

B. Mount hardware units at height indicated in the Door and Hardware Institute’s Recommended Locations for Builders Hardware for Standard Steel Doors and Frames, except:

1. As otherwise indicated or as required to comply with governing regulations.

2. Mount deadbolt (if any) centerline not more than 5-inches above latch set 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 ARTICLE LXX JOINT SEALANTS.

G. Fit face of all mortise parts snug and flush.

H. Operating parts must move freely and smoothly without binding, sticking or excessive clearance.

I. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

J. Install with manufacturer's fasteners conforming to requirements of this Article or those required for substrate. Expansion shields securing hardware such as door stops/holders to concrete or solid grouted masonry substrates should completely fill the depth and diameter of the drilled holes. Shimming of the shields or using of plastic shields is not acceptable.

K. Protect hardware from damage or marring of finish during construction. Use strippable coatings, removable tapes or other approved means.

L. 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 approved means.

M. Latch and Bolt: Install latch and bolt to automatically engage in keeper, whether activated by closer or manual push. In no case should additional manual pressure be required to engage latch or bolt in keeper.

N. Closers:

1. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

2. Carefully adjust closers to operate noiselessly and evenly.

3. Have manufacturer's representative regulate closers prior to Contracting Officer's acceptance of building.

O. Cabinet Work: Install cabinet hardware to conform to manufacturer's instructions and AWI Quality Standards, Guide Specifications and Quality Certification Program for quality of cabinet as specified.

76.24 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:

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.

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.

76.25 BASIS OF MEASUREMENT AND PAYMENT

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

76.26 HARDWARE GROUPS

HW GROUP 001

(EXTERIOR MAINTENACE SHOP DOORS)

4.0 EA	HINGE	A5111 4.5 X4.5 NFP	640
1.0 EA	EXIT DEVICE	E8271, TYPE 02, F08 (classroom) X LEVEL	313
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
1.0 EA	DOOR BOTTOM	R3G514	D
1.0 EA	THRESHOLD	J32180	D
	DOOR SEALS	R0U154	

HW GROUP 002

(EXTERIOR ADMINISTRATIVE DOORS)

4.0 EA	HINGE	A5111 4.5 X4.5 NFP	640
1.0 EA	EXIT DEVICE	E8271, TYPE 02, F09 (storeroom) X LEVEL	313
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
1.0 EA	DOOR CLOSER	C02021 PT4H	695
1.0 EA	DOOR BOTTOM	R3G514	D
1.0 EA	THRESHOLD	J32180	D
DOOR SEALS		R0U154	

HW GROUP 003

(EXTERIOR MAINTENACE SHOP DOORS)

8.0 EA	HINGE	A5111 4.5 X4.5 NFP	640
1.0 EA	EXIT DEVICE	E8271, TYPE 09, F08 (classroom) X LEVEL	313
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
1.0 EA	EXIT DEVICE	E8271, TYPE 02, F01 (exit only) X LEVEL	313
2.0 EA	DOOR BOTTOM	R3G514	D
1.0 EA	THRESHOLD	J32180	D
	DOOR SEALS	R0U154	

HW GROUP 004

(EXTERIOR ADMINISTRATIVE DOORS)

8.0 EA	HINGE	A5111 4.5 X4.5 NFP	640
1.0 EA	EXIT DEVICE	E8271, TYPE 09, F08 (classroom) X LEVEL	313
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619

1.0 EA	EXIT DEVICE	E8271, TYPE 02, F01 (exit only) X LEVEL	313
2.0 EA	DOOR CLOSER	C02021 PT4H	695
2.0 EA	DOOR BOTTOM	R3G514	D
1.0 EA	THRESHOLD	J32180	D
	DOOR SEALS	R0U154	

HW GROUP 005

(EXTERIOR ELEC ROOM DOORS)

8.0 EA	HINGE	A5111 4.5 X4.5 NFP	640
1.0 EA	EXIT DEVICE	E8271, TYPE 09, F09 (storeroom) X LEVEL	313
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
1.0 EA	EXIT DEVICE	E8271, TYPE 02, F01 (exit only) X LEVEL	313
2.0 EA	DOOR CLOSER	C02021 PT4H	695
2.0 EA	DOOR BOTTOM	R3G514	D
1.0 EA	THRESHOLD	J32180	D
	DOOR SEALS	R0U154	

HW GROUP 006

(INTERIOR MAINTENACE SHOP DOORS)

8.0 EA	HINGE	A5111 4.5 X4.5 NFP	640
1.0 EA	OFFICE LOCK	F04 (office) X LEVEL	613
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
2.0 EA	DOOR CLOSER	C02021 PT4H	695
1.0 EA	FLUSH BOLT	L04251	613
1.0 EA	DUSTPROOF STRIKE	L14011	613
	DOOR COORDINATOR		
	DOOR SEALS	R0U154	

HW GROUP 007

(INTERIOR OFFICE DOORS)

3.0 EA	HINGE	A8111 4.5 X4.5 NFP	640
1.0 EA	OFFICE LOCK	F04 (office) X LEVEL	613
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
1.0 EA	DOOR CLOSER	C02021 PT4H	695

HW GROUP 008

(INTERIOR OFFICE DOORS W/ WALL STOP)

3.0 EA	HINGE	A8111 4.5 X4.5 NFP	640
1.0 EA	OFFICE LOCK	F04 (office) X LEVEL	613
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
1.0 EA	DOOR CLOSER	C02021 PT4H	695
1.0 EA	WALL STOP	L22251	613

HW GROUP 009

(INTERIOR PRIVATE OFFICE AND CONFERENCE DOORS)

3.0 EA	HINGE	A8111 4.5 X4.5 NFP	640
1.0 EA	OFFICE LOCK	F04 (office) X LEVEL	613
1.0 EA	CORE	LFIC CORE 6 PIN GMK	619
1.0 EA	WALL STOP	L22251	613

HW GROUP 010

(INTERIOR RESTROOM, LOCKER RM, SHOWER RM DOORS)

3.0 EA	HINGE	A8111 4.5 X4.5 NFP	640
1.0 EA	PULL PLATE	J401 10”	613
1.0 EA	PUSH PLATE	J301 4” X 16”	613
1.0 EA	DOOR CLOSER	C02021 PT4H	695
1.0 EA	WALL STOP	L22251	613

END OF ARTICLE

ARTICLE LXXVII - GLAZING

77.1 SUMMARY

A. Article Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

B. Related Requirements:

1. ARTICLE LXXV ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.

77.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

77.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: Submit three (3) labeled 12” x 12” samples of each glass type used on the project.

C. Glazing Accessory Samples: Submit 12” long samples of each type of product and profile, including molded corners for gaskets.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

77.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Preconstruction adhesion and compatibility test report.

D. Sample Warranties: For special warranties.

77.5 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A fabricator with not less than ten (10) years' experience in the fabrication of systems similar to those indicated in material, design, and intent.

B. Installer Qualifications: An installation firm with not less than five (5) years of successful experience in the installation of systems similar to those indicated in material, design, and intent.

77.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

77.7 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

77.8 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

77.9 MANUFACTURERS / APPROVED EQUAL

A. Basis of Design: Vitro Architectural Glass (or approved equal)

B. Approved Equal: Any manufacturer providing glazing that meet material, coating, structural, performance, and installation requirements.

C. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

D. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

77.10 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems must withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing must withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.

a. Wind Design Data: As indicated on Drawings.
b. Basic Wind Speed: As indicated on drawings.
c. Importance Factor: 1.0.
d. Exposure Category: C.

2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

C. Windborne-Debris-Impact Resistance: Exterior glazing must pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.

2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with

16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic glass lites, properties are based on units with lites of thickness indicated.

2. For laminated-glass lites, properties are based on products of construction indicated.

3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.

5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.

6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

77.11 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Article or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label must indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

77.12 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Low-Iron Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.

C. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

D. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

E. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

77.13 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

77.14 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class per manufacturer’s recommendation:

Complying with ASTM C920, Type S, Grade NS, Use NT.

77.15 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

77.16 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Silicone with Shore A durometer hardness of 85, plus or minus 5.

2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Continuous aluminum spacer with all corners bent for rectangular units and joined with invisible, butyl key at seam.

2. P10981Spacers must be filled with desiccant or an extruded desiccant material on a minimum of two sides.

3. The seam must be located at the head of the lite typically. Lites with more than one seam due to their size will be identified and the seams located in agreement with the Architect. There will be a maximum of two seams per unit.

4. The date of manufacture must be discretely identified

5. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Silicone with Shore A durometer hardness per manufacturer's written instructions.

2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

77.17 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

77.18 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep systems.

3. Minimum required face and edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

77.19 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

77.20 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

77.21 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

77.22 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

77.23 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

77.24 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

77.25 BASIS OF MEASUREMENT AND PAYMENT

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

77.26 INSULATING-LAMINATED-GLASS SCHEDULE

A. Clear Insulating, Laminated Glass Type Type A Fixed:

1. Basis-of-Design Product: Vitro Architectural Glass (or approved equal).

2. Overall Unit Thickness: 1 inch.

3. Outdoor Lite: Laminated fully tempered float glass.

   a. Glass 1 (Outside Face): 3/16” (5mm) tempered glass (Glazing Color: Solar gray) (or approved equal)
   b. Interlayer: SentryGlas (SGP) 0.060” thickness
   c. Glass 2 (Inside face): 3/16” (5mm) tempered glass with Low-E coating Vitro Solarban 70(3) (Glazing Color: Clear) (or approved equal)

4. Interspace Content: 10% Air, 90% Argon.

5. Indoor Lite: 1/4” (6mm) fully tempered float glass (Glazing Color: Clear).

6. Winter Nighttime U-Factor: 0.45 maximum.

7. Summer Daytime U-Factor: 0.48 maximum.

8. SGHC: 0.25 maximum.

9. Safety glazing required.

END OF ARTICLE

ARTICLE LXXVIII - FIXED LOUVER

78.1 SUMMARY

A. Article Includes:

1. Fixed extruded-aluminum louvers.

B. Related Requirements:

1. ARTICLE LXVII SHEET METAL FLASHING AND TRIM

2. ARTICLE LXXXVIII INTERIOR PAINTING for field painting interior louvers.

78.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Article unless otherwise defined in this Article or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing in accordance with AMCA 500-L.

F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing in accordance with AMCA 540.

78.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.

C. Samples: For each type of metal finish required.

78.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance

requirements specified.

B. Windborne-debris-impact-resistance test reports.

C. Sample Warranties: For manufacturer's special warranties.

78.5 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

78.6 WARRANTY

A. Manufacturer must provide standard limited warranty for louver systems for a period of five (5) years from the date of Substantial Completion. When notified in writing from the Owner of a manufacturing defect, manufacturer must promptly correct deficiencies without cost to Owner.

B. Manufacturer must provide a 20-year limited warranty for 70% PVDF Flouropolymer Metal Finishes on extruded aluminum and formed steel substrates.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Five years from date of Substantial Completion.

D. Any forming or welding must be done prior to finishing. Post forming or welding will void the warranty.

78.7 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: Airolite K6746X (or approved equal)

B. Approved Equal: Any manufacturer providing louvers that meet the material, finish, profile, structural, and performance requirements.

78.8 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.

1. Wind Loads:

a. Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance:

1. As indicated on Drawings.

C. Louver Performance Ratings: Provide louvers complying with specified requirements, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 500-L.

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

78.9 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade, Windborne-Debris-Impact-Resistant Louver, Extruded Aluminum:

1. Louver Depth: 6 inches.

2. Frame and Blade Nominal Thickness: Not less than 0.080 inch.

3. Mullion Type: Exposed.

4. Louver Performance Ratings:

a. Free Area: Not less than 9.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
b. Point of Beginning Water Penetration: Not less than 1077 fpm.
c. Air Performance:

- Not more than 0.15-inch wg static pressure drop at 1077-fpm free-area velocity.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

78.10 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.

2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with stainless steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached.

2. Finish: Same finish as louver frames to which louver screens are attached.

3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening, Stainless Steel: 18-by-18 mesh, 0.009-inch wire.

78.11 BLANK-OFF PANELS

1. Uninsulated Blank-Off Panels: Metal sheet attached to back of louver.

2. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness.

3. Panel Finish: Same finish applied to louvers.

4. Factory installed blank-off panels with removable screws and neoprene gaskets.

78.12 MATERIALS

A. Aluminium Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.

2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.

C. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing in accordance with ASTM E488/E488M conducted by a qualified testing agency.

78.13 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

G. Provide subsills made of same material as louvers for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

78.14 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

78.15 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

78.16 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

78.17 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. 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.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with ARTICLE LXX JOINT SEALANTS for sealants applied during louver installation.

78.18 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace them with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

78.19 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXIX - NON-STRUCTURAL METAL FRAMING

79.1 SUMMARY

A. Article Includes:

1. Framing systems.

2. Suspension systems.

79.2 SUBMITTALS

A. Product Data:

1. Framing systems.

2. Suspension systems.

B. Shop Drawings: Metal Support Systems.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Evaluation Reports: For post-installed anchors and power-actuated fasteners from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

79.3 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculation, and other structural data by a registered professional. Engineer.

79.4 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

79.5 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction

identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

79.6 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated

2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220.

1. Thickness: 18 gauge minimum.

2. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

1. Double-Track System: Top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.

2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width sized to suit application.

1. Thickness: 18-gauge minimum.

E. Cold-Rolled Channel Bridging: Steel, 18-gauge minimum, with minimum 1/2-inch-wide flanges.

1. Thickness: 18-gauge minimum.

2. Depth: 1-1/2 inches.

3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels:

1. Thickness: 20-gauge minimum.

2. Depth: As indicated on Drawings.

G. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.

2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.

3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

H. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

79.7 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

D. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

79.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.

2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

79.9 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal

frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

79.10 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

79.11 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

79.12 INSTALLATION OF FRAMING SYSTEMS

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Screw to wood framing.

2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in ARTICLE LX THERMAL INSULATION, vertically and held in place with Z-shaped furring members spaced 24 inches o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

3. At exterior corners, attach wide flange of furring members to wall with short flange

extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

79.13 INSTALLATION OF SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.

2. Carrying Channels (Main Runners): 48 inches o.c.

3. Furring Channels (Furring Members): 24 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.

1. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

b. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

2. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

3. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, 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.

4. Do not attach hangers to steel roof deck.

5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

79.14 FIELD QUALITY CONTROL

A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

79.15 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXX - GYPSUM BOARD

80.1 SUMMARY

A. Article Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

B. Related Requirements:

1. ARTICLE LV SHEATHING for gypsum sheathing for exterior walls.
2. ARTICLE LXX JOINT SEALANTS for acoustical joint sealants installed in gypsum board assemblies.
3. ARTICLE LXXIX NON-STRUCTURAL METAL FRAIMING for non-structural steel framing and suspension systems that support gypsum board panels.
4. ARTICLE LXXXI CERAMIC TILING for cementitious backer units installed as substrates for ceramic tile.

80.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Gypsum ceiling board.
4. Impact, Moisture & Mold-resistant gypsum board.
5. Moisture & Mold-resistant gypsum board.
6. Gypsum board, Type C.
7. Cementitious backer units.
8. Interior trim.
9. Exterior trim.
10. Joint treatment materials.
11. Sound-attenuation blankets.
12. Acoustical sealant.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

80.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

80.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

80.5 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

80.6 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

80.7 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

80.8 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.

2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.

2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.

2. Long Edges: Tapered.

D. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X.

2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.

3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.

4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.

5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements in accordance with test in Annex A1.

6. Long Edges: Tapered.

7. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

E. Moisture & Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.

2. Long Edges: Tapered.

3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

80.9 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.

1. Thickness: 5/8 inch.

2. Long Edges: Tapered.

B. Glass-Mat Interior Gypsum Board: ASTM C1658/C1658M. With moisture- and mold-resistant and fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Core: 5/8 inch, Type C.

2. Long Edges: Tapered.

3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

80.10 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Thickness: 5/8 inch.

2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

80.11 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Plastic.

2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (control) joint.

B. Exterior Trim: ASTM C1047. For use in unconditioned spaces such as the Maintenance Shop.

1. Material: Plastic, or rolled zinc.

2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

80.12 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is

compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.

4. Finish Coat: For third coat, use drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

80.13 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2. Acoustical Sealant: As specified in ARTICLE LXX JOINT SEALANTS.

80.14 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

80.15 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

1. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

2. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

80.16 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.

2. Type X: As indicated on Drawings.

3. Ceiling Type: Ceiling surfaces.

4. Impact-Resistant Type: As indicated on Drawings.

5. Moisture & Mold-Resistant Type: As indicated on Drawings.

6. Type C: As indicated on Drawings.

7. Glass-Mat Interior Type C: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

80.17 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at showers, and where indicated on Drawings.

80.18 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

2. LC-Bead: Use at exposed panel edges.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

2. LC-Bead: Use at exposed panel edges.

80.19 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 2: Panels that are substrate for tile.

3. Level 5: At panel surfaces that will be exposed to view.

a. Primer and its application to surfaces are specified in ARTICLE LXXXVIII INTERIOR PAINTING.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

80.20 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and

other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

80.21 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXXI - CERAMIC TILING

81.1 SUMMARY

A. Article Includes:

1. Porcelain tile.
2. Thresholds.
3. Waterproof membranes.
4. Crack isolation membranes.
5. Setting material.
6. Grout materials.

B. Related Requirements:

1. ARTICLE LXX JOINT SEALANTS for sealing of movement joints in tile surfaces.
2. ARTICLE LXXX GYPSUM BOARD for tile backing panels.

81.2 DEFINITIONS

A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Article unless otherwise specified.

B. Large Format Tile: Tile with at least one edge 15 inches or longer.

81.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend. For tile with aesthetic classification V3 or V4, provide 12 tiles from same production run.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch lengths.
4. Metal flooring transitions 6-inch lengths.

81.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product, including product use classification.

B. Product Test Reports:

1. Tile-setting and -grouting products.

2. Certified porcelain tile.

3. Slip-resistance test reports from qualified independent testing agency.

81.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

81.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. An installer who has completed ceramic tile and stonework similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

81.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with unbroken seals and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

81.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

81.9 SOURCE LIMITATIONS

A. Manufacturers / Approved Equal

1. Basis of Design: Tile and accessories as shown in drawings (or approved equal).

2. Approved Equal: Any manufacturer providing tile and accessories that meet the material, color, pattern, performance, and installation requirements.

B. Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

2. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

3. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.

4. Obtain joint sealants from manufacturer of setting and grouting materials.

C. Accessory Products: Obtain each of the following products specified in this Article from a single manufacturer:

1. Stone thresholds.

81.10 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

81.11 PORCELAIN TILE

A. Porcelain Tile Type: Glazed.

1. Porcelain Tile Type “PT-1_

    a. Product: As indicated on drawings.

2. Porcelain Tile Type “PT-2”

    a. Product: As indicated on drawings.

3. Porcelain Tile Type “PT-3A”

    a. Product: As indicated on drawings.

4. Porcelain Tile Type “PT-3B”

    a. Product: As indicated on drawings.

5. Porcelain Tile Type “PT-4”

    a. Product: As indicated on drawings.

6. Certification: Tile certified by the Porcelain Tile Certification Agency.

7. Face Size: As indicated on drawings.

8. Face Size Variation: Rectified.

9. Thickness: As indicated on drawings.

10. Tile Color, Glaze, and Pattern: As indicated on drawings.

11. Grout Color: As indicated on drawings.

81.12 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Solid-Surface Thresholds: Homogeneous-filled plastic resin complying with ISFA-02-01.

1. Description:

    a. Type: Provide Standard type.
    b. Colors and Patterns: As indicated in drawings.

81.13 WATERPROOF MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.10and is recommended by manufacturer for application indicated. Include reinforcement and

accessories recommended by manufacturer.

B. Waterproof Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer that complies with ANSI A108/A118/A136.1 standards/ Include reinforcement and accessories as recommended by the manufacturer.

81.14 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Installer's option of material that complies with ANSI A108.02, paragraph 3.8.

2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A1064/A1064M except for minimum wire size.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Basis of Design: Laticrete 254 Platinum Plus (or approved equal).

2. Provide prepackaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

3. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to other requirements in ANSI A118.4.

C. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Basis of Design: Laticrete Multimax Lite (or approved equal).

2. Provide prepackaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

3. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to other requirements in ANSI A118.15.

81.15 GROUT MATERIALS

A. High-Performance Tile Grout: ANSI A118.7.

1. Basis of Design: Laticrete Permacolor Grout (or approved equal)

2. High-Performance Polymer-Modified Tile Grout: Factory-blended mixture of cement, graded aggregates, polymers and color-fast pigments to which only water must be added at Project site complying with ANSI A 118.7.

3. Polymer Type:

a. Dry, re-dispersible form, prepackaged with other dry ingredients.
b. Sanded grout for joints from 1/8-inch to 1/2-inch.
c. Un-sanded grout for joints less than 1/8-inch.

4. Colors: as indicated on drawings.

81.16 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

B. Metal Edge Trim: Profile designed for wall terminations and edge protection.

1. Basis of Design: Schluter Systems Jolly (or approved equal).

2. Description: L-shaped.

3. Terminations: End caps Inside corners Outside corners matching edge-protection profile.

4. Material and Finish: Brushed nickel anodized aluminum (ATGB) exposed-edge material.

C. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

81.17 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

3. 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.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

81.18 PREPARATION

A. Remove coatings, including curing compounds or other coatings that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.

2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

81.19 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.

2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

D. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile

Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.

2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

3. 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 plates, collars, or covers overlap tile.

4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

    a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
    b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
    c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

E. Thresholds: Install solid surface thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in improved modified dry-set mortar (thinset).

2. Fill joints between thresholds and adjoining tile set on cleavage membrane or waterproof membrane with elastomeric sealant.

F. Metal Flooring Transitions: Install at locations indicated.

G. Metal Wall Trim: Install at locations indicated on Drawings.

H. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

81.20 FIELD QUALITY CONTROL

A. Water Test:

1. Test of waterproofing membrane in showers and similar areas to be performed by Installation Contractor before setting tile.

   a. Perform test after 24 hours of waterproof membrane installation.
   b. Insert test plug in drain or waste line.
   c. Fill shower base with water, high enough that the membrane-to-drain connection and floor-to-wall transition can be evaluated, and mark wall.
   d. Check for leaks after 24 hours.

2. Test to be witnessed by Construction Manager.

B. Nonconforming Work:

1. Waterproof membrane will be considered defective if water level has dropped.

2. Remove and replace defective components and retest.

81.21 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

81.22 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

81.23 BASIS OF MEASUREMENT AND PAYMENT

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

81.24 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F121: Method ANSI A108.1B. Cement mortar bed (thickset) installed over cleavage membrane.

    a. Ceramic Tile Type: As indicated in drawings.
    b. Bond Coat for Cured-Bed Method: Improved modified dry-set mortar.
    c. Grout: High-Performance Polymer Tile Grout.
    d. Joint Width: 3/16 inch.

2. TCNA F122: Thinset mortar on waterproof membrane.

    a. Ceramic Tile Type: As indicated on drawings.
    b. Thinset Mortar: Improved modified dry-set mortar.
    c. Grout: High-Performance Polymer Tile Grout.
    d. Joint Width: 3/16 inch.

B. Interior Wall Installations, Wood or Metal Studs or Furring:

1. TCNA W245: Thinset mortar on glass-mat, water-resistant gypsum backer board over waterproof membrane.

    a. Ceramic Tile Type: As indicated on drawings.
    b. Thinset Mortar: Modified dry-set mortar.
    c. Grout: Polymer modified tile grout.
    d. Waterproof Membrane: As recommended by setting material manufacturer.
    e. Joint Width: 1/8 inch.

END OF ARTICLE

ARTICLE LXXXIII - RESILIENT BASE AND ACCESSORIES

83.1 SUMMARY

A. Article Includes:

1. Thermoplastic-rubber base.

83.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

83.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

83.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

83.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

83.6 THERMOPLASTIC-RUBBER BASE

A. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).

2. Style and Location:

a. Style B, Cove.

B. Thickness: 0.125 inch.

C. Height: 4 inches.

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Preformed.

F. Inside Corners: Preformed.

G. Colors: As indicated in drawings by manufacturer's designations.

83.7 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

83.8 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Articles and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

83.9 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

83.10 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

83.11 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum horizontal surfaces thoroughly.

3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

83.12 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXXIV - RESILIENT TILE FLOORING

84.1 SUMMARY

A. Article Includes:

1. Solid vinyl floor tile.

B. Related Requirements:

1. ARTICLE XXIX CAST-IN-PLACE CONCRETE

2. ARTICLE LXXXIII RESILIENT BASE AND ACCESSORIES

84.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color, texture, and pattern of floor tile required.

84.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

84.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to be included in maintenance manuals.

84.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish not less than one box for every 50 boxes or fraction thereof, or not less than 2% of total installed, whichever is less, of each type, color, and pattern of floor tile installed.

84.6 QUALITY ASSURANCE

A. Manufacturer: Provide flooring by a firm with a minimum of 10 years' experience in the production of resilient flooring of the type of equivalent to that specified.

B. Installer Qualifications: Engage an experienced installer with a minimum of 2 years' experience to perform work of this Article who has specialized in installing resilient flooring products similar to those required for this Project and with a record of successful in-service performance.

C. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

84.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

84.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 68 deg F or more than 85 deg F, in spaces to receive floor tile during the following periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

84.9 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: As specified (or approved equal)

B. Approved Equal: Any manufacturer providing resilient tile flooring that meets the material, structure, finish, performance, and installation requirements.

84.10 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

84.11 SOLID VINYL FLOOR TILE: LVT-1

A. Basis of Design: Armstrong Flooring Natural Creations with Diamond 10 (or approved equal)

B. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.

2. Type: B, Embossed Surface.

C. Thickness: 0.125 inch.

D. Wear Layer: 0.020 inch.

E. Size: 3 by 36 inches.

F. Colors and Patterns:

1. Color: Matiz – Key Lime Tide (NA 401)

2. Pattern: Stairstep Third

3. Gloss: Low gloss

84.12 SOLID VINYL FLOOR TILE: LVT-2

A. Basis of Design: Armstrong Flooring Parallel USA 20 (or approved equal)

B. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.

2. Type: B, Embossed Surface.

C. Thickness: 0.100 inch.

D. Wear Layer: 0.020 inch

E. Size: 18 by 18 inches.

F. Colors and Patterns:

1. Color: Havana Henna (J5263)

2. Pattern: Alternating Half

3. Gloss: Medium Gloss

84.13 MOULDING / TRANSITION STRIPS

A. Provide tapered mouldings of clear anodized aluminum and types as recommended by flooring manufacturer for both edges and transitions of flooring material specified. Provide vertical lip on mouldings of maximum ¼ inch. Provide bevel change in level between ¼ and 1/2 inch with a slope no greater than 1:2.

B. LVT to Carpet Tile / LVT / ESDEF

1. Basis of Design: Schluter Systems VINPRO-S

2. Height: 1/8”

3. Finish: Brushed Nickel Anodized Aluminum (ATGB)

84.14 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

84.15 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Articles and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

84.16 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.

4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by

resilient floor tile.

84.17 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

84.18 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Do not wash floor until after time period recommended by flooring manufacturer.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish as recommended by manufacturer.

84.19 BASIS OF MEASUREMENT AND PAYMENT

A. Work under this Article will not be measured nor paid for separately but should be

considered incidental to and included in the prices bid for the various items of work in this project.

END OF ARTICLE

ARTICLE LXXXV – RESINOUS FLOORING

85.1 SUMMARY

A. This Article includes:

1. Epoxy/Aliphatic Urethane Topcoat Seamless Flooring System

2. Electrostatic Dissipative Epoxy Flooring System

B. Related Articles include the following:

1. ARTICLE XXIX CAST-IN-PLACE CONCRETE

85.2 SUBMITTALS

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

B. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.

C. Material Certificates: For each resinous flooring component, from manufacturer.

D. Maintenance Data: For maintenance manuals.

E. Samples: Submit two 3x3 inch samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Owner in writing or approved by General Contractor prior to installation.

F. Product Schedule: For resinous flooring.

85.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

B. The Manufacturer must have a minimum of 10 years' experience in the production, sales, and technical support of epoxy and urethane flooring and related materials.

C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

D. Pre-installation Conference: Conduct conference at Project site before work and mockups begin.

85.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Maintain containers in clean condition, free of foreign materials and residue.

1. Remove rags and waste from storage areas daily.

85.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, safety, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

85.6 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: as specified (or approved equal).

B. Approved Equal: Any manufacturer providing resinous flooring that meets the material, coating, structure, finish, performance, and installation requirements.

85.7 Epoxy/Aliphatic Urethane Topcoat Seamless Flooring System (EF-1)

A. Basis of Design: Sherwin-Williams Hybri-Flex EB (or approved equal)

B. Thickness: 3/16” – 1/4”

C. Color: Medium Gray

D. Base: 6” Integral Base

E. System Materials

1. Topping: Sherwin-Williams, Poly-Crete SL resin, hardener and SL aggregate.

2. The broadcast aggregate must be Sherwin-Williams Flintshot or Q-Rok quartz aggregate.

3. Broadcast: Sherwin-Williams Resuflor Glaze, epoxy based two-component resin.

4. Grout coat: Sherwin-Williams Resuflor Glaze, epoxy-based, two-component resin.

5. Top coat: Sherwin-Williams Resutile AT aliphatic urethane multi-component resin.

F. Patch Materials

1. Shallow Fill and Patching: Use Poly-Crete MD (up to 1/4-inch)

2. Deep Fill and Sloping Material (over 1/4-inch): use Poly-Crete WR

G. Product Requirements

1. Topping: Poly-Crete SL

Percent Reactive		100%
VOC		0 g/L
Bond Strength to Concrete	ASTM D 4541	400 psi
Comprehensive Strength	ASTM C 579	9,000 psi
Tensile Strength	ASTM D 638	2,175 psi
Flexural Strength	ASTM D 790	5,076 psi
Impact Resistance @ 125 mils	MIL D-3134	160 inch lbs

2. Broadcast and Grout Coat: Resuflor Glaze

Percent Reactive		100%
VOC		<8 g/L
Water Absorption	ASTM D 570	0.04%
Tensile Strength	ASTM D 638	4,000 psi
Coefficient of thermal expansion	ASTM D 696	2x10-5 in/in/F
Flammability	ASTM D 635	Self-Extinguishing
Flame Spread/NFPA 101	ASTM E-84	Class A

3. Topcoat: Resutile AT

VOC		0 g/L	
60 Degree Gloss	ASTM D 523	75+/-5	
Mixed Viscosity, (Brookfield 25°C)		500 cps	
Tensile Strength	ASTM D 638	7,000 psi	
Abrasion Resistance	ASTM D4060	Gloss	Satin
CS 17 wheel (1,000 g load) 1,000 cycles		mg loss with grit	
		4	8
		mg loss without grit	
		10	12
Pot life @ 70° F, 50% R.H.		2 hours	
Dry properties			
70° F, 50% R.H.		8 hours tack free, 12 hours dry	
60° F, 30% R.H.		12 hours tack free, 18 hours dry	
80° F, 70% R.H.		4 hours tack free, 6 hours dry	
Full Chemical Resistance		7 days	

85.8 Electrostatic Dissipative Epoxy Flooring (ESDEF-1)

A. Basis of Design: Sherwin Williams Resuflor Topcoat SDU (or approved equal)

B. System Materials

1. Primer Coat: Resuflor MPE, 3-5 mils
2. Build Coat: Resuflor MPE, 12-14 mils
3. Topcoat: Resutile SDS (Satin), 2.7 mils
4. Color: As selected by Architect from manufacturer's full range.

C. System Properties

1. Resuflor Topcoat SDU

a. Body Voltage Generation, ANSI/ESD STM 97.2, 12 volts with ESD shoes, Method 2 ANSI/ESD S20.20, 32 volts with heel straps

b. Body Voltage Decay (with ESD shoes or heel straps AATCC 134-1979 (modified), 1,000 volts to < 10 volts in <1.0 seconds

c. Resistance to Ground in Combination with Person, ANSI/ESD STM 97.1(ANSI/ESD S20.20-Methood 1), <3.5 x 107ohms (ESD shoes or heel straps)

d. Surface Resistance Point to Point/ Point to Ground ESD Assoc. ANSI/ESD 7.1-2005, 1x105ohms to <1x109ohms

e. Abrasion Resistance Taber Abraser CS-17 Taber Wheel, 1,00 gram load, 1,000 revolutions, ASTM D4060, 38 mg/loss

f. Adhesion to Concrete, psi [MPa], ASTM D4541, 450 [3.10] (concrete failed)

g. Adhesion to Concrete, psi [MPa], ASTM D7234, 732 [4.48] (concrete failed)

h. Coefficient of Friction-James Friction Tester, ASTM D2047, 0.50

i. Coefficient of Friction-Wet Static, BOT 3000, ANSI/NFSI B101.1, 0.95

j. Compressive Strength, psi [MPa] (epoxy), ASTM D695, 13,500[93.1]

k. Flammability/Rate of Burn (topcoat resin), ASTM D635, 182 mm/min

l. König Hardness (3 mil/0.08 mm film) (topcoat resin only), ASTM D4366, 171.3

m. Resistance to Yellowing AS measured using ASTM D2244 after 1000 consecutive hours UV exposure in QUV, ASTM G154, <10 increase to yellow units (CIE Δb)

n. Shore D Hardness, ASTM 2240, 80-85 @ 0 sec |75-80 @ 15 sec

o. Tensile Strength, psi [MPa], ASTM 2370, 6,250 [43.1]

p. Percent Elongation, ASTM D2370,6%

q. Volatile Organic Compounds, VOC, lb/gal [g/l], ASTM D3960, Resuflor MPE A+B= 0.41 [49] Resutile SDU A+B=0.11 [<13]

r. Water Absorption (24-hour immersion), ASTM C413, 0.2% weight increase

D. Product Properties

1. Resuflor MPE: A neutral, two-component, high solids epoxy.

a. Percent Solids, by weight (by volume), ASTM D1475, A + B: 95.45 (94.56).

b. Volatile Organic Compound-VOC, ASTM D3960, Mixed A + B: 0.41 lb./gal (49 g/L).

c. Abrasion Resistance, mg loss, Taber Abraser, C-17 Taber Abrasion Wheel, 1,000 gram load, 1,000 revolutions, ASTM D4060: 83.1.

d. Coefficient of Friction-COF, James Friction Tester, ASTM D2047: 0.59-0.62.

e. Adhesion to Concrete, ASTM D5441: 732 psi (4.48 MPa) concrete failed.

f. Adhesion to Concrete, ASTM D7234: 450 psi (3.10 MPa) concrete failed.

g. Compressive Strength, ASTM D695: 13,500 psi (93.079 MPa).

h. Tensile Strength, ASTM D2370: 8,000 psi (55.158 MPa).

i. Percent Elongation, ASTM D2370: 5.

j. Shore D Hardness, ASTM D2240: 80-85 at 0 sec, 75-80 at 15 sec.

2. Resutile SDU-Satin: Is a high solids and light stable urethane which has a satin appearance for long lasting durability.

a. Surface Resistance, Point to Point / Point to Ground, ESD Assoc. ANSI/ESD 7.1-2005, 1x105 ohms to less than 1x109

b. Resistance to Ground in Combination with a Person, ANSI/ESD STM 97.1 (ANSI/ESD S20.20-Mthod 1), less than 3.5x107 ohms (ESD shoes or heel straps)

c. Body Voltage Generation, ANSI/ESD STM 97.2 (ASNI/ESD S20.20-Method 2), 12 volts with ESD shoes, 32 volts with heel straps

d. Body Voltage Decay (with ESD shoes of heel straps), AATCC 134-1979 (modified), 1,000 volts to less than 10 volts in less than 1.0 second

e. Volatile Organic Compound-VOC, ASTM D3960, 0.11 lb./g (less than 13 g/L)

f. Abrasion Resistance, Taber Abraser, CS-17 Taber Abrasion Wheel, 1,000 gram load, 1,000 revolutions, ASTM D4060, 38

g. Adhesion to Concrete, ASTM D44541, 450 psi (3.10 MPa)

h. Adhesion to Concrete, ASTM D44541, 450 psi (3.10 MPa)

i. Adhesion to Concrete, ASTM D7234, 732 psi (4.48 MPa)

j. Coefficient of Friction, James Friction Tester, ASTM D2047, 0.50

k. Wet Static Coefficient of Friction-BOT 3000, ANSI/NSFI V101.1, 0.95

l. Compressive Strength (epoxy), ASTM D695, 13,500 psi (93.1 MPa)

m. Flammability/Rate of Burn (topcoat resin), ASTM D635, 50 mm/min

n. Tensile Strength, ASTM D2370, 6,250 psi (43.1 MPa)

o. Percent Elongation, ASTM D2370, 6

p. Resistance to Yellowing, AS measured using ASTM D2244 after 1000 consecutive hours UV exposure in QUV, ASTM G154, less than 10 increase to yellow units (CIE Lab Delta b)

q. Kong Hardness (3mil/0.08 mm film) (topcoat resin), ASTM D4366, 171.3

r. Shore D Hardness (epoxy), ASTM D2240, 80-85 at 0 Sec, 75-80 at 15 sec

s. Water Absorption (24-hour immersion), ASTM D570, 0.2 percent weight increase

85.9 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with specified requirements.

85.10 PREPARATION

A. General

1. New and existing concrete surfaces must be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

2. Moisture Testing: Perform tests recommended by manufacturer and as follows.

   a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 20 lbs/1,000 sf/24 hrs.

   b. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.

   c. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer must be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.

3. Mechanical surface preparation

   a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics must be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.

   b. Floor areas inaccessible to the mobile blast machines must be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.

   c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut must be made to properly seat the system, providing a smooth transition between areas. The detail cut must also apply to drain perimeters and expansion joint edges.

   d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer’s recommendations.

4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufacturer’s recommendations.

85.11 INSTALLATION

A. Install flooring system in accordance with manufacturer's instructions and approved submittals at locations indicated on the Drawings.

B. Ensure concrete is dry, clean, and prepared in accordance with manufacturer's instructions.

C. Allow concrete to cure a minimum of 7 days before applying flooring system.

D. Mixing:

1. Mix material components together in accordance with manufacturer's instructions.

2. Mix only enough material that can be applied within working time.

3. Add and mix colorants with materials in accordance with manufacturer's instructions to achieve uniform color.

E. Apply flooring system materials to obtain consistent mil thickness and smooth, uniform appearance and texture.

F. Overlay: Apply overlay in accordance with manufacturer's instructions. Apply overlay to prepared concrete surface.

G. Traction Aggregate: Broadcast traction aggregate in accordance with manufacturer's instructions. Broadcast traction aggregate into wet overlay.

H. Cove:

1. Apply cove primer and cove in accordance with manufacturer's instructions at locations indicated on the Drawings.

2. Apply cove to height and shape as indicated on the Drawings.

3. Apply cove to create seamless, smooth transition between flooring and walls.

I. Seal Coat:

1. Apply seal coat in accordance with manufacturer's instructions.

2. Apply seal coat over traction aggregate.

85.12 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests must be conducted by the Applicator:

a. Temperature

- Air, substrate temperatures and, if applicable, dew point.

b. Coverage Rates

- Rates for all layers must be monitored by checking quantity of material used against the area covered.

85.13 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer’s directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other Articles.

85.14 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXXVI - TILE CARPETING

86.1 SUMMARY

A. Article Includes:

1. Carpet tile.

B. Related Requirements:

1. ARTICLE LXXXIII RESILIENT BASE AND ACCESSORIES for resilient wall base and accessories installed with carpet tile.

86.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.

2. Carpet tile type, color, and dye lot.

3. Type of subfloor.

4. Type of installation.

5. Type, color, and location of edge, transition, and other accessory strips.

6. Transition details to other flooring materials.

C. Samples for Verification: Actual sample of finished products for each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

86.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

B. Sample Warranties: For carpet tile.

86.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

86.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

86.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

86.7 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

86.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, the following:

a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
b. Loss of tuft-bind strength.
c. Excess static discharge.

d. Delamination.

3. Warranty Period: 15 years from date of Substantial Completion.

86.9 CARPET TILE CPT-1, CPT-2

A. Color and pattern as indicated on drawings (or approved equal).

B. Density: 6372 oz./cu. yd.

C. Pile Thickness: 0.113 inches for finished carpet tile.

D. Stitches: 10 per inch.

E. Gage: 1/12 inches.

F. Secondary Backing: Manufacturer's standard material.

G. Backing System: Synthetic.

H. Size: 18 by 36 inches.

86.10 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

86.11 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in ARTICLE XXIX CAST-IN-PLACE CONCRETE and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with

installation only after substrates have a maximum 75 percent relative humidity level measurement.

c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

86.12 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

86.13 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

86.14 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.

2. Remove yarns that protrude from carpet tile surface.

3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7.

86.15 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE LXXXVIII - INTERIOR PAINTING

88.1 SUMMARY

A. Article Includes:

1. Primers.

2. Water-based finish coatings.

B. Related Requirements:

1. ARTICLE LI METAL FABRICATIONS for shop priming metal fabrications.

88.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.

2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.

2. Apply coats on Samples in steps to show each coat required for system.

3. Label each coat of each Sample.

4. Label each Sample for location and application area.

C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Article. Include color designations.

88.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

88.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

88.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

88.6 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: Sherwin-Williams (or approved equal)

B. Approved Equal: Any manufacturer providing paints that meet the color, sheen, performance, and installation requirements.

C. Source Limitations: Obtain each paint product from single source from single manufacturer.

88.7 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system must be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products must be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated in a color schedule.

88.8 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

88.9 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to

substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

88.10 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

88.11 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor must touch up and restore painted surfaces damaged by testing.

2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor must pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

88.12 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.

2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.

3. Allow empty paint cans to dry before disposal.

4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

88.13 BASIS OF MEASUREMENT AND PAYMENT

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

88.14 INTERIOR PAINTING SCHEDULE

A. Gypsum Board Substrates:

1. High-Performance Architectural Latex System, MPI INT 9.2B (P-1, P-5):

a. Prime Coat: Interior latex primer sealer, MPI 50
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, high-performance architectural coating, MPI 140 satin.

2. High-Performance Architectural Latex System, MPI INT 9.2B (P-2, P-3, P-6):

a. Prime Coat: Interior latex primer sealer, MPI 50.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, high-performance architectural coating, MPI 141 semigloss.

3. High-Performance Architectural Latex System, MPI INT 9.2B (P-4):

a. Prime Coat: Interior latex primer sealer, MPI 50.

b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, high-performance architectural coating, MPI 142 flat.

END OF ARTICLE

ARTICLE LXXXIX - HIGH-PERFORMANCE COATINGS

89.1 SUMMARY

A. Article includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

a. Steel.
b. Galvanized metal.

2. Interior Substrates:

a. Steel.
b. Galvanized metal.

B. Related Requirements:

1. ARTICLE LIII PIPE AND TUBE RAILINGS for pipe and tube railings with coatings specified in this Article.

2. ARTICLE LXXXVIII INTERIOR PAINTING for general field painting.

3. ARTICLE CI METAL BUILDING SYSTEMS.

89.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.

2. Apply coats on Samples in steps to show each coat required for system.

3. Label each coat of each Sample.

4. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

89.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

89.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

89.5 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

89.6 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: AMERLOCK 400 VOC (or approved equal)

B. Approved Equal: Any manufacturer providing high-performance coatings that meet the material, coating performance, and installation requirements.

89.7 HIGH-PERFORMANCE COATINGS, GENERAL

A. VOC compliant high solids epoxy coating

1. Two component high-performance coating for new or old steel

2. VOC compliant for <100 g/L

3. Self-priming capability

4. Compatible with prepared, damp surfaces

5. Compatible with adherent rust remaining on prepared surfaces

6. Semi-gloss

7. DFT of 4.0 – 8.0 mils depending on system

8. Volume solids 83 – 2%

9. Temperature resistance (Continuous) to 200 deg F

10. Temperature resistance (Intermittent) to 350 deg F

B. Material Compatibility:

1. Materials for use within each paint system must be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products must be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

3. Products must be of same manufacturer for each coat in a coating system.

C. Colors: As selected by Architect from manufacturer's full range.

89.8 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

89.9 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of

subsequently applied coatings.

89.10 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations.

1. Use applicators and techniques suited for coating and substrate indicated.

2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat with a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied as recommended by the manufacturer. Tint undercoats to match color of finish coat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

89.11 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor must touch up and restore coated surfaces damaged by testing.

2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor must pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

89.12 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

89.13 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XC - GRAFFITI-RESISTANT COATINGS

90.1 SUMMARY

A. Article Includes:

1. Graffiti-resistant treatment applied to exterior exposed walls.

B. Related Requirements:

1. ARTICLE XXX UNIT MASONRY ASSEMBLIES for integral water-repellent admixture for unit masonry assemblies.

90.2 ACTION SUBMITTALS

A. Product Data:

1. Graffiti-resistant treatments.

B. Product Data Submittals:

1. Include manufacturer's printed statement of VOC content.

2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

90.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of graffiti-resistant treatment.

B. Sample Warranty: For special warranty.

90.4 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

90.5 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit coatings to be applied in accordance with manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.

2. Building has been closed in for not less than 30 days before treating wall assemblies.

3. Ambient temperature is above 40 deg F and below 90 deg F and will remain so for 24 hours.

4. Surface temperatures must not exceed 90 degrees.

5. Substrate is not frozen and substrate-surface temperature is above 40 deg F and

below 100 deg F.

6. Rain is not predicted within 24 hours.

7. Apply sealants minimum 24 hours, or as required by sealant manufacturer, whichever is greater, prior to application of graffiti-resistant treatment.

8. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

9. Apply only in well-ventilated areas.

90.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

90.7 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: PROSOCO, Inc. Sure Klean Weather Seal Blok-Guard & Graffiti Control VOC 15 (or approved equal)

B. Approved Equal: Any manufacturer providing graffiti-resistant coatings that meet the material, finish, performance, and installation requirements.

90.8 GRAFFITI-RESISTANT TREATMENT

A. Clear-drying, penetrating, solvent-based silicone for protecting masonry from graffiti attacks.

B. Comply with VOC requirements of authorities having jurisdiction.

C. Water Absorption Reduction per ASTM C140/C140M

D. Water Vapor Transmission per ASTM E96

E. Water Vapor Transmission per ASTM D 6490

F. Cleanability: Level 2 per ASTM D7089

90.9 GRAFFITI REMOVER

A. Product must be manufactured and approved for use by the graffiti-resistant treatment manufacturer.

90.10 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry in accordance with graffiti-resistant treatment manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.

2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.

3. Verify that required repairs are complete, cured, and dry before applying graffiti-resistant treatment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

90.11 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, in accordance with repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product in accordance with water-repellent manufacturer's written instructions and as follows:

1. Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

90.12 APPLICATION OF GRAFFITI-RESISTANT TREATMENT

A. Prepare graffiti-resistant treatment in accordance with manufacturer’s written instructions.

B. Apply graffiti-resistant treatment in accordance with manufacturer’s written instructions, by brush or spray application method, in coverage rate recommended by manufacturer for substrate.

90.13 FIELD QUALITY CONTROL

A. Test surfaces and materials to be treated to ensure compatibility and desired graffiti-resistant treatment results.

1. Sample Area:
   a. Size: 48 inches by 48 inches.
   b. Apply to substrate and allow to cure.
   c. Owner’s representative will inspect the cured test panel for approval.
   d. Maintain approved sample for comparison during the work.

90.14 CLEANING

A. Immediately clean graffiti-resistant treatment from adjoining surfaces and surfaces soiled or damaged by graffiti-resistant treatment application as work progresses. Correct damage

to work of other trades caused by graffiti-resistant treatment application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

90.15 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XCI - ROOM-IDENTIFICATION PANEL SIGNAGE

91.1 SUMMARY

A. Article includes room-identification signs that are directly attached to the building.

B. Related Requirements:

91.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

91.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.

2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.

3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Variable Component Materials: 8-inch Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.

2. Exposed Accessories: Full-size Sample of each accessory type.

D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

91.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

91.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

91.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

91.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Two years from date of Substantial Completion.

91.8 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

91.9 ROOM-IDENTIFICATION AND DIRECTIONAL SIGNAGE SYSTEM

A. Provide signs, plaques, directories, and dimensional building letters that are standard products of manufacturers regularly engaged in the manufacture of such products that essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Obtain signage from a single manufacturer with edges and corners of finished letter forms and graphics true and clean.

B. Standard Room Signs

1. Provide signs that include tactile letters, symbols and Braille for interior rooms or spaces where the sign is not likely to change over time. Tactile text descriptions are required for pictograms that are provided to identify a permanent room. Examples include interior signs that label restrooms, stairs, room numbers or letters, and room names. These permanent room signs can include paper inserts for updatable information.

C. Tactile Letters, Symbols and Braille

1. Provide ADA compliant material per 36 CFR 1191 which is raised 1/32 inch from the first surface, has a minimum 5/8 inch in height and is an ADA acceptable font. The color of the tactile letters is required to contrast with the sign face color per ADA standards. The ADA required Braille has a minimum durometer reading of 90. All raised letters, numbers and symbols are to comply.

D. Directional Signs

1. Directional signs provide arrows with messages which point to critical destinations such as departments, offices, or other pertinent destinations. These can be a panel sign system with a series of permanently attached messages or a modular system with updatable inserts. Directional signs have header panels with applied or direct print messages.

E. Type of Mounting for Signs

1. Provide surface mounted signs mounted with concealed mechanical fastening through the holders. Secure inserts in holders. Provide signs with aluminum projecting mount attachment extrusion to secure to wall surface, projecting, and double-sided signs. Provide mounting for projecting mount attachment extrusion by mechanical fasteners, selected based on wall conditions.

F. Exit Door Tactile Sign

1. Provide tactile sign with the message EXIT at each exit door that requires an exit sign to conform with NFPA 101. Sign tactile message is to comply with ICC/ANSI A117.1.

91.10 SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

91.11 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

3. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

D. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.

E. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

91.12 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

91.13 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

91.14 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to the accessibility standard.

3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

4. Do not install items that show visual evidence of biological growth.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Anchorage

1. Provide anchorage in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or shown includes slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Provide exposed anchor

2. and fastener materials compatible with metal to which applied with matching color and finish.

    a. Signs mounted to painted gypsum board surfaces must be removable for painting maintenance.
    b. Mount signs to lay-in ceiling grids with clip connections to ceiling tees.
    c. Install signs mounted on metal surfaces with magnetic tape.
    d. Install signs mounted on fabric surfaces with hook and loop tape or pin mount.
    e. Install signs to workstation panels with panel clips.

D. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.

5. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch away from edges to

prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.

6. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

91.15 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

91.16 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XCIII - PLASTIC TOILET COMPARTMENTS

93.1 SUMMARY

A. Article Includes:

1. Solid-plastic toilet compartments.

B. Related Requirements:

1. ARTICLE LXXIX NON-STRUCTURAL METAL FRAMING for blocking.

2. SARTICLE XCVI TOILET, BATH, AND LAUNDRY ACCESSORIES for accessories mounted on toilet compartments.

93.2 COORDINATION

A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall and ceiling to ensure that toilet compartments can be supported and installed as indicated.

93.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.

2. Show locations of cutouts for compartment-mounted toilet accessories.

3. Show locations of centerlines of toilet fixtures.

4. Show locations of floor drains.

5. Show overhead support or bracing locations.

C. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.

1. Size: Manufacturer's standard size.

93.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

93.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge(s) with associated fasteners.

2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.

3. Door Bumper: One bumper(s) with associated fasteners.

4. Door Pull: One door pull(s) with associated fasteners.

5. Fasteners: 10 fasteners of each size and type.

93.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

93.7 SOURCE LIMITATIONS

A. Obtain plastic toilet compartments from single source from single manufacturer.

93.8 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" for toilet compartments designated as accessible.

93.9 SOLID-PLASTIC TOILET COMPARTMENTS TP-1/US-1

A. Manufacturers / Approved Equals

1. Basis of Design: Scranton Hiny Hiders Solid Plastic Partitions/Screens (or approved equal)

2. Approved Equal: Any manufacturer providing partitions/screens that meet the material, construction, finish, hardware, and accessories.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color throughout thickness of material.

1. Color: As indicated on drawings.

E. Urinal-Screen Construction: Matching panel construction.

F. Pilaster Shoes: Manufacturer's standard design; stainless steel.

G. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

93.10 HARDWARE AND ACCESSORIES

A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.

1. Hinges:

a. Manufacturer's paired, wraparound, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.

- Material, Paired Hinge: Aluminum.

2. Latch and Keeper: Manufacturer's surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.

a. Material: Aluminum.

3. Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent in swinging door from hitting compartment-mounted accessories.

a. Material: Chrome-plated zamac.

4. Door Bumper: Manufacturer's rubber-tipped bumper at out swinging doors.

a. Material: Chrome-plated zamac.

5. Door Pull: Manufacturer's unit at out swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

a. Material: Chrome-plated zamac.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

93.11 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

E. Zamac: ASTM B86, commercial zinc-alloy die castings.

93.12 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet enclosures and 34-inch- wide doors with a minimum 32-inch-wide, clear opening for toilet enclosures designated as accessible.

93.13 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

93.14 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch.
b. Panels or Screens and Walls: 1 inch.

2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel or screen.

a. Locate wall brackets, so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

93.15 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

93.16 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XCIV – WET WALL PANEL SYSTEM

94.1 SUMMARY

A. Wet wall water-proof panels

B. Panel adhesive and color matched sealant

94.2 RELATED ARTICLES

A. ARTICLE LIV ROUGH CARPENTRY

B. ARTICLE LV SHEATHING

94.3 SUBMITTALS

A. Product Data: For each specified product. Include manufacturer's technical data sheets and published installation instructions.

B. Shop Drawings: Fully dimensioned shop drawings indicating wall panel and mounting system layouts, joinery and reveals, terminating conditions, substrate construction, cutouts, and holed. Include elevations, sections, and large-scale details; show attachment locations, blocking, and related components.

C. Samples: Verification samples for each wall panel color and pattern required.

1. Submit minimum 5x8 inch sample of each wall panel required. Include two samples jointed together representing typical exposed panel joint conditions.

94.4 QUALITY ASSURANCE

A. Installer Qualifications: Documented experience in installing wall panels similar in scope and complexity to the Project.

94.5 DELIVER, STORAGE, AND HANDLING

A. Storage and Protection: store materials protected from exposure to harmful weather conditions, at temperatures and humidity conditions recommended by manufacturer. Store panels flat on pallets or similar rack-type storage to preclude damage.

B. Ensure wall panels acclimate to installation area final occupancy temperature and humidity a minimum of 48 hours prior to time of installation.

C. Handling: Use extra care for front faces of panels. Use only non-abrasive cloths to avoid scratching finished surfaces.

94.6 PROJECT CONDITIONS

A. Environmental Requirements: Prior to installation, building must be enclosed with building interior spaces to receive the work climate-controlled, with a typical ambient temperature between 55 deg F and 80 deg F, and 40 percent to 50 percent relative humidity.

B. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

94.7 WARRANTY

A. Provide manufacturer's standard 10 Year Limited Warranty against material defects in wall

panel system.

94.8 MANUFACTURER / APPROVED EQUALS

A. Basis of Design: Wetwall Water-Proof Wall Panel System (or approved equal)

B. Approved Equal: Any manufacturer providing panels that meet the material, finish, profile, structure, performance, and installation requirements.

94.9 WET WALL PANELS

A. Panel Size: As indicated in drawings.

B. Panel Thickness: 0.43 inch nominal.

C. Panel Weight: Approximately 1.65 lb/sq. ft.

D. Design Pattern and Color: Tuscany Marbly W7057. Produced with enhanced laminate performance.

E. Panel Edge Configuration: Provide the following to suit installation conditions:

1. Tub/Shower Surrounds: Combination bullnose edge/flat edge, tongue edge/flat edge and groove edge/flat edge mated panels.
2. Panels Extending Beyond Surrounds: Tongue edge and groove edge.
3. Wing Walls: Combination flat and bullnose.
4. Feature Panels: two bullnose edges.

F. Panel Performance Criteria: Based on testing pursuant to ISO 4586, for the following properties:

1. Light Resistance: Slight effect; Test Method 32A and 33B.
2. Resistance to Staining: Not more than slight effect; test method 30A.
3. Resistance to Staining: 10; Test Method 31B.
4. Resistance to Wet Heat: No effect (non-gloss finishes) or slight effect (gloss finishes); Test Method 42.
5. Resistance to Dry Heat: No effect (non-gloss finishes) or slight effect (gloss finishes); Test Methods 17A and 18B.
6. Resistance to Impact (large): 40 inches; Test Method 25.
7. Resistance to Cigarette Burn: 210 seconds; Test Method 37.
8. Dimensional Stability 0.5 percent (machine direction) and 0.8 percent (cross direction); Test Method 22B.

94.10 ACCESSORY MATERIALS

A. Single Shelf Recessed Niche

1. From the same manufacturer as, and compatible with, the selected wet wall panel system
2. Approximate niche interior dimensions: 6 ½”W x 10 ½”H x 3 ¾”D

B. Panel Adhesive

C. Color Matched Sealant

94.11 FABRICATION

A. Fabricate components in shop to greatest extent practicable, in panel sizes and arrangement indicated according to approved shop drawings and manufacturer’s published fabrication requirements.

B. Provide cutouts for wall penetrations, trim edges according to manufacturer's published requirements.

94.12 EXAMINATION

A. Examine substrates and conditions that could adversely affect the work of this Article.

B. Substrates to receive wall panels must be sound, flat, smooth, dry and free from dust, loose paint, or other surface contaminants.

C. Plumbing fixtures and accessories must be removed prior to panel system installation.

D. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

94.13 PREPARATION FOR EXISTING TILE SUBSTRATES

A. Verify tile is solidly adhered to walls. Any loose tile must be removed, filled with and approved mastic, and sanded smooth.

B. Rough up glossy tile surfaces using a belt sander with 60-grit sandpaper.

C. Prepared surfaces must be dry, smooth, and free of any dust of other contaminants.

D. Wipe prepared surfaces with a damp cloth and allow to dry.

94.14 WALL PANELS INSTALLATION

A. General: Install wall panels plumb, level, and true according to approved shop drawings and manufacturer’s published installation instruction.

B. Tape of shower (or tub) drains prior to panel installation.

C. Cut panels using only approved power tools.

D. Dry fit panels, then mark plumbing locations for shower valves, shower heads, and similar items. Drill holes using only approved power tools.

E. Thoroughly clean panel backs prior to adhesive application on panel surfaces. Apply adhesive with bead dimensions, spacing, and locations from panel edges according to manufacturer’s recommendations. Press into place on installation substrates to ensure full adhesive contact.

F. Apply color matched sealant to tongue edge panel prior to installation on wall surfaces. After panels are installed on substrates, apply color matched sealant to corners and bottoms for a watertight installation. Remove excess sealant from panel surfaces. Allow to cure for 24 hours.

94.15 CLEANING AND PROTECTION

A. Clean wall panels according to manufacturer’s published maintenance instructions. Completely remove deleterious substances from finished surfaces using approved cleaning materials.

B. Protect completed work from damage during remainder of construction period.

94.16 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XCV - WALL AND DOOR PROTECTION

95.1 SUMMARY

A. Article Includes:

1. Corner guards.

95.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

95.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of exposed plastic material.

B. Sample Warranty: For special warranty.

95.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

95.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch-long units.

2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

95.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated areas protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.

2. Keep plastic materials out of direct sunlight.

3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.

95.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: one year from date of Substantial Completion.

95.8 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: Inpro Tape-On Corner Guards (Without Tape), or approved equal

B. Approved Equal: Any manufacturer providing panels that meet the material, profile, color, structure, performance, and installation requirements.

C. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

95.9 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 450 or less.

95.10 CORNER GUARDS

A. Surface-Mounted, Opaque-Plastic Corner Guards CG-1, CG-2: Fabricated as one piece from chemical sand stain-resistant unplasticized PVC; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.

1. Wing Size: Nominal 3/4 by 3/4 inch.

2. Height: 48 inches

3. Mounting: Adhesive.

4. Color and Texture: As indicated on drawings.

95.11 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Adhesive: As recommended by protection product manufacturer.

95.12 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Quality: Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections.

95.13 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

95.14 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

95.15 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

95.16 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with

chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting: Install corner protection in locations indicated on Drawings. Install corner protection above wall base.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

95.17 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

95.18 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XCVI - TOILET, BATH, AND LAUNDRY ACCESSORIES

96.1 SUMMARY

A. Article Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

B. Related Requirements:

1. ARTICLE LXXXI CERAMIC TILING for ceramic toilet and bath accessories.

96.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

96.3 ACTION SUBMITTALS

A. Product Data:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

C. Samples: When requested, submit each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

96.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

96.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

96.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace

mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

96.7 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 360 lbf concentrated load applied in any direction and at any point.

96.8 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single manufacturer.

B. Toilet Tissue (Roll) Dispenser TPD:

1. Bobrick B-540 (or approved equal)
2. Description: Double-roll dispenser with shelf.
3. Mounting: Surface mounted.
4. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Combination Towel (Folded) Dispenser/Waste Receptacle PTD/WR:

1. Bobrick B-3949 (or approved equal)
2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Surface mounted.
4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
5. Minimum Waste-Receptacle Capacity: 12 gal.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
7. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

D. Soap Dispenser SD:

1. Bobrick B-2111 (or approved equal)
2. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40-fl oz.
5. Materials: Stainless steel.
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

E. Grab Bar GB:

1. Bobrick B-6806 (or approved equal)
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
4. OD: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit <SND>:

1. Bobrick B254 (or approved equal)
2. Mounting: Partition mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

G. Seat-Cover Dispenser TSCD:

1. Bobrick B-221 (or approved equal)
2. Mounting: Surface mounted.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Lockset: Tumbler type.

H. Mirror Unit MIRROR:

1. Frame: Stainless steel channel.
    a. Corners: Welded and ground smooth.
2. Size: As indicated on Drawings.
3. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

I. Hook:

1. Bobrick B-76727 (or approved equal), mounted to interior of stall door.
2. Description: Double-prong unit.
3. Mounting: Concealed.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

96.9 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

B. Shower Curtain Rod:

1. Bobrick B-6107 (or approved equal)
2. Description: 1-inch- OD, straight rod.
3. Configuration: As indicated on Drawings.
4. Mounting Flanges: Exposed fasteners; in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Robe Hook:

1. Bobrick B-76727 (or approved equal)
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

96.10 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Article, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

96.11 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

96.12 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

96.13 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

96.14 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE XCIX - STEEL SHELVING

99.1 SUMMARY

A. Article Includes:

1. Adjustable Pallet Racks.

2. Cantilever Racks.

99.2 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Shelving Units: Structural steel cantilever rack systems and adjustable pallet rack system.

2. Anchorage and Accessories.

3. Installation Instructions.

4. Finishes.

B. Shop Drawings.

C. Test Reports: Shelving Units.

99.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing the brand name and identification of the manufacturer. Store inside under cover. Protect surfaces from damage.

99.4 DELEGATED DESIGN

A. Engineering Responsibility: Preparation of Shop Drawings including anchorage design and reactions, design calculation, and other structural data by a registered professional engineer.

B. Design Criteria:

1. Dead, live, wind, and seismic loads per code.

2. Exposure category per project location.

3. Consider open yard conditions.

99.5 QUALITY ASSURANCE

A. Manufacturer specializing in industrial storage racks, minimum of 5 years.

B. Installer approved by manufacturer.

99.6 MANUFACTURERS

A. Approved manufacturers, or approved equal:

1. Steel King Industries.

2. Ridg-U-Rak.

3. Nucor Warehouse Systems.

99.7 MANUFACTURED UNITS

A. Provide shelving units indicated. Provide floor and wall anchorage as required for project seismic zone.

99.8 ADJUSTABLE PALLET RACK SYSTEMS

A. Upright frames and beams.

B. Beam-to-frame connections (mechanical locking).

C. Safety clips.

D. Accessories: Row spacers, column protectors, wire decking.

E. Design:

1. Levels: 4-Rows of shelving.

2. Size: As indicated on drawings.

3. Beam Capacity: 8,000 lbs for interior racks; 10,000 lbs for exterior racks. Label beam capacity on each beam/rack.

4. Rack Beam Length: As indicated on drawings.

5. Upright Height: As indicated on drawings.

99.9 CANTILEVER RACK SYSTEMS

A. Structural steel columns and arms.

B. Arms adjustable at regular increments. Bolted end lips.

C. Base plates designed for anchorage.

D. Design:

1. Single- and double-sided cantilever rack.

2. Levels: 5 Levels.

3. Size: As indicated on drawings.

4. Arms: 48” long arms for interior racks and 60” long arms for exterior racks, as indicated on drawings.

5. Arm Capacity: 3,000 lbs for interior racks; 5,000 lbs for exterior racks. Label arm capacity on each arm/rack.

6. Column Spacing/Bracing Length: 3-feet on center max.

7. Upright Height: As indicated on drawings.

99.10 FINISH

A. Corrosion resistant. Provide the shelving units in the manufacturer’s standard colors as indicated. Clean metal by multiple stage phosphatizing and sealing process, for rust resistance and paint adhesion.

99.11 EXAMINATION

A. Before installation, examine shelving units for dents and scratches. Replace damaged shelving.

99.12 INSTALLATION

A. Install shelving according to manufacturer’s installation instructions. Make floor connections as indicated.

99.13 PROTECTION

A. Cover and protect shelving from damage during the completion of construction. Remove protection prior to acceptance of project.

99.14 BASIS OF MEASUREMENT AND PAYMENT

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

99.15 SCHEDULE

A. Pallet Racks: See floor plans for size and quantity of Pallet Racks.

B. Cantilever Rack: See floor plans for size and quantity of Cantilever Racks.

END OF ARTICLE

ARTICLE C - ROLLER WINDOW SHADES

100.1 SUMMARY

A. Article Includes:

1. Manually operated, single-roller shades.

B. Related Requirements:

1. ARTICLE LIV ROUGH CARPENTRY for wood blocking and grounds for mounting roller shades and accessories.

100.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.

100.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of shadeband material.

B. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

100.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to be included in maintenance manuals.

100.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

100.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

100.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

100.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

100.9 MANUFACTURERS / APPROVED EQUALS

A. Basis of Design: MechoShade Mecho/5 System (or approved equal)

B. Approved Equal: Any manufacturer providing panels that meet the material, installation, and performance requirements.

100.10 MANUALLY OPERATED, SINGLE-ROLLER SHADES

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10-lbs or for shades as recommended by manufacturer, whichever criterion is more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of

shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.

2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.

3. Shadeband-to-Roller Attachment: Manufacturer's standard method Adhesive attachment is not acceptable.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shadeband Material: Light-filtering fabric.

2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.

E. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open.

2. Endcap Covers: To cover exposed endcaps.

100.11 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.

2. Weave: Basketweave.

3. Openness Factor: 3 percent.

4. Color: As indicated on Drawings.

100.12 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible.

100.13 EXAMINATION

A. Proceed with installation only after unsatisfactory conditions have been corrected.

100.14 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions. Locate so shade band is at least 2 inches from interior face of glass. Allow proper clearances for window operations hardware.

B. Roller Shade Locations: At exterior windows.

100.15 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

100.16 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

100.17 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE CII - TERMITE CONTROL

102.1 SUMMARY

A. Article Includes:

1. Soil treatment.

B. References:

1. Title 7, United States Code, 136 through 136y – Federal Insecticide, Fungicide and Rodenticide Act; United States Code; 1947 (Revised 2001).

2. Hawaii Pesticide Law, Chapter 149A, HRS.

102.2 PREINSTALLATION MEETINGS

A. Convene a pre-installation meeting at least one week prior to beginning installation to review condition of preparation, storage and handling, installation procedures, superintendent, installer, installer's crew leader, and representatives of the trades affected by this work are required to attend. Notify the Architect at least 10 calendar days before the meeting.

102.3 ACTION SUBMITTALS

A. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate, manufacturer's installation instructions for each item to be incorporated into the system, and manufacturer's site conditions field reports. Materials must be provided with identification marks and data as required by the "City Standard Specifications". Submit written warranty at closeout.

1. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.

2. Include the EPA-Registered Label for termiticide products.

3. Test Reports: Indicate regulatory agency approval reports when required.

4. Treatment Application Report

5. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

6. Certificates: Submit certificates of the system installers. Submit product certificates signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

102.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of termite control product.

C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

1. Date and time of application.

2. Moisture content of soil before application.

3. Termiticide brand name and manufacturer.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes used, and rates of application.

6. Areas of application.

7. Water source for application.

D. Sample Warranties: For special warranties.

102.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:

1. Having minimum 2-years of experience.

2. Approved by manufacturer of treatment materials.

3. Licensed by the Hawaii State Pest Control Board and certified as a commercial applicator under the Hawaii Pesticide Lay by the Hawaii State Department of Agriculture.

B. Treatment Application Report: Include the following:

1. Date and time of application.

2. Moisture content of soil before application.

3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.

5. Dilutions, methods, volumes, and rates of application used.

6. Areas of application.

102.6 FIELD CONDITIONS

A. Soil Treatment:

1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having

jurisdiction.

2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

102.7 WARRANTY

A. Furnish a 2-year warranty against infestations or re-infestations by subterranean termites of the buildings or building additions constructed under this contract. Written warranty must be jointly signed by an officer of the Contractor and the supplier. Perform annual inspections of the buildings or building additions. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and building conditions have not been altered in the interim, take the following actions:

1. Include coverage for repairs to buildings and to contents damaged due to building damage.

2. Correct defective termite control installation and perform other treatment as may be necessary to eliminate subterranean termite infestation.

3. Repair damage caused by termite infestation, and if required, re-treat.

4. Re-inspect the building approximately 180 calendar days after the repair.

B. The Surety and the Contractor will not be held liable beyond two years from the project acceptance date.

C. The warranty period will commence from the project acceptance date.

102.8 MANUFACTURERS

A. Chemical Soil Treatment

1. Toxicant Chemical: EPA approved Termiticide commonly used in the State of Hawaii; synthetically color dyed to permit visual identification of treated soil.

2. Diluent: Recommended by toxicant manufacturer.

3. Vapor Retarder: As specified in ARTICLE LXII VAPOR RETARDERS.

B. Mixes: Mix toxicant to manufacturer’s instructions.

102.9 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

102.10 PREPARATION

A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

102.11 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.

2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.

3. Crawlspaces: Soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

102.12 INSTALLING METAL MESH BARRIER SYSTEM

A. Strictly follow the manufacturer's instructions published in Manufacturer's Installation Instruction Manual. In addition to the system manufacturer's instructions, place the stainless-steel mesh across all openings, joints, penetrations, and other termite entry points to the building (including all shrinkage cracks in concrete slabs and built penetrations in

slabs and walls that termites may use for access points) and in accordance with manufacturer's recommendations. Clamp, parge adhere, bond, or embed the steel mesh to the material surrounding the opening in accordance with the manufacturer's recommendations. Install with no gaps, penetrations, or damage to the mesh system. Submit steel mesh shop drawings of the termite steel mesh installation at all perimeter foundations, joints, and penetration conditions to the Contracting Officer for approval before installation.

B. To avoid an electrolytic reaction, do not place dissimilar metals in contact with the stainless-steel mesh.

C. Installation Sequence

1. Install the steel mesh barrier in accordance with the manufacturer's recommendations. Fit and clamp the mesh around all pipe penetrations, and terminate the mesh at the perimeters, as appropriate for the building construction and as described in the manufacturer's installation manual. Lap joint the mesh 0.39 to 0.59 inches and the joint may be strengthened by using bonding cement for a minimum distance of 20 inches along the joint.

2. Install special fittings that are appropriate to the construction, as described in manufacturer's installation manual.

3. Following installation of mesh and vapor barrier, install reinforcing steel and concrete, as specified under other Articles. Seal penetrations and shrinkage cracks through concrete slabs in accordance with manufacturer's recommendations.

D. To maintain resistance to termites, complete the system and do not disturb, penetrate, or damage during the remaining contract time period. Where required, integrate mesh into subsequent construction, as described in manufacturer's installation manual.

102.13 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

102.14 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE CIII - VEHICLE LIFT

103.1 SUMMARY

A. Article includes:

1. Two Post Vehicle Lift

103.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components, and finishes for lifts.

2. Include rated capacities, operating characteristics, electrical characteristics, safety features, controls, finishes, and accessories.

B. Shop Drawings: For each lift.

1. Include plans, elevations, sections, attachment details, and required clearances.

2. Indicate dimensions, weights, loads, and points of load to building structure.

3. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For surfaces and components with factory-applied color finishes.

103.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of lift.

C. Sample Warranty: For special warranty.

103.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lift to be included in the operation and maintenance manuals.

1. Include the following:

a. Operation and maintenance documentation directory manuals.
b. Emergency manuals.
c. Systems and equipment operation manuals.
d. Systems and equipment maintenance manuals.
e. Product maintenance manuals.
f. Parts list with sources indicated.
g. Recommended parts inventory list.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted use of lifts.

103.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

103.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of lifts that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

103.7 AUTOMOTIVE LIFT

A. TWO POST LIFT

1. The two post, symmetric vehicle lift must be capable of lifting 15,000-lbs, as well as meet the dimensions listed on the drawings. Ensure that the manufacturer's recommendations for minimum bay dimensions are met. The two-post lift must include the following:

a. Single-point safety release
b. Padded overhead safety shutoff system
c. Arm restraints
d. Stack adapters and pads to accommodate different types of vehicles

2. Concrete Floor

a. The two-post lift requires a minimum compressive strength of 3.000 psi with a minimum thickness of 4 inches. Concrete must be cured for at least 28 days. Do not install the lift on any other floor than concrete.

103.8 ELECTRICAL WORK

A. Provide electrical motor-driven equipment specified herein complete with motors, motor starters and controls complying with NEMA MG 1. Electrical characteristics should be as indicated. Extension to equipment from junction box and all control wiring must be under this Article and must comply with NFPA 70. Provide motor starters under this Article complete with properly sized thermal-overload protection in each phase and other appurtenances necessary for the motor control specified. Each motor should be sized to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor when operating at proper electrical system voltage. Provide control and protective or signal devices required for the operation specified and wiring required for controls and devices but not shown on the electrical plans.

103.9 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, critical dimensions, and other conditions affecting

performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

103.10 INSTALLATION

A. Following installation, adjust flows, timers, levelers, and similar components and operation devices as appropriate. After testing, and before acceptance, examine equipment to ensure that adjustments are correct and that any additional adjustments deemed necessary during product testing have been incorporated.

B. Wiring Method: Conceal conductors and cables within housings of units or building construction. Do not install conduit exposed to view in finished spaces. Bundle, lace, and route conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

C. Lubricate operating parts of lift, including drive mechanism, guide rails, hinges, safety devices, and hardware.

D. Test safety devices.

103.11 MANUFACTURER'S FIELD SERVICES

A. Provide the services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified. The representative must supervise the installation, adjustment, and testing of the equipment.

103.12 FIELD TRAINING

A. Provide a field training course for designated operating and maintenance staff members. Training must be provided for a total period of 4 hours of normal working time and must start after the system is functionally complete but prior to final acceptance tests. Field training must cover all of the items contained in the Operating and Maintenance Instructions. Submit six complete copies of operation manual outlining the step-by-step procedures required for system startup, operation, and shutdown. The manuals must include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Submit six complete copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals must include piping layout, equipment layout, simplified wiring and control diagrams of the system as installed. Operation and maintenance manuals must be approved prior to the training course.

103.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lifts. Include a review of emergency systems and emergency procedures to be followed at times of operational failure and other building emergencies.

B. Check operation of lifts with Owner's personnel present and before date of Substantial

Completion. Determine that operating systems and devices are functioning properly.

C. Check operation of lifts with Owner's personnel present not more than one month before end of warranty period. Determine that operating systems and devices are functioning properly.

103.14 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE CIV – BRIDGE CRANES

104.1 SUMMARY

A. This Article includes electrically operated crane systems.

104.2 SUBMITTALS

A. Product Data for crane and monorail system, indicating capacities, performance, operations, safety features, controls, finishes, and similar information. Indicate any variations from specified requirements.

B. Shop Drawings including dimensioned drawings showing plans, sections, and large-scale details indicating coordination with building structure and relationship with other constructions. Identify system components by name, part number, function, etc. to clearly show system conforms to specified requirements.

C. Wiring Diagrams detailing locations and wiring for power and control systems and differentiating clearly between manufacturer installed wiring and field installed wiring.

D. Spare Parts and Maintenance Manuals: Crane supplier must furnish two- (2) complete sets of replacement parts lists and maintenance manuals for the equipment after shipment. These manuals are to include key component breakaway pictures for ease of parts ordering, catalog cut pages, part numbers, sub-assembly details, and periodic inspection and maintenance requirements recommendations.

104.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage crane manufacturer or an installer approved by the manufacturer who has completed crane installations similar in material, components, design, and extent to that indicated for Project which have resulted in installations with a record of successful in-service performance for a period of at least five- (5) years.

B. Regulatory Requirements:

1. Comply with CMAA Specification No. 74, Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes.

2. Comply with OSHA requirements as they apply to overhead cranes.

3. All wiring to comply with the latest edition of the National Electrical Code.

4. Installation, unloading of all materials and load testing, including 125% load test in accordance with ANSI B30.11, Safety Code for Underhung Cranes and Monorail Systems." Final connection of the power source to the equipment at the level of the runway beams is to be performed by the Crane/Monorail Supplier.

C. Verification of Dimensions: The Contractor is responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. Verify all dimensions of the building that relate to fabrication of the crane and notify the Contracting Officer of any discrepancy before finalizing the crane order.

104.4 MATERIALS AND COMPONENTS

A. General: Provide systems that will fulfill requirements. Where components are not otherwise indicated, provide standard components, published by manufacturer and as required for a complete system. All components must be new equipment and the product of one manufacturer.

104.5 DESIGN

A. Provide top running overhead electric traveling (OET) crane conforming to CMAA 74, Class A (Standby or Infrequent Service) for indoor service, ASME B30.2, with a vertical lift and crane span as indicated in the Drawings.

B. Crane must fit within the parameters indicated in the drawings.

C. The crane must be pendant controlled and operated in spaces and within the loading conditions indicated. The pendant controller must be mounted on a separate festooned cable system from the trolley power supply. The crane must operate on 460-volts AC, 60 Hz, three phase power source. Maximum crane wheel loads (without impact) due to dead and live loads, with the trolley in any position, must not cause a more severe loading condition in the runway support structure than that produced by the design wheel loads and spacing indicated.

D. Provide a crane with a minimum rated capacity of 2 tons. Mark the rated capacity in both kilogram and pound units printed in different colors on both sides of the crane on the bridge girders. Capacity marks must be clearly visible to the operator at ground level.

E. Speeds: OET crane must have the following full load speeds (plus or minus 10 percent):

1. Hoist - rated speed of 28 feet per minute.

2. Trolley - rated speed of 80 feet per minute.

3. Bridge - rated speed of 120 feet per minute.

F. Structural Requirements must be in accordance with CMAA 74.

G. Bridge girder should be constructed of A-36 structural steel beams reinforced as necessary or fabricated plate box sections.

H. The bridge girders track end stops should be capable of withstanding the impact of a fully loaded trolley or carrier traveling at 50 percent of the full load speed.

I. Vertical Impact: Where powered hoists are used, an impact allowance must be included in design calculations for carriers (trolleys), cranes, and runway monorail tracks. The impact allowance must be 1/2% of the rated load for each foot per minute (1.6% of the rated load for each meter per minute) of hoisting speed with a minimum allowance of 15% and a maximum of 50%.

104.6 TRACK ELECTRIFICATION

A. Conductor bar must be TC/American Channel-Bar, or otherwise recommended by

manufacturer, roll formed electro-galvanized steel sections, rated 100 amps continuous. Insulation cover must be rigid bright red PVC, self-extinguishing, with an operating temperature of 150 degrees F.

B. Conductors are to be complete with mounting clips, end caps, splices with covers and power feeds.

C. Current collectors must be the sliding shoe type, spring loaded and so designed that sparking and loss of contact will be minimized.

D. Separate conductors must be provided for each phase. More than one conductor in a single enclosure will not be permitted.

E. A ground conductor must be provided throughout.

104.7 TROLLEYS

A. Under running single girder.

B. A monorail type carrier must be furnished to support the hoisting equipment and operate on the bridge girder.

C. Design should be such to facilitate easy installation or removal of wheels at any point along the track system without removing the carrier assembly from the track.

D. Trolley wheels must be made from high strength forged or machined steel, 5" minimum tread diameter. The wheel tread must be accurately machined to assure concentricity of axle and tread and hardened to 425 Brinell. Wheels are to be furnished with electro- plate finish, black oxide, or equal treatment, in lieu of paint.

E. Wheel bearings must be double row precision ball or taper roller bearings, lubricated and sealed at assembly, and fitted with external grease fittings. Bearings must have a minimum B-10 life of 5,000 hours.

104.8 CRANE END TRUCKS

A. End trucks must consist of rigid frame bolted direct to the crane bridge member, providing a rigid and square connection. The ratio of crane span to wheelbase must be a minimum of 8 to 1.

B. Restraining lugs must be provided to limit drop of end truck to not more than 1" in the event of wheel, yoke, axle or load bar failures. Restraining lugs must be placed on both sides of the rail so that if failure occurs, the rail is centrally loaded with the vertical axis.

C. Energy absorbing bumpers must be provided on all outboard ends of all cranes, including self-supporting crane systems.

104.9 CRANE DRIVES

A. The following types of crane drives should be used on the crane as a means of power to propel the crane.

1. Electric motor driven cranes should be driven by individual motorized trolley drives mounted on two or more end trucks, which provide traction dependent upon wheel loads. Both motorized trolley wheels should be driven simultaneously through a specially machined drive pinion. Drive wheels must have hardened treads and employ side guide rollers.

B. Individual friction tire drive-tractors are not acceptable.

C. All drives must be provided with disc type motor brakes.

D. All single and two speed electric motors should be squirrel cage type, totally enclosed. Motors must be provided with lifetime lubricated anti-friction bearings, unless otherwise specified.

104.10 CROSSBRIDGE AND MONORAIL POWER SOURCE

A. One of the following types of electrical power systems must be employed as a means of supplying power and control for hoist and crane travel motions.

1. Festooned system consisting of multi-conductor flat cables suspended from trolleys operating on a rigid trolley track mounted parallel to the bridge girder. Trolleys are to be equipped with cable saddles and clamps. The ends of each wire are to be prepared and tagged for field connection to the hoist carrier and should include a flat cable connector for adapting to the control panel.

2. For Interlocking Cranes: Rigid enclosed conductor bar system may be web mounted or downturned. Power and control circuits must have individual conductor bars.

B. Factory mounting and wiring of festooned or rigid enclosed conductor bar systems if required.

104.11 CRANE CONTROLS

A. Controls for the cranes:

1. Controls must be housed in a NEMA 4X enclosure for protection against dust and moisture.

2. A fused manual disconnect switch, housed in a NEMA 12 enclosure, with a lockable handle must be provided and wired into the incoming circuit from the runway power collectors.

3. A magnetic mainline contactor is to be provided and operated from the pushbutton station or radio remote control.

B. All motor starters must be adequately sized for crane duty consistent with horsepower requirements and must be of the reversing type, fully magnetic, with mechanical and electrical interlocks.

C. Each motor must be provided with thermal overload protection.

D. Fusing must be provided on the secondary side of the control circuit transformer.

E. Two-speed AC variable frequency drives with a 10:1 speed ratio as manufactured by Electromotive Systems, Inc. or approved equal.

F. The complete control panel is to be factory mounted and wired. All wires within the panel are to be marked and terminated on coded terminal strips.

104.12 HOISTS

A. Crane supplier must furnish as part of their contract a hoist of the type most suitable for the application under consideration.

1. Hoists and appurtenances must be designed to withstand all stresses imposed under safe operating conditions while handling loads within the rated capacity. Load bearing parts must be designed such that the static stress, calculated for rated load, must not exceed 20% of the ultimate strength of the material.

B. Electric hoists, except those that are radio controlled, are to be furnished completely with a suitable push button control station. Pushbutton arrangement is to be supplied with strain relief protection. Control actuators must be dead-man type with speed adjustment of multi-speed control obtainable by progressive depression of the pushbutton elements to increase motor lift speed and spring return to off position. Pushbutton control station for BC-8 should be suspended from a rigid enclosed trolley track system mounted parallel to the bridge, full span.

C. The braking system shall be capable under normal operating conditions with rated load to stop and hold the load when controls are released. Controlled lowering shall be limited to 120% of rated lowering speed. In the event of complete power failure, the load shall be stopped and held.

D. All bearings shall be heavy-duty, anti-friction type with a minimum B10 life of 5,000 hours. Motor bearings shall be lifetime lubricated, sealed ball bearings.

E. All gearing must meet AGMA quality specifications.

F. Bottom block shall be completely shrouded for safety and fabricated from steel. Sheaves or sprockets must be forged, rolled steel or machined alloy steel, heat treated, running on anti-friction bearings. Hooks are to be forged steel supported by anti-friction thrust bearings and permit 360degree rotation. Hooks shall be equipped with latches unless the application makes the use of the latch impractical. When required, a latch shall be provided to bridge the opening of the hook for the purpose of retaining slings, chains, etc., under slack conditions.

G. Motors shall be totally enclosed, specifically designed for hoist service capable of starting and operating under any condition within the designed capacity and provided with thermal overload protection (electric hoists).

H. Each Hoist shall incorporate an upper plugging type limit switch automatically stopping the hoist motion when the block reaches its highest position. Excessive hook drift shall cause the block to be momentarily reversed.

I. Electric hoist controls shall comply with N.E.C. requirements for the application being considered and shall include control circuit fusing and contactors mechanically and

electrically interlocked.

J. Electric chain hoists shall be provided with positive overload protection to prevent an overload lifting condition.

K. Electric chain hoists shall be provided with slack chain storage.

104.13 SYSTEM MARKING

A. All major components of the system shall be marked at the factory to assure prompt and proper field identification.

104.14 PAINTING

A. All material shall be cleaned of loose rust, mill scale and foreign matter.

B. Crane bridges, hoists, trolleys, runways and suspension fittings shall be painted one shop coat of manufacturer's standard finish.

C. Equipment must be adequately protected against damage and rust in shipment.

104.15 MANUFACTURER'S DRAWINGS AND DATA

A. General Arrangement Drawings: Drawings showing plan, elevation and sectional views along with all other pertinent data shall be provided by the Crane Supplier.

B. Panel Layout and Schematic Wiring Diagrams: Complete wiring diagrams shall be provided, showing all electrical devices, numbered terminal strips and wiring.

104.16 EXAMINATION

A. Examine supports with installer present for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of crane system.

B. Do not proceed with installation until unsatisfactory conditions are corrected.

104.17 INSTALLATION

A. Comply with manufacturer’s instructions and recommendations and install in accordance with approved shop drawings.

B. Coordinate work with work of other trades for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by Contractor to ensure dimensional coordination of the Work.

C. Install electrical conduit, wiring, disconnect switches, control stations, transformers and other electrical equipment and controls according to ANSI/NFPA 70 (NEC).

D. Install complete functional crane and hoist operator systems, including controls, power and control wiring, and equipment without initial stresses, forces or improvised fits, misalignments, nicks of high strength structural steel components, stress-raising welds and rough burrs. Make all adjustments of tracks, trolleys, drives, controls, interlocks and

ancillary equipment to provide smooth and proper equipment operation. All observed defects and deficiencies of safety devices, mechanical equipment and structural assemblies shall be immediately corrected.

E. Contractor shall provide all personnel and test weights necessary to conduct field no load functional and performance testing and 125% rated capacity load tests. Cal- OSHA Certification where required shall be provided. All testing shall be done in accordance with ANSI B30.11 and ANSI B30.16. Interlock transfer shall be functionally tested at 100% rated capacity.

F. Contractor shall notify the Owner's representative five (5) days prior to field testing.

104.18 FIELD QUALITY CONTROL

A. Acceptance Testing: Upon completion of installation and before permitting use of crane (either temporary or permanent) perform acceptance load tests as may be required by and recommended by Code and governing regulations or agencies.

104.19 ADJUSTING AND CLEANING

A. Lubricate bearings and sliding parts. Adjust to ensure proper operation.

B. Instruct Owner's personnel in proper use, operation, and daily maintenance of crane. Confer with Owner on requirements for a complete maintenance program.

C. Make a final check of operation of crane with Owner's personnel present just prior to date of substantial completion. Determine that control system and operating parts are functioning properly.

104.20 OPERATION AND MAINTENANCE MANUALS

A. Provide two hard copies of operation and two hard copies of maintenance manuals for the equipment furnished along with an electronic copy (PDF) of each on a Compact Disc. Provide one complete set prior to performance testing and final copies upon acceptance. Provide operation manuals that detail the step-by-step procedures required for system startup, operation, and shutdown. Include the manufacturer's name, model number, parts list, and brief description of all equipment and basic operating features. List in the maintenance manuals routine maintenance procedures, including weekly, monthly, semi-annual, and annual required maintenance items, possible breakdowns and repairs, and troubleshooting guides. Also include as-built drawings, redline drawings, piping and equipment layout, design calculations, Control Parameter Settings and printouts of any software, and simplified wiring and control diagrams of the system as installed. Also include brake disassembly, inspection and maintenance requirements from the crane manufacturer.

104.21 FIELD TRAINING

A. Conduct a training course for operating and maintenance staff and provide a copy of the training material to each participant. Cover all pertinent points involved in operating, starting, stopping, and servicing the equipment, including all major elements of the Operation and Maintenance Manuals. Demonstrate in course instructions all routine maintenance operations such as lubrication, general inspection, and basic troubleshooting.

104.22 WARRANTY

A. Crane supplier shall repair or replace products or components of its manufacture, which prove defective within a period of one year from date of installation. Machinery, parts, accessories and components manufactured by others are warranted only to the extent of the original manufacturer's warranty.

B. Return of products for repair or replacement will be made at the expense of the purchaser.

104.23 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE CVI - METAL LADDERS

106.1 SUMMARY

A. Article Includes:

1. Aluminum Ship's Ladders

106.2 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Manufacturer's data sheets on each product.

B. Shop Drawings:

1. Detailed fabrication of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.

2. Provide templates for anchors and bolts specified for installation under other Sections.

3. Provide reaction load for each hanger and bracket.

106.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

1. Record of successful in-service performance.

2. Sufficient production capacity to produce required units.

3. Professional engineering competent in design and structural analysis to fabricate ladders to attain designed operational and structural performance.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

106.4 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

106.5 MATERIALS

A. Aluminum Alloy Products

1. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

2. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

3. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

106.6 FABRICATION FINISHES

A. Aluminum Surfaces

1. Surface Condition

a. Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2. Aluminum Finishes

a. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

B. Ship Ladders: Not less than 1-1/4 inches high, 4-1/8 inch deep and 2 feet wide; tread spacing shall be 1 foot on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches in diameter with hemispheric end caps. Bolt, rivet or weld connections and anchor to supporting construction. Provide treads with non-slip surface as specified for safety treads.

106.7 GENERAL INSTALLATION REQUIREMENTS

A. Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Provide exposed fastenings of compatible materials, generally matching in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and support must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

106.8 WORKMANSHIP

A. Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact. Do not tack-weld exposed connections of work in place. Grind exposed welds smooth. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

106.9 ANCHORAGE, FASTENINGS, AND CONNECTIONS

A. Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-actuated fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine bolts, carriage bolts and powder-actuated threaded studs for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material.

Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

106.10 WELDING

A. Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

106.11 FINISHES

A. DISSIMILAR MATERIALS

1. Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M, asphalt-base emulsion.

B. FIELD PREPRARATION

1. Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matters.

C. ENVIRONMENTAL CONDITIONS

1. Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

106.12 BASIS OF MEASUREMENT AND PAYMENT

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

END OF ARTICLE

ARTICLE CVII- ARCHAEOLOGICAL MONITORING

107.1 DESCRIPTION

A. The Contractor shall provide or contract qualified Archaeologists to provide on-site and on-call archaeological monitoring in accordance with the Final Archaeological Monitoring Plan for the Kapalama Container Terminal wharf and Dredging Project, Kalihi and Kapalama Ahupuaa, Honolulu (Kona) District, Oahu, prepared by Cultural Surveyors Hawaii, Inc. dated December 2014, which is a reference attached to this specifications.

B. Per Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended the State Historic Preservation Officer's (SHPO) effect determination is no historic properties affected with implementation of the archaeological monitoring. The State Historic Preservation Division (SHPD) reviewed and accepted the Archaeological Monitoring plan dated December 2014. Under Hawai'i State historic preservation legislation, "Archaeological monitoring may be an identification, mitigation, or post-mitigation contingency measure. Monitoring shall entail the archaeological observation of, and possible intervention with, on-going activities, which may adversely affect historic properties" (HAR §13-13-279-3).

C. The extreme northern portion of the project area is believed to be the only location possible for pre-twentieth century in situ historic properties other than Auiki and Ananoho fishponds. The former Ananoho Fishpond wall arced through much of the north and central portion of the project area and the Auiki Fishpond wall arced through the west corner of the project area.

107.2 GENERAL REQUIREMENTS

A. The Archaeological Monitoring Plan covers the entire Kapalama Container Terminal. For this project the contractor is required to provide qualified archaeologist to monitor the Wharf and Dredging Project Area.

B. A combination of on-site and on-call archaeological monitoring is required. A review of the history of the project area indicates that on-site archaeological monitoring is not needed within the top 3 ft (0.9 m) of the present surface for most of the project area which appears to be entirely twentieth century fill. On-site archaeological monitoring for excavations below the present ground surface is, however, indicated for the northern 250 ft (76 m) of the project area understood as the area extending west from the northernmost open water of the pier 40/pier 41 berthing slot and approximating the makai edge of the mauka most row of warehouses. For the rest of the project area any excavations of less than 3 ft depth below the present ground surface will be addressed through on-call monitoring. On-site archaeological monitoring is also indicated for excavations to a depth greater than 3 ft in the area indicated as the location of the former Auiki and Ananoho Fishpond walls. Any departure from this will occur only following consultation with and written concurrence from the SHPD.

C. The monitoring fieldwork will likely encompass the documentation of Auiki and Ananoho fishpond walls and possibly subsurface archaeological deposits (e.g., trash pits, structural remnants) in the northern portion of the project area and will employ current standard archaeological recording techniques. This will include drawing and recording the stratigraphy of excavation profiles where cultural features (such as fishpond walls) or artifacts are exposed as well as representative profiles. These exposures will be photographed, located on project area maps, and sampled. Photographs and representative profiles of excavations will be taken even if no historically significant sites are documented. As appropriate, sampling will include the collection of representative artifacts, bulk sediment samples, and/or the on-site screening of measured volumes of feature fill to determine feature contents.

D. In the event of significant finds, the SHPD will be notified. If human remains are identified, construction activity in the vicinity will be stopped and no exploratory work of any kind will be conducted unless specifically requested by the SHPD. All human skeletal remains encountered during excavation will be handled in compliance with HAR §13-13-300 and HRS §6E-43.

107.3 ARCHAEOLOGIST'S ROLE AND RESPONSIBILITIES

A. The on-site archaeologist will have the authority to stop work immediately in the area of any findings so that documentation can proceed and appropriate treatment can be determined. In addition, the archaeologist will have the authority to slow and/or suspend construction activities in order to ensure that the necessary archaeological sampling and recording can take place.

107.4 EXECUTION

A. Before work commences on the project, an archaeologist shall hold a coordination meeting to orient the construction crew to the requirements of the archaeological monitoring program. At this meeting the monitor will discuss the procedures for both on-site and on-call monitoring. The archaeologist will also emphasize his or her authority to temporarily halt construction and state that all finds (including objects such as bottles) are the property of the State and may not be removed from the construction site.

B. Laboratory work will be conducted in accordance with HAR §13-13-279-5(6). Laboratory analysis of non-burial related finds will be tabulated and standard artifact and midden recording will be conducted. Artifacts will be documented as to provenience, measurements, mass, type of material, and presumed function. Photographs of representative artifacts will be taken for inclusion in the archaeological monitoring report. Bone and shell midden materials will be sorted down to species, when possible, and then tabulated by provenience. As appropriate, collected charcoal material obtained within intact cultural deposits will be analyzed for species identification. Charcoal samples ideal for dating analyses will be sent to Beta Analytic, Inc. for radiocarbon dating. If appropriate, artifacts may be sent to the University of Hawai‘i-Hilo Geoarchaeology Lab for Energy-Dispersive X-ray Fluorescence (EDXRF) analysis in order to identify and possibly geographically locate the source material. All analyzed samples, provenience information, and results will be presented in table form within the archaeological monitoring report.

C. The report will contain sections on monitoring methods, archaeological results, stratigraphy, and results of laboratory analyses, and it will present a synthesis of these results. The report will address the requirements of a monitoring report (pursuant to HAR §13-13-279-5). Photographs of excavations will be included in the monitoring report even if no historically significant sites are documented. Should burial treatment be completed as part of the monitoring effort, a summary of this treatment will be included in the monitoring report. Should burials and/or human remains be identified, then CSH will provide all appropriate additional written documentation (e.g., letters, memos, reports) that may be requested by the SHPD.

D. All burial materials will be addressed in accordance with SHPD directives. Materials not associated with burials will be temporarily stored at CSH's Waimānalo office until an appropriate curation facility is selected, in consultation with the landowner and the SHPD.

107.5 MEASUREMENT AND PAYMENT

A. A. All costs associated with archaeological monitoring and the treatment of burials, human skeletal remains, and associated cultural materials are included in the Allowance for Archaeological Monitoring, Proposal Item No. 10. Such costs include, but are not limited to, archaeological monitoring, documentation, excavation, analysis, curation, reburial, coordination with the State Historic Preservation Division (SHPD), and any other work required by HRS §6E-43, HAR §13-300, or written direction from the State or SHPD.

B. B. No separate measurement or direct payment will be made for burial treatment. The Contractor shall not proceed with burial treatment except as directed in writing by the State and SHPD.

C. C. If the Archaeological Monitoring Allowance is insufficient to cover required burial treatment, or if the required work is outside the scope of the Allowance, the State may authorize additional payment by Change Order, Construction Change Directive, or Force Account. The Contractor shall submit documentation of actual costs as directed by the State.

D. D. The Contractor shall not be entitled to additional compensation for delay, suspension, or disruption of work due to archaeological or burial findings, except as expressly provided in the Contract Documents.

E. E. Any unused portion of the Archaeological Monitoring Allowance shall be credited to the State at Project closeout.

Item No.	Pay Item	Pay Unit
10	Archaeological Monitoring	$50,000

END OF ARTICLE

ARTICLE CVIII – FURNITURE FIXTURES AND EQUIPMENT (FF&E)

108.1 SUMMARY

A. The Contractor and its products and services must meet the following requirements and specifications. See individual FF&E product specification sheets, as specified in the ARTICLE CVIII attachments.

B. Existing FF&E to be relocated and end user provided items are to be coordinated with HDOT-Harbors.

108.2 GENERAL REQUIREMENTS

A. Furnishings requirements are indicated in the FF&E specifications and drawings and include comprehensive power and data telecommunications provisions associated with the furnishings, as required.

B. Furnish all components, transportation, storage, labor, including installers, supervision, equipment, and supplies necessary to provide and install new seating, tables, and furnishings, including furnishings requiring assembly, ganging, or attachment to walls and floors, as indicated in the Contract Documents.

C. Review the furniture plans and related Contract Documents and coordinate the furnishing, delivery, assembly, installation, and attachment of furnishings with the Work of other trades.

D. Coordinate with the appropriate licensed and qualified trade Contractor for electrical and data work associated with powered or connected furnishings. Electrical and data work must be performed by the appropriately licensed and qualified trade Contractor.

E. Securely attach furnishings requiring anchorage to walls, floors, or other building components as indicated in the Contract Documents. Coordinate attachment locations and requirements with new construction prior to installation.

F. Verify field conditions, dimensions, access, and installation requirements prior to fabrication, delivery, and installation of furnishings. Notify the Architect of discrepancies or conditions that may affect the furnishing, delivery, assembly, or installation of the Work.

108.3 ACTION SUBMITTALS

A. Product Data: Submit product data for each type of product, including the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, features, finishes, power requirements, and operating instructions for each system and item of equipment.

2. Furniture Layout and Installation Drawings: Submit coordinated drawings showing furniture layouts, workstation configurations, and associated power, communications, electronic data processing (EDP), and local area network (LAN) provisions. Communications and LAN layouts may be submitted separately from the remaining workstation drawings. Submit all furniture manufacturer-prepared

drawings as a single coordinated submittal. At a minimum, include the following:

a. Overall Reference Drawings: Provide floor plans showing the locations of workstations, casegoods, and furniture at a scale of 1/8 inch = 1 foot. Verify existing field conditions and reflect them in the drawings. Clearly illustrate the overall space-planning concept and design intent.
b. Furniture Layout Drawings: Provide floor plans showing workstations, casegoods, furniture, panels, and associated components at a scale of 1/4 inch = 1 foot, unless otherwise specified. Identify each workstation by type. Verify existing field conditions and reflect them in the drawings.
c. Workstation Elevations: Provide dimensioned elevations for each workstation type, identifying panel frame configurations and all components by the manufacturer's catalog number. Draw elevations at a scale of 1/2 inch = 1 foot.
d. Panel Drawings: Show panel locations and critical dimensions relative to the finished faces of walls, columns, and adjacent panels. Indicate clearances and aisle widths. Key panel assemblies to a legend identifying width, height, configuration, frame composition, frame cover finishes, fabrics (including different selections within the project), power or nonpower configuration, connectors, and wall-mounting hardware. Coordinate panel locations with electrical, voice/data/LAN, mechanical, and fire protection fixtures. Verify existing field conditions and reflect them in the drawings.
e. Electrical Drawings: Show power provisions, including the type and location of feeder components (e.g., service-entry poles, base feeds, and ceiling feeds), powered receptacles, and other electrical components. Identify wiring configurations, including circuiting, switching, and internal and external connections, as applicable. Include a legend identifying the electrical components and configurations. Identify receptacles in typical furniture configurations that will connect to controlled building power circuits, as applicable, to meet ASHRAE 90.1 interior power requirements. Coordinate with the electrical drawings.
f. Wire Management Capacity Drawings: Show the wire management system and its capacity to accommodate power and communications cabling.
g. EDP Drawings: Show electronic data processing provisions, including the type and location of feeder components, communications jacks, and accessories. Identify wiring configurations, as applicable.

B. Samples for Verification for the following:

1. Plastic Laminate: 8 by 10 inches, for each type, color, pattern, and surface finish required.

2. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

3. Fabric: Manufacturer standard, for each type, color and pattern required.

4. Other Samples: 8 by 8 inches, for each color and texture specified.

108.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Warranty: Manufacturer standard warranty.

108.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each product and system to be included in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses and telephone numbers of local sources for products.

108.6 QUALITY ASSURANCE

A. Source Limitations: Obtain systems furniture through one source from a single manufacturer.

B. The Furnishings Contractor must provide all tools necessary to install the various systems and equipment.

C. The electrical work must be in accordance with the National Electrical Code and local amendments.

1. All wiring and electrical equipment must be UL labeled.

2. The electrical system must be complete and operational.

108.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in design, materials or workmanship within a specified warranty period. Failures include, but are not limited to, the following:

1. Delaminating components or other failures of glue bond.

2. Warping of components.

3. Failure of structural integrity of the fixed bases, tabletops, and accessories.

4. Deterioration of finishes.

108.8 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of furnishings with the Contractor and other trades to avoid interference with construction activities and to ensure that areas are ready to receive the Work.

B. Inspect furnishings upon delivery for damage, defects, shortages, and compliance with the approved submittals. Do not install damaged or defective furnishings. Notify the Architect promptly of any damage or discrepancies and obtain direction regarding replacement or corrective action.

C. Deliver furnishings in the manufacturer's original, unopened packaging, clearly identified with the project, furnishing type, item designation, quantity, and other information necessary for proper identification and handling.

D. Handle and transport furnishings in accordance with the manufacturer's written instructions. Use methods and equipment that prevent damage, soiling, distortion, scratching, denting, or other damage to furnishings and adjacent construction.

E. Store furnishings in a clean, dry, temperature-controlled, and secure location protected from moisture, direct sunlight, construction dust, dirt, staining, excessive humidity, and damage from construction operations.

F. Do not stack furnishings unless specifically permitted by the manufacturer.

G. Maintain protective coverings and packaging until furnishings are ready for installation. Do not use installed furnishings as work surfaces, ladders, scaffolding, supports, or storage areas.

108.9 FIELD CONDITIONS

A. Do not deliver furnishings until the building and designated installation areas are sufficiently complete, enclosed, dry, clean, and secure to permit proper installation and protection of the furnishings.

B. Deliver furniture only after painting, flooring, ceiling installation utility rough-in, and similar operations that could damage, soil, or deteriorate systems furniture have been completed in all installation areas. If furniture must be stored in other than installation areas, store only in areas where environmental conditions meet manufacturer's requirements.

C. Maintain temperature and humidity within the building at levels suitable for the proper installation, storage, and protection of furnishings and in accordance with the manufacturer's written recommendations.

D. Field conditions may vary from the dimensions, locations, and conditions indicated in the Contract Documents and furniture plans. Verify existing and constructed conditions prior to fabrication, delivery, and installation of furnishings. Indicate field measurements on Shop Drawings.

1. Verify field dimensions, electrical and data telecommunications locations, access, clearances, and other conditions that may affect the fit, function, or installation of furnishings.

2. Provide furnishings that properly fit the designated spaces and maintain the functional relationships, spatial clearances, and adjacencies indicated in the Contract Documents.

3. Verify existing and constructed conditions, as applicable:

    a. All offices, maintenance shops, work areas, and other furnished spaces.
    b. All associated power, telephone, data, and telecommunications outlet locations for complete installation.
    c. Dimensions, clearances, and other conditions that differ from those indicated in the Contract Documents and may affect the furnishing layout or installation.

4. Promptly notify the Architect of discrepancies or field conditions that require

modification to the furniture layout, dimensions, locations, or installation requirements. Do not proceed with modifications that affect the Contract Documents without approval.

E. Maintain required functional clearances, spatial relationships, and accessible routes and clearances in accordance with the Americans with Disabilities Act Accessibility Guidelines (ADAAG), where applicable.

F. Submit proposed adjustments to furniture locations or FF&E items resulting from field conditions to the Architect for approval prior to implementation.

G. Do not install furnishings in areas subject to ongoing construction activities that may result in damage, staining, contamination, excessive dust, moisture exposure, or other adverse conditions.

H. Coordinate final furniture installation with completion of adjacent construction, including flooring, wall finishes, ceilings, doors, electrical and data connections, and other work that may affect the installation or protection of furnishings.

108.10 INSTALLATION

A. Install furnishings in accordance with the manufacturer's written instructions, approved submittals, and the requirements of the Contract Documents.

B. Install furnishings plumb, level, square, aligned, stable, and securely anchored or connected as indicated in the Contract Documents and as recommended by the manufacturer.

C. Assemble furnishings shipped unassembled. Provide all labor, fasteners, hardware, tools, and equipment necessary for complete assembly and installation.

108.11 ADJUSTING

A. Adjust and align components, doors, drawers, panels, hardware, and other operable elements to provide smooth, proper, and uniform operation.

B. Replace damaged, defective, or improperly installed components that cannot be corrected by adjustment.

108.12 CLEANING AND PROTECTION

A. Remove protective coverings, labels, packing materials, debris, and other temporary materials from furnishings following installation.

B. Clean furnishings in accordance with the manufacturer's written instructions. Remove dust, dirt, fingerprints, adhesive residue, and other construction-related contaminants without damaging finishes or materials.

C. Do not use abrasive cleaners, solvents, or cleaning agents that may damage furniture finishes, fabrics, laminates, plastics, metals, or other materials.

D. Protect installed furnishings from damage, dust, moisture, staining, and other construction activities until Substantial Completion. Repair or replace furnishings damaged as a result of

improper delivery, storage, handling, installation, or protection.

108.13 BASIS OF MEASUREMENT AND PAYMENT

A. Furniture Fixtures and Equipment (FF&E) shall be paid for on a lump sum basis in the Proposal Schedule. Work under this Article will not be measured for payment but will be paid for at the Contract Lump Sum Price.

Item No.	Pay Item	Pay Unit
11	Furniture Fixtures and Equipment (FF&E) Package	LS

108.14 FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

A. Refer to FF&E Schedule as follows including FF&E Schedule – Specification Sheets for product description and requirements.

B. Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Contractor to verify any quantities with FF&E Floor Plans.

END OF ARTICLE

JOB P10981
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

FF&E SCHEDULE

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE				SUB CODE	NOTES
			P	D	M	B		
EXTERIOR								
SMOKE BREAK AREA & GENERAL								
EXT-1	3	bench, exterior						X1 @ entrance, X2 @ sidewalk next to break rm.
EXT-2	1	bulletin board, enclosed						
EXT-3	2	waste receptacle, exterior						
EXT-4	1	smoker's pole						
EXT-5	1	picnic table						
		EXISTING TO BE RELOCATED						
23	1	generator set	X					
ADMINISTRATION								
LOBBY (RM 100)								
AC-1c	1	waste receptacle, small						
AC-2b	1	recycling receptacle, small						
AC-4	1	bulletin board, 48x36						
CH-3	4	chair, multipurpose						
		CONSTRUCTION COST						
	2	fire extinguisher cabinet				X	CON	
MEN'S RESTROOM (RM 100MR)								
AC-1a	1	waste receptacle, large						
		CONSTRUCTION COST						
	1	paper towel dispenser				X	CON	manual; surface-mounted
MEN'S SHOWER (RM 100MS)								
AC-5a	4	shower curtain, 42"W						will not be tagged on plan
AC-5b	2	shower curtain, 108"W						will not be tagged on plan
CH-2a	1	ADA bench, 42"						
CH-9	1	ADA shower bench, foldable				X		
MENS LOCKER ROOM (RM 100ML)								
AC-1a	1	waste receptacle, large						
CH-2b	2	ADA bench, 48"						
ST-1	59	locker, 75"H				X		seismic brace to wall or each other
WOMEN'S RESTROOM (RM 100WR)								
AC-1a	1	waste receptacle, large						

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE				SUB CODE	NOTES
			P	D	M	B		
WOMEN'S RESTROOM (RM 100WR) (CONTINUED)								
		CONSTRUCTION COST						
	1	paper towel dispenser				X	CON	manual; surface-mounted
WOMENS SHOWER (RM 100WS)								
AC-5a	4	shower curtain, 42"W						will not be tagged on plan
AC-5b	2	shower curtain, 108"W						will not be tagged on plan
CH-2a	1	ADA bench, 42"						
CH-9	1	ADA shower bench, foldable				X		
WOMENS LOCKER ROOM (RM 100WL)								
AC-1a	1	waste receptacle, large						
CH-2b	1	ADA bench, 48"						
ST-1	25	locker, 75"H				X		seismic brace to wall or each other
BREAK ROOM (RM 100BR)								
AC-1a	1	waste receptacle, large						
AC-2a	1	recycling receptacle, large						
AC-4	2	bulletin board, 48x36				X		
AC-11	1	tv monitor, 65"	X	X				
AC-12	1	tv wall mount				X		
AP-1	3	residential refrigerator	X		X			
AP-2	1	coffee maker	X					
AP-3	2	microwave	X					
CH-3	60	chair, multipurpose						
T-1	12	table, 60x36						
T-4	6	table, 30x30						
		CONSTRUCTION COST						
	1	electric water cooler	X		X	X	CON	
	1	fire extinguisher cabinet				X	CON	
JAN (RM 100JC)								
AC-9	1	housekeeping cart						
AC-10	1	vacuum cleaner						
ST-3a	1	storage shelf, 3ft						

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE P	D	M	B	SUB CODE	NOTES
JAN (RM 100JC) (CONTINUED)								
		CONSTRUCTION COST						
	1	mop sink			X	X	CON	
	1	water heater			X		CON	
IT ROOM (RM 101TE)								
		[NO REQUIREMENTS]						
ELEC (RM 101EC)								
		[NO REQUIREMENTS]						
OPEN OFFICE (RM 101)								
AC-1c	13	waste recycling, small						
AC-2b	1	recycling receptacle, small						
AC-8	1	key storage, 400 slots						
AC-14	1	shredder	X					
CH-3	4	chair, multipurpose						
CH-5	12	chair, task						
ST-2	7	lateral file, 36 x 18						
WS-2	4	desk, L-shape	X	X				
WS-2a	4	desk, L-shape w/ modesty panel	X	X				
WS-3	4	desk, straight	X	X				
WS-4	4	desk, touch-down	X	X				
		CONSTRUCTION COST						
	1	copier					CON	
CONF (RM 102)								
AC-1c	1	waste receptacle, small						
AC-2b	1	recycling receptacle, small						
AC-6a	1	whiteboard, large				X		
AC-11	1	tv monitor, 65"	X	X				
AC-12	1	tv wall mount				X		
CH-4	10	chair, conference						
T-2	1	table, conference						
OFFICE 1 (RM 103)								
AC-1c	1	waste receptacle, small						
AC-2b	1	recycling receptacle, small						

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE				SUB CODE	NOTES
			P	D	M	B		
OFFICE 1 (RM 103) (CONTINUED)								
AC-6b	1	whiteboard, small				X		
CH-1	2	chair, guest						
CH-5	1	chair, task						
WS-2a	1	desk, L-shape w/ modesty panel	X	X				
OFFICE 2 (RM 104)								
AC-1c	1	waste receptacle, small						
AC-2b	1	recycling receptacle, small						
AC-6b	1	whiteboard, small				X		
CH-1	2	chair, guest						
CH-5	1	chair, task						
WS-2a	1	desk, L-shape w/ modeesty panel	X	X				
WAREHOUSE								
EWA WING								
STOREKEEPER (RM 201)								
AC-1a	2	waste receptacle, large						
ST-3b	16	storage shelf, 60x24				X		secure to wall or each other
		CONSTRUCTION COST						
	5	pallet rack, new					CON	X1 inside, x4 outside
	1	SAO Dispenser					CON	
	1	fire extinguisher cabinet				X	CON	
		EXISTING TO BE RELOCATED						
10	1	forklift charger, small					EXIST	12"W X 20"D x 31"H
38	1	forklift charger, large					EXIST	
E. CAB	1	storage cabinet, Justrite					EXIST	69-1/2"W x 60"D x 68-1/2"H
E. FC	1	flammable cabinet, 90 gal					EXIST	
E. FC	1	flammable cabinet, 30 gal					EXIST	
E. CT	1	platform truck					EXIST	
E. LKR	1	gas cylinder locker, 31x30					EXIST	
E. RK	1	spool rack					EXIST	48"W x 24"D x 84"H
E. ST	2	sign storage shelf					EXIST	
	18	pallet rack, existing					EXIST	
	1	forklift, large electric					EXIST	
	1	forklift, small diesel					EXIST	
	1	forklift, small electric					EXIST	
	1	portable AC unit					EXIST	

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE				SUB CODE	NOTES
			P	D	M	B		
STOREKEEPER (RM 201) (CONTINUED)								
		EXISTING TO BE RELOCATED						
		broom and dustpan set					EXIST	
		handtruck					EXIST	
		ladder					EXIST	
S&G OPEN SHOP & STORAGE (RM 202)								
ST-4b	18	storage cabinet, 60x24				X		secure to wall or each other
		CONSTRUCTION COST						
	2	pallet rack, new					CON	
	1	fire extinguisher cabinet				X	CON	
		EXISTING TO BE RELOCATED						
E.CAB	1	tool cabinet, large, Snap-On					EXIST	53"W x 30"D x 63"H
E. FC	1	flammable cabinet, 60 gal					EXIST	
E. FC	1	flammable cabinet, 45 gal					EXIST	
		ladder					EXIST	
		handtruck					EXIST	
		square dolly					EXIST	
WOOD SHOP (RM 203)								
AC-1a	4	waste receptacle, large						
AC-7	1	SDS station						
AC-15	7	anti-fatigue mat						
CH-6	3	stool						
ST-3b	3	storage shelf, 60x24				X		seismic brace/secure to each other
WS-1a	5	workbench, 120x36						
WS-1b	5	workbench, 72x36						
WS-1c	1	workbench, 48x36						
		CONSTRUCTION COST						
	1	pallet rack, new					CON	
	3	pallet rack uprights					CON	X2 inside, X1 outside
	1	fire extinguisher cabinet				X	CON	
		EXISTING TO BE RELOCATED						
01	1	radial arm saw, 16", De Walt	X				EXIST	48"W X 49"D X 60"H
02	1	stationary cabinet saw, SawStop	X				EXIST	61-3/4"W X 31-1/8"D x 34"H
03	1	shear, brake and roll machine, Dayton					EXIST	33"W X 16"D X 25"H
04	1	portable concrete mixer, Mud Mixer					EXIST	66-1/2"W x 27.5"D x 35"H
05	1	woodworking bandsaw, 15", JET	X				EXIST	29-1/2"W X 32"D x 74"H
06	1	belt and disc sander, Powermatic	X				EXIST	24"W x 31-1/4"D x 54-1/2"H
07	1	rolling miter saw w/ stand, De Walt					EXIST	52"W X 42"D X 59"H
08	1	radial arm saw, 10", Delta	X				EXIST	36"W X 24"D X 27"H

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE P	D	M	B	SUB CODE	NOTES
WOOD SHOP (RM 203) (CONTINUED)								
		EXISTING TO BE RELOCATED						
09	1	drill press, standing, Delta	X				EXIST	23"W X 15"D X 68"H
26	1	24-36" Planer	X				EXIST	
27	1	6-8" Jointer	X				EXIST	
32	1	universal wet/dry grinder, Delta	X				EXIST	13"W X11"D X 12"H
33	1	bench grinder, Delta	X				EXIST	23"W X 12"D X 14"H
E. CAB	3	storage cabinet, 60x24, Stronghold					EXIST	
E. CT	1	wood mobile cart					EXIST	49"W X 40"D X 45"H
E. FC	1	flammable cabinet, 45 gal					EXIST	outside
E. FC	2	flammable cabinet, 30 gal					EXIST	outside
E. TK	1	water tank					EXIST	48"W X 40"D X 45"H
E. VAC	3	wet/dry vacuum (shop vac)					EXIST	
		saw horse					EXIST	
		pallet jack					EXIST	
		mop and wringer bucket set					EXIST	
		broom and dustpan set					EXIST	
		dust mop					EXIST	
		handtruck					EXIST	
		utility cart					EXIST	
		ladder					EXIST	
		platform truck					EXIST	
		square dolly					EXIST	
		industrial fan	X				EXIST	
		step stool					EXIST	
		push broom					EXIST	
		roll ladder					EXIST	
ICE (RM 209)								
AP-4a	1	ice machine	X		X			outside
AP-4b	1	ice machine, bin						
AP-4c	1	ice machine, condenser	X					
DIAMOND HEAD WING								
ELEC/TC (RM 204)								
		[NO REQUIREMENTS]						
		CONSTRUCTION COST						
	1	fire extinguisher cabinet				X	CON	
MAINTENANCE SHOP (RM 205) & MEZZANINE								
AC-1a	4	waste receptacle, large						x1 at mezzanine
AC-7	1	SDS station						
AC-15	5	anti-fatigue mat						x1 at mezzanine

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE				SUB CODE	NOTES
			P	D	M	B		
MAINTENANCE SHOP (RM 205) & MEZZANINE (CONTINUED)								
CH-6	2	stool						
ST-3c	17	storage shelf, 48x24				X		secure to wall or each other
ST-4a	87	storage cabinet, 48x24				X		x84 at mezzanine
ST-4b	51	storage cabinet, 60x24				X		x16 at mezzanine
ST-5a	2	tool cabinet, large						53"W X 30"D X 63"H
ST-8	8	bin, tools						
WS-1a	5	workbench, 120x36						x1 at mezzanine
		CONSTRUCTION COST						
	13	pallet rack, new					CON	
		pallet rack uprights					CON	outside
	1	fire extinguisher cabinet				X	CON	
		EXISTING TO BE RELOCATED						
11	1	bench grinder, 8"	X				EXIST	19"W X 12-1/2"D
12	1	water jetter, Rigid, KJ-2200					EXIST	29"W X 32"D X 42"H
13	1	drum drain, Marathon					EXIST	
14	1	drum drain, Rigid					EXIST	
15	1	lathe, Rigid	X				EXIST	42"W X 32"D X 48"
16	1	512A lift					EXIST	60"W X 30"D
29	1	paint shaker					EXIST	
34	1	air compressor, Ingersoll Rand					EXIST	
41	2	paint stripper					EXIST	
42	1	miter saw, hand held	X				EXIST	
43	1	portable pressure washer	X				EXIST	
E. CAB	1	HILTI cabinet					EXIST	60"W X 24"D X 70"H
E. FC	1	flammable cabinet, 90 gal					EXIST	x1 BLDG MAINT.
E. FC	3	flammable cabinet, 60 gal					EXIST	x2 PAINT | x1 TOOLS & EQUIPMENT
E. FC	6	flammable cabinet, 45 gal					EXIST	x1 WHARF MAINT. | x3 PAINT | x2 MAINT. MECH.
E. FC	2	flammable cabinet, 30 gal					EXIST	x1 MAINT. MECH. | x1 PLUMB.
E. FC	1	flammable cabinet, 22 gal					EXIST	x1 AC
E. LKR	21	locker,18x24				X	EXIST	seismic brace
E. VAC	3	wet/ dry vacuum (shop vac)					EXIST	
E. WB	1	workbench, 42x24					EXIST	
		pallet jack					EXIST	
		mop and wringer bucket set					EXIST	
		broom and dustpan set					EXIST	
		dust mop					EXIST	
		handtruck					EXIST	
		utility cart					EXIST	
		ladder					EXIST	
		platform truck					EXIST	
		square dolly					EXIST	
		step stool					EXIST	
		push broom					EXIST	
		roll ladder					EXIST	
		spill kit					EXIST	

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE P	D	M	B	SUB CODE	NOTES
MAINTENANCE SHOP (RM 205) & MEZZANINE (RM 206A) (CONTINUED)								
		EXISTING TO BE RELOCATED						
		floor is wet sign					EXIST	
		paint stencil storage					EXIST	
		END USER PROVIDED						
31	1	key cutting station					EUP	51"W X 35"D X 37"H
STORAGE ROOM (RM 206)								
		[NO REQUIREMENTS]						
		CONSTRUCTION COST						
	5	pallet rack, new					CON	
	1	fire extinguisher cabinet				X	CON	
AUTO SHOP / AUTO MAINT STO (RM 207) & MEZZANINE (RM 207A)								
AC-1a	2	waste receptacle, large						
AC-7	1	SDS station						
CH-8	1	mechanic seat						
ST-4a	4	storage cabinet, 48x24				X		all located at mezzanine
ST-4b	6	storage cabinet, 60x24				X		all located at mezzanine
ST-5a	1	tool cabinet, large						
ST-6	1	small parts organizer, 64 slots				X		
ST-7a	3	tire rack, single-sided				X		secure to wall or each other; mezzanine
ST-7b	4	tire rack, double-sided				X		secure to wall or each other; mezzanine
WS-1c	1	workbench, 48x36						
		CONSTRUCTION COST						
	1	vehicle lift					CON	bid option
		EXISTING TO BE RELOCATED						
09	1	drill press, standing, Delta	X				EXIST	
17	1	auto battery charger, Associated	X				EXIST	15"W X 14"D X 23"H
18	1	auto battery charger, Pro-Logix	X				EXIST	19"W X 16"D X 23"H
19	1	bench grinder, autoshop	X				EXIST	
21	1	rim clamp tire changer, Coats	X				EXIST	
22	1	wheel balancer, Coats	X				EXIST	
37	1	parts washer	X				EXIST	
E. AC	1	spill kit					EXIST	
E. FC	2	flammable cabinet, 60 gal					EXIST	stored in Storage Room 206 due to space
E. FC	1	flammable cabinet, 55 gal					EXIST	stored in Storage Room 206 due to space
E. FC	2	flammable cabinet, 45 gal					EXIST	stored in Storage Room 206 due to space
E. ST	3	oil storage pallet, Enpac					EXIST	53"W X 29"D X 17"H
E. ST	6	oil storage drums					EXIST	

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE				SUB CODE	NOTES
			P	D	M	B		
AUTO SHOP / AUTO MAINT STO (RM 207) & MEZZANINE (RM 207A) (CONTINUED)								
		EXISTING TO BE RELOCATED						
		utility cart					EXIST	
		roll ladder					EXIST	
		floor creeper					EXIST	
		oil disposal					EXIST	
		spill kit					EXIST	
WELDING (RM 208) & OUTDOOR WELDING AREA								
AC-1a	2	waste receptacle, large						
AC-15	2	anti-fatigue mat						
CH-6	2	stool						
ST-3b	1	storage shelf, 60x24				X		seismic brace/secure to each other
ST-4b	1	storage cabinet, 60x24				X		
WS-1b	2	workbench, 72x36						
		CONSTRUCTION COST						
	1	fire extinguisher cabinet				X	CON	
	1	emergency shower/eyewash station			X		CON	
		EXISTING TO BE RELOCATED						
24	1	drill press, standing, Delta Model 20	X				EXIST	19"W x 28"D
25	1	bandsaw, welding	X				EXIST	60"W x 18"D
30	1	bench grinder w/ stand, welding					EXIST	20"W x 24"D; located outside
E. FC	1	flammable cabinet, 30 gal					EXIST	
E. WS	1	workstation 1, welding					EXIST	101"W x 48'D; located outside
E. WS	1	workstation 2, welding					EXIST	103"W x 97"D; located outside
		utility cart					EXIST	
		ladder					EXIST	
		END USER PROVIDED						
39	3	portable welder	X				EUP	
40	1	gas cart					EUP	

FURNITURE, FIXTURES & EQUIPMENT (FF&E) SCHEDULE

LOCATION: OAHU BASEYARD

PROJECT: HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET (JOB P10981) **DATE:** **2026**

CODE	QTY	ITEM DESCRIPTION	ARCH CODE				SUB CODE	NOTES
			P	D	M	B		

LEGEND

CODE

A	Artwork
AC	Accessories
AP	Appliances
CH	Chair
E	Equipment
EXT	Exterior
ST	Storage
T	Tables
WS	Workstatioin

ARCH CODE

P	Power
D	Data
M	Water Source/ Drain/ Venting
B	Blocking/ Physical mounting/ Seismic tether

SUB CODE

EUP	End User Provided
EXIST	Existing to be relocated
CON	Construction Cost

JOB P10981
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

FF&E SCHEDULE – SPECIFICATION SHEETS

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-1a

ITEM CODE	AC-1a
DESCRIPTION:	WASTE RECEPTACLE, LARGE
MANUFACTURER & PRODUCT:	Rubbermaid Commercial, Trash Can, FG395900GRAY or Approved Equal
DIMENSIONS:	
LENGTH:	19-1/2"
WIDTH:	19-1/2"
HEIGHT:	34-1/4"
FINISHES:	Gray
DETAILS:	• 50 gallon capacity. • Free standing type w/ no dolly. • Durable and crack resistant made of resin construction. • No lid included.

LOCATIONS

ROOM #	ROOM NAME	QTY
100MR	Men's Restroom	1
100ML	Men's Locker Room	1
100WR	Women's Restroom	1
100WL	Women's Locker Room	1
100BR	Break Room	1
201	Storekeeper	2
203	Wood Shop	4
205	Maintenance Shop	4
207	Auto Shop / Auto Maint Sto	2
208	Welding	2
TOTAL:		19

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-1c

ITEM CODE	AC-1c
DESCRIPTION:	WASTE RECEPTACLE, SMALL
MANUFACTURER & PRODUCT:	Rubbermaid Commercial, Trash Can, FG295700BLA or Approved Equal
DIMENSIONS:	
LENGTH:	11 1/4"
WIDTH:	11"
HEIGHT:	20"
FINISHES:	Black
DETAILS:	• 28 quart capacity. • Free-standing type to fit under typical desk. • All plastic construction won't chip, rust or dent. • Rolled rims add strength, and are easy to clean.

LOCATIONS

ROOM #	ROOM NAME	QTY
100	Lobby	1
101	Open Office	13
102	Conference	1
103	Office 1	1
104	Office 2	1
TOTAL:		17

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-2a

ITEM CODE	AC-2a
DESCRIPTION:	RECYCLING RECEPTACLE, LARGE
MANUFACTURER & PRODUCT:	Rubbermaid Commercial, Recycling Can, FG395973BLUE or Approved Equal
DIMENSIONS:	
LENGTH:	19 1/2"
WIDTH:	19 1/2"
HEIGHT:	19 1/2"
FINISHES:	Blue
DETAILS:	• 50 gallon capacity. • Free-standing type w/ no dolly. • Durable and crack resistant made of resin construction. • No lid included.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	1
TOTAL:		1

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-2b

ITEM CODE	AC-2b
DESCRIPTION:	RECYCLING RECEPTACLE, SMALL
MANUFACTURER & PRODUCT:	Rubbermaid Commercial, Recycling Can, FG295673BLUE or Approved Equal
DIMENSIONS:	
LENGTH:	14 1/2"
WIDTH:	10 1/2"
HEIGHT:	15"
FINISHES:	Blue
DETAILS:	• 28 quart capacity. • Free-standing type to fit under typical desk. • All plastic construction won't chip, rust or dent. • Rolled rims add strength, and are easy to clean.

LOCATIONS

ROOM #	ROOM NAME	QTY
100	Lobby	1
101	Open Office	1
102	Conference	1
103	Office 1	1
104	Office 2	1

TOTAL: 5

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-4

ITEM CODE	AC-4
DESCRIPTION:	BULLETIN BOARD, 48x36
MANUFACTURER & PRODUCT:	Quartet, Basic Cork Bulletin Board, 2304-24 or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	-
HEIGHT:	36"
FINISHES:	Natural Cork Silver Aluminum Frame
DETAILS:	• Bulletin board with natural cork surface. • Cork board hangs vertically or horizontally w/ easy pass-through mounting hardware. • Vendor to include needed accessories, mounting hardware, and to secure on wall studs.

LOCATIONS

ROOM #	ROOM NAME	QTY
100	Lobby	1
100BR	Break Room	2

TOTAL: 3

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-5a

ITEM CODE	AC-5a
DESCRIPTION:	SHOWER CURTAIN, 42"W
MANUFACTURER & PRODUCT:	Hookless, Shower Curtain, HBH10GA014274AM or Approved Equal
DIMENSIONS:	
LENGTH:	-
WIDTH:	42"
HEIGHT:	74" Hanging
FINISHES:	Vinyl - White
DETAILS:	• Ringless shower curtain; installs directly on rod. • Pair w/ liners to prevent mold and mildew.

LOCATIONS

ROOM #	ROOM NAME	QTY
100MS	Men's Shower	4
100WS	Women's Shower	4
TOTAL:		8

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-5b

ITEM CODE	AC-5b
DESCRIPTION:	SHOWER CURTAIN, 108"W
MANUFACTURER & PRODUCT:	Grainger Approved Vendor, Shower Curtain, 4EEY3 or Approved Equal
DIMENSIONS:	
LENGTH:	-
WIDTH:	108"
HEIGHT:	74" Hanging
FINISHES:	Vinyl - White
DETAILS:	• Ringless shower curtain; installs directly on rod. • Pair w/ liners to prevent mold and mildew.

LOCATIONS

ROOM #	ROOM NAME	QTY
100MS	Men's Shower	2
100WS	Women's Shower	2
TOTAL:		4

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-6a

ITEM CODE	AC-6a
DESCRIPTION:	WHITEBOARD, LARGE
MANUFACTURER & PRODUCT:	Ghent, Porcelain Whiteboards M1, M1-46-4 or Approved Equal
DIMENSIONS:	
LENGTH:	72"
WIDTH:	-
HEIGHT:	48"
FINISHES:	White board Satin anodized aluminum frame
DETAILS:	• Magnetic porcelain surface whiteboard. • Features porcelain-on-steel surface that resists scratching, denting and staining. • Vendor to include mounting hardware, necessary accessories such as tray, tray end caps, markers and erasers, and to secure on wall studs.

LOCATIONS

ROOM #	ROOM NAME	QTY
102	Conference	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-6b

ITEM CODE	AC-6b
DESCRIPTION:	WHITEBOARD, SMALL
MANUFACTURER & PRODUCT	Ghent, Porcelain Whiteboards M1, M1-34-1 or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	-
HEIGHT:	36"
FINISHES:	White board Satin anodized aluminum frame
DETAILS:	• Magnetic porcelain surface whiteboard. • Features porcelain-on-steel surface that resists scratching, denting and staining. • Vendor to include mounting hardware, necessary accessories such as tray, tray end caps, markers and erasers, and to secure on wall studs.

LOCATIONS

ROOM #	ROOM NAME	QTY
103	Office 1	1
104	Office 2	1
TOTAL:		2

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-7

ITEM CODE	AC-7
DESCRIPTION:	SDS STATION
MANUFACTURER & PRODUCT	Zing, SDS Station Kit Binder Holder, 2708 or Approved Equal
DIMENSIONS:	
LENGTH:	14"
WIDTH:	4" Depth
HEIGHT:	12"
FINISHES:	White & Red
DETAILS:	• SDS station with 1-1/2" binder, SDS station wall sign and wall rack. • Wall-mounted type. • Steel wall sign w/ plastic binder holder. • Vendor to provide necessary mounting hardware.

LOCATIONS

ROOM #	ROOM NAME	QTY
203	Wood Shop	1
205	Maintenance Shop	1
207	Auto Shop / Auto Maint Sto	1

TOTAL: 3

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-8

ITEM CODE	AC-8
DESCRIPTION:	KEY STORAGE, 400 SLOTS
MANUFACTURER & PRODUCT	Barksa, Key Cabinet, CB12490 or Approved Equal
DIMENSIONS:	
LENGTH:	25-1/4"
WIDTH:	5 3/4" Depth
HEIGHT:	21-3/4"
FINISHES:	Steel Gray
DETAILS:	• Wall-mounted key cabinet storage w/ 400 slots. • Standard lockable type. Vendor to ensure key is provided. • Includes labeled key shelves, key log index sheets, full set of colored key tags, and mounting hardware. • Vendor to include necessary hardware and secure key cabinet to wall studs.

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-9

ITEM CODE	AC-9
DESCRIPTION:	HOUSEKEEPING CART
MANUFACTURER & PRODUCT	Rubbermaid Commercial, Janitorial Cleaning Cart - Traditional, FG617388BLA or Approved Equal
DIMENSIONS:	
LENGTH:	46"
WIDTH:	21.75"
HEIGHT:	38.38"
FINISHES:	Frame: Black Plastic
DETAILS:	• Lightweight janitorial cart w/ front-access zippered bag to collect waste. • Can hold mop bucket wringer or up to 32-gallon container. • Has non-marring casters.

LOCATIONS

ROOM #	ROOM NAME	QTY
100JC	Janitor	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-10

ITEM CODE	AC-10
DESCRIPTION:	VACUUM CLEANER
MANUFACTURER & PRODUCT	Dayton, Upright Vacuum, 24Z193 or Approved Equal
DIMENSIONS:	
LENGTH:	13"
WIDTH:	15"
HEIGHT:	32"
FINISHES:	N/A
DETAILS:	• 120V, 960W power. • 50ft power cord length. • Bagless, corded upright vacuum w/ see-through chamber to show level of debris. • HEPA filtration type. • 13" cleaning path width. • UL listed. • 5-position head height adjustment.

LOCATIONS

ROOM #	ROOM NAME	QTY
100JC	Janitor	1

TOTAL: 1

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-11

ITEM CODE	AC-11
DESCRIPTION:	TV MONITOR, 65"
MANUFACTURER & PRODUCT	LG, 65" TV, 65QNED75URA or Approved Equal
DIMENSIONS:	
LENGTH:	57.2"
WIDTH:	1.7" (Depth)
HEIGHT:	33"
FINISHES:	N/A
DETAILS:	• Power: AC 120V, 50/60 Hz. • 65" TV w/ Bluetooth connection and support, ethernet input, HDMI, USB input (2), and Wi-Fi connection. • 4K Ultra HD display resolution with 4K QNED type. • Features dimming technology.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	1
102	Conference	1

TOTAL: 2

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-12

ITEM CODE	AC-12
DESCRIPTION:	TV WALL MOUNT
MANUFACTURER & PRODUCT	Peerless AV, Paramount™ Articulating Wall Mount for 39"-75" TVs, PA750, or Approved Equal
DIMENSIONS:	
LENGTH:	24.4"
WIDTH:	3-21.35" Range
HEIGHT:	16.75"
FINISHES:	Black Powder Coat
DETAILS:	• Universal tv mount that fits displays ranging from 39"-75". • Articulating type that can extend, retract, tilt and pivot (locking type). • Max capacity load at 100 lbs. • Integrated cable management for cords to be stored in. • Vendor to ensure that AC-11 TV Monitor, 65" will fit within TV Mount and will support its weight. • Vendor to secure tv mount to wall studs.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	1
102	Conference	1

TOTAL: 2

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-14

ITEM CODE	AC-14
DESCRIPTION:	SHREDDER
MANUFACTURER & PRODUCT	HSM of America, Paper Shredder, SECURIO B35c or Approved Equal
DIMENSIONS:	
LENGTH:	24-19/64"
WIDTH:	20-19/32"
HEIGHT:	34-13/64"
FINISHES:	White
DETAILS:	• Shreds: CD, Credit Cards, Paper, Paper Clips, and Staples. • Cut Style: Cross Cut • Shred Size: 3/16" x 1 1/8" • Shred Speed: 16 fpm • Waste Basket Capacity: 34.3 gallons • Security Level: 4 • Voltage 115V AC • Continuous Shred

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	1

TOTAL: 1

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AC-15

ITEM CODE	AC-15
DESCRIPTION:	ANTI-FATIGUE MAT
MANUFACTURER & PRODUCT	Notrax, Antifatigue Mat, 415S0034BL or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	36"
HEIGHT:	N/A
FINISHES:	Surface Material: Closed Cell PVC Foam - Black
DETAILS:	• Surface Design: Pebble • Resistant Properties: Dyna-Sheild, Insulation, Tear Resistant , Wear Resistant. • Anti Slip Backing/Surface. • Resist Damage: Light Chemicals. • Edge Style: Beveled, 4 Edges.

LOCATIONS

ROOM #	ROOM NAME	QTY
203	Wood Shop	7
205	Maintenance Shop	5
208	Welding	2
TOTAL:		14

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AP-1

ITEM CODE	AP-1
DESCRIPTION:	REFRIGERATOR, RESIDENTIAL
MANUFACTURER & PRODUCT	Whirlpool, 33-Inch Wide Top Freezer Refrigerator, WRT311FZDZ or Approved Equal
DIMENSIONS:	
LENGTH:	32-3/4"
WIDTH:	32-7/8"
HEIGHT:	66-1/4"
FINISHES:	Fingerprint-Resistant Stainless finish
DETAILS:	• 115V / 60Hz / 15/20 Amps. • 20 cu. Ft. top-freezer refrigerator with ice maker kit (provide ice tray). • LED interior lighting; electronic temperature controls; freezer temperature controls; quiet cooling. • (3) refrigerator shelves; (2) fixed and (3) adjustable door bins; (1) freezer shelf; (2) freezer door bins; frameless glass shelves; humidity-controlled crispers. • ADA compliant and UL listed.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	3

TOTAL: 3

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AP-2

ITEM CODE	AP-2
DESCRIPTION:	COFFEE MAKER
MANUFACTURER & PRODUCT	Keurig, Coffee Maker, 5000380411 or Approved Equal
DIMENSIONS:	
LENGTH:	10-1/4"
WIDTH:	12-1/8"
HEIGHT:	12-1/4"
FINISHES:	Black
DETAILS:	• 120V AC / 60Hz / 1,400 W power. • 12 oz maximum brewing capacity, 6 oz minimum. • Single serve cartridge or single serve cup use. • Uses either single coffee pod, reusable pod or built-in brew basket. • Separate water reservoir.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	1
TOTAL:		1

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AP-3

ITEM CODE	AP-3
DESCRIPTION:	MICROWAVE
MANUFACTURER & PRODUCT	Danby, Countertop Microwave, DBMW1121BBB or Approved Equal
DIMENSIONS:	
LENGTH:	20-1/4"
WIDTH:	15-3/4"
HEIGHT:	12-1/8"
FINISHES:	Black
DETAILS:	• Countertop type microwave. • 120V AC / 900W power. • 1.1 cu. ft. capacity. • Glass turntable included. • 6 convenient auto cook options; add 30 seconds; auto defrost; child/control lock out; express cook buttons; time cook.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	2

TOTAL: 2

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AP-4a

ITEM CODE	AP-4a
DESCRIPTION:	ICE MACHINE
MANUFACTURER & PRODUCT	Hoshizaki, Ice Maker, KM-1301SRJZ or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	27-3/8"
HEIGHT:	27 3/8"
FINISHES:	Stainless Steel
DETAILS:	• Voltage: 208/230V AC. • Up to 1,433 lbs. of ice production per 24 hrs. • Antimicrobial finish. • Icemaker Water Supply Line Min. 3/8" nominal ID copper water tubing or equivalent. Icemaker Drain Line: Min. 3/4" nominal ID hard pipe or equivalent. • Cresent cube type. • Frequency: 60 Hz. 1 Phase. • Pairs w/ ice bin AP-4b and remote condenser AP-4c. Vendor to ensure that icemaker, bin and condenser are compatible with each other.

LOCATIONS

ROOM #	ROOM NAME	QTY
209	Ice	1

TOTAL: 1

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AP-4b

ITEM CODE	AP-4b
DESCRIPTION:	ICE MACHINE, BIN
MANUFACTURER & PRODUCT	Hoshizaki, Ice Storage Bin, B-1300SS or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	41"
HEIGHT:	66"
FINISHES:	Stainless Steel Liner Material: Polyethylene
DETAILS:	• Storage Capacity: 1,304 lb. • Door Type: Bottom Hinged. • Vendor to include ice scoop. • Includes Legs. • Drain Type: 3/4" FPT. • Antimicrobial finish. • Pairs w/ icemaker AP-4a & remote condenser AP-4c. Vendor to ensure that icemaker, bin and condenser are compatible with each other.

LOCATIONS

ROOM #	ROOM NAME	QTY
209	Ice	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

AP-4c

ITEM CODE	AP-4c
DESCRIPTION:	ICE MACHINE, CONDENSER
MANUFACTURER & PRODUCT	Hoshizaki, Ice Machine Remote Condenser, URC-14FZ or Approved Equal
DIMENSIONS:	
LENGTH:	35.7"
WIDTH:	14.1"
HEIGHT:	36.5"
FINISHES:	Weather resistant cabinet finish
DETAILS:	• Voltage: 115v. Single Phase, 60Hz. Must be hard-wired on site (4 wire, including ground) • Quiet operation with weather resistant finish for longer life outside. • Vendor to allow for 24" clearance for best performance. • Vendor to include necessary tubing kit. • Pairs w/ icemaker AP-4a & ice bin AP-4b. Vendor to ensure that icemaker, bin and condenser are compatible with each other.

LOCATIONS

ROOM #	ROOM NAME	QTY
209	Ice	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-1



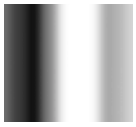
Image shown is an example for reference only.



Plastic Shell:
Shadow Gray



Seat: Vinyl
Blue Gray



Legs:
Chrome

Finishes shown are an example for reference only

ITEM CODE	CH-1
DESCRIPTION:	CHAIR, GUEST
MANUFACTURER & PRODUCT	Global Furniture, Moda, Four-legged Armchair, 6961, ~MDA, SHW, NM30, NC, CHM, FX, RG or Approved Equal
DIMENSIONS:	
LENGTH:	25"
WIDTH:	25"
HEIGHT:	31" Overall | 18" Seat Height
FINISHES:	Plastic Shell - Shadow Gray Seat - Vinyl - Blue Gray Legs - Chrome Plated Steel
DETAILS:	• Executive Guest-Style Chair with Armrest and four legged base. • Provide standard multi-surface glides for leveling. • No moisture barrier on seat; vinyl upholstery to be 100,000+ double rubs. • 275 lb. weight capacity.

LOCATIONS

ROOM #	ROOM NAME	QTY
103	Office 1	2
104	Office 2	2

TOTAL: 4

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-2a



Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	CH-2a
DESCRIPTION:	ADA BENCH, 42"
MANUFACTURER & PRODUCT	Salsbury Industries, Wood ADA Locker Bench, 77781-ADA-LGT or Approved Equal
DIMENSIONS:	
LENGTH:	42"
WIDTH:	20"
HEIGHT:	18"
FINISHES:	Light Maple Seat Powder-Coated Black Legs
DETAILS:	• ADA wood locker bench. • Constructed of solid butcher block wood. • Ideal for industrial, office or recreational locker room facilities. • Durable and easy to maintain. • Includes two (2) bolt mounted pedestals in an aluminum powder-coated finish.

LOCATIONS

ROOM #	ROOM NAME	QTY
100MS	Men's Shower	1
100WS	Women's Shower	1

TOTAL: 2

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-2b



Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	CH-2b
DESCRIPTION:	ADA BENCH, 48"
MANUFACTURER & PRODUCT	Salsbury Industries, Wood ADA Locker Bench, 77782-ADA-LGT or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	20"
HEIGHT:	18"
FINISHES:	Light Maple Seat Powder-Coated Black Legs
DETAILS:	• ADA wood locker bench. • Constructed of solid butcher block wood. • Ideal for industrial, office or recreational locker room facilities. • Durable and easy to maintain. • Includes two (2) bolt mounted pedestals in an aluminum powder-coated finish.

LOCATIONS

ROOM #	ROOM NAME	QTY
100WL	Women's Locker Room	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-2c



Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	CH-2c
DESCRIPTION:	ADA BENCH, 48" W/ BACK
MANUFACTURER & PRODUCT	Salsbury Industries, Wood ADA Locker Bench, 77782-ADAB-LGT or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	20"
HEIGHT:	39" (Overall)
FINISHES:	Light Maple Seat Powder-Coated Black Legs
DETAILS:	• ADA wood locker bench w/ back support. • Constructed of solid butcher block wood. • Ideal for industrial, office or recreational locker room facilities. • Durable and easy to maintain. • Includes two (2) bolt mounted pedestals in an aluminum powder-coated finish.

LOCATIONS

ROOM #	ROOM NAME	QTY
100ML	Men's Locker Room	2

TOTAL: 2

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-3



Image shown is an example for reference only.



Seat & Back:
Slate Gray Plastic

Finishes shown are an example for reference only

ITEM CODE	CH-3
DESCRIPTION:	CHAIR, MULTIPURPOSE
MANUFACTURER & PRODUCT	Sit On It, Lumin Multipurpose Chair, 1011 FT2 FC2 PS A0 CGR 133P SC15 AC or Approved Equal
DIMENSIONS:	
LENGTH:	20.7"
WIDTH:	22.8"
HEIGHT:	32.9" Overall | 17.3" Seat Height
FINISHES:	Plastic Shell - Slate Gray Wire Rod Sled - Silver/Polished Chrome
DETAILS:	• Wire rod sled base chair w/ plastic seat and no arms type. • Provide clear leveling glides. • No ganging hardware needed. • Packaged fully assembled in carton. • Fire retardancy protection CAL 133, plastic any quantity. • Weight capacity is 300 lbs.

LOCATIONS

ROOM #	ROOM NAME	QTY
100	Lobby	4
101	Open Office	4
100BR	Break Room	60

TOTAL: 68

NOTE:

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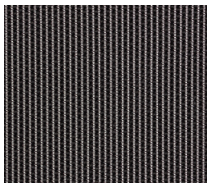
JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-4



Image shown is an example for reference only.



Mesh Back:
Onyx Black



Seat:
Vinyl - Element H20 Blue

Finishes shown are an example for reference only

ITEM CODE	CH-4
DESCRIPTION:	CHAIR, CONFERENCE
MANUFACTURER & PRODUCT	Sit On It, Focus 2.0 Task Chair, 1123 BK2 MB Y FC1 YCC01 LA10 AR4 BT1 BC1 CH1 CS5 or Approved Equal
DIMENSIONS:	
LENGTH:	28.5" (w/ arms) | 26" (w/out arms)
WIDTH:	26"
HEIGHT:	36.25"-39.75" Overall | 16.9"-20.4" Seat Height
FINISHES:	Frame & Base - Black Accent Color Frame - Fog Gray Mesh Back - Onyx Black Upholstery - Vinyl - Element in H20 Blue
DETAILS:	• Highback mesh w/ adjustable lumbar task chair. • Enhanced synchro mechanism type. • Black frame and Y-support color. Ocean accent color. • Height-adjustable arms, 5-star black nylon base w/ standard cylinder and carpet casters. • Package together knocked down. • Weight capacity is 300 lbs.

LOCATIONS

ROOM #	ROOM NAME	QTY
102	Conference	10

TOTAL: 10

NOTE:

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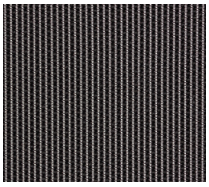
JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-5



Image shown is an example for reference only.



Mesh Back:
Onyx Black



Seat:
Vinyl - Element H20 Blue

Finishes shown are an example for reference only

ITEM CODE	CH-5
DESCRIPTION:	CHAIR, TASK
MANUFACTURER & PRODUCT	Sit On It, Focus 2.0 Task Chair, 1123 BK2 MB Y FC1 YCC01 LA10 AR4 BT1 BC1 CH1 CS5 or Approved Equal
DIMENSIONS:	
LENGTH:	28.5" (w/ arms) | 26" (w/out arms)
WIDTH:	26"
HEIGHT:	36.25"-39.75" Overall | 16.9"-20.4" Seat Height
FINISHES:	Frame & Base - Black Accent Color Frame - Fog Gray Mesh Back - Onyx Black Upholstery - Vinyl - Element in H20 Blue
DETAILS:	• Highback mesh w/ adjustable lumbar task chair. • Enhanced synchro mechanism type. • Black frame and Y-support color. Ocean accent color. • Height-adjustable arms, 5-star black nylon base w/ standard cylinder and carpet casters. • Package together knocked down. • Weight capacity is 300 lbs.

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	12
103	Office 1	1
104	Office 2	1

TOTAL: 14

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-6

ITEM CODE	CH-6
DESCRIPTION:	STOOL
MANUFACTURER & PRODUCT	Shopsol, Welding/Shop Stool, 1010303 or Approved Equal
DIMENSIONS:	
LENGTH:	14" Diameter
WIDTH:	X
HEIGHT:	19-26" Range
FINISHES:	Black Vinyl Seat Black Frame
DETAILS:	• Seat height adjustable pneumatic lever shop stool w/ swivel casters. • Round base and seat. • Made from materials that resists burning or deforming when exposed to spatter and heat. • Swivel type seat. • Weight capacity: 300 lbs.

LOCATIONS

ROOM #	ROOM NAME	QTY
203	Wood Shop	3
205	Maintenance Shop	2
208	Welding	2

TOTAL: 7

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-8

ITEM CODE	CH-8
DESCRIPTION:	MECHANIC SEAT
MANUFACTURER & PRODUCT	Whiteside, Mechanic Seat - Heavy-Duty, HRAS or Approved Equal
DIMENSIONS:	
LENGTH:	15"
WIDTH:	15"
HEIGHT:	22-27" Range (Seat Adjustable)
FINISHES:	Black Seat & Frame
DETAILS:	• Heavy-duty mechanic seat, seat height-adjustable. • Creeper seat style w/ maximum load capacity at 480lbs. • Steel frame w/ casters. • Include back for lumbar support.

LOCATIONS

ROOM #	ROOM NAME	QTY
207	Auto Shop / Auto Maint Sto	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

CH-9



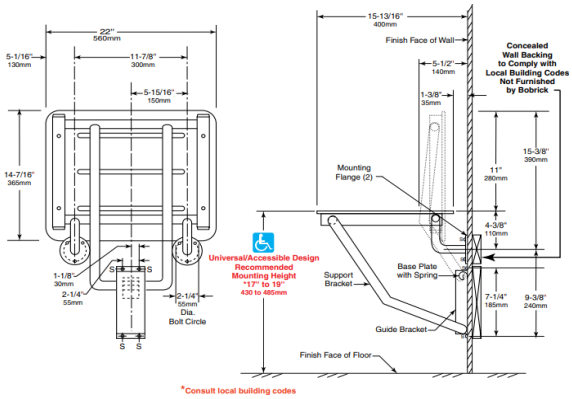


Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	CH-9
DESCRIPTION:	ADA SHOWER BENCH, FOLDABLE
MANUFACTURER & PRODUCT	Bobrick, Solid Phenolic Folding Shower Area Seat, B-5192 or Approved Equal
DIMENSIONS:	
LENGTH:	22"
WIDTH:	15-13/16"
HEIGHT:	-
FINISHES:	Solidly fused plastic laminate w/ matte finish melamine surface, ivory-colored face sheet, and black phenolic-resin core
DETAILS:	• Solid phenolic folding shower seat, ADA. • Surface doesn't delaminate. Integral slots for water drainage. Secured to frame with stainless steel carriage bolts and acorn nuts. • Frame: type 304 stainless steel w/ satin finish. 16-gauge, square tubing and 18-gauge seamless tubing. • Mounting flanges: type 304 stainless steel w/ satin finish and mounting screw holes. • Baseplate: type 304 heavy gauge stainless steel; Spring: type 301 stainless steel, spot-welded to baseplate; Guide Bracket: type 304 stainless steel.

LOCATIONS

ROOM #	ROOM NAME	QTY
100MS	Men's Shower	1
100WS	Women's Shower	1

TOTAL: 2

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

EXT-1

ITEM CODE	EXT-1
DESCRIPTION:	BENCH, EXTERIOR
MANUFACTURER & PRODUCT	Polly Products, Deluxe 6' Bench, ASM-DB6B or Approved Equal
DIMENSIONS:	
LENGTH:	72"
WIDTH:	25-7/8" Overall
HEIGHT:	31-9/16" Overall | 17-7/16" Seat Height
FINISHES:	HDPE Weathered Gray Back & Seat HDPE Black Frame
DETAILS:	• Exterior graded 6ft bench made of recycled HDPE for durability. • Weight capacity: 675lbs. • Impervious to moisture, rot, mold and insects. UV protected, solid color molded through. • Maintenance-free. • Vendor to provide bracket anchor kit for concrete.

LOCATIONS

ROOM #	ROOM NAME	QTY
	Exterior	3

TOTAL: 3

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

EXT-2

ITEM CODE	EXT-2
DESCRIPTION:	BULLETIN BOARD, ENCLOSED
MANUFACTURER & PRODUCT	Quartet, Enclosed Bulletin Board - Outdoor, 2124GGS or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	-
HEIGHT:	36"
FINISHES:	Silver Frame Cork Board
DETAILS:	• Swing door enclosed bulletin board for exterior use; wall-mounted type. • Vendor to ensure mounting hardware is included. • Durable to withstand weather and sunlight.

LOCATIONS

ROOM #	ROOM NAME	QTY
	Exterior	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

EXT-3

ITEM CODE	EXT-3
DESCRIPTION:	WASTE RECEPTACLE, EXTERIOR
MANUFACTURER & PRODUCT	Rubbermaid Commercial, Tailor ™ Metal Frame, 2182672 or Approved Equal
DIMENSIONS:	
LENGTH:	25.2"
WIDTH:	25.2"
HEIGHT:	44.6"
FINISHES:	Black Powder Coat
DETAILS:	• 41 gal. exterior graded waste receptacle. • Hinged lid enables easy waste removal. • Adjustable leg levelers for stability on uneven surfaces. Allows containers to be positioned in optimal areas. • Made to withstand heavy use and harsh weather conditions.

LOCATIONS

ROOM #	ROOM NAME	QTY
	Exterior	2
TOTAL:		2

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

EXT-4

ITEM CODE	EXT-4
DESCRIPTION:	SMOKER'S POLE
MANUFACTURER & PRODUCT	Tough Guy, Cigarette Receptacle, 12V178 or Approved Equal
DIMENSIONS:	
LENGTH:	14-1/2" Diameter
WIDTH:	X
HEIGHT:	41"
FINISHES:	Black Powder Coated Steel
DETAILS:	• Stand alone cigarette receptacle; portable type that can be relocated as needed.

LOCATIONS

ROOM #	ROOM NAME	QTY
	Exterior	1
	TOTAL:	1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

EXT-5

ITEM CODE	EXT-5
DESCRIPTION:	PICNIC TABLE
MANUFACTURER & PRODUCT	Polly Products, Deluxe 6' Picnic Table, ASM-DPT6 or Approved Equal
DIMENSIONS:	
LENGTH:	72"
WIDTH:	60-7/8"
HEIGHT:	31" Overall | 20" Seat Height
FINISHES:	HDPE Weathered Gray Seat & Top HDPE Black Frame
DETAILS:	• 6ft picnic table made of 100% recycled plastic. • Easy to maintain and clean. • Tabletop is 72"L x 29"W. • Seats are 72"L x 11-3/8"W. • Durable to resist weather, chemicals and physical wear. • Vendor to provide bracket anchor kit for concrete.

LOCATIONS

ROOM #	ROOM NAME	QTY
	Exterior	1
TOTAL:		1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-1

ITEM CODE	ST-1
DESCRIPTION:	LOCKER, 75"H
MANUFACTURER & PRODUCT	Strong Hold, Extra Heavy Duty Ventilated Single Tier Locker, 26-1H-24-1T-L-7024 or Approved Equal
DIMENSIONS:	
LENGTH:	24"
WIDTH:	24"
HEIGHT:	75"
FINISHES:	Dark Grey Powder Coated Steel
DETAILS:	• 14 GA steel w/ hexagon-punched doors and sides to allow visibility and ventilation. • Extra heavy duty single tier locker. • Includes (1) shelf, (1) hanger rod and (2) coat hooks. • 3-point locking system, compatible w/ standard padlock.

LOCATIONS

ROOM #	ROOM NAME	QTY
100ML	Men's Locker Room	59
100WL	Women's Locker Room	25
TOTAL:		84

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-2



Image shown is an example for reference only.



High Pressure Laminate:
Veranda Teak



Pull Style:
Contemporary Arch

Finishes shown are an example for reference only

ITEM CODE	ST-2
DESCRIPTION:	LATERAL FILE, 36X18
MANUFACTURER & PRODUCT	Steelcase, Currency, Lateral File, CRL2H or Approved Equal
DIMENSIONS:	
LENGTH:	36"
WIDTH:	18"
HEIGHT:	28"
FINISHES:	Laminate Top - HPL Milk White Laminate Fronts - HPL Veranda Teak
DETAILS:	• Freestanding 2 High lateral file w/ proud style high pressure laminate fronts and lock bar. • Each 12"H drawer includes side-to-side hanging bars that accommodate letter, legal, EDP, international A4, and foolscap suspended file folders. • Include counterweight; pulls to be contemporary. • Drawers have full extension steel ball-bearing slides; drawer interiors and accessories are black in color; single lock secures all drawers. • Provide leveling glides with a 1.5" adjustment range.

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	7

TOTAL: 7

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-3a

ITEM CODE	ST-3a
DESCRIPTION:	STORAGE SHELF, 3FT
MANUFACTURER & PRODUCT	Tennsco, Boltless Shelving - Medium Duty, ZB7-3624S-5C or Approved Equal
DIMENSIONS:	
LENGTH:	36"
WIDTH:	24"
HEIGHT:	84"
FINISHES:	Gray Powder Coated Steel
DETAILS:	• Medium-duty boltless shelving. • 1,000lb load capacity per shelf; five (5) shelves total. • Adjustable shelf increments by 1-1/2". • Ribbed steel decking provides a solid surface that prevents items from falling through it. Has ridges that create spaces for users to grab items on the decking without pinching fingers.

LOCATIONS

ROOM #	ROOM NAME	QTY
100JC	JAN	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-3b

ITEM CODE	ST-3b
DESCRIPTION:	STORAGE SHELF, 60X24
MANUFACTURER & PRODUCT	Tennsco, Boltless Shelving - Medium Duty, ZB7-6024S-5C or Approved Equal
DIMENSIONS:	
LENGTH:	60"
WIDTH:	24"
HEIGHT:	84"
FINISHES:	Gray Powder Coated Steel
DETAILS:	• Medium-duty boltless shelving. • 750lb load capacity per shelf; five (5) shelves total. • Adjustable shelf increments by 1-1/2". • Ribbed steel decking provides a solid surface that prevents items from falling through it. Has ridges that create spaces for users to grab items on the decking without pinching fingers.

LOCATIONS

ROOM #	ROOM NAME	QTY
201	Storekeeper	16
203	Wood Shop	3
208	Welding	1
TOTAL:		20

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-3c

ITEM CODE	ST-3c
DESCRIPTION:	STORAGE SHELF, 48X24
MANUFACTURER & PRODUCT	Tennsco, Boltless Shelving - Medium Duty, ZB7-4824S-5C or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	24"
HEIGHT:	84"
FINISHES:	Gray Powder Coated Steel
DETAILS:	• Medium-duty boltless shelving. • 850lb load capacity per shelf; five (5) shelves total. • Adjustable shelf increments by 1-1/2". • Ribbed steel decking provides a solid surface that prevents items from falling through it. Has ridges that create spaces for users to grab items on the decking without pinching fingers.

LOCATIONS

ROOM #	ROOM NAME	QTY
205	Maintenance Shop	17
TOTAL:		17

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-4a

ITEM CODE	ST-4a
DESCRIPTION:	STORAGE CABINET, 48X24
MANUFACTURER & PRODUCT	Durham, Storage Cabinet w/Swing Handle and Keyed Lock, 2505-4S-95 or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	24"
HEIGHT:	78"
FINISHES:	Gray Powder Coated
DETAILS:	• Stationary storage cabinet w/ adjustable shelves. • Four shelves in increments of 4". • Load capacity per shelf = 750lbs. • Lockable storage cabinet. Keys included. • Base w/ legs. • Industrial grade storage cabinet that is fully welded and assembled. Suitable for warehouses, machine shops, and other areas where cabinets may be exposed to impacts and other hazards.

LOCATIONS

ROOM #	ROOM NAME	QTY
205	Maintenance Shop	87
207	Auto Shop / Auto Maint Sto. & Mezzanine	4
TOTAL:		91

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-4b

ITEM CODE	ST-4b
DESCRIPTION:	STORAGE CABINET, 60X24
MANUFACTURER & PRODUCT	Strong Hold, Storage Cabinet - Super Duty, 56-244-6/5DB or Approved Equal
DIMENSIONS:	
LENGTH:	60"
WIDTH:	24"
HEIGHT:	78"
FINISHES:	Dark Gray Baked Enamel Steel
DETAILS:	• Stationary storage cabinet w/ adjustable shelves and bottom drawers. • Load capacity per shelf = 1650 lbs. • Lockable storage cabinet. • Includes four (4) adjustable shelves and six (6) drawers. • Industrial grade storage cabinet that is fully welded and assembled. Suitable for warehouses, machine shops, and other areas where cabinets may be exposed to impacts and other hazards.

LOCATIONS

ROOM #	ROOM NAME	QTY
202	S&G Open Shop & Storage	18
205	Maintenance Shop	51
207	Auto Shop / Auto Maint Sto.	6
208	Welding	1
TOTAL:		76

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-5a

ITEM CODE	ST-5a
DESCRIPTION:	TOOL CABINET, LARGE
MANUFACTURER & PRODUCT	Proto, Rolling Tool Cabinet, JSTV5539RD13BK or Approved Equal
DIMENSIONS:	
LENGTH:	55"
WIDTH:	22-3/8"
HEIGHT:	38-1/2"
FINISHES:	Glossy Black Body & Drawers
DETAILS:	• Heavy duty rolling, 13-drawer tool cabinet. • Fully extending drawer slide with ball bearing slide type. • Include top mat and drawer liners. • Central lockable system type include 2 key copies. • 4,000lb total load capacity.

LOCATIONS

ROOM #	ROOM NAME	QTY
205	Maintenance Shop	2
207	Auto Shop / Auto Maint Sto	1

TOTAL: 3

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-6

ITEM CODE	ST-6
DESCRIPTION:	SMALL PARTS ORGANIZER, 64 SLOTS
MANUFACTURER & PRODUCT	Akro-Mils, Drawer Bin Cabinet, 10164 or Approved Equal
DIMENSIONS:	
LENGTH:	20"
WIDTH:	6-1/2"
HEIGHT:	15-3/4"
FINISHES:	Black Plastic Frame Clear Plastic Bins
DETAILS:	• Wall-mountable small parts organizer w/ 64 bin storage. • Includes 12 vertical dividers. • Can be stacked on top of compatible small parts drawer cabinets with same width and depth to provide high-density storage.

LOCATIONS

ROOM #	ROOM NAME	QTY
207	Auto Shop / Auto Maint Sto	1

TOTAL: 1

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-7a

ITEM CODE	ST-7a
DESCRIPTION:	TIRE RACK, SINGLE-SIDED
MANUFACTURER & PRODUCT	Tennsco, Single Sided Boltless Tire Rack, ZST-6084S or Approved Equal
DIMENSIONS:	
LENGTH:	60"
WIDTH:	21"
HEIGHT:	84"
FINISHES:	Medium Gray Powder Coated Steel
DETAILS:	• Single sided boltless tire rack; rivet-connected. • Three (3) shelves and holds up to 24 tires. • Include 9" Wall Tie. • Ensure that average Passenger and Truck tires can fit into the shelf space. • Ensure to have adjustable shelves.

LOCATIONS

ROOM #	ROOM NAME	QTY
207	Auto Shop / Auto Maint Sto Mezzanine	3

TOTAL: 3

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-7b

ITEM CODE	ST-7b
DESCRIPTION:	TIRE RACK, DOUBLE-SIDED
MANUFACTURER & PRODUCT	Tennsco, Double Sided Boltless Tire Rack, ZDT-6084S or Approved Equal
DIMENSIONS:	
LENGTH:	60"
WIDTH:	42"
HEIGHT:	84"
FINISHES:	Medium Gray Powder Coated Steel
DETAILS:	• Double sided boltless tire rack; rivet-connected. • Six (6) shelves and holds up to 48 tires. • Include (12) Angle Beams; (12) Shelf Supports; (4) Cross Aisle Ties and (8) Uprights. • Ensure that average Passenger and Truck tires can fit into the shelf space. • Ensure to have adjustable shelves.

LOCATIONS

ROOM #	ROOM NAME	QTY
207	Auto Shop / Auto Maint Sto Mezzanine	4

TOTAL: 4

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

ST-8

ITEM CODE	ST-8
DESCRIPTION:	BIN, TOOLS
MANUFACTURER & PRODUCT	Rubbermaid Commercial, Vented Brute - 44 Gal. FG264360GRAY or Approved Equal
DIMENSIONS:	
LENGTH:	24"
WIDTH:	24"
HEIGHT:	31.5"
FINISHES:	Gray
DETAILS:	• Rounded handles make lifting and moving easier, and are reinforced to resist tearing or damage from heavy loads. • Reinforced base is engineered to be dragged over rough surfaces, extending life and overall durability even in tough environments. • Contoured base handles improve grip and ergonomics, reducing strain and improving efficiency when emptying containers. • Rim features integrated rib structure to increase strength and resist crushing.

LOCATIONS

ROOM #	ROOM NAME	QTY
205	Maintenance Shop	8

TOTAL: 8

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

T-1

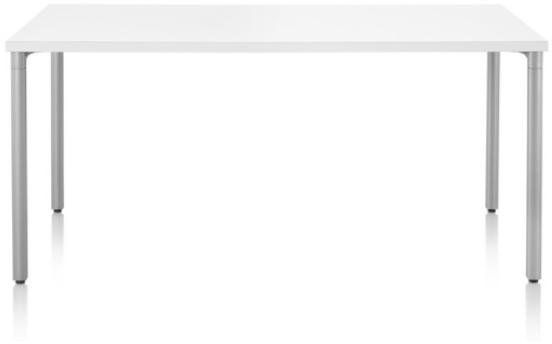
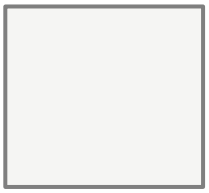
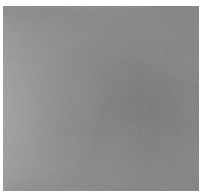


Image shown is an example for reference only.



Laminate:
Frosty White



Legs:
Silver

Finishes shown are an example for reference only

ITEM CODE	T-1
DESCRIPTION:	TABLE, 60X36
MANUFACTURER & PRODUCT	Herman Miller, Everywhere Table - Rectangular Table, DT1AS.3660LP139139BK57NTG or Approved Equal
DIMENSIONS:	
LENGTH:	60"
WIDTH:	36"
HEIGHT:	28-1/2"
FINISHES:	Laminate Top - Frosty White Legs - Silver
DETAILS:	• Rectangular café height table w/ high pressure laminate top w/ squared thermoplastic edge. • Post leg type, vendor to ensure leveling glides are provided at the end of each leg. • No grommets.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	12

TOTAL: 12

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

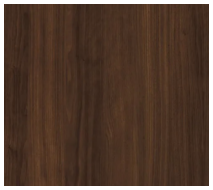
JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

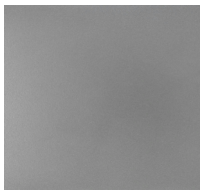
T-2



Image shown is an example for reference only.



High Pressure Laminate:
Columbian Walnut



Legs:
Silver

Finishes shown are an example for reference only

ITEM CODE	T-2
DESCRIPTION:	TABLE, CONFERENCE
MANUFACTURER & PRODUCT	Herman Miller, Everywhere Table - Soft Rectangle, Extended, DT1PS.42120LGLBVLBV613253 or Approved Equal
DIMENSIONS:	
LENGTH:	120"
WIDTH:	42"
HEIGHT:	28-1/2"
FINISHES:	Laminate Top - HPL Columbian Walnut Leg - Silver
DETAILS:	• 2-piece conference table w/ high pressure laminate top and squared thermoplastic edge. • Double 3-column base, spanner leg/base type. • Provide middle grommet cutouts for power cords to run through. • Provide leveling glides at the bottom of each leg. • Conference table that seats ten (10) people comfortably.

LOCATIONS

ROOM #	ROOM NAME	QTY
102	Conference	1

TOTAL: 1

NOTE:

Manufacturers are listed for reference to establish level of quality, color, texture, etc. and are not intended to limit products from other manufacturers. Products of other manufacturers with comparable quality, color, texture, etc. that meet the requirements of the drawings and specifications are acceptable. Vendor to verify any quantities with FF&E Floor Plan.

JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

T-4



Image shown is an example for reference only.

Laminate:
Frosty White

Legs:
Silver

Finishes shown are an example for reference only

ITEM CODE	T-4
DESCRIPTION:	TABLE, 30X30
MANUFACTURER & PRODUCT	Herman Miller, Everywhere Tables - Square, DT1BS3030LS139139BK57 or Approved Equal
DIMENSIONS:	
LENGTH:	30"
WIDTH:	30"
HEIGHT:	28-1/2"
FINISHES:	Laminate Top - Frosty White Legs - Silver
DETAILS:	• Square café height table w/ high pressure laminate top and thermoplastic squared-edge. • Single-column cross base type. • Provide leveling glides.

LOCATIONS

ROOM #	ROOM NAME	QTY
100BR	Break Room	6

TOTAL: 6

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

WS-1a



Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	WS-1a
DESCRIPTION:	WORKBENCH, 120 X 36
MANUFACTURER & PRODUCT	Benchpro, Benchpro Butcherblock Workbench KW36120+LP or Approved Equal
DIMENSIONS:	
LENGTH:	120"
WIDTH:	36"
HEIGHT:	30-36" Adjustable Height
FINISHES:	Top: Butcher Block Frame: Steel, Powder-Coated
DETAILS:	• Adjustable Height, Bolted. • 1-3/4" Top Thickness. • Overall Load Capacity: 6,600 lb. • Foot Type: Glide. • Leg Type: Straight. • Resistance: Chemical & Corrosion. • Open Based.

LOCATIONS

ROOM #	ROOM NAME	QTY
203	Wood Shop	5
205	Maintenance Shop & Mezzanine	5

TOTAL: 10

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

WS-1b



Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	WS-1b
DESCRIPTION:	WORKBENCH, 72 X 36
MANUFACTURER & PRODUCT	Benchpro, Benchpro Butcherblock Workbench, KW3672+LP or Approved Equal
DIMENSIONS:	
LENGTH:	72"
WIDTH:	36"
HEIGHT:	30-36" Adjustable Height
FINISHES:	Top: Butcher Block Frame: Steel, Powder-Coated
DETAILS:	• Adjustable Height, Bolted. • 1 3/4" Top Thickness. • Overall Load Capacity: 6,600 lb. • Foot Type: Glide • Leg Type: Straight • Resistance: Chemical & Corrosion • Open Based

LOCATIONS

ROOM #	ROOM NAME	QTY
203	Wood Shop	5
208	Welding	2

TOTAL: 7

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

WS-1c



Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	WS-1c
DESCRIPTION:	WORKBENCH, 48 X 36
MANUFACTURER & PRODUCT	Tennsco, Tennsco Butcherblock Workbench, WBA-1-3648W or Approved Equal
DIMENSIONS:	
LENGTH:	48"
WIDTH:	36"
HEIGHT:	27-7/8" - 35-3/8" Adjustable Height
FINISHES:	Top: Butcher Block Frame: Steel, Powder-Coated
DETAILS:	• Adjustable Height, Bolted. • 1 3/4" Top Thickness. • Overall Load Capacity: 4,000 lb. • Foot Type: Plain • Leg Type: Straight

LOCATIONS

ROOM #	ROOM NAME	QTY
203	Wood Shop	1
207	Auto Shop/ Auto Maint Sto.	1

TOTAL: 2

NOTE:

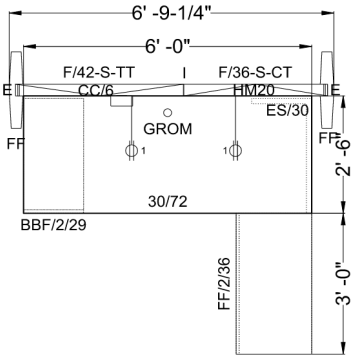
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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

WS-2







Laminate Top & Paint:
Milk White



Laminate (Proud Doors):
Veranda Teak



Pull Style:
Contemporary Arch

Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	WS-2
DESCRIPTION:	DESK, L-SHAPE
MANUFACTURER & PRODUCT	Steelcase, Fence System or Approved Equal
DIMENSIONS:	
LENGTH:	72" Desk | 36" Lateral File
WIDTH:	30" Desk | 18-3/4" Lateral File
HEIGHT:	28-1/2" Desk & Lateral File
FINISHES:	Laminate Top - HPL Milk White Paint/Trim (Panel System) - Milk White Laminate Fronts - HPL Veranda Teak
DETAILS:	• Freestanding desk with fixed box/box/file and half height modesty panel and post legs for support. • 2H lateral file to act as a return (Similar to ST-2). • Panel based system in-between workstations for power capabilities. • 1-1/8" thick High-Pressure Laminate worksurface. • Cable management brackets underneath desk. • Provide grommets at center for power cords to run through. • Include clamp-on power strip on desk. • Provide Polished Chrome lock and counterweight.

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	4

TOTAL: 4

NOTE:

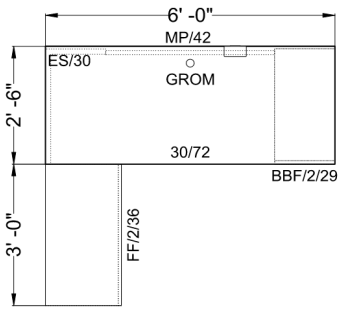
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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

WS-2a







Laminate Top & Paint:
Milk White



Laminate (Proud Doors):
Veranda Teak



Pull Style:
Contemporary Arch

Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	WS-2a
DESCRIPTION:	DESK, L-SHAPE W/ MODESTY PANEL
MANUFACTURER & PRODUCT	Steelcase, Universal and Currency, USWS (Desk), CRL2H (Lateral File) or Approved Equal
DIMENSIONS:	
LENGTH:	72" Desk | 36" Lateral File
WIDTH:	30" Desk | 18-3/4" Lateral File
HEIGHT:	28-1/2" Desk & Lateral File
FINISHES:	Laminate Top - HPL Milk White Paint/Trim (Panel System) - Milk White Laminate Fronts - HPL Veranda Teak
DETAILS:	• Freestanding desk with fixed box/box/file and half height modesty panel and post legs for support. • 2H lateral file to act as a return (Similar to ST-2). • 1-1/8" thick High-Pressure Laminate worksurface. • Cable management brackets underneath desk. • Provide grommets at center for power cords to run through. • Include clamp-on power strip on desk. • Provide Polished Chrome lock and counterweight.

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	4
103	Office 1	1
104	Office 2	1

TOTAL: 6

NOTE:

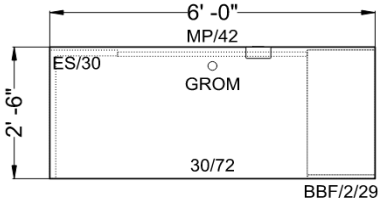
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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

WS-3







Laminate Top:
Milk White



Laminate (Proud Doors):
Veranda Teak



Pull Style:
Contemporary Arch

Image shown is an example for reference only.

Finishes shown are an example for reference only

ITEM CODE	WS-3
DESCRIPTION:	DESK, STRAIGHT
MANUFACTURER & PRODUCT	Steelcase, Universal, USWS (Desk), RPF3027AL (Pedestal) or Approved Equal
DIMENSIONS:	
LENGTH:	72"
WIDTH:	30"
HEIGHT:	28-1/2"
FINISHES:	Laminate Top - HPL Milk White Paint/Trim (Panel System) - Milk White Laminate Fronts - HPL Veranda Teak
DETAILS:	• Freestanding desk with fixed box/box/file and half height modesty panel and post legs for support. • 1-1/8" thick High-Pressure Laminate worksurface w/ 3mm plastic radius profile edge on front. • Provide Polished Chrome lock and counterweight. • Provide grommets at center for power cords to run through. • Include clamp-on power strip on desk.

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	4

TOTAL: 4

NOTE:

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JOB P10981

HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

WS-4

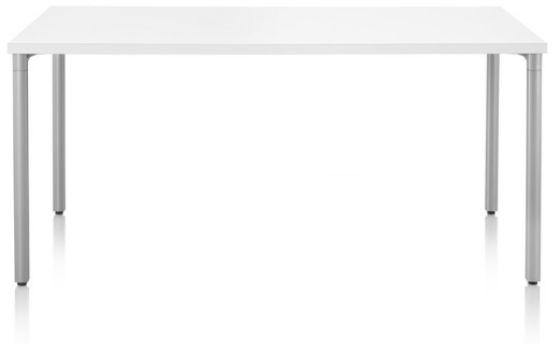
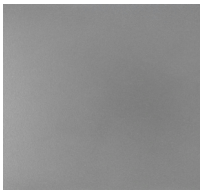


Image shown is an example for reference only.



High Pressure Laminate:
Frosty White



Legs:
Silver

Finishes shown are an example for reference only

ITEM CODE	WS-4
DESCRIPTION:	DESK, TOUCHDOWN
MANUFACTURER & PRODUCT	Herman Miller, Everywhere Rectangular Table, DT1AS.2436LP or Approved Equal
DIMENSIONS:	
LENGTH:	36"
WIDTH:	24"
HEIGHT:	28-1/2"
FINISHES:	Laminate - HPL Frosty White Legs - Silver
DETAILS:	• Rectangular squared edge table w/ high pressure laminate top. • Post legs w/ leveling glides. • Provide middle top grommet for power cords to run through.

LOCATIONS

ROOM #	ROOM NAME	QTY
101	Open Office	4

TOTAL: 4

NOTE:

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JOB P10981
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

FF&E PLANS

FURNITURE, FIXTURES AND EQUIPMENT (FF&E) LEGEND AND NOTES

ACCESSORIES (AC-#)

AC-1a	WASTE RECEPTACLE, LARGE
AC-1b	[NOT IN USE]
AC-1c	WASTE RECEPTACLE, SMALL
AC-2a	RECYCLING RECEPTACLE, LARGE
AC-2b	RECYCLING RECEPTACLE, SMALL
AC-3	[NOT IN USE]
AC-4	BULLETIN BOARD
AC-5a	SHOWER CURTAIN, 42"W
AC-5b	SHOWER CURTAIN, 108"W
AC-6a	WHITEBOARD, LARGE
AC-6b	WHITEBOARD, SMALL
AC-7	SDS STATION
AC-8	KEY STORAGE, 400 SLOTS
AC-9	HOUSEKEEPING CART
AC-10	VACUUM CLEANER
AC-11	TV MONITOR, 65"
AC-12	TV WALL MOUNT
AC-13	[NOT IN USE]
AC-14	SHREDDER
AC-15	ANTI-FATIGUE MAT

APPLIANCES (AP-#)

AP-1	REFRIGERATOR, RESIDENTIAL
AP-2	COFFEE MAKER
AP-3	MICROWAVE
AP-4a	ICE MACHINE
AP-4b	ICE MACHINE, BIN
AP-4c	ICE MACHINE, CONDENSER

CHAIR (CH-#)

CH-1	CHAIR, GUEST
CH-2a	ADA BENCH, 42"
CH-2b	ADA BENCH, 48"
CH-2c	ADA BENCH, 48" W/ BACK
CH-3	CHAIR, MULTIPURPOSE
CH-4	CHAIR, CONFERENCE
CH-5	CHAIR, TASK
CH-6	STOOL
CH-7	[NOT IN USE]
CH-8	MECHANIC SEAT
CH-9	ADA SHOWER BENCH, FOLDABLE

EXTERIOR (EX-#)

EXT-1	BENCH, EXTERIOR
EXT-2	BULLETIN BOARD, ENCLOSED
EXT-3	WASTE RECEPTACLE, EXTERIOR
EXT-4	SMOKER'S POLE
EXT-5	PICNIC TABLE

STORAGE (ST-#)

ST-1	LOCKER, 75"H
ST-2	LATERAL FILE, 36 X 18
ST-3a	STORAGE SHELF, 3FT
ST-3b	STORAGE SHELF, 60X24
ST-3c	STORAGE SHELF, 48X24
ST-4a	STORAGE CABINET, 48X24
ST-4b	STORAGE CABINET, 60X24
ST-5a	TOOL CABINET, LARGE
ST-5b	[NOT IN USE]
ST-6	SMALL PARTS ORGANIZER, 64 SLOTS
ST-7a	TIRE RACK, SINGLE-SIDED
ST-7b	TIRE RACK, DOUBLE-SIDED
ST-8	BIN, TOOLS

TABLE (T-#)

T-1	TABLE, 60X36
T-2	TABLE, CONFERENCE
T-3	[NOT IN USE]
T-4	TABLE, 30X30

WORKSTATIONS (WS-#)

WS-1a	WORKBENCH, 120X36
WS-1b	WORKBENCH, 72X36
WS-1c	WORKBENCH, 48X36
WS-2	DESK, L-SHAPE
WS-2a	DESK, L-SHAPE W/ MODESTY PANEL
WS-3	DESK, STRAIGHT
WS-4	DESK, TOUCH-DOWN

EXISTING TO BE RELOCATED

	SAW HORSE
	PALLET JACK
	MOP AND WRINGER BUCKET SET
	BROOM AND DUSTPAN SET
	DUST MOP
	HANDTRUCK
	UTILITY CART
	LADDER
	INDUSTRIAL FAN
	STEP STOOL
	PUSH BROOM
	ROLL LADDER
	SPILL KIT
	FLOOR IS WET SIGN
	PAINT STENCIL STORAGE
	FLOOR CREEPER
	OIL DISPOSAL
01	RADIAL ARM SAW, 16", DE WALT
02	STATIONARY CABINET SAW, SAWSTOP
03	SHEAR, BRAKE AND ROLL MACHINE, DAYTON
04	PORTABLE CONCRETE MIXER, MUD MIXER
05	WOODWORKING BANDSAW, 15" JET
06	BELT AND DISC SANDER, POWERMATIC
07	ROLLING MITER SAW W/ STAND, DE WALT
08	RADIAL ARM SAW, 10", DELTA
09	DRILL PRESS, STANDING, DELTA
10	FORKLIFT CHARGER
11	BENCH GRINDER, 8"
12	WATER JETTER, RIGID, KJ-2200
13	DRUM DRAIN, MARATHON
14	DRUM DRAIN, RIGID
15	LATHE, RIGID
16	512A LIFT
17	CHARGER, ASSOCIATED
18	CHARGER, PROLIX
19	BENCH GRINDER, AUTOSHOP
20	VEHICLE LIFT
21	RIM CLAMP TIRE CHANGER, COATS
22	WHEEL BALANCER, COATS
23	GENERATOR SET
24	DRILL PRESS, STANDING, DELTA MODEL 20
25	BANDSAW, WELDING
26	24-36" PLANER
27	6-8" JOINTER
28	LINCOLN IDEALARC 250 AMP SHOP WELDER
29	PAINT TOOL 1
30	CINCINNATI ELECTRICAL CO. 12" BENCH GRINDER
32	UNIVERSAL WET/DRY GRINDER, DELTA
33	BENCH GRINDER, DELTA
34	AIR COMPRESSOR, INGERSOLL RAND
35	DRILL PRESS, FLOOR 120 VAC, DAYTON 17"
36	GRINDER W/ STAND 120 VAC, DAYTON 8"
37	PARTS WASHER
38	FORKLIFT CHARGER, LARGE
41	PAINT STRIPPER
42	MITER SAW, HAND HELD
43	PORTABLE PRESSURE WASHER
E. CAB	STORAGE CABINET, 60X24, STRONGHOLD
E. CAB	STORAGE CABINET, JUSTRITE
E. CAB	HILTI CABINET
E. CAB	TOOL CABINET, LARGE, SNAP-ON
E. CT	WOOD MOBILE CART
E. CT	PLATFORM CART
E. FC	FLAMMABLE CABINET, 60 GAL
E. FC	FLAMMABLE CABINET, 55 GAL
E. FC	FLAMMABLE CABINET, 45 GAL
E. FC	FLAMMABLE CABINET, 30 GAL
E. FC	FLAMMABLE CABINET, 22 GAL
E. FC	FLAMMABLE CABINET, 90 GAL
E. LKR	LOCKER, 18X24
E. LKR	GAS CYLINDER LOCKER, 31X30
E. RK	SPOOL RACK
E. ST	OIL STORAGE PALLET, ENPAC
E. ST	SIGN STORAGE SHELF
E. TK	WATER TANK
E. VAC	WET/DRY VACUUM (SHOP VAC)
E. WB	WORKBENCH, 42X24
E. WS	WORKSTATION 1, WELDING
E. WS	WORKSTATION 2, WELDING

END USER PROVIDED

31	KEY CUTTING STATION
39	PORTABLE WELDER
40	GAS CART

FF&E LEGEND

FF&E ITEMS

EXISTING TO BE RELOACTED OR END USER PROVIDED

-# NEW FF&E TAGS

FURNITURE CATEGORY TAG

A	= ARTWORK
AC	= ACCESSORIES
AP	= APPLIANCES
CH	= CHAIR
E	= EQUIPMENT
EX	= EXTERIOR
ST	= STORAGE
T	= TABLE
WS	= WORKSTATION

EXISTING FF&E TAGS

EXISTING FURNITURE CATEGORY TAG

#	= EXISTING EQUIPMENT	
E. CAB	= "	* CABINETS
E. CT	= "	* CART
E. FC	= "	* FLAMMABLE CABINET
E. LKR	= "	* LOCKER
E. RK	= "	* RACK
E. ST	= "	* STORAGE
E. TK	= "	* WATER TANK
E. VAC	= "	* SHOP VACUUM
E. WB	= "	* WORKBENCH
E. WS	= "	* WORKSTATION

FF&E NOTES:

1. THE FF&E INCLUDES OFFICE FURNITURE, STORAGE AND SHOP EQUIPMENT.
2. FURNITURE LAYOUT IS SHOWN FOR REFERENCE ONLY.
3. MANUFACTURERS ARE LISTED FOR REFERENCE TO ESTABLISH LEVEL OF QUALITY, COLOR, TEXTURE, ETC. AND NOT INTENDED TO LIMIT PRODUCTS FROM OTHER MANUFACTURERS. PRODUCTS OF OTHER MANUFACTURERS WITH COMPARABLE QUALITY, COLOR, AND TEXTURE, ETC. THAT MEET THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS ARE ACCEPTABLE.
4. THE FF&E SHOWN ON THE "I" SHEETS ARE TO PROCURE AND SUPERVISE INSTALLATION OF THE FF&E, UNLESS INDICATED AS 'EXISTING' OR 'END USER PROVIDED'.

REVISION	DATE	DESCRIPTION	BY	APPROVED

LAURIE A. CHIKAZAWA
LICENSED PROFESSIONAL ARCHITECT
No. 17476
HAWAII, USA

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
EXP 4-30-28

RMA ARCHITECTS INC

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS

JOB TITLE
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

SHEET TITLE
FF&E LEGEND AND NOTES

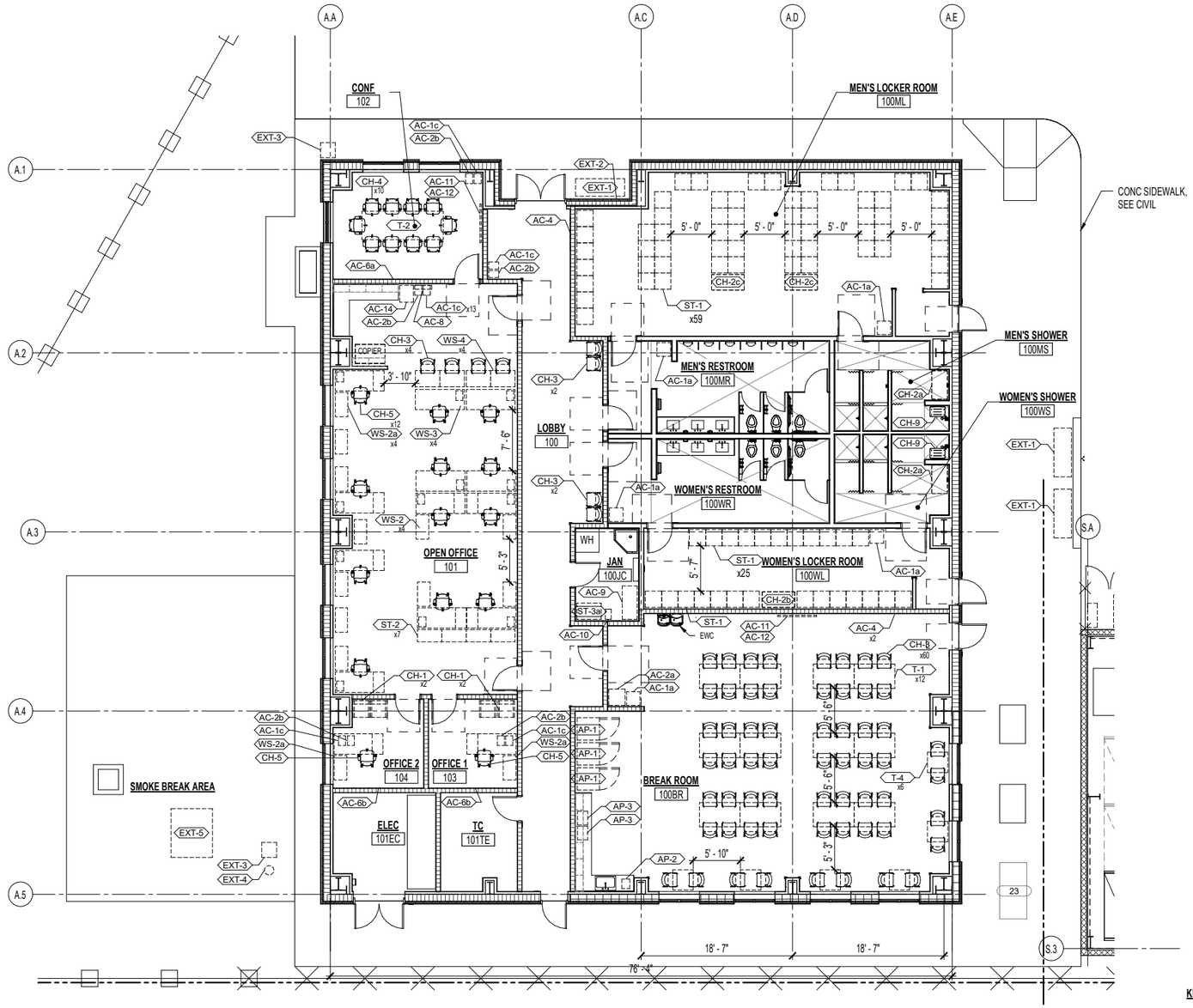
DESIGNED BY:	LC
DRAWN BY:	MB
CHECKED BY:	LC
DATE:	05/2026
SCALE:	AS SHOWN

JOB NUMBER
P10882

SHEET
I-001
151 OF 273 SHTS

FINAL SUBMITTAL - MAY 2026

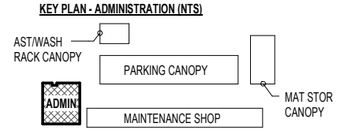
FF&E NOTES:
1. SEE SHEET 1-001 - FF&E LEGEND & NOTES FOR CORRESPONDING CODES .



A FIRST FLOOR FF&E PLAN - ADMINISTRATION
1/8" = 1'-0"

PLAN NORTH

KEY PLAN - ADMINISTRATION (NTS)



0 4' 8' 16'
SCALE: 1/8" = 1'-0"

LAURIE A. CHIKAZAWA
LICENSED PROFESSIONAL ARCHITECT
No. 17475
HAWAII, USA

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
EXP 4-30-28

RMA ARCHITECTS INC

REVISION	DATE	DESCRIPTION	BY	APPROVED

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS

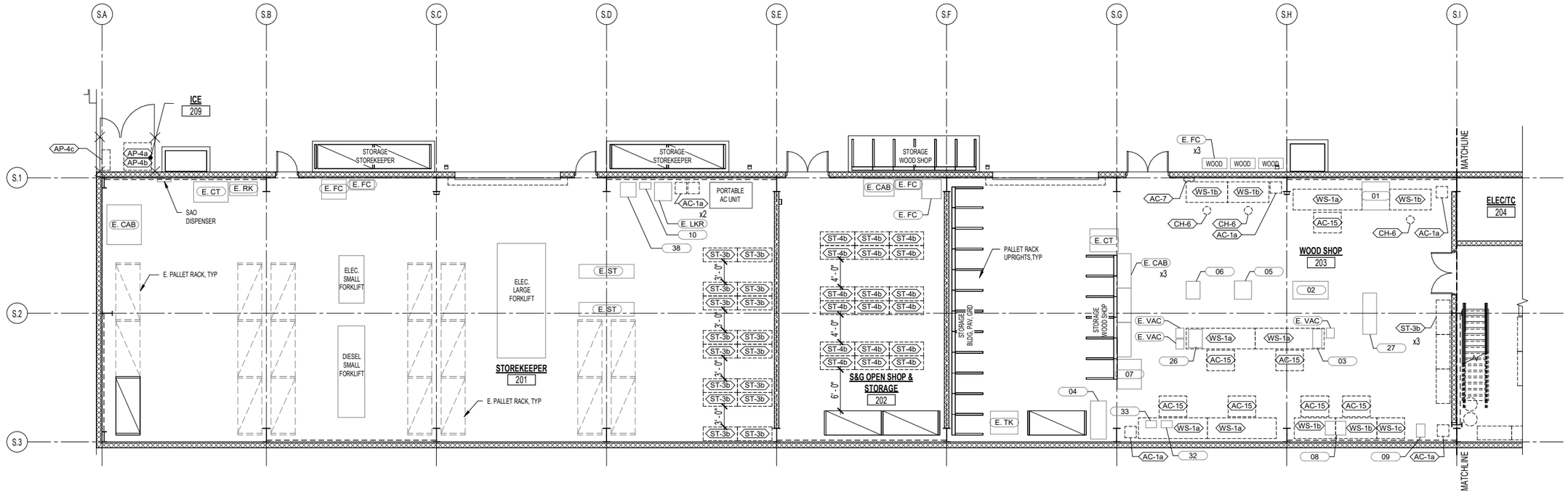
JOB TITLE
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

SHEET TITLE
FIRST FLOOR FF&E PLAN - ADMINISTRATION

DESIGNED BY:	LC	JOB NUMBER	SHEET
DRAWN BY:	MB	P10882	I-101
CHECKED BY:	LC		152 OF 273 SHTS.
DATE:	05/2026		
SCALE:	AS SHOWN		

FINAL SUBMITTAL - MAY 2026

FF&E NOTES:
1. SEE SHEET 1-001 - FF&E LEGEND & NOTES FOR CORRESPONDING CODES .

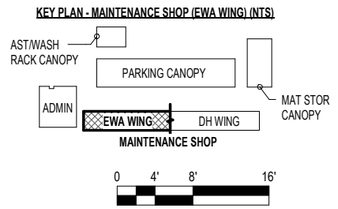


A FIRST FLOOR FF&E PLAN - MAINTENANCE SHOP (EWA WING)

1/8" = 1'-0"

PLAN NORTH

KEY PLAN - MAINTENANCE SHOP (EWA WING) (NTS)



0 4' 8' 16'

SCALE: 1/8" = 1'-0"

LAURIE A. CHIKAZAWA
LICENSED PROFESSIONAL ARCHITECT
No. 17478
HAWAII, USA

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
EXP 4-30-28

RMA ARCHITECTS INC

REVISION	DATE	DESCRIPTION	BY	APPROVED

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS

JOB TITLE
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

SHEET TITLE
FIRST FLOOR FF&E PLAN - MAINTENANCE SHOP (EWA WING)

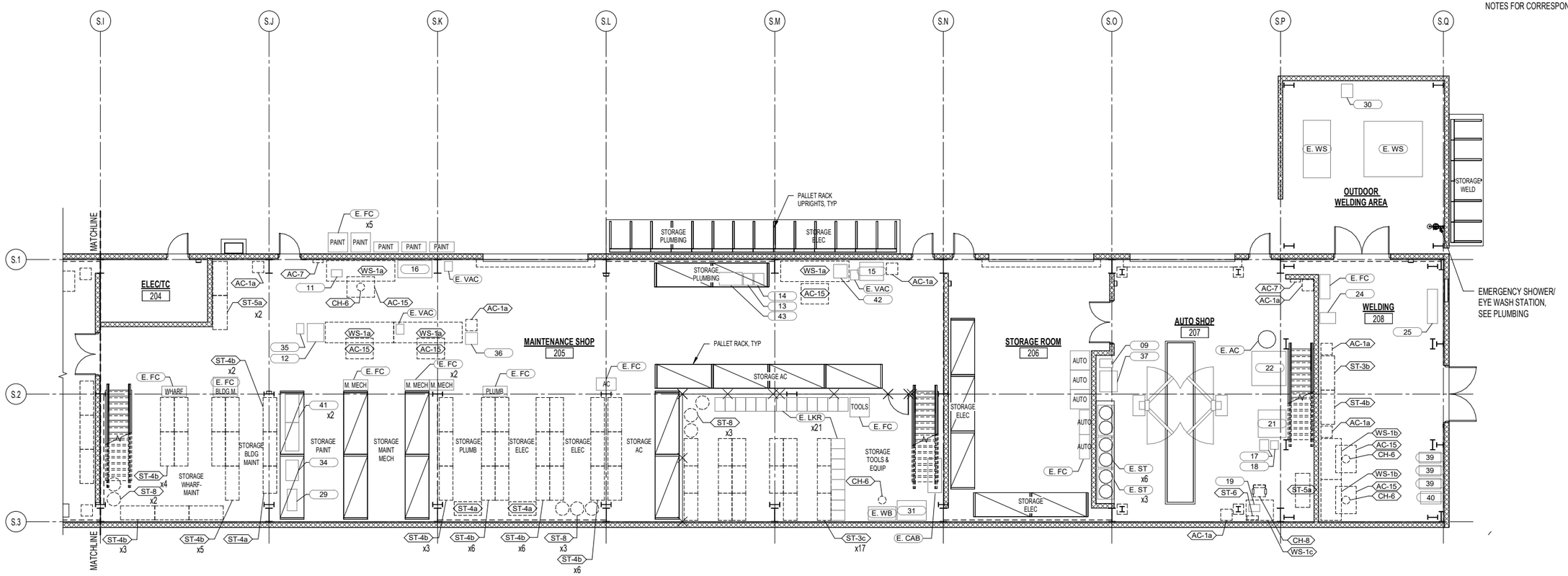
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DATE:	05/2026
SCALE:	AS SHOWN

JOB NUMBER
P10882

SHEET
I-111
153 OF 273 SHTS

FINAL SUBMITTAL - MAY 2026

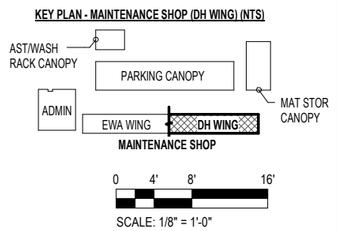
FF&E NOTES:
1. SEE SHEET 1-001 - FF&E LEGEND & NOTES FOR CORRESPONDING CODES .



A FIRST FLOOR FF&E PLAN - MAINTENANCE SHOP (DIAMOND HEAD WING)
1/8" = 1'-0"

PLAN NORTH

KEY PLAN - MAINTENANCE SHOP (DH WING) (NTS)



SCALE: 1/8" = 1'-0"

LAURIE A. CHIKAZAWA
LICENSED PROFESSIONAL ARCHITECT
No. 17475
HAWAII, USA

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
EXP 4-30-28

RMA ARCHITECTS INC

REVISION	DATE	DESCRIPTION	BY	APPROVED

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS

JOB TITLE
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

SHEET TITLE
FIRST FLOOR FF&E PLAN - MAINTENANCE SHOP (DIAMOND HEAD WING)

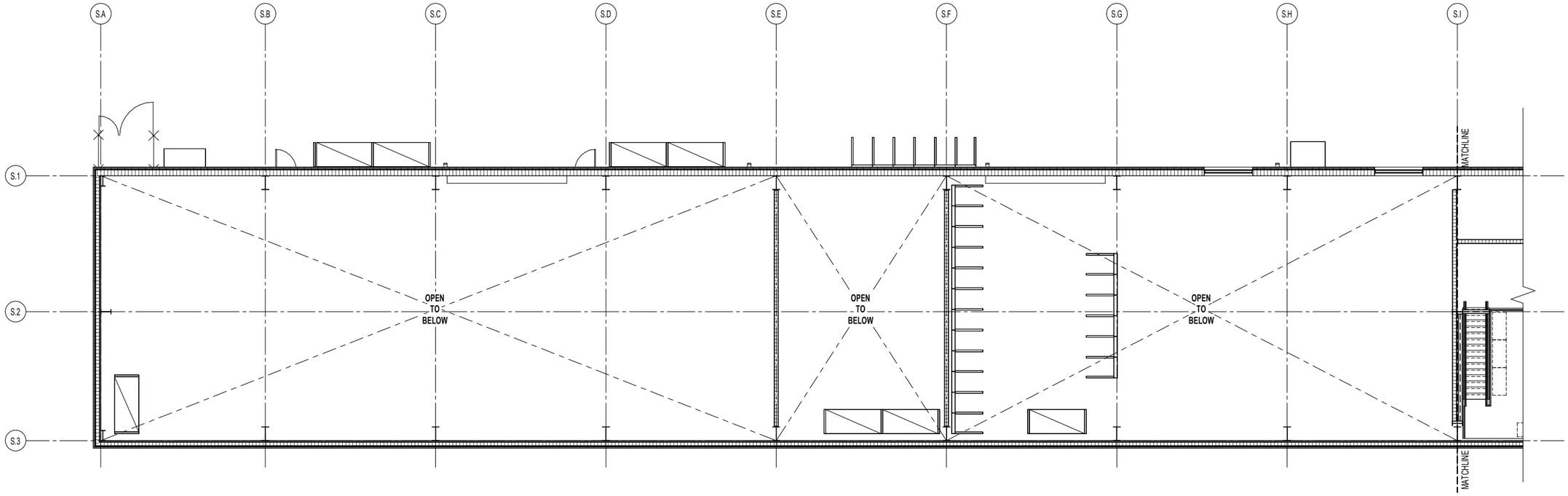
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DATE:	05/2026
SCALE:	AS SHOWN

JOB NUMBER
P10882

SHEET
I-112
154 OF 273 SHTS.

FINAL SUBMITTAL - MAY 2026

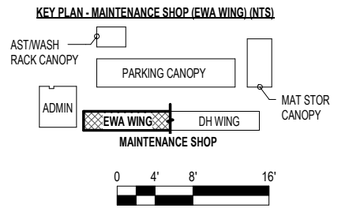
FF&E NOTES:
1. SEE SHEET 1-001 - FF&E LEGEND & NOTES FOR CORRESPONDING CODES .



A MEZZANINE FF&E PLAN - MAINTENANCE SHOP (EWA WING)
1/8" = 1'-0"

PLAN NORTH

KEY PLAN - MAINTENANCE SHOP (EWA WING) (NTS)



0 4' 8' 16'
SCALE: 1/8" = 1'-0"

LAURIE A. CHIKAZAWA
LICENSED PROFESSIONAL ARCHITECT
No. 17478
HAWAII, USA

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
EXP 4-30-28

RMA ARCHITECTS INC

REVISION	DATE	DESCRIPTION	BY	APPROVED

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS

JOB TITLE
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

SHEET TITLE
MEZZANINE FF&E PLAN - MAINTENANCE SHOP (EWA WING)

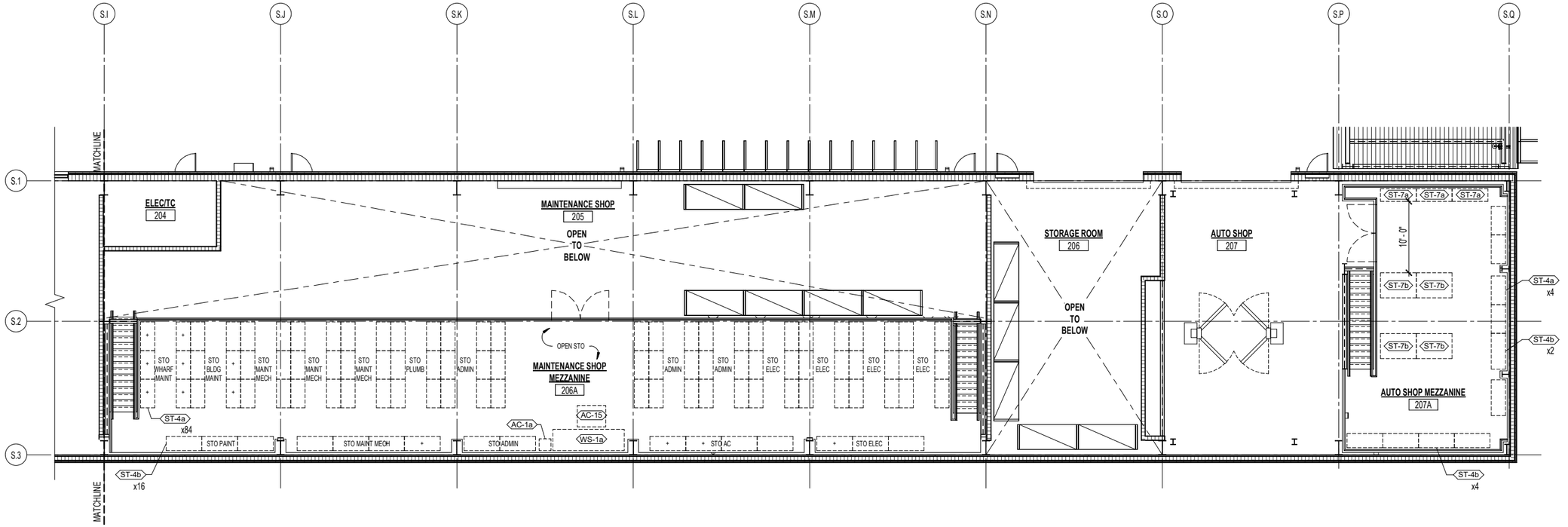
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P10882

SHEET
I-113
155 OF 273 SHTS

FINAL SUBMITTAL - MAY 2026

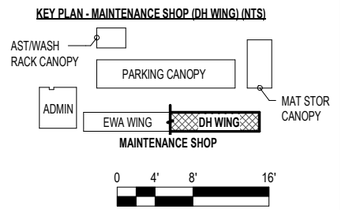
FF&E NOTES:
1. SEE SHEET I-001 - FF&E LEGEND & NOTES FOR CORRESPONDING CODES .



A MEZZANINE FF&E PLAN - MAINTENANCE SHOP (DIAMOND HEAD WING)
1/8" = 1'-0"

PLAN NORTH

KEY PLAN - MAINTENANCE SHOP (DH WING) (NTS)



LAURIE A. CHIKAZAWA LICENSED PROFESSIONAL ARCHITECT No. 17476 HAWAII, USA

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
EXP 4-30-28

RMA ARCHITECTS INC

REVISION	DATE	DESCRIPTION	BY	APPROVED

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS

JOB TITLE
HONOLULU HARBOR, NEW OAHU DISTRICT
BASEYARD RELOCATION AT AUIKI STREET

SHEET TITLE
MEZZANINE FF&E PLAN - MAINTENANCE SHOP (DIAMOND HEAD WING)

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DATE:	05/2026
SCALE:	AS SHOWN

JOB NUMBER
P10882

SHEET
I-114
156 OF 273 SHTS

FINAL SUBMITTAL - MAY 2026

Requirements of Chapter 104, HRS
Wages and Hours of Employees on Public Works Law

Chapter 104, HRS, applies to every public works construction project over $2,000, regardless of the method of procurement or financing (purchase order, voucher, bid, contract, lease arrangement, warranty, SPRB).

Rate of Wages for Laborers and Mechanics

- Minimum prevailing wages (basic hourly rate plus fringe benefits), as determined by the Director of Labor and Industrial Relations and published in wage rate schedules, shall be paid to the various classes of laborers and mechanics working on the job site. [§104-2(a), (b), Hawaii Revised Statutes (HRS)]

- If the Director of Labor determines that prevailing wages have increased during the performance of a public works contract, the rate of pay of laborers and mechanics shall be raised accordingly. [§104-2(a) and (b), HRS; §12-22-3(d) Hawaii Administrative Rules (HAR)]

Overtime

- Laborers and mechanics working on a Saturday, Sunday, or a legal holiday of the State or more than eight hours a day on any other day shall be paid overtime compensation at not less than one and one-half times the basic hourly rate plus the cost of fringe benefits for all hours worked. If the Director of Labor determines that a prevailing wage is defined by a collective bargaining agreement, the overtime compensation shall be at the rates set by the applicable collective bargaining agreement [§§104-1, 104-2(c), HRS; §12-22-4.1, HAR]

Weekly Pay

- Laborers and mechanics employed on the job site shall be paid their full wages at least once a week, without deduction or rebate, except for legal deductions, within five working days after the cutoff date. [§104-2(d), HRS]

Posting of Wage Rate Schedules

- Wage rate schedules with the notes for prevailing wages and special overtime rates, shall be posted by the contractor in a prominent and easily accessible place at the job site. A copy of the entire wage rate schedule shall be given to each laborer and mechanic employed under the contract, except when the employee is covered by a collective bargaining agreement. [§104-2(d), HRS]

Withholding of Accrued Payments

- If necessary, the contracting agency may withhold accrued payments to the contractor to pay to laborers and mechanics employed by the contractor or subcontractor on the job site any difference between the wages required by the public works contract or specifications and the wages received. [§104-2(e), HRS]

Certified Weekly Payrolls and Payroll Records

- A certified copy of all payrolls shall be submitted weekly to the contracting agency. [§104-3(a), HRS; §12-22-10, HAR]

- The contractor is responsible for the submission of certified copies of the payrolls of all subcontractors. The certification shall affirm that the payrolls are correct and complete, that the wage rates listed are not less than the applicable rates contained in the applicable wage rate schedule, and that the classifications for each laborer or mechanic conform with the work the laborer or mechanic performed. [§104-3(a), HRS; §12-22-10, HAR]

- Payroll records shall be maintained by the contractor and subcontractors for three years after completion of construction. The records shall contain: [§104-3(b), HRS; §12-22-10, HAR]
  - the name and home address of each employee
  - the last four digits of social security number
  - a copy of the apprentice's registration with DLIR
  - the employee's correct classification
  - rate of pay (basic hourly rate + fringe benefits)
  - itemized list of fringe benefits paid
  - daily and weekly hours worked
  - weekly straight time and overtime earnings
  - amount and type of deductions
  - total net wages paid
  - date of payment

- Records shall be made available for examination by the contracting agency, the Department of Labor and Industrial Relations (DLIR), or any of its authorized representatives, who may also interview employees during working hours on the job. [§§104-3(c), 104-22(a), HRS; §12-22-10, HAR]

Termination of Work on Failure to Pay Wages

- If the contracting agency finds that any laborer or mechanic employed on the job site by the contractor or any subcontractor has not been paid prevailing wages or overtime, the contracting agency may, by written notice to the contractor, terminate the contractor's or subcontractor's right to proceed with the work or with the part of the work in which the required wages or overtime compensation have not been paid. The contracting agency may complete this work by contract or otherwise, and the contractor or contractor's sureties shall be liable to the contracting agency for any excess costs incurred. [§104-4, HRS]

Apprentices

- Apprentice wage rates apply to contractors who are a party to a bona fide apprenticeship program which has been registered with the DLIR. In order to be paid apprentice rates, apprentices must be parties to an agreement either registered with or recognized as a USDOL nationally approved apprenticeship program by the DLIR, Workforce Development Division, (808) 586-8877, and the apprentice must be individually registered by name with the DLIR. [§12-22-6(1) and (2), HAR]

- The number of apprentices on any public work in relation to the number of journeyworkers in the same craft classification as the apprentices employed by the same employer on the same public work may not exceed the ratio allowed under the apprenticeship standards registered with or recognized by the DLIR. A registered or recognized apprentice receiving the journeyworker rate will not be considered a journeyworker for the purpose of meeting the ratio requirement. [§12-22-6(3), HAR]

Enforcement

- To ensure compliance with the law, DLIR and the contracting agency will conduct investigations of contractors and subcontractors. If a contractor or subcontractor violates the law, the penalties are: [§104-24, HRS]

  - First Violation — Equal to 25% of back wages found due or $250 per offense up to $2,500, whichever is greater.
  - Second Violation — Equal to amount of back wages found due or $500 for each offense up to $5,000, whichever is greater.
  - Third Violation — Equal to two times the amount of back wages found due or $1,000 for each offense up to $10,000, whichever is greater; and
    Suspension from doing any new work on any public work of a governmental contracting agency for three years.

  - A violation would be deemed a second violation if it occurs within two years of the **first notification of violation**, and a third violation if it occurs within three years of **the second notification of violation**. [§104-24, HRS; §12-22-25(b), HAR]

  - **Suspension**: For a first or second violation, the department shall immediately suspend a contractor who fails to pay wages or penalties until all wages and penalties are paid in full. For a third violation, the department shall penalize and suspend the contractor as described above, **except that if the contractor continues to violate the law, then the department shall immediately suspend the contractor for a mandatory three years. The contractor shall remain suspended until all wages and penalties are paid in full.** [§§104-24, 104-25, HRS]

- **Suspension**: Any contractor who fails to make payroll records accessible or provide requested information within 10 days, or fails to keep or falsifies any required record, shall be assessed a penalty including suspension as provided in Section 104-22(b) and 104-25(a)(3), HRS. [§104-3(c), HRS; §12-22-26, HAR]

- If any contractor interferes with or delays any investigation, the contracting agency shall withhold further payments until the delay has ceased. Interference or delay includes failure to provide requested records or information within ten days, failure to allow employees to be interviewed during working hours on the job, and falsification of payroll records. The department shall assess a penalty of $10,000 per project, and $1,000 per day thereafter, for interference or delay. [§104-22(b), HRS; §12-22-26, HAR]

- Failure by the contracting agency to include in the provisions of the contract or specifications the requirements of Chapter 104, HRS, relating to coverage and the payment of prevailing wages and overtime, is not a defense of the contractor or subcontractor for noncompliance with the requirements of this chapter. [§104-2(f), HRS]

For additional information, visit the department's website at *http://labor.hawaii.gov/wsd*
or contact any of the following DLIR offices:

Oahu (Wage Standards Division) .....(808) 586-8777
Hawaii Island.....(808) 974-6464
Maui and Kauai .....(808) 243-5322

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HARBORS DEVISION

PROPOSAL

PROPOSAL TO THE
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

PROJECT:	**HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD RELOCATION AT AUIKI STREET, OAHU, HAWAII**
PROJECT NO.:	**P10981**
COMPLETION TIME:	**All work for the project shall be completed within F I V E H U N D R E D F O R T Y (540) CALENDAR days from the date indicated in the Notice to Proceed (NTP) from the Department**
LIQUIDATED DAMAGES:	**FIVE THOUSAND AND NO/100 DOLLARS ($5,000)** for each and every calendar day which the Contractor has failed to complete the work or portions of the work on time.
PROJECT MANAGER:	Jonatthan Yee Department of Transportation Harbors 79 S Nimitz Hwy. Honolulu HI 96813 (808) 587-1956
ELECTRONIC SUBMITTAL:	**Bidders shall submit and upload the complete proposal to HIePRO prior to the bid opening date and time. Any additional support documents explicitly designated as confidential and/or proprietary shall be uploaded as a separate file to HIePRO. See SPECIAL PROVISIONS 2.8 PREPARATION AND DELIVERY OF BID for complete details. FAILURE TO UPLOAD THE COMPLETE PROPOSAL TO HIePRO SHALL BE GROUNDS FOR REJECTION OF THE BID.**

Director of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Sir:

The undersigned Bidder declares the following:

1. It has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this proposal.

2. It has not been assisted or represented on this matter by any individual who has, in a State capacity, been involved in the subject matter of this contract within the past two years.

3. It has not and will not, either directly or indirectly offered or given a gratuity (i.e. an entertainment or gift) to any State or County employee to obtain a contract or favorable treatment under a contract.

The undersigned Bidder further agrees to the following:

1. If this proposal is accepted, it shall execute a contract with the Department to provide all necessary labor, machinery, tools, equipment, apparatus and any other means of construction, to do all the work and to furnish all the materials specified in the contract in the manner and within the time therein prescribed in the contract, and that it shall accept in full payment therefore the sum of the unit and/or lump sum prices as set forth in the attached proposal schedule for the actual quantities of work performed and materials furnished and furnish satisfactory security in accordance with Section 103D-324, Hawaii Revised Statutes, within 10 days after the award of the contract or within such time as the Director of Transportation may allow after the undersigned has received the contract documents for execution, and is fully aware that non-compliance with the aforementioned terms will result in the forfeiture of the full amount of the bid guarantee required under Section 103D-323, Hawaii Revised Statutes.

2. That the quantities given in the attached proposal schedule are approximate only and are intended principally to serve as a guide in determining and comparing the bids.

3. That the Department does not either expressly or by implication, agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work, or to omit portions of the work, as may be deemed necessary or advisable by the Director of Transportation, and that all increased or decreased quantities of work shall be performed at the unit prices set forth in the attached proposal schedule except as provided for in the specifications.

4. In case of a discrepancy between unit prices and the totals in said Proposal Schedule, the unit prices shall prevail.

5. Agrees to begin work within 10 working days after the date of notification to commence with the work, which date is in the notice to proceed, and shall finish the entire project within the time prescribed.

6. The Director of Transportation reserves the right to reject any or all bids and to waive any defects when in the Director's opinion such rejections or waiver will be for the best interest of the public.

7. The undersigned Bidder further agrees to the following: Pursuant to HRS §103D-405(d), any contractor (including consultants) paid for services to develop or prepare specifications or work statements shall be precluded from submitting an offer or receiving a contract for that particular solicitation. This includes the preparation of reports relied upon by HDOT in the development of the project scope.

The Bidder acknowledges receipt of and certifies that it has completely examined the following listed items: the Hawaii Department of Transportation, Air and Water Transportation Facilities Division General Provisions for Construction Projects dated 2016, the Notice to Bidders, the Special Provisions, if any, the Technical Provisions, the Proposal, the Contract and Bond Forms, and the Project Plans.

In accordance with Section 103D-323, Hawaii Revised Statutes, this proposal is accompanied with a bid security in the amount of 5% of the total amount bid, in the form checked below. (Check applicable bid security submitted with bid.)

_____ Surety Bid Bond (Use standard form),

_____ Cash,

_____ Cashier's Check,

_____ Certified Check, or

_____ _____.
(Fill in other acceptable security.)

The undersigned Bidder acknowledges receipt of any addendum issued by the Department by recording in the space below the date of receipt.

Addendum No. 1 _____ Addendum No. 3 _____

Addendum No. 2 _____ Addendum No. 4 _____

In accordance with Section 103D-302, Hawaii Revised Statutes, the undersigned as Bidder, has listed the name of each person or firm, who will be engaged by the Bidder on the project as a Subcontractor or Joint Contractor and the nature of work to be done by each. **The Bidder must adequately and unambiguously disclose the unique nature and scope of the work to be performed by each Subcontractor or Joint Contractor.** For each listed firm, the Bidder declares the respective firm is a Subcontractor or Joint Contractor and is subject to evaluation as a Subcontractor or Joint Contractor. It is understood that failure to comply with the aforementioned requirements may be cause for rejection of the bid submitted.

Name of Subcontractor	Nature and Scope of Work
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

Name of Joint Contractor	Nature and Scope of Work
1.	
2.	
3.	

NOTES:

"None" or if left blank indicates no Subcontractor or Joint Contractor.

If more space is needed, attach additional sheets.

The undersigned hereby certifies that the bid prices contained in the attached proposal schedule have been carefully checked and are submitted as correct and final.

This declaration is made with the understanding that the undersigned is subject to the penalty of perjury under the laws of the United States and is in violation of the Hawaii Penal Code, Section 710-1063, unsworn falsification to authorities, of the Hawaii Revised Statutes, for knowingly rendering a false declaration.

_____
Bidder (Company Name)

By_____
Authorized Signature

_____
Print Name and Title

_____

_____
Business Address

_____
Business Telephone

_____
Date

_____
Contact Person (If different from above)

Phone:_____ Email:_____

NOTE:

If Bidder is a CORPORATION, the legal name of the corporation shall be set forth above, the corporate seal affixed, together with the signature(s) of the officer(s) authorized to sign contracts for the corporation. Please attach to this page current (not more than six months old) evidence of the authority of the officer(s) to sign for the corporation.

If Bidder is a PARTNERSHIP, the true name of the partnership shall be set forth above, with the signature(s) of the general partner(s). Please attach to this page current (not more than six months old) evidence of the authority of the partner authorized to sign for the partnership.

If Bidder is an INDIVIDUAL, the bidder's signature shall be placed above.

If signature is by an agent, other than an officer of a corporation or a partner of a partnership, a POWER OF ATTORNEY must be on file with the Department before opening bids or submitted with the bid. Otherwise, the Department may reject the bid as irregular and unauthorized.

PREFERENCES

Bidders acknowledge that while preferences are considered in the evaluation of bids, the award of the contract will be in the amount of the bid offered exclusive of any preferences.

A. HAWAII BIDDER PREFERENCE

In accordance with HRS §103D-302, the Hawaii bidder preference is applicable to this solicitation for evaluation purposes only. Bidders desiring to qualify for the five per cent (5%) preference shall submit with their bid a completed *Hawaii Bidder/Offeror Preference Certification Form* (Form SPO-081) at or before the time set for receipt of bids. Certifications submitted for previous or other solicitations will not be accepted.

( ) Yes, the Bidder elects to receive the Hawaii Bidder Preference and has included the Form SPO-081 with the bid.

B. APPRENTICESHIP AGREEMENT PREFERENCE

In accordance with HRS §103-55.6, the estimated value of this public works contract is $250,000 or more and the apprenticeship agreement preference is applicable to this solicitation for evaluation purposes only. Bidders desiring to qualify for the five per cent (5%) preference shall submit with their bid a complete, valid CERTIFICATION OF BIDDER'S PARTICIPATION IN APPROVED APPRENTICESHIP PROGRAM UNDER ACT 17 (Certification Form 1) ***for each apprenticeable trade*** the Bidder will employ on the project.

( ) Yes, the Bidder elects to receive the Apprenticeship Agreement Preference and has attached Certification Form(s) 1 for each apprenticeable trade the Bidder will employ for this project (excluding subcontractors).

By submission of this offer, the Bidder certifies that it has indicated **all apprenticeable trades that Bidder will employ** for this project (excluding subcontractors) by listing the applicable trades below:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

(Attach additional sheet if necessary.)

Form 1 Required. Failure to submit a valid Form 1 with the bid for every apprenticeable trade that Bidder will employ on the project will result in the preference being denied, regardless of whether the trade is listed above. If a Form 1 is submitted for a trade that is not listed above, the Form 1 will take

precedence over the listing and may be used to qualify Bidder for the preference.

Form 2 Required. If awarded the contract with the Apprenticeship Agreement Preference applied, then for the duration of the contract, the Bidder **shall** certify each month that work is being conducted on the project that the Contractor continues to be a participant in the relevant apprenticeship program for each trade it employs. Monthly certification shall be made on the Certification Form 2 and submitted to the HDOT.

Failure to comply with the requirements of the Apprenticeship Agreement Preference program will subject the Contractor to sanctions pursuant to HRS §103-55.6.

C. HAWAII PRODUCTS PREFERENCE

Hawaii Products Preference shall not apply to this solicitation.

D. RECYCLED PRODUCT PREFERENCE

Recycled Product Preference shall not apply to this solicitation.

STATE OF HAWAII
Hawaii Bidder/Offeror
Preference Certification Form
(As Defined in HRS103D-1001)

I, _____, _____ of
(Authorized Officer's Name) (Office or Position Held)

_____, certify the following:
(Name of Bidder/Offeror)

(1) That the Bidder/Offeror holds a valid commercial place of business located in the State of Hawaii at the following address:

_____

_____,

and that the above-named office was opened on the following date: _____,

and has been staffed by the Bidder/Offeror or an employee of the Bidder/Offeror for not less than two (2) consecutive years immediately preceding the time and date set for the opening of bids or receipt of proposals;

(2) That the bid or proposal in response to IFB/RFP No. _____, is submitted under the name under which the Bidder/Offeror is authorized to do business in the State;

(3) That not less than fifty-one percent (51%) of the total direct labor hours required for performance of the contract will be performed within the State; and

(4) If the Bidder/Offeror is a joint venture, the Bidder/Offeror is composed entirely of parties meeting the requirements of paragraphs (1), (2), and (3).

I certify under penalty of perjury that the above statements are true. I agree to maintain the above qualifications throughout contract performance; any changes in eligibility shall be reported to the Contract Administrator or purchasing agency's contact person identified in the RFP/IFB. I acknowledge that failure to maintain the above qualifications triggers a price adjustment equal to the value of the preference applied and may constitute cause for debarment under HRS §103D-702.

_____
Signature of Authorized Officer

_____
Print Name and Title

_____
Date

PROPOSAL SCHEDULE - PART I

HONOLULU HARBOR, NEW OAHU DISTRICT BASEYARD
RELOCATION AT AUIKI STREET, HONOLULU HARBOR, OAHU, HAWAII
JOB P10981

Item No.	Description	Approx. Quantity	Unit	Unit Price	Amount
1	Additional security services	ALLOW	ALLOW	ALLOW	$160,000.00
2	Mobilization and demobilization as described in Article XIII (not to exceed 6% of the sum of all items excluding the bid price of this item)	LS	LS	LS	$_____
3	Demolition, removal, handling and disposal of items as described on the plans and technical provisions, inclusive of coordination with utility owners, environmental protection, and compliance with Federal, State, and County hauling and disposal regulations; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work in place	L.S.	L.S.	L.S.	$_____
4	Excavation and Embankment for site grading, inclusive of backfill, hauling, removal and relocation of materials, equipment, tools, labor, materials, and incidentals	L.S.	L.S.	L.S.	$_____
5	Portland – Cement Concrete Pavement	LS	LS	LS	$_____
6	Water System	LS	LS	LS	$_____
7	Sewer System	LS	LS	LS	$_____
8	Drainage System	LS	LS	LS	$_____
9	Chain Link Fence and Vehicle Gate and Pedestrian Gate	LS	LS	LS	$_____
10	Archaeological Monitoring	ALLOW	ALLOW	ALLOW	$50,000.00
11	Furniture, Fixture, & Equipment (FF&E)	LS	LS	LS	$_____
12	Hazardous Soil Material Soil Disposal	ALLOW	ALLOW	ALLOW	$1,000,00.00

TOTAL AMOUNT FOR COMPARISON OF BIDS **$_____**

Notes:

1. Bids shall include all Federal, State, County and other applicable taxes and fees.
2. The TOTAL AMOUNT FOR COMPARISON OF BIDS shall be used to determine the lowest responsible bidder.
3. Bidders shall complete all unit prices and amounts. Failure to do so shall be grounds for rejection of bid.
4. If a discrepancy occurs between unit bid price and the bid price, the unit bid price shall govern.
5. **Bidders shall submit and upload the complete proposal to HIePRO prior to the bid opening date and time. Proposals received after said due date and time shall not be considered. Any additional support documents explicitly designated as confidential and/or proprietary shall be uploaded as a separate file to HIePRO. Bidders shall not include confidential and/or proprietary documents with the proposal. The record of each bidder and respective bid shall be open to public inspection.** Original (wet ink, hard copy) proposal documents are not required to be submitted. **Contract award shall be based on evaluation of proposals submitted and uploaded to HIePRO.**

   FAILURE TO UPLOAD THE COMPLETE PROPOSAL TO HIePRO SHALL BE GROUNDS FOR REJECTION OF THE BID.

   If there is a conflict between the specification document and the HIePRO solicitation, the specifications shall govern and control, unless otherwise specified.
6. The TOTAL AMOUNT FOR COMPARISON OF BIDS herein shall include all labor, materials, equipment, and incidentals necessary to construct all items, complete in place, all in accordance with the plans and specifications.
7. Submission of a Proposal is a warranty that the bidder has made anexamination of the project site and is fully aware of all conditions to be encountered in performing the work and the requirements of the plans and specifications.
8. The bidder's attention is directed to Section 2.11 – BID SECURITY of the "General Provisions", as amended by the Special Provisions.
9. If the lowest TOTAL AMOUNT FOR COMPARISON OF BIDS is less than, or approximately equal to the funds available for this project, an award will be made to the lowest responsible bidder.
10. If the lowest TOTAL AMOUNT FOR COMPARISON OF BIDS exceeds the funds available for this project, the State reserves the right to negotiate with the lowest responsible bidder as permitted under Section 103D-302, Hawaii Revised Statutes, as amended, to reduce the scope of work and award a contract.

SURETY BID BOND

Bond No. _____

KNOW TO ALL BY THESE PRESENTS:

That we, _____
(full name or legal title of offeror)
as Offeror, hereinafter called the Principal, and

_____
(name of bonding company)
as Surety, hereinafter called Surety, a corporation authorized to transact business as a Surety in the State of Hawaii, are held and firmly bound unto

_____
(State/county entity)
as Owner, hereinafter called Owner, in the penal sum of

_____
(required amount of bid security)
Dollars($_____),lawful money of the United States of America, for the payment of which sum well and truly to be made, the said Principal and the said Surety bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS:

The Principal has submitted an offer for

_____
(project by number and brief description)

NOW, THEREFORE:

The condition of this obligation is such that if the Owner shall reject said offer, or in the alternate, accept the offer of the Principal and the Principal shall enter into a contract with the Owner in accordance with the terms of such offer, and give such bond or bonds as may be specified in the solicitation or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof as specified in the solicitation then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed this _____ day of _____, _____

_____
Name of Principal (Offeror) (Seal)

_____
Signature

_____
Print Name and Title

_____
Name of Surety (Seal)

_____
Signature

_____
Print Name and Title

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HONOLULU, HAWAII

FORMS

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Performance Bond

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CONTRACT

THIS AGREEMENT, made this day of _____, by and between the STATE OF HAWAII, by its Director of Transportation, hereinafter referred to as "STATE", and «CONTRACTOR», «STATE_OF_INCORPORATON», whose business/post office address is «ADDRESS», hereinafter referred to as CONTRACTOR";

WITNESSETH: That for and in consideration of the payments hereinafter mentioned, the CONTRACTOR hereby covenants and agrees with the STATE to complete in place, furnish and pay for all labor and materials necessary for "«PROJECT_NAME_AND_NO»", or such a part thereof as shall be required by the STATE, the total amount of which labor, material and construction shall be computed at the unit and/or lump sum prices set forth in the attached proposal schedule and shall be the sum of «BASIC»----DOLLARS ($«BASIC_NUMERIC») as follows:

SAMPLE

TOTAL AMOUNT FOR COMPARISON OF BIDS……$«BASIC_NUMERIC»

which sum shall be provided from State funds, all in accordance with the specifications, the special provisions, if any, the notice to bidders, the instructions to bidders, the proposal and plans for «PROJECT_NO_ONLY», and any supplements thereto, on file in the office of the Director of Transportation. These documents, together with all alterations, amendments, and additions thereto and deductions therefrom, are attached hereto or incorporated herein by reference and made a part of this contract.

The CONTRACTOR hereby covenants and agrees to complete such construction within «WORKING_DAYS» from the date indicated in the Notice to Proceed from the State subject, however, to such extensions as may be provided for in writing under the specifications.

For and in consideration of the covenants, undertakings and agreements of the CONTRACTOR herein set forth and upon the full and faithful performance thereof by the CONTRACTOR, the STATE hereby agrees to pay the CONTRACTOR the sum of «BASIC»---DOLLARS ($«BASIC_NUMERIC») in lawful money, but not more than such part of the same as is actually earned according to the STATE's determination of the actual quantities of work performed and materials furnished by the CONTRACTOR at the unit or lump sum prices set forth in the attached proposal schedule. Such payment, including any extras, shall be made, subject to such additions or deductions hereto or hereafter made in the manner and at the time prescribed in the specifications and this contract.

An additional sum of «EXTRAS»-----DOLLARS ($«EXTRA_NUMERIC») is hereby provided for extra work.

SAMPLE

All words used herein in the singular shall extend to and include the plural. All words used in the plural shall extend to and include the singular. The use of any gender shall extend to and include all genders.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be duly executed the day and year first above written.

STATE OF HAWAII

_____
Director of Transportation

«CONTRACTOR» (Seal)

_____
Signature

_____
Print name

_____
Print Title

_____
Date

SAMPLE

PERFORMANCE BOND (SURETY)
(6/21/07)

KNOW TO ALL BY THESE PRESENTS:

That _____,
(Full Legal Name and Street Address of Contractor)

as Contractor, hereinafter called Principal, and _____

_____
(Name and Street Address of Bonding Company)

as Surety, hereinafter called Surety, a corporation(s) authorized to transact business as a surety in the State of Hawaii, are held and firmly bound unto the _____,
(State/County Entity)

its successors and assigns, hereinafter called Obligee, in the amount of _____

_____
DOLLARS ($_____), to which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above-bound Principal has signed a Contract with Obligee on _____, for the following project:_____
_____
_____
_____
_____
_____
hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE, the condition of this obligation is such that:

If the Principal shall promptly and faithfully perform, and fully complete the Contract in strict accordance with the terms of the Contract as said Contract may be modified or amended from time to time; then this obligation shall be void; otherwise to remain in full force and effect.

Surety to this Bond hereby stipulates and agrees that no changes, extensions of time, alterations, or additions to the terms of the Contract, including the work to be performed thereunder, and the specifications or drawings accompanying same, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such changes, extensions of time, alterations, or additions, and agrees that they shall become part of the Contract.

In the event of Default by the Principal, of the obligations under the Contract, then after written Notice of Default from the Obligee to the Surety and the Principal and subject to the limitation of the penal sum of this bond, Surety shall remedy the Default, or take over the work to be performed under the Contract and complete such work, or pay moneys to the Obligee in satisfaction of the surety's performance obligation on this bond.

Signed this _____ day of _____, _____.

(Seal) _____
Name of Principal (Contractor)

* _____
Signature

_____
Title

(Seal) _____
Name of Surety

* _____
Signature

_____
Title

*ALL SIGNATURES MUST BE ACKNOWLEDGED
BY A NOTARY PUBLIC

PERFORMANCE BOND

KNOW TO ALL BY THESE PRESENTS:

That we, _____
(full legal name and street address of Contractor)

as Contractor, hereinafter called Contractor, is held and firmly bound unto the

_____
(State/County entity)

its successors and assigns, as Obligee, hereinafter called Obligee, in the amount

_____DOLLARS $_____),
(Dollar amount of Contract)

lawful money of the United States of America, for the payment of which to the said Obligee, well and truly to be made, Contractor binds itself, its heir, executors, administrators, successors and assigns, firmly by these presents. Said amount is evidenced by:

☐ **Legal Tender;**

☐ **Share Certificate** unconditionally assigned to or made payable at sight to _____
Description:_____;

☐ **Certificate of Deposit**, No. _____, dated _____ issued by _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Cashier's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Teller's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Treasurer's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Official Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Certified Check** No. _____, dated _____ accepted by a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

WHEREAS:

The Contractor has by written agreement dated _____ entered into a contract with Obligee for the following Project:_____

_____

hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE,

The Condition of this obligation is such that, if Contractor shall promptly and faithfully perform the Contract in accordance with, in all respects, the stipulations, agreements, covenants and conditions of the Contract as it now exists or may be modified according to its terms, and shall deliver the Project to the Obligee, or to its successors or assigns, fully completed as in the Contract specified and free from all liens and claims and without further cost, expense or charge to the Obligee, its officers, agents, successors or assigns, free and harmless from all suits or actions of every nature and kind which may be brought for or on account of any injury or damage, direct or indirect, arising or growing out of the doing of said work or the repair or maintenance thereof or the manner of doing the same or the neglect of the Contractor or its agents or servants or the improper performance of the Contract by the Contractor or its agents or servants or from any other cause, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

AND IT IS HEREBY STIPULATED AND AGREED that suit on this bond may be brought before a court of competent jurisdiction without a jury, and that the sum or sums specified in the said Contract as liquidated damages, if any, shall be forfeited to the Obligee, its successors or assigns, in the event of a breach of any, or all, or any part of, covenants, agreements, conditions, or stipulations contained in the Contract or in this bond in accordance with the terms thereof.

The amount of this bond may be reduced by and to the extent of any payment or payments made in good faith hereunder.

Signed and sealed this _____ day of _____, _____.

(Seal)_____
Name of Contractor

_____
Signature*

_____
Title

*ALL SIGNATURES MUST BE ACKNOWLEDGED
BY A NOTARY PUBLIC

LABOR AND MATERIAL PAYMENT BOND (SURETY)
(6/21/07)

KNOW TO ALL BY THESE PRESENTS:

That _____,
(Full Legal Name and Street Address of Contractor)

as Contractor, hereinafter called Principal, and _____

_____,
(Name and Street Address of Bonding Company)
as Surety, hereinafter called Surety, a corporation(s) authorized to transact business as a surety in the State of Hawaii, are held and firmly bound unto the _____,
(State/County Entity)

its successors and assigns, hereinafter called Obligee, in the amount of _____

_____
_____ Dollars ($_____), to which payment Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above-bound Principal has signed Contract with the Obligee on _____ for the following project:_____
_____
_____
_____
_____
hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE, the condition of this obligation is such that if the Principal shall promptly make payment to any Claimant, as hereinafter defined, for all labor and materials supplied to the Principal for use in the performance of the Contract, then this obligation shall be void; otherwise to remain in full force and effect.

1. Surety to this Bond hereby stipulates and agrees that no changes, extensions of time, alterations, or additions to the terms of the Contract, including the work to be performed thereunder, and the specifications or drawings accompanying same, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such changes, extensions of time, alterations, or additions, and agrees that they shall become part of the Contract.

2. A "Claimant" shall be defined herein as any person who has furnished labor or materials to the Principal for the work provided in the Contract.

Every Claimant who has not been paid amounts due for labor and materials furnished for work provided in the Contract may institute an action against the Principal and its Surety on this bond at the time and in the manner prescribed in Section 103D-324, Hawaii Revised Statutes, and have the rights and claims adjudicated in the action, and judgment rendered thereon; subject to the Obligee's priority on this bond. If the full amount of the liability of the Surety on this bond is insufficient to pay the full amount of the claims, then after paying the full amount due the Obligee, the remainder shall be distributed pro rata among the claimants.

Signed this _____ day of _____, _____.

(Seal) _____
Name of Principal (Contractor)

* _____
Signature

_____
Title

(Seal) _____
Name of Surety

* _____
Signature

_____
Title

*ALL SIGNATURES MUST BE ACKNOWLEDGED
BY A NOTARY PUBLIC

LABOR AND MATERIAL PAYMENT BOND

KNOW TO ALL BY THESE PRESENTS:

That we, _____
(full legal name and street address of Contractor)

as Contractor, hereinafter called Contractor, is held and firmly bound unto _____
(State/County entity)

its successors and assigns, as Obligee, hereinafter called Obligee, in the amount

_____DOLLARS ($_____)
(Dollar amount of Contract)

lawful money of the United States of America, for the payment of which to the said Obligee, well and truly to be made, Contractor binds itself, its heir, executors, administrators, successors and assigns, firmly by these presents. Said amount is evidenced by:

☐ **Legal Tender;**

☐ **Share Certificate** unconditionally assigned to or made payable at sight to_____
Description:_____

☐ **Certificate of Deposit**, No. _____, dated _____ issued by _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Cashier's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Teller's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Treasurer's Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Official Check** No. _____, dated _____ drawn on _____ a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

☐ **Certified Check** No. _____, dated _____ accepted by a bank, savings institution or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration, payable at sight or unconditionally assigned to _____;

WHEREAS:

The Contractor has by written agreement dated _____ entered into a contract with Obligee for the following Project:_____

_____

hereinafter called Contract, which Contract is incorporated herein by reference and made a part hereof.

NOW THEREFORE,

The condition of this obligation is such that, if Contractor shall promptly and faithfully perform the Contract in accordance with, in all respects, the stipulations, agreements, covenants and conditions of the Contract as it now exists or may be modified according to its terms, free from all liens and claims and without further cost, expense or charge to the Obligee, its officers, agents, successors or assigns, free and harmless from all suits or actions of every nature and kind which may be brought for or on account of any injury or damage, direct or indirect, arising or growing out of the doing of said work or the repair or maintenance thereof or the manner of doing the same or the neglect of the Contractor or its agents or servants or the improper performance of the Contract by the Contractor or its agents or servants or from any other cause, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

AND IT IS HEREBY STIPULATED AND AGREED that suit on this bond may be brought before a court of competent jurisdiction without a jury, and that the sum or sums specified in the said Contract as liquidated damages, if any, shall be forfeited to the Obligee, its successors or assigns, in the event of a breach of any, or all, or any part of, covenants, agreements, conditions, or stipulations contained in the Contract or in this bond in accordance with the terms thereof.

AND IT IS HEREBY STIPULATED AND AGREED that this bond shall inure to the benefit of any and all persons entitled to file claims for labor performed or materials furnished in said work so as to give any and all such persons a right of action as contemplated by Sections 103D-324(d) and 103D-324(e), Hawaii Revised Statutes.

The amount of this bond may be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payments of mechanics' liens which may be filed of record against the Project, whether or not claim for the amount of such lien be presented under and against this bond..

Signed this _____ day of _____, _____.

(Seal)_____
Name of Contractor

_____
Signature*

_____
Title

ALL SIGNATURES MUST BE ACKNOWLEDGED BY A NOTARY PUBLIC

CHAPTER 104, HRS COMPLIANCE CERTIFICATE

The undersigned bidder does hereby certify to the following:

1. Individuals engaged in the performance of the contract on the job site shall be paid:

A. Not less than the wages that the director of labor and industrial relations shall have determined to be prevailing for corresponding classes of laborers and mechanics employed on public works projects; and

B. Overtime compensation at one and one-half times the basic hourly rate plus fringe benefits for hours worked on Saturday, Sunday, or a legal holiday of the State or in excess of eight hours on any other day.

2. All applicable laws of the federal and state governments relating to workers' compensation, unemployment compensation, payment of wages, and safety shall be fully complied with.

DATED at Honolulu, Hawaii, this _____ day of _____, 20___.

_____ «CONTRACTOR»
Name of Corporation, Partnership, or Individual

_____
Signature and Title of Signer

Notary Seal
NOTARY ACKNOWLEDGEMENT

Subscribed and sworn before me this
_____day of_____
Notary signature_____
Notary public, State of _____
My Commission Expires:_____

Notary Seal
NOTARY CERTIFICATION

Doc. Date: _____ #Pages: ____
Notary Name: _____ _____Circuit
Doc. Description: _____
_____
Notary signature_____
Date _____

PROVISIONS TO BE INCLUDED IN CONSTRUCTION PROCUREMENT SOLICITATIONS

1. Definitions for terms used in HRS Chapter 103B as amended by Act 192, SLH 2011:

   a. "Contract" means contracts for construction under 103D, HRS.

   b. "Contractor" has the same meaning as in Section 103D-104, HRS, provided that "contractor" includes a subcontractor where applicable.

   c. "Construction" has the same meaning as in Section 103D-104, HRS.

   d. "General Contractor" means any person having a construction contract with a governmental body.

   e. "Procurement Officer" has the same meaning as in Section 103D-104, HRS.

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

   g. "Shortage trade" means a construction trade in which there is a shortage of Hawai'i residents qualified to work in the trade as determined by the Department of Labor and Industrial Relations.

2. HRS Chapter 103B as amended by Act 192, SLH 2011–Employment of State Residents Requirements:

   a. A Contractor awarded a contract shall ensure that Hawai'i residents comprise not less than 80% of the workforce employed to perform the contract work on the project. The 80% requirement shall be determined by dividing the total number of hours worked on the contract by Hawai'i residents, by the total number of hours worked on the contract by all employees of the Contractor in the performance of the contract. The hours worked by any Subcontractor of the Contractor shall count towards the calculation for this section. The hours worked by employees within shortage trades, as determined by the Department of Labor and Industrial Relations (DLIR), shall not be included in the calculation for this section.

EXHIBIT 1

b. Prior to award of a contract, an Offeror/Bidder may withdraw an offer/bid without penalty if the Offeror/Bidder finds that it is unable to comply with HRS Chapter 103B as amended by Act 192, SLH 2011.

c. Prior to starting any construction work, the Contractor shall submit the subcontract dollar amount for each of its Subcontractors.

d. The requirements of this section shall apply to any subcontract of $50,000 or more in connection with the Contractor; that is, such Subcontractors must also ensure that Hawai'i residents comprise not less than 80% of the Subcontractor's workforce used to perform the subcontract.

e. The Contractor and any Subcontractor whose subcontract is $50,000 or more shall comply with the requirements of HRS Chapter 103B as amended by Act 192, SLH 2011.

1) Certification of compliance shall be made in writing under oath by an officer of the General Contractor and applicable Subcontractors and submitted with the final payment request.

2) The certification of compliance shall be made under oath by an officer of the company by completing a "Certification of Compliance for Employment of State Residents" form and executing the Certificate before a licensed notary public.

3) In addition to the certification of compliance as indicated above, the Contractor and Subcontractors shall maintain records such as certified payrolls for laborers and mechanics who performed work at the site and time sheets for all other employees who performed work on the project. These records shall include the names, addresses and number of hours worked on the project by all employees of the Contractor and Subcontractor who performed work on the project to validate compliance with HRS Chapter 103B as amended by Act 192, SLH 2011. The Contractor and Subcontractors shall retain these records and provide access to the State for a minimum period of four (4) years after the final payment, except that if any litigation, claim, negotiation, investigation, audit or other action involving the records has been started before the expiration of the four-year period, the Contractor and Subcontractors shall retain the records until completion of the action and resolution of all issues that arise from it, or until the end of the four-year period, whichever occurs later. Furthermore, it shall be the Contractor's responsibility to enforce compliance with this provision by any Subcontractor.

f. A General Contractor or applicable Subcontractor who fails to comply with this section shall be subject to any of the following sanctions:

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

2) Proceedings for debarment or suspension of the Contractor or Subcontractor under Hawai'i Revised Statues §103D-702.

3. Conflict with Federal Law: This section shall not apply if the application of this section is in conflict with any federal law, or if the application of this section will disqualify the State from receiving Federal funds or aid.

CERTIFICATION OF COMPLIANCE
FOR
EMPLOYMENT OF STATE RESIDENTS
HRS CHAPTER 103B, AS AMENDED BY ACT 192, SLH 2011

Project Title: _____

Agency Project No: _____

Contract No.: _____

As required by Hawai'i Revised Statutes Chapter103B, as amended by Act 192, Session Laws of Hawaii 2011–Employment of State Residents on Construction Procurement Contracts, I hereby certify under oath, that I am an officer of _____ and
(Name of Contractor or Subcontractor Company)
for the Project Contract indicated above, _____ was in
(Name of Contractor or Subcontractor Company)
compliance with HRS Chapter 103B, as amended by Act 192, SLH 2011, by employing a workforce of which not less than eighty percent are Hawai'i residents, as calculated according to the formula in the solicitation, to perform this Contract.

☐ I am an officer of the **Contractor** for this contract.

☐ I am an officer of a **Subcontractor** for this contract.

CORPORATE SEAL

_____
(Name of Company)

_____
(Signature)

_____
(Print Name)

_____
(Print Title)

Subscribed and sworn to me before this
____ day of _____, 2011.

_____
Notary Public, 1st Circuit, State of Hawai'i
My commission expires: _____

Doc. Date: _____ # of Pages_____ 1st Circuit
Notary Name: _____
Doc. Description: _____
_____
_____

_____
Notary Signature Date
NOTARY CERTIFICATION

EXHIBIT 2