

Silverdale Recycling and Garbage Facility (RAGF) Redevelopment Contract Documents – Issue for Bid

Prepared for
Kitsap County



September 2025

ParametriX

Silverdale Recycling and Garbage Facility (RAGF) Redevelopment Contract Documents – Issue for Bid

Prepared for

Kitsap County
614 Division Street
MS 34, Room 202
Port Orchard, WA 98366

Prepared by

Parametrix
1019 39th Avenue SE, Suite 100
Puyallup, WA 98374
T. 253.604.6600 F. 1.206.649.6353
www.parametrix.com

September 2025

Parametrix No. 553-1578-155

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.



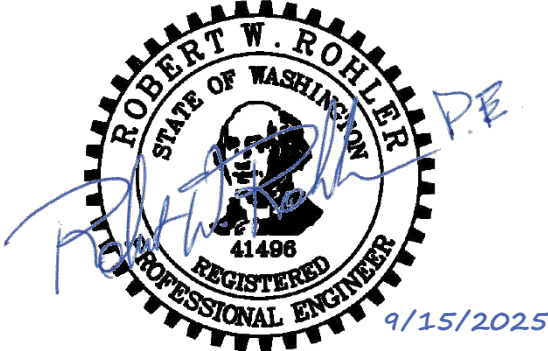
9/12/2025

Prepared by Karl R. Hufnagel, PE
(Division 00, Division 01, Section 02 41 00,
02 82 33, 02 83 33, Sections 10 14 10 and
10 74 00, Division 31, Sections 32 12 00,
32 16 00, 32 17 00, 32 31 00, and 34 71 13)



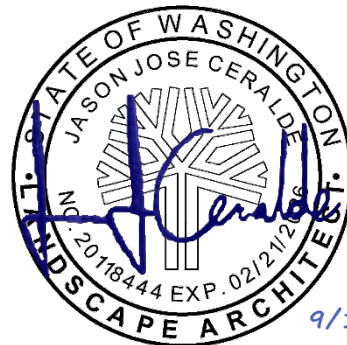
9/12/2025

Prepared by Jacob Watson Linke, PE
(Division 13)



9/15/2025

Prepared by Robert Rohler, PE
(Divisions 26, 28, and 40)



9/12/2025

Prepared by Jason Ceralde, PLA
(Sections 32 80 00, 32 91 00, 32 91 10,
32 92 00 and 32 93 00, 32 93 10)



9/12/2025

Prepared by Michael Dang, PE
(Sections 33 10 00, 33 12 20, 33 30 00,
33 31 12, and)

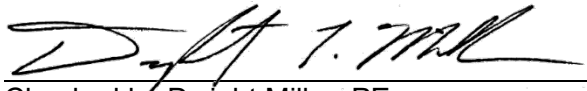


10/24/2025

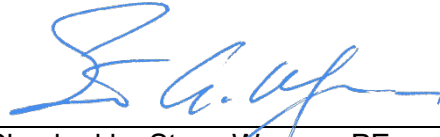
Prepared by Larry N. Storset, PE
(Divisions 22 and 23)

CERTIFICATION (CONTINUED)

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Checked by Dwight Miller, PE
(Division 00, Division 01, Section 02 41 00,
02 82 33, 02 83 33, Sections 10 14 10 and
10 74 00, Division 31, Sections 32 12 00,
32 16 00, 32 17 00, 32 31 00, and 34 71 13)



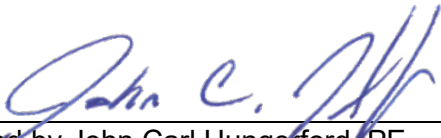
Checked by Steve Wagner, PE
(Division 13)



Checked by Connor Whitman, PE
(Divisions 26, 28, and 40)



Checked by Jens Swenson, PLA
(Sections 32 80 00, 32 91 00, 32 91 10,
32 92 00 and 32 93 00, 32 93 10)



Checked by John Carl Hungerford, PE
(Sections 33 10 00, 33 12 20, 33 30 00,
33 31 12, and 33 31 13)



Checked by Joel Linke, PE
(Division 22 and 23)



Approved by Daniel Moore, PE

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Prepared by Gary Scott, Associate Principal
(CSI Sections 02 41 19, 03 10 00, 03 20 00,
05 40 00, 05 52 13, 06 10 00, 06 16 00,
06 16 13, 06 20 23, 06 83 16, 07 11 13,
07 13 26, 07 18 00, 07 21 00, 07 27 27,
07 40 00, 07 41 13, 07 42 13, 07 62 00,
07 71 23, 07 72 00, 07 92 00, 08 11 13,
08 31 13, 08 33 23, 08 41 13, 08 51 13,
08 56 80, 08 71 00, 08 80 00, 08 90 00,
09 22 16, 09 29 00, 09 51 13, 09 65 13,
09 91 13, 09 91 23, 09 96 00, 10 14 00,
10 26 00, 10 28 00, 10 44 13, 10 44 16,
10 51 13, 12 24 13, 12 32 00, 32 39 13)



9/19/2025

Checked by Alex Rolluda, President
(CSI Sections 02 41 19, 03 10 00, 03 20 00,
05 40 00, 05 52 13, 06 10 00, 06 16 00,
06 16 13, 06 20 23, 06 83 16, 07 11 13,
07 13 26, 07 18 00, 07 21 00, 07 27 27,
07 40 00, 07 41 13, 07 42 13, 07 62 00,
07 71 23, 07 72 00, 07 92 00, 08 11 13,
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08 56 80, 08 71 00, 08 80 00, 08 90 00,
09 22 16, 09 29 00, 09 51 13, 09 65 13,
09 91 13, 09 91 23, 09 96 00, 10 14 00,
10 26 00, 10 28 00, 10 44 13, 10 44 16,
10 51 13, 12 24 13, 12 32 00, 32 39 13)

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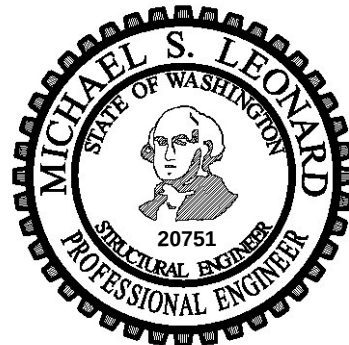
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Prepared by Serena Baxter
Sections 03 30 00, 05 15 00, 05 31 00,
05 40 00, 05 50 00, 05 50 20



Checked by Michael Leonard
Sections 03 30 00, 05 15 00, 05 31 00,
05 40 00, 05 50 00, 05 50 20.



Sept. 19, 2025

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September 24, 2025

Prepared by Matthew Fontaine, PE
Divisions 33 40 00



September 24, 2025

Checked by Colleen Mitchell, PE
Divisions 33 40 00

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END OF SECTION

Division 01

General Requirements

SECTION 01 11 00
SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
1. Definitions.
 2. Project description.
 3. Work by Owner and others.
 4. Progress of the Work.
 5. Work Phases and Milestones.
 6. Notices to Proceed.
 7. Milestones and Liquidated Damages.
 8. Warranty.
 9. Contract Documents and Available Information.
 10. Geotechnical Information.
 11. Coordination with Owner's Concurrent Operations.
 12. Project utility sources.

1.02 DEFINITIONS

- A. Throughout these Specifications certain terms are capitalized. Capitalized terms have the definitions assigned to them in the Specifications. Definitions of terms will be found throughout these Specifications. There is no one central location for the defined terms.
- B. A/E Representative: Owner's Technical Representative having roles and responsibilities as identified in the Owner's Construction Management Plan (Available Information). In general, the A/E Representative is responsible for development of design documents, interpretation of design intent, and for responding to all requests for information (RFI) and reviewing submittals.
- C. Construction Manager (CM): Owner's Technical Representative having roles and responsibilities as identified in the Owner's Construction Management Plan (Available Information). In general, the Construction Manager is responsible for monitoring and inspecting (including but not limited to quality assurance) the progress of the construction

work to verify that it conforms with the requirements of the Contract Documents. Additionally, the CM will assist in administering the elements of the Contract, including processing of progress payments and Change Orders, with the Project Representative and Contractor.

- D. Project Representative: Owner designee representing the Project as defined in the general terms and conditions of the Contract.
- E. Project: Has the meaning defined in the general terms and conditions of the Contract.
- F. Project Site: Has the meaning defined in the general terms and conditions of the Contract.

1.03 PROJECT DESCRIPTION

A. General:

1. The descriptions in this section are not intended to provide or be construed as a complete summary of the Contract Documents. The following only identifies in broad terms the general nature of the Work to be performed by the Contractor and its subcontractors.
2. Contractor shall perform and complete all Work in accordance with the requirements set forth in the Contract Documents.
 - a. This section is not suitable for use in determining measurement and payment.
3. This section should be read as if “Provide and Install” were included at the front of each sentence.
 - a. Responsibility for the providing and the installing of every element is borne by the Contractor.
4. Construction requires phasing of work as further described in this section and elsewhere in the Contract Documents.
5. Documentation prepared by the Contractor for purposes of identifying the Contractor’s construction planning and administration activities, including but not limited to the work plan documents indicated in this section.
6. Temporary facilities including but not limited to temporary utilities, office trailers, supplies, and items in accordance with requirements of Section 01 50 00, “Temporary Facilities and Controls.”
7. Permanent and temporary fencing, signage, and other means of protecting the public from hazards of the Project Site.
8. Traffic management, flagging (except where Owner-furnished flagging is specified), and control in accordance with the Contractor’s Traffic Control Plan.
9. Field survey, construction layout, staking and verification of utilities, datum verification, construction placement and completed Work verification survey.

10. Demolition/deconstruction, handling, processing, sorting, loading, removal, and disposal of existing permanent and impermanent structures, utilities, and roadways.
 11. Erosion and sedimentation control, including but not limited to any and all: hauling of Wastewater, street sweeping, piping, culverts, construction fence, jute mats, compost socks, geotextile, hydroseeding, seeding, flow spreaders, sheet plastic, sandbags, quarry spalls, rip rap, straw bales, stakes, silt fences, and catch basin protection.
 12. Management of Construction Runoff, Clean Surface Water runoff and Contaminated Surface and Ground Water and Contaminated Sediment, including but not limited to any and all: temporary storage of runoff in portable tanks; pumps; removal of sediment, including chemical flocculation if necessary to meet discharge permit limits; loading; tanker truck hauling of Contaminated Surface and Ground Water as Wastewater and, disposal at designated sanitary sewer locations off the Project Site; operation of the surface water detention and treatment system for Clean Surface Water and discharge to the surface water outfall system.
 13. Environmental controls, including dust, contaminated surface water runoff and construction dewatering, pest, street sweeping and cleaning, and noise control during construction.
 14. Protection of moisture-sensitive soils.
 15. Verification surveying of the completed work to confirm that all aspects of the Work have been completed to the elevations, lines, and grades indicated in the Drawings.
- B. Contractor's Planning and Training Responsibilities: The Contractor is responsible for planning prior to Milestone 2 (see below) for the transition from construction to Owner operation of the Milestone 2 facilities, including coordination of training for Owner's staff for the building systems and operational equipment.
- C. The principal items or elements of construction include but are not limited to:
1. Attendant building.
 2. Limited household hazardous waste (LLHW) building (optional bid item).
 3. New refuse shed building A.
 4. Rehabilitate refuse shed buildings B, C, D (optional bid item).
 5. Operator warming station.
 6. Storage building.
 7. Site work including grading, paving, guardrails, lighting, and site utilities.
 8. Sanitary sewer, electrical power, communications, and water utility connections.
 9. Frontage roadway, walkway, retaining wall, and drainage improvements including utility roadway restoration.
 10. Site retaining walls and railings.

1.04 WORK BY OWNER AND OTHERS

A. Permits:

1. The Owner obtains the permits identified in Section 01 41 00, "Regulatory Requirements," as Owner-furnished.
2. The Contractor is responsible to obtain and pay for the permits identified in Section 01 41 00, "Regulatory Requirements," as Contractor-furnished.

B. Owner's Testing and Inspection Services:

1. The Owner contracts with the testing and inspection agencies and/or uses in-house testing services for performing quality assurance services on the Project Site.
2. The Owner's testing and inspection agencies provide services for the Owner exclusively, except as indicated in this section and in Section 01 43 00, "Quality Assurance and Control."

3. Contractor Responsibilities:

- a. The Contractor is required to perform its own quality control program, including testing, inspection, and special inspections, as necessary to accommodate the Contractor's activities including source quality control testing as specified in Section 01 43 00, "Quality Assurance and Control," at no additional cost to the Owner.
 - 1) The Contractor is prohibited from employing the same testing and inspection agency or agencies employed by the Owner.
- b. The Contractor shall pay for testing of Work that is subject to corrective action or that was otherwise untested, not observed, or other problem attributable to the Contractor's performance of the Work.
- c. The Contractor shall pay for additional testing above and beyond that required by the Contract Documents to facilitate its means and methods.

C. Puget Sound Energy (PSE) Work:

1. PSE and/or their construction representative Potelco will perform the following work:
 - a. Providing a new electrical service entrance to the equipment rack south of the Attendant Building.
 - b. Providing transformer(s) at the PSE power pole (at Dickey Rd NW).
 - c. Providing service conductor connectors where the service line interconnects with PSE's equipment.

2. PSE will furnish, install, and maintain the following:
 - a. Revenue meter.
 - b. Current transformers (CT).
 - c. CT Meter wiring.
3. PSE will disconnect the existing electrical service entrance to existing Attendant Building.
4. PSE will disconnect the existing service conductor connectors at existing transformer.
5. PSE will remove existing meter from existing meter base at existing Attendant Building.

D. Communications and Data Service Work:

1. Lumen (Century Link) and Kitsap Public Utility District (KPUD) will install service entrance cables in conduits provided by the Contractor. Lumen and KPUD will terminate service entrance cables in the Server Room (Room 104) in the Attendant Building.

E. The Owner will supply and install security system cameras at locations shown on the Drawings.

F. Other Construction Work:

1. No other construction work by Owner or others is anticipated to occur on the Project Site concurrently with Contractor's Work, other than possible minor repairs and maintenance to Owner's facilities and equipment in the existing RAGF operating area.
2. Contractor shall provide reasonable access to other contractors who are performing such minor repair and maintenance.

1.05 WORK PHASES AND MILESTONES

- A. In order to accommodate the Owner's continued operations on the Project Site throughout the construction work, the Work is divided into Phases which begin with a Notice to Proceed and conclude with achievement of a Milestone.
- B. The following table summarizes the Phases of the Work, and their associated Notices to Proceed and Milestones which are then discussed in more detail below.

Table 1

PHASE NAME	DURATION (CALENDAR DAYS)	NOTICE TO PROCEED NUMBER	MILESTONE NUMBER
Preconstruction Phase	45	1	1
Phase 1	170	2	2
Transition Period	14	--	--
Phase 2	160	3	3
Total Contract Time	389	--	--

1.06 NOTICES TO PROCEED

- A. The Owner will provide written Notices to Proceed before commencement of work on each Phase of the Work.
- B. Notice to Proceed 1 – Preconstruction Phase, Milestone 1:
 - 1. Notice to Proceed 1 is planned to be issued within ten (10) calendar days after Contract Execution.
 - 2. The Owner's issuance of the Notice to Proceed 1 authorizes the Contractor to perform activities including work planning; scheduling; submittals; processing of submittals for and procurement of materials, products, and equipment for which submittals have been satisfactorily completed; and similar preparatory and administrative activities.
 - a. Prepare and submit the required Contractor work plans identified in the Contract Documents.
 - b. Prepare and submit other submittals including those indicated on the Submittal Schedule in Section 01 33 00, "Submittal Procedures," and as indicated elsewhere in the Contract Documents.
 - 3. Refer to the Submittal Schedule required under Section 01 33 00, "Submittal Procedures," for submittals which must be completed prior to the issuance of Notice to Proceed 2.
- C. Notice to Proceed 2 – Phase 1, Milestone 2:
 - 1. Notice to Proceed 2 will be issued when the required activities of the Preconstruction Phase are determined by the Project Representative to be Complete.
 - a. With respect to the Milestone 1 Phase, the word "Complete" means that all submittals identified in Section 01 33 00, "Submittal Procedures," as required Preconstruction submittals have been received, reviewed, resubmitted if necessary and determined to be acceptable by the Project Representative.
 - b. Receipt of a required submittal by the Project Representative does not constitute completion of the submittal.
 - 2. The Owner's issuance of Notice to Proceed 2 authorizes the Contractor to:
 - a. Take possession of the portions of the Project Site required for performance of Milestone 2 Work.
 - b. Proceed with prosecution of the Construction Work as follows.
 - 1) All Milestone 2 Phase Work in order to achieve Milestone 2 as defined below.
 - 3. Contractor is prohibited from performing any work other than that required to achieve Milestone 2.

D. Transition Period between Phase 2 and commencement of Phase 3:

1. A Transition Period is required between the completion of Phase 2 work and the issuance of Notice to Proceed for Phase 3 work to allow the Owner to relocate, startup and establish operations in the new Attendant Building and other Phase 1 facilities.
2. In addition to participating in pre-Transition Period planning and training, Contractor is required to assist the Owner with portions of its physical relocation to the new facilities.
3. Contractor shall plan in its Project Schedule a Transition Period of fourteen (14) days in duration. Any costs incurred by the Contractor associated with the Transition Period shall be included in Contract Price.
 - a. During the Transition Period, Contractor may not perform any Work associated with Phase 2 Phase except as identified below:
 - 1) Owner training for Phase 1 work facilities Substantially Completed.
 - 2) Preparation for Milestone 3 Phase Work.
4. If additional time is required for the Owner, with Contractor's assistance, to complete the Transition Period activities through no fault of the Contractor, appropriate adjustments in the Contract Time and Contract Price will be incorporated into the Contract by Change Order.

E. Notice to Proceed 3 – Phase 2 Milestone 3:

1. Notice to Proceed 3 will be issued when the Transition Period has been completed as determined by the Project Representative.
2. The Owner's issuance Notice to Proceed 3 authorizes the Contractor to:
 - a. Commence shared occupancy with Owner of the Phase 2 site area.
 - b. Proceed with prosecution of the remaining Construction Work (Milestone 3 Phase work).

1.07 MILESTONES AND LIQUIDATED DAMAGES

A. Preconstruction Phase:

1. All work specified to be completed in the Preconstruction Phase shall be completed no later than forty-five (45) calendar days after issuance of Notice to Proceed 1.
2. Liquidated Damages apply if the Contractor does not achieve Milestone 1 by the date specified in Notice to Proceed 1.
 - a. Refer to Section 01 20 00, "Payment Procedures," provisions.

B. Phase 1, Milestone 2:

1. All work specified and shown to be completed in Phase 1 shall be Substantially Complete no later than one hundred and seventy (170) calendar days after issuance of Notice to Proceed 2 in order to achieve a Certificate of Substantial Completion for Phase 1, Milestone 2.
2. Liquidated Damages apply if the Contractor does not achieve Milestone 2 by the date specified in Notice to Proceed 2.
 - a. Refer to Section 01 20 00, "Payment Procedures," provisions.

C. Phase 2, Milestone 3:

1. The remainder of the Construction Work not completed during Phase 1 shall be Substantially Complete no later than one hundred and sixty calendar days (160) days after issuance of Notice to Proceed 3 in order to achieve a Certificate of Substantial Completion for Phase 2, Milestone 3.
2. Liquidated Damages apply if the Contractor does not achieve Milestone 3 by the date specified in Notice to Proceed 3.
 - a. Refer to Section 01 20 00, "Payment Procedures," provisions.

D. Final Acceptance:

1. Final Acceptance is defined in Section 01 77 00, "Closeout Procedures."
2. Final Acceptance shall be achieved within forty-five (45) calendar days after issuance of the Certificate of Substantial Completion of Milestone 3.
3. No Liquidated Damages apply if the Contractor does not achieve Final Acceptance by the date specified in the Certificate of Substantial Completion of Milestone 3.
4. Final Acceptance requires, but is not limited to the following:
 - a. Transference of warranties from the Contractor to the Owner.
 - b. Completion of statutory retainage obligations.
 - c. Completion of construction record drawings.
 - d. Completion of all remaining obligations set forth in Section 01 77 00, "Closeout Procedures."

1.08 WARRANTY

- A. The Work shall be warranted in accordance with the general terms and conditions of the Contract.
- B. In addition, certain elements of the Work require extended warranties as defined within the technical sections in Divisions 2 through 40.
 - 1. Sample mandatory extended warranty documents are contained in Section 01 77 00, "Closeout Procedures."

1.09 CONTRACT DOCUMENTS AND AVAILABLE INFORMATION

- A. Refer to the general terms and conditions of the Contract.
 - 1. Documents designated "Available Information" provided by the Owner are not part of the Contract Documents. Available Information documents are provided by the Owner for the Contractor's information gathering and assessment activities.
 - a. Available Information is not warranted by any party.
 - b. Verify any information using the Contractor's own procedures, processes, and means.
 - c. Reliance on the Available Information for decision-making associated with the Project will be at the Contractor's risk.
- B. The following documents are designated Available Information:
 - 1. Updated Geotechnical Engineering Report, Silverdale Recycling and Garbage Facility, Aspect Consulting February 2, 2022.
 - 2. Critical Areas Report, Silverdale Recycling and Garbage Facility, Herrera Environmental Consultants, January 15, 2020, with updates.
 - 3. Hydrogeologic Report for the Silverdale Recycling and Garbage Facility, Parametrix, May 2022.
 - 4. Sound Levels Memorandum, The Greenbusch Group, January 28, 2022.
 - 5. Silverdale RAGF Traffic Study, Parametrix, May 8, 2020.
 - 6. Cultural Resources Assessment for the Silverdale Recycling and Garbage Facility, Aqua Terra Cultural Resource Consultants, April 11, 2022.
 - 7. Existing Silverdale RAGF Design Drawings.

C. Geotechnical Available Information:

1. Owner has referred to reports prepared by Aspect Consulting which are designated in Paragraph 1.09 B as Available Information documents.
2. The geotechnical information obtained from the reports is not part of these Contract Documents except the boring logs are specifically included in the Contract Documents; such information will be provided to the Proposers.
 - a. Boring logs for this Project are valid only as to the time and location of the investigation. Contractor shall proceed at its own risk for developing geotechnical interpretations beyond those parameters.
3. The geotechnical reports are not intended as Kitsap County's representations of geotechnical conditions, except for those conditions at the specific times and locations of the investigations.
4. Owner does not warrant and specifically disclaims responsibility for the interpretation by Contractor of such geotechnical information.
5. The Contractor may make its own interpretations, deductions, and conclusions as to the nature of the materials to be excavated, the difficulties of making and maintaining the required excavations and the difficulties of doing other work, such as pile placement, affected by geotechnical conditions, and shall accept full responsibility therefore.

1.10 COORDINATION WITH OWNER'S CONCURRENT OPERATIONS

- A. The Silverdale RAGF Station will remain open to receiving and transfer operations during the period from the Notice to Proceed through completion of all new construction.
- B. The Owner, with planning assistance from the Contractor, will transition operations from the existing RAGF facility arrangement to the new RAGF arrangement as the elements of the new facility are completed and available for Owner's use.
- C. Refer to the Drawings for traffic management details and requirements regarding the Owner's facility traffic including modifications to the existing road system to accommodate station customer and service contractor traffic and construction traffic.

1.11 PROJECT UTILITY SOURCES

- A. Water Service: Contractor shall arrange and pay for metered temporary water service. Contractor shall not connect to existing water system except as specifically approved by the Silverdale Water District and the Project Representative.
- B. Fire Protection Service: Contractor shall make provisions for fire protection for its operations utilizing the existing water system and portable firefighting equipment.
- C. Electrical Power: Contractor shall arrange and pay for temporary electrical service from Puget Sound Energy for its electrical power needs (including Owner office trailer), supplemented if necessary with standby engine generators. Meter and pay for all electrical power and fuel required.

- D. Telecommunications: Arrange and pay for telecommunications services as required in Section 01 50 00, "Temporary Facilities and Controls."
- E. Wastewater: Refer to Section 31 25 00, "Erosion and Sedimentation Controls," for Wastewater discharge locations.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 20 00
PAYMENT PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Schedule of Values.
 - 2. Liquidated Damages.
 - 3. Progress payments.
 - 4. Progress payment supporting materials.
 - 5. Resubmittal of progress payment applications.
 - 6. Conditions necessary for payment.

1.02 DEFINITIONS

- A. Schedule of Values:
 - 1. A breakdown of the Contract price approved by the County and used for the purpose of making monthly payments to the Contractor.

1.03 SCHEDULE OF VALUES

- A. Submit the Schedule of Values not later than 1 week following issuance of Notice to Proceed 1.
- B. Software: Microsoft Excel most recent edition; no other software will be permitted.
- C. Format:
 - 1. Develop a Schedule of Values format that is acceptable to the Project Representative, and that provides an effective tool for establishing monthly progress payment amounts.
 - 2. In general break down the work specified for each Lump Sum bid item using a differentiation of the work that parallels the divisions and sections contained in the project specifications and further divided among the project Work milestones.
 - 3. Allocate costs to the Schedule of Values items consistent with the scope of work associated with the line item.

- D. Prorate overhead and profit to the activities.
 - 1. Each item in the Schedule of Values, and Applications for Payment, are to be complete, including its proportional share of supervision, general overhead, and profit margin.
 - 2. Do not include state retail sales tax. Washington State Sales Tax (WSST) will be calculated by the Owner.
 - a. Except for that portion of the Work which is identified by Owner as Washington State Tax Rule 171 work.
- E. Round activity values to the nearest hundred dollars (\$100).
- F. Updates of the Schedule of Values:
 - 1. Provide coordinated Schedule of Values accompanying each Monthly Update Schedule, including approved Changes, for review and approval by the Project Representative.
 - 2. Show Change Orders as individual line items.
 - 3. Show the calculation to obtain the total, incorporating the authorized Change Order or Change Orders.
- G. On a monthly basis, coordinate the Schedule of Values with Monthly Update Schedules developed in accordance with Section 01 32 13, "Scheduling," including approved Changes.
 - 1. List each Change separately.
 - 2. Break down Changes into amounts, and items, which can be used effectively to evaluate current and subsequent Applications for Payment.

1.04 LIQUIDATED DAMAGES

- A. The Liquidated Damage amount set forth in this section will be assessed for Contractor's failure to achieve Substantial Completion of Preconstruction Phase, Milestone 1 by the date specified in the Contract.
- B. The Liquidated Damage amount set forth in this section will be assessed for Contractor's failure to achieve Substantial Completion of Phase 1, Milestone 2, by the date specified in the Contract.
- C. The Liquidated Damage amount set forth in this section will be assessed for Contractor's failure to achieve Substantial Completion of Phase 2, Milestone 3, by the date specified in the Contract.
- D. The Liquidated Damage reduction to the Contract Price for failure to reach Substantial Completion of Preconstruction Phase work is \$500 per calendar day, starting on the first calendar day after the contractual date established for Substantial Completion of this phase.
- E. The Liquidated Damage reduction to the Contract Price for failure to reach Substantial Completion of Phase 1 and Phase 2 work is \$1,000 per calendar day, starting on the first calendar day after the contractual dates established for Substantial Completion of these phases.

1.05 PROGRESS PAYMENTS

- A. The Owner shall make monthly progress payments for work performed by the Contractor. Progress payments will be based upon an agreed upon Schedule of Values, schedule of payments, critical milestones, and any agreed performance metrics. A breakdown of the Contract Amount shall be provided in enough detail to facilitate continued evaluation of applications for payment and progress reports.
 - B. The Contractor shall provide all labor, materials, tools, equipment, transportation, supplies, and incidentals required to complete all Work for the items included in the Proposal.
 - C. Items designated as Unit Price TN shall be measured and paid in accordance with the requirements of 2024 WSDOT Standard Specifications M 41-10.
 - D. Items designated as Lump Sum shall be complete payment for the Work required for that item of the Contract. Payment for all Lump Sum items shall include but not be limited to full payment for all labor, materials, supplies, equipment, tools, and all other things required to completely incorporate the items into the work in place as necessary to complete all architectural, structural, mechanical, plumbing, electrical, and other work as specified and as indicated on the Drawings. Contractor shall be responsible for coordinating all work among subcontractors as required to ensure the complete integration of building and site systems for complete and operational facility. Work included under Lump Sum for structures shall extend to the neat line, five feet from the extent of the footing.
 - E. Items designated as Minor Changes shall be paid per requirements of 1-04.4(1) of 2024 WSDOT Standard Specification M 41-10. A "Daily Record of Force Account Worked" signed by the Project Representative shall be required for payment.
 - F. Items designated as FA (Force Account) shall be paid per the requirements of 1-09.6 of 2024 WSDOT Standard Specifications M 41-10. A "Daily Record of Force Account Worked" signed by the Project Representative shall be required for payment.
1. Bid Item 33 – Trench Excavation Safety System Construction:
- a. Provide Trench, Excavation Safety System Construction in compliance with WAC 296-155 Part N, Excavation, Trenching and Shoring and RCW 49.17, Washington Industrial Safety and Health Act, for excavations associated with the Work. The cost of these safety systems shall not be considered incidental to any other Bid Item and any attempt to include the trench safety systems as an incidental cost is prohibited. The lump sum price shall be full compensation for all costs associated with the work covered under this bid item.
 - b. Bid Item 33 shall be Lump Sum and shall not be less than fifteen thousand dollars (\$15,000).

2. Rule 171 Work:

- a. Perform all work as specified or shown in the Contract Documents to construct road and road improvements within the right-of-way of Dickey Road NW. Do not include utility systems improvements that are for the benefit of the main project site.
- b. Lump sum and Unit Prices for Rule 171 Work shall be full compensation for all costs associated with the work covered under this cost item.

G. Submit Applications for Payment in accordance with the terms and conditions of the Contract.

H. Sign by authorized representative of the Contractor.

1.06 PROGRESS PAYMENT SUPPORTING MATERIALS

A. Provide in a consistent organization month to month.

B. Include the following types of information:

1. Percentage complete of cost-loaded items on the Baseline Schedule.
2. Current status of the Schedule of Values.
3. Hours worked and workforce identification, together with any staffing codes, and experience or pay grade levels.
4. Updated Monthly Cash Flow Projection.
5. Updated Monthly Production Reports.
6. Paid equipment lists and rental agreements.
7. Paid receipts.
8. Materials orders.
9. Work Purchased but not Installed:
 - a. Provide separate line items on the Application for Payment.
 - b. Identify the location, and disposition of materials, products, fabrications, and equipment as of the date of the Application for Payment.
 - c. Provide invoices.
 - d. Provide an insurance certificate or a copy of the bond from the bonded warehouse storing the material.
 - e. Provide photo documentation.
 - f. Identify exact material; include quantity and measurement unit.

1.07 RESUBMITTAL OF PROGRESS PAYMENT APPLICATIONS

- A. Should the Project Representative determine an Application for Payment is incomplete, improperly executed, or incorrect, it may be returned to the Contractor for resubmittal.
- B. Revise and resubmit in accordance with provisions of this section.
- C. Processing of the resubmittal will begin when required revisions have been submitted, and are deemed reviewable by the Project Representative.
- D. Comply with instructions provided by the Project Representative identifying required revisions.

1.08 CONDITIONS NECESSARY FOR PAYMENT

- A. Failure to comply with the requirements of this section will be cause for delay in review and acceptance of the Application for Payment as defined in the Contract.
- B. The Monthly Update Schedule identified in Section 01 32 13, "Scheduling," and is required to accompany Applications for Payment as a condition of receiving payment for Work accomplished each payment period.
- C. As-Built Drawings:
 - 1. Maintaining as-built drawings up to date.
- D. The following criteria must be met prior to Authorization for Payment of several specific activities:
 - 1. Mobilization:
 - a. For the purposes of this Contract, Mobilization shall mean the Contractor has received the Notice to Proceed, has established the Construction Office Trailers including utility hookups and all interior equipment and furnishings, has moved its primary construction equipment on site and is ready and able to proceed with construction operations. The maximum amount for Mobilization shall not exceed 2% of the Contract Price.
 - b. When 5% of the original Contract Price is earned, from Contract items, excluding amounts due or paid for Materials on Hand, 50% of the amount allowed for mobilization will be paid.
 - c. When ten 10% of the original Contract Price is earned, from Contract items, excluding amounts due or paid for Materials on Hand, 100% of the amount allowed for mobilization will be paid.
 - 2. Demobilization:
 - a. For the purposes of this Contract, demobilization shall mean the Contractor has received the Certificate of Substantial Completion for Milestone 4 Work, has removed the Construction Office Trailers including utility hookups and all interior

equipment and furnishings, has removed its primary construction equipment on site and no longer has a physical presence on the Project Site. The maximum amount for demobilization shall not be less than 0.5% of the Contract Price.

- b. When the conditions specified above for demobilization have been met 100% of the amount allowed for demobilization will be paid.

3. Final Acceptance Payment:

- a. When the Certificate of Final Acceptance is provided the final 1% of the Contract Price will be paid by the Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SCHEDULE OF VALUES FORM

- A. See the following pages for Owner preferred format of the Schedule of Values.

END OF SECTION

SCHEDULE OF VALUES FOLLOWS

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Project coordination.
 - 2. Preconstruction meeting.
 - 3. Preinstallation meetings.
 - 4. Weekly project meetings.
 - 5. RFI (Request for Information) meetings.
 - 6. Schedule for forms.

1.02 PROJECT COORDINATION

- A. General: Coordinate construction activities to ensure efficient and orderly performance of the Work and avoidance of interference with Owner's transfer station operations.
- B. Utilities:
 - 1. Coordinate construction activities with utility service providers required for performance of the Work.
- C. Be responsible for completion, and administration of required forms.
 - 1. The Owner will provide required and suggested forms and formats during and after the Preconstruction Meeting.
- D. Forms not prescribed by the Owner may be of the Contractor's own design, subject to the following.
 - 1. Contractor-designed forms shall use Arial typeface, 11 point type size, and shall be double-sided printed.
 - 2. Submit draft forms for review and approval by the Project Representative.

1.03 PRECONSTRUCTION MEETING

A. Schedule:

1. The Project Representative will schedule the Preconstruction Meetings.
2. It is anticipated that the initial Preconstruction Meeting will be held within 5 calendar days of Contract Execution.
 - a. Notice To Proceed is anticipated within 5 calendar days following the Preconstruction Meeting.

B. Purpose:

1. Establish lines of communication at the project working level.
2. Discuss and review administrative requirements of the Contract.
3. Review forms required to be used by the Contractor in administration of the Work.
4. Review and discuss design intent, user and concurrent operations issues, and permitting issues including requirements of authorities having jurisdiction.
5. Definition of and interpretation of roles, and responsibilities in performance of the Contract.
6. Review and discuss Contract Documents including Drawings and Specifications.
7. Review and discuss facility and site access, flagging activities, security, and procedural issues.
8. Discuss administration, and performance of sign-in and sign-out responsibilities.
9. Coordinate safety activities, including performance of the required Contractor's Health and Safety Plan.
10. Coordinate mobilization activities.

C. Notification: The Project Representative will notify the Contractor and required attendees not less than 2 calendar days in advance of the proposed meeting time.

D. Required Attendees:

1. Construction Manager.
2. Project Representative.
3. Transfer Station Operations Representative(s).
4. A/E Representative.
5. Contractor, including its project manager, superintendent, and the safety officer.
6. Significant subcontractors pertinent to the agenda.

- E. Meeting Minutes: The Project Representative will prepare and distribute the minutes from the Preconstruction Meeting.
- F. Authorities having jurisdiction may require their own preconstruction meeting with the Contractor and the Owner.
 - 1. Refer to individual permits for preconstruction meeting requirements.
 - 2. Contractor is responsible for arranging for these meetings.

1.04 PRE-INSTALLATION MEETINGS

- A. Pre-installation meetings will be scheduled for various portions of the Work as the Work progresses.
- B. The agenda of each pre-installation meeting shall include the following:
 - 1. Project conditions, including anticipated temperature and weather conditions, readiness of the substrate for installation; and project-specific issues affecting the Work of this section.
 - 2. Installation schedule, sequencing, and coordination with Work of other trades.
 - 3. Installation procedures.
 - 4. Quality assurance procedures; specifically Contractor accommodation of Project Representative inspections of the Work of the relevant section and other quality expectations.
- C. The following is a partial list of systems, assemblies, and products for which pre-installation meetings are required:
 - 1. Earthwork.
 - 2. Metal roofing.
 - 3. Membrane roofing.
 - 4. Metal siding.
 - 5. Field painting and coating.
 - 6. Steel erection.
 - 7. Cast-in-place concrete work.
 - 8. Special concrete work.
 - 9. Paving.
 - 10. Pavement striping.
 - 11. Landscaping and tree planting.

12. Mechanical systems and equipment (multiple meetings as necessary).
13. Electrical systems and equipment (multiple meetings as necessary).
14. Interior finishes (multiple meetings as necessary).
15. Underground utilities.
16. Others as determined by the Project Representative.

1.05 WEEKLY PROJECT MEETINGS

- A. Weekly Project Meetings will be directed, and led by the Project Representative.
- B. The Project Representative will prepare, coordinate, convene, and arrange Weekly Project Meetings.
- C. Purpose:
 1. Maintain and improve lines of communication.
 2. Demonstrate performance of administrative requirements of the Contract.
 3. Complete and maintain forms required to be used by the Contractor in administration of the Work.
 4. Review and discuss the Weekly Look Ahead Schedule.
 5. Review and discuss design intent, user and concurrent operations issues, work quality issues, and permitting issues including requirements of authorities having jurisdiction.
 6. Review and discuss specific Contract Documents including Drawings and Specifications.
 7. Maintain and improve facility and site access, flagging activities, security, and procedural issues.
 8. Review and improve ongoing safety activities including performance of the required Health and Safety Plan.
- D. Attend weekly project meetings; be prepared to discuss the agenda items identified in this section.
- E. Follow the direction of the Project Representative in preparation for weekly meetings, including:
 1. Ensure that the Contractor's project manager, superintendent, safety officer, representatives of subcontractors, and others are present in accordance with provisions of this section.
 2. Ensure that required attendees are prepared, and familiar with the Project and the Project Schedule.

3. Coordinate the time and place of the weekly meetings with the Project Representative.
4. Ensure the Project Representative has been consulted in advance of the meeting with respect to the proposed attendees, and their relationship to the Project.
5. Submit the Weekly Look Ahead Schedule at least twenty-four (24) hours in advance of the meeting.
6. Submit Weekly Reports:
 - a. Include a narrative describing the Work accomplished the preceding week.
 - b. Identify the completion of milestones, and work activities.
 - c. Indicate problems and resolution of problems occurring during the week.

F. Attendance at Weekly Project Meetings:

1. Construction Manager.
2. Project Representative.
3. Transfer Station Operations Representative(s).
4. A/E Representative.
5. Contractor, including its project manager, superintendent, safety officer, and others as requested by the Project Representative.
6. Subcontractors and vendors pertinent to the agenda.
7. Representatives of authorities having jurisdiction.

G. Agenda for Weekly Project Meetings:

1. Be prepared to discuss the following, to the extent deemed appropriate by the Project Representative:
 - a. Safety Report by the Contractor-designated safety representative.
 - b. Weekend work request, if any is requested by the Contractor for the coming week.
 - c. TESC discharge request, in the event discharge is needed or anticipated within the coming week.
 - d. Review and approve minutes or record of previous meeting.
 - e. Review work progress during the preceding week.
 - f. Note field observations, problems, and decisions.
 - g. Identify problems that impede planned progress.

- h. Coordinate activities to the Project Representative's satisfaction, to permit the Project Schedule to be maintained, or improved.
 - i. Review off-site fabrication processes, and status.
 - j. Develop corrective measures, and procedures to maintain or improve the Project Schedule.
 - k. Discuss progress of preparation and maintenance of administrative documents required in accordance with this section.
 - l. Discuss updates to the Monthly Update Schedule in accordance with Section 01 32 13, "Scheduling."
 - m. Review planned work identified in the Weekly Look Ahead Schedule in accordance with Section 01 32 13, "Scheduling."
 - n. Review impacts of Changes on the Project Schedule.
 - o. Discuss status, and action related to Changes.
 - p. Discuss additional scope, costs, schedule impacts, deviations, substitutions, and other Changes.
 - q. Review safety measures, including compliance with the required Health and Safety Plan, and cooperation with governmental agencies, and authorities having jurisdiction.
 - r. Review Apprenticeship and Subcontractor Opportunities.
 - s. Maintenance and improvement of quality, work standards, and competence.
 - t. Resolution of construction non-conformities.
 - u. Review of status logs of submittals, RFIs, and Change Orders.
- H. Meeting Minutes: The Project Representative will prepare and distribute minutes from each Weekly Progress Meeting.

1.06 REQUESTS FOR INFORMATION (RFI) MEETINGS

- A. RFI Meetings will be directed, and led by the Project Representative.
- 1. RFI responses are prepared by the Project Representative only, and in writing and are binding.
 - 2. Verbal responses, and discussions about RFIs are unofficial, non-final, and non-binding on the parties.
 - 3. RFI meetings will be scheduled to occur immediately following the weekly progress meeting.

B. Purpose:

1. Maintain and improve lines of communication about Contractor-initiated questions, and questions from subcontractors.
2. Prioritize RFI responses to the Contractor.
3. Review and discuss specific Contract Documents including Drawings and Specifications.

C. Attend RFI meetings; be prepared to discuss the agenda items identified in this section.

D. Follow the direction of the Project Representative in preparation for RFI meetings, including:

1. Ensure that the persons responsible for preparation of RFIs are present.
2. Ensure that required attendees are prepared to discuss the RFIs with the A/E Representative, in detail.

E. Attendance:

1. Construction Manager.
2. Project Representative.
3. A/E Representative.
4. Contractor, including its project manager, superintendent, and the Contractor's designated field engineer.

F. Agenda:

1. Review of previous RFI responses, and actions taken.
2. Review and discussion of current RFIs, and proposed responses by the Project Representative, when available.
3. Discussion of forthcoming RFIs anticipated by the Contractor, when available.

G. Meeting Minutes: The Project Representative will prepare and distribute minutes from each RFI Meeting if such minutes are deemed necessary.

1.07 DOCUMENTS

A. The Owner requires an original signed copy of every piece of written communication and submittals used in the Project.

1. Hardcopy documents are required.
2. Provide the hardcopy signed documents regardless of the document management system capabilities.
3. Provide the signed hardcopy documents to the Project Representative.

B. For documents created by the Contractor and/or its subcontractors:

1. Text: Submit electronically in Microsoft Word, current version.
2. Tables: Submit electronically in Microsoft Excel, current version.
3. Schedules: Submit electronically in Primavera (P3), or Approved Equal.
4. Figures and pictures: Submit electronically as PDF or JPG files.
5. Cut sheets from catalogs, and similar items: Scan, and submit as Adobe PDFs.
6. Drawings: Submit as PDF files, except:
 - a. Provide AutoCAD version of files when requested by the Project Representative.
7. For electronic files larger than 5 MB, download the electronic version as PDF to Owner's document control system.
8. Obtain prior approval from the Owner to submit an electronic version in a format other than those specified here.

C. Environmental Quality Monitoring:

1. For information such as sediment quality data and water quality data, submit the data in an Excel file, or
2. Use a format compatible with the Washington State Department of Ecology's SEDQUAL Database format.

D. Security and Reliability:

1. The Contractor is required to provide its own back up of electronic files that have been submitted.
2. The Contractor is required to keep a current paper copy of every document used or created for the Project.

E. Electronic Document Control System (DCS):

1. The Contractor is required to transmit and receive documents electronically, utilizing the Document Control System (DCS) provided by Owner.
2. Internet connection will be required for Contractor personnel to utilize the DCS.
3. Training of Contractor's personnel in the use of the DCS will be provided by Owner once, and is expected to require approximately 4 hours. Instruction to any subsequent Contractor personnel will be the responsibility of Contractor.
4. Cost of single DCS instruction will be borne by Owner, exclusive of Contractor's labor cost.
5. The DCS system document storage capacity does not relieve Contractor's responsibilities to maintain and protect separate electronic and hardcopy versions of all Contract Documents.

1.08 SUBMITTALS

- A. General: Submit the following in accordance with general terms and conditions of the Contract and Section 01 33 00, "Submittal Procedures."
- B. Contractor Staffing and Organization Chart:
1. Submit an Organization Chart showing the Contractor personnel and key points of contact with the Owner within 3 weeks following the First Notice to Proceed.
 2. Submit a list of Contractor's personnel and subcontractors, to include their responsibilities and contact information within 3 weeks following the First Notice to Proceed.
 - a. Include the project superintendent, safety officer, and Contractor project manager.
 - b. Provide telephone numbers with voice mail service, and email addresses monitored daily for each designee of the Contractor.
 - c. Indicate emergency and after-hours contacts, and the means of reaching these people.
 - d. Post copies of the list in the construction trailers.
 - e. Revise the list as approved by the Project Representative whenever changes in staffing may occur.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 UTILITY AND AGENCY CONTACT INFORMATION

UTILITY/AGENCY	CONTACT PERSON	CONTACT INFORMATION
PUGET SOUND ENERGY (Electrical Power)	Scott Tuscani, Customer and System Projects Southwest Electrical Distribution	360-689-3709 Scott.Tuscani@pse.com
Lumen Technologies (Century Link) (Communications)	Royce Klein	360-649-3045 Royce.Klein1@Lumen.com
Kitsap Public Utility District (KPUD) (High Speed Internet)	Scott Gard Paul Avis	sgard@kpud.org 360-626-7746 paul@kpud.org 360-626-7731

Kitsap County Fire Marshal Office (Fire Safety and Prevention Authority Having Jurisdiction)	Kristi Wlodarchak, Deputy Fire Marshal II	360-337-5777
SILVERDALE WATER DISTRICT (Water Supply)	Mike Pleasants, District Engineer Nolan Corpus, Engineer	(360) 447-3500
(Sewer)		

END OF SECTION

SECTION 01 32 13

SCHEDULING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Scheduling of Work.

1.02 DEFINITIONS

A. Preliminary Construction Schedule:

1. A preliminary Construction Schedule shall be submitted with the bid.

B. Baseline Schedule:

1. The complete Project Schedule reviewed and commented on by the Owner, with detailed information and work planning activities in accordance with this section.
2. The Baseline Schedule is required to be cost-loaded, resource-loaded, and activity coded.
3. Differences between the Preliminary Construction Schedule and the Baseline Schedule require the Contractor to demonstrate the reasoning and impacts for such changes.

C. Float Time: Time between the earliest start date, and the latest start date of an activity, or succession of dependent activities.

D. Weekly Look Ahead Schedule: Annotated, detailed version of the Monthly Update Schedule.

E. Monthly Update Schedule: Actual current Project Schedule reflecting actual progress to date, changes to the Baseline Schedule, and Changes to the Work.

F. Project Schedule: The approved Baseline Schedule, inclusive of any subsequent approved Changes.

G. Schedule of Values:

1. Meaning the same as identified in Section 01 20 00, "Payment Procedures."
2. Including the requirements identified in Section 01 20 00, "Payment Procedures."

1.03 PERFORMANCE

- A. Perform scheduling responsibilities required in this section.
- B. Be responsible for completion, and administration of required forms.
- C. Scheduling of Work:
 - 1. The scheduling requirements identified in this section are in addition to the requirements of the general terms and conditions of the Contract.
 - a. Failure of the Contractor to provide suitable and sufficient information may result in the Project Representative denying or delaying an Application for Payment.
 - 2. Scheduling of construction activities and preparation of construction activities is the responsibility of the Contractor.
 - 3. Use the Critical Path Method (CPM) of scheduling.
 - 4. Level of Detail Required:
 - a. Show a continuous flow of Work from the date of Contract Execution to Final Acceptance.
 - b. Do not exceed duration of 30 days for any single activity, unless otherwise approved by the Project Representative.
 - c. Use Notices to Proceed as constraints only.
 - d. Negative lag shall be addressed in accordance with directions received from the Project Representative.
 - e. Use start-start, and finish-start relationships, and milestone activities.
 - 5. Transition Period between Phase 2 and Phase 3:
 - a. Coordinate with the Project Representative and include in the Baseline Schedule and subsequent Monthly Schedule Updates a detailed breakdown of Contractor and Owner activities that must occur during the Transition Period.
 - b. The Project Representative will provide detailed input regarding the Owner's activities which shall be included in the Schedules for the Transition Period.
 - 6. Phase of Work:
 - a. Identify activities within the Notices to Proceed in accordance with Section 01 11 00, "Summary of Work."
 - b. Break down activities that are necessary to occur in more than one Notice to Proceed.

7. Software: Use a Primavera scheduling product acceptable to the Owner; or Approved Equal.
8. Cost Loading:
 - a. Cost load every activity when cost loading is required for a schedule submittal in accordance with provisions of this section.
 - b. Include progress schedule and reporting activities.
 - c. Include mobilization and demobilization activities.
9. Baseline Schedule:
 - a. Incorporate Project Representative comments from the Preliminary Construction Schedule.
 - b. The Baseline Schedule provides precedence diagram and cash flow projections and demonstrates cost-loading, resource-loading, activity-coding, and a defined critical path.
 - c. Provide a schedule which accurately describes completion of the Work within the Contract Time.
 - 1) Include temporary erosion and sedimentation control (TESC) implementation.
 - d. Cost load each activity.
 - e. Resource load each activity.
 - f. Assign an activity code for each activity.
 - g. No progress billing will be paid on the non-cost loaded, non-resource loaded, non-activity-coded Preliminary Construction Schedule.
 - h. When reviewed by the Project Representative, and after the Project Representative's comments have been resolved, the Baseline Schedule constitutes the Project Schedule for monitoring, and completion of the Work in performance of the Contract.
10. Monthly Update Schedule:
 - a. Include an updated Gantt or Pert diagram, monthly project cash flow projection (including Contractor and subcontractor work), narrative summary, and schedule data files to the Project Representative for review and analysis.
 - b. Narrative Summary: Briefly describe the progress of the Work and describe how the Work is progressing toward its scheduled completion.

- c. Identify milestones completed, major equipment deliveries, and problems arising during the month.
- d. Identify impacts on the schedule.
- e. Project the Work anticipated during the coming month; include major deliveries, and submittals.

11. Float Time:

- a. Float Time is for the Contract and is not for the exclusive use of either the Contractor or the Owner.
- b. Float should be used in priority of who demonstrates a reasonable need to utilize Float Time first, whether this is the Owner, or the Contractor.

12. Weekly Look Ahead Schedule: Annotated version of the Monthly Update Schedule that reflects work tasks to be completed in the next 3 week period and coordinated with the work results in the preceding 2 week period.

- a. Provide this schedule with greater detail than the Critical Path Method schedule.
- b. Prepare this schedule in a format that includes references to the appropriate Critical Path Method schedule activity numbers, and the Work Breakdown Structure.
- c. Include effects of identified Changes.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

1. Baseline Schedule:

- a. Submit within 14 calendar days after the Notice to Proceed 1.
- b. Provide four plots, and two electronic versions.

2. Monthly Update Schedules:

- a. Submit with each Application for Payment in accordance with Section 01 20 00, "Payment Procedures."

3. Weekly Look Ahead Schedule:

- a. Submit 24 hours in advance of Weekly Progress Meetings in accordance with Section 01 30 00, "Administrative Requirements."

1.05 QUALITY CONTROL

- A. Dates imposed on the Project by the Baseline Schedule are not binding on the Owner, and do not limit or restrain the Owner in its activities for administration of the Contract.
- B. Written Narratives:
 - 1. Provide when requested by the Project Representative.
 - 2. Show Contractor's determination of durations for Critical Path Method activities, and near-critical activities.
 - 3. Show crew strength, composition, experience level, number of shifts, hours per shift, and work days per calendar week.
 - 4. Show production curves for major commodities; include below grade pipe, concrete, piping, wire and cable.
 - 5. Show construction equipment requirements.
 - 6. Show supplier and delivery requirements.
- C. Network Diagrams: Include the following detailed information, in accordance with the Critical Path Method technique, when network diagrams are required by provisions of this section:
 - 1. Number.
 - 2. Description of activities, coordinated with the Work Breakdown Structure and the Schedule of Values.
 - 3. Activity duration.
 - 4. Early start and late start.
 - 5. Early finish and late finish.
 - 6. Predecessor activities.
 - 7. Successor activities.
 - 8. Total Float Time.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Submittal Procedures.
 - 2. Liquidated Damages.
 - 3. Submittal Schedule.
 - 4. Submittal Transmittal Form.

1.02 DEFINITIONS

- A. Complete: A submittal shall not be deemed complete until the submittal has been reviewed and returned by the Project Representative with one of the following annotations: (1) NO EXCEPTIONS TAKEN or (2) MAKE CORRECTIONS NOTED.
- B. Submittal Categories:
 - 1. Approval Submittals: Documentation necessary to demonstrate product, material, equipment, or manufacturer's qualifications compliance with Contract requirements.
 - 2. Quality Assurance Submittals: Documentation necessary to demonstrate product, material or equipment conformance with approved Approval Submittals.
 - 3. Closeout Submittals: Documentation required in accordance with Section 01 92 13, "Operation and Maintenance Manuals," and Section 01 77 00, "Closeout Procedures."

1.03 SUBMITTAL PROCEDURES

- A. Submittals will only be accepted from the Contractor.
 - 1. Materials provided by subcontractors and others who are not the Contractor will not be received and will not be reviewed or acted upon.
 - 2. All materials and submittals must be submitted to the Project Representative by the Contractor itself, and not through proxies.

B. On Hold Status:

1. A submittal deemed by the Project Representative to be On Hold will not be reviewed until it is corrected by the Contractor.
2. The Project Representative will return submittals which are not corrected by the Contractor during the On Hold period; the review and return time will be as for a resubmittal.

C. Identification of Submittals:

1. Identify each submittal by specification section number where the requirement for the submittal was identified.
2. Provide a submittal transmittal form indicating the date of the submittal, the subcontractor's name, and the date the submittal is supposed to be returned by the Project Representative in accordance with the Submittal Schedule.
3. Filenames shall include the specification section, and the date of the submittal.

D. Administrative Submittals:

1. These documents include:
 - a. Construction schedules in accordance with Section 01 32 13, "Scheduling."
 - b. Schedule of Values and Applications for Payment in accordance with Section 01 20 00, "Payment Procedures."
 - c. List of Subcontractors.
 - d. Submittal Schedule.
 - e. Permits not provided by the Owner but required in the course of the Work.
 - f. Source inspection and test reports in accordance with Section 01 43 00, "Quality Assurance and Control."

E. Required Submittal Dates:

1. Within Divisions 2 through 40, submittals are divided into four categories with the following default submittal date requirements:
 - a. Approval Submittals.
 - b. Quality Assurance Submittals.
 - c. Closeout Submittals.
2. Exceptions to the default submittal dates are noted in the attached submittal schedule.

3. The Submittal Schedule at the end of this section establishes the latest allowable dates for each submittal.
 - a. In general, unless otherwise noted, submittals shall be transmitted to the Project Representative no later than 60 calendar days before the product, material, assembly, system or other element of the Work covered by the submittal must be ordered so that it is delivered to the Project Site when needed in accordance with the Contractor's latest Project Schedule.
 - b. Contractor shall provide Latest Allowable Submittal Dates on the Submittal Schedule within 28 calendar days of the Notice to Proceed.
4. Review and Return Time: Submittals will be reviewed and returned to the Contractor within 30 calendar days after receipt of each submittal, or resubmittal.
5. Require that each subcontractor provide their respective submittal packages in advance of the submittal date, and with sufficient time to permit the Contractor's field personnel to review the submittals and forward them to the Project Representative for review and distribution.

F. Submittal Log:

1. Project Representative will maintain an electronic Submittal Log coordinated with the Submittal Schedule.
2. The Submittal Log will indicate where in the process of review any particular submittal should be, as a check for the Project Representative to administer the submittal review process.
 - a. Assign each submittal entry the appropriate Review Action designation in accordance with its status.
3. Submittal Log shall be revised by the Project Representative at least weekly, and be posted on the Project FTP or Teams site that will be setup and maintained by the Project Representative.

G. Shop Drawings:

1. Submit drawings drawn to an appropriate scale and sufficiently legible to discern detail.
2. Accurately and completely describe or otherwise identify any deviation from the Contract Documents.
3. Provide dimensions, identify adjacent materials, systems and Work of other systems to the best of your ability. Include field verified dimensions when appropriate.

H. Product Data:

1. Mark product data sheets to show choices and option selections.
2. Clearly identifying the system, assembly, material or product for which it is submitted using the names or terminology for the system, assembly, material or product in the Contract Documents.
3. Identify how accessories will be incorporated into assemblies.
4. Identify the basis of compliance with the requirements identified in the Contract Documents. When one or more criteria cannot be determined, identify the criteria which represent the basis for selection.

I. Samples:

1. Submit appropriately sized samples in accordance with the Contract Documents.
2. Clearly label samples, identifying the system, assembly, material or product for which it is submitted using the names or terminology for the system, assembly, material or product in the Contract Documents.
3. Provide five duplicate samples or sets of samples unless noted otherwise in the Contract Documents.
4. Include with samples a statement of the availability of each product, and compliance with applicable standards.
5. Submit a full set of choices when selection will be from a range of products.
 - a. Demonstrate finishes including color, sheen, texture, and other physical attributes including toughness, resistance to damage from scratching, crushing and wear.
6. Provide samples from the range of materials that are being proposed.

J. Manufacturer's Instructions:

1. Provide Manufacturer's Instructions as defined in Section 01 60 00, "Product Requirements."

K. Manufacturer's Contact Information:

1. Name, title, mailing address, phone number and e-mail address of the manufacturer's technical representative assigned to the Project.

L. Mockups:

1. Provide mockups where required in the Contract Documents.
2. Mockups identified in the Contract Documents may be incorporated into the Project unless otherwise determined by the Project Representative.
3. Mockups shall be produced and removed at Contractor's own expense.

M. Project Representative Response to Submittals:

1. Submittals will be returned to the Contractor by the Project Representative, including A/E Representative responses consistent with one of the following:
 - a. **NO EXCEPTIONS TAKEN:** Indicates submittal has been reviewed and appears to be in conformance with requirements of the Contract Documents. Contractor may proceed with construction shown on the submittal.
 - b. **MAKE CORRECTIONS NOTED:** Indicates submittal appears to be in conformance with requirements of the Contract Documents, with the exception of noted corrections. Contractor shall incorporate the corrections noted and may proceed with construction shown on the submittal. No resubmittal is required.
 - c. **AMEND-RESUBMIT:** Indicates submittal does not appear to be in conformance with the Contract Documents. A/E Representative's comments will be noted on the submittal or in a separate memorandum or letter from the Project Representative. Contractor shall recheck, make necessary revisions, and resubmit.
 - 1) Do not permit submittals marked "Amend-Resubmit" to be used at the Project Site, or elsewhere where Work is in progress.
 - d. **REFERENCE:** Indicates submittal gives general information incidental to but not required for construction.
 - e. **SUBMITTALS NOT REQUIRED-NO ACTION TAKEN:** Indicates that the submittal is not called for by the Contract Documents and that no action was taken by Project Representative on the gratuitous submittal.

1.04 LIQUIDATED DAMAGES

- A. Selected submittals must be completed within the time set for the Preconstruction Phase, Milestone 1 of the work.
 1. The submittals that must be completed within the Preconstruction Phase are identified in the Submittal Schedule below.
- B. Liquidated Damages apply if the Contractor does not achieve Milestone 1 by the date specified in Notice to Proceed 1.
 1. Refer to Section 01 20 00, "Payment Procedures" for Liquidated Damages provisions.

1.05 QUALITY ASSURANCE

- A. Personnel:
 1. Designate a single point of contact that will act through the course of the Project to administer the submittals.
 2. This person is to be solely responsible for delivering the submittals to the Project Representative in accordance with this section.

B. Contractor's Required Review: The Contractor shall review every submittal for completeness and will coordinate the Work prior to submitting materials to the Project Representative.

1. Completeness:

- a. Transmit complete submittal packages to the Project Representative at the previously agreed upon review dates established by the approved Submittal Schedule.
- b. Submittals without required information are not acceptable; such submittals will be returned for correction and resubmittal without further review.
- c. Review of submittals by the Project Representative does not relieve the Contractor of responsibility for errors in the submittals, and does not demonstrate an assumption of risks, or of liabilities by the Owner.

2. Contractor Coordination of Submittals:

- a. Submittals that are not reviewed by the Contractor, that are out of sequence with other submittals, or that are dependent on other Work that has not been coordinated, are not acceptable; such submittals will be returned for correction.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 SUBMITTAL SCHEDULE

- A. Check each specification section for the complete submittal requirements.
- B. The Submittal Schedule identifies the submittals that are required from the Contractor. Submittal Schedule shall be received from the Contractor within 14 calendar days of Notice to Proceed 1.
- C. For each item: Include Specification Section and paragraph and/or Plan detail as applicable. Include source and/or subcontractor as applicable. Include substitution request as applicable. Include CPM Schedule activity number as applicable. Include expected submittal date and latest allowable return date.

3.02 SUBMITTAL TRANSMITTAL FORM

- A. See following page.

SUBMITTAL TRANSMITTAL										
PROJECT TITLE: Silverdale Recycling and Garbage Facility (RAGF)					Parametrix NO. XXXXXXXXXXXXX			CONTRACT NO. XXXXXXXXXXXX		
PROJECT LOCATION: 8843 NW Dickey Road, Silverdale, WA 98383					CONTRACT TITLE: Facility Rebuild					
CONTRACTOR'S TRANSMITTAL					A/E REPRESENTATIVE REVIEW					
Check One This is: an original submittal☐ a first resubmittal☐ a _____ resubmittal☐ TRANSMITTAL NO. _____ SPEC. SECTION NO. _____					LEGEND: NENo Exceptions TakenARAmend Resubmit MCMake Corrections NotedRFReferenceNA Submittals Not Required, No Action Taken					
NO. COPIES	MANUFACTURER	MFR. NO.	REV. NO.	SUBJECT	Action Taken	DISTRIBUTION				
						Contractor	Constr. Manager	Project Rep.	Shop Drwg. File	Extra
Complete either (a) or (b) following: (a) We have reviewed the material, equipment, or other items contained in this submittal and certify that it is correct and in strict conformance with the Contract Documents (no exceptions). (b) We have reviewed the material, equipment, or other items contained in this submittal and certify that it is correct and in strict conformance with the Contract Documents except for the following deviations (list deviations): _____ _____ _____ For additional remarks see Serial Letter No. _____ CONTRACTOR'S NAME _____ ADDRESS _____ By _____DATE _____					Check One ☐ ☐ A/E REPRESENTATIVE'S REMARKS: 1. No marks or review comments on this submittal are intended to constitute changes affecting cost or time. 2. _____ _____ _____ _____ _____ _____ For additional remarks see Serial Letter No. _____ By _____DATE _____					

Materials Submittal Form

Project Name: _____

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. To fulfill the requirements of this program, this form must be completed for **each building material** (i.e. drywall, insulation, steel studs, etc) that you will be furnishing to the project. Wet-applied products are not included – please refer to the VOC Submittal Form.

Please fill out all of the information requested in the box below. Write “N/A” or “?” for information that does not apply or is undetermined. For questions about completing this form, please contact the general contractor for the project.

Sub-Contractor: _____ Contact: _____ Date: _____	Spec Section: _____ Material Name: _____ Manufacturer: _____
Material Cost (minus on-site labor and equipment): \$ _____	
Material Source Location: Location of Manufacture*: _____ City/State _____ Miles from the project site Location of Harvest/Extraction**: _____ City/State _____ Miles from the project site	
☐ I have attached manufacturer documentation stating the location of harvest/extraction.	
Recycled Content[†]: % Post-Consumer: _____ % % Post-Industrial: _____ % (Combined total cannot equal >100%)	
☐ I have attached manufacturer documentation stating the percentage of recycled content.	
Signature: _____	Date: _____

* Manufacturing refers to the final assembly of components into a building product. For example, the location of manufacture for structural steel would be the address of the fabrication shop (not the steel mill).

** Location of Harvest is where raw materials were extracted from the ground. For example, the location of harvest for gypsum is the gypsum mine. If the gypsum is recycled, then the harvest location is the gypsum recycling plant.

[†] Post-consumer content is from previous consumer use (bottles, cars) and post-industrial content is recaptured from the industrial process (fly ash, metal trimmings). If the type of recycled content is not specified, assume it is post-industrial.

[‡] Salvaged products are reclaimed from another building (ex: doors, floor tiles) and reused for the same purpose in the project.

LEED NC Materials Form, Copyright Paladino and Company, Inc. 2007

Materials Submittal Form

Wood Products

Project Name: _____

The project team is using the LEED Green Building Rating System® (www.USGBC.org). to measure the environmental impacts of the project. Therefore, the project team is pursuing and tracking materials the types of materials that are being used to construct the project.

Please fill out the information in the box below for each wood material that you will be furnishing to the project. Write "N/A" in any field that does not apply and a "?" for any information that you are unable to determine.

Contractor: _____ Contact: _____ Date: _____	Spec Section: _____ Material Name: _____ Manufacturer: _____

Material Cost (minus labor and equipment): \$ _____

Material Source Location:

Location of Fabrication:	_____ City/State _____ Miles from the project sit
Location of Forest:	_____ City/State _____ Miles from the project site

Recycled Content*:

% Post-Consumer:	_____ %
% Post-Industrial:	_____ %

☐ I have attached manufacturer documentation stating the percentage of recycled content.

* Post-consumer content is recycled waste that has been captured after consumer use and post-industrial content is recycled waste that has been captured from industrial processes. If no information is available on the source of the recycled content, assume it is post-industrial.

Salvaged Wood Content[†]: _____ %

☐ I have attached manufacturer information stating where the wood was salvaged from.

[†] Salvaged wood comes from the deconstruction of another building or structure.

FSC Certified Wood Content[‡]: _____ Chain of Custody Certificate Number

☐ I have attached a copy of the FSC Chain of Custody Certificate or Manufacturer documentation stating the product is FSC certified.

[‡] Only Forest Stewardship Council (FSC) certification qualifies for this point. Sustainable Forest Initiative (SFI) DOES NOT QUALIFY and is not an acceptable substitution for FSC certified wood.

Composite Wood Content[‡]: _____ Y/N Contains Urea-Formaldehyde Resins?

☐ I have attached manufacturer documentation stating that the composite wood DOES NOT contain any added urea-formaldehyde resins.

[‡] For clarification, composite includes MDF, plywood, straw/wheat board, bamboo and other agrifiber products

Signature:	Date:

Materials Submittal Form

Concrete

Project Name: _____

The project team is pursuing certification under the Leadership in Energy and Environmental Design (LEED) Green Building Rating System®. To fulfill the requirements of this program, this form must be completed for each different concrete mix that is used for the project.

Please fill out the information below. Gray boxes may be left blank. Write "N/A" or "?" for information that does not apply or is undetermined. For questions, please contact the contractor from whom you received this form.

Sub-Contractor: _____ **Manufacturer:** _____

Date: _____ **Contact:** _____

Concrete	Cost per cubic yard of mix (minus labor and equipment):	\$
	Volume of concrete provided (cubic yards):	CY
	Location of Manufacture ¹ :	City/State
	Miles from project site	

Concrete Mix Name/Number: _____

Component ²	% of mix (by weight)	% Recycled Content ³		Location of Harvest ⁴ (City, State)	Miles from Project
		(Post-Consumer)	(Post-Industrial)		
Cement					
Flyash			100%		
Aggregate 1: _____					
Aggregate 2: _____					
Sand					
Other: _____					

☐ I have included a manufacturer mix report that confirms the information in this chart.

Signature: _____ **Date:** _____

¹ Location of Manufacture refers to the address of the facility where the mix was combined.

² Water and chemical additives may be omitted from the component list.

³ Post-consumer content is from previous consumer use (ex: crushed pavement) and post-industrial content is recaptured from the industrial process (ex: fly ash). If the type of recycled content is not known, assume it is post-industrial.

⁴ Location of Harvest is where raw materials are extracted from the ground. For example, the location of harvest for aggregate is where the stone was mined. If the aggregate is recycled, then the harvest location is where the rock was crushed for recycling.

LEED NC version 2.1
VOC Submittal Form

Project Name: _____

If you are unable to find a compliant product, notify the contractor immediately so that an alternative can be discussed. Do not under any circumstances use a non-compliant product without written consent from the owner.

Please fill out the information in the chart below (see page two of this document for the LEED requirements):

Sub Contractor: _____ **Spec Section:** _____

Contact: _____ **Date:** _____

I plan on using the following VOC containing Adhesives, Sealants, Primers and/or Paint on the interior* of the project.

Product Name: (manufacturer and product ID)	Type of Product: (adhesive, sealant, paint, primer)	The product will be used for: (application description)	VOC Content in g/L (attach MSDS sheet and highlight VOC content)	Allowable VOC Content in g/L (from charts on next page)

☐ I have also attached copies of the MSDS for each VOC containing product listed in the chart above.

By signing below, I hereby certify that these are the only VOC products that I will use on the interior of the building.

Signature: _____ **Date:** _____

* Interior is defined as anything that is located to the indoor side of the vapor barrier

If you have any questions, please do not hesitate in contacting the contractor. Thank you for complying with the LEED requirements and contributing to the environmental goals of the project.

LEED NC version 2.1 VOC Requirements

The project team is using the LEED Green Building Rating System® (www.USGBC.org) to measure the environmental impacts of the project. One major environmental goal is to reduce the quantity of indoor air contaminants that are odorous, potentially irritating and/or harmful to the comfort and well-being of installers and occupants. Therefore, Volatile Organic Compound (VOC) limitations have been established products such as adhesives, sealants, paints, and primers.

Therefore, any products that you plan to use on the inside of the building, the VOC content, measured in grams/liter (g/L), must be below established limits. This information is required by law to be included on the Material Safety and Data Sheet (MSDS) and must be provided along with this submittal form. However, older MSDS may not have this information, in which case a letter from the manufacturer should be attained that states the VOC content of the product.

Below are tables that provide the VOC limits for adhesives, sealants, paints and primers. Each VOC containing product MUST fall below these VOC limits.

Architectural Applications	VOC Limit [g/L less water]	Specialty Applications	VOC Limit [g/L less water]
Indoor Carpet Adhesives	50	PVC Welding	510
Carpet Pad Adhesives	50	CPVC Welding	490
Wood Flooring Adhesive	100	ABS Welding	400
Rubber Floor Adhesives	60	Plastic Cement Welding	350
Subfloor Adhesives	50	Adhesive Primer for Plastic	650
Ceramic Tile Adhesives	65	Contact Adhesive	80
VCT and Asphalt Tile Adhesives	50	Special Purpose Contact Adhesive	250
Dry Wall and Panel Adhesives	50	Structural Wood Member Adhesive	140
Cove Base Adhesives	50	Sheet Applied Rubber Lining Operations	850
Multipurpose Construction Adhesives	70	Top and Trim Adhesive	250
Structural Glazing Adhesives	100		
Substrate Specific Applications	VOC Limit [g/L less water]		
Metal to Metal	30		
Plastic Foams	50		
Porous Material (except wood)	50		
Wood	30		
Fiberglass	80		

Aerosol Adhesives:	VOC weight [g/L minus water]
General purpose mist spray	65% VOCs by weight
General purpose web spray	55% VOCs by weight
Special purpose aerosol adhesives (all types)	70% VOCs by weight

See page one of this document for the VOC submittal form.

END OF SECTION

SECTION 01 35 29
HEALTH AND SAFETY

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Special project procedures.
 - 2. Governmental safety requirements.
 - 3. Health, safety, and emergency response procedures.
 - 4. Requirements for Contractor's Health and Safety Plan.
- B. Related Sections:
 - 1. Section 02 82 23, "Removal and Disposal of Asbestos Containing Materials."
 - 2. Section 02 83 33, "Removal and Disposal of Lead Containing Materials."
 - 3. Section 31 23 00, "Earthwork."
 - 4. Section 31 23 33, "Trench Safety Systems."

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:
 - 1. CERCLA.
 - 2. Federal Water Pollution Control Act (FWPCA).
 - 3. HAZWOPER - 29 CFR 1910.120.
 - 4. NIOSH/OSHA/USCG/EPA: Occupational Safety and Health Guidance Publication 85-115: Manual for Hazardous Waste Site Activities, October 1985.
 - 5. Puget Sound Clean Air Agency (PSCAA) Regulations.
 - 6. Revised Code of Washington (RCW):
 - a. RCW 49.17 – Washington Industrial Safety and Health Act.
 - b. RCW 70. 300 – Hazardous Waste Disposal Act.
 - c. RCW 70A.305 – Hazardous Waste Cleanup-Model Toxic Control Act.

7. Toxic Substance Control Act.
8. Washington Administrative Code (WAC).
 - a. Chapter 173-303 WAC: Dangerous Waste Regulations.
 - b. Chapter 296-24 WAC: Safety Standards for General Safety and Health.
 - c. Chapter 296-62 WAC: General Occupational Health Standards.
 - d. Chapter 296-155 WAC: Safety Standards for Construction Work.

1.03 DEFINITIONS

A. Hazardous Material: All of the following apply:

1. Materials as defined in the general terms and conditions of the Contract.
2. A solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (1) cause or significantly contribute to an increase in mortality or increase in serious, irreversible, or incapacitating reversible illness; or (2) pose substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed or otherwise managed.
3. Asbestos material, as defined in Puget Sound Clean Air Agency (PSCAA), Regulations III, Articles 3-4, Removal and Encapsulation of Asbestos Materials.

B. Health Safety Supervisor:

1. The person assigned by the Contractor, and responsible for implementation of the Contractor's Health and Safety Plan.
2. The Health Safety Supervisor can be the same person as the project superintendent.
3. The Health Safety Supervisor can be the same person as the Site Safety and Health Officer.

C. MSDS: Material safety data sheets.

D. Notice of Deficiency: written instruction from regulatory agencies, jurisdictions, and the Owner which identify required changes to the Contractor-prepared plans and programs identified as work of this section.

E. Permit-Required Confined Space:

1. It contains or has potential to contain a hazardous atmosphere.
2. It contains material that has potential for engulfing an entrant.
3. It is shaped inside such that someone entering could be trapped or asphyxiated.

4. It contains other recognized serious safety or health hazards.
5. Kitsap County as a policy considers all storm and sewer conveyance systems (manholes, tanks, pipes, etc.) as permit-required confined spaces.

F. Site Safety and Health Officer:

1. The person assigned by the Contractor, and thoroughly trained in rescue procedures, the use of safety equipment, and the use of gas detectors.
2. The Site Safety and Health Officer can be the same person as the Project Superintendent.
3. The Site Safety and Health Officer can be the same person as the Health Safety Supervisor.

1.04 PERFORMANCE

A. Prepare and implement the Health and Safety Plan.

1. Contractor personnel performing Work of the Project are to comply with the federal Occupational Safety and Health Act of 1970 (OSHA), including revisions, amendments, and regulations issued since the legislation was enacted.
2. Contractor personnel performing Work of the Project are to comply with the Washington Industrial Safety Act of 1973 (WISHA), including revisions, amendments, and regulations issued since the legislation was enacted.
3. Applicable safety standards include but are not limited to the following:
 - a. NIOSH/OSHA/USCG/EPA: Occupational Safety and Health Guidance Publication 85-115: Manual for Hazardous Waste Site Activities, October 1985.
 - b. Chapter 296-24 WAC: Safety Standards for General Safety and Health.
 - c. Chapter 296-62 WAC: General Occupational Health Standards.
 - d. Chapter 296-155 WAC: Safety Standards for Construction Work.
 - e. Chapter 173-303 WAC: Dangerous Waste Regulations.
4. Ascertain the extent to which applicable regulations affect Work of the Project.
 - a. In the case of conflict or inconsistency between the regulations, the more stringent regulation or requirement applies.
 - b. There is no acceptable deviation from the regulations.

B. Prepare and implement the Accident Prevention Program.

C. The Contractor may encounter suspect Dangerous Wastes and/or potentially Hazardous Material.

1. In the event suspect Dangerous Wastes are encountered, the Contractor shall have previously planned for and shall implement sufficient supervision, equipment, and trained workforce, as identified in the Earthwork Plan, to be able to continue the Work on the Project Site without delay, and to be able to continue Work on other areas of the Project Site without any additional cost incurred to the Owner.
 - a. Persons involved in the handling, cleaning up, and corrective actions associated with Dangerous Waste are to be currently certified, at a minimum, to the 40 hour HAZWOPER level – 29 CFR 1910.120.
2. In the event potentially Hazardous Materials are encountered, the Contractor shall have previously planned for and shall implement sufficient supervision, equipment, and trained workforce, including specialty subcontracted workforces as applicable and as identified in the Earthwork and Demolition Plans, to be able to continue the Work in other areas of the Project Site without delay, and to be able to continue Work on other areas of the Project Site without any additional cost incurred to the Owner.
 - a. Further, the Contractor shall have available, with a maximum response time of 24 hours, sufficient equipment, trained workforce, and planning to appropriately remove and temporarily store the potentially Hazardous Material while samples are tested and disposal determinations are made by the Project Representative.
 - b. Persons involved with the handling, cleaning up, and corrective actions associated with Hazardous Material shall be currently certified per regulations to perform the required work in accordance with all applicable safety and material handling requirements.
3. Other personnel not directly involved in the handling, cleaning up, and corrective actions associated with Dangerous Waste, including suspect Dangerous Waste, but that may be exposed to such conditions consistent with the description of occasional site workers, are to be trained, at a minimum, to the 24 hour HAZWOPER level – 29 CFR 1910.210.

1.05 SUBMITTALS

A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

B. Health and Safety Plan:

1. Provide a Health and Safety Plan within 3 weeks following the First Notice to Proceed.
 - a. Address all earthwork, below grade construction such as utility construction, fill, proof-rolling, surveying, and all other aspects of the Work through all stages of the Work.
 - b. The plan shall be specific to the project.
 - c. The Site Safety and Health Officer shall participate in the development of the plan.

- d. Include MSDS for chemical materials stored, used, or otherwise required for the Project.
 - e. A map and directions to hospitals and urgent care facilities.
- 2. Include training for specific work conditions associated with the Project.
 - 3. Provide a system of informing workers and others about the health and safety conditions of the Work.
 - 4. Include specific measures for continual assessment of working conditions in the vicinity of the excavation work area.
 - 5. Include procedures for employees and visitors to follow in the event of an emergency associated with earthwork activities.
 - 6. Include development and implementation of notification measures.
 - 7. Identify responsible parties to implement the Health and Safety Plan.
 - 8. Include coordination with the Project Representative regarding the shutdown and safety tagout/lockout of pressurized systems, electrical, mechanical, pneumatic, hydraulic, etc., systems, and other equipment and utilities.
 - 9. Include good housekeeping procedures in accordance with Chapter 296-155-020 WAC.

C. Accident Prevention Program:

- 1. The program must be specific to the Work, and the Project Site.
- 2. Outline the anticipated hazards and safety controls necessary to safeguard the Contractor's employees, the public, and Owner staff and representatives.
- 3. Include the name and telephone number of the Health Safety Supervisor responsible for implementation of the plan.

D. Revisions to the Health and Safety Plan and Accident Prevention Program:

- 1. Revise the Health and Safety Plan and Accident Prevention Program prior to the start of work as necessary to accommodate changes requested by the Owner, regulatory agencies, and jurisdictions having authority.
- 2. Revise the Health and Safety Plan and Accident Prevention Program as necessary to accommodate changes in site conditions.

E. Injury Summary Report:

- 1. Submit a completed Injury Summary Report, as attached, to the Project Representative the first weekday of each month.

- F. Identify all personnel, including subcontractor personnel, responsible for handling suspect Hazardous Material and provide current copies of the HAZWOPER certification prior to personnel performing work on the Project Site within 4 weeks following the Notice to Proceed.
- G. Provide current copies of the Asbestos Worker/Supervisor Certification prior to personnel performing asbestos related work, if any, on the Project Site.

1.06 QUALITY ASSURANCE

- A. Ensure that subcontractors receive a copy of this section.
- B. Post copies of the Health and Safety Plan, Accident Prevention Program, and all other applicable documents at the Contractor's job site office, and at each of the subcontractors' offices.

1.07 ADDITIONAL REQUIREMENTS

- A. Excavations:
 - 1. Refer to Section 31 23 33, "Trench Safety Systems."
- B. Perform whatever work is necessary for safety; be solely and completely responsible for conditions of the job site, including safety of all persons, and property continuously, 24 hours per day, 7 days per week, during the construction period.
- C. Accident Notifications:
 - 1. Report immediately to the Project Representative any accidents causing death, injuries, or property damage.
 - 2. Written Report:
 - a. Provide a written report to the Project Representative within 3 calendar days of the occurrence of an accident.
 - b. Provide full details, witness statements, and corrective actions being taken.
- D. Chemicals Labeling and Identification:
 - 1. Take steps to ensure containers of chemical materials at the Project Site are labeled and managed in accordance with the regulations.
 - a. Comply with Chapter 296-62 WAC.
 - 2. Maintain copies of MSDS for chemical materials stored, used, or otherwise necessary for the Work.
 - a. Include MSDS in the Health and Safety Plan as indicated in this section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Health Safety Supervisor:

1. Train, or administer training for all personnel in use of appropriate safety equipment utilized in the course of their work responsibilities.
2. Monitor personnel and implement corrective actions to ensure that personnel are correctly implementing requirements and procedures of the Health and Safety Plan.
3. Advise the Site Safety and Health Officer.

B. Site Safety and Health Officer:

1. Delegate authority to the Site Safety and Health Officer to direct any person, or personnel to follow the safety rules.
2. Administer recommendations, and instructions made by the Health Safety Supervisor.
3. Train, or administer training for all personnel in use of appropriate safety equipment utilized in the course of their work responsibilities.
4. Monitor personnel and implement corrective actions to ensure that personnel are correctly implementing requirements and procedures of the Accident Prevention Program.
5. Prepare and submit Injury Summary Reports in accordance with provisions of this section.
6. Equipment Management: Ensure availability and suitability of necessary air-monitoring, ventilation equipment, protective clothing, and other supplies and equipment identified in the Contractor-prepared plans.

3.02 FIELD QUALITY CONTROL

- A. Utilities: Take appropriate precautions in working on or near utilities, and Dangerous Systems.
- B. Failure to Perform Duties of this section: The Owner may stop the Work of the Project in response to the Contractor's failure to administer, revise and implement the required Health and Safety Plan, and the Accident Prevention Program.
1. The Contractor will not be granted schedule extensions or compensation arising from violations of health and safety on the Project.
- C. Compliance Monitoring: The Owner will continuously review the Contractor's performance of the Work of this section.

3.03 REPORTS – SEE FOLLOWING PAGE

INJURY SUMMARY REPORT

CONTRACTOR: _____
MONTH: _____ CONTRACT NO.: _____

OSHA RECORDABLE CASES

WORK GROUP	NUMBER OF CASES	
	Month	Year to Date
Hourly employees		
Supervisory personnel		

LOST TIME ACCIDENTS

WORK GROUP	NUMBER OF CASES	
	Month	Year to Date
Hourly employees		
Supervisory personnel		

TOTAL HOURS AT KITSAP COUNTY PROJECT SITE

Month	
Year to Date	

INCIDENT AND SEVERITY RATE

Date since last lost-time accident: _____
No. of hours worked since last lost-time accident: _____

Incident Rate =
$$\frac{\text{No. of OSHA Recordables} \times 200,000}{\text{Total Hours Worked}}$$

Severity Rate =
$$\frac{\text{No. of Lost Workdays} \times 200,000}{\text{Total Hours Worked}}$$

Rates	Month	Year to Date
Incident		
Severity		

Submit this completed form to the Project Representative on the first weekday of each month.

END OF SECTION

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
1. Compliance with codes, laws, regulations and rules.
 2. Fees.
 3. Permits.

1.02 REFERENCES

- A. The following is a partial list of Codes and Regulations central to the Project:
1. Kitsap County Code, TITLE 17 Zoning, TITLE 18 Environment, TITLE 19 Critical Areas Ordinance.
 2. Kitsap County Surface Water Design Manual. Kitsap County, Washington. 2021.
 3. 2024 Department of Ecology Stormwater Management Manual for Western Washington.
 4. 2021 International Building Code, including the following amendments:
 - a. Washington State Amendments.
 - b. Kitsap County Amendments.
 5. RCRA – Resource Conservation and Recovery Act.

1.03 PERFORMANCE

- A. Be fully informed of regulations which impact the Work.
- B. In event of conflict between standards, codes, and regulations;
1. Inform the Project Representative at the earliest opportunity.
 2. The Project Representative will determine the appropriate direction and communicate with the Contractor.
- C. Permits by Contractor:
1. Permit Milestones: Coordinate permit responsibilities and tasks with preparation and maintenance of schedules and other administrative activities in accordance with Section 01 30 00, “Administrative Requirements.”

2. Provide (apply and pay for) the following permits:
 - a. Fire Detection and Alarm System Permit.
 - b. All necessary street use permits in connection with Contractor's operations.
 - c. Any permits required for temporary facilities or utilities.
 - d. Sewer Connection Permit
 - e. Electrical Construction Permit
 - f. All other permits not specifically listed below as obtained by Owner.
 3. Fulfill the obligations and conditions on each permit affecting the Work.
 4. Bring conflicting requirements to the attention of the Project Representative, who will arrange for a determination to be made.
- D. Permits paid for and obtained by Owner:.
1. Washington State Department of Ecology:
 - a. NPDES Construction Stormwater General Permit.
 2. Kitsap County Department of Community Development:
 - a. Administrative Conditional Use Permit and State Environmental Policy Act (SEPA) Approval.
 - b. Site Development Activity Permit (includes Timber Harvest Approval).
 - c. Timber Harvest Application.
 - d. Commercial Construction Building Permits.
 - e. Mechanical and Plumbing Permit (included with the building permit review).
 - f. Sign Permit
 - g. Demolition Permit
 3. Kitsap County Public Works:
 - a. Right-of-Way Use Permit.
 - b. Sewer Availability Agreement

4. Kitsap Public Health District:
 - a. Solid Waste Handling Facility Operating Permit (permit ready, cannot be issued until existing permit is expired. New permit will go into effect January 1, 2026.)
 - b. Sewered Building Clearance
 5. Silverdale Water District:
 - a. Construction Agreement
 - b. Water Availability
 6. Bonneville Power Administration:
 - a. Land Use Permit.
 7. Puget Sound Energy (PSE):
 - a. Customer-Generator Systems Agreement.
- E. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
1. Permits:
 - a. Provide copies of Contractor-obtained permits to the Project Representative within three 3 days of the date of issuance by the permitting agencies.
 - b. Provide copies of permit cards that include progress notations made by inspectors acknowledging completeness of Work, for those permits requiring several inspections.
 - c. Provide copies of permit approvals to the Project Representative, when these become available.

1.04 ADDITIONAL REQUIREMENTS

- A. Work performed under permits must be inspected by the authority having jurisdiction prior to being considered part of the Work.
- B. Contractor shall be responsible for satisfactory completion of all Work required to obtain regulatory approval and sign off of permits applied to this Contract.
- C. Permit Posting:
 1. Post all permits at the site in a protected location.
 2. Use clear plastic pockets mounted on a wood panelboard for storage.
 3. Post project permits in one location.
 4. Do not post permits in unprotected or exterior locations.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
1. Specification Format and Content Explanation.
 2. Industry Standards.
 3. Governing Regulations/Authorities.

1.02 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into divisions and sections based on the Construction Specifications Institute's 2020 50-division format and MASTERFORMAT numbering system.
- B. Specification Content: These Specifications use certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
1. Abbreviated Language: Language used in Specifications and other Contract Documents are the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpreted as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
 2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.
 - a. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, referenced construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Unless noted otherwise, comply with the standard in effect as of the date of the Proposal.

C. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with referenced industry standards applicable to that entity's construction activity. Copies of referenced standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

D. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean the associated names. Names and addresses are subject to change and are believed to be, but are not ensured to be, accurate and up to date as of the date of the Contract Documents.

AAN	American Association of Nurserymen 1000 Vermont Ave NE, Suite 300 Washington, DC 20005-9419 (202) 789-2900
AASHTO	American Association of State Highway & Transportation Officials 444 North Capitol Street NW, Suite 249 Washington, DC 20001 (202) 624-5800
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094 (248) 848-3700
ACPA	American Concrete Pipe Association 1303 West Walnut Hill Lane, Suite 305 Irving, TX 75038-3008 (972) 506-7216
AI	Asphalt Institute 2696 Research Park Drive Lexington, KY 40511-8480 (859) 288-4960
A.I.A.	American Insurance Associates 9514 4th Street NE, Suite 102 Lake Stevens, WA 98258 (425) 322-0999
AIHA	American Industrial Hygiene Association 7200 Prosperity Ave, Suite 250 Fairfax, VA 22031 (703) 849-8888
AISC	American Institute of Steel Construction One East Wacker Drive, Suite 700 Chicago, IL 60601-1802 (312) 670-2400

AISI	American Iron and Steel Institute 1140 Connecticut Ave, NW, Suite 705 Washington, DC 20036 (202) 452-7100
AITC	American Institute of Timber Construction 7012 S. Revere Parkway, Suite 104 Centennial, CO 80112 (303) 792-9559
ANSI	American National Standards Institute 1819 L Street, NW, 6th Floor Washington, DC 20036 (202) 293-8020
AOSA	Association of Official Seed Analysts Illinois Department of Agriculture Seed Lab Box 19281 Springfield, IL 62794-9281 (217) 785-8487
APA	American Plywood Association 7011 So. 19th Tacoma, WA 98466 (206) 565-6600
API	American Petroleum Institute 1220 L Street NW Washington, DC 20005-4070 (202) 682-8000
ASC	Adhesive and Sealant Council 7979 Old Georgetown Road, Suite 500 Bethesda, MD 20814 (301) 986-9700
ASPE	American Society of Plumbing Engineers 8614 Catalpa Avenue, Suite 1007 Chicago, IL 60656-1116 (773) 693-2773
ASTM	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 (610) 832-9500
AWS	American Welding Society 550 NW LeJeune Road Miami, FL 33126 (305) 443-9353

AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235 (303) 794-7711
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173 (847) 517-1200
FM	FM Global Research 743 Reynolds Road West Glocester, RI 02814 (401) 567-5000
ICC	International Code Council 4051 West Flossmoor Road Country Club Hills, IL 60478-5795 (800) 214-4321
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 1568 Carrollton, GA 30112 (508) 394-4424
IEC	International Electrotechnical Commission (Regional Center for North America) 446 Main Street, 16th Floor Worcester, MA 01608 (508) 755-5663
IEEE	Institute of Electrical and Electronics Engineers 3 Park Avenue, 17th Floor New York, NY 10016-5997 (212) 419-7900
IESNA	Illuminating Engineering Society of North America 120 Wall Street, Floor 17 New York, NY 10005 (212) 248-5000
IMSA	International Municipal Signal Association 165 East Union Street P.O. Box 539 Newark, NY 14513-0539 (315) 331-2182
LPI	Lightning Protection Institute P.O. Box 99 Maryville, MO 64468 (800) 488-6864

NAPA	National Asphalt Pavement Association 5100 Forbes Blvd. Lanham, MD 20706-4407 (301) 731-4748
NCMA	National Concrete Masonry Association 13750 Sunrise Valley Drive Herndon, VA 20171-4662 (703) 713-1900
NEC NECA	National Electric Code (from NFPA) National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814 (301) 657-3110
NEMA	National Electrical Manufacturers Association 1300 North 17th Street, Suite 1752 Rosslyn, VA 22209 (703) 841-3200
NFPA	National Fire Protection Association One Batterymarch Park Quincy, MA 02169-7471 (617) 770-3000
NPCA	National Paint and Coatings Association 1500 Rhode Island Avenue NW Washington, DC 20005 202) 462-6272
NSF	National Sanitation Foundation 789 N Dixboro Road P.O. Box 130140 Ann Arbor, MI 48113-0140 (734) 769-8010
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077 (847) 966-6200
PCI	Prestressed Concrete Institute 209 W. Jackson Boulevard #500 Chicago, IL 60606 (312) 786-0300
PDI	Plumbing and Drainage Institute c/o Sol Baker 1106 W. 77th Street, South Drive Indianapolis, IN 46260 (317) 251-6970

SSPC	The Society for Protective Coatings 40 24th Street, 6th Floor Pittsburgh, PA 15222-4656 (412) 281-2331
USGBC	U.S. Green Building Council 1800 Massachusetts Avenue NW, Suite 300 Washington, DC 20036 (202) 742-3792
UL	Underwriters Laboratories 333 Pfingsten Road Northbrook, IL 60062 (847) 272-8800
WRI	Wire Reinforcement Institute 942 Main Street, Suite 300 Hartford, CT 06103 (800) 522-4974
WSC	Water Systems Council 1101 30th Street NW, Suite 500 Washington, DC 20007 (202) 625-4387
W.W.P.A.	Woven Wire Products Association P.O. Box 610280 Birmingham, AL 35261-0280 (800) 529-6691

- E. Federal Government Agencies: Names and titles of federal government standard or Specification producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard or Specification producing agencies of the federal government. Names and addresses are subject to change and are believed to be, but are not ensured to be, accurate and up to date as of the date of the Contract Documents.

COE	Corps of Engineers (U.S. Department of the Army) Chief of Engineers - Referral Washington, DC 20314 (202) 272-0660
CFR	Code of Federal Regulations Available from the Government Printing Office N. Capitol Street between G and H Street NW Washington, DC 20402 (202) 783-3238 (Material is usually first published in the "Federal Register")

CS	Commercial Standard (U.S. Department of Commerce) Government Printing Office Washington, DC 20402 (202) 377-2000
DOT	Department of Transportation 400 Seventh Street SW Washington, DC 20590 (202) 366-4000
EPA	Environmental Protection Agency 401 M Street SW Washington, DC 20460 (202) 382-2090
FS	Federal Specification (from GSA) Specifications Unit (WFSIS) 7th and D Street SW Washington, DC 20406 (202) 472-2205 or 472-2140
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) Government Printing Office Washington, DC 20402 (202) 523-6091
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, DC 20402 (202) 783-3238
USDA	U.S. Department of Agriculture Independence Ave. between 12th and 14th Streets SW Washington, DC 20250 (202) 447-8732
USPS	U.S. Postal Service 475 L'Enfant Plaza SW Washington, DC 20260 (202) 268-2000
WSDOT	Washington State Department of Transportation Transportation Building KF-01 Olympia, WA 98504

1.04 GOVERNING AUTHORITIES/STANDARDS

- A. The Project Representative has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contractor shall notify the Project Representative prior to contacting authorities having jurisdiction directly for information and decisions having a bearing on the Work.
- B. In addition to other standards, water system work shall be in accordance with the latest versions of the Silverdale Water District (SWD) Design, Development and Construction Standards for Extensions to the Water System and the Special Provisions for the Construction Standards for Extensions to the Water System. Work shall conform to the 2021 edition of the International Building Code with State of Washington hereafter referred to as the IBC.
- C. Conflicting Requirements: Where compliance with two or more of the governing standards is specified, and the standards may establish different or conflicting requirements, the following descending order of precedence is established unless noted otherwise:
 - 1. HWD Design, Development and Construction Standards for Extensions to the Water System and the Special Provisions for the Construction Standards for Extensions to the Water System .
 - 2. International Building Code (IBC) 2021.
 - 3. FM Global.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 43 00
QUALITY ASSURANCE AND CONTROL

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Quality Control Plan.
 - 2. Quality assurance, including:
 - a. Qualifications.
 - b. Manufacturers field services.
 - 3. Quality control, including:
 - a. Source quality control.
 - b. Field quality control.

1.02 REFERENCES

- A. American Council of Independent Laboratories (ACIL): Procurement and Effective Practice of Construction Materials Engineering and Testing.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Quality Control Plan: Provide within 30 calendar days of Notice to Proceed:
 - 1. Statement of how the Quality Control Plan will operate.
 - 2. A supporting organization chart indicating the Contractor's staff responsible for implementation and management of the Quality Control Plan.
 - 3. Description of Contractor's staff responsibilities for management oversight of the Quality Control Plan activities.
 - 4. Description of how the Quality Control Plan will be coordinated with quality control activities of the Owner.
 - 5. Copies of key suppliers' and manufacturers' quality control plans and procedures, including suppliers of vaults, hot mix asphalt, concrete, structural steel, and manufactured aggregates.
 - 6. Provide copies of Contractor's, suppliers' and manufacturers' quality control forms.

- C. Contractor's Testing Agency qualifications and accreditations.
- D. Contractor's design engineer/consultant qualifications, registrations, licenses and accreditations.
- E. Submit Manufacturer's and Supplier's source quality control test results, verifying compliance with the Contract Documents, prior to delivering materials and products to the Project Site.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturers providing products for incorporation into the Project are to be principally engaged in the business of manufacture of products for the building construction industry.
2. Manufacturers shall follow detailed written quality control plans and procedures, including testing and inspection by qualified in-house or independent testing agencies, in the manufacture of their products.
3. Manufacturers of technical products and equipment are required to have knowledgeable, experienced technical representatives available for answering questions and performing other responsibilities as indicated and appropriate for the Work.

B. Supplier Qualifications:

1. Suppliers for products, material and equipment for incorporation into the Project are to be principally engaged in the business of supplying wholesale products for the building construction industry.
2. Suppliers of materials that produce such as aggregates, hot mix asphalt and concrete, shall follow detailed written quality control plans and procedures, including testing and inspection by qualified in-house or independent testing agencies, in the manufacture of their products.
3. Suppliers are required to be able to provide services to assist the Contractor in procurement of such quantities and volumes of materials, products and items necessary for the Work.
4. Suppliers are required to expedite and otherwise facilitate the availability of sufficient quantities and volumes of materials, products, and items necessary for the Work.

C. Fabricator Qualifications:

1. Fabricators providing assemblies, products, fabrications and other custom unitized construction elements are to be principally engaged in the production of such equipment for the building construction industry.
2. Fabricators constructing elements of the Project that are subject to structural requirements of the codes applicable to the construction are to employ skilled, experienced employees to perform the Work.
3. Fabricators employees are to be competent and able to perform the necessary Work in conformance with the requirements.

D. Installer Qualifications:

1. Installers performing work activities of the Project are to be principally engaged in the performance of work activities for the building construction industry.
2. Installers are to be competent, experienced, qualified and appropriately informed about the work activities required to be performed.
3. Installers are to be adequately supervised by a person able to direct, correct, and otherwise adjust the work activities in progress to meet the standards of the Work.

E. Contractor's Design Engineer/Consultant Requirements:

1. Provide the following for each licensed professional engineer and other licensed individuals or companies whose services the Contractor proposes to rely upon:
 - a. Name, address, telephone number, and complete contact information.
 - b. Identify work hours of individuals with responsibility to the Project.
 - c. Identify relationship to the Project.
2. Engineering:
 - a. Employ licensed Professional Engineers registered in the State of Washington, and acceptable to the Owner.
 - b. Engineers performing structural calculations under the precepts of the IBC are required to be licensed Structural Engineers in the State of Washington.
3. Surveyor:
 - a. In accordance with Section 01 71 23, "Surveying."

F. Manufacturers Field Services:

1. Require supplier, distributor, and manufacturer to provide qualified field personnel.
2. Field personnel are required to:
 - a. Prepare manufacturer's field reports.
 - b. Identify suitability of conditions to receive work and notify Contractor if conditions are not suitable.
 - c. Identify important aspects of installation unique to the product, installation, and Project.
 - d. Identify quality of workmanship issues.
 - e. Assist startup of equipment and systems.

1.05 SOURCE QUALITY CONTROL

A. Source Quality Control Procedures:

1. Maintain quality control over suppliers, manufacturers, products, materials, and services to produce products and materials for the Work in compliance with Contract Documents and industry standards at the source where those products and materials are produced and/or manufactured.
2. Contractor's Testing Agency: Contractor shall engage inspection and testing service agencies, including independent testing laboratories and manufacturer and supplier in-house testing and inspection services, which meet the recommended qualification requirements, including requirements in ASTM standards referenced in Procurement and Effective Practice of Construction Materials Engineering and Testing of the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
 - a. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State of Washington.
3. Owner may conduct its own sampling and testing at the source to verify quality and compliance with Contract Documents.

1.06 FIELD QUALITY CONTROL

A. Testing and Inspection Services:

1. The Owner will conduct its own independent testing and inspection for Work performed at the Project Site.
 - a. Refer also to Section 01 11 00, "Summary of Work," paragraph 1.04 B. for further discussion of Owner testing and inspection services.
2. Results of the Owner's testing and inspection shall be the primary source of information for determining acceptability of the Work.
3. The Owner's testing and inspection service does not relieve the Contractor of the responsibility for quality control testing and inspection of the Work, as identified in Section 01 11 00, "Summary of Work."
4. Procedures for Owner provided testing and inspection services will be an agenda topic at the Preconstruction Meeting identified in Section 01 30 00, "Administrative Requirements."
5. Owner and Contractor testing and inspection services will:
 - a. Comply with identified standards and record information that substantially represents conditions important to the determination of conformance to the named standards.
 - b. Keep written records.

- c. Protect samples and other items from situations and physical conditions to the degree possible to prevent or reduce the potential for false, inaccurate or irregular results.
 - 1) Do not jostle samples of mixes.
 - 2) Maintain appropriate curing conditions consistent with good practice, and the intent of the standards.
 - d. Use only molds, and other appurtenances appropriate to the named tests.
 - e. Identify test procedures and modifications of test procedures deemed more appropriate and better suited for the Work, in advance.
 - 1) Obtain concurrence of the Project Representative prior to testing and inspecting using standards other than as named.
6. Contractor shall provide secure storage containers to protect material samples.
7. Contractor shall be responsible for costs of additional samples and testing of samples to facilitate accelerated concrete form and shoring removal.
- B. Manufacturer Technical and Field Services:
- 1. Contractor shall require suppliers and manufacturers to provide qualified manufacturer technical and field personnel in accordance with the Specifications, and when directed to do so by the Project Representative.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Environmental Controls.
 - 2. Temporary Utilities.
 - 3. Temporary Facilities.
 - 4. Temporary Controls.
 - 5. Protection of cellular communications facility.
- B. Related Sections:
 - 1. Section 31 25 00, "Erosion and Sedimentation Controls."

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section.
 - 1. Revised Code of Washington (RCW) Section 46.61.655 Dropping Load, Other Materials – Covering.
 - 2. RCW Chapter 70A.200 Waste Reduction, Recycling, Model Litter Control Act.

1.03 DEFINITIONS

- A. Clean Surface Water:
 - 1. Surface water runoff from areas of the Project Site which were not disturbed during the Work of this Contract, including runoff from areas with plastic sheet covering.
 - 2. Construction runoff with turbidity and pH at an acceptable discharge level in accordance with the Project permits that is not defined as Sediment Laden Surface Water.
- B. Sediment Laden Surface Water: Surface water runoff with turbidity or pH levels exceeding discharge criteria that would otherwise be Clean Surface Water.
- C. Contaminated Sediment: All sediment removed from collected surface water runoff (other than Clean Surface Water) and Contaminated Surface Water, including construction dewatering generated water, shall be considered contaminated. Contaminated Sediment shall not be incorporated into the Embankment, fills and backfills on the construction site and shall be hauled to an approved disposal site as further defined below.

- D. Wastewater: All Contaminated Surface Water, all ground water, and construction dewatering generated water is defined as Wastewater for purposes of this Contract, and shall be collected, treated if necessary to meet discharge permit limits, and disposed off the Project Site.

1. Wastewater cannot be treated and discharged with other stormwater using the east slope stormwater discharge line.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Information regarding Owner's Required Construction Trailer if trailer differs from the specified requirements.
- C. Wastewater handling and disposal plan to address the requirements for wastewater management as defined below.

1.05 ENVIRONMENTAL CONTROLS

- A. Dust and Odor Control: Provide, install, and maintain dust and odor control measures in accordance with the requirements of this section.
- B. Ventilation of Confined Spaces: Provide ventilation in accordance with state and federal regulations.
- C. Noise Control: Do not exceed local noise ordinance limits.
 1. Verify work activities comply with the rules by taking measurements as necessary and when directed to do so by the Project Representative.
 2. Take measurements using an appropriate sound pressure meter, and at locations around the site acceptable to the Project Representative.
- D. Dewatering of Excavations:
 1. Maintain excavations free of standing water.
 2. Dispose of surface and ground water removed from excavations in accordance with the requirements of Section 31 25 00, "Erosion and Sedimentation Controls," as Contaminated Surface Water.

1.06 TEMPORARY UTILITIES

- A. The Contractor shall be responsible to arrange and pay all monthly utility charges in conjunction with the construction office trailers.
- B. The Contractor shall be responsible to coordinate with utility service providers and pay all connection charges associated with the Contractor's needs, including Owner construction office trailers, for utility services.

C. Electrical Power and Lighting:

1. Contractor is responsible for design and construction of the temporary electrical power distribution system. It needs to provide electrical power for construction and for operation of temporary systems such as the tire wash.
2. Do not use the existing RAGF power and lighting to perform Work within the Construction Limits.
 - a. Contractor may use a metered service from the existing RAGF electrical power service for the temporary construction offices provided that Contractor pays for the energy and connection costs and provided that such use does not interfere in any way with Owner's ongoing operations.
3. Notify the Project Representative 2 calendar days in advance of any planned outages regardless of when these might occur, and regardless of whether such outages may affect the progress of the Work.
4. Do not interfere with, disrupt, damage, or destroy power and lighting at the transfer station.

D. Water:

1. Provide water, and water distribution for performance of the Work, including but not limited to the following activities:
 - a. Dust and odor control.
 - b. Concrete placement.
 - c. Compaction activities.
 - d. Tire wash (if used).
 - e. Street sweeping.
 - f. Potable water to temporary construction offices.
2. Fire Protection:
 - a. Perform a review to determine the location and adequacy of the nearest fire hydrants and other useable water sources that may be relied upon in the event of a fire emergency.
 - 1) Supplemental water sources and fire protection measures required by the Kitsap County Fire Marshal after Contract Execution, and during the course of construction, shall be arranged and paid for by the Contractor.
 - b. Review with the Kitsap County Fire Marshal the Contractor's contingency plan to facilitate fire department personnel and equipment access to the site during a fire emergency.

- c. Maintain within the Construction Limits supplementary equipment the Kitsap County Fire Marshal deems necessary to be made available to the fire department personnel in the event of a fire emergency.
- 3. Water Service to Existing Scale Facility:
 - a. Maintain water service to the existing RAGF until scale facility operations are relocated to the new scale facility.
 - 1) Provide temporary piping connections if necessary as the Work progresses.
 - b. Do not disrupt water service to the scale facility at any time during station operating hours.
- E. Wastewater Controls:
 - 1. There are no connections to sanitary sewer utility mains available on or near the Project Site, or within the vicinity of the RAGF.
 - 2. Contractor's Collection, Handling, Hauling and Disposal Activities:
 - a. The Contractor shall be responsible for the collection, handling, hauling, discharge and disposal of Wastewater and Contaminated Sediment, as defined in this section, generated within the Construction Limits and running onto the Project Site.
 - b. Collect, treat if necessary to meet discharge permit requirements, temporarily store, haul and discharge Wastewater and Contaminated Sediment generated within the Construction Limits to offsite facilities approved by the Washington State Department of Ecology, Kitsap County Public Health, and in accordance with applicable rules and regulations.
 - 1) Wastewater discharged shall not contain solids capable of settling exceeding 7 milliliters per liter as measured by using the Imhoff cone test by the Project Representative.
 - 2) The Contractor will be responsible for payment of applicable local fees associated with each of the approved discharge locations.
 - 3) The Contractor shall meter all Wastewater during the filling of tanker trucks.
 - 4) Written records shall be provided to the Owner at the end of each working day. These records shall include the following information:
 - a) Date and time of each discharge into the sanitary system.
 - b) Amount of water disposed of at each approved discharge point. The volume of each tanker load shall be listed separately and shall include the name of the driver of the tanker truck.
 - 5) Haul routes on the Project Site shall be maintained to allow hauling to occur during night time and extreme rain and winter weather.

- c. Design and Provide Contaminated Sediment collection areas and Wastewater storage tanks for the purposes of removal of Wastewater and sediment from the Construction Limits.
 - 1) Contaminated Sediment collection areas shall be continuously accessible by the Contractor's off-road equipment in all weather conditions.
 - 2) Locations of Contaminated Sediment collection areas must be reviewed by the Project Representative prior to installation, and relocation.
 - 3) The Contractor shall at its expense maintain the Contaminated Sediment collection areas and remove, handle, haul and dispose of Contaminated Sediment to an approved solid waste disposal facility approved by the Washington State Department of Ecology, Kitsap County Public Health, AND in accordance with applicable rules and regulations.
- d. The Contractor shall provide its own Wastewater storage tanks, if necessary, of sufficient capacity within the Construction Limits.
 - 1) Contractor supplied wastewater storage tanks shall be continuously accessible by the Contractor's over-the-road vehicles in all weather unless pumping is used for decanting tanks.

F. Surface Water Controls:

- 1. Refer to Section 31 25 00, "Erosion and Sedimentation Controls."
- 2. All collected Clean Surface Water shall be routed through appropriate detention and treatment facilities.
- 3. Contractor is responsible for maintenance and cleaning of the detention and treatment vaults, including the filters, until Final Acceptance.

G. Communications:

- 1. Provide a DSL or cable internet connection for communications to the Owner's construction trailer.
- 2. The Contractor shall be responsible to pay for the communication services through Final Acceptance.

1.07 TEMPORARY FACILITIES

- A. Access Roads and Parking: Comply with the requirements of the Owner-provided Traffic Management Plan indicated on the Drawings and as described in Section 01 55 26, "Traffic Controls."
- B. Staging Areas: Stage only as indicated on the Drawings, and/or at any Contractor provided areas on or off the Project Site as allowed by law and in a manner which does not impact Owner transfer station operations.

- C. Stockpiles: Stockpile only at Contractor-provided areas on or off the Project Site as allowed by law and in a manner which does not impact Owner's RAGF operations.
 - 1. Cover stockpiles inside the Project Site in accordance with Section 31 25 00, "Erosion and Sedimentation Controls."
- D. Temporary Haul Roads: Design, construct, and maintain temporary haul roads needed for site work to protect the permanent subgrade from damage, to control dust, and to minimize sediment laden runoff.
- E. Required Construction Office Trailers:
 - 1. Provide a minimum of two complete, unitized construction trailers in good condition, including automatic air conditioning and heating units, office lighting, convenience outlets, perforated metal stairs and railings, ADA compliant access ramps, two exterior doors each trailer, boot scrapers, and washable rubber walk mats at each door, and exterior intrusion alarm for each trailer with interior keypad.
 - a. One trailer is for the Owner's use and one trailer is for Contractor's use.
 - b. The Owner's trailer shall not be less than 400 square feet in useable floor area.
 - c. Trailer Security:
 - 1) Provide hasp-style supplementary locks on trailer doors.
 - 2) Provide unique locks and keys for each trailer.
 - 3) Provide an additional lock and key unique to the Owner's office, and provide all keys to this lock to the Project Representative.
 - 4) Provide pest screen and security grilles or security bars on windows of the trailers.
 - d. Provide weekly janitorial service, trash removal service, cleaning, vacuuming, including ample supply of drinking water, toilet paper, paper towels, disposable toilet seat covers, and liquid soap from Mobilization until Final Acceptance.
 - 1) Maintain and provide uninterrupted stocking of all these materials, and in sufficient quantity and replenishment such that all products are continuously available.
 - e. Provide and pay for Owner's construction trailer through Final Acceptance.
 - 2. Additional Requirements for Contractor's Required Construction Office Trailer(s):
 - a. As required for Contractor's needs including project meetings in a common space accommodating not less than fifteen people seated.
 - b. Provide wall racks and shelves to contain Contract Documents including returned submittal and other documents for reference use in meetings and conferences.
 - c. Provide the Contractor's own equipment indicated in Section 01 30 00, "Administrative Requirements."

3. Additional Requirements for Owner's Required Construction Office Trailer:
- a. The Owner's trailer will be used to house the Project Representative, and Construction Manager personnel and items.
 - b. Configure the unit with two offices and commons area. Each office shall be at least 80 square feet
 - c. Provide a meeting room in the middle of the trailer that is essentially an open area for use by several people.
 - d. Provide vinyl flooring throughout.
 - e. Provide stairs into each exterior door, and provide one ADA accessible, slip-resistant, all-weather ramp with handrails and guardrails.
 - f. Each office is to have at least one window.
 - g. Include in the meeting room a five shelf, heavy duty steel or wood bookcase with 36-inch width and 15-inch depth for storage of required reference standards necessary at the work site, in accordance with Section 01 42 19, "Reference Standards."
 - h. Assist the Owner's activities related to installation and move-in.
 - i. Provide two desks with file drawers, and two office chairs of a medium quality level with fabric upholstery, adjustable arms, wheels, seats and backs; used and rental furniture is acceptable provided it meets the acceptance of the Project Representative.
 - j. Provide a post-base drafting table with tilt function, with dimensions 42 inches by 60 inches.
 - k. Provide a drafting chair with extended seat height of a medium quality level with fabric upholstery, adjustable arms, wheels, seat and back; used and rental furniture is acceptable provided it meets the acceptance of the Project Representative.
 - l. Provide two wall-mounted plan racks, one for 36- by 48-inch size drawings and one for 24- by 36-inch size drawings, accommodating not less than twelve sets of plans each.
 - m. Provide one meeting tables with dimensions 3 feet by 8 feet, with folding, locking legs.
 - n. Provide eight stacking side chairs with fabric seats and backs.
 - o. Provide two five-drawer locking file cabinets with 36 inches width for use with legal size paper.
 - p. Provide two full-length shelves with 12-inch depth; support each shelf with four brackets designed to support 125 pounds each; install shelves from wall to wall; locate one shelf in each office.

- q. Provide six coat hooks, and an overhead shelf not less than 4 feet in length mounted at 80 inches AFF for purposes of Owner's hard hat storage, located near the entrance door.
 - r. Provide one refrigerator with freezer with size 18 cubic feet.
 - s. Provide one refrigerated water cooler with water delivery service using bottled water.
 - t. Provide one multifunction copier with print, copy scan, and fax functions installed. Copier shall have the following capabilities.
 - 1) Support color impressions and scanning.
 - 2) Support SMB and FTP scanning protocols.
 - 3) Minimum of paper sizes letter, legal, and 11 inch by 17 inch (11x17).
 - 4) Minimum speed for automatic document feeder shall be thirty-five pages per minute.
 - 5) Minimum speed for printing, copying, and scanning shall be 35 pages per minute.
 - 6) Finishing with stapling and collating.
 - u. Check, balance, adjust, and maintain the HVAC unit required for the Owner trailer at a minimum every 6 months.
- F. Parking: Include one American Disabilities Act (ADA) compliant parking stall accessible to the Owner's construction office trailer.
- G. Sanitary Facilities: Provide the following facilities, items, services and supplies, as a basic requirement solely for use of Contractor's and Owner's staff assigned to the required construction office trailers.
- 1. Provide sanitary and wash-up facilities in trailers or as separate facilities.
 - a. Provide one trailer-type temporary sanitary trailer with not less than four toilets and two sinks;
 - b. Provide a single additional lockable ADA accessible sani-can or portable toilet unit as a basic requirement beyond what the Contractor would determine for itself;
 - 1) Provide an external hand washing station utilizing fresh water, and stocked with paper supplies and handwashing detergent.
 - 2. Clean the facilities and provide service once per week.
- H. Project Signs:
- 1. Provide OSHA and WISHA accident prevention and warning signs in prominent locations per those regulations.

2. Provide one project identification sign as follows:
 - a. The sign shall be 8 feet wide by 4 feet high and shall conform to the letter sizes and styles, materials of construction, and project-specific mounting requirements of Section 10 14 10, "Site Signage."
 - b. The sign shall have a white background. The letters shall be black.
 - c. The sign shall consist of the following information:
 - 1) Kitsap County name and logo.
 - 2) Project Title.
 - 3) Contract Number.
 - 4) Contractor Name.
 - 5) Construction Manager Name.
 - 6) A/E Representative Name.
 - d. The sign shall be installed at the start of the site work and shall be removed after Substantial Completion.
 - e. A shop drawing for the sign shall be submitted to the Project Representative for review, prior to manufacture of the sign.
 - f. Place the sign near the existing site entrance in a location that will not be obscured during the workday when vehicles are using the main gate for access to and from the Project Site. The location shall be determined in consultation with the Project Representative.
3. Advertising signs are not permitted at the site.
4. Signs which identify the Contractor organization and security services at the site are permissible.

I. Designated Smoking Area:

- a. Smoking is prohibited on the Project Site.

1.08 TEMPORARY CONTROLS

A. Temporary Construction and Construction Aids:

1. Temporary construction and construction aids shall be of the Contractor's own design.

B. Traffic Management:

1. Comply with the Owner-provided Traffic Management Plan indicated on the Drawings and specified in Section 01 55 26, "Traffic Controls," and as modified by Contractor submittal.

- C. Vehicle Access and Parking: Comply with the requirements of the Owner-provided Traffic Management Plan indicated on the Drawings and specified in Section 01 55 26, "Traffic Controls."
- D. Temporary Barriers and Enclosures: Provide temporary barriers and enclosures as necessary to prevent accidents and injury.
- E. Security:
 - 1. Protect the Project Site from vandalism, trespass and neglect during progress of the Work.
 - 2. Contractor shall not rely on Owner's operations staff to provide security for the Project Site.
 - 3. Coordinate with Project Representative on methods to secure the Project Site.
 - 4. Provide continuous temporary fencing and signage where necessary for the safety of the public using the transfer station operating area.
 - 5. Notify the Project Representative in the event an unauthorized entry into the Project Site, or vandalism occurs to the Contractor's or Owner's property during the Project.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Dust Control Measures:
 - 1. Provide and install plastic piping, hoses, fittings, valves, sprinkler heads, watering truck, pumps, and ancillary items and equipment of the Contractor's own design for a complete, adjustable, temporary dust control system meeting the requirements of this section.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Installation of Dust Control Measures:
 - 1. Install and utilize dust control measures in concert with erosion control measures identified in Section 31 25 00, "Erosion and Sedimentation Controls."
 - 2. Employ dust control measures when directed by the Project Representative to do so.
 - 3. Move, or otherwise adjust the dust control measures on a regular basis to respond to changing needs and work locations.
- B. Contractor is responsible to locate, relocate during the course of the Work, and pay for all preparation necessary for placement of temporary construction offices and other support facilities, including earthwork, grading, utility connections, gravel surfacing, and restoration.
 - 1. Locations for temporary construction offices shall be coordinated with and approved by the Project Representative.

3.02 APPLICATION

- A. Operation of Dust Control Measures:
 - 1. Employ clean water for dust control measures.

3.03 RESTORATION

- A. Remove and uninstall temporary utility connections when the connections and services are no longer necessary.
- B. Restore utility systems to their original condition.

3.04 CLEANING

- A. Construction Office Trailers:
 - 1. Empty refuse cans, sweep, vacuum, and dust at least weekly and more frequently as necessary.
 - a. Schedule cleaning to occur at times convenient and acceptable to the Owner.
 - 2. Replace spent light bulbs with like kind.
 - 3. Maintain air filters in a clean condition.
 - a. Change filters not less than once every 6 months to provide clean air into the trailers.
- B. Maintain Project Site in a clean orderly condition and free from waste, debris, rubbish and similar materials.
- C. Prevent materials from escaping from vehicles by using appropriate securing methods.
 - 1. Cover and/or secure all loads in accordance with the requirements of RCW 46.61.655 and RCW 70A.200
- D. Clean vehicles in appropriate ways prior to vehicles leaving the site.
 - 1. All vehicles leaving the Project Site shall pass through the Tire Wash.

3.05 PROTECTION

- A. Protect work of this section from damage, deterioration, theft, destruction, and loss as required by the Contract Documents.
- B. Protect existing structures, property, cultivated and planted areas, and other surface improvements.
- C. Assess and protect subsurface utilities and improvements.
- D. Provide shoring, bracing, or other Work necessary to protect structures and improvements.

- E. Provide protection and special requirements identified elsewhere in the Contract Documents.
- F. Repair or replace damaged structures, pavement, improvements, utilities, materials and equipment to a condition equivalent to the condition prior to the damage, unless otherwise instructed by the Project Representative. All such remedial activities shall be at the Contractor's expense.

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Traffic controls.
- B. Related Sections:
 - 1. Section 01 11 00, "Summary of Work."

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:
 - 1. American Traffic Safety Services Association – Quality Guidelines for Work Zone Traffic Control Devices.
 - 2. USDOT Federal Highway Administration (FHWA) – NCHRP 350 Report – Recommended Procedures for the Safety Performance Evaluation of Highway Features.
 - 3. USDOT Federal Highway Administration – Manual on Uniform Traffic Control Devices 2009 Edition with Revisions 1, 2, and 3 and including Washington State modifications.
 - 4. Washington State Department of Transportation (WSDOT) Standard Plans Manual.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Manufacturer's Product Literature:
 - 1. Trailer-Mounted Dynamic Changeable Message Signs.
- C. State of Washington traffic flagger certification cards.

1.04 OWNER-PROVIDED TRAFFIC MANAGEMENT PLAN

- A. Comply with the requirements of the Owner-provided Traffic Management Plan indicated on the Drawings.
- B. In the event modifications to the Owner-provided Traffic Management Plan are desired by the Contractor, after execution of the Contract, comply with the following procedure for review by the Project Representative:
 - 1. Submit a written request to modify including the following:
 - a. The reasons for the proposed modification.
 - b. The proposed modification.
 - c. The effects of proposed modification on execution of the Work, if any.
 - d. Include drawings or sketches showing the proposed modifications to the Owner-provided Traffic Management Plan.
 - e. Comply with written directions given by the Project Representative.
 - f. Contractor requested changes to the Owner-provided Traffic Management Plan shall be made at no change to the Contract Price or Contract Time.
 - 2. Changes to the Owner-provided Traffic Management Plan require the review of the Project Representative.

1.05 TEMPORARY CONTROLS

- A. Ingress and Egress to Project Site:
 - 1. Accomplish ingress and egress with as little disruption to traffic as possible.
- B. Install traffic control devices oriented in the direction of traffic flow.
 - 1. At all times during performance of the Work, the Contractor shall manage traffic control activities with its own staff actively involved in the planning and management of the Work and shall be responsible for field implementation of the Owner-provided Traffic Management Plan, and any approved modifications.
 - a. The Contractor's Traffic Control Supervisor designees shall carry current flagging cards issued by the State of Washington.
 - b. The Contractor shall provide 24 hour telephone numbers where the Contractor's Traffic Control Supervisor designees can be reached.
 - c. The Traffic Control Supervisor shall not be subcontracted.

2. Provide adequate labor, sufficient signs and traffic control devices required to perform the traffic controls in accordance with the requirements of the Owner-provided Traffic Management Plan and for protection of the public, the Owner's property, and the Work.
3. Flagging and Flaggers:
 - a. Provide flaggers, and other personnel required for traffic control activities, except as noted below.
 - 1) Flaggers within the existing transfer station boundary shall be provided by the Owner.
 - 2) Contractor shall provide 7 calendar days' notice to Project Representative of the need for Owner-provided flaggers.
 - b. Provide safe, protected locations for flaggers to work from, and in accordance with the Health and Safety Plan.
 - c. Flagging performed in darkness shall be accompanied by sufficient lighting illumination for the flagging stations.
4. Signage: Provide signage in accordance with the Drawings.

1.06 QUALITY ASSURANCE

- A. Traffic control measures not in conformance with the requirements as determined by the Project Representative shall be corrected by the Contractor within 12 hours, at no additional cost to the County.
- B. The Contractor shall be responsible to monitor and maintain traffic control measures, including but not limited to:
 1. Resetting traffic cones and mislocated devices.
 2. Assuring visibility of all devices.
 3. Cleaning and repairing devices.
 4. Maintaining equipment.
 5. Replacing batteries and lamps.
 6. Adjusting devices to suit conditions.
 7. Accommodating vehicle queue conditions and lengths.
- C. Contractor's Traffic Control Supervisor's Duties:
 1. The Traffic Control Supervisor designees shall be required to expeditiously correct any deficiency, and or shortage of resources, when directed by the Project Representative to do so, at no additional cost to the Owner.

2. The Traffic Control Supervisor designees are responsible to ensure that all other persons performing traffic management have current flagger cards issued by the State of Washington.
3. The Traffic Control Supervisor shall maintain copies of the following references, readily accessible during performance of work activities:
 - a. The Owner-provided Traffic Management Plan, together with all approved modifications.
 - b. Copies of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD), including Washington State modifications.
 - c. A copy of the latest edition of "Quality Guidelines for Work Zone Traffic Control Devices."
4. Inspect traffic control devices, lighting, and signage for proper location, installation, message, cleanliness, and effect on the public, users, and others.

D. Flaggers:

1. Flaggers shall carry current flagger cards issued by the State of Washington.
2. Flaggers shall wear approved personal protection equipment including but not limited to hard hats and reflective vests.
3. To increase visibility during hours of darkness, flaggers shall wear either white coveralls (dry weather) or yellow raingear (wet weather) as appropriate for weather conditions.
4. Flaggers shall carry two-way radios, with batteries and range compatible with the Project, and shall have continuous and direct contact with Traffic Control Supervisor.
5. Flaggers shall carry Stop/Slow paddles.

- E. Additional Personnel: In addition to the personnel set forth above, Contractor shall add additional personnel which it believes is necessary to provide traffic safety at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Construction Signs: Provide where indicated on the Drawings.
- B. Barricades: Where barricades are used, the only acceptable means of weighting shall be with bags of sand that will rupture upon impact, weighing 40 pounds or less, and positioned not more than 1 foot above the ground surface.
- C. Traffic Drums: Shall be used or new, weighted to resist overturning, and of consistent configuration and profile to promote visual recognition in variable lighting and weather conditions.

- D. Jersey Barrier: Shall be Type 2 concrete barrier as shown on WSDOT Standard Plan C-8.
- E. Trailer-Mounted Dynamic Changeable Message Signs: Provide where indicated on the Drawings.
1. Comply with MUTCD Sections 2A.07, 2E.21, 6F.02 and 6F.55.
 2. Trailer-mounted, self-contained with battery power and solar panel battery charging capability.
 3. LED technology.
 4. Changed manually.
 5. Message: To be determined in consultation with Project Representative and changed to suit changing conditions at the Project Site.
 6. Manufacturers:
 - a. Aesys, www.aesys.com.
 - b. Adaptive Displays.
 - c. 13Axent, <https://axent.com.au>.
 - d. Ver-Mac, <https://www.ver-mac.com>.
 - e. WiPath, <https://wipathcommunications.com/>.
 - f. Or Approved Equal.
 7. Trailer-mounted signs remain the property of the Contractor and shall be removed not later than 15 calendar days following the Owner's issuance of the Certificate of Substantial Completion for Milestone 3.
- F. Traffic Cones: Where employed, stack multiple cones together to resist relocation and upset by wind.
- G. Warning Lights and Flashers: Provide where necessary to avoid accident or injury and ensure safety.
- H. Provide Category 1, 2, and 4 work-zone devices including equipment fitter with approved devices in accordance with MUTCD.
1. Category 1: Small, lightweight, channelizing, and delineating devices are required for this Project.
 2. Category 2: Barricades, portable sign supports, signs, and vertical panels; all meeting NCHRP 350 are required for this Project.
 3. Category 4: Portable and trailer-mounted dynamic signs, area lighting supports, and portable changeable signs are required for this Project.
- I. Category 3 hardware and equipment are not part of this Project.

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Product delivery, storage and handling requirements.
 - 2. Products submitted as “Or Approved Equal.”
 - 3. Substitution procedures prior to submission of proposals.
 - 4. Substitution procedures after Contract Execution.
 - 5. Products.

1.02 REFERENCES

- A. National Fire Protection Association (NFPA) Standards.

1.03 DEFINITIONS

- A. Approved Equal: A material, product, equipment, or process proposed by the Contractor that has the same function, quality, durability, appearance, strength, and design characteristics Equal To or better than those originally specified in the Contract Documents; and shall be compatible with all other systems, parts or components of the Project and Work under the Contract.
- B. Assembly: Two or more products, materials or components that are utilized together to produce a composite application that satisfies a set of requirements.
 - 1. Examples of Assemblies in these Contract Documents:
 - a. Standing seam metal roofing.
 - b. Metal wall panels.
- C. Equal To: A material, product, equipment, or process proposed by the Contractor being the same, or identical in value, and having no variance in proportion, structure, quantity, measure, or nature than those originally specified in the Contract Documents.
- D. Manufacturer: The entity or firm that produces, manufactures or assembles a material, product or item of equipment incorporated in the Work. “Vendor” and “supplier” are used interchangeably with “manufacturer.”
 - 1. Manufacturers specifically named in Division 2 through 40 specification sections are believed to have the capability of producing products, assemblies and/or systems that meet the requirements of the Contract Documents. Proposing a product, assembly or

system produced by one of the named manufacturers does not relieve the Contractor of the responsibility to demonstrate that the proposed product, assembly or system meets the requirements of the Contractor Documents.

- E. Manufacturer's Technical Representative: The person or persons designated by the Manufacturer as its representative(s) and technical authority(s) who is/are knowledgeable about and able to answer technical questions about the manufacturer's products, equipment and services.
- F. Manufacturer's Instructions: Written instructions and recommendations provided by the product manufacturer regarding the use, installation, preparation of Work to receive the product, or similar written guidance that is to be followed by the installer and provided as part of the product submittal or by the manufacturer's field representative.
 - 1. Manufacturer's Instructions provided by the manufacturer's field representative are subject to review and approval of the Project Representative.
- G. Qualified Professional Engineer: A Professional Engineer who is legally authorized to practice in Washington State (licensed) and who is experienced in providing engineering services related to a specific system, assembly or product proposed by the Contractor to meet the requirements of the Contract Documents.
 - 1. For systems, assemblies, or products that are structural in nature and performance, the Qualified Professional Engineer shall be a licensed structural engineer.
- H. System: Equipment of an electrical and/or mechanical nature that requires some form of energy input to operate and produce a useful result.
 - 1. Examples of Systems in these Contract Documents:
 - a. HVAC equipment.
 - b. Standby Engine Generator.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Substitution Requests:
 - 1. Submit the Substitution Request Form at the end of this section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Arrange deliveries of items in accordance with the Project Schedule identified in Section 01 32 13, "Scheduling."
2. Deliver products in undamaged condition.
 - a. Deliveries are to be made in manufacturer's original packaging, with seals and labels intact.
 - b. Inspect deliveries immediately to ensure compliance with requirements of the Contract Documents and approved submittals.
 - c. Ensure that products are properly protected.

B. Store products, items, materials and equipment as follows:

1. Seals and labels are to remain intact until such time protective coverings are removed.
2. Protective covers must remain in place until items are prepared for installation.
 - a. Remove and replace protective covers which get wet, or are otherwise damaged to the degree that leaving the protective covers in place threatens the integrity of the item.
3. Store products susceptible or subject to damage by the elements in weathertight enclosures.
4. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
5. Do not allow storage of combustible materials inside enclosed spaces except when allowed in accordance with applicable NFPA Standards, and the Kitsap County Fire Marshal.
6. Exterior Storage:
 - a. Store fabricated products above ground.
 - 1) Position on blocking or skids.
 - 2) Prevent soiling, staining, and other damage.
 - 3) Cover products subject to deterioration using impervious sheet coverings.
 - 4) Provide adequate ventilation to prevent formation of condensation.
 - b. Store loose granular materials in well-drained areas, and on solid unyielding surfaces.
 - 1) Prevent mixing and contamination with foreign matter.
7. Arrange storage to allow for unimpeded periodic inspection.

C. Safety Data Sheets:

1. The Contractor is responsible for interpretation of information contained in Safety Data Sheets (SDS).
2. Do not submit or send Safety Data Sheets for review unless specifically requested by the Project Representative. Remove SDS sheets from submittals prior to transmittance.
3. Submit SDS sheets when required for demonstration of sustainability objectives being met.

D. Protection:

1. Protect items after installation.
 - a. Protect structures and Work from damage through Owner issuance of Certificate of Substantial Completion.
 - b. Protect against traffic damage.
2. Repair or replace damaged items, products, materials and, equipment.

1.06 SUBSTITUTIONS

A. General:

1. Substitution Requests shall comply with the following.
 - a. Substitution Requests prior to the submission of Proposal are to be performed in accordance with instructions contained in the Request for Proposals.
 - b. Substitution Requests after Contract Execution are to be performed in accordance with requirements of this section.

B. Substitution of items, materials, and processes:

1. Products for the Project are specified “Or Approved Equal” unless identified otherwise in this section.
 - a. It is the Contractor’s responsibility to demonstrate to the Project Representative’s satisfaction that the products being proposed are Approved Equals to the products identified in the Contract Documents.
 - 1) All substitutions shall be accompanied with documentation that indicates the pertinent environmental performance criteria of the substitute material are equal or superior to the specified material.

- b. The Project Representative will not unreasonably withhold acceptance of an approvable equal product.
 - 1) Decisions of the Project Representative regarding substitutions are final and not subject to appeal.
 - 2) Do not assume acceptance at any time prior to written acceptance in a submittal response prepared by the Project Representative.
 - c. Lack of complete information, defective information, or other problem associated with Available Information for a named product does not relieve the Contractor of the responsibility to demonstrate the approvability and equal-ness of an "Or Approved Equal" product for the intended application or purpose.
2. Submit the same required information for products that are being proposed by the Contractor as Approved Equal, as would be required for the named items, materials and equipment.
- C. Substitution Requests after the Contract Execution:
- 1. Submit a completed Substitution Request Form with the associated submittal information for the material, product, equipment, or process.
 - a. Fill out the form included in this section fully and completely.
 - b. The Contractor's Representative shall sign the document.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All material, products, and equipment incorporated in the completed Work shall be new and acceptable for the use intended except where reuse of materials, products, and equipment is specifically indicated in the Contract Documents.

PART 3 – EXECUTION

3.01 GENERAL

- A. All material, products and equipment incorporated in the completed Work shall be installed in accordance with the manufacturer's instructions unless such instructions are contrary to the requirements of the Contract Documents as determined by the Project Representative.

SECTION 01 60 00 SUBSTITUTION REQUEST FORM

DATE: _____

CONTRACT FOR SILVERDALE RECYCLING AND GARBAGE FACILITY

_____ hereby submits for Kitsap County's
(NAME OF CONTRACTOR)
consideration the following item instead of the specified item for the above project:

<u>SECTION</u>	<u>PARAGRAPH</u>	<u>SPECIFIED ITEM</u>

PROPOSED SUBSTITUTION: _____

Provide product data sheets, manufacturer's written installation instructions, drawings, details and similar information to demonstrate the Contractor's proposed substitution is an Approved Equal. Where answers require additional space, provide information on additional attached pages. Fill in blanks below:

State differences between proposed substitution and specified item. Differences include but are not limited to interrelationship with other items; materials and equipment; function; utility; life cycle costs; applied finishes; appearance; and quality.

Demonstrate how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract.

What effect does the proposed substitution have on dimensions indicated on the Drawings and previously reviewed Shop Drawings?

What effect does the proposed substitution have on the construction schedule and Contract Time?

What effect does the proposed substitution have on the Contract Price? This includes all direct, indirect, impact and delay costs.

Manufacturer's guarantees of the proposed and specified items are:

_____ Same _____ Different (explain on attachment)

The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.

Submitted by:

For use by Project Representative:

Contractor's Signature

Accepted _____ Accepted as Noted _____

Not Accepted _____ Received Too Late _____

Firm

By _____

Address _____

Date _____

Remark _____

Date _____

Telephone _____

A/E Representative Remarks on Substitution: _____

END OF SECTION

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SECTION 01 70 00
EXECUTION REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes the following:

1. Examination.
2. Installation.
3. Construction.
4. Tolerances.
5. Site Restoration.
6. Cleaning.
7. Protection.

1.02 REFERENCES

A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:

1. Revised Code of Washington (RCW) – Chapter 19.122.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXAMINATION

A. The Contractor shall require the subcontractors, suppliers, and installers of each element of the Work to perform a detailed inspection of work conditions prior to its performance of Work.

1. Inspect substrates, quality of work, conditions of the work area, and activities associated with adjacent and concurrent work by others.
2. Review all Contract Documents, RFI responses, Changes to the Work, Shop Drawing reviews.

B. Contractor and its subcontractors, suppliers, and installers shall not proceed with Work until unsatisfactory conditions are remedied.

1. Beginning work constitutes acceptance of conditions.

C. Contractor Responsibilities for Existing Underground Conditions, Utilities, Structures, and Improvements:

1. Certain Available Information and Drawings provided by the Owner indicate existence of underground conditions, obstructions, utilities, structures, and improvements known to the Owner prior to execution of the Contract, which are within the Construction Limits.
 - a. Review and verify the Available Information and Drawings prior to performing Work adjacent, above or otherwise potentially affecting underground conditions, obstructions, utilities, structures, and improvements.
 - b. Immediately notify the Owner of conditions which are not as indicated within the Available Information and Drawings.
2. Coordinate efforts to locate existing underground utilities.
 - a. Follow procedures of Chapter 19.122 RCW.
3. Examine, mark and record location of existing underground utilities, structures and improvements prior to commencing other Work activities.
4. Repair or replace any underground utilities, structures or improvements which are damaged or destroyed or rendered unusable by actions caused by or arising from the performance of Work by the Contractor.

D. Contractor Responsibilities for Existing Above-Grade Utilities:

1. The Contractor shall be responsible to coordinate its work activities around existing above-grade utilities, e.g., meters, light poles, electrical lines, transformers.
2. In the event the Contractor elects to adjust, move or relocate existing above-grade utilities, the Contractor shall obtain the approval of the Project Representative or Owner, and furnish information necessary, 14 calendar days prior to making such adjustments or relocations.
3. The Contractor shall be responsible for costs associated with its decision to adjust, move, or relocate existing above-grade utilities.
4. No additional costs shall be paid by the Owner if the Contractor elects to make such adjustments or relocations.

3.02 INSTALLATION

A. General:

1. Provide all attachments, connection devices, and accessory components necessary for the completion and physical attachment and support of the Work.
2. Comply with requirements of regulatory agencies and authorities having jurisdiction for bracing, restraints, supports, and attachments.

B. Install equipment, products, coatings, materials, and finishes in accordance with the Contract Documents and manufacturer's written installation instructions.

1. In the event there is a conflict or inconsistency between the Contract Documents and manufacturer's written installation instructions, promptly inform the Project Representative of such issue through a Request for Information.

C. Work Results:

1. Install components, products, materials, equipment, and other items, and assemblies, only during appropriate weather conditions for that Work.
2. Coordinate installation activities such that these activities do not subject unfinished Work to adverse weather, cold temperatures, or other conditions detrimental to the Work.

3.03 CONSTRUCTION

- A. All construction means and methods, and any specialized techniques, employed or selected by the Contractor in the performance of the Work are the sole responsibility of the Contractor.
- B. The Contractor's work shall be coordinated to correctly interface, fit and come together with adjacent surfaces and utility structures, roadway surfaces, and grades.

3.04 TOLERANCES

A. Preconstruction Conditions:

1. Variation from Owner-provided survey elevations as indicated on the Drawings: Plus or minus 3 inches.
2. Variation from Owner-provided survey horizontal locations as indicated on the Drawings: 3 inches in any direction.
3. Variations of preconstruction conditions from Owner-provided survey elevations and horizontal locations less than the stated 3 inch tolerances shall not entitle the Contractor to an adjustment in Contract Price.

B. Substantial Completion Conditions:

1. Earthwork and Paving:
 - a. Conform to the grades and contours indicated on the Drawings.
 - b. Deviation from Scheduled Compacted Thickness: Plus or minus 1/4 inch.
 - c. Variation from Design Elevation: Plus or minus 1 inch.
 - d. Variation from Design Horizontal Location: 1 inch in any direction.

2. Retaining Walls:

- a. Deviation from Design Elevation: Plus or minus 1 inch.
 - b. Variation from Design Horizontal Location: 1 inch in any direction.
 - c. Variation in Plumb: 1/2 of one 1%.
- 3. Buildings and Building Elements:
 - a. Deviation from Design Elevation: Plus or minus 1/2 inch.
 - b. Variation from Design Horizontal Location: 1/2 inch in any direction.
 - c. Variation in Plumb: 2/10 of 1%.
- 4. Anchor Bolts, Base Plates and Concrete Embeds:
 - a. Deviation from Design Elevation: Plus or minus 1/2 inch.
 - b. Variation from Design Horizontal Location: 1/16 of an inch in any direction.
- 5. Utility Systems:
 - a. Deviation from Design Elevation: Plus or minus 1/2 inch.
 - b. Deviation from Design Horizontal Position: Plus or minus 1 inch.
 - c. Deviation from Design Pipe Slope (gravity lines only): Plus 1/2 or minus 0 inch per foot.
- 6. Review other sections for additional tolerance information. More stringent tolerances in other sections or required by Manufacturers of products and equipment being supplied on the project shall supersede the tolerances above.

3.05 SITE RESTORATION

- A. All areas, items, utilities or structures damaged or destroyed by the Contractor or its subcontractors and suppliers during the construction of this Project, whether inside or outside of the Construction Limits, shall be restored by the Contractor to the satisfaction of the Project Representative, and in accordance with the requirements of this section, prior to the issuance of the Certificate of Substantial Completion.

3.06 CLEANING

- A. Maintain the Project Site in a neat and orderly condition, removing empty containers, rags and rubbish daily.
- B. Cleaning of Vehicles:
 - 1. Before leaving the Project Site, all vehicles and equipment shall be free of dust, mud, rocks, debris, and soils.

C. Street Cleaning:

1. All Project Site roadways used by Contractor's trucks or any other equipment hauling material to and from the area shall be kept clean by the Contractor and shall be continuously serviced by the Contractor's use of broomed vacuum sweeper trucks to control dust and mud.
 - a. Contractor shall comply with all permit requirements to keep public roadways clean of dust, dirt, and debris. Any associated costs shall be paid at no additional cost to the Owner.
2. Damage to roadway surfaces from the direct or indirect result of the Contractor's operation shall be repaired by the Contractor to the satisfaction of the responsible agency and the Project Representative at no additional cost to the Owner.
3. Do not allow sediment laden or contaminated surface water to enter stormwater systems.

D. Remove rocks, dirt, debris, trash, shavings, filings, and surface dust from limited access spaces, equipment vaults, manholes and similar spaces.

E. Clean Project Site, Yard and Grounds.

1. Clean landscaped areas, and undeveloped areas of the property, regardless of whether these were within the Construction Limits.
2. Sweep paved surfaces to a broom-clean condition.
3. Remove stains, petrochemical spills, and other foreign deposits.

3.07 PROTECTION

A. Temporary Protective Coverings:

1. Refer to Section 01 50 00, "Temporary Facilities and Controls," for Daily Cover requirements.
2. Temporary protective coverings shall include sheet plastic, tarpaulins, sand bags, geotextiles, matting, and accessories as identified in the Contract Documents.
3. Apply temporary protective coverings when, where, and to the degree required by the Contract Documents to ensure continuous protection from damage, deterioration, and prohibited exposures until Substantial Completion of the Milestone related to the protected work is achieved.
4. Apply temporary protective coverings appropriate to the installation.
5. Removal:
 - a. Remove temporary protection devices and facilities when requested by the Project Representative.

- b. Do not remove protection when subsequent work activities including corrective work could damage surfaces.

B. Limitation of Exposures:

1. Supervise and coordinate construction activities to ensure no part of the construction completed, or in progress, is subject to deleterious exposure during the construction period.
2. Protect against the following exposures:
 - a. Excessive loading, including static and dynamic forces.
 - b. Excessive pressures.
 - c. Excessive high and low temperatures.
 - d. Ice contamination of materials and products.
 - e. Air contamination, pollution, solvents, chemicals, including release of volatile organic compounds inside Owner's buildings in concentrations greater than necessary in accordance with the Contract Documents.
 - f. Construction traffic.
 - g. Soiling, staining.
 - h. Mold, mildew, bacteria, and other organic processes.
 - i. Excessive electrical current or load.
 - j. Inadequate separation and/or isolation between dissimilar materials.
 - k. Improper shipping, handling, packing.
 - l. Unprotected, improper, insufficient storage.

END OF SECTION

SECTION 01 71 23
SURVEYING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Acceptance of Owner-provided survey.
 - 2. Construction surveying.
 - 3. Completed Work Verification Survey.

1.02 RELATED SECTIONS

- A. Section 31 23 00, "Earthwork."

1.03 DEFINITIONS

- A. DTM: Digital terrain modeling.
- B. Project Datum:
 - 1. As indicated on the Drawings.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Surveyor Qualifications:
 - 1. Provide the following for each licensed professional surveyor whose services the Contractor proposes to rely upon:
 - a. Name, address, telephone number, and complete contact information.
- C. Field Engineering:
 - 1. Prior to commencing layout, provide the Project Representative a complete closed survey loop identifying the project benchmarks, and data demonstrating these points relative to the Project Datum.
- D. Contractor's Letter of Acceptance of Owner-Provided Survey (as shown on the Drawings) or written notice of discrepancies of Owner-provided survey.

E. Completed Work Verification Survey:

1. Submit electronic survey, certified by the Contractor's surveyor, of the entire completed Work including, but not limited to, earthwork, paving, retaining walls, conduits, and utility systems documenting the physical completion and accuracy of Work in accordance with the Contract Documents as amended.
 - a. Submittal shall be provided to the Owner prior to Contractor's Request for Substantial Completion.
2. Demonstrate that the Work complies with the construction tolerances specified in Section 01 70 00, "Execution Requirements."

1.05 ACCEPTANCE OF OWNER-PROVIDED SURVEY

- A. The nature and extent of the Work is dependent on original ground surface elevations and planimetric features as presented on the Drawings and the Site Preparation contractor Completed Work Verification Survey.
- B. The Contractor has a single opportunity, during the Preparation Phase of the Contract, to either accept or to identify differences or discrepancies in the Owner-provided survey, as shown on the Drawings.
 1. Differences or discrepancies refer to variations in the elevations and locations shown on the Drawings and the Site Preparation contractor Completed Work Verification Survey that exceed the allowable tolerances stated in Section 01 70 00, "Execution Requirements."
- C. The Contractor has the option of:
 1. Surveying the original ground surface elevations and planimetric features prior to beginning Construction Work at the site, AND/OR
 2. Accepting the elevations and planimetric features indicated on the Drawings.
- D. Contractor's Letter of Acceptance of Owner-Provided Survey:
 1. If the Contractor accepts the Owner-provided survey, the Contractor shall provide a letter stating the Contractor has reviewed and accepted the Owner-provided survey, as shown on the Drawings, and that the information is complete and accurate within the Tolerances of Preconstruction Conditions in accordance with Section 01 70 00, "Execution Requirements," Paragraph 3.04.
 - a. The Contractor's Letter of Acceptance of Owner-Provided Survey shall be provided not later than 14 calendar days after Notice to Proceed 1.

E. Contractor Identification of Correction of Owner-Provided Survey:

1. If the Contractor does not accept the Owner-provided survey, the Contractor shall complete its own survey and identify and quantify discrepancies, errors, or differences in a letter to the Owner not later than 14 calendar days after Notice to Proceed 1.
2. Provide a digital terrain model (DTM) of the Contractor's survey to the Project Representative upon completion of the Contractor's survey.
 - a. The Project Representative will compare the Contractor's DTM with the Owners DTM to attempt to substantiate the Contractor's results.
3. In the event of a discrepancy between the Owner and Contractor surveys, the Owner shall reconcile the difference through additional survey and consultation with the Contractor.
4. If the Owner-reconciled survey differs beyond the Tolerances, specified within Section 01 70 00, "Execution Requirements," Paragraph 3.04, from the Owner-provided survey, as indicated on the Drawings, the Contractor may request an adjustment to the Contract Price or Contract.

1.06 CONTRACTOR'S OWN SURVEY WORK

- A. Perform surveying activities sufficient to set out and control the Work.
1. Contractor has the option of setting up a GPS beacon on the roof of the existing transfer building during the Phase 2 work.

1.07 QUALITY ASSURANCE

- A. Survey work of this section is to be performed by a licensed Professional Land Surveyor registered in the State of Washington.
- B. Corrections of the Work due to survey errors and omissions are the responsibility of the Contractor.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

- A. Benchmarks:
1. Identify and maintain a minimum of three permanent benchmarks or control points on the Project Site for setting out the Work.

B. Surveying and Layout:

1. Work from lines and levels established by the Survey Control provided in the Drawings.
2. Establish secondary benchmarks and control points to set lines and levels throughout the Project Site.
3. Locate and flag/stake the continuous Construction Limits and selected sections of Property Line indicated on the Drawings.
 - a. Construction Limits flagging shall consist of continuous yellow construction flagging stapled to wood stakes at a maximum spacing of 20 feet.
 - b. Keep the flagging in place, fully functional, until directed to remove it by the Project Representative.
4. Locate and layout site improvements, including but not limited to pavements, grade stakes, grading, fill and topsoil placement, utility slopes, cut slopes, and invert elevations.
5. Locate and layout batter boards for structures, vaults, control lines, and levels.
6. Provide and maintain temporary means of checking and rechecking layout to confirm correct and accurate placement of materials and items between major milestones indicated on the Project Schedule.
7. Accurately record information on the Record Drawings on a regular basis as a condition for payment in accordance with requirements of Section 01 20 00, "Payment Procedures."

C. Do not scale Contract Documents provided by the Owner.

D. Surveyor Log:

1. Maintain a Surveyor Log of control data and other survey work on the Project Site.
2. Provide access to the Surveyor Log when required by the Project Representative.

3.02 COMPLETED WORK VERIFICATION SURVEY

A. Survey the completed work and compile into a Completed Work Verification Survey.

1. Indicate retaining walls, site improvements, and utilities. Show dimensions, locations, angles, and elevations of the Work.

B. Upon physical completion of the Work of Milestone 3, and in support of the Contractor's Request for Substantial Completion of Milestone 3, submit the Completed Work Verification Survey.

- C. Completed Work Verification Survey shall include all aspects of the Work including, but not limited to, elevations and grades within the Construction Limits on a 20-foot by 20-foot grid system in addition to survey points at:
1. All changes in grades.
 2. Edge of pavements - not more than 20 feet between points and at all changes in direction of the pavement edges.
 3. Building ground floor elevations at corners of floors.
 4. Utility system locations, grades and elevations including rim and invert elevations of all structures and the location and elevation of all valves and fittings.
 5. Retaining wall locations and elevations including bottom of footings, top of walls.
 6. Exterior light fixture locations.
 7. Exterior sign locations.
 8. Location of landscape irrigation system main lines, valves and lateral lines.
 9. Artwork structures.
- D. Survey results shall be in an electronic format, including a DTM.
- E. Project Representative will check the Contractor's Completed Work Verification Survey and report any discrepancies to the Contractor for resolution as part of the Substantial Completion Punch List.
- F. Prior to the issuance of Certificate of Substantial Completion, discrepancies shall be corrected, resurveyed and the Completed Work Verification Survey shall be updated and resubmitted.

3.03 FIELD QUALITY CONTROL

- A. Survey Accuracy: Measurements performed in accordance with requirements of this section are to be accurate within 0.01 feet in both vertical and horizontal planes.

3.04 PROTECTION

- A. Protect benchmarks and control points used in the Work of this section.

END OF SECTION

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Substantial Completion.
 - 2. Punchlist procedures.
 - 3. Final Completion, Final Acceptance and Payment.
 - 4. Project record documents.
 - 5. Warranties.
 - 6. Schedule of Contract closeout procedures.
- B. Related Sections:
 - 1. Section 01 92 13, "Operation and Maintenance Manuals."

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:

1.03 DEFINITIONS

- A. Record Documents: Various documents that define the constructed facility that are kept current by neat, legible hand annotation of all deviations from what is shown or required by the Contractor during the course of construction to accurately document the "as constructed" facility, including the following:
 - 1. The Drawings.
 - 2. The Specifications (Divisions 0 through 40).
 - 3. Addenda.
 - 4. Change Orders.
 - 5. Architect's Supplemental Information (ASI).
 - 6. Request for Information (RFI).
 - 7. Completed Work Verification Survey: electronic copy and one full size hard copy.
 - 8. Coordinated utility plans.

1.04 SUBSTANTIAL COMPLETION

- A. Contractor shall notify the Owner that the Work is Substantially Complete as required by the general terms and conditions of the Contract.
- B. The Owner and the Contractor shall follow the procedures stated in the general terms and conditions of the Contract for determining Substantial Completion, and the issuance of Punch Lists.
- C. In addition to the requirements in the general terms and conditions of the Contract , the Contractor shall within its Request for Substantial Completion:
 - 1. Provide the Completed Work Verification Survey in accordance with Section 01 71 23, "Surveying."
 - 2. Obtain and submit releases enabling Owner's full and unencumbered use of the Project, including access to utilities and other administrative approvals.
 - 3. Make final changeover of locks, keys, gates, and other access restriction measures consistent with removal of the Contractor's personnel from the Project Site.
 - 4. Deliver tools, spare parts, extra stock of materials, and similar physical items to the Owner in accordance with requirements of the Contract Documents.

1.05 PUNCH LIST PROCEDURES

- A. The Owner shall prepare the Punch List (list of incomplete items of Work including discrepancies found in the Completed Work Verification Survey) when notified by the Contractor that the Work is Substantially Complete.
- B. The Contractor shall correct all Punch List items and re-issue the Project Representative's Punch List forms, with their initials and date complete, along with a written statement that the entire Project is physically complete and ready to receive the Certificate of Substantial Completion.
- C. Prior to issuance of the Certificate of Substantial Completion, the Owner shall perform all necessary inspections to verify that all Punch List items of Work are complete.

1.06 FINAL PAYMENT AND ACCEPTANCE

- A. Owner shall notify the Contractor of Final Acceptance of the Project.
- B. The Owner and the Contractor shall follow the procedures stated in the general terms and conditions of the Contract for determining Final Acceptance and Final Payment.
- C. In addition to the requirements for final payment and final acceptance specified in the general terms and conditions of the Contract, the Contractor shall submit to the Project Representative the following 21 calendar days before Final Acceptance unless noted otherwise:
 - 1. Final Affidavits of Amounts Paid.
 - 2. Final, complete Record Documents 10 calendar days following issuance of the Certificate of Substantial Completion.

3. Final Application for Payment.
4. Completed permits 10 days following issuance of the certificate of Substantial Completion.
5. In addition, complete the following:
 - a. Complete Project Site cleanup.
 - b. Complete all remaining obligations as set forth within this section.
6. Complete or fulfill all additional requirements required by County, State, and federal law.

1.07 PROJECT RECORD DOCUMENTS

- A. Provide to the Project Representative one complete set of the Project Record Documents in accordance with the requirements of this section.

1.08 WARRANTIES

- A. In addition to the one year warranty applicable to all the Work, certain elements of the project are to be warranted for an extended period following the completion of the initial one year warranty.
- B. The Contractor shall execute 2-year, 5-year, 7-year, and 10-year warranties for the Work as indicated in the sample warranty documents attached to this section:
 1. Do not propose alternative warranty language.
 2. The Project Representative will finalize each of the warranty documents by adding Contractor's logo, name, address, contact information, dates, and other missing information at the time of warranty completion.
- C. Each warranty document lists the work elements to which the warranty applies.
- D. Provide two executed copies of each warranty document required by the Contract Documents 10 days following issuance of the Certificate of Substantial Completion for the portion of the Work covered by that warranty.

1.09 SCHEDULE OF CONTRACT CLOSEOUT PROCEDURES

- A. The following Closeout Procedures Checklist gives the order and responsibility for the requirements of the Final Contract Closeout. This list may not include all items required by the general terms and conditions of the Contract and other Specification sections.
- B. Contract Closeout Documents Checklist: Complete the items indicated, and submit this Checklist when directed by the Project Representative.

Responsibility	#	Procedure	Date
Contractor	1.	Notify Owner that the Work is Substantially Complete.	
Owner	2.	Inspect the Work, prepare Punch List and issue Certificate of Substantial Completion.	
Contractor	3.	Notify the Owner that Punch List items have been completed.	
Owner	4.	Verify that Punch List items have been completed.	
Contractor	5.	Prepare the Final Application for Payment that includes the following: a. Affidavit of Wages Paid for Contractor and all Subcontractors. b. Release of Liens Certificate from all Subcontractors. c. Project Record Documents. d. Operation and Maintenance Manuals/Video. e. Warranties. f. Stamped permit set of documents. g. Final Affidavit of Amounts Paid to Subcontractors. h. Certificate of Compliance. i. Reports for compliance with KCC 12.16.	
Owner	6.	Issue Notice of Completion and Final Acceptance.	
Owner	7.	Prepare Notice of Completion of Public Works Contract and send to State Department of Revenue with copy to Employment Security Office, and Labor and Industries.	
Owner	8.	Receive the following from the state: a. Certificate of Payment of State Excise Taxes, Dept. of Revenue. b. Certificate of Payment of Contributions and Interest – Department of Employment Security. c. Letter from State Department of Labor and Industries - Contract Compliance Unit.	
Owner	9.	Initiate Lien Search 45 days after date of Final Acceptance: a. Receive Lien Search Results from Records.	
Owner	10.	Process release of retainage when all state releases are received and liens are cleared.	

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

(ATTACHMENT A FOLLOWS)

SECTION 01 77 00A
ATTACHMENT A

Seven (7) Year Warranty	
ISSUE TO: Kitsap County Solid Waste Division 614 Division Street, MS-27 Port Orchard, WA 98366 CONTACT PERSON: Keli McKay Means, Solid Waste Projects and Operations Manager (360) 337-5665	Installed At: Silverdale Recycling and Garbage Facility 8843 NW Dickey Road Silverdale, Washington 98383
ISSUE BY: Contractor Address – Line 1 Address – Line 2 Phone Number WA Contractor License No.	CONTACT PERSON: Name, Title Phone Number E-mail Address
<i>Emergency hours (6:00pm – 7:00am) contact information for operable systems and equipment, including systems with moving parts.</i> CONTACT PERSON: Name, Title Phone Number(s)	
We, [CONTRACTOR NAME], certify that the items listed in the attached Table 1.10 - <i>Items Subject to Seven (7) Year Warranty</i> were installed at the Silverdale Recycling and Garbage Facility, and the work performed is in strict compliance with the Contract Documents. In compliance with the general terms and conditions of the Contract; and Section 01 77 00 - 1.08, [CONTRACTOR NAME] shall, in cooperation with Kitsap County, promptly repair, replace, or otherwise appropriately correct any such defect or nonconformity discovered during the Warranty Period. [CONTRACTOR NAME] warrants and guarantees that the work on the Silverdale Recycling and Garbage Facility project is free from defects and nonconformities in equipment, material, design, or workmanship performed by [CONTRACTOR NAME] and or its subcontractors and suppliers for a period of two (2) years. [CONTRACTOR NAME] also warrants and guarantees that all work performed shall remain watertight, free from leaks, and free from installation defects, for a period of two (2) years. The Warranty Period is effective from the Substantial Completion date of [DATE]. The Warranty Period will expire on [DATE].	
[CONTRACTOR NAME] AUTHORIZED OFFICER [NAME] PROJECT MANAGER DATE	NOTARY

Table 1.10 – Items Subject to Seven (7) Year Warranty

[illegible]

SECTION 01 92 13
OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes preparation of operation and maintenance (O&M) manuals.

1.02 SCHEDULE

- A. Submit initial draft of the O&M Manual no later than 90 days prior to the request for issuance of the Substantial Completion certificate for Milestone 2 work.
- B. Submit the final O&M Manual no later than 30 days prior to issuance of the Substantial Completion certificate for Milestone 3 work.

1.03 OPERATION AND MAINTENANCE MANUALS

- A. Coordinate, assemble, and submit four final sets of O&M Manuals that include O&M information for each product, material, system and piece of equipment or equipment assembly specified in the Contract Documents as noted below.

Item	Description	Specification Section
1.	Various Division 09, 10, 11 and 12 Architectural sections not specifically listed below	Refer to Sections
2.	Architectural Woodwork	06 40 00
3.	Standing-Seam Metal Roofing	07 41 00
4.	Membrane Roofing	07 50 00
5.	Firestopping	07 84 00
6.	Access Doors	08 31 00
7.	Fixed Aluminum Windows	08 51 13
8.	Motorized Service Window	08 56 59
9.	Door Hardware	08 71 00
10.	Toilet and Bath Accessories	10 28 00
11.	Fire Suppression Systems	21 10 00
12.	Heat Trace Systems	22 05 33
13.	Electric Water Heaters	22 33 00
14.	Plumbing Fixtures	22 40 00
15.	Emergency Eyewash and Showers	22 45 00
16.	HVAC Controls	23 09 23
17.	Fans and Ventilators	23 34 00

Item	Description	Specification Section
18.	Air Filters	23 41 00
19.	Heat Pumps and Air Conditioners	23 81 26
20.	Electric Heating Equipment	23 83 13
21.	Grounding and Bonding	26 05 26
22.	Panelboards	26 24 16
23.	Electricity Metering	26 05 33
24.	Wiring Devices	26 27 26
25.	Standby Engine Generator	26 36 13
26.	Automatic Transfer Switches	26 36 26
27.	Lighting	26 50 00
28.	Intercom Systems	28 15 23
29.	Fire Detection and Alarm System	28 31 00
30.	Temporary Irrigation System	32 80 00
31.	Landscaping	32 90 00
32.	Water System Valves, Hydrants and Appurtenances	33 10 00
33.	Sanitary Sewerage	33 30 00
34.	Oil/Water Separators including Coalescing Plates	33 40 00
35.	Control Systems Equipment	40 67 00

Include any additional listed equipment in the specifications.

- B. The O&M Manual shall be assembled as a single combined manual.
- C. All manufacturers' literature in each manual shall be original, not copies.
- D. Manuals shall be bound in a series of three inch, D-ring binders with durable plastic covers.
 - 1. The front cover shall be imprinted with the title of the Project (Silverdale Recycling and Garbage Facility), the name of the Owner (Kitsap County– Solid Waste Division), and the name of the Contractor.
 - 2. The back edge (spine) shall be imprinted with the abbreviated name of the Project (Silverdale Recycling and Garbage Facility), Owner (Kitsap County Solid Waste Division), and the year of completion of the Project.
 - 3. Manuals shall be 8-1/2 by 11 inches in size except for oversize drawings, which shall be bound in fold-out fashion or folded and placed inside a bound-in envelope.
 - 4. Multiple, thinner binders are preferred to extra-large and bulky binders where subdivisions of the contents permit.
 - 5. Manual volumes shall not exceed 3 inches in thickness.

6. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
7. Equipment operating instructions and test reports shall be bound in front of maintenance instructions and other materials.

E. Each O&M manual shall include the following:

1. A title indicating its contents permanently labeled on the outside of the binder.
2. A cover sheet identifying equipment with the process or assembly in which it is used according to (1) location, (2) specification section number and title, and (3) Contract Document drawing number.
3. Table of Contents for each volume, with material, equipment, or system description identified, typed on white paper. Each volume shall have a complete table of contents showing the volume divisions and other information.
4. Instructions and data prepared by the manufacturer, including the following as applicable:
 - a. Equipment operating instructions including startup and shutdown procedures, safety precautions, and instructions on specific controls.
 - b. Electrical test reports, including electrical system and motor test reports.
 - c. A complete set of applicable reviewed approval submittals.
 - 1) A complete set of applicable reviewed product data clearly identifying the system, assembly, material or product using the names or terminology for the system, assembly, material or product in the Contract Documents
 - d. Assembly drawings.
 - e. Complete parts lists.
 - f. Bill of materials.
 - g. Wiring diagrams.
 - h. Maintenance and repair instructions to cover any routine operation required to ensure satisfactory performance and longevity of the product, material or equipment, such as lubrication instructions and lists of lubricants, cleaning, adjustment, replacement of parts, etc.
 - i. Maintenance summary forms.
 - j. Copy of extended warranty.

5. Divide manuals into the following sections:

- a. Part 1: Directory, listing names, addresses, and telephone numbers of A/E Representative, Contractor, subcontractors, and major equipment suppliers.
- b. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:
 - 1) Significant design criteria.
 - 2) List of equipment.
 - 3) Parts list for each component.
 - 4) Operating instructions.
 - 5) Maintenance instructions for equipment and systems.
 - 6) Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 7) Summary listing of warranty dates.
- c. Part 3: Project documents and certificates, including the following:
 - 1) Shop drawings and product data.
 - 2) Certificates.
 - 3) Photocopies of warranties.

F. Three unbound copies of each volume shall be submitted for approval.

- 1. After review by the Project Representative, revise content as required by Project Representative's comments and submit the number specified.
- 2. All copies of the final O&M Manual shall be submitted to the Project Representative before final payment will be made.

G. Three bound copies of the final approved O&M Manual will be submitted.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

Division 02

Existing Conditions

SECTION 02 41 00
DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes deconstruction, removal, and salvage or disposal of various existing improvements including, but not limited to, building superstructure slabs and foundations, building mechanical and electrical systems, refuse crane, top portion of building support piles, asphalt and concrete pavement; cement concrete curb and gutter; fencing; signs; light fixtures; fencing; poles; and other items necessary for the accomplishment of the Work.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards."

1.03 DEFINITIONS

- A. Relocate: Preserve the feature and the functionality of the feature. Move the feature to the designated location on the Project Site.
- B. Remove: Take appropriate action to eliminate the feature from the Project Site. Removal may include disposal or salvage.
- C. Salvage: Preserve and protect the feature and the functionality of the feature. Move the feature to the designated location off the Project Site and turn over custody to the Owner.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures":
 - 1. Demolition Plan not later than fourteen days prior to the intended start of demolition work: Demolition Plan shall discuss the following.
 - a. Sequencing of the work.
 - b. Protection of workers and the public.
 - c. Traffic control, where demolition is adjacent to existing facility operations.
 - d. Environmental protection.
 - e. Means and methods to minimize disposal and maximize salvage.
 - f. Demolition disposal procedures.
 - g. Salvaged items to be delivered to Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PREPARATION

A. Identification:

1. Field locate and mark all structures to be removed.
2. Existing Utilities:
 - a. Locate utilities within or adjacent the Project Site.
 - b. Take all necessary precautionary measures to protect site utilities.
 - c. Provide adequate means of support and protection during removal operations for utilities that are to remain in service.
 - d. Do not interrupt existing utilities serving facilities occupied by County or others, except when permitted in writing by County, and then only after acceptable temporary utility services have been provided if required by County.
 - 1) Provide minimum 7 calendar days notice to Project Representative and utility owner, and receive written notice to proceed before interrupting any utility.
 - e. Coordinate with utility companies for shutoff of services, if lines are active.

B. Protection:

1. Maintain facility operations traffic for the duration of the work in accordance with Owner-provided Traffic Management Plans.
2. Provide erosion and sedimentation controls in accordance with Section 31 25 00, "Erosion and Sedimentation Controls," prior to initiating work.
3. Take all necessary precautionary measures to protect all utilities, structures and surrounding areas.

3.02 DEMOLITION/DECONSTRUCTION

- A. Remove facilities as indicated on the Drawings and as necessary to complete the work.
- B. Unless determined as unsalvageable by the Project Representative, all items designated for salvage shall be removed with care to prevent damage.
- C. If, in the opinion of the Project Representative, salvageable features were unnecessarily damaged, damaged salvageable features shall be replaced or repaired, to the satisfaction of the Project Representative, by the Contractor at no additional cost to the Owner.

- D. Salvaged material shall remain the property of the Owner. Storage of salvaged materials shall be at the direction of the Project Representative.
- E. Salvaged and/or Relocated items as shown or indicated on the Drawings:
 - 1. Fire hydrants.
 - 2. Water meters.
 - 3. Other items as indicated by the Project Representative.

3.03 SAWCUTTING

- A. Make a neat vertical saw cut at the boundaries of the asphalt and/or concrete area to be removed.
 - 1. Care shall be taken when saw cutting so as not to damage any of the existing asphalt concrete pavement to remain in place.
 - 2. Sawcutting shall extend through the full pavement depth, or to a maximum depth of 12 inches which ever is less.
 - 3. Any pavement damaged by Contractor due to its operations shall be repaired or replaced at no cost to the County.
 - 4. Contractor is responsible for ensuring that special precautions are taken so that no concrete or concrete by-products, or products and by-products used in the saw cut of asphalt or concrete, are discharged into any storm drain or surface water system.
- B. Wastewater from cutting operations:
 - 1. Wastewater from Portland Cement Concrete, masonry, and asphalt concrete cutting operations shall not be discharged to storm drainage systems or surface waters.
 - 2. Cutting operations increase the pH of wastewater, therefore, filtering of wastewater prior to discharge is NOT acceptable.
 - 3. To thoroughly clean saw cuts where necessary, use high pressure water (high pressure water is considered greater than 1400 psi).
 - 4. All wastewater shall be collected using a wet-dry vacuum or pumped into drums for disposal.
 - 5. Disposal of the waste liquid shall be to Contractor provided eco-pans or other approved containment vessel for disposal offsite in accordance with environmental regulations.
 - 6. Impervious surfaces contaminated with sediment and grit from cutting or pulverizing operations shall be cleaned by sweepers to prevent contaminants from entering the storm drainage system or surface waters when it rains.

3.04 REMOVAL OF PAVEMENT AND CURBS

- A. Pavement and curbs shall be sawcut in such a fashion to form a neat break line.
- B. All transitions to existing asphalt or cement concrete roadways and curb and gutter shall be vertically sawcut full depth with straight, uniform edges.
- C. Removing Asphalt Concrete Pavement:
 - 1. Existing asphalt concrete pavement shall be removed at the locations indicated in the Drawings or as designated by the Project Representative.
 - 2. Removal shall be accomplished by making a neat longitudinal vertical cut along the boundaries of the area to be removed.
 - 3. Sawcutting shall be accomplished as previously specified with a self-propelled machine capable of cutting to a 12 inch depth. The use of pneumatic hammers or punches will not be permitted.
 - 4. Care shall be taken in removing the pavement not to damage any of the existing pavement that is to remain in place.
 - 5. Any remaining pavement damaged due to Contractor operations shall be replaced by the Contractor, to the satisfaction of the Project Representative, at Contractor's expense.
- D. Removing Cement Concrete Curb and Gutter:
 - 1. Existing cement concrete curb and gutter shall be removed as shown on the Drawings.
 - 2. Removal shall be accomplished by making a neat longitudinal vertical cut along the boundaries of the area to be removed or closest expansion/construction joint.
 - 3. Care shall be taken in removing the curb and gutter such as not to damage any curb and gutter or pavement that is to remain in place.
 - 4. Any remaining curb and gutter damaged due to Contractor operations shall be replaced by the Contractor, to the satisfaction of the Project Representative, at Contractor's expense.
- E. Removing Pavement Markings:
 - 1. Existing pavement markings including plastic stop bars and traffic arrows, and lane markers shall be removed at all locations indicated on the Drawings and as required for revisions to traffic lanes in accordance with Owner-provided Traffic Management Plan.
 - 2. Removal of existing pavement markings shall be conducted using such methods to prevent damage to the remaining pavement. Do not use chemicals that may be harmful to the pavement.
 - 3. Damaged pavement shall be replaced at Contractor's expense.
 - 4. Painted and thermoplastic pavement markings shall be removed by sandblasting or other method approved by Project Representative. All markers to be removed shall be done without damaging the pavement.

3.05 REMOVAL AND/OR RESETTING OF MISCELLANEOUS ITEMS

- A. Remove and/or reset miscellaneous items as described in the Drawings and as necessary to satisfactorily complete the work.
- B. Items requiring resetting shall be protected from damage during removal as far as is practical. If, in the opinion of Project Representative, an item requires replacement due to the Contractor's operations it shall be replaced in kind at Contractor's expense.
- C. Fencing and signs identified for removal shall be legally disposed of by Contractor. Post holes shall be filled with approved excavated material from elsewhere on-site.
- D. Lighting fixtures identified for removal shall be disconnected and removed, including foundations and associated wiring.

3.06 DISPOSAL OF MATERIAL AND DEBRIS

- A. Materials, except those identified as salvage, resulting from the removal of structures and obstructions shall be hauled to an approved off-site waste disposal site, secured by the Contractor and shall be disposed of in such a manner as to meet the requirements of state, county, and municipal regulations regarding health, safety, and public welfare.
- B. Burning of material shall not be permitted.
- C. Removed salvageable material shall remain the property of County. Project Representative will identify salvageable material and describe where material shall be stored.

END OF SECTION

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SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Demolition and removal of roofing system as indicated on Drawings.

1.02 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.03 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.04 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report that indicates the measures proposed for protecting individuals and property. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations.
- D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.05 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Storage or sale of removed items or materials on-site is not permitted.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.
- C. Catalog and document: waste stream of materials, separated by type and materials recycled that are diverted from waste stream.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Review Project Record Documents of existing construction. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- B. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
 - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.02 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
- B. Remove temporary barricades and protections where hazards no longer exist.

3.03 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level.
 - 2. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 3. Dispose of demolished items and materials promptly.

- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.04 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them accordingly.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

3.06 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.07 SELECTIVE DEMOLITION SCHEDULE

- A. Refer to Architectural demolition Plans for complete demolition schedule and scope of Work.

3.08 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	024119.D	SELECTIVE DEMOLITION

END OF SECTION

SECTION 02 82 33
REMOVAL AND DISPOSAL OF ASBESTOS-CONTAINING MATERIALS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes specifications for removal, handling, transportation, and disposal of asbestos-containing materials (ACM) from structures scheduled for demolition. ACM have not been identified through the Regulated Building Materials Assessment Report; however, ACM may be subject to inadvertent discovery. It is the responsibility of the Contractor to test for ACM in areas that were not tested by the Regulated Building Materials Assessment Report.

1.02 REFERENCES

- A. This section incorporates by reference the latest revision of the following documents:
1. International Building Code (IBC).
 2. Code of Federal Regulations (CFR):
 - a. 29 CFR 1910 Occupational Safety and Health Standards.
 - b. 29 CFR 1926 OSHA Construction Standards.
 - c. 40 CFR 61 National Emission Standards for Hazardous Air Pollutants Subpart M-Asbestos.
 - d. 40 CFR 763 Asbestos.
 3. Washington Administrative Code (WAC):
 - a. WAC 296-24 General Safety and Health Standards.
 - b. WAC 296-62 General Occupational Health Standards.
 - c. WAC 296-65 Asbestos Removal and Encapsulation.
 4. National Institute for Occupational Safety and Health (NIOSH).
 5. Washington Department of Labor and Industries.
 6. Revised Code of Washington (RCW):
 - a. RCW 49.17 Washington Industrial Safety and Health Act (WISHA).

1.03 DEFINITIONS

- A. Abatement: Procedures to control fiber release from asbestos-containing building materials. Includes encapsulation, enclosure, and removal.
- B. Adequately Wetted: Sufficiently mixed or coated with water or an aqueous solution to prevent dust emissions.
- C. Asbestos Abatement Project: Any demolition, renovation, repair, construction, or maintenance activity of any public or private facility that involves the repair, enclosure, encapsulation, removal, salvage, handling, or disposal of any material with potential for releasing asbestos fibers from asbestos-containing material into the air.
- D. ACM: Asbestos-containing Material. Asbestos or material containing asbestos in excess of 1% by weight.
- E. Air Cell: Insulation usually used on pipes and duct work comprised of corrugated cardboard containing asbestos.
- F. Airlock: A system for permitting restricted ingress or egress while allowing air movement from an uncontaminated area to a contaminated area during negative air pressure conditions in the work area, typically including two curtained doorways at least 6 feet apart.
- G. Amended Water: Water containing a wetting agent or surfactant.
- H. Area Monitoring: Sampling of asbestos fiber concentrations within the asbestos removal area which is representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.
- I. Asbestos: The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
- J. Asbestos-Containing Material (ACM) Waste: Asbestos-containing or contaminated materials or objects requiring disposal.
- K. Asbestos Fibers: This expression refers to asbestos fibers having an aspect ratio of three to one and longer than 5 micrometers.
- L. Asbestos Removal Contractor: The asbestos abatement firm contracted to perform the asbestos abatement services addressed in these Specifications.
- M. Authorized Visitor: Owner's Representative or a representative of any of the regulatory agencies having jurisdiction over the project.
- N. Bridging Encapsulant: A liquid material that can be applied to ACM that controls the possible release of asbestos fibers from the material by creating a membrane over the surface. Also referred to as a sealant when used to seal residual fibers left on a surface from which asbestos has been removed.
- O. Breathing Zone: An area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and the center at the nose or mouth of an employee.

- P. Certified Asbestos Workers: Workers who have received training through an accredited training center in accordance with regulations as set forth in 40 CFR Part 763 and as required by WAC 296 62 in accordance with the requirement of WAC 296-65.
- Q. Clean Room: An uncontaminated area or room, which is part of the decontamination enclosure system, with provisions for storage of workers' street clothes and protective equipment.
- R. Clearance Air Sample: The air monitoring sample taken after all abatement is completed and prior to deregulation of work areas. Provide clearance air samples equal to or better than the outside ambient air (less than 0.01 fiber/cubic centimeter).
- S. Containment: An enclosure with restricted access where the air is filtered.
- T. Control Device Asbestos Waste: Any ACM Waste that is collected in a pollution control device.
- U. Curtained Doorway: A device to allow ingress or egress from one (1) room to another while permitting minimal air movement between the rooms, typically constructed by placing three overlapping sheets of plastic over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one (1) sheet along one (1) side of the doorway, and securing the vertical edge of the other sheets along the opposite vertical side of the doorway.
- V. Decontamination Enclosure System: A decontamination enclosure system for workers, materials and equipment, including a designated area of the work area adjacent and connected to the regulated area including an Equipment Room, Shower Room, and Clean Room formed by connecting a series of rooms with curtained doorways forming airlocks between any two (2) adjacent rooms.
- W. Demolition: The wrecking or removing of any load-supporting structural member and any related removing or stripping of friable asbestos materials.
- X. Encapsulant: A material which is applied to ACM to minimize or eliminate potential release of asbestos fibers, either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding the components together (penetrating encapsulant).
- Y. Equipment Room: A contaminated area or room, which is part of the decontamination enclosure system, with provisions for storage of contaminated clothing and equipment.
- Z. Excursion Limit: The maximum personal exposure concentration of asbestos fibers for any 30-minute period (1.0 fiber per cubic centimeter of air (f/cc)).
- AA. Friable Asbestos Material: Material that contains more than 1% asbestos by weight and that can be crumbled, pulverized, or reduced to power by hand pressure when dry.
- BB. Glovebag: A customized bag for covering friable ACM with gloves to allow work inside the bag.

- CC. HEPA Filtered Equipment: High efficiency particulate air filtered equipment with a filter capable of collecting and retaining asbestos fibers.
- DD. Mini Enclosure Method: An abatement method that establishes an isolation zone as a sub-area of the total area. Air exchanges requirements are a minimum of four per hour. Decontamination facilities include two air chamber airlocks, double suiting and HEPA vacuuming.
- EE. Mini Isolation Method: A method of isolation area preparation where only the portion or portions of the total room area containing ACM are isolated. Decontamination facilities and air exchanges are identical to those under standard isolation.
- FF. Modified Glove Bag: An abatement method utilizing a standard glove bag within an isolation area under negative pressure of at least four air exchanges per hour.
- GG. Mudded Pipe Insulation Section: A section of pipe insulation covering plumbing fittings, usually 12-inch diameter or less.
- HH. Negative Air System: A localized and HEPA filtered exhaust system capable of maintaining a constant, low velocity air flow into the Decontamination Enclosure Systems and Work Area from adjacent uncontaminated and unsealed areas.
- II. Non-Friable Asbestos Material: Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not release fibers in excess of the asbestos control limit during any appropriate use, handling, demolition, storage, transportation, processing, or disposal.
- JJ. Outside Air: The air outside buildings and structures.
- KK. Particulate Asbestos Material: Finely divided particles of asbestos material.
- LL. PCM: Phase Contrast Microscopy.
- MM. PLM: Polarized Light Microscopy.
- NN. Personal Monitoring: Sampling of asbestos fiber concentrations within the breathing zone of an employee.
- OO. Removal: All herein specified procedures necessary to strip all ACMs from the designated areas and to dispose of these materials in a permitted facility.
- PP. Renovation: The removing or stripping of friable asbestos materials used on any pipe, duct, boiler, tank, turbine, furnace or structural member. Operations in which load supporting structural members are wrecked or taken out are included.
- QQ. Sealing Agent: A liquid product similar to a Bridging Encapsulant that is applied to surfaces from which asbestos has been removed to prevent release of any residual asbestos fibers into the environment.

- RR. Shower Room: A room between the Clean Room and the Equipment Room in the worker decontamination enclosure system, with hot and cold or warm running water and suitably arranged for complete showering during decontamination. The Shower Room provides an airlock between contaminated and clean areas.
- SS. Standard Isolation: An asbestos removal process, which includes enclosing the entire area prior to and during the removal.
- TT. Stripping: Removing friable asbestos materials from any pipe, duct, boiler, tank, turbine, furnace, or structural member from any building, structure, facility, or installation.
- UU. Structural Member: Any load-supporting member, such as beams and load-supporting walls, or any non-load-supporting member, such as ceilings and non-load-supporting walls.
- VV. Supervisor for Full-Scale Asbestos Abatement: A person who has been trained and certified in accordance with a state-approved EPA Asbestos Training Center. Such persons are required for any negative containment abatement.
- WW. Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.
- XX. Suspect ACM: Material encountered during removal work that is suspected of being ACM, based on proximity to other ACM, or other indicators.
- YY. TEM: Transmission Electron Microscopy.
- ZZ. Time Weighted Average: The TWA is an 8 hour time weighted average airborne concentration of fibers longer than 5 micrometers per cubic centimeter of air.
- AAA. Visible Emissions: Emissions containing particulate asbestos material that are visually detectable without the aid of instruments. These do not include condensed uncombined water vapor.
- BBB. Waste Manifest: A record of shipment and disposal of ACM waste.
- CCC. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with amended water, and by afterwards disposing of these cleaning tools as asbestos- contaminated waste. Use of HEPA filtered vacuums are recommended during wet cleaning.
- DDD. Work Area: The area where asbestos-related work or removal operations are performed that is defined and/or isolated to prevent the spread of asbestos dust, fibers, or debris, and entry by unauthorized personnel.

1.04 SUBMITTALS

- A. Procedures: See Section 01 33 00, "Submittal Procedures."
- B. Permits: See Section 01 41 00, "Regulatory Requirements."
 - 1. It is the responsibility of the Contractor to identify any permits needed to perform the work in accordance with local, state, and federal guidelines.
 - 2. It is the responsibility of the Contractor to test for ACM in areas that were not tested by the Regulated Building Materials Assessment Report prior to demolition.
 - 3. 10 days prior to work, it is the responsibility of the Contractor to file an Asbestos/Demolition Notification with the Puget Sound Clean Air Agency regardless if there are asbestos-containing materials (ACM) present on the demolition site.
- C. Asbestos Work Plan.
- D. Documentation of air monitoring results:
 - 1. Copies of air monitoring sample chains-of-custody.
 - 2. Analysis reports.
- E. Record of abatement activities including disposition of ACM Waste removed from the Site, one copy of every completed waste manifest to verify proper disposal, all Contract changes clearly indicated, project photographs, supervisor's daily field reports, and similar final record documentation within 30 days of completion of the project. Project photographs will show conditions before and after asbestos removal.
- F. Copies of waste profiles, transportation, disposal certification, and signed manifests from the landfill within 30 days of completion. Documentation shall include:
 - 1. Name and address of landfill.
 - 2. Name of landfill employee authorized to accept asbestos waste.
 - 3. Quantity removed from work site.
 - 4. Quantity disposed of at landfill.
- G. Medical surveillance for all personnel working within the control area in accordance with the regulations, as well as workers' post-Contract medical surveillance results.
- H. Copies of all applicable permits and notifications required for work, including those for the Puget Sound Clean Air Agency (PSCAA) and Washington Department of Labor and Industries (L&I).
- I. Qualifications.
- J. Certifications.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Work shall be completed by a licensed asbestos removal contractor with the following minimum experience:
 - a. Satisfactory completion of at least three asbestos abatement projects of similar scope.
 - b. Licensed in the state of Washington.
2. Contractor personnel performing the work shall have the following experience:
 - a. 1 year experience in the task they are to perform.
 - b. 3 years or more experience in asbestos abatement.
 - c. Supervisor: Certified asbestos supervisor.

B. Certification:

1. Personnel working within the control areas shall be certified asbestos workers.
2. The asbestos supervisor shall be certified for Full-Scale Asbestos Abatement.
3. Personnel shall have respirator fit test certification (qualitative/quantitative) for the respirators they intend to use.

C. The Owner's Representative shall conduct perimeter and clearance air monitoring for quality assurance/quality control (QA/QC) purposes.

D. The independent qualified testing laboratory for air samples shall be a satisfactory participant in the NIOSH Proficiency Analytical Testing (PAT) program and American Industrial Hygiene Association (AIHA) registry.

1.06 SITE CONDITIONS

- ### **A. Existing utilities may be used if of adequate capacity. The power and water distribution systems in existing building may not be suitable for use. Any work the Contractor finds necessary for power distribution and water distribution shall be at the Contractor's expense.**

1.07 ASBESTOS WORK PLAN

- ### **A. Present the methods to be used for removal and disposal of ACM. Include a detailed plan of the work procedures to be used in the removal of materials containing asbestos in compliance with all applicable Federal, State, and local regulations. As a minimum, include the following components in the plan:**
1. Subcontractor qualifications, experience, and license number.
 2. Work procedures and sequences.

3. Required Permits and Notifications.
 4. Exposure monitoring plan, include person responsible for air monitoring program.
 5. Respiratory Protection Program.
 6. Personal Protective Equipment.
 7. Personnel Decontamination Procedures.
 8. Administrative Controls.
 9. Emergency Plan.
 10. Housekeeping Practices.
 11. Engineering Controls/Equipment.
 12. Medical Surveillance Program.
 13. Heat and/or Cold Stress Monitoring and Management.
 14. Employee Training Certificates and Medical Surveillance.
 15. Certifications and qualifications of the asbestos supervisor.
 16. Signage.
 17. Laboratory qualification information.
 18. Plans for disposing of ACMs.
 19. Decontamination of Equipment and Areas.
 20. Manufacturer's literature on equipment and materials.
 21. Material safety data sheets for any chemicals.
 22. Record Keeping.
 23. Disposal facility information.
 24. Respirator fit test records.
- B. Job Hazard Analysis and Hazard Communication (HCS-HASP Addendum, 6-mil polyethylene, preprinted with labels as required by EPA regulation 40 CFR 61.150 (a) (I) (iv) (v), WAC Chapter 296-62-007721, and OSHA regulation 29 CFR, 1926.1101.

1.08 PAYMENT

- A. If ACM is found, any work to remove and dispose of ACM shall be paid through force account. See Section 01 20 00, "Payment Procedures."

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Provide necessary labor, equipment, and material to remove, transport and dispose of ACM in accordance with all Federal, State, and local regulations and standards. Work includes obtaining required permits, notifying appropriate agencies, and performing required air monitoring.
- B. In accordance with State of Washington Administrative Code (WAC) 296-62-07721 (1)(c)(iii), a good faith survey of the structure that is to be demolished has been conducted and provided by the Owner. A summary of findings is shown on the Contract Drawings for building to be demolished, and individual reports are available as reference documents. Review each survey and become familiar with its contents.

2.02 MATERIALS

- A. Provide disposal drums that are metal or fiberboard with locking ring tops; labeled in accordance with EPA regulation 40 CFR 61.150 (a) (I) (iv) (v).
- B. Warning signs as required by WAC Chapter 296-62-07721.
- C. Construct walls separating abatement work area from other areas of fire retardant wood or metal framing to support product barriers in all openings larger than 4 feet by 8 feet. For wood framing adhere to International Building Code 23-4. Cover the framing with 5/8-inch, type "X" gypsum wall board.
- D. Tape:
 - 1. Capable of sealing joints of adjacent sheets of plastic sheet and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials.
 - 2. Capable of adhering under dry or wet conditions, including use of amended water.
 - 3. Minimum 2-inch wide.
- E. For surfactant (Wetting Agent) use ENVIRO-WET, ASBESTO-WET, NANCOL or equivalent approved by the Owner's Representative including 50% polyoxyethylene ether and 50% polyoxyethylene or polyglycol ether and mix with water in accordance with manufacturer's directions.
- F. Use encapsulation materials that are non-flammable, nonhazardous (nonsolvent or petroleum based) penetrating type.

- G. Use non-hazardous solvent mastic remover capable of effectively removing mastic or other adhesive.
- H. Danger Signs and Labels: Provide danger signs and labeled barricades at all approaches to asbestos work areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide and affix labels to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.
1. Danger Sign: Vertical format conforming to 29 CFR 1910.145(d)(4)
 2. Warning Labels: Provide labels of sufficient size to be clearly legible, displaying the following warning:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

BREATHING ASBESTOS DUST MAY

CAUSE SERIOUS BODILY HARM

3. Warning Signs: Provide signs of sufficient size to be clearly legible, displaying the following warning:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING

ARE REQUIRED IN THIS AREA

- I. Provide full body disposable protective clothing, including head, body and foot coverings including material impenetrable by asbestos fibers (Tyvek® or equivalent) for workers and authorized visitors in sizes adequate to accommodate movement without tearing.
- J. Provide additional safety and fall protection as necessary to workers and authorized visitors.
- K. Provide non-skid footwear to abatement workers. Ensure disposable clothing is adequately sealed to the footwear to prevent body contamination.
- L. Provide goggles to personnel engaged in asbestos operations when the use of a full face respirator is not required.

2.03 EQUIPMENT

- A. Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH). Provide personnel engaged in the removal and demolition of asbestos from negative pressure enclosures and visitors with Type C supplied air respirators, continuous flow or pressure demand, operated with either an auxiliary positive pressure self-contained apparatus or HEPA filter.
- B. Equip negative air machines with HEPA filtering. Utilize pressure differential equipment continuously from first disturbance of ACM until completion of successful final inspection. Do not discharge unfiltered air outside the work area via air movement system or air filtering equipment. Maintain the exchange rate at no less than four air changes per hour. Continuously monitor and record the pressure differential across isolated barriers using a pressure differential monitoring device. Maintain the pressure differential at a minimum of 0.02 inch water.
- C. A continuous-read strip chart manometer.
- D. Design air compressor to provide air volumes and pressure in accordance with respirator requirements. Compressors must meet the requirements of 29 CFR 1910.134(d), and be equipped with an in-line carbon monoxide monitor. Provide the compressed air system with a receiver of adequate capacity to allow escape of the personnel in case of compressor failure.
- E. Provide miscellaneous equipment, such as scaffolds, in accordance with task requirements.
- F. HEPA Filter Vacuums:
 - 1. With disposable collection bags for the project
 - 2. Filters that are 99.97% efficient for retaining fibers of 0.3 micron or larger
- G. Respirator Protection:
 - 1. Provide the necessary respiratory protection for the work to be performed. Don respiratory protection equipment and level of protection in accordance with applicable regulations and standards.
 - 2. Type C respiratory protection is required for abatement activities inside a negative air enclosure. This includes continuous flow-supplied air system with HEPA filter escape respirator.
 - 3. Half-face respirators may be used for abatement of non-friable ACM and glovebag procedure. The air monitoring results may be used to justify upgrades or downgrades of the respiratory protection. The Site Safety and Health Officer (SSHO) may propose changes to the Owner's Representative for evaluation. Downgrades of respiratory protection will only be allowed after approval by the Owner's Representative. Disposable half-face respirators may not be used.

4. Properly maintain, clean, and store the respirators.
5. Provide respiratory protection for authorized visitors wishing to enter a negative air enclosure, as needed. These include, but are not limited to inspectors from the regulatory agencies.

PART 3 – EXECUTION

3.01 EXAMINATION AND PROTECTION

- A. Suspect ACM: If suspect ACM is discovered during demolition activities, notify Owner's Representative immediately and stop work in the immediate area. Cordon off area to prevent contamination of clean areas. Allow access for the Owner's Representative to collect a representative sample of the material and submit for testing using PLM, as well as TEM if necessary. Estimate quantity of additional suspect ACM to Owner's Representative for appropriate documentation.
- B. Coordinate with the Engineer and/or Owner's Representative to locate underground utilities prior to beginning construction. Do not disturb utilities encountered which were not previously shown or otherwise located without approval from the Engineer.
- C. Air Monitoring
 1. Collect air samples required by regulations for the abatement activity on the project. These may include pre-abatement, area and perimeter, personal, short-term excursion limit, and clearance samples. The Owner's Representative may elect to conduct air sampling for quality assurance/quality control (QA/QC) purposes.
 2. Collect air samples in accordance with established procedures and protocols (i.e., NIOSH Method 7400, as revised). Take air samples at an approximate height of 60 inches from the work floor. Be responsible for regular calibration of the sample pumps.
 3. Submit the air samples to an independent qualified testing laboratory.
 4. Analyze the samples by PCM method. Fiber concentrations detected above the allowable limit may have to be tested by TEM method. Make test results available for review prior to the start of work the next day.
 5. Take pre-abatement samples prior to start of activities in an area where negative air enclosure will be constructed. Obtain the sample during a period where there are no activities. If the fiber count exceeds 0.01 f/cc, then re-sample the area prior to completion of enclosure.
 6. Ensure the area samples inside an enclosure do not exceed 1.0 f/cc. If such concentration is detected, stop work immediately to evaluate the work procedures. Clean the work with HEPA vacuuming and wet cleaning. Take another sample to demonstrate that the fiber count is below 0.01 f/cc. The work may start up after the cleaning has been completed and in accordance with procedural revisions that may be agreed upon with the Owner's Representative.

7. Take the perimeter air samples upwind and downwind of the work area where there is no enclosure. Obtain the perimeter samples for a negative air enclosure at the personnel decontamination station, waste loadout, and HEPA/negative air machine exhaust(s). If the fiber count exceeds 0.01 f/cc, the Owner's Representative may request analysis of the sample by TEM procedure; the Owner's Representative may request to clean the perimeter area prior to start of a shift.
8. Take personal and short term exposure limit (STEL) samples as required by the activities and the regulations. Post the personal air sample test results within 24 hours from collection.
9. Take the clearance air sample at the completion of abatement activities inside an enclosure prior to inspection and encapsulation. Take additional clearance samples if the area fails inspection, requiring additional abatement. For acceptable fiber count, use the pre-abatement result or less than 0.01 f/cc, whichever is less.
10. Limit the maximum flow rate of collecting air samples to 2.5 liters/minute for personal samples and 10.5 liters/minute for inside and outside work area air samples.

3.02 PREPARATION

- A. Notifications: Prepare and submit necessary permits and notifications, amendments, and/or request for alternate means of compliance to the regulatory agencies including, but not limited to, Puget Sound Clean Air Agency (PSCAA) and Washington Department of Labor and Industries (L&I). Provide timely notification of asbestos removal, abatement, hauling and disposition as may be required by such agencies. Have a copy of all said permits and notifications at the Site.
- B. Utilities:
 1. Provide temporary power and lighting in the area where abatement is taking place and ensure safe installation of temporary power sources and equipment in accordance with applicable electrical code requirements. Use ground fault interrupters to service any temporary and existing power sources utilized during project performance. Refer to OSHA requirements for temporary lighting under the construction standard, 29 CFR 1926.56 (Illumination), 1926.400 (Electrical Standards), and 1926.401 (Temporary Lights).
 2. Provide necessary water for the work. This includes potable water for consumption and shower, if necessary, and for abatement activities. If a source of water is available on Site, use the source with approval from the Owner's Representative.
 3. Properly dispose of wastewater generated during the project.
 4. Be responsible for utility connections and subsequent disconnects. This includes repairs that may be necessary to restore the connection.

3.03 REMOVAL OF ASBESTOS

- A. Spray asbestos material with amended water, using spray equipment capable of providing a “mist” application to reduce the release of fibers. Saturate the material sufficiently to wet it thoroughly. Spray the asbestos material repeatedly during work process to maintain wet conditions and to minimize asbestos fiber dispersion.
- B. After completion of stripping work, wire brush and/or wet sponge or clean surfaces from which asbestos has been removed, or clean by an equivalent method to remove visible material. Keep surfaces being cleaned wet during this work.
- C. Place removed ACM in labeled disposal bags of 6-mils thickness immediately upon removal. Thoroughly clean the external surfaces of bags by wet sponging in the designated area of the work area. Place the waste bags in a second, clean bag at the waste loadout for disposal. Do not drop or drag the waste bags. Ensure that containers are removed from the regulated area by workers who have entered from uncontaminated areas dressed in clean coveralls. Ensure that workers do not enter from contaminated areas into the clean area during any phase of project.
- D. Bag and secure ACM in a locked container at the end of each workday. Do not leave any debris, unsecured equipment, or tools on the work site past the end of each workday.
- E. Conduct work in a manner that prevents spread of ACM. Be responsible for the cost associated with cleanup of ACM spread outside the work areas.
- F. For mini-enclosures and glovebag of ACM, other than thermal system insulation, use a HEPA vacuum to maintain a negative pressure.
- G. The waste bags generated during a roofing abatement project may be slid through an enclosed chute directly into a lined waste bin. Otherwise, lower waste bags to the ground. Under no circumstances allow waste bags to be dropped.
- H. Asbestos-containing wallboard systems, which contain less than 1% ACM as a composite of the drywall and associated joint compound, shall be removed by mechanical means, where practicable. If removal is accomplished by hand, then wet, nonaggressive methods and HEPA filtered vacuums should be used followed by a prompt cleanup. For removal by hand, asbestos awareness and hands-on training as prescribed in WAC 296-62-07722(5) is required for workers. Supervision is required by a competent person as defined in WAC 296-62-07703.
- I. Enclosure Systems:
 - 1. Build suitable framing and line with 6 mils polyethylene sheeting sealed with tape at lap joints in the plastic for enclosures and decontamination enclosure system rooms.
 - 2. For access between contaminated and uncontaminated rooms of areas, use an airlock. Use a curtained doorway for access between any two rooms within the decontamination enclosure systems. Provide a minimum distance between two curtained doorways of 6 feet.

3. Decontamination Enclosure System: Construct a decontamination enclosure contiguous to each isolation area including three totally enclosed chambers as follows:
 - a. An equipment/waste loadout decontamination station including a Washdown Room, Holding Room, and Clean Room for removal of equipment and materials from work area. Do not allow personnel to enter or exit isolation area through this unit.
 - b. A Shower Room with two curtained doorways, one to the Equipment Room and one to the Clean Room. Supply the shower with at least one shower with hot and cold or warm water. Provide hot and cold water for showering. Pay careful attention to the shower enclosure to ensure against leaking of any kind. Ensure a supply of soap at all times in the Shower Room. Filter shower water through a 5 micrometer-filter system prior to disposal.
 - c. A Clean Room with one curtained doorway into the shower and one entrance or exit to noncontaminated areas of the building. Provide sufficient space in the Clean Room for storage of the workers' street clothes, towels, and other noncontaminated items.
4. Provide and post in the Equipment Room and the Clean Room the decontamination and work procedures to be followed by workers, as described in this Specification.
5. Ensure workers and authorized visitors, upon entering the job site, remove street clothes in the clean Change Room and put on the required PPE.
6. Ensure workers and authorized visitors, each time they leave the work area, remove gross contamination from clothing before leaving the work area, proceed to the Equipment Room and remove all clothing except respirators. Still wearing the respirator, proceed naked to the showers, clean the outside of the respirator with soap and water while showering, remove the respirator, and thoroughly shampoo and wash themselves. Remove filters and wet them and dispose of filters in the container provided for the purpose, and wash and rinse the inside of the respirator. Ensure that following showering and drying off, each worker and authorized visitor proceed directly to the clean Change Room and dress in clean clothes at the end of each day's work, or before eating, smoking or drinking. Store contaminated work footwear in the Equipment Room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from equipment and access area. Dispose contaminated protective clothing in receptacles for disposal with other asbestos-contaminated material.
7. Work in a mini-enclosure area may be conducted wearing a double suit of protective clothing over street clothes. Decontaminate by HEPA-vacuuming out suit completely and removing outer suit in the inner airlock chamber and proceeding to outer airlock to remove inner suit. Completely HEPA-vacuum and wet wipe clean waste containers before removing from the inner airlock. Then double bag waste containers in the outer airlock and again HEPA-vacuum and wet clean before removing from the outer airlock.
8. Ensure workers removing waste containers from the decontamination enclosure enter the Shower Room wearing a respirator and dressed in clean coveralls.

9. Do not allow workers to eat, drink, or chew gum at the work site except in the established Clean Room. No smoking or chewing tobacco shall be permitted in the Clean Room.
10. Ensure workers are fully protected with appropriate respirators and protective clothing from the time of first disturbance of ACMs prior to commencing actual asbestos abatement and until final clean-up is completed.
11. Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
12. Visually inspect enclosures at the beginning of each work period. Dispersive smoke methods will be used to test effectiveness of barriers. Repair all damage immediately.
13. Clean external surfaces of contaminated containers and equipment thoroughly by wet cleaning before moving such items into the decontamination enclosure system for final cleaning and removal to uncontaminated areas.

3.04 CLEANING

- A. For friable and nonfriable material, remove visible accumulations of asbestos material and debris. Wet-clean all surfaces within the work area.
- B. For friable and nonfriable materials, ensure the windows, doors, and HVAC vents remain sealed and any HEPA filtration negative air pressure systems, air filtration and decontamination enclosure systems remain in service during cleaning operations.
- C. For friable materials, clean all surfaces in the work area and other contaminated areas with water and/or with HEPA vacuum equipment. After cleaning the work area, allow surfaces to dry completely (6 hours minimum) and again wet-clean or clean with HEPA vacuum equipment surfaces in the work area. After completion of the second cleaning operation and after the surface has dried, a complete visual inspection will be performed of the work area to ensure that the work area is dust free. If the inspection indicates that removal and clean-up performance is satisfactory as determined by the Owner's Representative, the work area will be sampled under aggressive conditions.
- D. Where encapsulant is used following a period of time sufficient to allow the encapsulant to dry completely, remove plastic sheeting covering walls and floors and dispose of as ACM waste. Surfaces exposed by the removal of plastic sheeting on walls and floors will be thoroughly cleaned using acceptable methods. If underlying surface cleaning is not satisfactory as determined by the Owner's Representative, reclean all surfaces. Leave critical barriers including plastic sheets covering doors, vents, windows, air plenum grills, and the decontamination barriers in place during final (aggressive) air testing. If project performance is not satisfactory as determined by the Owner's Representative, reclean all surfaces.
- E. Include sealed drums and equipment used in the work area in the clean-up and removal from work areas, via the decontamination enclosure system, at an appropriate time in the cleaning sequence.

F. Final inspections shall be conducted by the Owner's Representative on each work area. When a final inspection and testing determines that the area is free of visible accumulation of dust and ambient air is within control limits for "clean air" – (less than 0.01 f/cc) – remove any decontamination enclosure systems for the cleaned area and thoroughly wet clean. Dispose of materials from the Equipment Room And shower as contaminated waste. Ensure the Contractor and Owner's Representative carry out a final check to ensure that no dust or debris remains on surfaces as a result of dismantling operations.

G. Disposal of ACM Waste:

1. Bag gross asbestos debris by the end of each workday. Dispose of ACM Waste as the work progresses to prevent exceeding available storage capacity on site. Provide caution signs as specified herein. Remove sealed and labeled containers as asbestos waste and dispose of containers at an authorized disposal site in accordance with the requirements of the Puget Sound Clean Air Agency. Transport in a vehicle compartment completely lined with 6 mils polyethylene sheeting and dispose of at the permitted disposal site. Submit documentation including name and address of landfill, name of landfill employee authorized to accept asbestos waste, quantity removed from work site, and quantity disposed of at the landfill.
2. For hauling and disposal, comply with 40 CFR 61, Subpart M, and state, regional, and local standards. Ensure workers unloading material wear appropriate PPE when handling asbestos materials at the disposal site.
3. Only undamaged and sealed plastic bags will be disposed of in the landfill. If the bags have been broken or damaged, place the damaged bags in a sealed drum and dispose.

END OF SECTION

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SECTION 02 83 33
REMOVAL AND DISPOSAL OF MATERIAL CONTAINING LEAD

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies requirements for the screening, removal and disposal of materials containing lead from structures designated for demolition as part of the Contract. Materials containing lead have been identified through the Regulated Building Materials Assessment Report.

1.02 REFERENCES

- A. This section incorporates by reference the latest revision of the following documents:
1. Code of Federal Regulations (CFR):
 - a. 29 CFR 1910 Occupational Safety and Health Standards.
 - b. 29 CFR 1926 OSHA Construction Standards.
 - c. 40 CFR 260 Hazardous Waste Management Systems: General.
 - d. 40 CFR 261 Identification and Listing of Hazardous Waste.
 - e. 40 CFR 262 Standards Applicable to Generators of Hazardous Waste.
 - f. 40 CFR 263 Standards Applicable to Transporters of Hazardous Waste.
 - g. 40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Disposal and Storage Facilities.
 - h. 40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
 - i. 40 CFR 268 Land Disposal Restrictions.
 2. Washington Administrative Code (WAC):
 - a. WAC 296-155 Safety Standards for Construction Work.
 - b. WAC 173-303 Dangerous Waste Regulations.
 3. National Institute for Occupational Safety and Health (NIOSH):
 - a. NIOSH Method 7105.

1.03 DEFINITIONS

- A. Action Level: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an eight (8) hour period. As used in this section, "30 micrograms per cubic meter of air" refers to the action level.
- B. Air Monitoring: The process of measuring the lead content of a specific volume of air in a stated period of time. Perform analysis of air samples in accordance with the methods specified by the National Institute for Occupational Safety and Health (NIOSH Method 7105).
- C. Area Monitoring: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations that may reach the breathing zone of personnel potentially exposed to lead.
- D. Breathing Zone.
- E. Certified Industrial Hygienist (CIH).
- F. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over an eight (8) hour workday to which an employee is exposed.
- G. HEPA Filtered Equipment.
- H. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.
- I. Lead-Based Paint (LBP): Paint or other surface coating that contains lead in excess of 1.0 milligram per centimeter squared or 0.5 percent by weight.
- J. Lead-Based Paint Hazard (LBP Hazard): Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.
- K. Lead-Containing Paint (LCP): Lead-based paint or other similar surface coating containing lead or lead compound in excess of 0.06 percent by weight of the total nonvolatile content of the paint.
- L. Lead Permissible Exposure Limit (PEL): The permissible exposure to lead during an eight (8) hour shift. Fifty micrograms per cubic meter of air as an eight (8) hour time-weighted average.
- M. Personal Monitoring: Sampling of lead concentrations within the breathing zone of an employee to determine the eight (8) hour time-weighted average concentration in accordance with WAC 296-155-176. Take samples that are representative of the employee's work tasks.
- N. Site Safety and Health Officer (SSHO).
- O. Waste Manifest: Form used by haulers of solid and dangerous waste that lists type and quantity of waste, the generator it originated from, the transporter that shipped it, and the treatment, storage, or disposal facility to which it is being shipped.

1.04 SUBMITTALS

- A. Procedures: See Section 01 33 00, "Submittal Procedures."
- B. Lead Management Plan.
- C. Documentation of employee personnel air monitoring results relative to the OSHA and WISHA respiratory protection level compliance. Include copies of air monitoring sample chains-of-custody and analysis reports.
- D. Record of lead control activities including disposition of each type of lead-containing item removed from the Site, Contract changes clearly indicated, project photographs, supervisor's daily field reports, and similar final record documentation.
- E. Results of all field tests for lead content, as specified herein.
- F. Copies of waste profiles, transportation, signed disposal manifests from the landfill, and certificates of disposal from the landfill. Include documentation from recycling facility, acknowledging receipt of the sampling data pertaining to the materials received, and confirming the facility's acceptance of the materials as lead-containing.
- G. Workers' post-Contract medical surveillance results.
- H. Qualifications.
- I. Certifications.

1.05 QUALITY ASSURANCE

- A. Handle lead-containing materials in accordance with current state and federal regulations including, but not limited to, WAC 296-155-176 and 29 CFR 1926.62, as part of the work. Segregate lead-coated or lead-containing components as necessary for compliance with lead regulations.
- B. Qualifications:
 - 1. Abatement Contractor: Satisfactory completion of at least three lead abatement projects of similar scope.
 - 2. Required Contractor-personnel qualifications:
 - a. One (1) year or more experience in the task they are to perform.
 - b. Supervisor: Three (3) years or more experience in lead management practices, and eight hours training in lead management.
 - 3. Independent testing laboratory: Minimum of three (3) years of operation conducting toxicity characteristic leaching procedure (TCLP) for lead-containing materials.

C. Certifications:

1. That personnel working within the control areas have a minimum of two (2) hours lead awareness training.
2. That personnel working within the control area are under medical surveillance in accordance with the regulations.

1.06 LEAD MANAGEMENT PLAN

- A. Present methods to be used in compliance with Labor and Industries (L&I) requirements. The Lead Management Plan may be submitted in conjunction with the Health and Safety Program (HASP), see Section 01 35 29, "Health and Safety." Work may not proceed until the complete submittal package has been reviewed and accepted by the Owner's Representative.
- B. Include detailed air and lead material sampling methodologies to be used for the Owner's Representative's review and approval. Be responsible for delays and associated costs resulting from revising an inadequate Lead Management Plan.
- C. At a minimum, include the following components in the plan:
 1. Exposure Monitoring Plan, include person responsible for Air Monitoring Program.
 2. Respiratory Protection Program.
 3. Personal Protective Equipment.
 4. Personal Hygiene Practices, including wash station.
 5. Administrative Controls.
 6. Emergency Plan.
 7. Housekeeping Practices.
 8. Engineering Controls/Equipment.
 9. Medical Surveillance.
 10. Heat and/or Cold Stress Monitoring and Management.
 11. Employee Training and Medical Surveillance Certificates.
 12. Signage.
 13. Independent Testing Laboratory Qualification Information.
 14. Plans for disposing of lead-containing items, coatings, and debris.
 15. Plans for recycling of lead items.

16. Decontamination of Equipment and Areas.
17. Record Keeping.
18. Disposal Facility Information.
19. Respirator Fit Test Records.
20. Job Hazard Analysis, and Hazard Communication (HCS-HASP Addendum; including any Material Safety Data Sheets).
21. Schedule of Activities.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Perform Work necessary to adequately protect workers from lead exposures during the general demolition process and surface preparation activities.
- B. Perform Work measures necessary to adequately control dust during activities where lead-containing materials are disturbed as required by WAC 296-155-176 and air pollution standards as required by the Puget Sound Clean Air Agency (PSCAA).

2.02 MATERIALS AND EQUIPMENT

- A. Protective Clothing, Equipment, and Supplies: Equipment, including protective clothing and respirators, used in the execution of this Contract and provided to visitors to the Site shall comply with the applicable federal, state, and local regulations. Respirators shall conform to the OSHA requirements in 29 CFR 1910.134.
- B. Temporary Service: Supply equipment, material, supervision, and labor necessary to accomplish the lead related work. Provide utilities needed to perform the work. Existing utilities may be used if of adequate capacity. The power and water distribution systems in existing buildings may not be suitable for the use. Any work the Contractor finds necessary for power distribution and water distribution shall be at the Contractor's expense.

PART 3 – EXECUTION

3.01 EXAMINATION AND PROTECTION

- A. Take necessary precautions to avoid damage to existing structures, their appurtenances, monitoring wells, or utilities outside of the clearing limits that may be affected by work activities and are intended to remain following site development. Be responsible for identifying structures that are to remain.

3.02 PREPARATION

- A. Establish a Control Area that includes a perimeter enough to perform the work around the building or area that contains lead or lead-coated materials. Include in the control area the pathway for transport of lead-containing material to a stockpile or storage area, if the debris is not immediately transported from the site. Provide and display caution signs, in clearly visible areas, at entrances indicating that hazardous material work is being conducted and that unauthorized persons shall not enter. Provide signs that comply with WAC 296-155-176 regulations.
- B. Prepare the decontamination unit for use at entrances and exits from the Work Area as described in the Lead Management Plan.
- C. Prepare the lead-waste staging area as described in the Lead Management Plan.
- D. Restrict access to work sites by maintaining a daily log of personnel entering Work Areas, including workers and other authorized personnel and their start/stop times.
- E. Establish and post written emergency procedures within each Work Area, including emergency contact names and contact phone numbers, plans for medical emergencies, temporary loss of electrical power or water, and procedures for an emergency. Be responsible for establishing and posting contingency procedures to workers on site.
- F. Conduct health and safety meetings as required in the Contract Documents.

3.03 REMOVAL

- A. Perform removal of lead-containing items in accordance with the accepted Lead Management Plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-containing paint is impacted or when building components are demolished. Employ procedures that do not create the potential for contaminating surrounding areas or materials with lead-containing coatings or dust.
- B. Coordinate the work of trades to ensure that work is performed in accordance with the applicable regulations and that the control limits are maintained both inside and outside the control area.
- C. Access work areas through decontamination areas. Only allow access to the work area for appropriate workers, Subcontractors, authorized personnel, and project consultants.
- D. Prevent dust generation to the maximum extent practicable. Do not use dry scraping, dry sanding, or dry grinding on Lead-Containing Paint or Lead contaminated surfaces without a full enclosure equipped with negative air machines. Restrict the use of water to the smallest quantity necessary to minimize dust and to avoid the potential of contaminant migration through run-off or ponding. Never allow liquids generated during removal to come into contact with uncontaminated soils, drains, surfaces or conduits which may constitute a release to the environment.

- E. Perform removal in areas of Lead Containing Paints in accordance with approved Health and Safety Plans. Use procedures and equipment required to limit occupational and environmental exposure to lead when Lead-Containing Paint is impacted or when building components are removed.
- F. Handle, store and dispose of lead-coated debris in accordance with applicable federal, state and local requirements.
- G. Decontaminate personnel and equipment whenever people or equipment leave the work site as described in the Lead Management Plan. Package, store, label, and dispose of decontamination waste according to applicable requirements. Store or dispose of contaminated equipment, tools or materials that cannot be decontaminated.
- H. Grossly inadequate health, safety or environmental precautions on the part of the Contractor or the belief that the Contractor's personnel, the general public or the environment are or may be exposed to an immediate hazard, may be cause for the Owner's Representative to suspend the site work and ask personnel to evacuate the hazard area. The Contractor shall not be compensated for such delays.

3.04 FIELD QUALITY CONTROL

- A. While performing the work, site inspections may be carried out by L&I/WISHA, OSHA, EPA/Ecology inspectors and/or local building or health officials. If found to be in violation of pertinent regulations, cease work immediately until the violation is resolved. Be responsible for standby time required to resolve the violation. Make available complete sets of equipment (such as respirators and disposable clothing) that may be required for entry to the control area to the inspectors for inspection of the control area. Such requests will only be made during working hours.
- B. No simple relationship exists between the concentration of lead in paint and the potential worker exposure if lead becomes airborne. Evaluate whether or not workers are exposed to concentrations in air in excess of the action level of 0.03 milligram per cubic meter (mg/m³). If the action level is exceeded, requirements for training, medical monitoring, and air sampling is triggered. If the PEL of 0.05 mg/m³ is exceeded, more requirements must be met, including use of respiratory protection equipment.
- C. Monitor airborne concentrations of lead in accordance with WAC 296-155-176, and as specified herein. Perform air monitoring, testing, and reporting using the CIH or the Site Safety and Health Officer (SSHO).
- D. Submit results of air monitoring samples within 24 hours after the air samples are taken. Notify the Owner's Representative immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.
- E. The CIH is responsible for reviewing analytical sample results, and proposing all corrective action needed.
- F. If the area air monitoring results are above the action level of 30 micrograms per cubic meter of air, the Owner's Representative has the option of stopping work until the work procedures and lead hazard controls are revised to the satisfaction of the Owner's Representative.

3.05 CLEANING AND TESTING

- A. Maintain surfaces of the lead control area as free of accumulations of paint chips and dust as practicable. Restrict the spread of dust and debris and keep waste from being distributed over the work area. Do not use compressed air to clean up the area. At the end of each shift, clean the area of visible lead paint contamination by vacuuming with a HEPA-filtered vacuum cleaner and wet mopping the area.
- B. Collect and analyze representative samples of construction debris for toxicity characteristic leaching procedure (TCLP) analysis as required under WAC 173-303 to determine appropriate disposal methods.
- C. Segregate lead components to be disposed of separate from general construction waste as determined by the TCLP test results as required by WAC 173-303. Include the proper packaging and disposal of lead-containing items in the Work.
- D. Collect lead-containing waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1910.1025.
- E. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, and WAC 173-303. Comply with land disposal restriction notification requirements as required by 40 CFR 268. The option of recycling of construction components will be allowed if in accordance with regulations and Specifications herein.
- F. Complete manifesting of hazardous waste in conformance with EPA, DOT, and all other applicable federal, state, and local regulation.
- G. Employ only Transporter and Disposal Facilities that have EPA identification numbers. Submit the name, address, and EPA Identification Number of the Transporter and Disposal Site to the Engineer for review and approval prior to the disposal of hazardous waste.
- H. Disposal Documentation: Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD), or recycling facility is approved for lead disposal or recycling by the EPA and State or local regulatory agencies. Submit one (1) copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.

END OF SECTION

Division 03

Concrete

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Form-facing material for cast-in-place concrete.
 - 2. Shoring, bracing, and anchoring.

1.02 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints.
 - c. Forms and form-removal limitations.
 - d. Shoring and reshoring procedures.
 - e. Anchor rod and anchorage device installation tolerances.

1.04 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Exposed surface form-facing material.
 - 2. Concealed surface form-facing material.
 - 3. Forms for cylindrical columns.
 - 4. Pan-type forms.

5. Void forms.
 6. Form ties.
 7. Waterstops.
 8. Form-release agent.
- B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
1. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301 (ACI 301M).
 - a. Location of construction joints is subject to approval of the Architect.
 2. Indicate location of waterstops.
- C. Samples:
1. For waterstops.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing and inspection agency.
- B. Field quality-control reports.
- C. Minutes of preinstallation conference.

1.06 QUALITY ASSURANCE

- A. Testing and Inspection Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Mockups: Formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 1. Build panel approximately 100 sq. ft. in the location indicated or, if not indicated, as directed by Architect.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.02 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete", and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with straight or tapered end forms.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

2.03 WATERSTOPS (WS)

- A. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies Inc.; ADCOR 500S or a comparable product by one of the following:
 - 1. CETCO.
 - 2. Sika Corporation.
- C. Accessories: ADCOR 500S Adhesive.

2.04 INJECTABLE WATERSTOPS (IWS)

- A. Injectable waterstops in below grade concrete control and/or construction joints providing means of injecting grout/resin to create a continuous diaphragm to prevent liquid migration.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies Inc.; INJECTO Tube Groutable Hose Waterstop System or a comparable product by one of the following:
 - 1. CETCO.
 - 2. Sika Corporation.
- C. Injection Grouts: Manufacturer's standard as part of injection system.

2.05 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive damp proofing or waterproofing.

PART 3 - EXECUTION

3.01 INSTALLATION OF FORMWORK

- A. Comply with ACI 301 (ACI 301M).
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Division 03 Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes.
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
 - 2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
 - 3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.

- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 6. Space vertical joints in walls.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 - 5. Clean embedded items immediately prior to concrete placement.

3.03 INSTALLATION OF WATERSTOPS

- A. Install as indicated at detailed locations and in below grade locations at all concrete cold joints and intersections; foundation to footing; and foundation wall to slab transition. Install waterstop continuously at all basement slab cold joint/construction joints. Install at any below grade slab cold joints.
- B. Self-Expanding Rubber Strip Waterstops: Reference manufacturer's literature for recommendations on installation, including but not limited to, the following:
 - 1. Construction Joint:
 - a. On irregular concrete faces, apply a 1/2 inch bead of Adcor 500S Adhesive as bedding for Adcor 500S.

- b. Secure Adcor 500S using masonry nails 1-1/2 in.- 2 in. long with a washer 3/4 in. in diameter. Hilti EM6-20-12 FP8 shot fired fixings with 1/4 in. nuts and 3/4 in. diameter washers may also be used. Fixings should be spaced at a maximum of 12 in. centers with a minimum spacing that ensures proper contact to substrate.
- c. Adcor 500S joints should overlap a minimum of 4 in., ensuring full contact between jointed pieces.
- d. Adcor 500S can be bent around corners; however on complex geometry use Adocr 500S Adhesive to fill any gaps.
- e. Any damaged sections should be removed and repaired with a new section of Adcor 500S.
- f. Keep Adcor 500S dry prior to pouring concrete.
- g. Pipe Penetration:
 - 1) Adcor 500S Adhesive must be applied to dry substrates only. Apply by brush to the substrate. Wait until surface is dry to touch, and then press Adcor 500S firmly into place.
 - 2) Adcor 500S joints should overlap a minimum of 4 in., ensuring full contact between jointed pieces.
 - 3) Keep Adcor 500S dry prior to pouring concrete.
- 2. Injectable Waterstops: All installation, inspection, injection, and vacuuming operations shall be in strict accordance with the injectable hose system manufacturer's instructions and shall be done by an approved applicator of the injectable hose system manufacturer or under the direct supervision of the reinjectable hose system manufacturer's representative.
 - a. Allow concrete to cure for 28 days prior to injection work.

3.04 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

- B. Clean and repair surfaces of forms to be reused in the Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
 - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

- 1.

<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a. 031000.IWS	INJECTABLE WATERSTOP
b. 031000.WS	WATERSTOP

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Zinc repair material.
3. Bar supports.
4. Mechanical splice couplers.
5. Structural thermal break insulated connection system.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

- 1. Location of construction joints is subject to approval of the Architect.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For testing and inspection agency.
- B. Welding certificates.
- C. Field quality-control reports.
- D. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.
 - 1. Build panel approximately 100 sq. ft. for formed surface in the location indicated on Drawings or, if not indicated, as directed by Architect.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.
 - 2. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
 - 3. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Structural Thermal Break Insulating Connection System: Structural thermal break insulated connection system shall withstand the following loads and stresses:
 - 1. Dead Loads: As indicated on Drawings.
 - a. Shear Load: As indicated on Drawings.
 - b. Bending Moment: As indicated on Drawings.
 - 2. Live Loads: As indicated on Drawings.
 - a. Shear Load: As indicated on Drawings.
 - b. Bending Moment: As indicated on Drawings.
- B. Seismic Performance of Structural Thermal Break Insulated Connection System: Structural thermal break Insulated connection system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.0.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Headed-Steel Reinforcing Bars: ASTM A970/A970M.

2.03 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, ASTM A775/A775M epoxy coated.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

- b. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - c. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
- D. Mechanical Splice Couplers: ACI 318 (ACI 318M) Type 1, same material of reinforcing bar being spliced; mechanical-lap type.
- E. Structural Thermal Break Insulated Connection System:
 - 1. Tension Rods: Carbon steel with crimped Type 316 stainless steel rods.
 - 2. Shear Reinforcement Rods: ASTM A276/A276M, Type 316 stainless steel tube.
 - 3. Pressure pads: ASTM A276/A276M, Type 316 stainless steel.
 - 4. Insulation body: Polystyrene.
- F. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain.
- G. Zinc Repair Material: ASTM A780/A780M.

2.04 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.02 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318 (ACI 318M).
- G. Install structural thermal break insulated connection system in accordance with manufacturer's instructions.

3.03 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.04 INSTALLATION TOLERANCES

- A. Comply with ACI 117 (ACI 117M).

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
 - 1. Steel-reinforcement placement.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

- 1.

<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a. 032000.SR	STEEL REINFORCEMENT

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, documentation of non-conforming concrete, concrete repair procedures, and concrete protection.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture, which shall identify its intended use according to the Drawings. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Mixture shall be formulated such that mixing water shall not be required or added after the concrete leaves the batch plant.
 - 2. Engineer responsible for the concrete mixture formulation shall provide a signed and stamped letter certifying that the admixtures used are compatible with one another.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- E. Samples: For vapor retarder.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and testing agency.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Curing compounds.
 - 6. Floor and slab treatments.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor retarders.
 - 10. Semirigid joint filler.

11. Joint-filler strips.

12. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 – PRODUCTS

2.01 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 302.
 - 3. ACI 117.

2.02 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 3. High-density overlay, Class 1 or better.

4. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 5. Structural 1, B-B or better; mill oiled and edge sealed.
 6. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
 7. Overlaid Finnish birch plywood.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- G. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.03 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- E. Deformed-Steel Wire: ASTM A 1064/A 1064M.

- F. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- H. Galvanized-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from galvanized-steel wire into flat sheets.

2.04 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780/A 780M.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
- D. Metallic material other than A316 stainless steel or hot-dipped galvanized steel is not allowed within 2 inches of floor surfaces and 1 inch of wall surfaces. This includes plastic-coated steel.

2.05 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- C. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
 - 2. Fly Ash: ASTM C 618, Class F.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 - 4. Silica Fume: ASTM C 1240, amorphous silica.

- D. Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- E. Air-Entraining Admixture: ASTM C 260/C 260M.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- G. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
- H. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
- I. Water: ASTM C 94/C 94M and potable.

2.06 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.07 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.08 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing, Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.09 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4500 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, as indicated.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement and as recommended by floor hardener manufacturer and other manufacturers of other materials specified for the concrete surface.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.44.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 – EXECUTION

3.01 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.

- I. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.03 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
 - 3. Do not load structural concrete with more than 10% of its weight until it has reached its 28-day specified compressive stress.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.05 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 WATERSTOP INSTALLATION

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.08 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or

planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined and unintended construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.09 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to view.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated and at troweled finishes.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated.
 - 2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4500 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. **Moisture-Retaining-Cover Curing:** Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
3. **Curing Compound:** Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. **Removal:** After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
4. **Curing and Sealing Compound:** Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. **Defective Concrete:** Identify and document all concrete that is out of conformance with the Project Documents. Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar where such material is appropriate according to the manufacturer's recommendations.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Project Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Project Representative. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness within 48 hours of finishing.

END OF SECTION

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Division 05

Metals

SECTION 05 15 00
STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Field-installed shear connectors.
 - 3. Grout.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
 - 2. Structural General Notes on Drawings.

1.03 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
 - 2. Welded built-up members with plates thicker than 2 inches (50 mm).
 - 3. Column base plates thicker than 2 inches (50 mm).
- C. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- D. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Force-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.04 COORDINATION

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

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.06 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 - 5. Identify members and connections of the Seismic-Load-Resisting System.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.
- D. Qualification Data: For Installer, fabricator, and shop-painting applicators.
- E. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- F. Welding certificates.

- G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- H. Mill test reports for structural steel, including chemical and physical properties.
- I. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
 - 5. Shop primers.
 - 6. Non shrink grout.
- J. Survey of existing conditions.
- K. Source quality-control reports.
- L. Field quality-control reports.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- E. Coordination: The General Contractor shall ensure sequencing with adequate schedule for review and approval of fall protection and photovoltaic system layout drawings prior to steel framing detailing.

F. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 (2016) and AISC 341s1 (2016).
3. AISC 360 (2016).
4. Research Council on Structural Connections' (RCSC's) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.08 DELIVERY, STORAGE, AND HANDLING

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

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Refer to Structural Drawings for additional requirements.
- B. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
- C. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.02 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50 (345).
- B. Channels, Angles, S-Shapes: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50 (345).

- C. Plate and Bar: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50 (345).
- D. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50 (345).
- E. Cold-Formed Hollow Structural Sections: ASTM A 1058/A 1085M, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Weight Class: As indicated on Structural Drawings.
 - 2. Finish: Black except where indicated to be galvanized.
- G. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- H. Steel Forgings: ASTM A 668/A 668M.
- I. Stainless-Steel Bars and Shapes: ASTM A276, Type 316L.
- J. Stainless-Steel Steel Forgings: ASTM A484.
- K. Stainless-Steel Steel Castings: ASTM A743.
- L. Welding Electrodes: Comply with AWS requirements.

2.03 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip or mechanically deposited zinc coating.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.

- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Mechanically deposited zinc coating.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- F. At Stainless Steel Members and Components: Provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- G. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1) (A4).
- H. Headed Anchor Rods: ASTM F 1554, Grade 55, weldable, straight.
1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 4. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
- I. Threaded Rods:
1. General: ASTM A 36/A 36M.
 - a. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - b. Washers: ASTM A 36/A 36M carbon steel.
 - c. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C or Mechanically deposited zinc coating, ASTM B 695, Class 50.
 2. At Stair No. 4: Type 316 stainless-steel, ASTM A276.
 - a. Nuts: Type 316 stainless-steel.
 - b. Washers: Type 316 stainless-steel.
 - c. Finish: Mill finish.
- J. Clevises and Turnbuckles:
1. General: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
 2. At Stair No. 4: Made from cold-finished Type 316 stainless-steel bars, ASTM A743.

- K. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- L. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.04 PRIMER

- A. Primer: SSPC-Paint 25, Type I Type II, zinc oxide, alkyd, linseed oil primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.05 GROUT

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

2.06 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

- G. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.07 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, Pretensioned, or Slip critical, as indicated in Structural Drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.08 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Galvanized surfaces.
 - 5. Surfaces enclosed in interior construction.
- B. Surface Preparation, General: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. At non-exposed structural steel locations, provide SSPC-SP 3, "Power Tool Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.09 GALVANIZING

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

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize welded door frames attached to structural-steel frame and located in exterior walls.
3. Applications: Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame, elements located in exterior walls, exposed elements outside the building envelope, and elsewhere as indicated in Drawings and Structural General Notes.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

- D. Splice members only where indicated.
- E. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- H. Following erection, remove erection tabs; if grinding or torching is required, ensure abraded area is reprotected with primer at primed steel, or galvanizing repair paint at galvanized steel.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, Pretensioned, or Slip critical, as indicated in Structural Drawings.
- B. 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 overlap.
 - 3. Remove flux immediately.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.

b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

c. Ultrasonic Inspection: ASTM E 164.

d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.06 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 05 31 00
STEEL DECKING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof Deck.

1.02 SYSTEM DESCRIPTION

- A. Primary metal deck, and connections as required to provide a complete framing system to structural steel according to this section and the Drawings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Manufacturer Data: Submit manufacturer's data, specifications and installation instructions.

- C. Operation manuals for mechanical fastener installation tools.

- D. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

- E. Informational Submittals:

1. Welding certificates.

2. Product Certificates: For each type of steel deck.

3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

- a. Power-actuated mechanical fasteners.

4. Evaluation Reports: For steel deck.

5. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

- B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.02 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following where indicated:
 - 1. Color: Gray top surface with white underside.
- B. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 minimum, G90 zinc coating.
- D. Deck Profile: As indicated.
- E. Profile Depth: As indicated.
- F. Design Uncoated-Steel Thickness: As indicated.
- G. Span Condition: As indicated.
- H. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.03 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- G. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: ASTM A 780.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Coordinate reinforcing requirements of openings in first paragraph below with applicable sections.
- H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- I. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- J. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated on the Drawings, but not less than the following:
 - 1. Weld Diameter: 5/8 inch, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, spaced as indicated and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

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SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cold-formed metal exterior wall framing.
2. Cold-formed metal wall framing separating interior conditioned spaces and unconditioned spaces.
3. Load bearing cold-formed metal wall framing.
4. Cold-formed metal joist framing.
5. Accessories required for bracing and attaching metal framing to structure.
6. Plywood sheathing and fasteners to cold-formed metal framing.

1.02 SYSTEM DESCRIPTION

- A. Primary and secondary cold-formed metal framing, bracing, bridging, plates, gussets, clips, fittings, reinforcement, and connections as required to provide a complete framing system to structural steel or concrete framing according to this section and the Drawings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Manufacturer Data: Submit manufacturer's data, specifications and installation instructions for cold-formed metal framing.
- C. Operation manuals for mechanical fastener installation tools.
- D. Shop Drawings:
1. Plan and elevation views of all metal framing systems, including location and framing of all openings. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 3. Material specifications, member sizes, and properties.

4. Details of track, web stiffeners, stud bracing, blocking, bridging, and other members as required to provide a complete installation.
5. Details of connections including welding, mechanical fasteners, and accessory items.
6. Design loads for cold-formed steel framing as shown on the Drawing or as required by IBC.

E. Quality Assurance Submittals:

1. Research/evaluation reports: for cold-formed metal framing.
2. Product test reports.
 - a. Steel sheet.
 - b. Expansion anchors.
 - c. Power-actuated anchors.
 - d. Mechanical fasteners.
 - e. Vertical deflection clips.
 - f. Horizontal drift deflection clips
 - g. Miscellaneous structural clips and accessories.

F. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1. Mill certificates.
2. Welder's certificates that verify AWS qualification within the previous 12 months.
3. Welding Procedure Specification (WPS).
4. Welding electrodes.
5. Manufacturer's and Installer's Qualifications.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Manufacturer's and Installer's Qualifications:

1. Material and products shall be manufactured by a company with current AISI or AF&PA certification, and is continuously and regularly employed in the manufacture of similar materials at the time of bid.
2. Installation shall be by an installer that has been in the business of erecting similar materials for at least five (5) consecutive years at the time of bid; and can show evidence of satisfactory completion of projects of similar size and scope.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of one of the following manufacturers shall be incorporated in the Work of this section:
- B. Metal Framing and Connectors:
1. SCAFCO Steel Stud Manufacturing Co. – www.scafco.com.
 2. Steeler, Inc. – www.steeler.com.
 3. Clark Dietrich Metal Framing – www.clarkdietrich.com.
 4. Simpson Strong-Tie Company, Inc. – www.strongtie.com.
 5. Or Approved Equal.

C. Powder Actuated Fasteners:

1. Hilti Corporation – www.hilti.com.
2. Dewalt/Powers Fasteners – www.anchors.dewalt.com/.
3. Or Approved Equal.

2.03 MATERIALS

A. Cold-formed metal framing: ASTM A1003.

1. 16 gauge (54 mil) and heavier: 50 ksi, Structural Quality (SQ), Grade 50, Type H.
2. 18 gauge (43 mil) and lighter: 33 ksi, Structural Quality (SQ), Grade 33, Type H.

B. Mechanical Fasteners: ASTM C1002.

C. Welding Electrodes:

1. Comply with AWS standards.
2. Unless otherwise indicated, filler material shall be E70.

D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Cold-formed metal framing shall be formed from steel sheets complying with ASTM A653, with G-60 hot-dip galvanized coating.

F. Dimensions and Properties: Calculate section properties in accordance with AISI Cold-Formed Steel Design Manual.

2.04 ACCEPTABLE PRODUCTS

A. Cold-formed steel members are typically called out on the Drawings using standard SSMA designations.

B. Studs: Unless otherwise indicated, roll-formed channel studs shall be 20 gauge (33 mil) minimum, roll-formed channel studs of 3-1/2-inch size for internal and 5-1/2 for external walls, fabricated from 25-gauge steel with flanges not less than 1-3/8-inch wide; knurled on outside face; punched to receive mechanical and electrical work; suitable to receive wallboard and plaster finishes specified. Provide 16-gauge double studs at door jambs, typical.

C. Tracks: Flanges shall not be less than 1-1/4 inches; width and gauge to suit studs, unpunched as indicated on the Drawings.

D. Joists: 18-gauge (43 mil) minimum, sizes as indicated on the Drawings. Provide stiffened flanges with return lip.

- E. Furring Channels: 20 gauge (33 mil), 7/8" deep with knockouts for conduit installation, suitable to receive wallboard attached with self-drilling drywall screws, unless otherwise indicated. Size and gauge shall be as indicated on the Drawings.
- F. Z-Girts: 20 gauge (33 mil) unless otherwise indicated. Size and gauge shall be as indicated on the Drawings.
- G. Bridging, Blocking and Fire Stops: Standard for manufacturer of metal studs, Same depth as studs or joists, 0.0566-inch minimum design thickness, unpunched.
- H. Accessory Material: All incidental and accessory materials, methods, tools and equipment are required for the satisfactory fabrication and erection of framing, as indicated on the Drawings, including fasteners, attachments and anchorages to building construction. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33 ksi.
- I. Bracing Straps, Angle Bracing, Clip Angles: minimum gauge and thickness to match attached stud or panel as indicated on Drawings.
- J. Mounting Plates: 0.0566-inch minimum design thickness by 8 inches by 18 inches.
- K. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1 inch plus the design gap. Vertical design deflection gap is 0.75."
- L. Plywood sheathing:
 - 1. Wood structural panels and sheathing shall conform to DOC PS-1.
 - 2. Panels applied to exterior walls or roofs shall be manufactured with exposure 1 or exterior rated glue.
 - 3. Wall sheathing: 15/32" with panel span rating 32/16.
 - 4. Plywood shall be fire-treated where indicated.
- M. Mechanical Fasteners:
 - 1. Corrosion resistant coated.
 - 2. Self-drilling, self-tapping steel drill screws.
 - 3. Low profile head beneath sheathing, Manufacturer's standard profile elsewhere.
- N. Powder Actuated Fasteners: As indicated on the Drawings.

2.05 FINISHES

- A. Galvanize all surfaces with a G60 coating complying with ASTM A653.

2.06 SOURCE QUALITY CONTROL

- A. Shop-fabricated steel shall be provided by a fabricator with current AISI certification.

2.07 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by mechanically deposition according to ASTM B 695, Class 50.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.08 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.09 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.02 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Provide smooth level bearing surfaces for bottom track of load bearing walls.
- D. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- E. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- F. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- G. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- H. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.03 LOAD-BEARING WALL INSTALLATION

- A. Install tracks in accurate alignment in accordance with approved layouts and manufacturer's recommendations; secure to building construction, as indicated on the Drawings; where not indicated on the Drawings, provide minimum 5/16-inch diameter power-driven fasteners at 16 inches on center. Position studs in tracks and secure, as indicated on the Drawings. Space studs and joists no more than 16 inches on center.
- B. Provide jack studs between bottom track and sills of openings, and between top track and sills of openings, and between top track and headers and lintels of openings. Locate studs no more than two inches from all abutting partitions, partition corners, door frames, jambs and other interrupting construction.
- C. At door jambs and at free ends of partitions, provide 16-gauge doubles studs placed back to back. Above and below openings, provide cut studs, as necessary to maintain the specified stud spacing.
- D. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks.
- E. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- F. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- G. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- H. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated. Cut ends of framing members with saw or shear to bear uniformly against abutting members. Flame cutting is not permitted.
- I. All structural framing members shall be full-length without splices, unless indicated otherwise.
- J. Immediately install bridging and solid blocking to support joists. Maximum spacing of bridging shall be 5 feet.
- K. Install web stiffeners at joists where indicated.
- L. Web Penetrations:
- M. Drilled holes for other trades shall be limited to the middle 1/3 of the joist depth within the middle 1/3 of the span, unless indicated otherwise. Minimum spacing between drilled holes shall be 1-1/2 times the joist depth. Notching of joist flanges and flame cutting of holes are not permitted.
- N. Fasten members together in accordance with AISI, Cold-Formed Steel Design Manual, Part IV, Connections. Wire tying is not permitted.

- O. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- P. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
- Q. Provide cut sections or runner channel, zinc coated steel backing plates, doubled and nested studs, load bearing studs and other items, as indicated, for the support of wall-hung fixtures, shelving, cabinets, hand rails and toilet accessories. Cut ends of runner and backing plates to each stud. Fasten studs carrying the weight of wall-hung items to the bottom runner channel.
- R. Install horizontal bridging in stud system, spaced vertically 48 inches on center. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of 1-1/2 by 0.0329 inch (minimum) and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- S. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- T. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.04 NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: as indicated on drawings; 16" minimum.

- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - a. Install solid blocking at 96-inch.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- G. Where wall can not carry to ceiling with deflection track installed brace top of wall with 45 degree braces at 4'-0" oc.

3.05 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 40 00 A
COLD-FORMED METAL FRAMING ADD-ON

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing.
- B. Exterior wall sheathing.
- C. Accessories
- D. Fasteners

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

- A. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud layout.
 - 2. Describe method for securing studs to tracks and for bolted, welded or screwed framing connections.
- D. Calculations: The manufacturer shall design metal framing system, including anchors for loads specified in the Seattle Building Code. Complete design calculations signed and sealed by a professional civil or structural engineer registered in the State of Washington shall be submitted prior to the delivery of such items.
- E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.
- F. Welding Certificates

G. ICC-ES Research/Evaluation Reports indicating that each of the following complies with requirements:

1. Cold-formed metal framing m
2. Expansion anchors.
3. Power-actuated anchors.
4. Screw fasteners

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 1. Marino: www.marinoware.com.
 2. The Steel Network, Inc: www.SteelNetwork.com.
 3. AllSteel Products, Inc.: www.allsteelproducts.com
 4. California Expanded Metal Products Company: www.cemcosteel.com
 5. ClarkDietrich Building Systems: www.clarkdietrich.com

6. Consolidated Fabrications Corp.; Building Products Division:
www.confabbpd.com
7. SCAFCO Corp., www.scafco.com
8. Steel Construction Systems: www.steelconsystems.com
9. Steeler Inc., www.steeler.com
10. United Metal Products, Inc. www.unitedmetalproducts.info.
11. Substitutions: See Section 01 33 10 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

- A. General: Gauge based on wall height, galvanized, studs at 16" on center unless noted otherwise. Built-up jambs, header and sills as required. Strength" $F_y=33\text{ksi}$ for 18 and 20 gauge. $F_y= 50\text{ksi}$ for 12, 14, and 16 gauge.
- B. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 1. Depth: As indicated on the drawings.
- C. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.
 1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members; minimum 16 gage, 0.06 inch thickness.
 2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, screws and anti-friction bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
 3. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated.

4. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated.
5. Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 WALL SHEATHING

- A. Wall Sheathing: Glass mat faced gypsum; ASTM C1177/C1177M, square long edges, 1/2 inch.
 1. Type and Thickness: 1/2 - inch thick.
 2. Edge and End Configuration: Glass-matts both sides and long edges.
 3. Special Conditions: Provide sheathing for vertical application and at horizontal furring.
- B. Products: subject to compliance with requirements
 1. Product Standard "Dens-Glass Gold Exterior Guard" by Georgia-Pacific Corp. Or approved equal.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- D. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- E. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

- F. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- G. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.06 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts, Washers and Clips:
 - 1. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123/A 123M.
 - 2. Anchor Bolts: ASTM F 1554, Grade 36 threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
 - 3. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 4. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
 - 5. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 6. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere
- B. Anchorage Devices: Powder actuated.
- C. Welding: In conformance with AWS D1.1.

2.07 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.

2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.03 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C 1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- F. Install load bearing studs, brace, and reinforce to develop full

strength and achieve design requirements.

- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non- load bearing framing.
- J. Attach cross studs to studs for attachment of fixtures anchored to walls.
- K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- L. Touch-up field welds and damaged galvanized surfaces with primer.
- M. 1 Fasten jamb members together to uniformly distribute loads
- N. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates
- O. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.04 WALL SHEATHING

- A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
- C. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch (9-mm) setback where non-load-bearing construction abuts structural elements.
- D. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

- E. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- F. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

3.05 TOLERANCES

- A. Maximum Variation from True Position: 1/8 inch.
- B. Maximum Variation of any Member from Plane: 1/8 inch. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finish materials.

3.06 REPAIRS AND PROTECTIONS

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing.
- B. Exterior wall sheathing.
- C. Accessories.
- D. Fasteners.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.03 SUBMITTALS

- A. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
 - 1. Indicate stud layout.
 - 2. Describe method for securing studs to tracks and for bolted, welded or screwed framing connections.
- D. Calculations: The manufacturer shall design metal framing system, including anchors for loads specified in the Seattle Building Code. Complete design calculations signed and sealed by a professional civil or structural engineer registered in the State of Washington shall be submitted prior to the delivery of such items.
- E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.
- F. Welding Certificates.

G. ICC-ES Research/Evaluation Reports indicating that each of the following complies with requirements:

1. Cold-formed metal framing.
2. Expansion anchors.
3. Power-actuated anchors.
4. Screw fasteners.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 1. Marino: www.marinoware.com.
 2. The Steel Network, Inc: www.SteelNetwork.com.
 3. AllSteel Products, Inc.: www.allsteelproducts.com.
 4. California Expanded Metal Products Company: www.cemcosteel.com.
 5. ClarkDietrich Building Systems: www.clarkdietrich.com.
 6. Consolidated Fabrications Corp.; Building Products Division: www.confabbpd.com.
 7. SCAFCO Corp., www.scafco.com.
 8. Steel Construction Systems: www.steelconsystems.com.
 9. Steeler Inc., www.steeler.com.

10. United Metal Products, Inc. www.unitedmetalproducts.info.

11. Substitutions: See Section 01 60 00, "Product Requirements."

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

- A. General: Gauge based on wall height, galvanized, studs at 16" on center unless noted otherwise. Built-up jambs, header and sills as required. Strength" Fy=33ksi for 18 and 20 gauge. Fy= 50ksi for 12, 14, and 16 gauge.
- B. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Depth: As indicated on the drawings.
- C. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.
 - 1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members; minimum 16 gage, 0.06 inch thickness.
 - 2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, screws and anti-friction bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
 - 3. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated.
 - 4. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated.
 - 5. Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 WALL SHEATHING

- A. Wall Sheathing: Glass mat faced gypsum; ASTM C1177/C1177M, square long edges, 1/2 inch.
 - 1. Type and Thickness: 1/2 - inch thick.
 - 2. Edge and End Configuration: Glass-matts both sides and long edges.
 - 3. Special Conditions: Provide sheathing for vertical application and at horizontal furring.

B. Products: subject to compliance with requirements:

1. Product Standard "Dens-Glass Gold Exterior Guard" by Georgia-Pacific Corp. or approved equal.

2.05 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- D. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- E. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- F. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- G. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.06 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts, Washers and Clips:
 - 1. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123/A 123M.
 - 2. Anchor Bolts: ASTM F 1554, Grade 36 threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
 - 3. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 4. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
 - 5. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 6. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

- B. Anchorage Devices: Powder actuated.
- C. Welding: In conformance with AWS D1.1.

2.07 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Install insulation, specified in Division 07 Section 07 21 00 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.03 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C 1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

- F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non- load bearing framing.
- J. Attach cross studs to studs for attachment of fixtures anchored to walls.
- K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- L. Touch-up field welds and damaged galvanized surfaces with primer.
- M. 1 Fasten jamb members together to uniformly distribute loads.
- N. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates
- O. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.04 WALL SHEATHING

- A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
- C. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch (9-mm) setback where non-load-bearing construction abuts structural elements.
- D. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- E. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- F. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

3.05 TOLERANCES

- A. Maximum Variation from True Position: 1/8 inch.
- B. Maximum Variation of any Member from Plane: 1/8 inch. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finish materials.

3.06 REPAIRS AND PROTECTIONS

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 20
HANDRAILS AND RAILINGS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Metal handrails.
 - 2. Metal guardrails.
- B. Section does not include Architecturally Exposed Steel requirements.
- C. Related Sections:
 - 1. Section 05 15 00, "Structural Steel Framing."
 - 2. Section 09 96 00, "High-Performance Coatings."

1.02 SUBMITTALS

- A. Approval Submittals:
 - 1. Product Data:
 - a. Concrete anchors.
 - b. Bolts, washers and nuts.
 - c. Concrete inserts.
 - d. Welding electrodes.
 - 2. Shop and Erection Drawings: Plans, elevations, and details of fabricated structural steel components that include the following:
 - a. Details of each piece, lengths, connections, welded studs, stiffeners, splices, holes, and other information that describes the fabricated steel.
 - b. Location of steel elements described in item a, as required for fabrication and erection.
 - c. Grade of steel and shop coat requirements.
 - d. Welds noted with standard AWS symbols. Distinguish between shop and field welds, and show size, length, and type of each weld.
 - e. Bolt type, size and length. Distinguish between shop and field bolts.
 - f. Plans and elevations that show steel embedments in concrete.

B. Quality Assurance/Control Submittals:

1. Welding Procedure Specification (WPS).
2. Welder's certificates that verify AWS qualification within the previous 12 months.
3. Manufacturer's Technical Representative contact information.
4. Producer's or Manufacturer's certificates of compliance for the following products.
 - a. Welding electrodes.
 - b. Bolts and bolted assemblies.
 - c. Mill test reports for all steel members.
5. Fabricator's and Erector's Qualifications.

1.03 QUALITY ASSURANCE

- A. Comply with Section 05 15 00, "Structural Steel Framing."
- B. Comply with requirements of the IBC for maximum opening sizes, where required, and regulations for all handrail and guardrail heights, clearances, and terminations.
- C. Fabricator's and Erector's Qualifications:
 1. Material shall be fabricated by a company that is continuously and regularly engaged in the manufacture of similar materials, for a period of at least five (5) consecutive years at the time of proposal.
 2. Erection shall be performed by an erector that has been in the business of erecting similar material for at least five (5) consecutive years at the time of proposal.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of one of the following manufacturers may be incorporated in the Work of this section:
 1. Hilti, Inc. – www.us.hilti.com.
 2. Dewalt/Powers Fasteners, Inc. – www.dewalt.com.
 3. Simpson Strong-Tie Company, Inc. – www.simpsonanchors.com.
 4. Or Approved Equal.

2.02 MATERIALS

A. Steel:

1. Plate and Bar: ASTM A36.
2. Channels, Angles: ASTM A36.
3. Structural Tubing: ASTM A500; Grade B.
4. Pipe: ASTM A53; Type E or S; Grade B, schedule 40 unless otherwise indicated.

B. Welding Electrodes:

1. Comply with AWS standards.
2. Unless otherwise indicated, filler material shall be E70.

2.03 MANUFACTURED UNITS

A. Bolts, fasteners, and related manufactured hardware items:

1. Provide specific grade where indicated in the Drawings; if any.
 - a. Unless otherwise specified, provide fasteners in compliance with ASTM A325.
2. All bolts/fasteners shall be galvanized with ASTM A153 class C hot dip galvanizing.
3. Provide 304 stainless steel fasteners and accessories for any parts not normally available hot dip galvanized.

2.04 FABRICATION

A. Metal Handrails and Guardrails:

1. Provide as indicated on the Drawings.
2. Configuration: Straight; unitized; segmental, with slip joints at intervals allowing for expansion and contraction.
3. Accurately form pipe railing components to suit stairs, ramps and landings to each other and to building structure.
4. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Drill/tap holes prior to galvanizing.

B. Welds:

1. Grind smooth.
2. Assemble welded connections by methods such as seal welds that will exclude moisture from hidden joint areas and areas not accessible after fabrication.

2.05 FINISHES

A. Refer to Section 09 96 00, "High-Performance Coatings" for finishes and finish related activities not addressed in this section.

B. Interior Surfaces:

1. Provide coating grade 55 galvanizing in compliance with ASTM A123.

C. Exterior Surfaces:

1. Provide coating grade 55 galvanizing in compliance with ASTM A123 and Performance Coatings in compliance with Section 09 96 00, "High-Performance Coatings."

D. Surfaces embedded in concrete or mortar: Extend galvanizing/Performance Coating of partially embedded members to a depth of two (2) inches.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify conditions are satisfactory to receive Work of this section. Do not commence Work until unsatisfactory conditions have been corrected.

B. Beginning of Work constitutes acceptance of conditions.

3.02 PREPARATION

A. Supply items required to be cast into concrete and placed in partitions with setting templates.

B. Protect against galvanic action from uncoated dissimilar metals coming in contact with one another.

3.03 INSTALLATION

A. General:

1. Install components plumb, and level unless otherwise indicated to be installed in inclined or sloped surfaces.
2. Provide anchors, plates, angles, hangers, struts, and other necessary items for a complete installation.

3. Field weld components indicated on the Drawings.
 - a. Perform field welding in accordance with AWS.
4. Install bolts, washers, nuts and related fastenings.
5. Obtain approval from the Project Representative prior to field cutting, or otherwise permanently modifying fabricated items once delivered to the Project Site.

B. Manufacturer's Instructions:

1. Contact the product representative to confirm appropriate procedures prior to beginning installation.
2. Comply with manufacturer's instructions, including technical bulletins and product catalog data.

3.04 REPAIR/RESTORATION

- A. Touchup Painting: Cleaning and touchup of Performance Coatings are specified in Section 09 96 00, "High-Performance Coatings" and ASTM A780.
- B. Perform touchup and repair before surfaces become inaccessible due to other Work.

3.05 FIELD QUALITY CONTROL

- A. Walk through the complete Project with Project Representative to assure all metal fabrication are appropriately fastened, secured, restrained, removable, flush, level, and as indicated on the Drawings and this section.
 1. Comply with accessibility standards for limitations of deviation from plane, for vertical edge limitations, slopes and cross slopes, slip resistance, and other criteria in accordance with applicable codes.

3.06 PROTECTION

- A. Provide protection and maintain conditions in a manner that ensure that structural framing and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Stainless-steel pipe and tube railings.
 - 2. Steel pipe and tube railings.

1.02 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes on stainless steel.
- D. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and handrail brackets.
 - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of finishing and connecting members at intersections.
- E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- F. Welding certificates.

- G. Qualification Data: For professional engineer.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.6, "Structural Welding Code--Stainless Steel."
 - 3. WABO Certification.

1.04 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.05 COORDINATION AND SCHEDULING

- 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.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Stainless Steel: 60 percent of minimum yield strength.
 - 2. Steel: 72 percent of minimum yield strength.

- B. Structural Performance: Provide railings capable of withstanding 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.
- C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- D. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.02 METALS, GENERAL

- A. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.03 STAINLESS STEEL

- A. General: Provide stainless steel hand railings, brackets and fasteners as indicated.
 - 1. Interior railings and brackets: 304 stainless steel.
 - 2. Exterior railings and brackets: Marine grade 316 stainless steel, Alloy 316/316L, ASTM 240.
- B. Tubing: ASTM A 554, Grade MT 304316L.
- C. Pipe: ASTM A 312/A 312M, Grade TP 304316L.
- D. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.
- E. Plate and Sheet: ASTM A 666, Type 304316L.

2.04 STEEL AND IRON

- A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.05 FASTENERS

- A. General: Provide the following:
 - 1. Interior Stainless-Steel Railings: Type 304 stainless-steel fasteners.
 - 2. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - 3. Exterior Stainless-Steel Railings: Type 316 stainless-steel fasteners; A276 Type 316, ASTM A193 Gr.B8M, A320 Gr. B8M.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 2. Provide tamper-resistant flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors: Provide cast-in-place or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.06 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalanizing welds in steel, complying with SSPC-Paint 20.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.07 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. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

- C. 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.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- 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 overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form changes in direction as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.08 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - 1. Directional Satin Finish: No. 4.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.09 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For non-galvanized steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. 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 railings:
 - 1. Interior Railings indicated to Receive Zinc-Rich Primer (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

- G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 3. 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.
- 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.

3.03 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.04 ANCHORING POSTS

- A. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- B. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.

3.05 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends connected to railing ends using non-welded connections.

3.06 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For steel-framed gypsum board partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.07 ADJUSTING AND CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Primer Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.08 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.

3.09 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

- 1.

<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a. 055213.HSS	HANDRAIL STAINLESS STEEL

END OF SECTION

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Division 06

Wood, Plastics,
and Composites

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Framing with dimension lumber and timbers.
 2. Rooftop equipment bases and support curbs.
 3. Wood blocking, cants, and nailers.
 4. Wood furring.
 5. Wood sleepers.
 6. Utility shelving.
 7. Plywood backing panels.

1.02 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Timber: Lumber of 5 inches nominal or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.03 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. 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 according to ASTM D 5664.
 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
 5. For adhesives, documentation including printed statement of VOC content.
 6. Laboratory Test Reports : For laminating adhesive, sealers and primers documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. For composite wood products, documentation indicating that product contains no urea formaldehyde.
- B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.04 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES
1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Shear panels.
 4. Power-driven fasteners.

5. Powder-actuated fasteners.
6. Expansion anchors.
7. Metal framing anchors.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire--retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 – PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 3. 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 lumber.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15% unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP U1; Use Category UC2.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19%. 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.
 - 1. For exposed lumber indicated to receive a stained or natural finish.
- D. Application: Treat all rough carpentry unless otherwise indicated.
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying 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 according to ASTM E 84, 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. Exterior Type: Treated materials shall comply with requirements specified above for fire- retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28% or less when tested according to ASTM D 3201 at 92% relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19%. Kiln-dry plywood after treatment to a maximum moisture content of 15%.

- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

2.04 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: See drawings.
- B. Load-Bearing Partitions and Ceiling Joists: See drawings.

2.05 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
 - 7. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber as indicated on drawings.
- C. For utility shelving, provide lumber with 15% maximum moisture content and any of the following species and grades:
 - 1. Hem-fir or hem-fir (north); Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
 - 2. Spruce-pine-fir (south) or spruce-pine-fir; Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For concealed boards, provide lumber with 15% maximum moisture content and any of the following species and grades:
 - 1. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 - 2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

- E. 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.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.06 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, in thickness indicated or, if not indicated, not less than as shown on drawings nominal thickness.
 - 1. Tele Com backing board to be fire rated.

2.07 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 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 A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency. See drawings for additional requirements.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.08 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements on the drawings, provide products by one of the following:
 - 1. Simpson Strong-Tie Co., Inc.
 - 2. USP Structural Connectors.
 - 3. Phoenix Metal Products, Inc.
 - 4. Or Approved Equal.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304. Use for exterior locations and where indicated.
- F. Hangers, ties, and anchors as indicated on drawings.
- G. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, as indicated on drawings.
- H. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and as indicated on drawings.
- I. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, as indicated on drawings.

2.09 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

- C. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. 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.
- D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. 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.
- H. 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.
 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- I. Sort and select lumber so that natural characteristics will 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.
 - J. Comply with AWP A 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.
 - a. All fasteners and attachments to copper naphthenate shall be double hot dipped galvanized or have appropriate galvanation protection.
 - K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
 - M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 1. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

3.02 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- 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.

3.03 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring at 16 inches o.c.

3.04 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
 - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4- inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

3.05 ROOF FRAMING INSTALLATION

- A. Roof Framing: Provide framing as indicated on drawings.
- B. Provide framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.06 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA- registered label.

END OF SECTION

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SECTION 06 16 00
SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.

1.02 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.

1.03 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 for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PANEL PRODUCTS

- A. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated in Structural Drawings and notes.
- C. Factory mark panels to indicate compliance with applicable standard.

2.02 WALL SHEATHING

- A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, Exterior, Structural I sheathing or as otherwise indicated on structural Drawings and notes.
 - 1. Span Rating: As indicated on structural Drawings and notes.
 - 2. Nominal Thickness: Not less than 15/32 inch. See Structural.

2.03 ROOF SHEATHING

- A. Plywood Sheathing for Use as Cover Board: Either DOC PS 1 or DOC PS 2, Exterior, Structural I sheathing or as otherwise indicated on structural Drawings and notes.

- 1. Nominal Thickness: Not less than 3/4 inch.

2.04 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

- 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.

- B. Nails, Brads, and Staples: ASTM F1667.

- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

- D. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.05 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

- 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.01 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. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

- D. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.

3.03 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1. <u>KEYNOTE</u>	<u>DESCRIPTION</u>
a. 061600.PW	PLYWOOD
b. 061600.PWS	PLYWOOD SHEATHING

END OF SECTION

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SECTION 06 16 13
STRUCTURAL INSULATED SHEATHING WITH MEMBRANE COATING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
1. Vapor-permeable structural insulated sheathing exterior wall panels and accessories.
 2. Fluid-applied water resistive air barrier membrane system applied to openings, penetrations and transitional breaks in water-resistant membrane sheathing system.
 - a. Connections of the walls to the roof membrane.
 - b. Connections of the walls to the foundations.
 - c. Seismic and expansion joints.
 - d. Piping, conduit, duct and similar penetrations.
 - e. Masonry ties, screws, bolts and similar penetrations.
 - f. All other air leakage pathways in the building envelope.

1.02 SUBMITTALS

- A. Manufacturer's Product Data: Submit data sheets for structural insulating sheathing, Fluid-applied water resistive air barrier membrane system and accessories. Include instructions for handling, storage, installation, and protection.
- B. Installation details for fluid-applied water resistive air barrier membrane system applied to openings, inside and outside corners, penetrations and transitional breaks in water-resistant membrane sheathing system.
- C. Manufacturer's Installation Instructions: Indicate special handling criteria, installation sequence, cleaning procedures, and standard installation procedures.
- D. Manufacturer's demonstrated compliance with NFPA 285 assembly.
- E. Sample product warranty.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall be a company that regularly manufactures and assembles structural insulated sheathing in its own fabrication and owned facilities.
- B. Field Quality Control Plan:
 - 1. Visually inspect fasteners, flashings, and waterproofing.
 - 2. Photographically document observations and maintain record of observations.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Transport and handle items in accordance with manufacturer's instructions.
- B. Coordinate deliveries in order to avoid delay in, or impediment of, progress of the Work.
- C. Store packaged materials in original containers with seals unbroken and labels, including grade seal, intact until time of use, in accordance with manufacturer's instructions. Do not stack.
- D. Store installation system materials in a dry location and handle in a manner to prevent chipping, breakage, and contamination.
- E. Store structural insulating sheathing boards off ground, under cover, and keep dry. Pallets shall sit on even gravel or concrete surface when able.
- F. Maximum panel stack height thirty (30) panels. Do not double stack pallets.
- G. Long term panel storage shall be kept in a warehouse condition.
- H. Protect latex additives, organic adhesives, epoxy adhesives and sealants from freezing or overheating in accordance with manufacturer's instructions; store at room temperature when possible.
- I. Protect insulated panels from prolonged UV and weather exposure prior to installation. Edges of panels shall remain covered in factory wrapped packaging prior to installation. Outdoor storage prior to installation requires a waterproof tarpaulin and elevated storage above ground level a minimum of four (4) inches if removed from factory pallet shipping platform.

1.05 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Sheathing panels may be installed at any temperature.
- C. Special consideration shall be followed for accessory sealants. Follow manufacturer's instructions for temperature limitations on seam sealant requirements.

1.06 WARRANTY

- B. Provide manufacturer's Limited Ten-Year Warranty.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Material Performance: Provide air barrier materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.004 cfm/ft² @ 1.57 psf) when tested in accordance with ASTM E2178.
- B. The water vapor permeance Desiccant method, (Procedure A) and Water method (Procedure B) shall be determined in accordance with ASTM E96 and shall be declared by the material manufacturer.
- C. Assembly Performance: Provide a continuous air barrier in the form of an assembly that has an air leakage not to exceed 0.04 cubic feet per minute per square foot under a pressure differential of 1.57 pounds per square foot (0.04 cfm/ft² @ 1.57 psf) when tested in accordance with ASTM E2357. The assembly shall accommodate movements of building materials by providing expansion and control joints as required. Expansion/control joints, changes in substrate and perimeter conditions shall have appropriate accessory materials at such locations.
 - 1. The air barrier assembly shall be capable of withstanding combined design wind, fan and stack pressures, both positive and negative on the envelope without damage or displacement, and shall transfer the load to the structure.
 - 2. Materials of the air barrier assembly shall not displace adjacent materials in the assembly under full load.
 - 3. The air barrier assembly shall be joined in an airtight and flexible manner to the air barrier materials of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations, creep, and anticipated seismic movement.

D. Fire Performance Characteristics: Provide water-resistive barrier meeting the following fire-test characteristics.

1. Surface-Burning Characteristics (ASTM E 84):

- a. Flame spread index: 5 or less.
- b. Smoke developed index: 15 or less.

2.02 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide insulated wall sheathing products from MaxLife Industries; 4995 South Main Street, Salisbury, North Carolina 28147; www.maxlifeindustries.com; 1-844-629-4968, cs@maxlifeindustries.com, or comparable products by another manufacturer.
- B. Requests for substitutions will be considered in accordance with provisions of Division 01 Section 01 60 00, "Product Requirements."

2.03 INSULATED SHEATHING

A. ArmorWall VP, consisting of facer boards, rigid insulation, sheathing, air/weather barrier and related system components for a continuous and watertight installation.

1. Type: UL Classified and Audited Production.

- a. Magnesium Oxide (MgO) Board Facer; 1/2" thickness.

2. Fused Rigid Foam Insulation.

- a. Class 1 Rated Urethane Insulation.
- b. Fused directly to rear face of sheathing layer.
 - 1) Laminations are not acceptable.
- c. Closed Cell Content equal to or greater than 90%.

3. Air and Water-Resistive Barrier.

- a. Factory applied vapor permeable.
 - 1) ASTM E96 Method B Water Vapor Transmission: 18 perms at 10 mils.
 - 2) ASTM E2178 Air Permeance: 0.0005 cfm/sf at 1.57 psf.

4. Panel Size

- a. 4 feet by 8 feet.
- b. 4 feet by 10 feet.

5. Thickness/R-Value per ASTM C518.
 - a. 3 3/4 inches composite thickness with R-Value of R-21.

2.04 PANEL FASTENERS

- A. Fasteners shall be approved ArmorWall panel fasteners. Fasteners are 304 stainless steel with oversized heads. Length of fasteners shall be as determined by the panel manufacturer.
 1. ArmorWall panels require Concealor Low Profile Fasteners #14-13 DP1 in 304 stainless steel.
 - a. For use in 18-gauge or higher steel.
 - 1) Minimum fastener penetration of through the steel with a minimum of three (3) threads showing on the opposite face.
 - b. For use in concrete substrates
 - 1) Pre-drill panel and concrete substrate using a 3/16" (0.187") masonry drill bit.
 - 2) Install fastener using a 2,000 RPM hammer drill.
 - 3) Minimum embedment depth into substrate of one-inch.
 - 4) Do not exceed one one-half inch embedment.
 2. ArmorWall panels require Concealor Low Profile Fasteners 1/4-14 DP3 in 304 stainless steel.
 - a. For use in 18-gauge steel to 1/4" plate steel.
 - 1) Minimum fastener penetration of through the steel with a minimum of three (3) threads showing on the opposite face.

2.05 ACCESSORIES

- A. Joints and Fastener Heads shall be covered with manufacturer required sealant and/or coating.
 1. Sealant (SLT): ArmorSeal Sealant gunnable grade polyether sealant.
- B. Sheathing Opening Return Board (SR): Rough openings in assemblies and walls and where indicated on Drawings.
 1. ArmorWall VP returns factory sized to width of full rough opening depth.
 2. ArmorWall VP Board shall field trimmed to width of full rough opening depth.

C. Window and Door Sills shall be coated with manufacturer required coating.

1. Sealant (SLT): ArmorSeal Sealant brush grade polyether sealant.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.
- B. Do not begin installation until exterior walls have been properly prepared.
- C. Verify that all exterior wall assembly construction has been completed to the point where the insulation may correctly be installed.
- D. Verify built-in items, penetrations and rough openings are correct and properly located.

3.02 PREPARATION

- A. Protect surrounding area from possible damage during installation of structural insulated sheathing.
- B. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- C. If deficiencies exist, consult Architect. Correct deficiencies in accordance with manufacturer's recommendations.
- D. Beginning installation constitutes Contractor's acceptance of existing conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
- E. Exposed insulation must always be protected from open flame and kept dry.
- F. Fasten structural insulated sheathing to the structural base wall.
- G. Exterior wall insulation layer is not intended to be left exposed for extended periods of time in excess of fifteen (15) days without adequate protection. If extended exposure is anticipated all exposed foam surfaces including corners, window and door openings, should be covered with a compatible waterproof tape. Contact MaxLife Industries for guidance on exposed materials.
- H. Install ArmorSeal gunnable sealant at all fastener heads, seams, inside and outside corners providing a one-inch seal in either direction of each seam or opening.

3.04 FIELD QUALITY CONTROL AND TOLERANCES

- A. Perform field quality control inspection as specified in Part 1, Quality Assurance.
- B. Joint thickness: No gaps greater than 1/4 inch allowed without installation of supplemental low-rise field applied foam insulation and backer rod for sealants.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Cover the top and edges of unfinished wall panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.
- C. Wet panels shall be allowed to completely dry prior to application of cladding.
- D. Do not leave factory coated air and weather barrier surfaces exposed to weather longer than one hundred eighty (180) days without approval from manufacturer.
- E. Repair or replace damaged products before Substantial Completion.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 – PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	061613.AVB	AIR VAPOR BARRIER
b.	061613.SIS	STRUCTURAL INSULATED SHEATHING
c.	061613.JS	JOINT SEALANT
d.	061613.JSB	BACKER ROD WITH JOINT SEALANT
e.	061613.SR	SHEATHING OPENING RETURN BOARD

END OF SECTION

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SECTION 06 20 23
INTERIOR FINISH CARPENTRY

PART 1 – GENERAL

1.01 SUMMARY

- A. This section includes the following:
 - 1. Medium density fiberboard wainscoting (MDF).

1.02 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. Paneling: Paneling includes wood furring, blocking, and shims for installing paneling, unless concealed within other construction before paneling installation.

1.03 SUBMITTALS

- A. General: Submit in conformance with NAAWS (latest edition) Section 1, "Submittals."
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
- C. Shop Drawings for MDF Paneling: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - 1. Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - 2. Show centerline locations and sizes of furring and blocking, including concealed blocking specified in other sections.
- D. Samples for Initial Selection:
 - 1. Two sets of samples of each trim profile used.
- E. Qualification Data: For Installer.

1.04 QUALITY ASSURANCE

- A. Quality Standard: Unless otherwise indicated, comply with NAAWS for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- B. Fabricator Qualifications: Shop that 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. Shop is a certified participant in AWI's Quality Certification Program; or certified participant in WI's Certified Compliance Program (AMC - Accredited Millwork Companies); or a non-certified shop that is able to fabricate to WI's Certified Compliance Program requirements per the NAAWS.
- C. Installer Qualifications: Certified participant in AWI's Quality Certification Program; or a certified participant of WI's Certified Compliance Program; or a non-certified installer that is able to install to WI's Certified Compliance Program requirements per the NAAWS.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Provide wainscot mock-ups for review.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.
- C. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, 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.
- C. Field Measurements: Where woodwork and paneling is 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 woodwork and paneling by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork and paneling without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.07 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

- A. General: Provide materials that comply with requirements of NAAWS quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:

- C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
1. Fire Retardant MDF: Industrial grade medium density fiberboard (formaldehyde-free) and fire retardant. Exposed faces MDF, per APA, in size and thickness indicated. ANSI A208.2, Grade MD.
 - a. Basis of Design Product: Subject to compliance with requirements, provide Roseburg Forest Products (800) 245-1115; Medite FR or comparable MDF with recovered and recycled fiber and no-added formaldehyde and Class 1 fire-retardant material. ANSI A208.2-2002 compliant.
 - 1) Flame Spread: 20; Smoke Density: 100.
 - 2) Flame Spread Rating, ASTM E 84: Class A.

2.02 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. 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.
1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Where galvanized finish is indicated, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.
 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
1. Do not use adhesives that contain urea formaldehyde.
 2. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement or Resorcinol.
 3. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
 4. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

5. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Wood Glues: Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Multipurpose Construction Adhesive: Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - c. Contact Adhesive: Use contact adhesive that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Complete fabrication, including assembly, finishing, 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.
 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, 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.
 1. Seal edges of openings in countertops with a coat of varnish.

2.04 MDF WAINSCOTTING (MDF)

- A. Fire Retardant MDF: Industrial grade medium density fiberboard (formaldehyde-free) and fire retardant. Exposed faces MDF, per APA, in size and thickness indicated. ANSI A208.2, Grade MD.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Roseburg Forest Products (800) 245-1115; Medite FR or comparable MDF with recovered and recycled fiber and no-added formaldehyde and Class 1 fire-retardant material. ANSI A208.2-2002 compliant.
 - a. Flame Spread: 20; Smoke Density: 100.
 - b. Flame Spread Rating, ASTM E 84: Class A.
 - 2. Fasteners at MDF Paneling: Provide screws countersunk at regular intervals into surface at opaque finished wall panels. Fastener size as required for panel stability. Align fasteners horizontally and vertically on panels unless indicated otherwise on Drawings.
 - 3. Thickness: 3/4 inch, unless otherwise indicated on Drawings.
 - 4. Density: 48 lbs/cu. ft.
 - 5. Moisture Content: 6 to 8 percent average, oven-dry basis.
 - 6. Size: As indicated on Drawings.
- B. Finish: Opaque painting per Division 09 Section "Interior Painting", color as indicated in Finish Schedule on Drawings.

2.05 FINISHING

- A. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
- B. Field Finishing of MDF Paneling:
 - 1. Finishing: Opaque painting per Division 09 Section "Interior Painting."

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- 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.

3.02 PREPARATION

- A. 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.
- B. Before installing interior finish carpentry, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
- C. Coordinate prior to erection of wall sheathing materials the location of all wood paneling edge framing, blocking and strapping members to allow fasteners of adjacent paneling members to be placed allowing panel edge setback of fasteners for all paneling. Provide sufficient surface area of edge framing, blocking and strapping allowing equal set back of fasteners from panel edges on adjacent panels.
- D. Clean substrates of projections and substances detrimental to application.

3.03 INSTALLATION, GENERAL

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- D. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

3. 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.
4. 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.

3.04 MDF WAINSCOT INSTALLATION

- A. Before installation, condition paneling to average prevailing humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
- C. Coordinate prior to erection of wall sheathing materials the location of all wood paneling edge framing, blocking and strapping members to allow fasteners of adjacent paneling members to be placed allowing panel edge setback of fasteners for all paneling. Provide sufficient surface area of edge framing, blocking and strapping allowing equal set back of fasteners from panel edges on adjacent panels.
- D. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/16 inch.
- E. Scribe and cut paneling to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Anchor paneling to supporting substrate with blind nailing. Do not use face fastening unless covered by trim or otherwise indicated.
- G. Complete finishing work specified in this section to extent not completed at shop or before installation of paneling. Fill finish nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.
- H. Repair damaged and defective paneling, where possible, to eliminate functional and visual defects; where not possible to repair, replace paneling. Adjust for uniform appearance.
- I. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.05 ADJUSTING AND CLEANING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.
- B. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.06 PROTECTION

- A. Protect installed products from damage from weather and other causes during remainder of the construction period.
- 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.
- C. Protect finished paneling from subsequent trade damage.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 – PRODUCTS for information on the following keynotes:

- 1.

<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a. 062023.MDF	MDF WAINSCOTING

END OF SECTION

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SECTION 06 83 16
FIBERGLASS REINFORCED PANELING (FRP)

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes the following:
 - 1. Fiberglass-reinforced plastic panels.
 - 2. Trim.

1.02 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).
- B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor 2013a.
- C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2017.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- F. FM 4880 - Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials 2017.

1.03 SUBMITTALS

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- B. Samples: Submit two samples 24 by 24 inch in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:

1. Crane Composites, Inc: www.cranecomposites.com/#sle.
2. Marlite, Inc; Symmetrix with Sani Coat - Basis of Design: www.marlite.com/#sle.
3. Panolam Industries International, Inc; Panolam FRP: www.panolam.com/#sle.
4. Or approved equal.

2.02 PANEL SYSTEMS

A. Wall Panels FRP:

1. Panel Size: 4 by 8 feet.
2. Panel Thickness: 0.10 inch.
3. Color: Dark gray or any manufacturer-supplied color subject to Architect's approval.
4. Attachment Method: Adhesive only, with trim and sealant in joints.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.

1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
2. Class 1 fire rated when tested in accordance with FM 4880.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
5. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.

B. Trim: Steel; Brushed Stainless

C. Adhesive: Type recommended by panel manufacturer, solvent free

D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- G. Remove excess sealant after paneling is installed and prior to curing.

3.03 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	068316.FRP	FRP WAINSCOTING

END OF SECTION

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Division 07

Thermal and
Moisture Protection

SECTION 07 11 13
BITUMINOUS DAMP PROOFING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt damp proofing for walls in contact with soil or other backfill, including the following:
 - a. Outside surfaces of all exterior below-grade walls.
 - b. Landscape walls.

1.02 SUBMITTALS

- A. Product Data: Manufacturer's printed data sheet, for specified products.
- B. Certificates: Product certificates signed by manufacturer certifying that:
 1. Materials comply with specified performance characteristics and physical requirements.
 2. Installer is qualified and approved by manufacturer.
- C. Manufacturer's installation instructions.
- D. Manufacturer's report on field inspection of substrates, prior to installation.
- E. Executed warranties.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm with not less than 10 years' experience manufacturing waterproofing of the type specified, able to provide test reports showing compliance with specified performance characteristics, and able to provide on-site technical representation to advise on installation.
- B. Installer Qualifications: Experienced in work of the type specified in this section and approved in writing by waterproofing manufacturer.
- C. Standards: Comply with latest applicable non-conflicting provisions of following:
 1. NRCA - Roofing and Waterproofing Manual, Waterproofing and Dampproofing.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.05 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit damp proofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of damp proofing in enclosed spaces. Maintain ventilation until damp proofing has cured.

1.06 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official; warranty period: 5 years commencing on Date of Substantial Completion.
- B. Installer's Warranty: Provide warranty signed by installer that reads as follows:
 - 1. Installer warrants that, upon completion of the work, surfaces treated with waterproofing will be and will remain free of water leakage resulting from defective workmanship or materials for a period of 1 year from Date of Substantial Completion.
 - 2. In the event that water leakage occurs within the warranty period from such causes, the installer shall, at his own expense, repair, replace, or otherwise correct such defective workmanship and materials.
 - 3. Installer shall not be liable for consequential damages.
 - 4. Installer's liability shall be limited to repair, replacement, or correction of defective workmanship and materials.
 - 5. This warranty excludes leaks or other defects due to causes beyond the installer's control, including but not limited to structural failure, movement of the structure, fire, earthquakes, tornadoes, and hurricane-like conditions.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary damp proofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.02 COLD-APPLIED, EMULSIFIED-ASPHALT DAMP PROOFING

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. BASF Corporation.
 - 2. Euclid Chemical Company (The); an RPM company.
 - 3. Henry Company.
 - 4. Karnak Corporation.
 - 5. W. R. Meadows, Inc.
- B. Trowel Coats: ASTM D 1227, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.03 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by damp proofing manufacturer for intended use and compatible with bituminous damp proofing.
- B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- D. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by damp proofing manufacturer.
- E. Protection Course: ASTM D 6506, 1/8 inch-thick, semi-rigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
 - 1. Adhesive: Type recommended in writing by damp proofing manufacturer for protection course type.

2.04 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel acceptable to damp proofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, with or without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous damp proofing work.
 - 1. Test for surface moisture according to ASTM D 4263.
- B. Obtain damp proofing manufacturer's approval of substrates; submit field inspection report.
- C. Do not install unless substrate and ambient air temperature are within range acceptable to damp proofing manufacturer.
- D. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with damp proofing. Prevent damp proofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the damp proofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.03 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for damp proofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply damp proofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend damp proofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of damp proofing. Damp proofing coat for embedding fabric is in addition to other coats required.

- C. Where damp proofing exterior face of inner wythe of exterior masonry cavity walls, lap damp proofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend damp proofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap damp proofing at least 1/4 inch onto shelf angles supporting veneer.

3.04 COLD-APPLIED, EMULSIFIED-ASPHALT DAMP PROOFING

- A. Concrete Foundations: Apply two brush or spray coats of semi-fibrated, semi-mastic, asphalt emulsion damp proofing materials, at rate of 125 wet mils, to produce uniform, dry film thickness of not less than 1/8 inch.
- B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 5 gal./100 sq. ft.
- C. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 5 gal./100 sq. ft.

3.05 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured damp proofing. Comply with damp proofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Install protection course within 24 hours of damp proofing installation (while coating is tacky) to ensure adhesion.

3.06 DRAINAGE PANEL INSTALLATION

- A. Molded- Sheet Drainage Panels: Where indicated, install panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Comply with damp proofing-material and manufacturers' written instructions for attachment Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. Install protection course before installing drainage panels.

3.07 CLEANING AND PROTECTION

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- B. Remove damp proofing materials from surfaces not intended to receive damp proofing.
- C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct damp proofing that does not comply with requirements; repair substrates, and reapply damp proofing.

3.08 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	071113.BD	BITUMINOUS DAMP PROOFING

END OF SECTION

SECTION 07 13 26
SELF-ADHERING SHEET WATERPROOFING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Modified bituminous sheet waterproofing for vertical applications.
 - 2. Double-layer modified bituminous sheet waterproofing for horizontal applications.

1.02 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
 - 2. 12-by-12-inch square of insulation.
 - 3. 4-by-4-inch square of drainage panel.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of twenty (20) years' experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five (5) years.
- B. Installer Qualifications: A firm that is acceptable to waterproofing manufacturer for installation of waterproofing required for this Project. Firm with not less than five (5) waterproofing projects similar to requirements for this Project with satisfactory in-service performance.

- C. Preinstallation Conference: Conduct conference at Project site.
1. Prior to installation of waterproofing and associated work, meet at Project site with installer of each component of associated work, inspection and testing agency representatives (if any), manufacturer's representative and installers of work requiring coordination with waterproofing work. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
 2. Notify Architect at least (48) hours before conducting meeting.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
1. Build for each typical waterproofing installation, including accessories, to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: 100 sq. ft. minimum in area or as indicated on Drawings.
 - b. Description: waterproofed panel; to represent finished work including internal and external corners.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- E. Standards: Comply with latest applicable nonconflicting provisions of following:
1. NRCA - Roofing and Waterproofing Manual, Waterproofing and Dampproofing.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
 - 2. Proceed with waterproofing and associated work only when existing and forecasted weather conditions will permit work performance in accordance with manufacturers' recommendations and warranty requirements.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.
- C. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed.

1.06 WARRANTY

- A. Special Project Warranty: Provide special warranty by manufacturer, installer, and Contractor for work of this section, agreeing to uncover and repair or replace sheet membrane waterproofing that fails in materials or workmanship within specified warranty period. This Warranty is in addition to and a not limitation of other rights Owner may have against Contractor under Contract Documents.
 - 1. Warranty Period: Ten (10) years from the Date of Substantial Completion.
- B. Submit a written warranty, signed by manufacturer and the installer, covering failure of the sheet waterproofing to remain watertight and prevent moisture from penetrating within the specified warranty period and agreeing to repair, finish or replace wall panels and components that show evidence of deficiencies. Warranty shall also include the responsibility for removal and replacement of all work concealing the waterproof system. Upon completion, work which was removed and replaced must be approved by the Port of Kalama.
- C. Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 – PRODUCTS

2.01 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide one of the following:
 - a. GCP Applied Technologies; Bituthene 3000.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
 - c. American Hydrotech, Inc.; VM 75.
 - d. Meadows, W. R., Inc.; SealTight Mel-Rol.
 - 2. Physical Properties:
 - a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
 - f. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
 - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.02 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.

- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Flexible Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
- G. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
- I. Protection Course:
 - 1. Semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows (per ASTM D 6506 Standard Specification for Asphalt Based Protection for Below-Grade Waterproofing):
 - a. Thickness: 1/4 inch, nominal.
 - b. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 - 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 3. Verify that compacted subgrade is dry, smooth, and sound; and ready to receive adhesive-coated HDPE sheet.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
- B. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.03 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths to provide a minimum of 2 thicknesses of sheet membrane over areas to receive waterproofing.
- E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.
- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

- I. Install protection course with butted joints over waterproofing membrane immediately.
- J. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

3.04 HDPE SHEET WATERPROOFING APPLICATION

- A. Install blindside sheet waterproofing according to manufacturer's written instructions.
- B. Horizontal Applications: Install with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch minimum lap widths and end laps. Overlap and seal seams. Overlap, stagger, and seal end laps with detail tape to ensure watertight installation.
- C. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- D. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- E. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
- F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.
- G. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

3.05 FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.
- B. Water Flood Test: test horizontal waterproofing over occupied spaces prior to Concrete pour in the presence of Manufacturer's representative. Correct any failed membrane and retest until passing.

3.06 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.

- C. Protect installed board insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	071326.HBW	HORIZONTAL BLINDSIDE WATERPROOFING
b.	071326.PC	PROTECTION COURSE

END OF SECTION

SECTION 07 18 00
TRAFFIC COATINGS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes traffic coatings for the following applications:
 - 1. To mark clear area around hand wash and emergency eye wash sinks.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.
- B. Samples for Initial Selection: For each type of exposed finish.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of traffic coating.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer or manufacturers of similar coating systems.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates.
- B. Do not install traffic coating until any items that penetrate membrane have been installed.

1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Adhesive or cohesive failures.
 - b. Abrasion or tearing failures.
 - c. Surface crazing or spalling.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations:
 - 1. Obtain traffic coatings from single source from single manufacturer.
 - 2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide primers; base coat, intermediate coats, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 TRAFFIC COATING

- A. Traffic Coating: Manufacturer's standard, traffic-bearing, seamless, water-resistant membrane system with integral wearing surface for pedestrian traffic service condition; according to ASTM C957/C957M.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Siplast; StreetBond or a comparable product by one of the following:
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Or approved.

- B. Primer: Epoxy base liquid primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.
 - 1. Basis-of-Design Product: StreetBond QS Concrete Primer, two-component epoxy polyamide pretreating primer.
- C. Topcoats: Epoxy-modified acrylic, 3 coats minimum.
 - 1. Basis-of-Design Product: StreetBond SB120 two-part epoxy-modified acrylic coating system with StreetBond Colorant additive.
 - 2. Thicknesses: Minimum dry- or wet-film thickness as recommended in writing by manufacturer for substrate and service conditions indicated, measured.
 - 3. Colors: As indicated on Drawings or as otherwise selected by Architect from manufacturer's full range.

2.04 ACCESSORY MATERIALS

- A. Joint Sealants: As specified in Division 07 Section 07 92 00 , "Joint Sealants."

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.
- B. Verify that substrates are visibly dry and free of moisture.
 - 1. Test for moisture according to ASTM D4263.
 - 2. Test for moisture content by method recommended in writing by traffic-coating manufacturer.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after substrate construction and penetrating work have been completed.
 - 2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
 - 3. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- B. Priming: Prime substrates according to manufacturer's written instructions.
 - 1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.
- C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.
- D. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings.
- E. Concrete Substrates:
 - 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - 2. Remove concrete fins, ridges, and other projections.
 - 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D4258.

3.03 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.
 - 1. Comply with recommendations in ASTM C1193 for joint-sealant installation.

3.04 TRAFFIC-COATING APPLICATION

- A. Apply traffic coating according to ASTM C1127 and manufacturer's written instructions.
- B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.
- C. Start traffic-coating application in presence of manufacturer's technical representative.

- D. Verify that wet-film thickness of each coat complies with requirements every 100 sq. ft. (9 sq. m).
- E. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

3.05 FIELD QUALITY CONTROL

- A. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

3.06 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

- 1.

<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a. 071800.TC	TRAFFIC COATING

END OF SECTION

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SECTION 07 21 00
THERMAL INSULATION

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Extruded polystyrene foam-plastic board.
 2. Sound-attenuation blankets.
 3. Firestopping insulation.
 4. Spray-applied insulation (insulation for miscellaneous voids).

1.02 DEFINITIONS

- A. Thermal Conductivity (K value): Units of Btu-inch/hour per square foot per degree F.
- B. Glass Mineral Wool: Interchangeable with fiber glass, but replacing the term in the attempt to disassociate and differentiate Glass Mineral Wool from the potential health and safety risk of special purpose or reinforcement products that do not meet the bio solubility criteria of insulation made from glass. Rock Mineral Wool will replace the traditional Mineral Wool label. Both are used in lieu of the Mineral Fiber label.
- C. UL Environment Formaldehyde Free Verification Requirements: For a product to be verified as formaldehyde free, product samples must have a measured emission factor of less than or equal to 5 $\mu\text{g}/\text{m}^2\text{h}$ at 24 elapsed hours or 3 $\mu\text{g}/\text{m}^2\text{h}$ at 336 elapsed hours. An emission factor of 5 $\mu\text{g}/\text{m}^2\text{h}$ corresponds to measured chamber concentration of 2.5 $\mu\text{g}/\text{m}^3$ for a typical building ratio of 0.5 m^2/m^3 . This chamber concentration is comparable to, or below typical outdoor air concentrations. This demonstrates that the formaldehyde exposure from products labeled as formaldehyde free will not contribute to airborne formaldehyde concentrations at greater levels than those found in the natural outdoor environment.
- D. UL Classified: UL has tested and evaluated samples of the product with respect to certain properties of the product. UL Classifies products to:
1. Applicable UL requirements.
 2. Standards for safety.
 3. Standards of other National and International organizations.
- E. EPD Submittals: As Certified by UL Environment.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct at Project site.
 - 1. Review methods, materials and requirements of building envelope opening perimeter and penetration insulation.

1.04 ACTION SUBMITTALS

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

1.05 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
 - 1. Provide test report, produced by an independent laboratory, showing test results that indicate physical properties of the products provided meet or exceed the requirements of this section.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.
- C. Manufacturer's Certificate: For each product, provide written letter, signed by manufacturers, certifying that products provided meet or exceed specified requirements.
- D. Manufacturer's Instructions: Submit the following:
 - 1. General installation/application instruction.
 - 2. Environmental conditions required for installation and installation techniques.
- E. Qualification Statements:
 - 1. Installer's/Applicator's: Submit qualification statement including a copy of manufacturer's certificate.
- F. Third Party Validation UL Environment Required for Minimum 50% Recycled Content and Formaldehyde Free.
- G. EPD Declarations when available.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience.
- B. Formaldehyde Free: 3rd Party Certified with UL Environmental Validation.
- C. Surface-Burning Characteristics: As determined by testing protocol required to achieve UL Classified rating. Identify products with appropriate markings of Underwriters Laboratories.

1.07 FIELD CONDITIONS

- A. Limitations: Proceed with application only when existing and forecasted weather and substrate conditions permit insulation to be installed according to manufacturers' written instructions and warranty requirements.

1.08 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. Deliver, store, and handle material to avoid exposure to sunlight and contact with flammable materials.
- C. Store materials in dry, weathertight enclosures.
- D. 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.

PART 2 – PRODUCTS

2.01 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD (XPS)

- A. Performance Requirements:
 - 1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 2. Compressive Strength, Minimum psi: 25 per ASTM D1621.
 - 3. Water Absorption, Maximum Percent by Volume: 0.3, per ASTM C272.
 - 4. Water Vapor Permeance, Maximum Perm: 1.5, per ASTM E96.
 - 5. R-Value: Five per inch minimum, per ASTM C 177/C 518 at 40 degrees F.
- B. Below Grade Insulation: ASTM C578, Type IV; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.

- C. Exterior Wall Insulation: ASTM C578, Type IV; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.
 - 1. Width: 16 inches, 24 inches, or 48-inch-wide with scored faces, as required for application between anchors.
- D. Thickness: As necessary to achieve required R-value indicated on Drawings.
- E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dow Chemical Company; STYROFOAM Brand.
 - a. Exterior Foundation Drainage and Insulation: Perimate.
 - b. Roofing Insulation: Deckmate.
 - c. Cavity Wall Insulation: Cavitymate.
 - d. Tunnel Insulation: Highload 60.
 - 2. Owens Corning; Foamular.
 - 3. Kingspan Insulation LLC; GreenGuard.

2.02 SOUND ATTENUATION BLANKETS (SAB)

- A. 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.
 - a. Surface Burning Characteristics when tested in accordance with ASTM E 84:
 - 1) Maximum flame spread: 25.
 - 2) Maximum smoke developed: 50.
 - 2. Recycled Content: Postconsumer recycled glass content of not less than 50 percent.
 - 3. Application: Refer to Drawings for locations.
 - 4. Sound Transmission Class: See Wall Types for STC rating.

- B. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C 553, Type I, Type II, or Type III; not less than 1-lb/cu. ft. density; treated to be nondusting; thickness as indicated on Drawings.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Owens Corning; Selectsound Black Acoustic Blanket, or comparable products by one of the following:
 - a. Acoustic Sonic, Inc.
 - b. CertainTeed Corporation.
 - c. Johns Manville.
- C. Unfaced glass mineral wool acoustical insulation. EPD Certified by UL Environment, complying with ASTM C 665, Type I. Non-combustible when tested in accordance with ASTM E 136.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis of Design: EcoBatt Quiet Therm Insulation by Knauf Insulation or comparable product.

2.03 FIRESTOPPING INSULATION

- A. Firestopping Insulation for Fire Resistive Joint Systems and Through-Penetrations In Rated Assemblies:
 - 1. Thickness: As indicated on Drawings.
 - 2. Facing: Unfaced.
 - 3. Surface Burning Characteristics:
 - a. Flame Spread 0.
 - b. Smoke Developed 0.
- B. Fire-Resistive Joint and Through-Penetration Applications:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Thermafiber, Inc., an Owens Corning Company; Thermafiber Safing Insulation.
- C. Insulation for Head of Wall Applications:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Thermafiber, Inc., an Owens Corning Company; Thermafiber Top-Stop Insulation.

2.04 INSULATION FOR MISCELLANEOUS VOIDS

- A. General: Fill voids with insulation R-value required for each assembly, roofs and walls, as indicated on Drawings.
- B. Insulation For Miscellaneous Voids:
 - 1. Spray In Foam (SIF); Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - a. Basis-of-Design Products: Subject to compliance with requirements, at voids greater than 3 inches wide and 2 inches deep, provide DuPont Spray Polyurethane Foam (SPF) Insulation (CM Series), or the following:
 - 1) BASF Corporation; Spraytite 178.
 - b. Basis of Design Products: Subject to compliance with requirements, at voids less than 3 inches wide and 2 inches deep, provide Dupont FROTH-PAK ULTRA Premium Foam Insulation, or comparable product by one of the following:
 - 1) Foam It Green.
 - 2) Tiger Foam.
 - 3) Touch 'n Seal.
 - 2. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I (pneumatic application); with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 - a. Products: Subject to compliance with requirements, Subject to compliance with requirements, provide the following:
 - 1) Basis of Design: Owens Corning; ProCat Insulation.

2.05 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness securely in position with self-locking washer in place.
 - 1. Products: Subject to compliance with requirements, products that may be incorporated into the work include:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-hangers.
 - b. Gemco; Spindle Type.
 - c. Or approved.

2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness securely in position with self-locking washer in place.
1. Products: Subject to compliance with requirements, products that may be incorporated into the work include:
 - a. Gemco; 90-Degree Insulation Hangers.
 - b. Or approved.
 2. Angle: Formed from 0.030-inch thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. 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.
1. Products:
 - a. AGM Industries, Inc.; RC150 or SC150.
 - b. Gemco; Dome-Cap, R-150 or S-150.
 - c. Or approved.
 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in crawl spaces, ceiling plenums, attic spaces, or in any location where sharp ends of spindles will be exposed to human contact.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 to 3 inches as indicated or otherwise required between face of insulation and substrate to which anchor is attached.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
1. Products:
 - a. AGM Industries, Inc.; TACTOO GPA-72 Adhesive.
 - b. Gemco; Tuff Bond Hanger Adhesive.
 - c. Or approved.

2.06 ACCESSORIES

- A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- 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. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. 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.

3.03 INSTALLATION OF BELOW-GRADE INSULATION

- A. Installation of Slab Insulation:
 - 1. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - a. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
 - b. Stagger multiple layers of insulation.
 - 2. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - a. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

B. Installation of Foundation Wall Insulation:

1. Butt panels together for tight fit.
2. Adhesive Installation: Install with adhesive or press into tacky waterproofing or damp proofing according to manufacturer's written instructions.

3.04 INSTALLATION ON CONCRETE

A. Install insulation on concrete and CMU substrates by adhesively attached, spindle-type insulation anchors, as follows:

1. Fasten insulation anchors to concrete and CMU substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness and application indicated.
2. After adhesive has dried, install insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles. In areas behind bleacher, cut off spindles at locking washers to limit hazard for maintenance personnel in areas behind bleachers.

3.05 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to 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.

- 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. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions. Include consideration of the following:
 - a. Temperature and humidity of substrate and immediate environment.
 - b. Proper ventilation.
 - c. Providing non-damaging pressure relief for voids being filled.
 - d. Application to clean substrate, free from visible water and ice.
 - e. Do not over-fill voids to prevent over-pressurization.
 - f. Trim off visible leakage without damaging visible finish surfaces and materials.
 - g. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
 3. Fill all voids of framing of opening perimeter and penetrations of building envelope. Items include but are not limited to windows, doors, storefront and curtain wall systems, louvers, metal deck closures, piping and mechanical equipment penetrations, and electrical items. Provide a thermally insulated building envelope.
 4. Coordinate sequencing of installation of insulation materials to allow other trades installation of materials ahead of foam or batt installation.
 5. Do not block or inhibit water pathways for drainage including but not limited to weep holes when install opening perimeter and penetration insulation.

3.06 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	072100.SAB	SOUND ATTENUATION BLANKETS
b.	072100.SIF	SPRAY IN FOAM
c.	072100.XPS	EXTRUDED POLYSTYRENE BOARD INSULATION

END OF SECTION

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SECTION 07 27 27
SELF-ADHERING VAPOR-PERMEABLE AIR-BARRIER MEMBRANE

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Self-adhered water resistive air barrier membrane systems for applications as follow:
 - a. Structural insulated sheathing: at rough openings and over parapets.

1.02 SUBMITTALS

- A. Product Data: Submit material Manufacturer's Product Data, material manufacturer's instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, Technical Data, and tested physical and performance properties.
1. Submit letter from primary air barrier material manufacturer indicating approval of materials that are proposed to be used that are not currently listed in the accessories section of this specification for that manufacturer's material.
 2. Include statement from the primary air barrier material manufacturer that the materials used in their air barrier assembly which will be used to adhere to the underlying substrate are chemically compatible to the substrate material.
- B. Submit samples of the following:
1. Manufacturer's sample warranty.
 2. Components, minimum 12 inch lengths.
 3. Membrane flashings.
 4. Sealants.
- C. Detail Drawings: Submit drawings showing details of all typical conditions, for sealing around rough openings and over parapets.
1. Include statement that materials are compatible with adjacent materials proposed for use.
 2. Include required values for field adhesion test on each substrate.

1.03 QUALITY ASSURANCE

- A. Single Source: Self-adhered water-resistive vapor permeable air barrier membrane components and accessories must be obtained as a single-source membrane system to ensure total system compatibility and integrity.
- B. Manufacturer Qualifications
 - 1. Manufacturer of specified products listed in this section to have minimum 10 years of continued experience in the manufacture and supply of highly vapor permeable water resistive air barrier products successfully installed in similar project applications.
 - 2. Manufacturer of specified products listed in this section to have experienced in-house technical and field observation personnel qualified to provide expert technical support.
- C. Installer Qualifications
 - 1. Installer Qualifications: A firm that is acceptable to the self-adhering water resistive air barrier membrane manufacturer for installation of products required for this Project with a minimum of five (5) years' experience. Firm with not less than five (5) projects similar to requirements for this Project with satisfactory in-service performance.
- D. Mock-Up
 - 1. Flash around a typical window rough opening and over parapet with flashing tape overlapping sheathing board, sealing seams per manufacturer's instructions.
 - 2. Allow 48 hours for inspection of mock-up by Architect before proceeding with water-resistive vapor permeable air barrier work.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Field Test Requirements:
 - 1. Air leakage tests, water penetrations tests, and adhesion tests shall be performed during the construction phase.

1.04 PRE-INSTALLATION CONFERENCE

- A. Contractor shall convene one week prior to commencing work of this section.
- B. Ensure all contractors responsible for creating a continuous plane of water and air tightness are present.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Refer to current Product Installation Instructions and SDS at www.vaproshield.com for proper storage and handling.
- B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- C. Store roll materials on end in original packaging. Protect rolls from direct sunlight and inclement weather until ready for use.
- D. Waste Management and Disposal
 - 1. Separate and recycle waste materials in accordance with Waste Management and Disposal Plan, and with the Waste Reduction Work Plan.

1.06 COORDINATION

- A. Ensure continuity of the fully self-adhered water-resistive vapor permeable air barrier system throughout the scope of this section.
 - 1. Air barrier vapor permeable membrane to include self-adhered air barrier, transition membranes and sealants at penetrations.
 - 2. Drainage plane to include drainage cavity, water resistive barrier and flashings to the exterior.

1.07 WARRANTY

- A. Provide manufacturer's standard material warranty in which manufacturer agrees to provide replacement material for the fully self-adhered water-resistive vapor permeable air barrier sheets installed in accordance with manufacturer's instructions that fail due to material defects within 20 years of the date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Henry Company; BlueskinVP 160 Self-adhered Vapor Permeable Water & Air Barrier.
 - 2. Soprema; Sopraseal Stick VP Membrane.
 - 3. VaproShield LLC, Gig Harbor, WA (866-731-7663, www.vaproshield.com; Wrapshield SA and RevealShield.

2.02 AIR BARRIER MATERIALS

- A. Self-adhered air barrier flashing components for application around rough openings and over parapets.
- B. Basis-of-Design Products: Subject to compliance with requirements, provide the following products from Henry Company or comparable products from one of the manufacturers listed above:
 - 1. BlueskinVP 160 accessory products by Henry Company, El Segundo, CA (800-486-1278, www.henry.com).
 - a. Air Barrier Accessory Materials:
 - 1) Liquid Flashing: Henry Air-Bloc LF Liquid-Applied Flashing; Moisture-curing single component elastomeric liquid-applied flashing using a highly advanced Silyl-Terminated Polyether (STPE) polymer curing to a monolithic membrane; having the following typical physical properties:
 - (a) Air Permeance (ASTM E2178): Pass. Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass.
 - (b) Water Vapor Permeance (ASTM E96): 21.8 perms @ 25 mils. Water Resistance (AC212/ASTM D2247): Pass.
 - (c) Nail Sealability (AAMA 711): Pass.
 - 2) Rough-Opening Flashing (ROF): Henry® Metal Clad® Self-Adhered Water Resistive Air Barrier. Non-vapor permeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound integrally laminated to a high strength polyethylene with surface layer of metallic aluminum film; having the following typical physical properties:
 - (a) Thickness: 45 mils (1.14 mm).
 - (b) Water Vapor Permeance (ASTM E96): 0.014 perms.
 - (c) Nail Sealability (ASTM D1970): Pass.
 - 3) Sealants:
 - (a) Building Envelope Sealant: Henry 925 BES Sealant; Moisture cure, medium modulus polymer modified sealing compound.
 - (b) Termination Sealant: Henry 212 All Purpose Crystal Clear Sealant; One-part high performance synthetic rubber sealant.
 - b. Henry Butyl Based Flashing used at roof transitions.
 - c. High-Temp Flashing Membrane (HTF): Henry PE200HT at parapet caps and other areas where exposed to high-temp sheet metal from Sun Baking.

PART 3 – EXECUTION

3.01 GENERAL

- A. Verify that surfaces and conditions are ready to accept the work of this section. Ensure that penetrating work by other trades is in place and complete. Notify Architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be dry, sound, clean, free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the water resistive air barrier membrane flashings. Fill voids and gaps in substrate greater than 7/8 inch in width to provide an even surface. Strike masonry joints full-flush. Prepare surfaces by brushing, scrubbing, scraping, grinding or compressed air to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the self-adhered sheet air barrier. Wipe down metal surfaces to remove release agents or other non-compatible coatings using clean sponges or with a material chemically compatible with the primary air material.
- C. Minimum application temperature of fully self-adhered flashings to be above 20 °F.

3.02 COORDINATION OF SELF-ADHERED VAPOR PERMEABLE AIR BARRIER MEMBRANE INSTALLATION

- A. Self-Adhering Flashing: Install air barrier accessory materials to provide continuity throughout the building envelope in a shingle fashion. Install materials in accordance with manufacturer's recommendations and as follows (unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials).
- B. Installation Summary:
 - 1. Self-adhered vapor permeable air barrier sheets may be installed vertically or horizontally over the outside face of exterior sheathing board or other approved substrates.
 - 2. Install fully self-adhered vapor permeable air barrier sheet complete and continuous to substrate in a sequential minimal 3 inch overlapping weatherboard.
 - 3. Stagger all end lap seams.
 - 4. Roll installed membrane with roller to ensure positive contact and adhesion with substrate immediately.

3.03 WINDOW, DOOR AND OTHER WALL OPENINGS

- A. Install vapor impermeable flashings around window or wall openings subject to the opening size and installation of window, door or louver type. Install vapor impermeable flashing membrane into rough wall openings for the sill, jambs and head, to the distance specified by the manufacturer.
- B. Remove release film, align flashing membrane and apply pressure to ensure positive contact. Roll Lap seams to ensure adhesion. Provide lap seams in singled fashion, to shed water.

3.04 FIELD QUALITY CONTROL

- A. Make notification when sections of work are complete to allow review prior to covering fully self-adhered water-resistive vapor permeable air barrier system.
- B. Owner may engage independent consultant to observe substrate and membrane installation prior to placement of cladding system(s) and provide written documentation of observations.
 - 1. Observe Pull Testing requirements to ensure proper adhesion, especially during damp, rainy conditions.

3.05 PROTECTION

- A. Protect wall areas covered with self-adhered water-resistive vapor permeable air barrier from damage due to construction activities, high wind conditions, and extended exposure to inclement weather.
- B. Review condition of fully self-adhered water-resistive vapor permeable air barrier prior to installation of cladding. Repair, or remove and replace damaged sections with new membrane.
- C. Recommend to cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed fully self-adhered water-resistive vapor permeable air barrier installations.
- D. Remove and replace water-resistive weather barrier accessories affected by chemical spills or surfactants.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	072727.BBF	BUTYL-BASED THERMAL RESISTANT FLASHING
b.	072727.FF	FLEXIBLE FLASHING
c.	072727.HTF	HIGH-TEMP FLASHING MEMBRANE
d.	072727.LF	LIQUID FLASHING

END OF SECTION

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SECTION 07 40 00
PREFORMED METAL SOFFIT PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This section includes furnishing and installing preformed metal soffit panel assemblies, flashing, metal trim and accessories as indicated on the drawings and specified herein.

1.02 PERFORMANCE REQUIREMENTS

- A. Provide manufactured soffit panel assemblies complying with performance requirements indicated and capable of withstanding thermally induced movement and exposure to weather without failure or infiltration of water to the building interior.

1.03 SUBMITTALS

- A. Shop Drawings: Show layout of panels, details of fabrication and details of accessory items.
- B. Samples: Submit samples as requested by Project Representative.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall have a minimum of 10 years' experience supplying metal roofing systems to the region where the work is to be done.
- B. Field Measurements: Take field measurements of structure or substrates to receive panel system prior to fabrication of panels.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store all materials out of the weather in a clean, dry, well-ventilated area.
- B. Elevate one end of bundles so moisture can drain.
- C. Do not allow standing moisture on bundles of panels, flashing or flat sheets.

1.06 WARRANTY

- A. For painted metal roofs, provide manufacturer's written warranty covering 50 year rust perforation and against failure of factory applied Kynar 500 Fluoroceram finish for 30 years.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Taylor Metal Products, Inc., www.taylormetal.com.
- B. McElroy Metal, www.mcelroymetal.com.
- C. Or approved equal.

2.02 PANELS

- A. Profile:
 - 1. Taylor Metal perforated soffit panels providing 12 5/8" coverage.
 - 2. Perforated ventilating panels shall provide a minimum of 17-sq. in. free air space per lineal foot of panel.
- B. Gauge and Grade of Metal:
 - 1. Steel - Painted:
 - a 26 gauge (.018 steel thickness prior to painting) per ASTM A-653 structural quality G- 90 hot dip galvanized steel.
 - 2. Steel - Galvalume Plus: Acrylic coated 24 gauge, 55% zinc/aluminum coated steel conforming to ASTM A-792, coating class AZ55.
- C. Finish:
 - 1. Kynar 500 (Fluoroceram) coating standard three coat, thermo-cured, full strength 70 percent resins.
- D. Color: As selected by the Project Representative from the manufacturer's standard colors.

2.03 ACCESSORIES

- A. Fasteners: Use fasteners as recommended by the manufacturer, suitable for the application and design loads.
 - 1. Galvanized and Oxyseal/Xylon coated for exterior application.
 - 2. Provide exposed fasteners with heads matching color of roof panels and flashings by means of factory applied coating.
 - 3. Locate and space exposed fasteners in true vertical and horizontal alignment.

2.04 PANEL FABRICATION

A. Panel, flashing and accessory fabrication:

1. To be roll formed and fabricated at factory. Field formed panels are not acceptable.
2. Manufacturer's standard procedures and processes must meet indicated performance requirements and comply with indicated profiles and dimensions and structural requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Metal panel installation:

1. Install per manufacturer's instructions and per details on drawings.
2. Field cutting panels by torch or abrasive wheel prohibited where cut is exposed to final view.
3. Install metal roof panels with concealed fasteners in each screw slot of pre-slotted screw flange.

3.02 CLEANING AND PROTECTION

A. Damaged units:

1. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Project Representative.

B. Cleaning:

1. If applicable, remove temporary coatings and strippable film prior to installation.

KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	074000	PREFORMED METAL SOFFIT PANELS

END OF SECTION

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SECTION 07 41 13
STANDING SEAM METAL ROOF PANELS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Standing-seam metal roof panels.
 - 2. Extruded polystyrene foam-plastic board insulation.
 - 3. Underlayment materials.
 - 4. Vapor retarder.

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: 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.
- C. Samples: For each type of metal panel - 12 inches long by panel width.

1.04 INFORMATIONAL SUBMITTALS

- A. Product test reports.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.07 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: 2 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. Finish Warranty Period: 25 years from date of Substantial Completion.
- C. Special Weather-tightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25%.
- B. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for steep-slope roof products.
- C. Energy Performance: Provide roof panels with an aged Solar Reflectance Index of not less than 0.64 when tested according to CRRC-1.
- D. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
 - 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.

- E. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 0.022 cfm per linear foot of joint at static test pressure differential of 12.00 psf.
- F. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: No leakage through panel joints at 15.00 psf.
- G. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
 - 1. Water Penetration: No leakage through panel side-seams and endlaps after 6 hours when tested according to ASTM E2140 at a static water pressure head of 6.00 inches.
- H. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: ASCE 7.
- I. 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°F, ambient; 180°F, material surfaces.

2.02 STANDING-SEAM METAL ROOF PANELS

- A. General: 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 clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
 - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; 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. SSP-1 Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span, A BlueScope Steel Company; Span-Lok hp Metal Roofing or a comparable product by one of the following:
 - a. CENTRIA Architectural Systems.
 - b. Morin - A Kingspan Group Company.

- c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - d. Taylor Metal Products.
 - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Nominal Thickness: 0.028 inch (24 gauge).
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from Manufacturer's full range.
 - 3. Clips: Two-piece floating to accommodate thermal movement.
 - a. Material: 0.034 inch (22 gauge), zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - 4. Joint Type: Double folded.
 - 5. Panel Coverage: 12 inches.
 - 6. Panel Type: Striated.
 - 7. Panel Height: 2.0 inches.
- C. Metal Soffit Panels (Non-Vented): Low profile, concealed fastener panel.
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span Full 12 inch Flush Panel, with 2 ribs spaced 4 inches on center, or comparable product from one of the following:
 - a. Fabral.
 - b. Firestone Metal Products, LLC.
 - c. MBCI; a division of NCI Building Systems, L.P.
 - d. Morin; a Kingspan Group company.
 - e. Architectural Metal Systems (AMS).
 - 2. Material: Zinc-coated (galvanized) steel sheet, 0.028 inch (24 gauge) thickness.
 - a. Exterior Finish: DURA TECH 5000 - Premium 70% Fluoropolymer (PVDF) Coating.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 3. Panel Coverage: 12 inches.
 - 4. Panel Height: 1 inch.
 - 5. Accessories: Jamb closure J-molding trim, finish to match soffit panels.

2.03 MATERIALS

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Nominal Thickness: 0.028 inch (24 gauge).
 - 2. Exterior Finish: Dura Tech 5000 (PVDF) polyvinylidene difluoride by AEP Span or comparable 2-coat fluoropolymer resin coating system.
 - 3. Color: As selected by Architect from manufacturer's full range.

2.04 COVER BOARD

- A. Refer to Division 06 Section "Sheathing" for plywood cover board.

2.05 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; Styrofoam Brand Deckmate Plus Extruded Polystyrene Foam Insulation or a comparable product by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Kingspan Insulation Limited.
 - d. Owens Corning.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Layer in ashlar pattern.
- C. Mechanical or adhesive attachment.

2.06 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment (SHU): Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus 20°F (29°C); ASTM D1970.
 - 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AEP Span.
 - b. ATAS International, Inc.
 - c. Carlisle WIP Products; a brand of Carlisle Construction Materials.
 - d. GCP Applied Technologies Inc.
 - e. Henry Company.
 - f. Owens Corning.
 - g. Polyglass U.S.A., Inc.
 - h. Protecto Wrap Company.
 - i. SDP Advanced Polymer Products Inc.
- B. Low Slope Underlayment: For roof slopes less than 1:12.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span; Underlayment HT or comparable product by one of the following:
 - a. GCP Applied Technologies Inc.
 - b. Or approved.
- C. Water-Resistive Flashing Membrane and Tape: Manufacturer's recommended Self-adhered underlayment flashing membrane and tape.
- D. Penetration Sealant: Manufacturer's recommended water-resistive air barrier sealant compatible with sheet membrane.

2.07 VAPOR RETARDER AND AIR BARRIER

A. Roof Vapor Retarder/Air Barrier:

1. Reinforced-Polyethylene Vapor Retarders: Self-adhesive vapor retarder/air barrier membrane composed of SBS modified bitumen adhesive on the bottom surface and a tri-laminated woven polyethylene on the top surface, and weighing not less than 0.16 pound/sq. ft., with water vapor permeance rating of 0.017 perm.
 - a. Minimum thickness: 30 mils.
2. Products:
 - a. Duro-Last, Inc., Duro-Last Vapor Barrier, 074113.VR.
 - b. Or approved.
3. Meet requirements of UL 1256.

2.08 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 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, fascia, 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 premolded 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.
 1. Color: Metal fascia and trim to match AEP Span color as selected by architect to match adjacent materials.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

- E. 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; 1/2 inch wide and 1/8 inch (thick).
 - 2. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- F. Z-Purlins (ZP): Manufacturer's standard zee-shaped purlins with non-slotted web, fabricated from hot-dip galvanized steel sheet complying with ASTM A 924 and A 653 (A 525), Coating Designation Z180 (G60); 18 gauge minimum, face flange of 1-1/4 inches, cover board-attachment flange of 7/8 inch minimum, and of depth required to fit insulation thickness indicated.

2.09 FABRICATION

- A. General: 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 and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.10 FINISHES

- A. Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70% PVDF resin by weight in color coat.
- B. Color:
 - 1. As selected by Architect from manufacturer's full range.
 - 2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 – EXECUTION

3.01 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.
 - 2. Examine roof decking to verify that joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over decking 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.

3.02 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.03 VAPOR-RETARDER/AIR BARRIER INSTALLATION

- A. Apply vapor retarder/air barrier over clean, dry deck under flat insulation boards in accordance with manufacturer's instructions.
- B. Self-adhering vapor retarder/air barrier to be applied parallel with flutes in strict accordance to Manufacturer's written instructions.
- C. Overlap longitudinal joints a minimum of 3-inches and roll seams. End laps must overlap a minimum of 6-inches.
- D. End seams: install metal plate to support end seams across decking.
- E. Shingle vapor retarder/air barrier to weather to create a weather resistant surface.
- F. Allow inspection prior to cover.
- G. Tears/Punctures: Repair tears or punctures in vapor retarder/air barrier immediately before concealment by application of gypsum board or other construction with approved taping materials. Cover with approved 2-1/2 inch wide self-adhesive vapor retarder/air barrier tape for an airtight seal.

- H. Completely seal vapor retarder/air barrier at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.
- I. At the end of each work day, seal vapor retarder/air barrier water-tight to protect installed work.

3.04 UNDERLAYMENT INSTALLATION

- A. Self-Adhering High-Temperature Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.05 THERMAL INSULATION INSTALLATION

- A. Coordinate installing metal roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install insulation under area of roofing to achieve required thickness indicated to over entire roof. Install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
 - 1. Fasten to resist wind uplift in accordance with insulation manufacturer's requirements and requirements for metal roof assembly by roofing manufacturer. Boards must fit tight and conform to deck surface. Should insulation manufacturer's fastening requirements differ from those of roofing manufacturer, follow most stringent requirements.
- D. Placement: Stagger joints in both directions of successive insulation board layers. Place insulation per manufacturer's instructions for standing seam roofing, with insulation loosely butted to allow for expansion/contraction. Cover installed insulation system promptly with cover board and roofing system. Replace wet insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

3.06 COVER BOARD INSTALLATION

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Butt cover boards together and fasten to roof deck.
 - 1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.
- B. Cover board shall be neatly cut to fit around penetrations and projections.

3.07 METAL PANEL INSTALLATION

- A. 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 manufacturer approved 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. Factory applied continuous ribbon of sealant to seal joints of metal panels, using sealant or tape as recommend 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.
- B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. See Division 07 Section, "Sheet Metal Flashing and Trim".

3.08 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.

3.09 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for further information on the following keynotes:

1. KEYNOTE DESCRIPTION:

- a. 074113.AT ANGLE TRIM.
- b. 074113.CB COVER BOARD.
- c. 074113.FA FASCIA.
- d. 074113.FL FLASHING.
- e. 074113.GT GABLE TRIM.
- f. 074113.MSP METAL SOFFIT PANEL.
- g. 074113.RT RECEIVER TRIM.
- h. 074113.SHU SELF-ADHERING HIGH TEMP SHEET UNDERLAYMENT.
- i. 074113.SSP STANDING SEAM METAL ROOF PANEL.
- j. 074113.VR VAPOR RETARDER.
- k. 074113.ZC ZEE CLOSURE.
- l. 074113.ZP Z-PURLINS.

END OF SECTION

SECTION 07 42 13
METAL WALL PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal wall panels.
2. Polycarbonate panels

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Meeting: Conduct preinstallation meeting at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review air and water barrier installation, flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review of procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.03 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Provide shop drawings prepared by manufacturer or manufacturer's authorized dealer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale 3-inch per foot of all required trim and extrusions needed for a complete installation
 - 1. Include data indicating compliance with performance requirements.
 - 2. Indicate points of supporting structure that must coordinate with modular metal panel system installation.
- C. Samples for Initial Selection: For each product specified including sealants and gaskets. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification: Provide 24-inch section of wall panel showing, horizontal joinery, vertical joint return, panel stiffener and anchoring details. Provide 12-inch long pieces of each extruded aluminum trim.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency.
- B. Qualification Information: For Installer and Installer's field supervisor.
- C. Manufacturer's warranty: Submit sample warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved manufacturer listed in this section with minimum 10 years' experience in manufacture of similar products in successful use in similar applications.
 - 1. Approval of Substitutions After Award: include the following for proposed substitutions, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Sample submittal from similar project.

- d. Project References: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
 - e. Sample warranty.
- B. Wall Systems Installer Qualifications: Experienced Installer with minimum of 5 years' experience with successfully completed projects of a similar nature and scope.
- C. Mockups: Build mockup in size and location indicated. Show details of modular metal panel system. Demonstrate methods and details of installation. Show details of vertical joints, penetrations, doors, windows, louvers, pipe openings, inside and outside corners, top and bottom of wall, horizontal and vertical joints.
- 1. Approval of mockup does not relieve Contractor of responsibility to comply with all requirements of contract documents.
 - 2. Approved mockup may become part of installation if approved by Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of modular metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage.
- 1. Deliver, unload, store, and erect modular metal wall panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

1.08 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.
- B. Field Measurements: Verify locations of structural members, adjoining construction and wall openings dimensions by field measurement before panel fabrication and indicate measurements on final shop drawings.

1.09 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.

1.10 WARRANTY

- A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal wall panel assemblies that fail in materials and workmanship within two years from date of Substantial Completion.

- B. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace wall panels that display evidence of deterioration of finish within **30** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 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: For wind loads, no greater than 1/240 of the span.
- B. 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.

2.02 SYSTEM DESCRIPTION

- A. Modular metal wall panel system consisting of metal panels in a rainscreen application as part of the assembly described below:
 - 1. Modular Metal Wall Panels over Outside-Insulated Framed Wall System: Modular metal panels applied as exterior rainscreen cladding over wall framing specified in Division 05 Section "Cold-Formed Metal Framing" with exterior sheathing specified in Division 06 Section "Sheathing," an applied membrane that provides air, moisture, and water vapor control specified in Division 07 Section "Self-Adhering Vapor-Permeable Air-Barrier Membrane," and insulation within the framing and applied outboard of the sheathing specified in Division 07 Section "Thermal Insulation." Metal wall panel installation specified in this section includes metal framing for panel attachment as indicated on Drawings.

2.03 MATERIALS

- A. MP1: Refuse Sheds A, B, C, & D Metal Roofing and Siding Panels
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span, A BlueScope Steel Company; PBR Metal Roofing and Siding Panels or a comparable product by one of the following:
 - a. CENTRIA Architectural Systems.
 - b. Morin - A Kingspan Group Company.

- c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
- d. Taylor Metal Products.
- 2. Panel Width: 36-inch coverage.
- 3. Thickness: Match existing gauge.
- 4. Fasteners: Exposed
- 5. Accessories: Clips, trims and flashings, panel penetration flashings, fasteners, profile closures, and sealant as recommended by panel manufacturer.
- 6. Color: Match existing colors or manufacturer's standard colors selected by the Owner and the Architect.

B. MP2: Attendant Building, LHHW Building, and Warming Station Metal Siding Panels

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span, A BlueScope Steel Company; Select PC10-12 Perception Collection Metal Siding Panels, or a comparable product by one of the following:
 - a. CENTRIA Architectural Systems.
 - b. Morin - A Kingspan Group Company.
 - c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - d. Taylor Metal Products.
- 2. Panel Width: 12-inch coverage.
- 3. Thickness: 0.034 inch (22 gauge).
- 4. Fasteners: Concealed
- 5. Accessories: Clips, trims and flashings, panel penetration flashings, fasteners, profile closures, and sealant as recommended by panel manufacturer.
- 6. Color: Match existing refuse shed color or manufacturer's standard color selected by the Owner and the Architect.

C. PP1: Refuse Shed Polycarbonate Panel Siding

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide AEP Span SUNSKY Polycarbonate PBR Siding Panel to match MP1 profile, or a comparable product by one of the following:
 - a. Western States Netak Roofing.
 - b. MBCI.
 - c. or approved equal.

2. Panel Width: 36-inch coverage.
3. Thickness: 0.032 inch (minimum).
4. Fasteners: Exposed.
5. Accessories Clips, trims and flashings, panel penetration flashings, fasteners, profile closures, and sealant as recommended by panel manufacturer.
6. Color: Soft White or manufacturer's standard color selected by the Owner and the Architect.

2.04 METAL PANEL FINISHES

- A. Exterior Panel Finish: Provide primer and finish coat on exposed faces; provide primer on concealed faces of panels.
 1. Dura Tech™ 5000: Polyvinylidene Fluoride, full 70 percent Kynar 500/Hylar 5000, consisting of a baked-on 0.15- 0.20 mil corrosion resistant primer and a baked-on 0.70-0.80 mil finish coat with a specular gloss of 8 to 15 when tested in accordance with ASTM D523 at 60 degrees or approved equal.
 2. Color: Match existing refuse shed colors or manufacturer's standard color/s selected by the owner and the architect.
- B. Interior Panel Finish: Corrosion-resistant primer; primer coat dry film thickness: 0.15 mils; polyester paint; dry film thickness of 0.35 mils, off-white to light gray in color.

2.05 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system indicated.
 1. Z-Furring Members: Manufacturer's standard zee-shaped furring members with slotted or non-slotted web, fabricated from hot-dip galvanized steel sheet complying with ASTM A 924 and A 653 (A 525), Coating Designation Z180 (G60); with minimum base metal (uncoated) thickness of 33 mils, (20 gauge), face flange of 1-1/4 inches, wall-attachment flange of 7/8 inch, and of depth required to fit insulation thickness indicated.
- 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 premolded 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, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. J-Trim (JT):
 1. AEP Span; J-Trim, shape and size as indicated on Drawings.
 2. Provide additional trim pieces, i.e. Outside Corner, where indicated or as needed.
- E. 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.
- F. 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, nonsag, 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.

2.06 SUB-GIRT METAL FRAMING ANGLES (SG)

- A. Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G90 hot-dip galvanized zinc coating.
 1. Horizontal Sub-Girt Metal Framing Angles: 0.048 inch (18 gauge) minimum nominal thickness.
 - a. Sub-Girts to sized and gauged in association with Project requirements as indicated on Drawings.
 - b. Provide perforations of not less than 1/4 inch diameter for every 4 inches along the top, flat, leg of metal framing angle for drainage of rain screen cavity.
 2. Sill Channels: 0.048 inch (18 gauge) minimum nominal thickness, with perforations as described above.

2.07 FABRICATION

- A. General: Fabricate modular metal panels and accessories at factory identical to tested units using manufacturer's standard procedures and processes necessary to meet performance requirements.
 - 1. Provide components of modular metal panel system that are products of one manufacturer, including modular metal panels, head and sill trim, bottom weep, starter flashing, and metal copings.
- B. Modular Metal Panels: Fabricate modular metal panels requiring no further fabrication or modification in field.
 - 1. Horizontal Joints: Dry seal, drained and back ventilated.
 - 2. Vertical Joints: Pre-formed returns.
 - 3. Reveals: 3/4 inch, unless otherwise indicated.
 - 4. System Depth: As indicated on Drawings.

2.08 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. Steel Panel Finishes:
 - 1. Two-Coat Fluoropolymer (standard): AAMA 621. 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.
 - 2. Concealed Finish: Apply pretreatment and such manufacturer's standard white or light-colored acrylic or polyester backer fin consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- D. Exposed Trim, Flashings and Fastener Finish: Match panel finish.
 - 1. Thickness: 0.060 inch nominal.
 - 2. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for additional requirements.
- E. Colors: Match existing refuse shed colors or manufacturer's standard colors selected by the owner and the architect.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine modular metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of modular metal panel system.
 - 1. Inspect framing that will support modular metal panel system to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to modular metal wall panel system manufacturer.
 - a. Maximum deviations acceptable to modular metal panel system manufacturer:
 - 1) 1/4-inch in 20 feet vertically or horizontally from face plane of framing.
 - 2) 1/2-inch maximum deviation from flat substrate on any building elevation.
 - 3) 1/8-inch in 5 feet.
 - 2. Confirm presence of acceptable framing members to match installation requirements of modular metal panel system.
 - a. Confirm framing minimum 0.048 inch (18 gauge) at maximum 24 inch spacing.
 - 3. Verify that window, door, louver and other penetrations match layout on shop drawings.
- B. Notify Contractor in writing of out-of-tolerance work and other deficient conditions prior to proceeding with modular metal wall panel system installation.

3.02 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 MODULAR METAL PANEL SYSTEM INSTALLATION

- A. General: Install modular metal panel system in accordance with approved shop drawings and manufacturer's recommendations.
- B. Installation: Attach panels to metal sub-framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings.
 - 1. Horizontal Joinery: Working from base of installation to top, connect upper panel to lower panel at joinery.
 - 2. Vertical Joinery: Provide reveal between vertical ends of panels as shown on shop drawings.

3. Galvanic Action: Where elements of modular metal wall system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- C. Framing and other components shall be straight to match plane of panel as required to meet the installed panel tolerances with straight, sharply formed edges.
- D. Rainscreen Installation: Proceed with installation of manufacturer's dry seal horizontal joinery. Keep open spaces in horizontal joinery intended to ventilate cavity behind system.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report. Correct deficiencies noted in report.

3.05 CLEANING AND PROTECTION

- A. Remove temporary protective films within 2 weeks of erection. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.
- B. Replace damaged panels and accessories that cannot be repaired by field repair.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	074213.BT	BASE TRIM
b.	074213.CS	CLOSURE STRIP
c.	074213.F	FURRING
d.	074213.FT	FASTENER
e.	074213.IMP	INTERIOR METAL WALL PANEL
f.	074213.JC	JAMB CLOSURE
g.	074213.JT	J-TRIM
h.	074213.MP1	METAL PANEL STYLE 1
i.	074213.MP2	METAL PANEL STYLE 2

- j. 074213.PP1 POLYCARBONATE PANEL STYLE 1
- k. 074213.SF SILL FLASHING
- l. 074213.SG SUB-GIRT METAL FRAMING ANGLES
- m. 074213.WC WALL CORNER
- n. 074213.ZC ZEE CLOSURE
- o. 074213.ZF Z-FURRING

END OF SECTION

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Manufactured Products:
 - a. Manufactured through-wall flashing and counterflashing.
 - b. Manufactured reglets and counterflashing.
2. Formed Products:
 - a. Formed roof drainage sheet metal fabrications.
 - b. Formed low-slope roof sheet metal fabrications.
 - c. Formed wall sheet metal fabrications.
 - d. Formed equipment support flashing.
3. Plastic Assemblies and Components:
 - a. Downspouts.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled works. Details and drawings are to be drafted using CAD drafting. Include the following:
 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.

5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 7. Details of special conditions.
 8. Details of connections to adjoining work.
 9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
 3. Accessories and Miscellaneous Materials: Full-size Sample.
 4. Aluminum Samples: Samples to show full range to be expected for each color required.
- E. Qualification Data: For qualified fabricator.
- F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- G. Warranty: Sample of special warranty.

1.03 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop 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.
- B. Sheet Metal flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
1. NRCA - Latest Edition of the NRCA Roofing and Waterproofing Manual.

- C. Mockups: Build Integrated Exterior Mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build exterior mockup of typical roof edge, including built-in gutter, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 2. Review methods and procedures related to sheet metal flashing and trim.
 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.04 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. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.05 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which 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 Hunter units when tested according to ASTM D 2244.

- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Special Warranty for Installation: Installer agrees to repair or replace components of sheet metal flashing and trim that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, rupturing or cracking.
 - b. Wrinkling or buckling.
 - c. Loose parts.
 - d. Failure to remain weathertight, including uncontrolled water leakage.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
 - f. Galvanic action between sheet metal roofing and dissimilar materials.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall 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 shall not rattle, leak, or loosen, and shall remain watertight.
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in:
 - 1. Refer to Structural General Notes for Wind Up-Lift tables.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120°F, ambient; 180°F, material surfaces.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finishes:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70% 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.
 - 3. Colors:
 - a. Typical sheet metal trim: Match Sherwin Williams Iron Ore SW 7069.
 - b. Vertical flashing at windows, as indicated on Drawings: Color to match Pure+ FreeForm; Vikings Helmet, #17-0535-1. See Division 07 Section "Metal Wall Panels."
 - c. Trim to match of corrugated metal siding colors: AEP Span; Silversmith and Slate Grey. See Division 07 Section "Metal Wall Panels."
 - 4. Concealed Finish: Pretreat with 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.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.
 - 1. Finish: 2B (bright, cold rolled) and 4 (polished directional satin) as selected by Architect.
 - 2. Surface: Smooth, flat.
- D. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
 - 2. Surface: Smooth, flat.

3. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70% 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.
4. Colors: See colors for aluminum sheet above.
5. Concealed Finish: Pretreat with 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.

2.03 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970; stable after testing at 240°F.
 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20°F.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
 - b. GCP Applied Technologies (formerly W. R. Grace); Ultra.
 - c. Henry Company; Blueskin PE200 HT.

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and 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.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized): Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100% tin.

D. Sealant Tape: Pressure-sensitive, 100% solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.05 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Heckmann Building Products Inc.
 - c. Hickman, W. P. Company.

- d. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
- e. Sandell Manufacturing Company, Inc.
- 2. Material: Stainless steel, 0.019 inch thick.
- 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- 4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
- 5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
- 6. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- 7. Finish: As selected by Architect.

2.06 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. 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.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

- C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams: 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.
- I. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- J. Do not use graphite pencils to mark metal surfaces.

2.07 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Fabricated Gutters:
 - 1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required and indicated.
 - 2. Materials;
 - a. Pre-finished ANSI/ASTM A653 Galvanized sheet steel, minimum 0.034 inch (22 gauge).
 - 3. Size: As indicated on Drawings
 - 4. SMACNA Style: As indicated on Drawings.
 - 5. Finish:
 - a. Exterior Finish: Polyvinylidene fluoride (PVDF) minimum 70% Kynar resin, dry film thickness 0.8 mils minimum.
 - b. Exterior primer: Baked on epoxy primer coat, dry film thickness 0.2 mils minimum.
 - c. Color: Custom color to match Architects' sample.
 - d. Interior finish: Factory standard prime-coat, dry film thickness 0.5 mils minimum.

6. Expansion Joints: Built in.
7. Accessories:
 - a. Wire ball downspout strainer.
 - b. Anchorage Devices: Type as recommended by manufacturer.
 - c. Expansion Joints: Provide manufacturer's standard expansion joint assemblies allowing for minimum 3/4 inch thermal movement. Spacing per manufacturer.
 - d. Gutter Brackets: Fabricate from 0.14 inch (10 gauge) steel, galvanize and finish to match color of gutter. Multiple shapes required.
 - e. Top Gutter brackets: Fabricate 2 inch wide, from 0.060 inch (16 gauge) steel, galvanize and finish to match color of gutter. Space at no greater than 18 inches o.c.
- B. Downspouts: Fabricate sheet metal downspouts complete with elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 1. Fabricated Hanger Style: SMACNA figure designation Fig.1-35E- Round; 4-inch diameter.
 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch thick.
- C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:
 1. SMACNA: Fig. 1-27A or as indicated on Drawings.
 2. Stainless Steel: 0.0188 inch thick.

2.08 PLASTIC DOWNSPOUTS (PDS)

- A. Downspouts: Fabricate plastic downspouts complete with elbows. Furnish with metal hangers.
 1. Provide ASTM D1785 compliant, 6 inch dia., Schedule 40, Type 1, Grade 1 PVC plastic pipe.
 2. Provide ASTM D2466 compliant Schedule 40 PVC plastic fittings, sized for pipe. Provide elbows, couplings, cleanouts, adapters, reducers, etc. as required for drainage system.
 3. Provide compatible solvent for assembly of PVC plastic components.
 4. Fabricated Hanger Style: SMACNA figure designation Fig.1-35E- Round; 4-inch diameter.

- B. Color: Sherwin Williams; Iron Ore SW 7069. See Division 09 Section "Exterior Painting" for paint coatings.

2.09 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
1. Coping Profile: SMACNA figure designation 3-4A.
 2. Joint Style: Butt, with 6-inch wide, concealed backup plate and 4-inch wide, exposed cover plates.
 3. Fabricate from the following materials:
 - a. Galvanized Steel: 22 gauge galvanized steel.
 - b. Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.
- B. Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following materials:
1. Galvanized Steel: 0.034 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.034 inch thick.
- C. Roof Edge Flashing and Fascia Cover: Fabricate from the following materials:
1. Galvanized Steel: 0.034 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.034 inch thick.
- D. Roof Edge and Heat Welded Flashing:
1. Material: Polymer coated metal provided in gauge and color: see sections listed above.
- E. Base Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
- F. Counterflashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 thick.
- G. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

H. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

I. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0312 thick.

2.10 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch long, but not exceeding 12-foot- long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch high, end dams where flashing is discontinuous. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.
2. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 6-inches beyond wall openings. Form head and sill flashing with 2-inch high, end dams. Fabricate from the following materials:

1. Zinc Galvanized Steel: 0.022 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

PART 3 – PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.03 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. 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 watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

- D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as shown and as required for watertight construction.
 - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70°F, set joint members for 50% movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40°F.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel and aluminum sheet.
 - 2. Pre-tinning is not required for zinc-tin alloy-coated stainless steel.
 - 3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- G. Rivets: Rivet joints in matching colored metal where indicated and where necessary for strength.

3.04 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches apart. Provide end closures

and seal watertight with sealant. Slope to downspouts. Provide top brackets for gutters spaced not more 36 inches apart.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous cleat flashing.
4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
2. Provide wire ball strainer at each downspout location.
3. Provide elbows at base of downspout to direct water away from building.
4. Connect downspouts to underground drainage system indicated.

D. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and solder] or seal with elastomeric sealant to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

3.05 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 16-inch centers.
 1. Coordinate flashing required to be fabricated of coated metal used to heat weld flashing to PVC membrane. Coordinate with Division 07 sections.

- C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
 - 2. Anchor interior leg of coping with neoprene washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of anchor and washer at 36-inch centers.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.06 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in
- C. Reglets: Installation of reglets is specified in
- D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.
- E. Rubberized flexible flashing at Louvers: Install rubberized flexible flashings in louver opening and into plenum sheet metal of mechanical duct. Install inside duct floor of plenum (3'-0" back and 3" up sides) and up sides to provide drainage plane for wind-driven rain to drain back out of sheet metal enclosure.

3.07 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.08 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. 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.

3.09 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1. KEYNOTE DESCRIPTION:

- a. 076200.DE DRIP EDGE.
- b. 076200.DH DOWNSPOUT HANGERS.
- c. 076200.FA FASCIA.
- d. 076200.G GUTTERS.
- e. 076200.GB GUTTER BRACKETS.
- f. 076200.MDS METAL DOWNSPOUTS.
- g. 076200.RC REGLETS & COUNTERFLASHINGS.
- h. 076200.SMF SHEET METAL FLASHING.
- i. 076200.TWF THROUGH-WALL FLASHING.

END OF SECTION

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SECTION 07 71 23
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Prefinished galvanized steel gutters and downspouts.

1.02 SUBMITTALS

- A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- B. Product Data: Provide data on prefabricated components.

1.03 QUALITY ASSURANCE

- A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.
- B. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- B. Prevent contact with materials that could cause discoloration, staining, or damage.

1.05 DESIGN REQUIREMENTS

- A. Conform to SMACNA Architectural Sheet Metal Manual for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Prefinished Galvanized Steel Sheet: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
 - 1. Finish: Shop precoated with Polyvinylidene Fluoride Coating.
 - 2. Color: As selected by architect from manufacturer's standard colors.

2.02 COMPONENTS

- A. Gutters: SMACNA square style profile. Refer to drawings for size and details.
- B. Downspouts: PVC material with cleanouts.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with CDA requirements.
 - 2. Gutter Supports: Brackets.
 - 3. Downspout Supports: Brackets.
- D. Fasteners: Galvanized steel, with soft neoprene washers.

2.03 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; solder watertight.

2.04 FACTORY FINISHING

- A. Polyvinylidene Fluoride Coating: Minimum 70% Kynar 500/Hylar 500 resin, two coat finish, complying with AAMA 2605.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Slope gutters 1/4 inch per foot.
- D. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
- E. Connect downspouts to storm sewer system. Grout connection watertight.

END OF SECTION

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Preformed flashing sleeves.

1.02 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.
- C. Warranty: Special warranty specified in this section.

1.03 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.06 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing materials and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
 - 1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes and roof expansion joints.

1.07 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

2.02 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated and mill phosphatized for field painting.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
- C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coated.
 - 3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
 - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2605, except as modified below:
 - 1) Humidity Resistance: 2000 hours.
 - 2) Salt-Spray Resistance: 2000 hours.

- D. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and mill finish. Coil-coat finish as follows:
1. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturer's written instructions.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.
 2. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.
- E. Aluminum Extrusions and Tubes: ASTM B 221, alloy and temper recommended by manufacturer for type of use, mill finished.
- F. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.

2.03 MISCELLANEOUS MATERIALS

- A. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- B. Polyethylene Sheet: 6-mil- thick, polyethylene sheet complying with ASTM D 4397.
- C. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
1. Slip Sheet: Rosin-sized paper, minimum 6 lb/100 sq. ft..
- D. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- F. Elastomeric Sealant: ASTM C 920, polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.
- H. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.04 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashings: Double-wall metal flashing sleeve, urethane insulation filled, with integral deck flange, 12 inches high, with removable metal hood and metal collar, and as follows:
 - 1. Available Manufacturers:
 - a. Thaler Metal Industries Ltd.
 - 2. Metal: Aluminum sheet, 0.064 inch thick, mill finished.
 - 3. Diameter: As indicated or as required for roof penetrations.
- B. Vent Stack Flashing: Metal flashing sleeve, with integral deck flange, uninsulated, and as follows:
 - 1. Available Manufacturers:
 - a. Thaler Metal Industries Ltd.
 - 2. Metal: Aluminum sheet, 0.064 inch thick, mill finished.
 - 3. Height: 13 inches.
 - 4. Diameter: As indicated or as required for roof penetrations.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, and clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 - 2. Verify dimensions of roof openings for roof accessories.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum or stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Preformed Flashing Installation:
 - 1. Secure to roof membrane according to vent and stack flashing manufacturer's written instructions.
- F. Seal joints with elastomeric or butyl sealant as required by manufacturer of roof accessories.

3.03 TOUCH UP

- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.04 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

3.05 KEYNOTE SCHEDULE

A. Products in this specification section are cited in the drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1. KEYNOTE DESCRIPTION:

- a. 077200.PF PREFORMED FLASHING SLEEVE.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between metal panels.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - e. Control and expansion joints in ceilings, and other overhead surfaces.
 - f. Other joints as indicated.
2. Exterior joints in the following horizontal traffic surfaces:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Joints between different materials listed above.
 - c. Other joints as indicated.
3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - e. Other joints as indicated.
4. Interior joints in the following horizontal traffic surfaces:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.

- c. Repair joints in concrete slab by sealant application at random cracks, isolation joints and penetrations.

1.02 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.03 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- B. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- C. Qualification Data: For Installer.
- D. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Field Test Report Log: For each elastomeric sealant application.
- G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Warranties: Special warranties specified in this section.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - b. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
- F. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
1. Joints in mockups of assemblies specified in other sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.
- G. Preinstallation Conference: Conduct conference at Project.

1.06 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this section within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this section within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

2.02 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.03 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by sealant manufacturer, based on testing and field experience.

- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.04 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Single-Component-Neutral-Curing Silicone Sealant:
 - 1. Products:
 - a. Dowsil; 795, or other equivalent product.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Tremco; Spectrem 1 (Basic).
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 100/50.

4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 - a. Use O Joint Substrates: Coated glass; aluminum coated with a high-performance coating; galvanized steel; brick; ceramic tile; and wood.
6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

F. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Products:
 - a. Dowsil; 818 High Performance Mold Resistant Sealant.
 - b. Pecora Corporation; 898 NST.
 - c. Tremco; Tremsil 600 White.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

G. Urethane Joint Sealant:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation.
 - b. Bostik, Inc.
 - c. Lymtal, International, Inc.
 - d. May National Associates, Inc.
 - e. Pacific Polymers International, Inc.
 - f. Pecora Corporation.
 - g. Polymeric Systems, Inc.
 - h. Schnee-Morehead, Inc.

- i. Sika Corporation; Construction Products Division.
 - j. Tremco Incorporated.
- 2. Type: Single component (S) or multicomponent (M).
- 3. Grade: Pourable (P) or nonsag (NS).
- 4. Class: 25.
- 5. Uses Related to Exposure: Traffic (T).

2.05 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type OP; Grade, minus 18 deg C.; Class 25 per ASTM C920.
- B. Products:
 - 1. BASF Corporation; MasterSeal NP 520 Siliconized Acrylic Sealant.
 - 2. Bostik Findley; Bosti-Flex Plus Multi-Purpose Siliconized Acrylic Sealant.
 - 3. Pecora Corporation; AC-20+.
 - 4. Schnee-Morehead, Inc.; Acryl-R SM8200.
 - 5. Tremco; Tremflex 834 Siliconized Acrylic Sealant.

2.06 PREFORMED JOINT SEALANTS

- A. Preformed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
 - 1. Products:
 - a. Dowsil; 123 Silicone Seal.
 - b. GE Silicones; UltraSpan US1100.
 - c. Pecora Corporation; Sil-Span.
 - d. Tremco; Spectrem Ez Seal.
- B. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and

airtight seal when compressed to the degree specified by manufacturer; and complies with the following:

1. Products:
 - a. EMSEAL Joint Systems, Ltd.; Emseal Backerseal.
 - b. illbruck Sealant Systems, Inc.; Wilseal 600.
 - c. Polytite Manufacturing Corporation; Polytite B.
 - d. Sandell Manufacturing Co., Inc.; Polyseal.
2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

2.07 PREFORMED TAPE SEALANTS

- A. Back-Bedding Mastic Tape Sealant: Preformed, butyl-based elastomeric tape sealant with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Tape Sealant: Closed-cell, PVC foam tape sealant; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 1. Type 1, for applications in which tape acts as the primary sealant.
 2. Type 2, for applications in which tape is used in combination with a full bead of liquid sealant.

2.08 JOINT-SEALANT BACKING (JSB)

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape 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. Provide self-adhesive tape where applicable.

2.09 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 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 joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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, blast cleaning, 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.
3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on 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 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.

3.03 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 C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

- E. 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.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Installation of Preformed Tapes: Install according to manufacturer's written instructions.
- H. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

- I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

3.04 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
4. Inspect tested joints and report on the following:
 - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.
5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 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.

3.06 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	079200.BBT	BOND BREAKER TAPE
b.	079200.BR	BACKER ROD
c.	079200.CSB	CYLINDRICAL SEALANT BACKING
d.	079200.JS	JOINT SEALANT (WITHOUT BACKER ROD)
e.	079200.JSB	BACKER ROD WITH JOINT SEALANT
f.	079200.PJS	PREFORMED FOAM JOINT SEALANT
g.	079200.PTS	PREFORMED TAPE SEALANT
h.	079200.RS	BACKER ROD & SEALANT

END OF SECTION

Division 08

Openings

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite, and transom frames.
3. Factory finishing hollow metal doors and frames and factory machining for hardware.
4. Louvers installed in hollow metal doors.
5. Light frames and glazing installed in hollow metal doors.

1.02 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating,, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
1. Elevations of each door design.
 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 condition.
 6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.
 8. Details of moldings, removable stops, and glazing.
 9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.

1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450°F above ambient after 30 minutes of standard fire-test exposure.

2. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

- a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Label each individual glazed lite.

E. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.

1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:

- a. Typical Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.35 maximum, R-Value 2.9 minimum, including insulated door, thermal-break frame and threshold.

2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.30 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).
- F. Sound Transmission Class (STC) Rated Doors: Provide sound transmission class rated doors fabricated as sound-reducing types with testing according to ASTM E 90, and classifications according to ASTM E 413. Submit manufacturer's written results of STC ratings from testing performed by a qualified independent testing agency for sound resistant doors.
- G. Pre-Submittal Conference: Conduct conference with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, 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 finish of 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 work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

- A. Coordinate installation of anchorages 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.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. Ceco Door Products; an Assa Abloy Group company.
 - 3. Curries Company; an Assa Abloy Group company.
 - 4. Republic Steel Products.
 - 5. Steelcraft; an Ingersoll-Rand company.
 - 6. Stiles Hollow Metal.
- B. Fire-Resistive Door Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. SAFTIFIRST, Safety and Fire Technology, Inc., a division of O'Keefe's Inc. (888-653-3333).

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Zcoating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-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.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density;

with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

1. Provide exterior insulated door assemblies with a minimum of 0.36 U-value.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities. Do not apply to fire-rated frames.

J. Dissimilar Metals: provide isolation protection of dissimilar metals.

2.03 STANDARD HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral core, or vertical steel-stiffener core.

a. Polystyrene and Polyurethane (Insulated) Doors: Where indicated, provide doors fabricated as thermal-rated assemblies.

1) Thermal-rated assemblies shall have a minimum R-value 11 or better.

b. Standard Vertical Steel-Stiffener Core: Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).

c. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.0598-inch) thick steel, Model 2 (Fully welded, seamless face and edges).

4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 8. Basis of Design:
 - a. CECO Door Products (C) - Steel-Stiffener: Medallion Series.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 3 and Physical Performance Level B (Heavy Duty), Minimum 0.042-inch thick steel, Model 2 (Fully welded, seamless face and edges).
 4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Edge, 1/8 inch in 2 inches.
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 3/16 inch plate, 1-1/4 by 9 inches or minimum 0.067 continuous channel with pierced holes, drilled and tapped.
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 8. Basis of Design:
 - a. CECO Door Products (C) - Temperature Rise: Medallion 450 Series.

2.04 ENERGY EFFICIENT HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
 - 1. Design: Flush panel.
 - 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 0.0299 inch thick steel stiffeners at 6 inches on-center internally welded at 5 inches on center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a minimum R Factor of 11.01, per ASTM C518.
 - 3. Level/Model: Level 2 and Physical Performance Level A (Extra Heavy Duty), Minimum 0.042 inch thick steel, Model 2 (Fully welded, seamless face and edges).
 - 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Edge, 1/8 inch in 2 inches.
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 3/16 inch thick plate, 1-1/4 by 9 inches.
 - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
 - 8. Basis of Design:
 - a. CECO Door Products (C) - Trio-E Series.

2.05 SOUND RESISTANT DOORS

- A. Subject to the same compliance standards and requirements as standard hollow metal doors, provide manufacturer's standard sound resistant acoustic core tested in accordance with ASTM E 90, ASTM E 413, and ASTM E 1332 standards. Fabricate with minimum 16 gauge construction, 1-3/4 inch thickness, combined with standard flush frames designed for mid-range and high range sound attenuation from STC 39 through

STC 52 applications. Furnish complete with perimeter sound seals, bottom seals, and threshold as required for specified STC rating.

1. Basis of Design:

- a. CECO Door Products (C) - Sound-Tech Series.

2.06 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

- 1. Fabricate frames with mitered or coped corners.
- 2. Fabricate frames, with the exception of knock down types, with “closed and tight” miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
- 3. Frames for Level 3 Steel Doors (up to 48 inches in width): Minimum 0.067-inch thick steel sheet.

4. Basis of Design:

- a. CECO Door Products (C) - SQ/SU and SR Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

- 1. Fabricate frames with mitered or coped corners.
- 2. Fabricate frames, with the exception of slip-on drywall types, with “closed and tight” miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
- 3. Frames for Level 2 Steel Doors: Minimum 0.053-inch thick steel sheet.
- 4. Frames for Wood Doors: Minimum 0.053-inch thick steel sheet.
- 5. Frames for Borrowed Lights: Minimum 0.053-inch thick steel sheet.

6. Basis of Design:

- a. Drywall: CECO Door Products (C) - DU/DQ, DC, and DC Series.

7. Fire Rated Frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

8. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.07 ENERGY EFFICIENT HOLLOW METAL FRAMES

- A. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate from minimum 16 gauge galvanized steel, with positive 3/8" vinyl thermal break and integral vinyl weatherstripping. Thermal break frames available as knock down types only.

- 1. Basis of Design:

- a. CECO Door Products - Thermal Break SQT and SRT Series.

- B. Weatherstripped Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated weatherstripped profiles with 1/8" integral kerf formed into the frame soffit able to receive manufacturer's listed gasket material. Available for use in both masonry and drywall construction, with fire rating up to 3 hours complying with NFPA 105, UL 1784, and ASTM E-283 Test criteria.

- 1. Basis of Design:

- a. CECO Door Products - Weatherstripped SQW and SRW Series.

2.08 FRAME ANCHORS

- A. Jamb Anchors:

- 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

- 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.09 HOLLOW METAL PANELS

- A. Provide hollow metal panels 1 inch thick of same materials, construction, and finish as specified for adjoining hollow metal work.

2.10 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- C. Provide louvers for doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch thick, cold-rolled hot dip galvanized steel sheet set into 0.032-inch thick steel frame by Anemostat Door Products, or approved.
 - 1. Interior: Inverted Zee blade type.
 - 2. Exterior: Zee blade type.

2.11 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 18 gauge (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

- E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.

- 1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.12 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

2.13 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861 (Custom).
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Glazed Lites: Factory cut openings in doors.
 - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
 - 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges.
 - 5. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness. Wire nut connections are not acceptable.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Four-sided door frames, for roof access, must be face welded.

2. Sidelight 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 butt welding.
3. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges. Provide countersunk, flat Phillips head exposed screws and bolts for exposed fasteners unless otherwise indicated.
6. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness.
7. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers.
 - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware.
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

- b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
- 10. Door Silencers: Except on weather-stripped doors, 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.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished.
 - 1. Locate hardware as indicated on final Shop Drawings, or if not indicated, according to ANSI/NAAMM-HMMA 861.
 - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.

3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.14 STEEL FINISHES

- A. Preparation: Clean, treat and paint exposed surfaces of steel door and frame units, including galvanized surfaces. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
- B. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 2. Primer for Fire Rated Doors: Tnemec Polyamide epoxy- Series 66 at 4 mils DFT at all fire-rated interior frame surfaces. Provide primer in different color than primer specified above. Do not apply asphaltic emulsion on fire rated doors.

2.15 PAINT COLOR AND GLOSS:

- A. As selected by Architect from manufacturer's full range.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with HMMA 840.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly fill with Spray foam insulation, Specified in Division 07 Section "Thermal Insulation," behind frames.
 4. Solidly pack mineral-fiber insulation inside hollow metal frames.
 5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/32 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/32 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/32 inch measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/32 inch, measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 1/4 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 1/2 inch.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops 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.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. 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.
- C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

3.05 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1. KEYNOTE DESCRIPTION:

- a. 081113.HMD HOLLOW METAL DOOR.
- b. 081113.HMF HOLLOW METAL FRAME.

END OF SECTION

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Galvanized steel access doors and frames in walls and ceilings for mechanical and electrical systems, fire rated where required, and lockable.
2. Attic access ladder and hatch.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, 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. Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.04 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.05 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.02 ACCESS DOORS AND FRAMES (AD)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - 1. Nystrom, Inc.
 - 2. Babcock-Davis.
 - 3. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - 4. Karp Associates, Inc.
 - 5. Larsens Manufacturing Company.
 - 6. Milcor; Commercial Products Group of Hart & Cooley, Inc.
- B. AD1 - Flush Access Doors with Exposed Flanges:
 - 1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 2. Locations: Walls and ceilings, as indicated or as otherwise required.
 - 3. Latch and Lock: Prepared for mortise cylinder.
- C. AD2 - Recessed Access Doors with Concealed Flanges:
 - 1. Description: Door face recessed 5/8 inch for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge, and optional gasketing.
 - 2. Locations: Wall and ceiling, as indicated or as otherwise required.
 - 3. Door Size: As indicated on Drawings.
 - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, minimum 16 gauge, factory primed.
 - 5. Frame Material: Nominal 0.060 inch, 16 gauge, factory primed.
 - 6. Latch and Lock: Prepared for mortise cylinder.

2.03 FIRE-RATED ACCESS DOORS AND FRAMES (FRP)

A. Fire-Rated, Flush Access Panel Doors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Nystrom; U-Series fire-rated, Uninsulated Access Door model UT or a comparable product by one of the following:
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Babcock-Davis.
 - c. Karp Associates, Inc.
 - d. Larsens Manufacturing Company.
 - e. Milcor; a division of Hart & Cooley, Inc.
2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Door: 14 gauge Steel.
4. Frame: 16 gauge Steel.
5. Flange: 1 inch Exposed, Drywall Bead Flange model UT.
6. Size: As indicated on Drawings.
7. Location: Walls, as indicated on Drawings, or as otherwise required.
8. Certification: UL listed "B" label for 1-1/2 hours.
9. Finish: White Powder Coat.
 - a. Color: As selected by Architect from manufacturer's standard color(s).
10. Latch and Lock: Prepared for mortise cylinder.

2.04 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS).
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.05 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.
 - 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder.

2.06 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 Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 – EXECUTION

3.01 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.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. At locations indicated on Drawings, mechanically attach additional layer of unfinished 5/8 inch thick gypsum board to backside of access doors; cut around obstructions and to allow proper operation of door.

3.03 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

3.04 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1. KEYNOTE DESCRIPTION:

- a. 083113.AD ACCESS PANEL DOOR.
- b. 083113.FRP FIRE-RATED ACCESS PANEL.

END OF SECTION

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SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Service doors.

1.02 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. 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.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For overhead coiling doors, accessories, and components, from manufacturer.
- C. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- D. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.05 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.
 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.06 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.
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors, fire-rated service door and coiling counter door from single source from single manufacturer.
 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- C. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2. Seismic Component Importance Factor: 1.25.
- D. Performance Requirements Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, include structural analysis data.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Summary of forces and loads on walls and jambs.

2.03 OVERHEAD COILING DOORS

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Cornell; a CornellCookson company; Rolling Service Door Model ESD10 or a comparable product by one of the following:
 - a. Clopay Building Products.
 - b. Cookson; a CornellCookson company.
 - c. McKeon Door Company.
 - d. Overhead Door Corporation.
 - e. Wayne Dalton; a division of Overhead Door Corporation.

2.04 DOOR ASSEMBLY

- A. Curtain Slats:
 - 1. Galvanized Steel: No. 5F (prefinished with GalvaNex™ Coating System), Grade 40 steel, ASTM A 653 galvanized steel zinc coating. Gauge as required to meet performance requirements, but not less than 22 gauge.

2. Finish: Powder coat.
 - a. Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
 - 1) SpectraShield color as selected by Architect from manufacturer's full range.
- B. Endlocks: Alternate slats each secured with two 2.5 inch (6.35 mm) rivets. Fabricate interlocking sections with high strength nylon – available to 21'5" width. Provide endlocks/windlocks as required to meet specified wind load.
- C. Bottom Bar:
 1. Extruded Aluminum (Standard to 21'4" opening width): Extruded aluminum alloy 6063-T5.
 2. Finish: Powder coat.
 - a. Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
 - 1) SpectraShield color as selected by Architect from manufacturer's color range to match slats.
- D. Guides:
 1. Structural steel angles, 3/16 inch minimum thickness. Provide windlock bars as required, removable bellmouths, and bottom bar stoppers of same material.
 2. Finish: Powder coat.
 - a. Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
 - 1) SpectraShield color as selected by Architect from manufacturer's color range, to match slats.
- E. Counterbalance Shaft Assembly:
 1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
 2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. (110 N). Provide wheel for applying and adjusting spring torque

F. Brackets:

1. Fabricate from minimum 3/16 inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
 - a. Finish: Powder coat.
 - 1) Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
 - a) SpectraShield color as selected by Architect from manufacturer's color range, to match slats.

G. Hood:

1. Galvanized steel with reinforced top and bottom edges. Provide intermediate support brackets as required.
 - a. Finish: Powder coat.
 - 1) Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
 - a) SpectraShield color as selected by Architect from manufacturer's color range, to match slats.

H. Weatherstripping:

1. Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides.
2. Guides: Vinyl strip sealing against fascia side of curtain.
3. Hood: Neoprene/rayon baffle to impede air flow above coil.
4. Lintel Seal: Nylon brush seal fitted at door header to impede air flow.

I. Rapid Response:

1. Curtain Configuration: 3 feet of extra curtain material.
2. Guide Configuration: 56" removable lower guide section for quick access to curtain for repairs.
3. Impactable Bottom Bar: 2 structural steel angles with flexible connecting members.

2.05 MATERIALS AND FINISHES

- A. Galvanized steel shall have GalvaNex Coating System with SpectraShield top coat.
 - 1. ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding baked-on base coat and powder coat finish.

2.06 OPERATION

- A. Manual ControlGard Chain Hoist: Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide. Chain hoist to include integral brake mechanism that will immediately stop upward or downward travel and maintain the door in a stationary position when the hand chain is released by the user.

2.07 ACCESSORIES

- A. Locking:
 - 1. Padlockable slide bolt on coil or fascia side of bottom bar at each jamb extending into slots in guides.
 - 2. Other locking requirements as indicated or as directed by Architect.

2.08 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.

PART 3 – EXECUTION

3.01 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.

3.02 INSTALLATION

- 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. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- E. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- F. Fire-Rated Doors: Install according to NFPA 80.
- G. Coordinate installation of electrical service with Division 26 Electrical. Complete wiring from disconnect to unit components.
- H. Power-Operated Doors: Install according to UL 325.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. 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.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.04 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.05 CLEANING AND PROTECTION

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Protect installed products until completion of project.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 083323.C CURTAIN.
 - b. 083323.H HOOD.
 - c. 083323.JG JAMB GUIDES.
 - d. 083323.L LOCK DEVICE.
 - e. 083323.MO MANUAL DOOR OPERATOR.
 - f. 083323.OCD OVERHEAD COILING DOOR.
 - g. 083323.SD SERVICE DOOR.
 - h. 083323.T TRACKS.

END OF SECTION

SECTION 08 41 13
ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Exterior thermally-broken storefront framing.

1.02 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."
- B. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) - AAMA Glossary (AAMA AG).
- C. AAMA: American Architectural Manufacturers Association.
- D. AWS: American Welding Society.
- E. ASTM: American Society for Testing and Materials.
- F. BHMA: Builders Hardware Manufacturers Association.
- G. ICC: International Code Council.
- H. SSPC: The Society for Protective Coatings.
- I. UL: Underwriters Laboratories, Inc.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
 - 2. Elevations at 1/4 inch scale.
 - 3. Detail sections of typical composite members.
 - 4. Anchors and reinforcement.

5. Hardware mounting heights.
 6. Glazing details.
 7. Miscellaneous cover, corner and closure pieces.
 8. Infill panels.
 9. For entrance doors, coordinate with hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, 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.
- F. Other Action Submittals:
1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- G. Delegated Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional Construction manager, licensed in jurisdiction of Project, responsible for their preparation.
1. Detail fabrication and assembly of aluminum-framed systems.
 2. Include design calculations.
- H. Qualification Data: For qualified Installer.
- I. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

- J. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- K. Source quality-control reports.
- L. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.
- M. Field quality-control reports.
- N. Maintenance Data: For aluminum-framed systems to include in maintenance manuals. Warranties: Sample of special warranties.
- O. Close-out Submittal: Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- F. Pre-installation Conference: Conduct conference at Project site.
- G. Mockups: Build mockups to verify selections made under submittals above and to set quality standards for installation.
 - 1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - a. Build mockup of typical wall areas as shown on Drawings.
 - b. Field testing shall be performed on mockups according to requirements in "FIELD QUALITY CONTROL" article.

- c. Mockups: Install sealant in mockups of assemblies specified in other sections that are indicated to receive joint sealants specified in this section. Use materials and installation methods specified in this section
- 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on shop drawings.

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Water leakage through fixed glazing and framing areas.
 - d. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. 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 according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, peeling, or chipping.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

1.07 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional Construction manager, to design aluminum-framed entrances and storefronts.
- B. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
 2. Dimensional tolerances of building frame and other adjacent construction.
 3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Glazing-to-glazing contact.
 - e. Noise or vibration created by wind and by thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.
 - h. Failure of operating units.
- C. Design aluminum-framed systems, including comprehensive engineering analysis by a qualified Professional Construction manager, licensed in the State of Washington, using performance requirements and design criteria indicated.
- D. Structural Loads:
 1. Wind Loads: As indicated on Structural Drawings.
 2. Seismic Loads: As indicated on Structural Drawings.

E. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to $L/360$ of clear span or $1/8$ inch, whichever is smaller.

F. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150% of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2% of span.
3. Test Durations: As required by design wind velocity, as but not fewer than 10 seconds.

G. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Structural Drawings.
2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

H. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

I. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20% of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

J. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120°F, ambient; 180°F, material surfaces.

- K. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
1. Glass to Center:
 - a. low-e: 62 frame and 68 glass.
 - b. clear: 63 frame and 56 glass.
- L. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall be as follows:
 - a. Glass to Center:
 - 1) Fixed glazed storefront assembly with low-e argon filled IGU shall have a U-value of not more than 0.38.
 - b. Storefront Doors: Provide entrance doors having an average U-factor of not more than 0.60 as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC):
 - a. Provide values in accordance with 2018 International Energy Conservation Code (IECC) - Chapter 4, Table C402.4 Building Envelope, for Climate Zone 5 and Marine 4 as follows:
 - 1) $PF < 0.2$ for south, east and west orientation SHGC = 0.38 or less. For north orientation SHGC = 0.51 or less.
 - 2) $0.2 < PF < 0.5$ for south, east and west orientation SHGC = 0.46 or less. For north orientation SHGC = 0.56 or less.
 - 3) $PF > 0.5$ for south, east and west orientation SHGC = 0.61 or less. For north orientation SHGC = 0.61 or less.
 - b. Fixed Glazing, Framing Areas and Entrance Doors: SHGC for the system of not more than 0.38 as determined according to NFRC 200.
- M. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than:
1. Glass to Exterior - 38 (STC) and 31 (OITC) when glazed with 1 inch thick insulating glass units (glazing assembly: 1/4 inch thick tempered glass - 1/2 inch air space - 1/4 inch thick tempered glass).

2.02 MANUFACTURERS

- A. Basis-of-Design Manufacturer for Storefront Systems: Subject to compliance with requirements, provide products specified below by Kawneer North America, an Arconic company, or comparable products by one of the following:
 - 1. Arcadia, Inc.
 - 2. EFCO Corporation.
- B. Storefront Types:
 - 1. Exterior Storefront:
 - a. Kawneer Trifab 451 T, Thermal Storefront Framing.
 - b. Dimensions: 2 inches by 4-1/2 inches.
- C. Entrance Doors:
 - 1. Storefront Entry Doors: Kawneer Insulpour 500T Wide Stile thermally broken doors within thermally broken door frames. Refer to Door Schedule on Drawings for hardware not specified herein.
 - a. Kawneer extrusion components consist of the following:
 - 1) Top Rail: 5 inches.
 - 2) Panic Mid-Rail: 4 7/16 inches (5 inch sightline).
 - 3) Bottom Rail: 12 1/4 inches.
 - 4) Vertical Stile: 5 inches.
 - 5) Glass Stop: As provided by manufacturer.
 - 6) Pull: Kawneer; CO-12/CP-11 push/pull set in finish selected by Architect.
 - 2. Refer to Drawings for elevations of doors.

2.03 MATERIALS

- A. Aluminum: Extruded aluminum shall be 6063-T6 alloy and temper.
 - 1. Sheet and plate:
 - 2. Extruded bars, rods, profiles, and tubes:
 - 3. Extruded structural pipe and tube.
 - 4. Structural profiles.

- B. Steel Reinforcement: 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 according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
 - 1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.04 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally improved.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: As indicated.
- B. Formed Trim: Provide aluminum formed trim in profiles indicated.
 - 1. Type: Extrusion wherever possible, otherwise fabricate from brake shaped aluminum plate.
 - 2. Finish: Match framing members.
 - 3. Material Thickness: Minimum 0.080 inch frame and 0.125 inch vent.
 - 4. Provide watertight visible joints with no visible fasteners.
- C. Compensation Channels: Provide compensation channels to match system material and finish where required by manufacturer or indicated in Drawings. Provide all components for compensation channel system including fasteners and attachment devices.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. 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.
 - 3. Do not use exposed fasteners except for application of hardware. For application of hardware, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, or fabricated from stainless steel.

- F. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials or Dead-soft, 0.018-inch-thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.
- H. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
 - 1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
 - 1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Color: As selected by Architect.

2.06 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
 - 1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.
- C. Storefront Reinforcement: Provide internal reinforcement for jamb at strike side and hinge side of entrance doors continuously both sides of vertical frame.
- D. Entrance Door Hardware.

2.07 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing from exterior for vision glass and exterior for spandrel glazing.
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using shear-block system around doors and screw-spline or shear block systems for all other components.
- F. Entrance Door Frames: Reinforce frame as required to support loads imposed by door operation and frame hardware.
 - 1. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
 - 2. Backer plates must be used to reinforce jambs at door hinges.
- G. Entrance Door Hardware Installation: Coordinate factory installed entrance door hardware to the greatest extent possible.

2.08 ALUMINUM FINISHES

- A. Superior Performing Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70% PVDF or FEVE 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.

1. Color and Gloss:

a. SF1: Black; as selected by Architect from manufacturer's full range.

1) Coordinate color match with storefront break metal and clad wood doors and windows.

b. SF2: Permafluor Redwood.

1) Refer to Finish Schedule and Drawings for accent color locations.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, 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.

3.02 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.

2. Do not install damaged components.

3. Fit joints to produce hairline joints free of burrs and distortion.

4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

- D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Division 08 Section "Glazing."
- G. Installation of Aluminum-Framed Entrance Doors: Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
- H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.03 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft
 - 2. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

- C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.05 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 084113.A ALUMINUM 'L' ANGLE.
 - b. 084113.CC COMPENSATION CHANNEL.
 - c. 084113.ED ENTRANCE DOOR.
 - d. 084113.FT FORMED TRIM.
 - e. 084113.SCT SILL CAP/TRACK.
 - f. 084113.SF STOREFRONT FRAMING.
 - g. 084113.SPF SILL PAN FLASHING.
 - h. 084113.T THRESHOLD.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Aluminum windows for exterior locations.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene at project site one week before starting work of this section.

1.03 SUBMITTALS

- A. Product Data: Provide component dimensions, information on glass and glazing, and internal drainage details.
- B. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, window details and installation requirements.
- C. Samples: Submit two samples, 12 by 12 inch (300 by 300 mm) in size illustrating typical corner construction, accessories, and finishes.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
- F. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40°F (5°C).
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.07 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Provide 10 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 – PRODUCTS

2.01 PERFORMANCE CLASS AND GRADE

- A. Grade and performance class for windows as follows:
 - 1. Picture Windows: Performance Class LC. Performance Grade 25.
 - 2. Awning Window: Performance Class CW. Performance Grade 30.
 - 3. Mull Bar: Performance Grade 35.

2.02 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Milgard Thermally Improved Aluminum Series Windows and Doors, www.milgard.com 1-800-645-4273, or comparable products by one of the following:
 - 1. Marlin Windows, Inc.
 - 2. Quaker Windows and Doors.

2.03 WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with related flashings, and anchorage and attachment devices.

1. Frame Depth: 2-1/4 inches (57.1 mm).
2. Provide units factory glazed.
3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
4. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
7. Thermal Movement: Design to accommodate thermal movement caused by 180°F (82.2°C) surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.

- B. Fixed, Non-Operable Type:

1. Construction: Thermally broken.
2. Nailing fin: manufacturer's standard nailing fin.
3. Glazing: Insulating glass units; clear; low-e.
4. Exterior Finish: Class II natural anodized.
5. Interior Finish: Class II natural anodized.

- C. Window Groups: For groups of windows use Double Jamb with Narrow Sightline in between.

2.04 PERFORMANCE REQUIREMENTS

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:

1. Performance Class (PC): See 2.01 Performance Class and Grade.
2. Performance Grade (PG): See 2.01 Performance Class and Grade.

- B. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
- C. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure as follows:
 - 1. Awning Window: Laboratory water test pressure of 4.5 psf.
 - 2. Picture Window: Laboratory water test pressure of 3.75 psf.
- D. Air Leakage: Maximum of 0.1 cu ft/min sq ft (0.5 L/sec sq m) per unit area of outside frame dimension, with 6.27 psf (300 Pa) differential pressure when tested in accordance with ASTM E283.
- E. Fenestration Assembly Thermal Transmittance (U-value): Comply with ASHRAE Std 90.1 I-P for building envelope requirements for applicable climate zone.

2.05 COMPONENTS

- A. Frames: 1-1/4 inch wide by 2-1/4 inch deep profile, of 0.060 inch thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of screw fastened type.
- B. Fasteners: Stainless steel.
- C. Glazing Materials: As specified in Division 08 Section "Glazing."

2.06 MATERIALS

- A. Aluminum Members:
 - 1. Extruded aluminum prime billet 6063-T6 alloy for primary components, 6063-T6, or 6061-T6 for structural components, all in accordance with (ASTM B221).
- B. Structural Thermal Break Construction:
 - 1. Frame and sash members shall include a structural thermal barrier, applied in the manufacturer's facility, using concealed low-conductance poured-in-place polyurethane in a pre-treated cavity.
 - 2. After proper curing, the aluminum bridge section must be removed to provide a 1/2" minimum separation between interior and exterior metal surfaces.
 - 3. The thermal barrier cavity shall have a manufactured mechanical lock applied consisting of abrading or lancing of the extrusion cavity prior to application of poured-in-place polyurethane.
 - 4. Thermal Break Performance Requirements:
 - a. Shear strength: minimum 2,500 Lbf in accordance with (AAMA TIR-A8).

- b. Flexural strength: minimum 19,000 psi in accordance with (AAMA D 790).
- c. Thermal conductivity of barrier material: maximum 0.84 BTU-in/(hr-ft²-°F) in accordance with (ASTM C 518).
- d. Systems employing non-structural thermal barriers, or barrier systems absent of a mechanical lock application are not acceptable.

2.07 FINISHES

- A. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils (0.01 mm) thick.
- B. Finish Color: Clear anodized.
- C. Apply one coat of bituminous coating to concealed aluminum and steel surfaces in contact with dissimilar materials.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- F. Install glass in accordance with requirements specified in Division 08 Section "Glazing."

3.03 FIELD QUALITY CONTROL

- A. Provide services of aluminum window manufacturer's field representative to observe for proper installation of system and submit report.

- B. Provide field testing of installed aluminum windows by AAMA accredited independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
 - 1. Perform tests on one individual window of each type in designated locations as directed by Architect.
 - 2. Field test for water penetration in accordance with AAMA 502.12 Field Testing of Newly Installed Fenestration Products ASTM E1105; test pressure shall be 2/3 (two thirds) of the tested and rated laboratory performance for field testing.
 - 3. Field test for air leakage in accordance with ASTM E783 ASTM E283-04 with uniform static air pressure difference of 1.57 psf (75 Pa).
 - a. Maximum allowable rate of air leakage is 1.5 times specified rate of 0.10 cfm/sq ft (0.5 L/s sq m) as indicated in AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.
- D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 085113.AW ALUMINUM WINDOW.

END OF SECTION

SECTION 08 56 80
ALUMINUM PASS-THRU SLIDING SERVICE WINDOWS

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes:

1. Aluminum, medium-duty commercial sliding service windows as indicated in drawings and in sections.

1.02 COORDINATION

A. Coordinate installation of anchorages for sliding service windows. Furnish setting drawings, templates, and directions for installing anchorages, including anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, weights and finishes for window units.

B. Shop drawings: For sliding service windows.

1. Include plans, elevations, sections, and attachment details.
2. Full-size section details of framing members, including reinforcement, and stiffeners.
3. Hardware for sliding window units.
4. Glazing details.

C. Samples for Initial Selection: For frame members with factory-applied color finishes.

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

1. Framing: 12-inch-long sections of frame members.

E. Cutaway Sample: Corner of sliding service window, made from 12-inch (305-mm) lengths of full-size components, and showing details of the following:

1. Joinery.
2. Anchorage.
3. Glazing.

- F. Certification: Provide printed data in sufficient detail to indicate compliance with the contract documents.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Examination reports documenting inspections of substrates, areas, and conditions.
- C. Field quality-control reports documenting inspections of installed products.
 - 1. Field quality-control certification signed by Contractor.
- D. Sample Warranty: For special warranty.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver windows crated to provide protection during transit and job storage. Crate glazing separate from frames unless factory glazed.
- B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.
- C. Store windows at building site under cover in dry location on raised blocks to prevent incidental moisture damage.

1.07 PROJECT CONDITIONS

- A. Field measurements: Check opening by accurate field measurement before fabrication.
 - 1. Show recorded measurements on shop drawings.
 - 2. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including deflections exceeding 1/4 inch (6 mm).
 - b. Excessive air leakage.

- c. Faulty operation of sliding window hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
- B. All material and workmanship shall be warranted against defects for a period of one (1) year from the original date of purchase.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER'S

- A. Basis of design: SW Series, Aluminum Frame Sliding Service Windows manufactured by: C.R. Laurence Co., Inc. (CRL), (800-421-6144, www.crlaurence.com).
 - 1. Catalog Number: D1038A; CRL Horizontal Sliding Florence Model Pass-Thru Assembly With D7 Header / No Screen.

2.02 MATERIALS

- A. Frames: Aluminum frame modules shall be constructed of 6063-T5 extruded aluminum. Poly-pile weather stripping and slide locks.
 - 1. Frame Size: see drawings for sizes.
 - 2. Window Hardware and Accessories:
 - a. Window glides on top-hung nylon slides.
 - b. Poly-pile weather stripping.
 - c. Slide locks.
 - 3. Finish: All aluminum to be clear anodized, Class I, 0.018 mm or thicker.
 - 4. Color and Gloss: Clear anodized.
- B. Glazing: Refer to Drawings and Division 08 Section "Glazing."
- C. Options:
 - 1. Keyed lock.

2.03 FABRICATION

- A. General: Fabricate sliding service windows to provide a complete system for assembly of components and anchorage of window units.
 - 1. Provide units that are reglazable from the interior side without dismantling the exterior side of framing.
 - 2. Prepare sliding service windows for field glazing unless preglazing at the factory is indicated.

- B. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.
- C. Glazing Stops: Finish glazing stops to match window framing.
 - 1. Exterior Glazing Stops: Welded or integral to framing.
 - 2. Interior Glazing Stops: Removable, coordinated with glazing indicated.
- D. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- E. Factory-cut openings in glazing for speaking apertures (where occurs).
- F. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- G. 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.

2.04 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of sliding service windows.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of sliding service windows.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install window in accordance with manufacturer's printed instructions and recommendations. Repair damaged units as directed or replace with new units.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing sliding service windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.

- C. Removable Glazing Stops and Trim: Fasten components with security fasteners.
- D. Fasteners: Install sliding service windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials.
- E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.03 ADJUSTING

- A. Adjust horizontal-sliding, transom sliding service windows to provide a tight fit at contact points for smooth operation and a secure enclosure.
- B. Remove and replace defective work, including sliding service windows that are warped, bowed, or otherwise unacceptable.

3.04 CLEANING AND PROTECTION

- A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances. Take care to avoid damaging the finish.
 - 1. Lubricate sliding service window hardware.
- B. Clean glass of preglazed sliding service windows promptly after installation.
- C. Institute protective measures required throughout the remainder of the construction period to ensure that all the windows do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

3.05 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain sliding service windows.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for further information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 085680.SSW SLIDING SERVICE WINDOW.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes: The complete finish hardware requirements for the project. Quantities listed are for the Contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.

1.02 SUBMITTALS

- A. Product Data: Submit Six (6) copies of manufacturer's data for each item of finish hardware.
- B. Hardware Schedule: Submit Six (6) copies of a detailed Finish Hardware Schedule. The submitted Finish Hardware Schedule shall indicate the complete designation of every item required for each door or opening. List each opening individually. Each heading shall indicate opening location, handing, degree of opening, door size, type, fire rating, Door and Frame material. A cross-reference for any abbreviations or symbols used shall be included. Schedules in coded or horizontal format are unacceptable. Submittals not conforming to these requirements will be returned without review, for re-submittal.
- C. Color Samples: Submit Six (6) set of color charts and physical samples of each product requiring color selection.
- D. Templates: Furnish hardware templates for each fabricator of doors, frames and other work to be factory prepared for the installation of hardware.
- E. Operations and Maintenance Data. Prior to substantial completion, furnish Two (2) Copies of Maintenance and Operations Manuals, furnished in a clearly marked, tabbed, 3-ringed binder. Manuals shall contain final copy of the Finish Hardware Submittal, Product Data, Templates, Key Schedule, Installation Instructions, and Warrantees. Provide manufacturer's names, addresses and phone numbers.
- F. Keying Schedule: After receipt of the approved finish hardware schedule, the finish hardware supplier shall be responsible to arrange a meeting with the Architect and/or Owner to determine the keying requirements for the entire project. This request shall be made through the contractor. At this meeting the keying system shall be discussed and all lockset functions reviewed to insure they are functioning correct. At the same meeting any electrical operations and conditions affecting the access controls and other electronic operators and controls shall be reviewed and confirmed. Four complete copies of the keying schedule and explanations of the operation of the electronic hardware shall be submitted to the contractor for distribution to the appropriate parties. This document should contain riser diagrams and point to point wiring diagrams to facilitate the correct installation of the material.

1.03 QUALITY ASSURANCE

- A. Supplier: Finish hardware shall be supplied by a recognized builders' hardware supplier who has been furnishing hardware in the same area as the project for a period of not less than five (5) years. They shall be a factory-authorized distributor of the Locksets and Door Closers.
- B. organization shall include a member certified Architectural Hardware Consultant, who is available at all reasonable times during the course of the work to meet with the Owner, Architect or Contractor for project hardware consultation.
- C. Source: Obtain each kind of Hardware (Butts, Locksets, Exit Devices, Door Closers, etc.) from only one manufacturer, although several may be indicated as offering products complying with requirements.
- D. Installer: Finish hardware shall be installed only by experienced tradesmen in compliance with trade union jurisdictions, either at the door and frame fabrication plant or at the project site.
- E. Regulatory Requirements:
 - 1. All finish hardware shall comply with applicable local and/or state current building codes.
 - 2. Hardware for fire-rated openings shall also be in compliance with all fire building codes applicable to the district in which the building is located. Provide only hardware which has been tested and listed by "UL" for the types and sizes of doors required, and which complies with the requirements of the door and doorframe labels.

1.04 DELIVERY, STORAGE & HANDLING

- A. Packaging: All items of hardware shall be delivered to jobsite in manufacturer's original packages. Each item or package is to be separately tagged with identification related to the final hardware schedule. Basic installation instructions shall be included in the packages. Deliver packaged hardware items at proper times to proper locations (shop or project site) for installation.
- B. Storage: The General Contractor shall provide a secure and dry area for storage of hardware items and must protect the materials and finishes.
- C. The Hardware Supplier shall inventory the hardware jointly with the Contractor at the jobsite, until both parties are satisfied that the quantity is correct.
- D. Provide secure lockup for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items, which are not immediately replaceable so that the completion of the work will not be delayed by hardware losses, both before and after installation.

1.05 WARRANTY

- A. Finish hardware shall be guaranteed against defects in workmanship and operation for a period of one (1) year, backed by a factory guarantee of the hardware manufacturer. The following products shall be guaranteed for periods beyond One (1) Year:
 - 1. Locks – Three (3) Years.
 - 2. Door Closers - Ten (10) Years Mechanical, Two (2) Electrical.

1.06 MAINTENANCE

- A. Furnish One (1) Set of Special Tools required for installation and adjustment, which shall be delivered directly to the Owner prior to substantial completion.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Finish: Except as noted otherwise in the hardware groups, finishes of hardware materials are as follows:
 - 1. Butts – Exterior 630, interior US26D (626) Dull Chrome.
 - 2. Locksets, Exit Devices, Pulls, Kickplates (630) Stainless Steel.
 - 3. Closers – Alum.
 - 4. Thresholds – Alum.
 - 5. Misc – 626 or as listed.
 - 6. The designations used for the hardware finishes are those listed in ANSI/BHMA A156.18, “Materials and Finishes”.
- B. Butts:
 - 1. Manufacturer Listed: Ives (except anchor hinges, Stanley).
 - 2. Acceptable Substitutions: Bommer.
 - 3. Hinges shall have Flat Button Tips.
- C. Locksets and Cylinder:
 - 1. Manufacturer Listed: Medco.
 - 2. Acceptable Substitutions: Match Owner Standard.
 - 3. Design: 17L.

4. Backset: 2-3/4".
5. All Locksets shall be capable of accepting Medco cylinders.
6. All Locksets and Latchsets shall be listed with Underwriters Laboratories for A label and lesser class doors.
7. Provide Curved Lip Strikes with adequate projection to protect door trim. Provide flat, flush lip strikes for pairs of doors with overlapping Astragals.
8. Provide manufacturers standard wrought or plastic strike boxes.

D. Door Closers:

1. Listed Manufacturer: Sargent.
2. Acceptable Substitutions: None - Match District Standard.
3. Furnish SNB Through Bolts for all Doors.

E. Stops & Holders:

1. Furnish Overhead Stop and Holders sized as recommended by Manufacturer.
2. Where wall stops are not applicable, furnish floor stops 1215 or Overhead Stops if required.

F. Door Silencers:

1. Furnish Rubber Door Silencers for all openings not specified to have Smoke Gasketing or Weatherstrip.
2. Quantity: Furnish three (3) for each single doorframe, and four (4) for each pair of doorframes.

2.02 KEYING

- A. All cylinders for this project shall be subject to the existing Medco Key system per District Standard. Cylinders will be furnished in "H8" keyway. Provide interchangeable core cylinders at all doors.
- B. All cylinders to be construction keyed.
- C. All keys shall be furnished with visual key control.
- D. Key Quantities:
 1. Two (2) Construction Control Keys.
 2. Two (2) Control keys.

3. Eight (8) Construction Keys.
4. 6 total GMK's & MK's.
5. Three (3) each change keys per keyed cylinder.
6. Group key quantities to be finalized at the key conference.

2.03 HARDWARE SCHEDULE

- A. Refer to drawings for related information concerning the following hardware group. Quantities indicated in any instance are for supplier convenience only and are not guaranteed.
- B. Hardware Group:
 1. HW SET: 01:

3	EA	HINGES	5BB1HW 4.5x4.5 NRP	626	IVE
1	EA	LOCKSET	18K241111-524-29	626	MED
1	EA	SURFACE CLOSER	1431-CO2011	Alum	SAR
1	EA	FLOOR STOP	4S444	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

PART 3 – EXECUTION

3.01 PREPARATION

- A. Hardware shall be installed by skilled mechanics to Architect's satisfaction. Conform strictly to manufacturer's templates and instructions.
- B. Examination: Examine Doors, Frames, and related items for conditions that would prevent the proper application of the Finish Hardware. Do not proceed until defects are corrected.
- C. Provide solid blocking for all wall stops and magnetic holders.
- D. Fasteners: Check all conditions and use fastening devices as needed to securely anchor all hardware as per manufacturer's published templates. Self-tapping sheet metal screws are not acceptable. All Door Closers, Exit Devices, Surface Mounted Overhead Stops, and Magnetic Holder Door Armatures on wood doors shall be mounted with Shoulder through bolts.

3.02 INSTALLATION

- A. Comply with the current edition of "Washington State Rules and Regulations for Barrier Free Design" and Title III of the "Americans with Disabilities Act."
- B. Mounting Heights: Mounting Heights: Mount units at heights as recommended in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames (1990)" by Doors and Hardware Institute, except as indicated below. Products not

specifically covered shall be installed in accordance with the manufacturers templates and instructions.

1. Hinges:

- a. Top Hinge: 7-1/4", Top of frame rabbet to centerline of hinge.
- b. Bottom Hinge: 12-1/4", Bottom of Frame to centerline of hinge
- c. Intermediate Hinges: Centered, equal spacing between top and bottom hinges.
 - 1) Mortise Lock Strikes: 40", bottom of frame to centerline of Strike.
 - 2) Wall Stops: Locate Wall Stops intended for use with Lever Handle Locksets and Exit Devices at the Centerline of the Spindle or Pull.

C. Install each hardware item in compliance with manufacturer's instructions.

1. Wherever cutting and fitting are required to install hardware surfaces, which will be painted or finished at a later time, install each item completely and then remove and store in a secure place. After completion of the finishes, re-install each item.
2. Do not install surface-mounted items until finishes have been completed on the substrate.
3. Furnish Overhead Stop and Holders with maximum degree of opening that project conditions will allow.
4. Locate Floors Stops at maximum degree of opening that project conditions will allow. Do not locate Floor Stops where they create a hazardous condition. Stops should be located no more than 1/3 Door width from the Latch Edge of the Door.

D. Adjust and check each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.

3.03 ADJUSTMENT

- A. Final Adjustment: Wherever hardware installation is made more than one (1) month prior to acceptance or occupancy, make a final check and adjustment of all hardware items during the week prior to acceptance or occupancy. Clean and lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Door Closer Adjustment: After mechanical systems have been balanced, adjust Door Closers to comply with following CABO/ANSI A117.1 - 1992 Requirements:
 1. Closing Speed: With the door open 70 degrees, the door closer shall be adjusted so that the door will take at least three (3) seconds to move to a point where the leading edge of the door is three from latching.

2. Opening Force: The maximum force for pushing or pulling a door open shall be as follows: (these forces do not apply to the force required to retract latch bolts or disengage other devices securing the door.
 - a. Fire Doors: The minimum opening force allowable by the appropriate administrative authority.
 - b. Exterior Doors: 8.5 lbf.
 - c. Interior Doors: 5.0 lbf.
- C. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes.

END OF SECTION

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SECTION 08 80 00

GLAZING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.02 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Fabricators: Firms that Fabricate glazing assemblies, including insulated glazing units. Fabricated insulated glazing units shall comply with ASTM E2188, E2189, and E2190. Approved manufacturers shall have certifications including:
1. IGCC: Insulating Glass Certification Council.
 2. IGMA: Insulating Glass Manufacturers Alliance.
 3. SGCC: Safety Glazing Certification Council.
 4. Vitro Architectural Glass CFP: Certified Fabricator Program.
 5. Guardian Select SunGuard Fabricator.
- C. Deterioration of Coated Glass: Defects developing from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.
- D. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture or film on interior surfaces of glass.

- E. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- F. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

1.03 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 - 1. Coated glass.
 - 2. Insulating glass.
- C. Glazing Accessory Samples: For gaskets, sealants, and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- 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 the qualified professional Construction manager responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers, manufacturers of insulating-glass units with sputter-coated, low-e coatings, glass testing agency, and sealant testing agency.
 - 1. Glass Fabrication Certifications.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, glazing sealants, and glazing gaskets.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Warranties: Sample of special warranties.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI/ASQC 9002 1994. Qualified insulating-glass manufacturers shall have a location and equipment that is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations: Obtain glass and glazing materials from one source for each product indicated. Coatings and finished assemblies, such as insulating units and laminated units, to be manufactured by the same fabricator in order to have a common source of warranty.

1.06 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements:
 - 1. Protect glass from edge damage during handling. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.

2. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.08 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 below 40°F.

1.09 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass 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 manufacture.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which 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 the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 1. Warranty Period: 10 years from date of manufacture.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Bendheim.
 2. Cardinal Glass Industries.
 3. Guardian Glass.

4. Hartung Glass.
 5. J.E. Berkowitz.
 6. Northwestern Industries, Inc.
 7. Oldcastle Building Envelope.
 8. Viracon, Inc.
 9. Vitro Architectural Glass.
- B. Source Limitations for Glass: Obtain coated glass from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: 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. Delegated Design: Engage a qualified professional Construction manager to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.
1. Design Wind Pressures: As indicated on Drawings.
 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.
 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- 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 6 mm thick.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 - a. Fixed glazed storefront and curtain wall assemblies shall have a U-value of not more than 0.38.
 - b. Glazed hollow metal storefront entrances shall have a U-value of not more than 0.60.
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.03 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 section or in referenced standards.
 1. GANA 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 shall 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 IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 1. Minimum Glass Thickness for Exterior Lites: 6.0 mm.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3, Class I (clear) unless otherwise indicated.

- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. Maximum peak to valley rollerwave 0.003 inch in the central area and 0.008 inch within 10.5 inches of the leading and trailing edge
 3. For clear or low-iron glass 1/4 to 3/8 inch thick without ceramic frit or ink, maximum plus or minus 100 mD (millidiopter) over 95% of the glass surface.
 4. Maximum bow and warp 1/32 inch per lineal foot.
 5. For uncoated glass, comply with requirements for Condition A.
 6. For coated vision glass, comply with requirements for Condition C (other coated glass).
 7. All tempered safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
 8. Provide heat soak testing for all fully tempered glass conforming to EN14179 which includes a 2 hour dwell at 290°C, plus or minus 10°C.
- C. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and complying with other requirements specified.
- D. Insulating Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 2190 and with requirements specified in this Article and in Part 2 Insulating-Glass Units Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 Performance Requirements Article.
 2. Provide FT (fully tempered) glass lites where safety glass is indicated or required.
 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 4. Sealing System: Comply with requirements in Division 07 Section "Joint Sealants." Dual seal, with primary and secondary sealants of polyisobutylene and silicone.
 5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: Aluminum with black, color anodic finish.
 - b. Desiccant: Molecular sieve or silica gel, or blend of both.
 - c. Corner Construction: Manufacturer's standard corner construction.

2.05 LOW-E COATINGS

- A. Low-e Coating: Vacuum deposition (sputter-coating) process.
- B. Low-e Coating for Insulating Glass (IG) Basis-of-Design Product: Subject to compliance with requirements, provide Vitro Architectural Glass; Solarban 70, or comparable product by one of the following:
 - 1. Bendheim.
 - 2. Cardinal Glass Industries.
 - 3. Guardian Glass; SunGuard SuperNeutral 54.
 - 4. J.E. Berkowitz.
 - 5. Oldcastle Building Envelope.
 - 6. Viracon, Inc.
 - 7. Vitro Architectural Glass; Solarban 67.
- C. Low-e Coating for Insulating Glass, Laminated (IGL) Basis-of-Design Product: Subject to compliance with requirements, provide Vitro Architectural Glass; Solarban 60, or comparable product by one of the following:
 - 1. Bendheim.
 - 2. Cardinal Glass Industries.
 - 3. Guardian Glass; SunGuard SN 68.
 - 4. J.E. Berkowitz.
 - 5. Oldcastle Building Envelope.
 - 6. Viracon, Inc.

2.06 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, or, thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.07 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. May National Associates, Inc.; Bondaflex Sil 290.
 - d. Pecora Corporation; 890.
 - e. Sika Corporation, Construction Products Division; SikaSil-C990.
 - f. Tremco Incorporated; Spectrem 1.

C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.08 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100% 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 C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. 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 the 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.

2.09 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of 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: 100% Silicone to prevent contamination with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Glazing Channel and Stop Profiles: aluminum channels supplied by CR Laurence Co., In., Finishing and Fabrication.
 - 1. Glazing Channel Profile: Channel; aluminum; WU3BLSL: 1-inch high glazing channel; black powder coat finish.
 - 2. Glazing Stop Profile: Channel; aluminum; WU1DUSL: 1 1/2-inch high glazing channel; black powder coat finish.
- E. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- F. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- G. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

- H. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.10 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.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 – EXECUTION

3.01 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.

3.02 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 will leave visible marks in the completed work.

3.03 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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. 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.
- H. 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 according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. 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.
- L. 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 by gasket manufacturer.

3.04 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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.

3.05 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 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 by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.06 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.

3.07 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.08 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. 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; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project 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.

3.09 GLAZING SCHEDULE

- A. Provide the following glass types, as indicated in elevations on Drawings:
 - 1. GL-1: Insulating glass unit (IGL) consisting of the following:
 - a. Outer Lite: Minimum 1/4 inch thick clear, fully-tempered glass with low-e coating on No. 2 surface.
 - b. Airspace: Argon.
 - c. Inner Lite: Minimum 1/4 inch thick clear, fully tempered glass.
 - 2. GL-3: Monolithic tempered glass, minimum 1/4 inch thick fully tempered glass.

3.10 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for further information on the following keynotes:

1. KEYNOTE DESCRIPTION:

- a. 088000.GC GLAZING CHANNEL.
- b. 088000.GL GLASS TYPE.
- c. 088000.IG INSULATING GLASS.
- d. 088000.TG TEMPERED GLASS.

END OF SECTION

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Fixed, extruded-aluminum louvers.
 - 2. Extruded aluminum horizontal screen.
 - 3. Louver/damper.

1.02 PERFORMANCE REQUIREMENTS

- A. Design louvers, including comprehensive Construction managing analysis by a qualified Professional Construction manager, licensed in Washington State, using structural and seismic performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall 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.
 - 1. Wind Loads: Determine loads based on pressures as indicated in the Structural Drawings and Notes.
- C. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. See Structural General Notes for design earthquake spectral response acceleration, short period (Sds) for Project, and Component Importance Factor.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.03 SUBMITTALS

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

- C. Samples: For each type of metal finish required.
- D. Performance Requirements Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by a qualified Professional Construction manager, licensed in Washington State, responsible for their preparation.
- E. Product Test Reports: Based on tests performed according to AMCA 500-L.

1.04 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to product installation including, but not limited to, the following:
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 zinc coating, mill phosphatized.
- D. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 2. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 - 3. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - 4. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.02 FABRICATION, GENERAL

- A. 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.
- B. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, concealed from view, as standard with louver manufacturer unless

otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

- C. Provide sub-sills made of same material as louvers or extended sills for recessed louvers.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louver:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties, Inc., Model 7" Deep Storm Resistant Fixed Horizontal Louver Model RS-7705 or comparable product by one of the following:
 - a. Air Balance Inc.; a Mestek company.
 - b. Air Flow Company, Inc.
 - c. Airolite Company, LLC (The).
 - d. All-Lite Architectural Products.
 - e. American Warming and Ventilating, Inc.; a Mestek company.
 - f. Arrow United Industries; a division of Mestek, Inc.
 - g. Ruskin Company.
 - h. Greenheck Fan Corporation.
 - i. Industrial Louvers, Inc.
 - j. Reliable Products, Inc.
 - k. Ruskin Company; Tomkins PLC.
 - l. United Enertech Corp.
 - m. Or approved.
2. Louver Depth: See drawing for depths.
3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch or frames.
4. Louver Performance Ratings:
 - a. Free Area: Not less than 8.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
 - b. Air Performance: Intake Pressure drop at 900 fpm free area velocity 0.225 in. H₂O. Exhaust pressure drop at 900 fpm free area velocity 0.194 in. H₂O.

- c. Wind-Driven Rain Performance: AMCA certified and licensed to bear the AMCA seal. The louver test was based on a 39.370" x 39.370" core area. Unit tested at a rainfall rate of 3.0 inches per hour and with a wind directed to the face of the louver at a velocity 29.1-mph.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
- B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening:
 - 1. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009 inch wire.
 - 2. Bird Screening: Stainless steel, 1/2-inch-square mesh, 0.047-inch wire.

2.05 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70% 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.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate and place louvers and vents 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. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.
- E. Protect galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

3.02 INSTALLATION OF FLEXIBLE FLASHING AT EXTERIOR LOUVERS DUCTWORK

- A. At louver and ductwork joints cover all duct and louver sill and plenums bottoms with peel and stick asphaltic "Flexible Flashing" as specified in Division 06 Section "Sheathing."
- B. Apply "flexible flashing" to the internal surfaces of the duct. Flashing to span the entire internal width of duct and return up the sides of the duct 3 inches vertically from bottom.
- C. Extend flexible flashing on bottom and sides 2'-6" towards building interior from joint of duct and louver.
- D. Flashing to lap over louver/duct joint. Make flashing from single sheet. No seams allowed in any direction.

3.03 KEYNOTE SCHEDULE

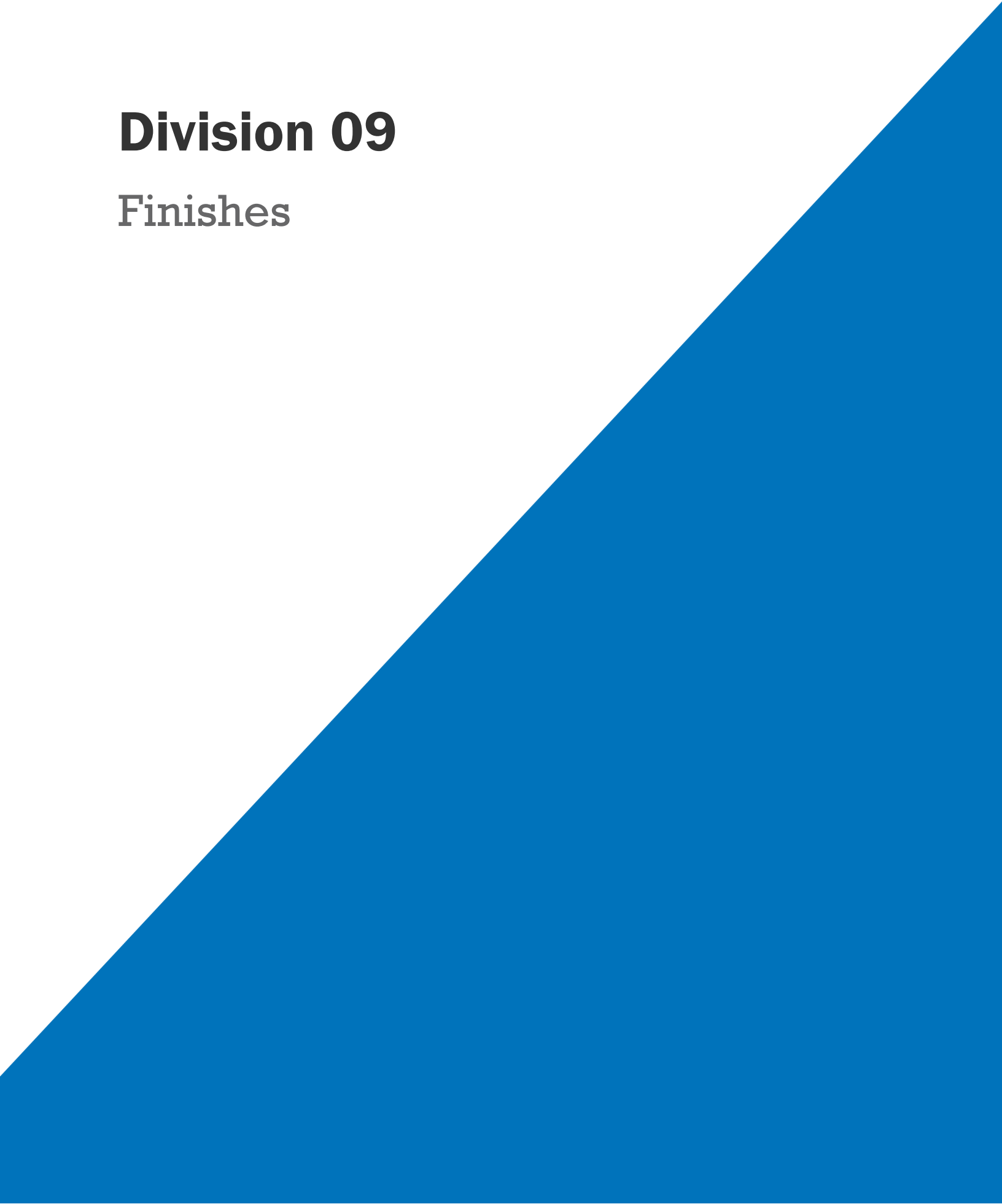
- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 089000.L LOUVER.

END OF SECTION

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Division 09

Finishes



SECTION 09 22 16
NONSTRUCTURAL METAL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing members for the following applications:
 - a. Interior framing systems for partition walls, framed soffits, and furring.
 - b. Interior suspension systems for ceilings, and suspended soffits.

1.02 SUBMITTALS

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

1.03 QUALITY ASSURANCE

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- B. Refer to Structural General Notes and Drawings for additional requirements.

PART 2 – PRODUCTS

2.01 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 10%.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated. Refer to Structural General Notes and drawings for additional requirements.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coatings: ASTM A 653/A 653M, G40 hot-dip galvanized, typical, except for framing in wet locations use G60.

2.02 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch-diameter wire.

- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.1046-inch diameter.
- C. Flat Hangers: Steel sheet, in size indicated on Drawings, minimum 1 by 3/16 inch by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 54 mils and minimum 1/2-inch-wide flanges.
 - 1. Depth: 1-1/2 inch.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 54 mils bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 - 2. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 18 mils (25 gauge).
 - b. Depth: As indicated on Drawings.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 18 mils (25 gauge).
 - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.
- F. Ceiling Mounted TV and LCD brackets require coordination and additional suspended structure for the ceiling mounting of this equipment in suspended GWB ceilings.

2.03 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 18 mils, 25 gauge.
 - 2. Depth: As indicated in Drawings.
 - 3. Interior Framing Limiting Heights: Assume 5 psf for interior partitions with GWB both sides for 16 inches oc is L/360.
 - a. 4 inch stud at 16 inches oc @ 18 mils, (25 gauge) thickness = 13'-4" max. Height.
 - b. 4 inch stud at 16 inches oc @ 33 mils (20 gauge) thickness = 15'-11" max. Height.
 - c. 6 inch stud at 16 inches oc @ 18 mils, (25 gauge) thickness = 17'-11" max. Height.

- d. 6 inch stud at 16 inches oc @ 33 mils (20 gauge) thickness = 21'-4" max. Height.
 - e. Stud walls and ceiling hung walls that are over max. Height specified above are required to comply with requirements in Division 05 Section "Cold-Formed Metal Framing."
4. Ceramic Tile stud walls: shall be provided with minimum 33 mils (20 gauge) thick studs.
5. Framing at Door and Window Openings:
- a. Any opening at 2'-8" width to 4'-0" width shall be framed with minimum 33 mils (20 gauge) thick studs; provide double 33 mils (20 gauge) thick jamb stud framing at heavy doors (300 lbs. max.) up to 4'-0" openings. Openings over 4'-0" wide and heavier than 300 lbs. provide stud design specifically to meet load criteria and Contractor is required to refer to Structural Drawings and General Notes.
 - b. Openings which are fire rated are required to be minimum of 33 mils (20 gauge) thickness thick studs.
 - c. Structural Drawings and General Notes: If any of the above criteria is exceeded, refer to the Structural Drawings for other design requirements.
6. Soffits for Mechanical Ducts: Qualified as 24 by 24 inch maximum for unbraced soffits; braced soffits exceeding the limitations of the Braced Soffit Design Maximum Dimensions shall reference Structural Drawings and General Notes and shall have the Contractor submit a design supported by calculations.
7. Thickness: 18 mils, (25-gauge) unless otherwise required by Structural Drawings. Refer to Structural Drawings for additional structural requirements at high walls and suspended ceiling transitions; wall mounted equipment; support of overhead walkways; support of catwalks; overhead mechanical equipment and other wall supported items.
- a. Depth: 2 inches where indicated.
 - b. Depth: 4 inches, unless otherwise indicated.
 - c. Depth: 6 inches where indicated.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
- 1. Deflection Track: Steel sheet top runner 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.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.

- 2) Superior Metal Trim; Superior Flex Track System (SFT).
 - 3) Or approved
- C. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
- 1. Products:
 - a. ClarkDietrich Building Systems; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com.
 - b. CEMCO; FAS Track 1000: www.cemcosteel.com.
- D. Firestop for Fluted Decking: A flat strap with two (2) strips for 1/2 inch to 1-1/4 inch intumescent installed continuous and parallel with the deck flutes. It provides firestopping within the flute void while eliminating mineral wool and providing continuous backing for wall framing.
- 1. Basis of Design Products:
 - a. CEMCO; FAS Strap.
 - 1) Hot-dipped galvanized steel.
 - 2) ASTM A 653.
 - 3) ASTM A1003 Grade 33 Type H for 33 ksi yield strength steel for 20 gauge with a minimum G60 coating complying with ASTM A 924.
 - 4) Grade 50 Type H 50 ksi yield strength for 50 ksi yield strength for 16 gauge with a minimum G60 coating complying with ASTM A 924.
 - 5) UL listing for one and two hour head of wall fire rated wall assemblies.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
- 1. Minimum Base-Metal Thickness: 33 mils (20 gauge) thickness.
- F. Cold-Rolled Channel Bridging: 54 mils bare-steel thickness, with minimum 1/2-inch wide flanges.
- 1. Depth: 1-1/2 inches or as indicated by Structural drawings and general Notes, whichever is more restrictive.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches 68 mils (14gauge) thick, galvanized steel.

- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 18 mils (25 gauge).
 - 2. Depth: 7/8 inch.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical.
 - 2. Minimum Base Metal Thickness: 18 mils (25 gauge).
- I. Cold-Rolled Furring Channels: 54 mils bare-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 33 mils (20 gauge).
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch minimum bare-metal thickness of 33 mils (20 gauge) thickness, and depth required to fit insulation thickness detailed.
- K. Metal Wall Backing: for fastener backing at wall locations to be clad with wainscot, decorative panels, veneer wall paneling, etc.
 - 1. Metal Backing Thickness: 33 mils (20 gauge) thickness by width required to provide fasten retention for wall paneling.

2.04 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 33 mils (20 gauge).
- B. Flange Width: 1-5/8 inches, minimum.

2.05 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 – EXECUTION

3.01 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.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
 - 1. Additional Blocking: Required at location(s) of equipment that is indicated on Contract Drawings as: Owner-furnished Owner-installed; Owner Furnished Contractor Installed; or (NIC) "Not in Contract." Contractor is responsible for coordination and installation of blocking/backing size, location, and installation of same for items listed below:
 - a. Toilet Accessories.
 - b. Television brackets.
 - c. Wall-mounted manual projection screens.
 - d. Modular Casework.
 - e. Music Instrument Storage.
 - f. Multi-Media Board- OFOI.
 - g. Menu bulletin boards.
 - h. Pamphlet rack.
 - i. Residential Equipment.
 - j. Wall anchoring blocking for seismic anchors at filing systems and tall metal shelves.

- 2. Thickness: 33 mils (20 gauge) minimum.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- E. Isolation: Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations as follows; where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements, and where non-bearing partition and wall framing abuts overhead structure. Provide slip or cushioned type joints as detailed to attain lateral support and avoid axial loading.

3.04 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- 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, countersplaying, or other equally effective means.
 - 2. 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.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. 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.
 - 4. 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.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

- 8. 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.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. 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.

3.05 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacing's indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 - 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 - 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
 - 1. Joist Spacing: 16 inches.
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
 - 1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.06 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
 - 1. Space studs as follows:
 - a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
 - b. Multilayer Application: 16 inches o.c., unless otherwise indicated.
 - c. Tile backing panels: 16 inches o.c., unless otherwise indicated.
- C. Install tracks (runners) 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 penetrating 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 runner 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. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 5. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

D. 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.

E. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-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.

F. 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.

3.07 INSTALLING PERFORATED GYPSUM WALLBOARD ASSEMBLIES

- A. Comply with shop drawing or field markup requirements for framing installation. Do not proceed with installation until approved by Architect.
- B. Comply with manufacturer's printed instructions for installation of framing members.

3.08 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	KEYNOTE	DESCRIPTION:
a.	092216.RFC	RESILIENT FURRING CHANNEL.
b.	092216.SS	STEEL STUDS.
c.	092216.T	TRACK.
d.	092216.WA	WALL ANGLE.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's current technical literature for each component.

B. Samples: For the following products:

1. Board: Submit sample of each panel product specified, 4 inches x 6 inches.
2. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.

C. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

D. Manufacturer Instructions: Provide manufacturer's written installation instructions.

1.03 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.

B. Pre-Installation Conference: Schedule meeting, no less than ten (10) days prior to installation of gypsum board; with Owner, Contractor, insulation firestopping /sealant / acoustical/ plaster / drywall installers, mechanical and electrical contractors, and Architect / Acoustical Consultant in attendance.

C. Agenda: Review details of acoustically rated assemblies, such as wall interfacing, expansion joint locations, sealant work, firestopping, sound insulation envelopes, and mechanical / electrical penetrations.

D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Simulate finished lighting conditions for review of mockups.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Test any products from non-USA countries to verify that products do not contain asbestos. Submit documentation.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic and other causes in accordance with GA-238 and manufacturer recommendations. Stack product flat to prevent sagging. In addition, follow guidelines found in GA-801.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements, GA-216 requirements, or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products intended to stay dry until installation areas are enclosed and conditioned. Products with exposure warranties can be installed per manufacturer recommendations.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are 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.

PART 2 – PRODUCTS

2.01 PANELS, GENERAL

- A. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20% by weight.
- B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.02 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C36/C36M-03e1 withdrawn 2005 replaced by ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. USG Corporation.
 - b. CertainTeed Gypsum, Inc.
 - c. G-P Gypsum.
 - d. National Gypsum Company.
 - e. PABCO® Gypsum, a division of PABCO® building products.
- 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. 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 according to ASTM D3274.

2.03 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Corner bead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.

2.04 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats. Light Weight joint compounds are not allowed.

1. Prefilling: At open joints, rounded or beveled panel edges, 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 setting-type, sandable topping or drying-type, all-purpose compound.

5. Moisture-Resistant Gypsum Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to wood and 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.

D. Sound Attenuation Blankets: ASTM C 665, 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. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10% by weight.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- 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.

3.02 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- 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, except floors. 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.
- I. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: At all locations unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces.
 - 3. Moisture- and Mold-Resistant Type: All inside surfaces of exterior walls- Typical.
 - 4. Moisture Resistant Type: Install at exposed wall areas of restrooms and kitchens.
- 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 vertically (parallel to framing) or 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. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.04 INSTALLING 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 according to ASTM C 840 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.
 - 3. L-Bead: Use where indicated.

3.05 FINISHING 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, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 4: At all panel surfaces that will be exposed to public view and at all concealed locations such as behind casework, chalkboards, whiteboards, tackboards and markerboards.
 - 2. Level 3: In accordance with referenced standard and as follows:
 - a. Partial Finishing: Omit third coat and sanding on drywall work in attics, interstitial spaces, and elsewhere as approved by Architect. The two-coat system applied to these areas is required to be smooth and uniform.

3.06 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. 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.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 092900.CB CORNERBEAD.
 - b. 092900.CJ CONTROL JOINT.
 - c. 092900.GBC GYPSUM BOARD TYPE C.
 - d. 092900.GWB GYPSUM WALL BOARD TYPE X.

END OF SECTION

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SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Acoustical Ceiling Tiles for panel ceiling systems.
 - 2. Metal Suspension Systems.
 - 3. Wire hangers, main runners and cross tees.
 - 4. Metal Edge Moldings.

1.02 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. LR: Light Reflectance coefficient.
- C. NRC: Noise Reduction Coefficient.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension system members and or .
 - 2. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other sections.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.

2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- E. Delegated-Design Submittal: For seismic restraints for ceiling systems.
1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional Construction manager responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For acoustical testing agency.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- C. Maintenance Data: For finishes to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.08 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.09 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0% of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0% of quantity installed.

PART 2 – PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

- A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25% by weight.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional Construction manager to design seismic restraints for ceiling systems.
- B. Design and installation is required to comply with ASTM E580 as modified by ASCE 13.5.6.2.2(a-c). Suspended ceilings installed per NWCB TB 401 are an approved method.
- C. Seismic Performance: Comply to current code requirements and local jurisdictional codes for this project location. Below are design requirements for ceiling system support and seismic restraint calculations and details. The design criteria are as follows:
 - 1. IBC Seismic Design Category: Meet the requirements of the IBC code providing a Heavy-Duty Grid (min. 16 lbs./ft.) with a minimum perimeter edge angle flange width of 2 inches and installed within the following standards:
 - a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.

- b. CISCAs Guidelines for Systems Requiring Seismic Restraint: Comply with CISCAs "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
 - c. ASCE 7, "Minimum Design Loads for Buildings and Other Structures":
- D. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.03 ACOUSTICAL PANELS AND TILES

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.04 ACOUSTICAL PANELS AND TILES FOR ACOUSTICAL CEILINGS (ACT)

- A. Mineral Fiber and Fiberglass Ceiling Tiles: Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation; Saint-Gobain North America.
 - 3. Rockfon (Rockwool International).
 - 4. USG Corporation.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

C. Acoustical Panel Types:

1. Type ACT1: Armstrong World Industries; ULTIMA High NRC, item #1943.
 - a. Classification (ASTM E1264): Type IV, Form 2, Pattern E.
 - b. Size: 24 inch by 48 inch by 3/4 inch.
 - c. Profile: Square Lay-in 15/16 inch.
 - d. Material: Wet-formed mineral fiber, fine textured panel. Contains a broad-spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew. Includes sag-resistance performance.
 - e. Recycled Content: Up to 89%.
 - f. VOC: Third party (GREENGUARD Gold) certified for low-emitting performance, meets California Department of Public Health's (CDPH) Standard Method v1.1 - 2010 (CA Section 01350).
 - g. Fire Performance: Class A (UL).
 - h. Sound Absorption (NRC): 80.
 - i. Sound Blocking (CAC): 35 minimum.
 - j. Articulation Class (AC): 170.
 - k. Color: Flat White.
 - l. Light Reflectance (LR): 88%.
 - m. Grid: Armstrong World Industries; PRELUDE XL 15/16" Exposed Tee.
2. Type ACT2: Armstrong World Industries; Cirrus Second Look III, #511.
 - a. Classification (ASTM E1264): Type III, Form 1, Pattern EIK.
 - b. Size: 24 inch by 48 inch by 3/4 inch.
 - c. Profile: 9/16 inch beveled tegular.
 - d. Substrate: Wet-formed mineral fiber with factory applied latex paint. Contains a broad-spectrum antimicrobial additive on the face and back of the panel that provides resistance against the growth of mold and mildew. Includes sag-resistance performance.
 - e. Recycled Content: Greater than 50%.

- f. VOC: Third party (GREENGUARD Gold) certified for low-emitting performance, meets California Department of Public Health's (CDPH) Standard Method v1.1 - 2010 (CA Section 01350).
 - g. Fire Performance: Class A (UL).
 - h. Sound Absorption (NRC): 0.65.
 - i. Sound Blocking (CAC): 35.
 - j. Color: Flat White.
 - k. Light Reflectance (LR): 85%.
 - l. Grid: Armstrong World Industries; Suprafine, 9/16 inch.
3. Type ACT3: Type IX, Form 2, Pattern G wet-formed mineral fiber with factory-applied latex paint; CAC 33; Class A; Light Reflectance 0.89; square edge, white; 24 by 48 by 5/8 inch thick; refer to Drawings for locations and configurations.
- a. Basis-of-Design Product: Kitchen Zone by Armstrong, or comparable product by one of the specified manufacturers.
 - b. Suspension System: Prelude 9/16 inch grid by Armstrong, or comparable product by one of the specified manufacturers.
4. Type ACT4: Similar to ACT2, set in a ceiling cloud formation with floating ceiling edge trim.
- a. Basis-of-Design Product: Armstrong World Industries; Armstrong World Industries; Cirrus Second Look III, #511 or comparable product by one of the specified manufacturers.
 - 1) Size: 24 inch by 48 inch by 3/4 inch.
 - 2) Profile: 9/16 inch beveled tegular.
 - b. Grid: Armstrong World Industries; Suprafine, 9/16 inch.
 - c. Suspension System: Armstrong; or comparable product by one of the specified manufacturers.
 - d. Metal Edge Molding (MEM): Axiom Classic, 6 inch straight, #AX6STRWH.
 - 1) Floating Ceiling Edge: Match Grid with trim at perimeter of grid system, with accessory T-bar connection clips in ceiling areas using Uptight Clips.
- D. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.05 EXPOSED TEE GRID SYSTEM

- A. Exposed Tee Grid System: Armstrong World Industries heavy-duty class grid systems indicated for ceiling types listed above or approved.
 - 1. Color: White, or as otherwise indicated in Finish Schedule on Drawings.

2.06 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard pure white (off-white not acceptable) factory-applied matte finish for type of system indicated. For other applications and unless otherwise noted.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.
- E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
- J. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.07 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING (MSS)

- A. Basis-of-Design Products: Subject to compliance with requirements, provide Armstrong World Industries; Prelude XL 15/16" Exposed Tee in white, or comparable products by one of the following:
 - 1. CertainTeed Corporation; Saint-Gobain North America.
 - 2. Rockfon (Rockwool International).
 - 3. USG Corporation.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel cold-rolled sheet.
 - 5. Cap Finish: Provide manufacturer's pure white (off-white not acceptable) matte finish for exposed type of system indicated, unless otherwise required.

2.08 METAL EDGE MOLDING (MEM)

- A. Extruded Aluminum Perimeter Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. Standard Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - a. Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils.

B. Penetration Escutcheon and Trim:

1. Provide penetration escutcheon(s) for penetration(s) of acoustical panel ceiling panels. Use penetrating material/assembly manufacturer's standard escutcheon if escutcheon covers penetration hole at perimeter of penetration. Where escutcheon is not provided by penetrating material/assembly manufacturer provide material matching perimeter trim for the exposed dimension and in same color/finish as trim. Where penetration occurs in field of panel provide components allowing for non-visible support of escutcheon that allows removal and reinstallation as required. Provide escutcheons sized for penetrations in compliance with seismic regulations, if not otherwise indicated in Contract Documents.
2. Provide perimeter trim of acoustical panel ceiling panels where penetrated in panel field or at edges. Use ceiling panels manufacturer's specified trim in color and finish, matching in exposed dimension except those requiring oversized dimension(s). Where penetration occurs in field of panel provide components for non-visible support of trim that allows removal and reinstallation as required. Provide perimeter trim in compliance with seismic regulations, if not otherwise indicated in Contract Documents.

2.09 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

- a. Pecora Corporation, AC-20 FTR Acoustical and Insulation Sealant.
- b. USG Corporation, SHEETROCK Acoustical Sealant.
- c. Or Approved

2. Acoustical Sealant for Concealed Joints:

- a. Pecora Corporation; BA-98.
- b. Tremco, Inc.; Tremco Acoustical Sealant.
- c. USG Corporation.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

- 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Splay hangers only where required and to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of four tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

7. Do not support ceilings directly from roof deck.
 8. When wood framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 6 inches from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to roof deck.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install penetration escutcheons and trim where acoustical ceiling panels are penetrated. No exposed unfinished edges allowed.
- F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.

5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.04 FIELD QUALITY CONTROL

- A. Special Inspections: Owner may engage a qualified special inspector to perform the following special inspections and prepare reports:
 1. Suspended ceiling system.
 2. Hangers, anchors and fasteners.

3.05 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.06 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 1. KEYNOTE DESCRIPTION:
 - a. 095113.ACT ACOUSTICAL CEILING TILE.
 - b. 095113.AP ACOUSTICAL PANEL.
 - c. 095113.AS ACOUSTICAL SEALANT.
 - d. 095113.FCE FLOATING CEILING EDGE TRIM.
 - e. 095113.MEM METAL EDGE MOLDING.
 - f. 095113.MSS METAL SUSPENSION SYSTEM.
 - g. 095113.PT PERIMETER TRIM.
 - h. 095113.WH WIRE HANGER.

END OF SECTION

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Resilient base.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.03 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Mockups: Provide resilient products with mockups specified in other sections.

1.04 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°F or more than 90°F.

1.05 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70°F or more than 95°F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55°F or more than 95°F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 – PRODUCTS

2.01 RESILIENT BASE

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements, provide Roppe Corporation; Pinnacle Rubber Wall Base or comparable products by one of the following:
 - a. Flexco, Inc.
 - b. Johnsonite; a Tarkett company.
 - c. Mannington Commercial; Burke.
 - d. Nora by Interface.
 - e. or approved equal
- B. Materials:
 - 1. Resilient Base Standard: ASTM F 1861.
 - a. Material Requirement: Type TS (rubber, vulcanized thermoset).
 - b. Manufacturing Method: Group I (solid, homogeneous).
 - 2. Minimum Thickness: 0.125 inch.
 - 3. Height: 6 inches, unless otherwise indicated.
 - 4. Lengths: Coils in manufacturer's standard length.
 - 5. Outside Corners: Preformed.
 - 6. Inside Corners: Preformed.
 - 7. Finish: Matte.
 - 8. Color: Black

2.02 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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 and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 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 practicable 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.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop 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.

3.05 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION.
 - a. 096513.RB RESILIENT BASE.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface preparation and the application of paint systems on the following exterior substrates:
 - a. Steel.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. 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. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. VOC content.

1.03 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. Paint: 2%, but not less than 1 gal. of each material and color applied.

1.04 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 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°F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.06 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95°F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85%; at temperatures less than 5°F above the dew point; or to damp or wet surfaces.

1.07 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.08 WARRANTY

- A. Warranty Period: two years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 1. Behr Paint Company.
 - 2. Benjamin Moore & Co.
 - 3. Miller Paint Co.
 - 4. PPG Paints.
 - 5. Sherwin-Williams Company (The).
 - 6. Tnemec.

2.02 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Colors: As indicated in Finish Schedule on Drawings, or, if not indicated, as selected by Architect.

2.03 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.

3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 – EXECUTION

3.01 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.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions 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.
- 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.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
 1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.03 APPLICATION

- 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 items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. Unless otherwise approved by the Architect, apply a minimum of four coats of paint where deep or bright colors are used to achieve satisfactory results.
- D. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- E. Sand and dust between each coat to provide an anchor for next coat, and to remove defects visible from a distance up to 39 inches.
- F. Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- G. 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.

3.04 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 shall 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 shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
- B. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are found by the Architect:
1. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
 4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- D. Painted surfaces rejected by the inspector or Architect shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- 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.

3.06 EXTERIOR PAINTING SCHEDULE

- A. Exposed Steel Substrates: (High Traffic: doors and frames):

- 1. Alkyd System: MPI EXT 5.1T.
 - a. Prime Coat: Primer, H.B. Self-priming Epoxy, MPI #120.
 - b. Intermediate Coat: Polyurethane, MPI #72.
 - c. Topcoat: Polyurethane, MPI #72.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 099113.PT PAINT SYSTEM.

END OF SECTION

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SECTION 09 91 23
INTERIOR PAINTING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface preparation and the application of paint systems on the following interior substrates:
 - a. Hollow metal doors and frames.
 - b. Gypsum board.

1.02 DEFINITIONS

A. Gloss Levels:

1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
5. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
6. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
7. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 1. Submit Samples on rigid backing, 8 inches square.

2. Label each coat of each Sample.
3. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.04 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.
 5. Environmental handling requirements.

6. Surface preparation requirements.
 7. Application instructions.
- B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45°F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.06 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95°F.
- B. Do not apply paints when relative humidity exceeds 85%; at temperatures less than 5°F above the dew point; or to damp or wet surfaces.

1.07 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. Paint: Coordinate with the Kitsap County regarding quantity of each material and color applied.

1.08 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide specified products, or comparable products by one of the following:
1. Behr Paint Company.
 2. Benjamin Moore.
 3. Kelly-Moore Paints.
 4. PPG Paints.

5. Rodda Paint Co.
 6. Sherwin-Williams Company (The).
- B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with the following:
1. Products are approved by manufacturer in writing for application specified.
 2. Products meet performance, specified properties and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus 2%.
- C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL

- A. Material Compatibility:
1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Colors: Refer to Section 3.06 - Interior Painting Schedule.

PART 3 – EXECUTION

3.01 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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

a. Gypsum Board: 12%.

2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions, applicable to substrates 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.

2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

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.

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 abraded areas of shop paint, and 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. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.03 APPLICATION

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.
 6. Apply paints and primers to achieve the recommended wet and dry film thickness published on the manufacture's Product Data Sheets.
- 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.

3.04 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 shall 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 shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.
- B. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are found by the Architect:
1. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.

2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
 4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, and similar contaminants).
- C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- D. Painted surfaces rejected by the inspector or Architect shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.05 CLEANING AND PROTECTION

- A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. 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.
- C. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

- A. General: Refer to Finish Schedule on Drawings for sheen and color of each product listed below. If not in Finish Schedule; as selected by Architect.
- B. Metal Substrates (Aluminum, Steel, Galvanized Steel):
 - 1. Heavy Duty, High Contact Areas - Waterbased/Single Component Urethane Modified Latex System: Including, hollow metal doors and frames.
 - a. Prime Coat:
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry. Color: Off White.
 - b. Intermediate Coat: Water-based Single Component Urethane, matching topcoat.
 - c. Topcoat: Water-based Single Component Urethane:
 - 1) S-W Pro Industrial Pre-Catalyzed Waterbased Urethane, Gloss, B65-0112 Series, at 4.0 to 5.0 mils wet, 1.4 to 1.7 mils dry, per coat. Color: Extra White.
- C. Wood Substrates: Heavy Duty, High Contact Areas - Waterbased/Single Component Urethane System: Including MDF wainscot and trim.
 - 1. Shop Prime Coat: Pre-prime in shop with one of the following oil, solvent based, primer/sealers:
 - a. S-W Extreme Block Interior/Exterior Stain Blocking Alkyd Primer, B49W00600.
 - b. S-W ProBlock Interior Oil-Based Primer, B79W08810.
 - 2. Intermediate Coat: Water-based Single Component Urethane, matching topcoat.
 - 3. Topcoat: Water-based Single Component Urethane, semi-gloss:
 - a. S-W Pro Industrial Waterbased Alkyd Urethane, Semi-Gloss, B53-0115 Series, at 4.0 to 5.0 mils wet, 1.4 to 1.7 mils dry, per coat.
- D. Gypsum Board Substrates:
 - 1. Latex System:
 - a. Prime Coat: Primer, latex, all interior spaces:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry. Color: White
 - b. Intermediate Coat: Latex, interior, matching topcoat.

- c. Topcoat: Best Commercial Grade Latex, interior, flat:
 - 1) S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat. Color: Extra White.
- d. Topcoat: Best Commercial Grade Latex, interior, eggshell:
 - 1) S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat. Color: Extra White.
- e. Topcoat: Best Commercial Grade Latex, interior, semi-gloss:
 - 1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat. Color: Extra White.
- 2. Water-Based Light Industrial Coating System, Epoxy, all wet locations.
 - a. Prime Coat: Primer sealer, latex, interior:
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry. Color: White.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial Epoxy Modified Acrylic coating, interior water-based, sheen:
 - 1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46W0115 Series, Semi-Gloss, at 4.0 mils wet, 1.5 mils dry, per coat. Color: Extra White.

3.07 3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 099123.EPT EPOXY PAINT.
 - b. 099123.PT PAINT SYSTEM.
 - c. 099123.UPT URETHANE PAINT SYSTEM

END OF SECTION

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SECTION 09 96 00
HIGH-PERFORMANCE COATINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Coating systems applied to exposed structural steel.

1.02 DEFINITIONS

A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.03 SUBMITTALS

A. Comply with Division 01 Section "Submittal Procedures" for submittal procedures.

B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

C. Color Samples: Submit manufacturer's color samples showing full range of standard colors.

D. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

E. Applicator's Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:

1. Project name and location.
2. Name of owner.
3. Name of contractor.
4. Name of architect.
5. Name of coating manufacturer.
6. Approximate area of coatings applied.
7. Date of completion.

F. Warranty: Submit manufacturer's standard warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Specialize in manufacture of coatings with a minimum of 5 years successful experience.
2. Able to demonstrate successful performance on comparable projects.
3. Single Source Responsibility: Coatings and coating application accessories shall be products of a single manufacturer.

B. Applicator's Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.
2. Applicator's Personnel: Employ persons trained for application of specified coatings.

C. Preapplication Meeting: Convene a preapplication meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer's representative. Review the following:

1. Environmental requirements.
2. Protection of surfaces not scheduled to be coated.
3. Surface preparation.
4. Application.
5. Repair.
6. Field quality control.
7. Cleaning.
8. Protection of coating systems.
9. Coordination with other work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.

4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Tnemec Inc., www.tnemec.com, local contact: TNW Inc., Rick Gilbreath, 206-777-5643, or a comparable semi-gloss Zinc-rich/Urethane coating system by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints.
 - 3. Sherwin-Williams Company (The).
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall 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 shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- C. Colors: As indicated in finish schedule on Drawings.

2.02 MEDIUM EXPOSURE COATING SYSTEM

- A. Interior Steel Coating System:
 - 1. System Type: Organic zinc-rich/Epoxy/Urethane.
 - 2. Surface Preparation: SSPC-SP 6.
 - 3. Shop Primer: Series 94-H20 @ 2.5-3.5 mils DFT.
 - 4. Field Intermediate: Series 27FC @ 4-6 mils.
 - 5. Field Finish Coat: Series 1072V Fluoronar @ 2-3 mils DFT.
 - 6. Total DFT: 8-12.5 mils DFT.
- B. Sheen: Semigloss.
- C. Color: As selected by Architect from Manufacturer's full range or as indicated on Drawings in the Finish Schedule.

2.03 HIGH EXPOSURE COATING SYSTEM

A. Exterior Steel Coating System:

1. System Type: Organic zinc-rich/Epoxy/Fluorourethane.
2. Surface Preparation: SSPC-SP 6/NACE 3.
3. Shop or Field Primer: Series 90-97 Theme-Zinc. DFT 2.5 to 3.5 mils.
4. Field Intermediate Coat: Series 73 Endura-Shield DFT 2.0 to 3.0 mils.
5. Field Finish Coat: Series 1071V Fluoronar DFT 2.0 to 3.0 mils.
6. Total DFT: 6.5 to 9.5 mils.

B. Sheen: Semigloss.

C. Color: As selected by Architect from Manufacturer's full range or as indicated on Drawings in the Finish Schedule.

2.04 PERFORMANCE CRITERIA

A. System Type: Organic Zinc-rich/Urethane.

1. QUV – ASTM D 4587 (8 hours UV, 4 hours Condensation):
 - a. No blistering, cracking or chalking. No more than 15.2 units gloss change and 1.40 DED Hunter Lab Scale color change after 4000 hours exposure.
 - b. Adhesion - ASTM D 4541 (Method E, Type V).
 - c. No less than 1,645 psi (14.06 MPa).
 - d. Salt Spray (Fog) - ASTM B 117.
 - 1) No blistering, cracking, rusting or delamination of film or creepage at scribe after 5,376 hours exposure.
2. QUV - ASTM D 4141, Method C (EMMAQUA):
 - a. No blistering, cracking or chalking. No less than 79% gloss retention, no more than 9 units gloss loss and no more than 0.45 DEHunter color change (white) after 3,500 MJ/m² (128,951 MJ/m² total) EMMAQUA exposure.
3. QUV - ASTM D 6695 XENON Arc weathering:
 - a. No blistering, cracking or chalking. No less than 90% gloss retention (2.4 units gloss change) and no greater than 0.20 DE00 color change (beige) after 8,000 hours Xenon Arc exposure. (TR5972).

B. Flexibility & Elongation - ASTM D 522 (Method A, Conical Mandrel):

1. No less than 12.80% elongation, average of three tests.

C. Cleanability - MIL-PRF-85285D Section 4.6.13:

1. No less than 99% cleaning efficiency, average of two tests.

2.05 ACCESSORIES

A. Coating Application Accessories:

1. Accessories required for application of specified coatings in accordance with manufacturer's instructions, including thinners.
2. Products of coating manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which coating systems are to be applied. Notify Architect of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 SURFACE PREPARATION OF STEEL

- A. Prepare steel surfaces in accordance with manufacturer's instructions.
- B. Fabrication Defects:
1. Correct steel and fabrication defects revealed by surface preparation.
 2. Remove weld spatter and slag.
 3. Round sharp edges and corners of welds to a smooth contour.
 4. Smooth weld undercuts and recesses.
 5. Grind down porous welds to pinhole-free metal.
 6. Remove weld flux from surface.

- C. Ensure surfaces are dry.
- D. Exterior Steel Surfaces: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3.
- E. Totally Spray-Applied Shop Coating Systems for Steel: Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3.
- F. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
- G. Shop Primer: Prepare shop or field primer to receive field coat in accordance with manufacturer's instructions.

3.04 APPLICATION

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- C. Keep containers closed when not in use to avoid contamination.
- D. Do not use mixed coatings beyond pot life limits.
- E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- F. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.05 REPAIR

- A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.06 FIELD QUALITY CONTROL

A. Inspector's Services:

1. Verify coatings and other materials are as specified.
2. Verify surface preparation and application are as specified.
3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
 - a. Check for holidays on interior steel immersion surfaces using holiday detector.
 - b. Report:
 - 1) Submit written reports describing inspections made and actions taken to correct nonconforming work.
 - 2) Report nonconforming work not corrected.
 - 3) Submit copies of report to Architect and Contractor.

B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.07 CLEANING

- #### **A. Remove temporary coverings and protection of surrounding areas and surfaces.**

3.08 PROTECTION OF COATING SYSTEMS

- #### **A. Protect surfaces of coating systems from damage during construction.**

3.09 KEYNOTE SCHEDULE

- #### **A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:**

1.	KEYNOTE	DESCRIPTION:
a.	099600.PT	HIGH-PERFORMANCE PAINT COATING.

END OF SECTION

Division 10

Specialties

SECTION 10 14 00
SIGNAGE

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
1. Panel signs.
 2. Room Identification signs.
 3. Field-applied, vinyl-character signs.
 4. Maximum Occupancy Plaques.
 5. ADA Restroom Plaques.
 6. Cutout Dimensional Characters.

1.02 1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; International Code Council; 2009 (ANSI).
- D. American Society for Testing and Materials (ASTM) International:
1. ASTM A36 - Specification for Carbon Structural Steel.
 2. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
 3. ASTM A500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 4. ASTM A501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 5. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 6. ASTM B221- Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 7. ASTM B241 - Specifications for Aluminum and Aluminum-Alloy Tube, Extruded, Seamless.

- E. Underwriter's Laboratories (UL): Standard for Electric Signs (UL 48).
- F. US Department of Transportation (US DOT): FHWA Color Tolerance Chart.

1.03 REGULATORY REQUIREMENTS

- A. Accessibility Requirements:
 - 1. State of Washington, WAC 51-50-1101.
 - 2. US DOT requirements.

1.04 ACTION SUBMITTALS

- A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- B. Shop Layouts: Provide full-size accurate computer pen-plotted shop layouts, by Gerber, or approved. Show accurate letter and line spacing, for each sign required, including layouts of text, rules, bands, Braille, arrows and symbols, and borders, on full size paper backgrounds. For repetitive text or messages with minor variations, in arrow direction or text differences provide typical layout. For unique messages with differences in line length and/or justification, provide specific layouts.
 - 1. Field Mock-up: Prior to fabrication, provide paper mock-up with graphic visible from a distance. Install with blue tape, in place, for approval by Architect of size, spacing and location.
- C. Shop Drawings: Submit Shop Drawings for fabrication and installation of specialty signs. Include elevations, and large-scale details of sign wording and lettering layout. Show anchorage and accessory items. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, reinforcement, accessories, layout, and installation. Furnish location template drawings for items supported or anchored to permanent construction. Submit full typographic alphabet and numerals, in typeface and weight as specified. Submit full-size spacing templates for individually mounted dimensional letters, arrows, symbols and numbers. See notes on drawings for requirements. Where multiple quantities are shown on the Message List, coordinate with Owner to determine final locations and messages. Drawings may show generic messages and mounting conditions. Contractor shall verify all specific locations, clearances and messages prior to fabrication. Provide updated As-Built Message List and Sign Location Plans for Owner's use.
 - 1. Signage shop drawings: provide 1/16": 1'-0" scale plan showing the plan layout of all signage types provided by the approved signage scheduled locations and door locations.
- D. Shop Drawings: For panel 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 others, and accessories.
 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
 4. Show locations of electrical service connections.
 5. Include diagrams for power, signal, and control wiring.
- E. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 3. Submit for approval by Owner through Architect prior to fabrication.
- F. 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. Panel Signs: Not less than 12 inches square, including corner.
 2. Room-Identification Signs: Full-size Sample.
 3. Field-Applied, Vinyl-Character Signs: Full-size Sample of characters on glass.
 4. 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.
 5. Dimensional Characters: Full-size Sample of dimensional character.
 6. Exposed Accessories: Full-size Sample of each accessory type.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.
- C. Permits: Installer shall provide permits and certifications, as required, for approval of Code agencies. Coordinate with General Contractor.

- D. Art: Submit artwork for special symbols, arrows, logos, and graphics. Coordinate with Architect to obtain electronic art, logos and text from Owner, where required. Design files may be made available by the Architect in EPS format, as guides for developing layouts, but are not to be considered production electronic files.
- E. Text Verifications: Provide a list of all text to be included on signage for approval by Architect and the Owner, prior to fabrication. Text shown on Drawings is provided for the purpose of bidding only. Final wording on signage is subject to confirmation and possible revision by the Owner, after the start of the Contract, prior to fabrication.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Ten (10) years documented experience: in the fabrication, installation and data management of signage and environmental graphic design elements, and the use of computerized Gerber (or approved) sign making equipment. Contractor shall have successful experience in the layout, fabrication and installation of the specified sign types.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of 5 years' experience.
- C. ADA Reference Standards: September, 1992, Washington State "Illustrated Handbook for Barrier Free Design"; and the Americans with Disabilities Act (ADA) Accessibility Guidelines for Building and Facilities - Federal Register/Vol. 56, No. 144/Friday, July 26, 1991/Rules and Regulations 354157, Section 4, Chapter 4.30 "Signage." Maintain a copy at job site during installation.
- D. Revisions: Contractor shall allow for revisions to the text and layouts, and requests by Owner or Architect, for specific layouts showing unique messages, including text revisions, leading and kerning revisions, during the submittal review, without additional cost. Revisions initiated by the Contractor shall be clearly marked.
 - 1. Provide layouts for specific signs "where text of signs to be determined" are required. Provide fabrication-ready artwork, for approval, of all symbols, arrows and logos. The symbols and logos shown are for reference and layout purposes only and shall not be used for reproduction. Provide camera-ready art for approval by Architect.
- E. Pre-Installation Conference: Prior to Installation, Contractor shall meet with General Contractor, Owner's Representative, and Architect to review approved submittals installation procedures and requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- C. Maintain this minimum temperature during and after installation of signs.

1.09 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. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Sign Manufacturers/Fabricators: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Manufacturers of Panel Signs:
 - a. Mohawk Sign Systems.
 - b. Doty + Associates.
 - c. Inpro Corporation.
 - d. The Southwell Company (1-800/950-8068).
 - e. Trade-Marx Sign & Display.
 - 2. Manufacturers of Dimensional Letters:
 - a. Andco Industries Corp.
 - b. A.R.K. Ramos Manufacturing Company, Inc.

- c. ASI Sign Systems, Inc.
- d. Gemini, Inc.
- e. Inpro Corporation.
- f. Matthews International Corp.
- g. Metal Arts.
- h. Metallic Arts, Inc.
- i. The Southwell Company (1-800/950-8068).

2.02 SIGNAGE APPLICATIONS

- A. Coordinate with the Owner and the Architect for sign types, layout and message for each sign and locations.
- B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.03 MATERIALS

- A. Adhesive Vinyl: All text and symbols at sign type shall be 3M "Scotchlite" Plus sheeting, series 680. Use application tape (SCPM) as specified in manufacturer's bulletin 4.3, and 3M pre-spacing tape (SCPS-2) as specified in manufacturer's bulletin 4.3. All text and symbols are color #680-10-White, unless noted otherwise. Conform to 3M installation recommendations: (800) 328-3908. Adhesive shall not be visible on vinyl applied to second surface of clear acrylic.
- B. Acrylic Sheet Plastic: Use Plexiglas II as manufactured by Rohm and Haas Co., or equal. Thickness shall be as indicated on drawings or not less than 1/8" thick. Sign Fabricator shall provide color and finish samples of all plastics for approval before fabrication; no substitution in color, thickness, or finish of plastics will be accepted without written approval. All plastics shall be of uniform color, translucence and illumination, as supplied by manufacturer. Any exposed edges of acrylic shall be finished so as no saw marks are visible.
- C. Printing: Use digital or screen process to print copy. After printing coat the copy with opaque background color to prevent adhesives and tape from showing through. Use exterior grade paint by Ink Dezyne or approved for copy and background colors, as recommended by acrylic manufacturers for optimum adherence and nonfading for exterior and interior wet conditions. Apply copy to the second surface of clear acrylic sheet forming the panel face to produce precisely formed opaque images, free from rough edges. Provide photographically produced graphics with clean, sharp lines; no hand cut screens or friskets shall be accepted.

- D. Tactile/Braille: Tactile copy shall comply with ADA Accessibility Guidelines. Raised copy thickness not less than 1/32 inch (0.8mm). Grade 2 Braille shall accompany tactile copy. Produce precisely formed characters with square cut edges free from burrs and cut marks. Fabricator is responsible for proper and accurate Grade 2 Braille translation.
- E. Vinyl Die-Cut and Pattern Cut-out Graphics: Use 3M Scotchcal Opaque, Translucent or Scotchlite Reflective Sheeting where specified. Use pressure-sensitive, non-yellowing, non-peeling and weather resistant vinyls as specified. Use approved fonts and equipment as specified.

2.04 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, 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. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head, spanner-head, or one-way-head slots unless otherwise indicated.
 - 4. 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. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
 - 5. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- D. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

2.05 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. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 5. Internally brace signs for stability and for securing fasteners.
 - 6. Provide rebates, lugs, and brackets 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.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.
- D. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
 - 1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner. Furnish two blank inserts for each sign for Owner's use.
- E. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
 - 1. Stainless-Steel Brackets: Factory finish brackets to match sign background with No. 4 finish unless otherwise indicated.

2.06 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.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.07 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class II, 0.010 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.08 2.08 METALLIC-COATED STEEL FINISHES

- A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.
- B. Factory Prime Finish: After cleaning and pretreating, apply an air-dried primer compatible with the organic coating to be applied over it.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

2.09 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, and prepare for coating according to coating manufacturer's written instructions.
 - 1. For Baked-Enamel or Powder-Coat Finish: After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
- B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.

- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

2.10 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 2. Directional Satin Finish: No. 4.

2.11 SIGN TYPES

- A. Refer to Drawings for sign types, layout and message for each sign and locations.
- B. Flat Signs: Signage media without frame.
 - 1. Edges: Square.
 - 2. Corners: Square.
 - 3. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non-glare on front.
 - 4. Wall Mounting of One-Sided Signs: Tape adhesive.
- C. Letter and Pictogram: As indicated on Drawings.
- D. Encapsulated Braille signs.
- E. International Symbol of Accessibility Signs: Contrasting colors as indicated on Drawings, conforming to Washington State Accessibility requirements.
- F. Pictograms:
 - 1. Accompany with equivalent verbal description placed directly below pictogram.
 - a. Pictogram:
 - 1) Height of Pictogram: 5 inches high or as indicated on Drawings.
 - b. International Symbol of Accessibility: Face to the right.
- G. Tactile Signage Media:
 - 1. Encapsulated Signs - Total Thickness: 1/4 inch.

H. Non-Tactile Signage Media:

1. Permanent Non-Tactile Text, Graphics, and Illustrations (Directional and informational signs not required to be tactile such as maximum occupant load signs):
 - a. Reverse Engraved Signage Panels: Reverse engrave through colored engraving plastic back ply and back paint text color so that image appears through clear face ply.

2.12 PANEL SIGNS

- A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 1. Solid-Sheet Sign (SS) of Port of Kalama logo mounted on building: Aluminum sheet/plate cut out in shape indicated on Drawings from JPG file to be provided by Architect.
 2. Thickness: 3/8-inch.
 3. Surface-Applied, Flat Graphics: baked enamel or powder coat.
 - a. Colors: SW 7566 Westhighland White and SW 6818 Valiant Violet.
 - b. Etched and Filled Graphics: Sign face etched or routed to receive enamel-paint infill.
 4. Mounting Type: Flush stud mount; size, quantity, and arrangement per sign manufacturer.

2.13 PLASTIC SIGNS

A. Materials:

1. Encapsulated Braille signs in sizes indicated.
 - a. 1/4 inch thick, satin (non-glare) finish.
 - b. Backer: 1/4" thick.

B. Fabrication:

1. Tactile Text and Pictograms:
 - a. Provide light-sensitive, water-wash Encapsulated face layer bonded to modified acrylic back-up panel to produce a composite sheet with overall thickness of 1/4 inch.
 - 1) Edges: Smooth, slightly beveled, free of burrs and flaws.
 - 2) Corners: Square.
 - 3) Text: Aligned and evenly spaced.

- b. Tactile Braille:
 - 1) 1/32 inch raised Grade 2 Braille.
 - 2) Match Braille message to tactile sign text.
- 2. Margins and Justification: Left justified, evenly spaced, and as indicated on Drawings.
- C. Fabrication:
 - 1. Make provisions for mounting pedestal base to base plate at cast in anchor, as necessary for secure permanent attachment. Predrill holes for anchor bolt connection at foundation pedestal.

2.14 DIMENSIONAL CHARACTERS

- A. Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles.
 - 1. Approved Manufacturers:
 - a. InPro Corporation.
 - b. Metal Arts; Division of L & H Mfg. Co.
 - c. Metallic Arts.
 - d. ASI Sign Systems, Inc.
 - 2. Character Material: Flat cut metal.
 - 3. Character Height: See drawings for character height.
 - 4. Thickness: As indicated on Drawings.
 - 5. Finishes:
 - a. Integral Aluminum Finish, AAMA 611, Class I, 0.018 mm or thicker, or painted. See signage drawings.
 - 6. Mounting: Stud mount with 1-inch stand-off spacer sleeve.
 - 7. Typeface: As indicated on drawings or as noted in Finish Schedule.
- B. Materials:
 - 1. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Accessories:

1. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - a. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 - b. Sign Mounting Fasteners:
 - 1) Concealed Studs: Concealed (blind), threaded studs, screwed into back of sign assembly.
2. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Fabrication:

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.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Verify that electrical service is correctly sized and located to accommodate signs.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as required by the Owner, as indicated on the drawings, and according to accessibility standard.
- C. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - 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. Projecting 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 spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
 - 3. 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.
 - 4. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.

5. 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.
 6. 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.
- D. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.
 - E. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.03 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.

3.04 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 1. KEYNOTE DESCRIPTION.
 - a. 101400.AL ALUMINUM LETTERS.
 - b. 101400.IPS INTERIOR PANEL SIGNS.
 - c. 101400.OLS OCCUPANT LOAD SIGNS.
 - d. 101400.RS ROOM SIGN.
 - e. 101400.SS SOLID-SHEET SIGN.

END OF SECTION

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SECTION 10 14 10
SITE SIGNAGE

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies informational and regulatory signs.

1.02 QUALITY ASSURANCE

- A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
MUTCD	Manual of Uniform Traffic Control Devices (current edition)

1.03 DESIGN REQUIREMENTS

- A. General:
1. All signs shall have rounded corners and mounting holes in accordance with the project Plans.
- B. Sign size and type shall be in accordance with the project Plans.

1.04 SUBMITTALS

- A. Procedures: Section 01 33 00, "Submittal Procedures."
- B. Samples of sign materials, mounting hardware, and shop drawings of all signs.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Brady.
- B. Seton.
- C. Approved equal.

2.02 FABRICATION

- A. Fade-proof graphic permanently embedded 1/8-inch-thick fiberglass reinforced plastic; guaranteed not to chip, fade or peel for 15 years.

PART 3 – EXECUTION

3.01 GENERAL

A. Mount signs as follows:

1. Sign mounting shall be in accordance with the project Plans.

3.02 EXECUTION

- A. Do not begin production until all shop drawings have been approved.
- B. Fasten surface-mounted signs to wall with expansion bolts or suitable anchors.
- C. Conceal all fasteners as much as possible.
- D. Use backup materials as required to achieve concealed mounting.

END OF SECTION

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Surface-mounted stainless steel corner guards.
 - 2. Plastic Wall Guards (Chair Rails).

1.02 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, and fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each corner protection unit.
- B. Shop Drawings: For each corner protection unit showing locations and extent. Include sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of corner protection unit indicated.
- D. Maintenance Data: For each corner protection unit to include in maintenance manuals.
- E. Warranty: Sample of special warranty.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain corner protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of corner protection units and are based on the specific system indicated.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store corner protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Store corner protection components for a minimum of 72 hours at room temperature of 70°F.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of corners, columns, and other construction contiguous with impact-resistant corner-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.06 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace door and wall protection components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M.
- B. High Density Polyethylene: Lengths of high density polyethylene shall be extruded from chemical and stain resistant post consumer and post industrial recycled material.
 - 1. Fire Performance Characteristics: NFPA Class B fire rating.
 - 2. Surface burning characteristics (ASTM E-84):
 - a. Flame spread: 55.
 - b. Smoke development: 450 or less.
 - 3. Compression (ASTM D6108): 92,249 psi.
 - 4. Flexure (ASTM D6109): 98,956 psi.
 - 5. Fastener Shear (ASTM D6177): 2,464 pounds.
 - 6. Density (ASTM D6111): 0.68559 grams/cubic centimeter.
- C. Aluminum Extrusions: ASTM B 221 (ASTM B 221M) for 6063-T5.
- D. Corner Guard Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

- E. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
 - 1. Wall Guard Fasteners: 3/16" diameter, bevel-headed fastener that is an appropriate length for the wall guard and the substrate.
- F. Adhesives: As recommended by protection product manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.02 MANUFACTURED UNITS

A. General:

- 1. Source Limitations: Obtain corner guards from single source from single manufacturer.

B. Corner Guards:

- 1. Approved Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Inpro Corporation (IPC).
 - b. Construction Specialties, Inc.
 - c. Babcock-Davis.
 - d. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - e. Korogard Wall Protection Systems; a division of koroseal Interior Products, LLC.
 - f. Nystrom, Inc.
 - g. Pawling Corporation.
- 2. Stainless Steel Corner Guards (SCG): Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - a. Basis of Design Manufacturer:
 - 1) PC Door and Wall Protection Systems, InPro Corporation, PO Box 406 Muskego, WI 53150 (800-222-5556).

b. Basis of Design Product:

- 1) Stainless Steel Corner Guard.
 - a) Model: IPC #181128H-304, 1-1/2 by 1-1/2 by 96 inches, 1/8 inch radius, screw-on.
 - b) 304 Stainless Steel, 16 gauge; NSF approved.
 - c) Height: As required for installation from top of finish floor to underside of ceiling, unless otherwise indicated on Drawings.
 - d) Color and Texture: No. #4 satin.
- 2) Wing Size: Nominal 1-1/2 by 1-1/2 inches.
- 3) Corner Radius: Minimum 1/8 inch.
- 4) Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.
- 5) Provide matching filler piece between corner guards on end walls.

C. Wall Guards:

1. Basis of Design Manufacturer:

- a. IPC Door and Wall Protection Systems, InPro Corporation, PO Box 406 Muskego, WI 53150 USA; Telephone: 800-222-5556, Fax: 888-715-8407, or approved.

2. Basis of Design Product:

- a. NuTree Wall Guard.
 - 1) Model: IPC #NT-180.
 - 2) Height: 6".
 - 3) Depth: 1/2".
 - 4) Finish: Smooth.
 - 5) Color: To be selected by Architect from Manufacturer's four color choices.

2.03 FABRICATION

- A. Fabricate corner protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

- B. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates and corner areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine wall to which corner 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 corner protection units 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.

3.02 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant corner protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION, GENERAL

- A. General: Install corner protection unit's 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.
 - 1. Install corner protection units in locations and at mounting heights indicated on Drawings.

3.04 CORNER GUARDS INSTALLATION

- A. Installation Quality: Install corner guards 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. Install corner guards from top of finish flooring to underside of ceiling unless otherwise indicated on Drawings.
- C. Adhesive: Field applied heavy duty adhesive.
- D. Fasteners: Pre-drilled beveled holes and phillips head screws.

- E. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Adjust end and top caps as required to ensure tight seams.

3.05 WALL GUARD INSTALLATION

- A. Cut the wall guard to the required length.
- B. Trim all factory edges square before installation.
- C. Drill 3/16" holes with a countersink to accommodate the bevel-headed fastener on the wall guard. Holes should be 4" from each end and spaced evenly over the entire length (6 anchors per 12' length).
- D. Position and level the wall guard on the wall, and transfer mounting holes to the wall with a marker. Drill appropriate holes for the fastener system at each mark on the wall. Mount the wall guard with the fasteners tighten the screws to secure the wall guard. You may choose to cover the screw head with colored caulk.
- E. With lengths over 12', align the pieces of the wall guard on the wall leaving an 1/8" gap for interior installations and 3/8" to 1/2" for exterior installations, to allow for expansion between sections. Secure them to the wall with fasteners, 4" on either side of the joint.

3.06 CLEANING

- A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

3.07 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 102600.PWG PLASTIC WALL GUARD.
 - b. 102600.SCG STAINLESS STEEL CORNER GUARD.

END OF SECTION

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.

1.02 DEFINITIONS

- A. Owner-Furnished Contractor Installed Material: OFCI.
- B. Owner-Furnished Owner Installed Material: OFOI.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.
- C. Maintenance data.
- D. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

- 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.

1.05 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.
- B. Warranty Toilet Accessories: 2 years from the Date for Substantial Completion.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Basis of Design Product selection is provided with other Manufacturers, with the stipulation that Manufacturers' other than Basis of Design are required to provide a Comparable product.
 - 1. Definition: Comparable Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

2.02 PERFORMANCE REQUIREMENTS

- 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.

2.03 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Products: As listed for each product, or comparable product by one of the following:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. American Specialties, Inc.
 - 3. Bradley Corporation.
 - 4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
- B. Toilet Tissue (Roll) Dispenser: OFCI:
 - 1. Basis-of-Design Product: Scott Essential Coreless Jumbo Roll Dispenser #09602:
 - a. Size: 14.25" x 9.75" x 6".
- C. Paper Towel Roll Dispenser: OFCI:
 - 1. Basis of Design Product: Scott Pro Mod Manual Hard Roll Towel Dispenser #34346:
 - a. Size: 12.66" x 16.44" x 9.18".
- D. Liquid-Soap Dispenser: OFCI:
 - 1. Basis-of-Design Product: Scott Essential Manual Skin Care Dispenser #92145.
 - a. Size: 4.85" x 8.36" x 5.43".

E. Grab Bar:

1. Basis-of-Design Product: ADA/ANSI compliant Bobrick Concealed Mounting with flange cover.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

F. Seat-Cover Dispenser: OFOI.

1. Basis of Design Product: TBD.
 - a. Size: Plan for 12" x 17.3" x 5.3".

G. Mirror Unit:

1. Basis-of-Design Product: Bobrick - Tempered Glass units; B-1658 series.
2. Frame: Stainless-steel channel B-1658.
 - a. Corners: Mitered and mechanically interlocked.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

H. Sanitary-Napkin Disposal Unit: OFOI:

1. Basis-of-Design Product: HOSPECO ND-1W.
 - a. Wall type, for sanitary napkins, white enamel.
 - b. Size: 4.5" x 7.25" x 11".
 - c. Sku# 33990.

I. Robe Hook:

1. Basis-of-Design Product: Bobrick B-211 Heavy-Duty Clothes Hook with Exposed Mounting.
 - a. Description: One piece hook and flange. Flange is 2 3/4-inches in diameter. Projects 3 7/16-inch from wall.
 - b. Material and Finish: Brass-casting with satin nickel-plated finish.

J. Waste Receptacle

1. Waste receptacles: Surface-mounted with 8" projection. Capacity: 6 gallons.
 - a. Bobrick Washroom Equipment, Inc.
 - b. American Specialties, Inc.
 - c. Bradley Corporation.

2.04 UNDERLAVATORY GUARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Plumberex Specialty Products, Inc.
 2. Truebro by IPS Corporation.
- B. Underlavatory Guard :
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 2. Material and Finish: Antimicrobial, molded plastic, white.

2.05 CUSTODIAL ACCESSORIES

- A. Basis-of-Design Product: All listed Products are Basis of Design as Bobrick Products, unless indicated otherwise. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
 4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Utility Shelf and Mop Holder:

1. Basis-of-Design Product: Bobrick B-224.
2. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside. Four anti-slip mop/broom holders with spring-loaded cam.
3. Length: 36 inches.
4. Material and Finish: Not less than nominal 18 gauge stainless steel, No. 4 finish (satin).

2.06 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install accessories according to 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.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf when tested according to ASTM F 446.

3.02 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for further information on the following keynotes:
1. KEYNOTE DESCRIPTION.
 - a. 102800.GB GRAB BAR.
 - b. 102800.LSD LIQUID SOAP DISPENSER.
 - c. 102800.M MIRROR.
 - d. 102800.SCD SEAT COVER DISPENSER.
 - e. 102800.TTD TOILET TISSUE DISPENSER.
 - f. 102800.TD TOWEL DISPENSER.
 - g. 102800.ULG UNDERLAVATORY GUARDS.
 - h. 102800.USM UTILITY SELF WITH MOP HOLDER.

END OF SECTION

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, and cabinet type, trim style, and panel style.
 - 2. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. 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.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.04 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.02 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. J. L. Industries, Inc., a division of Activar Construction Products Group;
 - b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
 - c. Larsen's Manufacturing Company.
 - d. Watrous Division, American Specialties, Inc.
- B. Cabinet Construction: Nonrated and 1-hour fire rated.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Steel sheet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim. Provide where walls are of insufficient depth for semirecessed cabinet installation.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Vertical duo panel with frame.
- I. Door Glazing: Tempered break glass or Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

L. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
2. Steel: Baked enamel or powder coat.

2.03 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.04 GENERAL FINISH REQUIREMENTS

- 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 of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. 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.

2.05 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning".
- B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below, or at heights acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Provide inside latch and lock for break-glass panels.
 - 2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

3.04 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.05 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION:
 - a. 104413.FXC FIRE EXTINGUISHER CABINET.
 - b. 104413.FCR FIRE EXTINGUISHER CABINET – RECESSED.
 - c. 104413.FCS FIRE EXTINGUISHER CABINET - SEMI-RECESSED.
 - d. 104413.FCM FIRE EXTINGUISHER CABINET - SURFACE MOUNTED.

END OF SECTION

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SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- C. Warranty: Sample of special warranty.

1.03 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.04 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - e. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - f. Larsen's Manufacturing Company.
 - 2. Handles and Levers: Manufacturer's standard.
 - 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Type A: Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A: 40-B: C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

- C. Type B: Class-K Wet Chemical Type in Stainless Steel Container: UL-rated 2-A: K, 20-lb nominal capacity, with potassium bicarbonate-based wet chemical in stainless steel container.
- D. Type C: Clean-Agent Type in Steel Container: UL-rated 5-B: C, 4.75-lb nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gauge.

2.02 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - e. Larsen's Manufacturing Company.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Locations: Because drawings do not distinguish type/location of extinguisher allow the following locations determine the type and location of extinguisher as per the Reference Plan sheet room locations:
 - 1. Type A: Rooms 000; 003; 004; 201.
 - 2. Type B: Rooms 105
 - 3. Type C: Rooms 106A; 132; 146.
- B. General: Install fire extinguishers and mounting brackets in locations indicated on plan and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.03 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:

1.	<u>KEYNOTE</u>	<u>DESCRIPTION</u>
a.	104416.FXB	FIRE EXTINGUISHER BRACKET
b.	104416.FX	FIRE EXTINGUISHER
c.	104416.FX1	FIRE EXTINGUISHER - TYPE FXB-A
d.	104416.FX2	FIRE EXTINGUISHER - TYPE FXC-A
e.	104416.FX3	FIRE EXTINGUISHER - TYPE FXB-K
f.	104416.FX4	FIRE EXTINGUISHER - TYPE FXC-K

END OF SECTION

SECTION 10 51 13 METAL LOCKERS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes heavy duty knock-down lockers.
 - 1. Welded lockers are an acceptable substitution.

1.02 SUBMITTALS

- A. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Show the following:
 - 1. Dimensioned drawings including plans, elevations, and sections to show locker locations and interfaces with adjacent substrates.
 - 2. Details of assembly, erection, anchorage and clearance requirements.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect locker finish and adjacent surfaces from damage.

1.04 WARRANTY

- A. Period: warranty for 3 years from the Date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. DeBourgh Manufacturing Company; 27505 Otero Avenue, La Junta, CO 81050 (800-328-8829; DeBourgh.com).
 - 2. List Industries, Superior Lockers, 401 Jim Moran Blvd., Deerfield Beach, FL 33442 (800-776-1342; www.listindustries.com).
 - 3. Penco Products, Inc., 1820 Stonehenge Drive, Greenville, NC 27858 (800-562-1000; PencoProducts.com).
 - 4. Republic Storage Products, LLC, 3743 Boettler Oaks Dr. Suite A, Uniontown, OH 44685 (800-477-1255, republicstorage.com).
- B. Provide only metal lockers fabricated in the United States by a single domestic manufacturer.

2.02 MATERIALS

- A. Steel: Prime grade mild cold-rolled sheet steel free from surface imperfection, capable of taking a high-grade enamel finish and in compliance with ASTM A1008.
- B. Steel: Sheet steel components shall be fabricated using zinc-coated steel free from surface imperfection, capable of taking a high-grade enamel finish and in compliance with ASTM A879.
- C. Hooks: Zinc plated forged steel, ball ends.
- D. Bolts and Nuts: Zinc plated truss fin head bolts and hex nuts.

2.03 HEAVY DUTY LOCKERS

- A. Heavy Duty Lockers: All locker body components made of cold rolled steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.
 - 1. Size and Configuration: As indicated on Drawings.
 - 2. Basis of Design: Subject to compliance with requirements, provide Penco Knocked Down lockers, or welded lockers, or comparable products by one of the manufacturers listed above.
- B. Locker Body: Knock-Down Lockers.
 - 1. Sides, Bottoms, Tops, and Shelves:
 - a. 16-gauge steel.

2. Backs: Solid 18-gauge steel.
 - a. Groups to 48 inches wide: One-piece back.
 - b. Groups over 48 inches wide: Two-piece back.
3. Doors:
 - a. 14-gauge steel.
 - b. Standard louver door.
4. Sides: Vertical frames and sides.
 - a. Intermediate vertical side frames: Frame channel securely welded to locker side.
 - b. No Ventilation: Solid Sides.
5. Tops: Notched and formed sheet; one continuous flat top for each group of lockers.
6. Bottoms: Notched and formed sheet; one continuous bottom for each group of lockers, suitable for anchoring to bases.
7. Shelves: Flanged four sides with additional return flange on front edge to increase strength.
8. Door frames, 16-gauge formed in a channel shape with continuous vertical door strikes.

C. Locker Doors: One-piece sheet steel.

1. Multi-Point Latch Doors: Full channel formation of adequate depth to fully conceal lock bar on lock side, channel formation on hinge side, right angle formations across top and bottom, with holes for attaching number plates.
2. Doors over 30 inches High: Provide with 3-inch-wide 20-gauge full height reinforcing pan welded to inside face of door at 6 inch centers.
3. Provide holes for attaching number plates.
4. Ventilation for locker doors: Provide louvered doors in manufacturer's standard louver pattern.

CI. Hinges:

1. Continuous Hinges: Continuous piano hinge for the full height of the door.

CII. Base: 14-gauge steel, 2 flanged outward at top for support of lockers, flanged inward at bottom for anchoring to floor.

1. Finish: To match lockers.

2.04 DOOR HANDLES AND LATCHING

A. 1 and 2 Tier Lockers:

1. Multi-point latching with recessed handles:

- a. Recess finger-lift control handle in door.
- b. Pocket: 22-gauge brushed stainless steel securely fastened to door with two tabs and a positive tamper-resistant decorative fastener. Pocket depth sufficient to prevent a combination padlock, built-in combination lock, or key lock from protruding beyond door face.
- c. Provide lock hole cover plate for use with padlocks.
- d. Attach 14-gauge formed steel lifting piece to latching channel with one concealed retaining lug and one rivet, assuring a positive two-point connection.
- e. Handle Finger Lift: Molded, sound-deadening, attached with rivet; padlock eye for use with 9/32 inch diameter padlock shackle.
- f. Latch Clip: Glass-filled nylon engaging the door frame and holding the door shut.
 - 1) Doors 20 inches (0.508 m) to 48 inches (1.22 m) high: Two points.
- g. Locking Device: Positive, automatic type, whereby locker may be locked when open, then closed without unlocking.
- h. Firmly secure one rubber silencer in frame at each latch hook.

2.05 INTERIOR EQUIPMENT

A. Lockers:

1. Hat Shelf: Located approximately 9 inches below top of locker, in lockers 30 inches tall or taller.
2. Hooks: Two single-prong wall hooks and one double-prong ceiling hook.
 - a. Chrome hooks; no paint.

2.06 2.06 ACCESSORIES

- A. Number Plates: Provide each locker with a polished aluminum number plate, 2-1/4 inches wide by 1 inch high, with black numerals not less than 3/8 inch high; 4-digit number will be assigned by Owner; attach to face of door with two aluminum rivets.
- B. Finished End Panels: Minimum 16-gauge steel formed to match locker depth and height, 1 inch (25 mm) edge dimension; finish to match lockers and install with concealed fasteners.

- C. Front Fillers: 20-gauge steel formed in an angle shape, with 20-gauge slip joint angles formed in an angle shape with double bend on one leg forming a pocket to provide adjustable mating with angle filler.
 - 1. Attachment by means of concealed fasteners.
 - 2. Finish to match lockers.
- D. Recess Trim: 18-gauge steel, 3 inch face dimension.
 - 1. Vertical and/or horizontal as required.
 - 2. Standard lengths as long as practical.
 - 3. Attach to lockers with concealed clips.
 - 4. Provide necessary finish caps and splices.
 - 5. Finish to match lockers.

2.07 FABRICATION

- A. Fabricate lockers square, rigid, without warp, with metal faces flat and free of distortion.
- B. Welded Lockers: Pre-assemble lockers by welding into one piece structures in groupings most practical for job requirements, welds free of burrs; maximum width of group to be 54 inches; no bolts, nuts, or rivets allowed in assembly of main locker groups.
- C. Finish: Enamel powder coat paint finish electrostatically applied and properly cured to manufacturer's specifications for optimum performance. Finishes containing volatile organic compounds and subject to out-gassing are not acceptable. Locker exterior and interior shall be painted the same color.
 - 1. Powder Coat - Dry Thickness: 1 to 1.2 mils.
 - 2. Powder Coat Plus - Dry Thickness: 2 to 2.2 mils.
 - 3. Color: Custom color to match Architect's sample as noted in Finish Schedule on Drawings.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrates are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install metal lockers and accessories at locations shown in accordance with manufacturer's instructions.
- B. Install lockers plumb, level, and square.
- C. Anchor lockers to floor or base and wall at 48 inches or less, as recommended by the manufacturer.
- D. Bolt adjoining locker units together to provide rigid installation.
- E. Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.
- F. Install front bases between legs without overlap or exposed fasteners. Provide end bases on exposed ends.

3.03 ADJUSTING AND CLEANING

- A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.
- B. Touch-up with factory-supplied paint and repair or replace damaged products before substantial completion.

3.04 PROTECTION

- A. Protect installed products until completion of project.

3.05 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. Keynote Description:
 - a. 105113.CH COAT HOOKS.
 - b. 105113.CB CONTINUOUS BASE.
 - c. 105113.FP FILLER PANEL.
 - d. 105113.FEP FINISHED END PANEL.
 - e. 105113.ML METAL LOCKERS.
 - f. f105113.RT RECESS TRIM.

END OF SECTION

SECTION 10 74 00
HEATED FIBERGLASS ENCLOSURE

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section covers furnishing and installing an above-ground fiberglass enclosure for piping and valves as shown in the Drawings.

1.02 REFERENCES

- A. American Society for Sanitary Engineering (ASSE):
 - 1. 1060, Performance Requirements for Outdoor Enclosures for Fluid Conveying Components

1.03 ADAPTATION OF PRODUCT

- A. Furnish product readily adaptable for installation and operation in the manner shown on the Drawings.

1.04 QUALITY ASSURANCE

- A. Qualifications: the enclosure manufacturer shall be a company specializing in the manufacture of such enclosures with at least 10 years of successful field experience and be ASSE 1060 Seal Certified.

1.05 SUBMITTALS

- A. All submittals shall be accordance with Section 01 33 00, unless otherwise noted.
- B. Submit complete shop drawings with detailed dimensions, specifications, color choices, and data for material used, parts, devices, and other accessories forming part of the structure.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Off load structure according to manufacturer's instructions.
- B. Inspect structure completely and report any damage during shipping.
- C. Store structure on level, firm ground or platform and protect from construction traffic and damage.
- D. Store products in shipping containers and maintain in a dry location until installation.

PART 2 – PRODUCTS

2.01 HEATED FIBERGLASS ENCLOSURE

- A. The enclosure shall be a flip top style heated fiberglass enclosure and sized to fit piping and related appurtenances.
- B. Enclosure shall ship fully assembled to allow for quick installation.
- C. Drain ports shall be sized for full port backflow discharge and are designed for a one-way operations – allowing for backflow discharge but not allowing wind, debris, or small animals to enter the enclosure.
- D. Fiberglass shall be a minimum of 1/8-in thick thixotropic polyester resin reinforced with fiberglass strand. Fiberglass shall be protected with UV inhibited isophthalic polyester gel coat.
- E. Insulation shall be 1-inch to 1.5-inch unicellular, nonwicking, polyisocyanurate foam frothed and sprayed in place and shall have the following properties:
 - 1. R-Value: 8.
 - 2. Dimensional stability: less than 2% linear change.
 - 3. Compressive Strength: 51 psi.
 - 4. Flame Point: 325°F.
 - 5. Water Absorption: 0.037 psf.
 - 6. Porosity: 91%.
- F. Heating equipment shall conform to ASSE 1060 Class 1.
 - 1. Heating equipment shall protect the piping and equipment from exterior temperatures to -30°F.
 - 2. Heating equipment shall maintain the enclosure interior at 40°F in accordance with ASSE 1060 1.2.2.1.
 - 3. Heaters shall be UL or ETL listed for wet/damp locations.
- G. Metallic mounting hardware is to be 304 grade stainless steel.
- H. The enclosure is to include the following standards options:
 - 1. Door hardware is to include two fixed-pin hinges, nonlockable handle, and padlock hasps. Contractor shall provide two padlocks, keyed to the same key as the pump station entry door and sized to work with the two hasps provided for the heated enclosure.
 - 2. Heat Trace, 110 V, 3-W or 5-W Heat trace wire connected downstream of the provided GFI.

3. 110 V, 20-A GFCI protected weather resistant duplex outlet with weatherproof continuous use cover.
 4. All wire shall be run through 1/2-inch flexible sealed PVC flexible conduit.
 5. All wiring shall be completed with minimum #12 solid copper.
 6. Power connection: Junction Box shall be provided to allow for a single point of connection for incoming electrical.
 7. Mounting Hardware: Provide 316 stainless steel padlock anchoring staples for padlocks.
- I. Manufacturer and Products:
1. Hot Box HB2ST or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's recommendations.
- B. A reinforced concrete slab, with dimensions as shown on the Drawings, shall be provided as a base for the enclosure.
- C. Verify that the concrete is sloped as shown on the Drawings and of correct dimensions to receive the structure. Correct any deficiencies before proceeding.
- D. Enclosure shall be installed plumb, level and square.
- E. Fasten to foundation using specified fasteners at specified spacing.
- F. Connect to power from protected circuit.
- G. Enclosures shall be located and oriented as indicated on the Drawings or as otherwise directed by the Owner's Representative.

END OF SECTION

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Division 12

Furnishings

SECTION 12 24 13
ROLLER WINDOW SHADES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, 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.

1. Manually Operated Shades.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square in colors indicated. Mark inside face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

E. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 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.

1.07 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.
- C. Coordination of Electrical Rough-In Locations: In sufficient time prior to installation, provide on-site coordination of electrical services to electrically operated shade locations. Verify that layout is provided prior to beginning installation.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roller shades that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design Manufacturer: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include provide Hunter Douglas, 60% visibility, roller shade, or comparable product from the following:
 - 1. BTX Window Automation, Inc.
 - 2. Draper Inc.
 - 3. Hunter Douglas Company.
 - 4. Lutron Electronics Co., Inc.
 - 5. Mecho Systems.
 - 6. Silent Gliss USA, Inc.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.02 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- 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 lifting heavy roller shades.
 - a. Provide for shade bands that weigh more than 10 lb. or for shades as recommended by manufacturer, whichever criteria are 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 inside face of shade and left side of inside face of shade. Verify with Architect and building conditions.

2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
- F. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
1. End Minimum Light Gap Between Shades: 1-1/2 inches, unless otherwise indicated.
 2. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling/soffit installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel. Pocket shall fully enclose shade pocket on all sides.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than height indicated on Drawings.
 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.03 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric (60%): Woven fabric, stain and fade resistant.
1. Source: Roller-shade manufacturer.
 2. Type: 100% PVC free.
 3. Orientation on Shadeband: Up the bolt.
 4. Openness Factor: 60% maximum.
 5. Color: As indicated in Finish Schedule in Drawings.

2.04 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°F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch plus or minus 1/8 inch
 - 2. 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 except as follows:
 - 3. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 - 4. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Edges and Finish: All edge seams and end cuts shall be tailor for opening, any uneven or out of plumb seams or edges will be cause for rejection.

3.03 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 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.

3.05 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 - 1. KEYNOTE DESCRIPTION.
 - a. 122413.RWS ROLLER WINDOW SHADES.

END OF SECTION

SECTION 12 32 00
MANUFACTURED WOOD CASEWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Plastic laminate-faced wood cabinets.
2. Plastic-laminate materials.
3. PVC edgebanding for plastic laminate.
4. Solid-surfacing material countertops.

1.02 DEFINITIONS

A. Definitions in the AWI/AWMAC/WI's "Architectural Woodwork Standards" apply to the Work of this section.

B. Exposed Exterior Surfaces: defined as all exterior surfaces exposed to view, including:

1. All surfaces visible when doors and drawers are closed, including knee spaces.
2. Underside of cabinet bottoms over 42 inches above the finished floor, including cabinet bottoms behind light valences and the bottom edge of light valences.
3. Cabinet tops under 80 inches above the finished floor, or if 80 inches and over and visible from an upper building level or floor.
4. Front edges of stretchers, ends, divisions, tops, and bottoms.
5. Sloping tops of cabinets that are visible.

C. Exposed Interior Surfaces: defined as all interior surfaces exposed to view in open casework or behind transparent doors, including:

1. Shelves, including edgebanding.
2. Divisions and partitions (front end in an exposed surface).
3. Interior face of ends (sides), backs, and bottoms (including pull outs). Also included are the interior surfaces of cabinet top members 36 inches or more above the finished floor.
4. Interior face of door and applied drawer fronts.

- D. Semi-Exposed Surfaces: defined as those interior surfaces only exposed to view when doors or drawers are opened, including:
1. Tops and bottoms of shelves, including front edgebanding (front edge is an exposed surface).
 2. Divisions and partitions (front edge is an exposed surface).
 3. Interior face of ends (sides), backs, and bottoms (including a bank of drawers). Also included are the interior surfaces of cabinet top members 35 inches or more above the finished floor.
 4. Drawer sides, sub fronts, backs, and bottoms.
 5. The underside of cabinet bottoms between 24 and 42 inches above the finished floor.
 6. Security and dust panels or drawer stretchers.
- E. Concealed Surfaces: defined as those exterior or interior surfaces that are covered or not normally exposed to view including:
1. Toe space unless otherwise specified.
 2. Sleepers, stretchers, and solid sub tops.
 3. The underside of cabinet bottoms less than 24 inches above the finished floor.
 4. The flat tops of cabinets 80 inches or more above the finished floor, except if visible from an upper floor or building level.
 5. The three non-visible edges of adjustable shelves.
 6. The faces of cabinet ends of adjoining units that butt together.
- F. Plywood: a panel manufactured of three or more layers (plies) of wood or wood products (veneers or overlays and/or core materials), generally laminated into a single sheet (panel).
1. Primary Core Materials:
 - a. Veneer Core: Traditional "Plywood" consisting of a panel core made up of an odd number of plies, 3 or more alternating layers of veneers, pressed and glued into a single sheet. The two outside veneer layers are the face and back. Veneer core is further separated into two groups according to materials and manufacturing:
 - 1) Hardwood Veneer: Panels manufactured of hardwood veneers.
 - 2) Softwood Veneer: Panels manufactured of softwood veneers.

- b. Veneer core shall not be used in cabinet construction, except where indicated for the following:
 - 1) Cabinet bases (toe kick materials).
 - 2) Drawer sides, backs, and bottoms.
 - 3) Vertical dividers.
- c. Combination Core: Cores constructed of three or five plies of veneer, sandwiched between laminations of MDF. Typically the combination of these materials result in stronger lighter weight, dimensionally stable panels with increased screw holding ability, and superior surface flatness. Combination core shall be used for all cabinet construction, including the following:
 - 1) Cabinet tops, bottoms, ends.
 - 2) Shelves.
 - 3) Doors.
 - 4) Drawer fronts.

1.03 1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including field joints and filler panels and countertop joints. Indicate manufacturer's catalog numbers for casework.
- C. Samples for Initial Selection: For cabinet finishes and for each type of material indicated.
 - 1. CFC Combination Core.
 - 2. Plastic Laminate: Three (3) samples, 8-by-10-inch, for each type of finish and edging.
 - 3. Hardware: One (1) sample of each type and finish.
 - 4. Edgebanding: 6 inches in length of thickness indicated.
 - 5. Solid surface countertop material: One (1) sample of each color and edging, 6 inches square.
- D. Samples for Verification: For cabinet finishes and for each type of material indicated and the following:
 - 1. CFC Combination Core.
 - 2. Plastic Laminate: Three (3) samples, 8-by-10-inch, for each type of finish and edging.

3. Hardware: One (1) sample of each type and finish.
 4. Edgebanding: 6 inches in length of thickness indicated.
 5. Solid surface material: One (1) sample of each color and edging, 6 inches square.
- E. Schedule: Submit Keying Schedule of locks listing each room (by number), each location (by N/S/E/W wall), each cabinet (upper, lower, full height - door or drawer); so Owner's keying requirements can be marked thereon and transmitted to Contractor.
- F. Qualification Data: For qualified Installer.
- G. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Quality Standards: Comply with AWI/AWMAC/WI's woodwork association quality standards in accordance with requirements for work specified in this section
1. Grade: Premium.
- C. Installer Qualifications: Certified participant in AWI's Quality Certification Program; or a certified participant of WI's Certified Compliance Program; or a non-certified installer that is able to install to WI's Certified Compliance Program requirements per the NAAWS.
- D. Source Limitations: Obtain manufactured laminate casework and countertops from single source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured wood casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.
- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install manufactured wood casework until spaces are enclosed and weathertight, utility roughing-in, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions acceptable based upon referenced standards at occupancy levels during the remainder of the construction period.
1. Maintain temperature between 60 and 90°F and relative humidity between 25 and 55% during the remainder of the construction period.

- B. Field Measurements: Verify actual dimensions of construction contiguous with manufactured laminate casework by field measurements before fabrication.

1.07 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements in walls and partitions for support of manufactured laminate casework.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured wood casework that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of components or other failures of glue bond.
 - b. Warping of components.
 - c. Failure of operating hardware.
 - d. Deterioration of finishes.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advanced Custom Cabinets (Coeur d'Alene, ID).
 - 2. Cascade Casework (Lebanon, OR).
 - 3. Central Cabinet Systems (Tacoma, WA).
 - 4. Frontier Door & Cabinet LLC (Tacoma, WA).
 - 5. Genothern (Tumwater, WA).
 - 6. Interior Wood Products (Olympia, WA).
 - 7. Pacific Cabinets Inc., (Ferdinand, ID).

2.02 MATERIALS, GENERAL

- A. Maximum Moisture Content for Lumber: 7% for hardwood and 12% for softwood.
- B. Hardwood Plywood: HPVA HP-1.

- C. Softwood Plywood: DOC PS 1.
- D. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue (at wet locations).
- E. CFC Combination Core: Veneer core consisting of Western softwood inner core, with outer plies on both faces consisting of medium density fiberboard (MDF) resulting in a smooth laminating surface with minimal telegraphing. 5-ply for 1/2 inch thickness, 7-ply for 3/4 inch thickness, and 9-ply for 1 inch thickness.
 - 1. Basis of Design Product: Roseburg SkyPly Combination Fiber Core CFC Veneer Core panels with no added urea-formaldehyde, or approved equal.
- F. Marine Grade Veneer Core: Marine-grade plywood that is produced entirely of Group 1 species of veneer, sanded on both faces. The maximum core-gap size permitted is 1/8 inch. Its exposure durability rating is EXTERIOR and the glue used is a water resistant structural adhesive.
 - 1. Basis of Design Product: Roseburg AB Marine with grade A face panel, Grade B or better western softwood and Grade B back. No added urea-formaldehyde (NAUF), exterior, water resistant phenolic glue. Or approved equal.
 - a. Marine Grade Veneer Core shall be used at the following locations:
 - 1) Toe Kick materials.
- G. Moisture Resistant MDF: Engineered wood product of softwood wood fibers with moisture resistant wax and a resin binder formed at high temperature and pressure. Meets ANSI A208.2 Grade 155.
 - 1. Basis of Design Product: Roseburg; Medex MDF, with no added urea-formaldehyde (NAUF), and meets grade MR50 moisture resistance. Or approved equal.
 - a. Moisture Resistant MDF shall not be used for the following:
 - 1) Counter subtops at wet locations.
- H. Plastic Laminate (PL): High-pressure decorative laminate complying with NEMA LD 3.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart LLC and Formica Corporation; Plastic Laminate or comparable products by one of the following:
 - a. ABET Inc.
 - b. Arborite, Division of Wilsonart Canada ULC.
 - c. Laminart LLC.
 - d. Nevamar Company, LLC.
 - e. Pionite; a Panolam Industries International, Inc. brand.
 - 2. Source Limitations: Obtain from single source from single manufacturer.

- I. Thermoset Decorative Panels: CFC Combination core finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- J. Edgebanding for Plastic Laminate (PVC):
 - 1. 1mm PVC banding, machine applied.
 - 2. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius where indicated.
 - 3. Edgebanding Locations:
 - a. Cabinet Bodies with Door/Drawer Face: 3 mm PVC.
 - b. Cabinet Bodies Where Open Compartment: 3 mm PVC.
 - c. Cabinet Shelves with Door Face: 1 mm PVC on front edge only, except at glass doors, use Grade VGS plastic laminate.
 - d. Cabinet Shelves Where Open Compartment: 3 mm PVC on front edge only.
 - e. Cabinet Door/Drawer Faces: 3 mm PVC.
 - f. Countertops: 3 mm PVC.
 - g. Window Sills: 3 mm PVC.
 - 4. PVC Edgebanding Color: As selected by Architect from casework manufacturer's full range to match adjacent laminate surfaces.
- K. Edgebanding for Thermoset Decorative Panels: 3 mm thick PVC edge and matching thermoset decorative panels.

2.03 CABINET MATERIALS

- A. Exposed Cabinet Materials:
 - 1. Plastic Laminate:
 - a. Countertop Surfaces: Grade HGS; Post Forming HGS is acceptable.
 - b. Exposed Casework Surfaces: Grade VGS.
 - 2. Provide specified PVC edge-banding on all exposed edges, except at cabinets with glass doors provide Grade VGS edge banding on shelves.

B. Semi-Exposed Cabinet Materials:

1. Plastic Laminate: Grade VGS.
 - a. Provide plastic laminate for interior faces of doors and drawer fronts and where indicated.
2. Thermoset Decorative Panels: Provide thermoset decorative panels for semi-exposed surfaces unless otherwise indicated.
3. Unless otherwise indicated, provide specified edge-banding on all semi-exposed edges.

C. Concealed Cabinet Materials:

1. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces, is not permitted. Cabinet liner of comparable weight is acceptable.

2.04 DESIGN, COLOR, AND FINISH

A. Design: Provide manufactured laminate casework of the following design:

1. Reveal overlay with wire pulls. Provide base, wall, and full height units with drawer fronts, doors, and fixed panels overlaying and partially concealing cabinet body, unless otherwise indicated.

B. Thermoset Decorative Panel Colors, Patterns, and Finishes: White.

C. Plastic-Laminate Colors, Patterns, and Finishes: As indicated in Finish Schedule on Drawings or as selected by Architect from plastic-laminate manufacturer's full range of standard and premium colors and finishes.

D. PVC Edgebanding: Woodtape, or as selected by Architect from manufacturer's complete line.

1. Edgebanding Color to match exterior laminate.

2.05 CABINET FABRICATION

A. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch combination core plywood, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces.
 - a. Cabinet Bases: Factory assembled and factory attached to each individual cabinet. Cabinet sides extending to the floor will not be accepted. Fabricate from veneer core plywood, 3/4-inch thick.

2. Tops and bottoms shall be glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets. Mechanical or metal hardware fasteners joining cabinet top and bottom panels to the sides will not be accepted.
 3. Shelves: 1 inch thick combination core plywood core, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces.
 4. Backs of Cabinets: 1/4 inch thick medium density fiberboard panel fully captured by the cabinet top, bottom and side panels. Finish to match cabinet interior. 3/4 by 4 inch particleboard rails shall be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail shall be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength. Plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces.
 5. Drawer Fronts: 3/4-inch combination core plywood, plastic-laminate faced.
 6. Drawer Sides and Backs: 1/2-inch solid-wood or veneer core hardwood plywood, with glued dovetail or multiple-dowel joints.
 7. Drawer Bottoms: 1/4-inch hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch material for drawers more than 30 inches wide.
 8. Doors: 3/4-inch combination core plywood, plastic-laminate faced.
 9. Cabinet Sub-Tops: Base units, except sink base units: Full sub-top glued and doweled to cabinet sides. Mechanical or metal hardware fasteners joining cabinet sub-top panel to the sides will not be accepted.
 - a. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.
 10. Fasteners: Do not use exposed fasteners except where unavoidable. Match finish of metal fastener to surrounding material, unless otherwise indicated. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
 11. Adhesives: Rigid PVA glue line, of adhesives designed for laminate applications. Spray on adhesives will not be allowed.
- B. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.
1. Cabinet top and bottom corner filler: same as cabinet construction. Close off the top and bottom of casework intersecting corners (inside and outside corners).
- C. Fixed Vertical Dividers: Provide 3/4 inch combination core plywood panels doweled to cabinet components.

2.06 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.
- B. Butt Hinges: Chrome-plated, semiconcealed, five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 36 inches high, and provide three hinges for doors 36 inches or more in height.
 - 1. Swing: 270 degree swing.
- C. Pulls: Solid aluminum or chrome-plated brass wire pulls, fastened from back with two screws. For sliding doors, provide recessed chrome-plated flush pulls.
 - 1. Select from the manufacturer's pre-approved Vendor Stock Pull Program.
 - 2. Metal wire pull; satin chrome finish.
 - 3. All pulls with 96 mm spacing on screws. Pull designs shall comply with the Americans with Disability Act (ADA).
- D. Door Catches: Zinc-plated, dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches high. Pull force shall not exceed 5 lb. per Americans with Disability Act (ADA).
- E. Drawer Slides: BHMA A156.9, Type B05051/B05052/B05053.
 - 1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated, steel ball-bearing slides.
 - 2. Box Drawer Slides: Grade 1HD-100.
- F. Drawer Stops: Provide BBW No. W06, Glynn Johnson No. 22, Ives No. 21, or Quality No. 1337B resilient bumpers so drawer stop is achieved by contact of two (2) bumpers in backside of each drawer front with face of cabinet frame.
- G. Adjustable Shelf Clips: PX Industries, Allen Fields Co., Heavy Duty # 55536 clear (W.I.C. rated 500 lbs.) clips with double pin or approved; with four (4) per shelf (up to 36 inch wide), suitable for 32mm pin spacing and 3/4 inch or 1 inch shelf thickness.

2.07 COUNTERTOPS

- A. Countertops, General: Provide smooth, clean exposed tops and edges in uniform plane free of defects.
 - 1. Provide front overhang of 1-1/2 inches and end overhang of 1 inch over base cabinets.
 - 2. Corners shall have 1/4 inch radiused edges.

- B. Joints: Fabricate countertops without joints, where possible, or in sections for joining in field, with joints at locations indicated on shop drawings.
1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
- C. Solid Surfacing Material (SSM) and Solid Surfacing Material Tops (SST): Homogeneous-filled plastic resin complying with ICPA SS-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Corian Solid Surface or a comparable product by one of the following:
 - a. E. I. du Pont de Nemours and Company.
 - b. Formica Corporation.
 - c. LG Hausys America, Inc., HI-MACS.
 - d. Wilsonart LLC.
 2. Type: Provide Standard type unless Special Purpose type is indicated.
 3. Colors and Patterns: As indicated in Finish Schedule on Drawings.
 4. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - a. Grade: Premium.
 5. Configuration: As indicated.
 6. Countertops: 1/2 inch thick, solid surface material laminated to high density particleboard with exposed edges built up with 1-1/2 inch thick, solid surface material.
 7. Backsplashes: where indicated, 1/2-inch-thick, solid surface material.
 8. Fabricate tops with shop-applied edges. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 9. Cutouts and Holes:
 - a. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - 1) Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
 - 2) Provide vertical edges, rounded to 3/8 inch (10 mm) radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch (5 mm) into fixture opening.

- 3) Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch (10 mm) into fixture opening.
- b. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
- c. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of manufactured wood casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CASEWORK INSTALLATION

- A. Install level, plumb, and true; shim as required, using concealed shims. Where manufactured wood casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
 1. Per standards, scribes are allowable to a maximum width of 1-1/2", except for inside corners that may be up to 2 1/2" to allow doors and drawers to open without conflict.
- B. Base Cabinets: Set cabinet's straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
 1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 16 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
- C. Wall Cabinets: Hang cabinet's straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, or framing, blocking, or reinforcements in walls or partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
 1. Fasten through back, near top and bottom, at ends, and not more than 16 inches o.c.
 2. Use expansion anchors at solid masonry.
 3. Use No. 10 wafer-head screws sized for 1-inch penetration at wood hanging strips.

4. Use No. 10 wafer-head screws sized for 1-inch penetration into wood framing or blocking at wood-framed partitions.
- D. Install hardware uniformly and precisely. Set hinges snug and flat. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- E. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.03 INSTALLATION OF TOPS

- A. Field Jointing: Where possible make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
- B. Secure tops to cabinets with Z- or L-type fasteners or equivalent, using two or more fasteners at each front, end, and back.
- C. Solid Surface mounting adhesives, use 100% silicone sealant where recommended by manufacturer.
- D. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
- E. Secure backsplashes and end splashes to tops with concealed metal brackets at 16 inches o.c. and walls with adhesive.
- F. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.
- G. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
- H. Form joints between components using manufacturer's standard joint adhesive.
 1. Reinforce as required.
 2. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
 3. Rout and finish component edges with clean, sharp returns.
 4. Rout cutouts, radii and contours to template.

- I. Install components plumb and level, in accordance with approved shop drawings and product installation details.
 1. Tops:
 - a. Flat and true to within 1/8 inch (3 mm) of a flat surface over a 10-foot length.
 - b. Allow a minimum of 1/16 inch to a maximum of 1/8 inch (3 mm) clearance between surface and each wall.
 - c. Solid Surface Tops: Form field joints using manufacturer's recommended adhesive (Corian® Joint Adhesive), with joint widths no greater than 1/8 inch (3 mm) in finished work.
 - d. Keep components and hands clean when making joints.
 2. Sinks/Lavatory Bowls: Adhere undermount sinks/lavatory bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
 - a. Adhere undermount sinks/lavatory bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
 - b. Adhere drop-in sinks/bowls to countertops using silicone sealant and manufacturer-recommended adhesives.
 - c. Provide backsplashes and endsplashes as indicated on the drawings.
 3. Provide backsplashes and endsplashes as indicated on the drawings.

3.04 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

3.05 KEYNOTE SCHEDULE

- A. Products in this specification section are cited in the Drawings as KEYNOTES. See PART 2 - PRODUCTS for information on the following keynotes:
 1. KEYNOTE DESCRIPTION.
 - a. 123200.FEP FINISHED END PANEL.
 - b. 123200.FS FILLER STRIPS.

- c. 123200.PL PLASTIC LAMINATE.
- d. 123200.PLV PLASTIC LAMINATE VALANCE.
- e. 123200.PVC PVC EDGEBANDING.
- f. 123200.PW PLYWOOD.
- g. 123200.SST SOLID SURFACING MATERIAL TOPS.
- h. 123200.WC MANUFACTURED WOOD CASEWORK.

END OF SECTION

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Division 13

Special Construction

SECTION 13 05 41

SEISMIC RESTRAINT REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies the anchorage and bracing for equipment and seismic anchoring and bracing for suspended equipment and equipment over 200 pounds.

1.02 QUALITY ASSURANCE

- A. Reference Standards: This section incorporates by reference the latest revisions of the following documents. These documents are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
IBC 2018	International Building Code
ASCE/SEI 7-16	Minimum Design Loads for Buildings and Other Structures

1.03 SUBMITTALS

- A. Procedures: Section 01 33 00, "Submittal Procedures."
- B. List of freestanding equipment weighing 200 pounds or more.
- C. Anchorage details for equipment and freestanding items weighing between 200 and 400 pounds.
- D. No less than 4 weeks in advance of equipment installation, for items weighing over 400 pounds. Required anchorage and bracing drawings and calculations bearing the stamp of a Professional Engineer; show the criteria used to determine seismic coefficients and forces applied to the equipment, including seismic zone, soil profile type, and importance factors.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

- A. In accordance with IBC, all equipment shall be anchored and braced to resist seismic forces prescribed in the code and ASCE/SEI 7, Chapter 13 or 15. All equipment includes equipment which is free standing, supported by stand frames, suspended, anchored to walls, and anchored to floors or slabs.
- B. Seismic anchorage and bracing for equipment shall be designed by a State of Washington Registered Structural Engineer using the site-specific seismic criteria.

1.05 SITE SEISMIC CRITERIA

- A. Short Periods, $S_d = 0.987$
- B. Importance Factor, $I_e = 1.0$.
- C. Site Class = D.
- D. Occupancy Risk Category: II.
- E. Seismic Design Category: D.
- F. Response Modification Coefficient and Amplification Factors: In accordance with ASCE/SEI 7 Sections 13.5 or 13.6.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

Division 22

Plumbing

SECTION 22 05 00
PLUMBING, GENERAL

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, tools, equipment, and services for all plumbing work as specified in Division 22, and as shown on the drawings.
- B. All work shall be completely coordinated with the work of all other trades and shall conform to all other provisions of the Contract Documents.
- C. Furnish and install all materials, appurtenances, devices, and miscellaneous items not specifically mentioned herein or noted on the drawings, but which are necessary to make a complete working installation of all plumbing systems.
- D. All plumbing fixtures and devices furnished or installed under other divisions of the specifications which require connection to the plumbing systems shall be connected under this division of the specifications.
- E. To eliminate all possible errors and interferences, this Contractor shall thoroughly examine the Architectural, Structural, Civil and Electrical Drawings and Specifications before work is started, and shall consult and coordinate with each of the Contractors regarding the work.
- F. The Contractor shall notify the Project Representative of any discrepancies or conflicts within the Contractor Documents or between the Contractor Documents and field conditions. The Contractor shall not proceed with any work or the purchasing of any materials for the area(s) of conflict until obtaining written instructions from the Project Representative on how to proceed. Any work done by the Contractor after his discovery of such discrepancies or conflicts and prior to obtaining the Project Representative's instructions on how to proceed, shall be done at the Contractor's expense.

1.02 DRAWINGS

- A. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.
- B. The drawings are diagrammatic and show the general arrangement of the construction and therefore do not necessarily show all offsets, fittings and accessories which are required to form a complete and operating installation.
- C. The precise location of plumbing fixtures and devices shall, in every case, be subject to the Project Representative's approval, and no allowances will be permitted the Contractor for any changes resulting from his failure to secure approval.
- D. The Contractor shall be responsible for checking field conditions and verifying all measurements and relationships indicated on the drawings before proceeding with the work.
- E. The installation of plumbing systems shall follow the drawings as closely as actual building construction and the work of other trades permit.

1.03 SYSTEM DESCRIPTION

- A. The work includes providing complete and operational plumbing systems for the Attendant Building, Operator Warming Station Building, and LHHW Building as shown on the drawings and described herein.
- B. Insulation: The work shall include furnishing and installing piping insulation in accordance with the Washington State Energy Code and as described herein.
- C. Plumbing Fixtures and Devices: The work shall include furnishing and installing all plumbing fixtures and all accessories necessary to provide complete and operable systems as shown on the drawings and as described herein.
- D. Outside Utilities: Field verify locations of exterior utilities prior to commencing with work to connect to utilities outside of the building.

1.04 DEFINITIONS

“Provide” means “furnish and install complete and ready for use”.

“Governing codes” means “the applicable provisions of the:

Washington State Energy Code - 2018

International Building Codes - 2018

Uniform Plumbing Code - 2018

NFPA National Fire Codes – Latest Additions

Washington State General Safety and Health Standards and all local amendments to these codes.

“Finished Areas” means “areas listed on the architectural drawings as receiving a finish coat of paint”.

“As indicated” means “as shown on the drawings and described in the specifications”.

“Concealed” means “built into the construction and not exposed to view”.

“As required” means “as necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all governing codes”.

Abbreviations:

AFF Above Finish Floor

ANSI American National Standards Institute

ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
CISPI	Cast Iron Soil Pipe Institute
IAPMO	International Association of Plumbing and Mechanical Officials
NEMA	National Electric Manufacturers Association
NFPA	National Fire Protection Association
NPS	Nominal Pipe Size
per	in accordance with
PSI	Pound per Square Inch Gage Pressure
PVC	Polyvinyl chloride
SP	Static Pressure
UL	Underwriter's Laboratories
w.g.	Water Gage (inches of water)
W.P.	Working Pressure

Additional abbreviations are as listed on the drawings or elsewhere in these specifications.

1.05 QUALITY ASSURANCE

- A. All work shall be in accordance with the codes which are defined as making up the "Governing Codes".
- B. It shall be the Contractor's responsibility to acquaint themselves with the requirements of all applicable codes.
- C. On completion of the work, satisfactory evidence shall be furnished to show that all work has been installed in accordance with all codes and that all inspections required have been successfully passed.
- D. Permits and Fees: Refer to the Instructions to Bidders Specification Section.
- E. Contractor shall coordinate with the electrical work provided under Division 26 including coordinated shop drawings.

1.06 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data.
 - 2. Manufacturer's Written Instructions.
 - 3. Shop Drawings.
 - 4. Samples.
 - 5. Sample Warranties: Provide a Sample Warranty for each Warranty required in this section:
 - a. Each Sample Warranty shall be marked 'SAMPLE'.
 - b. Include project-specific information, and proposed exclusions, if any, identified by the manufacturer.
 - 6. Statement of Installer Qualifications.
 - 7. Manufacturer's Technical Representative Contact Information.
 - 8. Engineering Calculations.
 - 9. Certified Test Results.
 - 10. Sample Warranty.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 92 13, "Operation and Maintenance Manuals."
 - 2. Special Warranties.
- D. Provide submittals for all equipment supplied under the work of this division.
- E. Refer to individual Division 22 specification sections for additional information and shop drawing requirements.

1.07 RECORD DATA

- A. Record Drawings: The contractor will be furnished with a clean, full-size set of construction drawings which shall be used to update project plumbing drawings for submittal to the Project Representative. Contractor identification shall be added to each of the drawings which indicate the name of the responsible contractor for the "Record" information and the

date of the "Record" drawing submittal. All changes from the original contract drawings shall be delineated with bubbled clouding keyed or flagged to the "Record" drawing revision. At the completion of the project, the contractor shall deliver to the Project Representative one complete set of redline contract drawings upon which any changes during construction are neatly drafted.

1.08 SPECIAL TOOLS

- A. At the completion of the project this Contractor shall furnish to the Project Representative one complete set of any and all special tools such as odd size wrenches, keys, etc. which are necessary to service or adjust any piece of equipment installed under this contract. Each tool shall be marked or tagged to identify its use.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products by the manufacturers listed as Acceptable Manufacturers are acceptable substitutions for the specified products. Products by these manufacturers used as substitutions shall be equal to or superior to the specified item in function, appearance, and quality.
- B. The approval of a manufacturer as an Acceptable Manufacturer applies to the Manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications. Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any substitutions.

2.02 SUBSTITUTIONS

- A. All substitutions for products under Division 22 shall be reviewed for acceptance by the Project Representative as indicated herein.
- B. To obtain acceptance of desired substitutions the manufacturer, Contractor or supplier shall submit the following information on the proposed substitution in accordance with Section 01 60 00, "Product Requirements."
 - 1. Differences between proposed substitution and specified item with a summary describing the technical benefit in using the proposed substitution.
 - 2. Changes in building design required to accommodate the proposed substitutions.
 - 3. Effect that the proposed substitution has on other trades.
 - 4. Complete technical data on the proposed substitution.
- C. Proposed substitutions shall match the specified item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Project Representative shall review the proposed substitution for conformance with the plans and specifications in addition to prior technical support experience with the proposed manufacturer and/or local manufacturer's representative and shall make a determination of acceptance or nonacceptance based on this criterion.

- D. The acceptance of a substitution applies to the manufacturer only, and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.
- E. The Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any substitutions.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive the Work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of Work constitutes acceptance of conditions.

3.02 WORKMANSHIP

- A. This Contractor shall furnish and install all equipment included in the Contract to provide completed systems with a neat and finished appearance. If, in the judgment of the Project Representative any portion of the work has not been installed in accordance with the drawings and specifications in a neat workmanlike manner, the Contractor shall be required to revise the work and comply with the drawings and specifications in an acceptable manner to the Project Representative, at no increase in cost to the Owner.

3.03 CUTTING AND PATCHING

- A. The General Contractor shall provide all required spaces and provisions in structures of new construction for the installation of work of all other contractors or subcontractors who are responsible to coordinate requirements for their equipment, Cutting and Patching of structures in place made necessary to admit work, repair defective work, or by neglect of contractors and subcontractors to properly anticipate their requirements, shall be done by the General Contractor at the expense of the Contractors or subcontractors responsible.
- B. Patching Materials: Patching shall be with materials of like kind and quality of the adjoining surface by skilled labor experienced in that particular trade.
- C. Areas to be Cut and Patched: Wherever floors, walls, ceilings, plates, fire stops, or framing members are cut, openings shall be reinforced as directed to maintain structural integrity and to comply with Building Code requirements.
- D. Cutting of Structural Features: Make no cuts or alterations to any structural framing members without explicit consent of the Project Representative and then only under his direction. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. All required cutting to install material shall be accomplished with the use of saw cutting equipment.

3.04 INSTALLATION

- A. Install plumbing fixtures and devices to permit easy access for normal maintenance, so that parts requiring periodic replacement or maintenance can be removed. Relocate items which interfere with access.
- B. Devices which are manually adjusted or operated shall be located so as to be easily accessible. Any such items which are not in the open shall be made accessible through access openings in the building construction.
- C. Gauges, thermometers, instrumentation and other components which are installed to monitor equipment performance, operating conditions, etc., shall be oriented so as to be easily read by a person standing on the floor. Provide necessary brackets and hangers as needed.
- D. If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Project Representative before installing the item in a poor access location.

3.05 WATERPROOFING

- A. Where any work pierces waterproofing, method of installation shall be as approved by the Project Representative before work is done. Contractor shall furnish all necessary caulking and flashing required to make openings absolutely watertight.
- B. All equipment or material located outdoors shall be waterproof.

3.06 FINAL INSPECTION AND INSTRUCTION

- A. Prior to acceptance of the Plumbing work, the Contractor shall put all Plumbing systems into operation so that they may be inspected by the Project Representative and the Owner's representatives on the operation and maintenance of all equipment. The contractor shall provide a minimum 2 hour instruction period to review each major item of equipment and provide instructions by the installing subcontractor. Refer to other sections of Division 22 for additional instruction and training requirements.
- B. The Contractor's Representatives who conduct these instructions and demonstrations shall be qualified foremen or superintendents acquainted with this project and the trades involved.
- C. Instructions: Shall include preliminary discussion on the system's operation and presentation of information from product submittal data with appropriate references to drawings, followed by a tour of the building spaces explaining maintenance requirements, access methods, servicing, and maintenance procedures, temperature settings and available system and equipment adjustments.
- D. Notice of the Contractor's readiness to conduct the instruction and demonstrations shall be given to the owner and Project Representative at least one week prior to proposed periods and mutually agreed upon times arranged.

END OF SECTION

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SECTION 22 05 19
GAUGES FOR PLUMBING SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Liquid-in glass thermometers.
 - 2. Thermowells.
- B. Related Sections:
 - 1. 01 33 00, "Submittal Procedures."
 - 2. 01 42 19, "Reference Standards."
 - 3. 01 43 00, "Quality Assurance and Control."
 - 4. 01 60 00, "Product Requirements."
 - 5. 01 77 00, "Closeout Procedures."
 - 6. 22 11 16, "Domestic Water Piping."
 - 7. 22 11 19, "Domestic Water Piping Specialties."
 - 8. 22 45 00, "Emergency Plumbing Fixtures."

1.02 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:
- B. American Society of Mechanical Engineers (ASME) <http://www.asme.org>.
 - 1. ASME B40.200 – Thermometers, Direct Reading and Remote Reading.
 - 2. ASME B1.1 – Unified Inch Screw Threads (UN and UNR Thread Form).
 - 3. ASME B1.20.1 – Thread Depth.

1.03 DEFINITIONS

- A. Thermowell: A fitting used to provide isolation between a temperature sensor and the environment whose temperature is to be measured.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data on all products submitted.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."
 - 2. Special Warranties:

1.05 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements," and the requirements of this section.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. Terice, H.O. Co.
 - b. Weiss Instruments, Inc.
 - c. Winters Instruments - U.S.
 - d. Or Approved Equal.
 - 2. Standard: ASME B40.200.
 - 3. Case: Cast aluminum; nominal size unless otherwise indicated.
 - 4. Case Form: Adjustable angle unless otherwise indicated.
 - 5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1% of scale range or one scale division, to a maximum of 1.5% of scale range.

B. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI .
4. Material for Use with Steel Piping: CRES CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1 ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

C. Heat-Transfer Medium: Mixture of graphite and glycerin.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.
- B. Install thermowells with socket extending a minimum of one-third of pipe diameter and in vertical position in piping tees.
- C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- D. Install thermowells with extension on insulated piping.
- E. Fill thermowells with heat-transfer medium.
- F. Install thermometers in the following locations:
 - 1. Outlet of each water heater.
 - 2. Outlet of each thermostatic mixing valve.
 - 3. Additional locations as indicated on Drawings.

3.03 ADJUSTING

- A. Adjust faces of meters and gauges to proper angle for best visibility.

3.04 SCHEDULES

- A. Thermometer schedule:
 - 1. All thermometers shall be the following: Industrial style, liquid in-glass type.
- B. Thermometer scale-range schedule.
- C. Scale range for domestic water: 0° to 210°F.

END OF SECTION

SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.
- B. Related Sections:
 - 1. 01 33 00, "Submittal Procedures."
 - 2. 01 42 19, "Reference Standards."
 - 3. 01 43 00, "Quality Assurance and Control."
 - 4. 01 60 00, "Product Requirements."
 - 5. 01 77 00, "Closeout Procedures."
 - 6. 22 11 16, "Domestic Water Piping."

1.02 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards;" and as listed herein. The following is a list of standards referenced in this section:
 - 1. American Society of Testing and Materials (ASTM) <http://www.astm.org>
 - a. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings.
 - 2. Manufacturers Standardization Society. <http://www.msshq.org>
 - a. MSS SP-80 – Bronze Gate, Globe, Angle, and Check Valves.
 - b. MSS SP-110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
 - 3. American Society of Mechanical Engineers (ASME) <http://www.asme.org>:
 - a. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
 - b. ASME B1.20.1 – Pipe Threads, General Purpose, Inch.

1.03 DEFINITIONS

- A. Actuator – A mechanical device for moving and controlling valves.
- B. EPDM – Ethylene propylene diene Monomer rubber.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: For each type of product submitted
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.05 DELIVERY, STORAGE AND HANDLING

- A. Prepare valves for on-site storage as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Hand Lever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With 1-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.
3. Copper Pressure-Seal-Joint Fittings: Wrought copper or cast bronze fittings with EPDM-rubber O-ring seal at each end.

2.02 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Milwaukee Valve Company.
 - c. Nibco, Inc.
 - d. Viega Conbraco Industries; Apollo Valves.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - f. Or Approved Equal.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded, Solder joint or pressure seal.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.03 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - e. Or Approved Equal.
2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.03 APPLICATION

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends, solder-joint valve-ends or pressure seal ends.

3.04 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.05 DOMESTIC, HOT, COLD AND TEPID-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: May be provided with threaded solder-joint or pressure-sealed ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, bronze with bronze trim.
 - 3. Bronze Swing Check Valves: Class 125, bronze disc.

3.06 EXAMINATION

- A. Verify 3 Work constitutes acceptance of conditions.

3.07 PREPARATION

- A. Field Measurements: Verify on job before beginning Work.

3.08 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.

END OF SECTION

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Metal pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Fastener systems.
 - 4. Equipment supports.
 - 5. Pipe sleeves.
 - 6. Seals.
- B. Related Sections:
 - 1. 01 33 00, "Submittal Procedures."
 - 2. 01 42 00, "Reference Standards."
 - 3. 01 43 00, "Quality Assurance and Control."
 - 4. 01 60 00, "Product Requirements."
 - 5. 01 77 00, "Closeout Procedures."
 - 6. 09 96 00, "High-Performance Coatings"
 - 7. 22 11 16, "Domestic Water Piping."
 - 8. 22 13 16, "Sanitary Waste and Vent Piping."
 - 9. 22 40 00, "Plumbing Fixtures."
 - 10. 22 45 00, "Emergency Plumbing Fixtures."

1.02 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards" and as listed herein. The following is a list of standards referenced in this section:
 - 1. NPS - American National Standards Institute Nominal Pipe Size – <http://www.ansi.org>.
 - 2. American Society of Mechanical Engineers (ASME) B31.9 – Working Pressure and Temperature Limits <http://www.asme.org>.

3. American Society for Testing Materials (ASTM) – <http://www.astm.org>.
 - a. ASTM C533 – Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - b. ASTM C552 – Standard Specification for Cellular Glass Thermal Insulation.
 - c. ASTM C591 – Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
4. Manufacturer's Standardization Society (MSS):
 - a. SP-58 Pipe Hangers and Supports -Materials, Design, Manufacture, Selection, Application and Installation.
 - b. SP-69 Pipe Hangers and Supports – Selection and Application.
 - c. SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices.

1.03 DEFINITIONS

- A. Galvanized – Iron or Steel coated with zinc.

1.04 SYSTEM DESCRIPTION

- A. Supports, sleeves and seals for piping systems within the building and that extend to five feet outside building foundations.

1.05 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 1. Product Data: On all products submitted.
- C. Closeout Submittals:
 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 92 13, "Operation and Maintenance Manuals."

1.06 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 TRAPEZE PIPE HANGERS

- #### **A. Description:** MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 2. ERICO International Corporation.
 3. National Pipe Hanger Corporation.
 4. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 5. Piping Technology & Products, Inc. <http://www.pipingtechnology.com>.
 6. Or Acceptable Equal.
- B. Insulation-Insert Material for Hot Piping:** Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig, ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems:** Insert and shield shall cover entire circumference of pipe.

- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 PIPE SLEEVES

- A. Inside diameter of pipe sleeves shall be at least 1/2 inch larger than the outside diameter of the pipe or pipe covering and so as to follow free movement of piping.
- B. Sleeve ends shall be cut flush with finished surfaces, except in rooms having floor drains where sleeves shall be extended 3/4 inch above finished floor unless otherwise noted.
- C. Sleeves through structural elements shall be fabricated from Schedule 40 steel pipe.
- D. Sleeves through nonstructural elements shall be fabricated from 18 gauge galvanized sheet metal or 24 gauge spiral duct.

2.05 SEALS

- A. General Sealants:
 - 1. Silicone Sealant: Furnish single-component type similar to "General Electric Silicone Sealant 1300", or "Dow-Corning No. 780", or Approved Equal, with Dow "Ethafoam Rod" backing material.
 - 2. Sealant Color: Furnish stock colors to match adjacent material, as approved by the Architect.
- B. Exterior Wall, Below Grade Wall and Floor Seals:
 - 1. Seals for penetrations in exterior masonry or concrete walls, all below grade wall and below grade concrete floor penetrations shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal assembly shall expand when mechanically tightened to provide an absolute watertight seal between the pipe and wall opening. Sizing shall be per manufacturer's recommendations. Seal shall be Thunderline "Link-Seal" or Approved Equal.

PART 3 – EXECUTION

3.01 INSTALLERS

- A. Minimum 5 years documented experience.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Section 22 40 00, "Plumbing Fixtures" and Section 22 45 00, "Emergency Plumbing Fixtures" for requirements for pipe positioning systems for plumbing fixtures.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- H. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - b. Cold water piping shall be installed with pipe clamps direct to piping without shield inserts.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/2 to NPS 1-1/4: 6 inches long and 0.048 inch thick.
 - 4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- I. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- J. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.03 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in sections specifying piping systems and equipment.

- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS-58 and MSS-69 Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30. Provide with insulation shield for insulated piping.
 - 2. Steel Pipe Clamps (MSS-58 and MSS-69 Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 3. Pipe Hangers (MSS-58 and MSS-69 Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS-58 and MSS-69 Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
 - 5. Adjustable, Swivel-Ring Band Hangers (MSS-58 and MSS-69 Type 10) For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 8. Provide with insulation shield for insulation piping.

3.04 INSTALLATION OF PIPE SLEEVES

- A. Provide pipe sleeves for all piping passing through walls, floors, roofs, foundations, footings and grade beams.
- B. Set sleeves plumb and level, in proper position, tightly fitted into the work.
- C. Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire or smoke rating.
- D. Seal around all pipes inside of pipe sleeve.

3.05 INSTALLATION OF SEALS

- A. Caulk with sealant all joints as called for on the drawings and all joints at the interior and exterior wall juncture of all mechanical items such as, but not limited to, plumbing fixtures, domestic water piping and waste and vent piping.
- B. Seals shall be of material and workmanship to maintain the fire and smoke rating of element being penetrated.
- C. Seals shall be watertight where an opening may be exposed to water or moisture. All below grade pipe penetrations shall be sealed using mechanically expanded "Link-Seals" for water tight seal.
- D. Sealant Installation:
 - 1. Apply sealants with hand-pointing tools. Fill joints completely flowing into joint to back up material, spreading laterally without voids to full contact with joint sides. Use masking tape each side of joint where appearance of materials each side of joint is important. Prime surfaces as recommended by sealant manufacturer.
 - 2. Tool joint surfaces smooth with water or solvent of type and in manner recommended by sealant manufacturer. Install sealants only when temperatures are within manufacturer's recommended limits.
 - 3. Where sealed penetrations are exposed to view, paint to match adjacent material as directed by the Architect.

3.06 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.07 PROTECTION

- A. Corrosion Protection:
 - 1. All galvanized and ungalvanized non-stainless steel supports, brackets, clips, clamps, bracing, standoffs, framing, shims, and the like provided to attach and support mechanical components to the buildings, and other defined supporting elements shall be coated using a high-performance coating system specified in Section 09 96 00, "High-Performance Coatings."
 - a. Nongalvanized steel elements shall be coated using coating system PC-1.
 - b. Galvanized steel elements shall be coated using coating system PC-2.
 - 2. Steel supports, brackets, clips, clamps, bracing, standoffs, framing, shims and the like fabricated from highly corrosion resistant steel alloy shall not require coating.

3. To the maximum extent practical, the coating systems shall be shop applied and field touched up rather than field applied.
4. All fasteners (screws, bolts, washers, nuts, and the like) used to assemble the coated supports, brackets, clips, clamps, bracing, standoffs, framing, shims, and the like shall be stainless steel, type 304 or 316 or similar highly corrosion resistant steel alloy."

END OF SECTION

SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Heat Tracing for exposed water piping and drains:

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 22 07 00, "Plumbing Insulation."
7. 22 11 16, "Domestic Water Piping."
8. 22 40 00, "Plumbing Fixtures."
9. 22 45 00, "Emergency Plumbing Fixtures."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:

1. National Electrical Codes.

1.03 SUBMITTALS

A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."

B. Approval Submittals:

1. Product Data: For each type of product indicated.
2. Product instruction sheets and training materials.

C. Closeout Submittals:

1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."
2. Special Warranties: 2 year manufacturer's warranty.

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.
- B. Installation personnel shall be familiar with the manufacturer's product instruction sheets and training materials.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements," and the requirements of this section.

PART 2 – PRODUCTS

2.01 HEAT TRACE MATERIALS

- A. Pre-Assembled self-regulating heating cables for freeze protection of pipes, valves and trap drain assemblies.
- B. Heat cables provided in 120 V with various line lengths with plug-in power cord.
- C. Heat trace cable shall be nVent RAYCHEM FrostGuard or approved equal.
- D. Heat trace cable product instruction sheets and training materials available at www.nvet.com.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.
- C. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the heat trace cable.
- D. Verify that surfaces to be heat traced are clean and dry.
- E. Verify that power supply through a GFI receptacle is available for connection of heat trace cable.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install system in accordance with applicable codes and regulations, National Electrical Codes and manufacturer's written instructions, and this section.
- B. Install heat trace cable prior to insulation of piping, stop valves and P-traps.
- C. Install heat trace cable to ensure full coverage of piping, stop valves and P-traps to ensure adequate coverage for freeze protection.

END OF SECTION

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPE AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.
- B. Related Sections:
 - 1. 01 33 00, "Submittal Procedures."
 - 2. 01 42 19, "Reference Standards."
 - 3. 01 43 00, "Quality Assurance and Control."
 - 4. 01 60 00, "Product Requirements."
 - 5. 01 77 00, "Closeout Procedures."
 - 6. 22 11 16, "Domestic Water Piping."
 - 7. 22 13 16, "Sanitary Waste and Vent Piping."
 - 8. 22 40 00, "Plumbing Fixtures."
 - 9. 22 45 00, "Emergency Plumbing Fixtures."

1.02 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards," and as listed herein.

1.03 SYSTEM DESCRIPTION

- A. All Division 22 system piping, specific system isolation valves and equipment shall be identified and labeled as specified in this section. Refer to individual sections and Drawings for piping system, valves and equipment identification. Plumbing fixtures and

plumbing fixture stops provided under Section 22 40 00, "Plumbing Fixtures," and Section 22 45 00, "Emergency Plumbing Fixtures," shall not be labeled except water heaters and thermostatic mixing valves provided in these sections shall be labeled.

1.04 SUBMITTALS

A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."

1. Submit a list of all proposed Tags and Labels.

B. Approval Submittals:

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

a. Include project-specific information, and proposed exclusions, if any, identified by the manufacturer.

2. Samples: For color, letter style, and graphic representation required for each identification material and device.

3. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

4. Valve labeling to include building water service isolation valves.

C. Quality Assurance Submittals:

1. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.

D. Closeout Submittals:

1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.05 QUALITY ASSURANCE

A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of 01 60 00, "Product Requirements," and the requirements of this section.

PART 2 – PRODUCTS

2.01 EQUIPMENT LABELS

A. Equipment Labels:

1. Plastic Labels for Equipment:

- a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch thick, and having predrilled holes for attachment hardware.
- b. Letter Color: Black.
- c. Background Color: White.
- d. Maximum Temperature: Able to withstand temperatures up to 160°F.
- e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- f. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- g. Fasteners: Stainless-steel rivets, self-tapping screws or size 1/0 plumbers brass safety chain.
- h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- i. Label Content: Include equipment's Drawing designation or unique equipment number.
- j. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 VALVE LABELS

A. Plastic Labels for Valves:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch thick, and having pre-drilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.

4. Maximum Temperature: Able to withstand temperatures up to 160°F.
5. Minimum Tag Size: 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch.
7. Fasteners: size 1/0 plumbers brass safety chain.

B. Label Content: Valve service descriptor.

2.03 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded per ANSI Color Code Standards, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to fully cover the circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
- E. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 PREPARATION

- A. Field Measurements: Verify on job before beginning Work.
- B. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.03 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.

B. Equipment Label Installation:

1. Install or permanently fasten labels on each major item of mechanical equipment.
2. Locate equipment labels where accessible and visible.

C. Valve and Pipe Label Installation:

1. Provide pipe labels where piping is exposed or above accessible ceilings in finished spaces; accessible maintenance spaces such as attics and mechanical spaces as follows:
 - a. Label each building water service isolation valve.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. At access doors that permit view of concealed piping.
 - d. Near major equipment items and other points of origination and termination.

END OF SECTION

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SECTION 22 07 00
PLUMBING INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Insulation Materials:
 - a. Fiberglass insulation.
 - b. Calcium silicate.
 - c. Flexible elastomeric.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Field-applied jackets.
8. Tapes.
9. Securements.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 22 05 19, "Gauges for Plumbing Systems."
7. 22 05 23, "General Duty Valves for Plumbing."
8. 22 05 29, "Hangers and Supports for Plumbing."

9. 22 05 53, "Identification for Plumbing Pipe and Equipment."

10. 22 11 16, "Domestic Water Piping."

11. 22 11 19, "Domestic Water Piping Specialties."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:

1. American Society of Testing and Materials (ASTM): www.astm.org.

- a. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- b. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
- c. ASTM C196 – Standard Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement.
- d. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.
- e. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

2. Military Specifications (MIL):

- a. MIL A 3316C – Military Specification Adhesives, Fire-Resistant, Thermal Insulation: www.wbdg.org.
- b. MIL PRF-19565C – Performance Specification for Coating Compounds, Thermal Insulation, Fire- and Water Resistant, Vapor Barrier.

3. California Department of Health Services: www.cdph.ca.gov.

- a. Standard Practice for Testing of VOCs from Various Sources Using Small-Scale Environmental Chambers.

4. American Society of Heating, Refrigeration and Air Conditioning: www.ashrae.org.

- a. ASHRAE 90-1 – Standards for Buildings Except Low Rise Residential Buildings.

5. National Fire Protection Association (NFPA) : www.nfpa.org:

- a. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating.

NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

1.03 DEFINITIONS

- A. ASJ – All Service Jacket.
- B. PVC – Poly Vinyl Chloride.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
- C. Quality Assurance Submittals:
 - 1. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.

1.05 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.
- B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- C. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- D. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29, "Hangers and Supports for Plumbing."

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements," and the requirements of this section.
- B. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

PART 2 – PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Mineral or Glass Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000-Degree Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - d. Or Approved Equal.
 - 2. Type I, 850°F (454°C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in “Factory-Applied Jackets” Article.

2.02 INSULATING CEMENTS

- A. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
 - 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Ramco Insulation, Inc.; Thermokote V.
 - b. Or Approved Equal.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
 - 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services’ “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers,” including 2004 Addenda.

B. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Or Approved Equal.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. Speedline Corporation; Polyco VP Adhesive.
 - d. Or Approved Equal.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.05 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 - d. Or Approved Equal.
 - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over insulation.
 - 4. Service Temperature Range: 0 to +180°F.
 - 5. Color: White.

2.06 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Pittsburgh Corning Corporation; Pittseal 444.
 - e. Or Approved Equal.
- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: -100 to +300°F.
 - 5. Color: White or gray.
 - 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
- 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Or Approved Equal.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: -40 to +250°F.
 - 5. Color: White.
 - 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.07 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96 , Procedure A, and complying with NFPA 90A and NFPA 90B.

2.08 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2%.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 - d. Or Approved Equal.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500%.
 - 6. Tensile Strength: 18 lbf/inch in width.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.
- C. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
- D. Verify that systems to be insulated have been tested and are free of defects.
- E. Verify that surfaces to be insulated are clean and dry.

3.02 PREPARATION

- A. Field Measurements: Verify on job before beginning Work.
 - 1. Surface Preparation: Clean and prepare surfaces to be insulated.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Keep insulation materials dry during application and finishing.
- F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- G. Install insulation with least number of joints practical.
- H. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- I. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge.
 - 3. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- J. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.
- K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- L. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Acceptable preformed pipe insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage and vent piping except exposed P-traps located outside.
 - 2. Underground piping.
 - 3. Cold water piping.
- D. Insulate domestic hot water and tepid hot water piping.
- E. Insulation Installation on Fittings, Valves and Unions:
 - 1. Do not insulate over valves and unions except for valves exposed to freezing.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 5. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 6. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- F. Insulate instrument connections for thermometers on insulated pipes. Shape insulation at connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.05 INSTALLATION OF MINERAL OR GLASS FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

3.06 PIPING INSULATION SCHEDULE

A. Piping insulation shall be one of the following:

1. Mineral or glass fiber.

B. CW - Domestic cold water piping:

1. Do not insulate domestic cold water piping except where exposed to freezing.

C. Domestic hot water piping:

1. All pipe sizes: Insulation shall be one of the following:
 - a. Mineral or glass fiber: 1 inch thick.

D. Tepid water Piping:

1. All pipe sizes: Insulation shall be one of the following:
2. Mineral glass fiber: 1 inch thick.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Domestic water piping and fittings.
2. Under-building slab domestic water piping and fittings connected to domestic water service piping.
3. Specialty valves.
4. Flexible connectors.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 22 05 19, "Gauges for Plumbing Systems."
7. 22 05 23, "General Duty Valves for Plumbing."
8. 22 05 53, "Identification for Plumbing Pipe and Equipment."
9. 22 11 19, "Domestic Water Piping Specialties."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:

1. American Society of Mechanical Engineers (ASME): www.asme.org:
 - a. ASME B1.20.1 – Pipe Threads, General Purpose.
 - b. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
 - c. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

- d. ASME B16.24 –Cast Copper Alloy Pipe Flanges and Flanged Fittings.
 - e. ASME B18.2.1 – Square and Hex Bolts and Screws, Inch Series.
 - f. ASME B31.9 – Building Services Piping.
 - g. ASME B813 – Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
2. American Society of Testing and Materials (ASTM): www.astm.org:
 - a. ASTM B 32 – Standard Specification for Solder Metal.
 - b. ASTM B 88 – Standard Specification for Seamless Copper Water Tube.
 - c. ASTM B 813 – Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
 - d. ASTM B 828 – Standard practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
 3. American Welding Society (AWS): www.aws.org:
 - a. AWS A5.8 – Specification for Filler Metals for Brazing and Braze Welding.
 4. Manufacturer’s Standardization Society (MSS): www.mss.org:
 - a. MSS SP-123 – Non-Ferrous Threaded and Solder Joint Unions.
 5. CDA Copper Tube Hand Book.
 6. American Water Works Association (AWWA): <https://www.awwa.org>.
 - a. AWWA C110 – American National Standard for Ductile-Iron and Gray-Iron Fittings. for Water.
 - b. AWWA C219 – Bolted Sleeve-Type Couplings for Plain-End Pipe.
 - c. AWWA C651 – Disinfecting Water Mains.
 - d. AWWA C652 – Disinfecting of Water-Storage Facilities.

1.03 DEFINITIONS

- A. Domestic water piping: Water piping that has been installed, cleaned, disinfected, flushed and sample-tested satisfactorily for human consumption.
- B. Non-potable water piping: Water piping which is isolated from potable water piping by approved backflow prevention devices and is labeled “Non-Potable Water”.
- C. MSS – Manufacturers Standardization Society of the Valve and Fitting Industry.

1.04 SYSTEM DESCRIPTION

- A. The water piping systems consist of a network of insulated hot, cold, and tepid potable water piping which connect the plumbing fixtures, water heaters, and water specialties into an integrated plumbing system.

1.05 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.06 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements," and the requirements of this section.

PART 2 – PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

- 5. Copper Pressure-Seal-Joint Fittings:
 - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - b. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
 - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 2. Copper Pressure-Seal-Joint Fittings:
 - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - b. NPS 3 and NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.03 PIPE JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.04 SPECIALTY VALVES

- A. Comply with requirements in Section 22 05 23, "General Duty Valves for Plumbing," for general-duty metal valves.
- B. Comply with requirements in Section 22 11 19, "Domestic Water Piping Specialties," for drain valves and vacuum breakers.

2.05 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.

2.06 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Pressure Rating: 150 psig at 180°F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig minimum.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Description:
 - a. Electroplated steel nipple.
 - b. Pressure Rating: 300 psig at 225°F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.07 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 PREPARATION

- A. Field Measurements: Verify on job before beginning Work.

3.03 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.
- B. Piping Installation:
 - 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
 - 2. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
 - 3. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Section 22 05 19, "Gauges for Plumbing Systems," for pressure gauges and Section 22 11 19, "Domestic Water Piping Specialties," for drain valves and strainers.
 - 4. Install shutoff valve immediately upstream of each dielectric fitting.

5. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Section 22 11 19, "Domestic Water Piping Specialties," for pressure-reducing valves.
6. Install water piping level and plumb.
7. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
8. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
9. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
10. Install piping adjacent to equipment and specialties to allow service and maintenance.
11. Install piping to permit valve servicing.
12. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
13. Install piping free of sags and bends.
14. Install fittings for changes in direction and branch connections.
15. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
16. Install pressure gauges on suction and discharge piping from each plumbing pump. Comply with requirements in Section 22 05 19, "Gauges for Plumbing Systems," for pressure gauges.
17. Install thermometers on outlet piping from each water heater. Comply with requirements in Section 22 05 19, "Gauges for Plumbing Systems," for thermometers.
18. Install sleeves for piping penetrations of walls, ceilings, and floors.
19. Install sleeve seals for piping penetrations of concrete walls and slabs.
20. Install escutcheons for piping penetrations of walls, ceilings, and floors.

C. Joint construction:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
4. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
5. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
6. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
7. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
8. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

D. Valve installation:

1. General-Duty Valves: Comply with requirements in Section 22 05 23, "General Duty Valves for Plumbing," for valve installations.
2. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball for piping NPS 2 and smaller.
3. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Section 22 11 19, "Domestic Water Piping Specialties."
 - a. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - b. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

E. Transition fitting installation:

1. Install transition couplings at joints of dissimilar piping.
2. Transition Fittings in Underground Domestic Water Piping:
 - a. NPS 1-1/2 and Smaller: Fitting-type coupling.

F. Dielectric fitting installation:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

3.04 FLEXIBLE CONNECTOR INSTALLATION

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Plumbing Fixtures and Emergency Plumbing Fixtures: Cold-hot-tepid-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture sections for connection sizes.

3.06 IDENTIFICATION

- A. Identify system components. Comply with requirements in Section 22 05 53, "Identification for Plumbing Pipe and Equipment," for identification materials and installation.

3.07 PIPING SCHEDULES

- A. Above grade potable and tepid water piping shall be Type L copper with solder or pressure-seal-joint fittings.
- B. Below grade potable water piping shall be Type K soft copper tube with brazed fittings. Piping shall have no joints underground except at connection to exterior potable water service piping.

3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 1. Fill domestic potable water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and for corrective action required.
- D. Water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.09 CLEANING

- A. Clean interior of water piping systems. Remove dirt and debris as work progresses.
- B. Clean and disinfect nonpotable water piping and potable domestic water piping as follows:
1. Purge all new piping.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION

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SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Water hammer arrestors.
2. Trap seal primer valves.
3. Trap seals.
4. Access Doors.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 22 05 53, "Identification for Plumbing Pipe and Equipment."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:

1. American Society of Mechanical Engineers (ASME) www.asme.org:
 - a. ASME A112.1.2 – Air Gaps in Plumbing Systems.
 - b. ASME A112.18.1 –Plumbing Supply Fittings.
 - c. ASME A112.21 – Non-Vitreous Plumbing Supply Fixtures.
 - d. ASME B1.20.7 – Hose Coupling Screw Threads (Inch).
2. American Society of Safety Engineers (ASSE) www.asse.org:
 - a. ASSE 1010 – Water Hammer Arrestors.

- b. ASSE 1011 – Hose Connection Vacuum Breakers.
 - c. ASSE 1018 – Performance Requirements for Trap Seal Primer Valves – Potable Water Supplied.
 - d. ASSE 1044 – Trap Seal Primer – Drainage Types and Electric Design Types.
3. American Water Works Association (AWWA) www.awwa.org:
 - a. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.
 4. Plumbing and Drainage Institute (PDI-WH) 201 - Water Hammer Arrestor Standard. www.pdionline.org.
 5. National Sanitation Foundation (NSF) 61 – Drinking Water System Components – Health Effects; Sections 1 through 9. www.nsf.org.

1.03 DEFINITIONS

- A. CWP – Continuous working pressure.
- B. GPM – Gallons per minute.
- C. NSF – National Sanitation Foundation.
- D. PSIG – Pounds per square inch, gage pressure.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, “Submittal Procedures.”
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, “Closeout Procedures.”

1.05 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, “Quality Assurance and Control,” and the requirements of this section.
- B. Comply with NSF 61, “Drinking Water System Components - Health Effects; Sections 1 through 9.”
- C. Performance requirements: 125 psig, unless otherwise indicated.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
 - 1. Manufacturers: Subject to compliance with requirements of the Contract Documents products by one of the following manufacturers may be incorporated in the work of this section:
 - a. PPP Inc.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - e. Or Approved Equal.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Metal bellows or Copper tube with piston.
 - 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.02 TRAP-SEAL PRIMER VALVES

- A. Supply-Type, Trap-Seal Primer Valves:
 - 1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. PPP Inc.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Sioux Chief Manufacturing Company.
 - e. Mifab Inc.
 - f. Josam Company.

- g. Or Approved Equal.
- 2. Standard: ASSE 1018 and ASSE 1044.
- 3. Pressure Rating: 125 psig minimum.
- 4. Body: Bronze.
- 5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
- 6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
- 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
- 8. Where indicated, electronic trap primers shall be provided with an electric plug connector.

2.03 TRAP SEAL

- A. In addition to providing trap primers, each 2" and 3" floor drain shall be provided with a Sure Seal Trap Guard or Approved Equal.

2.04 ACCESS DOORS

- A. Interior Access Doors:
 - 1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of one of the following manufacturers may be incorporated into the work of this section:
 - a. Nystrom: www.nystrom.com.
 - b. Acudor: www.acudor.com.
 - c. Williams Brothers: www.ubdoors.com.
 - d. Elmdor: www.elmdorstoneman.com.
 - e. Or Approved Equal.
 - 2. Features:
 - a. Door: 14 gauge cold rolled steel.
 - b. Frame: 18 gauge cold rolled steel with 1-inch flange.
 - c. Hinged: Concealed continuous piano.
 - d. Latch: Factory provided screw driver latch.
 - e. Finish: Paintable powder coat except stainless steel in restrooms and wet locations.

- f. Size: As noted on Drawings, minimum size 12-inch x 12-inch where size not indicated.
- 3. Acceptable Products:
 - a. Nystrom NTM.
 - b. Williams Brothers WP 6P 100.
 - c. Acudor MS-7000.
 - d. Elmdor DW Series.
 - e. Or Approved Equal.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.
- B. Install water hammer arresters in water piping according to PDI-WH 201.
- C. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1%, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- D. Install trap primer seal valves at all floor drains in addition to trap seals at all 2 inch and 3 inch floor drains.
- E. Piping installation requirements are specified in other Division 22 sections. Drawings indicate general arrangement of piping and specialties.
- F. Access Door installation:
 - 1. Coordinate framing of openings with other trades before fabricating or installing access doors. Provide detailed measurements for door locations to service intended concealed elements.
 - 2. Position units as indicated on Drawings and where required for service access.
 - 3. Install frames plumb and level.

4. Secure frames rigidly in place.
5. Joints: Apply sealant in accordance with provisions of Section 07 92 00, "Joint Sealant."
6. Comply with Manufacturer's instructions in O&M Manuals under Section 01 77 00, "Closeout Procedures."
7. Provide finish painting for prime coat or powder coat doors in accordance with Section 09 91 23, "Interior Painting," to match color of adjacent finished surfaces.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.04 ADJUSTING

- A. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Pipe, tube, and fittings.
2. Verification of invert elevations at points of connection to outside sanitary sewer piping.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 22 05 29, "Hangers and Supports for Plumbing."
7. 22 13 19, "Sanitary Waste and Vent Piping Specialties."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:

B. American Society of Testing and Materials (ASTM): www.astm.org.

1. ASTM D 2235 – Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
2. ASTM D 2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
3. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
4. ASTM D 2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
5. ASTM D 2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste and Vent Pipe Fittings.

6. ASTM D 2665 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
7. ASTM D 2855 – Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) pr Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets
8. ASTM D 3311 – Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
9. ASTM D 5926 – Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent Sewer, Sanitary, and Storm Plumbing Systems.
10. ASTM F 402 – Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
11. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
12. ASTM F 628 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core.
13. ASTM F 656 – Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
14. ASTM F 891 – Standard Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core.

C. Manufacturer's Standardization Society (MSS): www.mss.org:

1. SP-58 Pipe Hangers and Supports -Materials, Design, Manufacture, Selection, Application and Installation.
2. SP-69 Pipe Hangers and Supports – Selection and Application.

D. Uniform Plumbing Code – (UPC): www.upc.org.

1.03 DEFINITIONS

- A. MSS - Manufacturer's Standardization Society.

1.04 SYSTEM DESCRIPTION

- A. The waste and vent system consists of a network of drainage and vent piping interconnected with the building plumbing fixtures and drains to provide drainage and connection to the outside sanitary sewer lines from the building.
- B. Prior to proceeding with installation of underground piping, establish invert elevations relative to the building finish floor elevation.

1.05 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.06 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements," and the requirements of this section.

PART 2 – PRODUCTS

2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 ABS PIPE AND FITTINGS

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.
- C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- D. Solvent Cement: ASTM D 2235.
 - 1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
 - B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
 - C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
 - D. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - E. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- 1. Sleeve Materials:
 - 1) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas. Exposed piping within equipment spaces and within the Maintenance Shop shall be installed with cast iron pipe and fittings.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.
- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2% downward in direction of flow for piping NPS 3 and smaller; 2% downward in direction of flow for piping NPS 4 and larger unless specifically noted otherwise on the Drawings.
 - 2. Horizontal Sanitary Drainage Piping: 2% downward in direction of flow.
 - 3. Vent Piping: 0.5% down toward vertical fixture vent or toward vent stack.
- J. Make connections to underground ABS and PVC piping according to ASTM D 2321 (exterior use only).
- K. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 22 13 19, "Sanitary Waste and Vent Piping Specialties."

- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors.
- N. Install sleeve seals for piping penetrations of concrete walls and slabs. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 JOINT CONSTRUCTION

- A. Plastic, Non-Pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29, "Hangers and Supports for Plumbing."
 - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - 3. Vertical Piping: MSS SP-58 and MSS SP 69 Type 8 or Type 42 clamps.
 - 4. Install individual, straight, horizontal piping runs:
 - 1. MSS SP-58 and MSS SP 69 Type 1, adjustable, steel clevis hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base.

3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 22 13 19, "Sanitary Waste and Vent Piping Specialties."

3.06 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.

3.07 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.08 SCHEDULES

- A. Piping Schedule:
 1. Concealed aboveground, soil and waste piping shall be one of the following:
 1. ABS Schedule 40 pipe and fittings.
 2. PVC Schedule 40 pipe and fittings.
 2. Concealed aboveground vent piping shall be one of the following:
 1. ABS Schedule 40 pipe and fittings.
 2. PVC Schedule 40 pipe and fittings.
 3. Underground, soil, waste, and vent piping under the building slab shall be one of the following:
 1. ABS Schedule 40 pipe and fittings.
 2. PVC Schedule 40 pipe and fittings.
 4. Exterior underground soil and waste piping shall be one of the following:
 1. ABS Schedule 40 pipe and fittings.
 2. PVC Schedule 40 pipe and fittings.

3.09 INSPECTION AND TESTING

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
- E. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
- F. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- G. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
- H. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
- I. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- J. Prepare reports for tests and required corrective action.

END OF SECTION

SECTION 22 13 19
SANITARY WASTE AND VENT PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Cleanouts.
2. Roof flashing assemblies.
3. Miscellaneous sanitary drainage piping specialties.
4. Flashing materials.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 07 72 00, "Roof Accessories."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards" and as listed herein. The following is a list of standards referenced in this section:

1. American Society of Mechanical Engineers (ASME):
 - a. ASME A112.1.2 – Air Gaps in Plumbing Systems.
 - b. ASME A112.3.1 – Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above and Below-Ground.
 - c. ASME A112.36.2M – Cleanouts.

2. American Society for Testing and Materials (ASTM):
 - a. ASTM A74 – Standard Specification for Cast Iron Soil Pipe and Fittings.
 - b. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - c. ASTM B 32 – Standard Specification for Solder Metal.
 - d. ASTM D 4068 – Standard Specification for Chlorinated Polyethelene (CPE) Sheeting for Concealed Water-Containment Membrane.
3. National Sanitation Foundation (NSF) 14 – Plastic Piping System Components and Related Materials: www.nsf.org.
4. SSPC – Paint 12 – Cold Applied Asphalt Mastic (Extra Thick Film).

1.03 DEFINITIONS

- A. Galvanized – Iron or steel coated with zinc.
- B. Firestop – Materials used to close open parts of a building to prevent spread of fire.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 1. Product Data: For each type of product indicated.
- C. Closeout Submittals:
 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.05 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of 01 60 00, "Product Requirements" and the requirements of this section.

1.07 SEQUENCING

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 – PRODUCTS

2.01 CLEANOUTS

- A. Exposed:
 - 1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - b. Watts Drainage Products Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation.
 - d. Or Approved Equal.
 - 2. Standard: ASME A112.36.2M for cast iron cleanout test tee.
 - 3. Size: Same as connected drainage piping.
 - 4. Body Material: ABS or PVC as required to match connected piping.
 - 5. Closure: Countersunk brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - b. Watts Drainage Products Inc.

c. Zurn Plumbing Products Group; Specification Drainage Operation.

1) Or Approved Equal.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.

3. Size: Same as connected branch.

4. Type: Adjustable housing heavy-duty, adjustable housing.

5. Body or Ferrule: Cast iron.

6. Outlet Connection: Spigot.

7. Closure: Brass plug with tapered threads.

8. Adjustable Housing Material: Cast iron.

9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy, polished bronze in finished areas and rough bronze in unfinished areas.

10. Frame and Cover Shape: Round.

11. Top Loading Classification: Extra heavy duty in traffic areas and heavy duty in other areas.

12. Riser: ASTM A 74, Extra-heavy in traffic areas and service class in other areas, cast-iron drainage pipe fitting and riser to cleanout.

13. Standard: ASME A112.3.1.

14. Size: Same as connected branch.

15. Housing: Stainless steel.

16. Closure: Stainless steel with seal.

17. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:

a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

b. Watts Drainage Products Inc.

c. Zurn Plumbing Products Group; Specification Drainage Operation.

d. Or Approved Equal.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: ABS or PVC as required to match connected piping.
5. Closure: Countersunk drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.02 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. Grainger.
 - b. Schneider-Simpson Sheet Metal.
 - c. Or Approved Equal.

2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

B. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

C. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.04 FLASHING MATERIALS

- A. Zinc-Coated Steel Sheet: ASTM A 653, with 0.20% copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Solder: ASTM B 32, leadfree alloy.
- F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.

- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- F. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- G. Piping installation requirements are specified in other Division 22 sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- H. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - a. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - b. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - c. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- B. Set flashing on floors and roofs in solid coating of bituminous cement.
- C. Secure flashing into sleeve and specialty clamping ring or device.
- D. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 72 00, "Roof Accessories."
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 CONSTRUCTION

- A. Piping installation requirements are specified in other Division 22 sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.05 FIELD QUALITY CONTROL

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.
- C. Perform tests and inspections and prepare test reports.
- D. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.06 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
1. Plumbing fixtures and trim.
 2. Floor mount flush valve type water closet.
 3. Wall hung lavatory.
 4. Single compartment kitchen sink.
 5. Wall hung washup sink.
 6. Electric water heaters.
 7. Thermostatic mixing valves.
 8. Floor drains.
 9. Grated floor drain.
 10. Funnel floor drain.
 11. Freeze proof hose bibb.

1.02 RELATED SECTIONS:

- A. 01 33 00, "Submittal Procedures."
- B. 01 42 19, "Reference Standards."
- C. 01 43 00, "Quality Assurance and Control."
- D. 01 60 00, "Product Requirements."
- E. 01 77 00, "Closeout Procedures."
- F. 22 05 19, "Gauges for Plumbing Systems."
- G. 22 05 23, "General Duty Valves for Plumbing."
- H. 22 07 00, "Plumbing Insulation."
- I. 22 11 16, "Domestic Water Piping."
- J. 22 11 19, "Domestic Water Piping Specialties."
- K. 22 13 16, "Sanitary Waste and Vent Piping."

1.03 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards;" and as listed herein.
- B. The following is a list of standards referenced in this section:
 - 1. Uniform Plumbing Code (UPC).
 - 2. American Society of Heating, Refrigeration and Air Conditioning: www.ashrae.org
 - a. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - 3. American Society of Safety Engineers (ASSE) www.asse.org:
 - a. ASSE 1017 – Temperature Activated Mixing Valves for Hot Water Distribution Systems.
 - b. ASSE 1069 – Guidelines for Temperature Control Devices in Domestic Hot Water Systems.
 - c. ASSE 1070 – Performance Requirements for Water Temperature Limiting Devices.
 - 4. National Sanitation Foundation (NSF) 61 – Drinking Water System Components – Health Effects; www.nsf.org.

1.04 DEFINITIONS

- A. Plumbing Brass: P-traps, stops, strainers, tailpieces, flanges and other brass fittings and accessories not including faucets.
- B. ASME: American Society of Mechanical Engineers
- C. CSA: Canadian Standards Association.
- D. IAMPO: International Association of Plumbing & Mechanical Officials.

1.05 SYSTEM DESCRIPTION

- A. Furnish and install all plumbing fixtures and trim.
- B. Provide new approved fixtures and fittings.
- C. All fixtures and fittings shall be free from flaws and blemishes with finished surfaces clear, smooth, and bright.
- D. All products and connections shall be in compliance with the Uniform Plumbing Code and Authority Having Jurisdiction (AHJ).

1.06 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
 - 2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.07 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
- B. Water Closets:
 - 1. American Standard: www.americanstandard.com.
 - 2. Eljer: www.eljer.com.
 - 3. Gerber: www.gerberonline.com.
 - 4. Kohler: www.kohler.com.
 - 5. Proflo: <https://proflobrand.com>.
 - 6. Toto: www.totousa.com.
 - 7. Zurn: www.zurn.com.
 - 8. Or Approved Equal.

C. Toilet Seats:

1. American Standard: www.americanstandard.com.
2. Eljer: www.eljer.com.
3. Gerber: www.gerberonline.com.
4. Kohler: www.kohler.com.
5. Toto: www.totousa.com.
6. Zurn: www.zurn.com.
7. Church: www.churchseats.com.
8. Or Approved Equal.

D. Carriers:

1. J.R. Smith: www.jrsmith.com.
2. Josam Company: www.josam.com.
3. Wade: www.wade-drains.com.
4. Zurn: www.zurn.com.
5. Or Approved Equal.

E. Lavatories:

1. American Standard: www.americanstandard.com.
2. Eljer: www.eljer.com.
3. Gerber: www.gerberonline.com.
4. Kohler: www.kohler.com.
5. Toto: www.totousa.com.
6. Zurn: www.zurn.com.
7. Or Approved Equal.

F. Sinks:

1. Elkay: www.elkay.com.
2. Just: www.justsinks.com.
3. Or Approved Equal.

G. Faucets:

1. Speakman Company: www.speakmancompany.com.
2. Chicago Faucets: www.chicagofaucets.com.
3. American Standard: www.americanstandard.com.
4. Symmons Industries: www.symmons.com.
5. Delta: www.deltafaucet.com.
6. Or Approved Equal.

H. Floor Drains:

1. Zurn: www.zurn.com.
2. Josam Company: www.josam.com.
3. Wade: www.wadedrains.com.
4. J.R. Smith: www.jrsmith.com.
5. Or Approved Equal.

I. Hose Bibbs:

1. Zurn: www.zurn.com.
2. Josam Company: www.josam.com.
3. Wade: www.wadedrains.com.
4. J.R. Smith: www.jrsmith.com.
5. Or Approved Equal.

J. Plumbing Brass:

1. American Standard: www.americanstandard.com.
2. Brasscraft: www.brasscraft.com.
3. Chicago Faucet: www.ChicagoFaucets.com.
4. Engineered Brass Company: www.justmfg.com.
5. Kohler: www.kohler.com.
6. Oatey: www.oatey.com.
7. Proflo: www.proflo.com.
8. Or Approved Equal.

K. Electric Water Heaters:

1. A.O. Smith: <https://www.hotwater.com>.
2. Rheem: <https://www.rheem.com>.
3. Bradford White: <https://bradfordwhite.com>.
4. Or Approved Equal.

L. Thermostatic Mixing Valves:

1. Watts: <https://watts.com>.
2. Sloan: <https://sloan.com>.
3. Cash Acme: <https://cashacme.com>.
4. Caleffi: <https://caleffi.com>.
5. Bradley: <https://bradleycorp.com>.
6. Or Approved Equal.

2.02 ACCEPTABLE PRODUCTS

A. P-1 Floor mount flush valve type water closet:

1. Vitreous china, elongated bowl, 1.28 GPF, ADA compliant Kohler Model K-96057 top spud flushometer toilet – or Approved Equal.
2. Seat: White open front seat with anti-microbial agent, Kohler Lustra Model K-4670-CA-0 or Approved Equal.
3. Flush Valve: Sloan 111-1.28 high efficiency flush valve, 1.28 GPF or Approved Equal.

B. P-2 Wall Hung Lavatory – ADA Compliant:

1. Vitreous china, wall hung Kohler Kingston Model K-2007, or Approved Equal, single hole drilling.
2. Faucet: Zurn AquaSpec Model Z82200-XL-3M, or Approved Equal, Single Lever Handle, Single Hole Deck-Mount, 0.5 GPM flow, ADA Compliant.
3. Carrier: J.R. Smith as required to support fixture or Approved Equal.
4. Plumbing Brass: Kohler 7715 grid drain and tail piece, or Approved Equal, with 17 gauge seamless chrome plated P-trap with 2-inch minimum trap seal, chrome plate, loose key stops with flexible risers.

C. P-3 Single Compartment Sink – ADA Compliant:

1. Sink: Stainless steel, self rimming. Just SL-ADA-2225-A-GR, or Approved Equal, 18 gauge stainless steel, 22 inch by 16 inch by 6-1/2 inch deep single bowl ADA compliant sink, 4-hole drilling.
2. Plumbing brass: Just J35 or approved equal with 17 gauge seamless chrome plated P-trap with 2-inch minimum trap seal, chrome plated, loose key stops with flexible risers. Provide separate stop for dishwasher hot water connection.
3. Faucet: Delta Model 470-WE-DST, single handle pull out faucet, ADA compliant. or Approved Equal.
4. Accessories: Delta Model 72020 Kitchen Air Gap Fitting or Approved Equal.
5. Dishwasher Hookup: Provide drain connection from dishwasher through air gap fitting and hot water supply from dishwasher stop valve.

D. P-4 Washup Sink:

1. Sink: Wall hung single bowl washup sink, Elkay Model EWS25202 or Approved Equal, 14 gauge 304 Stainless Steel, wall faucet arrangement with 8-inch center to center hole drillings, with 6-inch high backsplash, rear center drain outlet with service access from inside wall access door. Wall access door shall be provided under Section 22 11 19, "Domestic Water Piping Specialties."
2. Plumbing brass: 3-inch P-trap drain fitting with base plate and adjustable base with 3-inch strainer and cleanout fitting, Elkay Model LK173 or Approved Equal.
3. Faucet: Utility 8-inch Centerset Wall Mount Faucet with 7-inch Vented Spout, 2-inch lever handles, 1/2-inch Offset Inlets and Stops Elkay Model LK940VS07L2S or Approved Equal.

E. WH-1 Water Heater:

1. Water Heater: 20 gallon glass lined electric water heater with high density anode rod, A.O. Smith Dura-Power Model DEL-20, or Approved Equal. Heater shall be rated at 4.5 KW, 240 V, single phase, 60 cycle.
2. Working Pressure: 150 psig.
3. Elements: Single element, medium watt density with zinc plated copper sheath.
4. Listing: UL Listed and meeting the standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IES 90.1. Accessories:
5. Accessories: CSA Certified and ASME rated T&P relief valve, seismic restraint straps in compliance with UPC 507.2 and Therm-X-Trol ST-5 Expansion Tank, or Approved Equal.
6. Warranty: Manufacturer's limited 3-year warranty.

F. WH-2 Water Heater:

1. Water Heater: 80 gallon glass lined electric water heater with two high density anode rods, bottom inlet and top outlet, bottom drain valve, ASME T&P relief valve, A.O. Smith Gold Series, Model DRE-80-6, or Approved Equal. Heater shall be rated at 6.0 KW, 240 V, single phase, 60 cycle.
2. Working Pressure: 150 psig.
3. Elements: Three element, nonsimultaneous, low watt density. Each element controlled by an individual mounted thermostat and high temperature cutoff switch.
4. Listing: UL Listed and meeting the standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IES 90.1.
5. Accessories: CSA Certified and ASME rated T&P relief valve, seismic restraint straps in compliance with UPC 507.2 and Therm-X-Trol ST-5 Expansion Tank, or Approved Equal.
6. Warranty: Manufacturer's limited 3-year warranty.

G. TMV-1 Thermostatic Mixing Valve:

1. Thermostatic Mixing Valve: Temperature actuated mixing valve, 3/4-inch size, Watts Series LFMMVM1-US 3/4, or Approved Equal, with adjustable temperature setting between 80°F and 120°F, set at 115°F.
2. Listings: Certified to ASSE 1017, ASSE 1069 and ASSE 1070, NSF/ANSI 61 and IAPMO listed.
3. Accessories: Insertion type thermometers on mixing valve discharge fitting with thermal well per Section 22 05 19, "Gauges for Plumbing Systems."

H. TMV-2 Thermostatic Mixing Valve:

1. Thermostatic Mixing Valve: Temperature actuated mixing valve, 1/2-inch size, Watts Series LFMMVM1-US 1/2, or Approved Equal, with adjustable temperature setting between 80°F and 120°F, set at 115°F.
2. Listings: Certified to ASSE 1017, ASSE 1069 and ASSE 1070, NSF/ANSI 61 and IAPMO listed.
3. Accessories: Insertion type thermometers on mixing valve discharge fitting with thermal well per Section 22 05 19, "Gauges for Plumbing Systems."

I. TMV-3 Thermostatic Mixing Valve: Emergency Shower and Eyewash thermostatic mixing valve provided under Section 22 45 00 – Emergency Plumbing Fixtures.

J. HB-1 Freeze Proof Hose Bibbs:

1. Zurn Model Z1310 Ecolotrol Wall Hydrant, nonfreeze, antisiphon, automatic draining or Approved Equal.
2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.

3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS $\frac{3}{4}$.
7. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle Finish: Polished nickel bronze.
9. Operating Keys: Two with each wall hydrant.

K. FD-1 & FD-2 Floor Drains:

1. Zurn Model Z415B floor drain, 6-inch round polished bronze strainer with trap primer connection or Approved Equal.
2. Trap Seal Protection: Trap primer and trap seal per Section 22 11 19, "Domestic Water Piping Specialties."

L. TD-1 Trench Drain:

1. Trench Drain: Zurn Z7112, or Approved Equal, frame and grate system, 120-inch long, 12-inch wide with DGE Ductile Iron Slotted Grate – Class E load rating, for installation in formed sump utilizing two sections for a total length of 20 feet.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install floor-mounted water closets on closet flange attachments to drainage piping.
- C. Install counter-mounting fixtures in and attached to casework.
- D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 22 05 23, "General Duty Valves for Plumbing."
- E. Install open front toilet seats on water closets.
- F. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- G. Install traps on fixture outlets.
 1. Exception: Omit trap on fixtures with integral traps.
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 22 07 00, "Plumbing Insulation."
- I. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.
- J. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.03 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16, "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16, "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust discharge temperature settings on thermostatic mixing valves.

3.05 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

END OF SECTION

SECTION 22 45 00
EMERGENCY PLUMBING FIXTURES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Emergency shower and eye wash.
2. Thermostatic mixing valve.

1.02 RELATED SECTIONS:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 22 05 19, "Gauges for Plumbing Systems."
7. 22 05 23, "General Duty Valves for Plumbing."
8. 22 05 33, "Heat Tracing for Plumbing Pipe and Equipment."
9. 22 11 16, "Domestic Water Piping."
10. 22 11 19, "Domestic Water Piping Specialties."
11. 22 40 00, "Plumbing Fixtures."

1.03 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards;" and as listed herein.
- B. The following is a list of standards referenced in this section:
1. Uniform Plumbing Code (UPC).
 2. American National Standards Institute: www.ashrae.org
 - a. ANSI Z358.1 – American National Standard for Emergency Eyewash and Shower Equipment.

3. American Society of Safety Engineers (ASSE) www.asse.org:
 - a. ASSE 1071 – Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.
4. National Sanitation Foundation (NSF) 61 – Drinking Water System Components – Health Effects; www.nsf.org.

1.04 SYSTEM DESCRIPTION

- A. Provide emergency shower and eyewash fixture for connection to a tepid water supply for showering and flushing in case of exposure to injurious materials.
- B. All products and connections shall be in compliance with the Uniform Plumbing Code and Authority Having Jurisdiction (AHJ).

1.05 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 1. Product Data: For each type of product indicated.
 2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Diagram power, signal and control wiring.
- C. Quality Assurance Submittals:
 1. Field quality-control tests.
 2. Comply with provisions of Section 01 43 00, "Quality Assurance and Control."
 3. Compliance with ASSE 1071 and ANSI Z358.1 for fixtures and mixing valves.
- D. Closeout Submittals:
 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.06 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.
- B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. ASSE 1071 -: "Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment."
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:

1. Haws: www.hawesco.com.
2. Guardian: www.gesafety.com.
3. Bradley: www.bradleycorp.com.
4. Speakman: www.speakman.com.
5. Leonard: www.leonardvalve.com.
6. Acorn: www.acorneng.com.
7. Or Approved Equal.

2.02 ACCEPTABLE PRODUCTS

- A. ESW-1 – Emergency Shower and Eyewash:
 1. Combination shower and eyewash shall include hydrodynamic shower head with 20 gpm flow control and stainless-steel eyewash unit with 1.2 gpm flow control and yellow ABS plastic spray outlet pop-off dust cover.
 2. Unit shall include stainless steel 11-inch round bowl with green Soft-Flo ABS plastic eyewash anti-surge heads with integral flow control and yellow ABS plastic spray outlet pop-off dust covers.
 3. Unit shall include 1-1/4-inch Schedule 40 hot-dipped galvanized steel pipe and fittings along with powder-coated cast-iron 9-inch diameter floor flange.
 4. Ball valves shall be stay open stainless steel and equipped with self-draining feature to prevent freezing.
 5. Unit shall include universal signage, lever pull or push of stainless steel flag for activation.
 6. Haws Model 8300.158 Axion MSR Emergency Shower and Eyewash or Approved Equal.

B. Thermostatic mixing valve:

1. Thermostatic mixing valve shall provide a flow range of 1 to 31 GPM.
2. Mixing valve shall be lead free certified to NSF61. Maximum inlet pressure: 125 psi.
3. Maximum inlet temperature: 180°F.
4. Mixing valve shall be installed with inlet check valves.
5. Mixing valve shall control outlet temperature over a wide range of flow.
6. Provide insertion type thermometer per Section 22 05 19, "Gauges For Plumbing Systems" on outlet side of mixing valve to measure temperature of stream.
7. Control mechanism shall employ paraffin-based thermal actuation technology.
8. Redundant Anti-Scald Protection with internal cold water bypass. Main tempering valve provides primary protection while backup shutoff valve provides secondary high-temp protection. Internal cold water bypass supplies cold water if hot water supply or main tempering valve fails.
9. Mixing valve shall be ASSE 1071 and ANSI Z358.1 listed.
10. Haws Thermostatic Mixing Valve Model 9201E or Approved Equal.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.
- C. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

3.02 PREPARATION

- A. Field Measurements: Verify on job before beginning Work

3.03 INSTALLATION

- A. Coordinate installation of emergency fixtures and thermostatic mixing valves with installation of piping and accessories provided under Section 22 11 19, "Domestic Water Piping Specialties," Section 22 11 16, "Domestic Water Piping," and Section 22 40 00. Plumbing Fixtures" (Electric Water Heater) for delivery of hot and tepid water for the operation of the emergency fixtures.

- B. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- C. Install fixtures level and plumb.
- D. Fasten fixtures to substrate.
- E. Install shutoff ball valves in water-supply piping to emergency fixtures. Provide warning labels at all shutoff valves supplying hot and cold water to emergency fixtures indicating that valves shall remain open except for fixture servicing and that lockout/tagout procedures shall be used. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 05 23, "General Duty Valves for Plumbing."
- F. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 11 16, "Domestic Water Piping" and for labeling specified in Section 22 05 53, "Identification for Plumbing Pipe and Equipment."
- G. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 22 05 19, "Gauges for Plumbing Systems."
- H. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations.
- I. Install mixing valves and emergency fixtures in accordance with applicable codes and regulations, Manufacturer's Instructions and this section.

3.04 SYSTEM STARTUP AND ADJUSTMENT

- A. Startup and adjust thermostatic mixing valves to delivery tepid water to the emergency fixtures in accordance with Manufacturer's Instructions.
- B. Verify operation of emergency fixtures to provide indicated water flows for a minimum duration of 15 minutes.
- C. Verify operation of thermostatic mixing valves to delivery indicated water flow rates and temperature.
- D. Verify operation of thermostatic mixing valves to delivery cold water through the bypass feature in the event of loss of hot water supply.

3.05 CONNECTIONS

- A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.
- B. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to discharge to sanitary waste through area floor drain.

- C. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.06 IDENTIFICATION

- A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 05 53, "Identification for Plumbing Piping and Equipment."

3.07 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Flush system thoroughly after mixing valve installation.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized for water heater, start units to confirm proper unit operation. Operate emergency shower for a minimum duration of 15 minutes and confirm discharge temperature does not fall below 60°F.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.08 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

3.09 DEMONSTRATION AND TRAINING

- A. Provide one 2-hour training session for maintenance personnel on the operation of the emergency fixtures, the periodic testing requirements for the emergency fixtures and the adjustment and testing of the thermostatic mixing valves.

END OF SECTION

Division 23

Heating, Ventilating, and
Air Conditioning (HVAC)

SECTION 23 05 00
HVAC, GENERAL

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, tools, equipment, and services for all mechanical work as specified in Division 23, and as shown on the drawings.
- B. All work shall be completely coordinated with the work of all other trades and shall conform to all other provisions of the Contract Documents.
- C. Furnish and install all materials, appurtenances, devices, and miscellaneous items not specifically mentioned herein or noted on the drawings, but which are necessary to make a complete working installation of all mechanical systems.
- D. All mechanical equipment and devices furnished or installed under other divisions of the specifications which require connection to any mechanical systems shall be connected under this division of the specifications.
- E. To eliminate all possible errors and interferences, this Contractor shall thoroughly examine the Architectural, Structural and Electrical Drawings and Specifications before work is started and shall consult and coordinate with each of the Contractors regarding the work.
- F. The Contractor shall notify the Project Representative of any discrepancies or conflicts within the Contract Documents or between the Contract Documents and field conditions. The Contractor shall not proceed with any work or the purchasing of any materials for the area(s) of conflict until obtaining written instructions from the Project Representative on how to proceed. Any work done by the Contractor after his discovery of such discrepancies or conflicts and prior to obtaining the Project Representative's instructions on how to proceed, shall be done at the Contractor's expense.

1.02 DRAWINGS

- A. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.
- B. The drawings are diagrammatic and show the general arrangement of the construction and therefore do not necessarily show all offsets, fittings and accessories which are required to form a complete and operating installation.
- C. The precise location of equipment shall, in every case, be subject to the Project Representative's approval, and no allowances will be permitted the Contractor for any changes resulting from his failure to secure approval.
- D. The Contractor shall be responsible for checking field conditions and verifying all measurements and relationships indicated on the drawings before proceeding with the work.
- E. The installation of all systems shall follow the drawings as closely as actual building construction and the work of other trades permit.

1.03 SYSTEM DESCRIPTION

- A. The work includes providing complete and operational mechanical systems for the facility as shown on the drawings and described herein.
- B. Insulation: The work shall include furnishing and installing all duct insulation and all refrigerant piping insulation in accordance with the Washington State Energy Code and as described herein.
- C. Heating, Ventilating & Air Conditioning Systems: The work shall include furnishing and installing heat pump and air conditioning indoor units, heat pump and air conditioning outdoor units, refrigeration piping, exhaust fan, ventilation supply fan, electric heaters, louvers and air terminals, ductwork, controls, and all accessories necessary to provide complete and operable systems as shown on the drawings and as described herein.
- D. Air Balancing: The contractor will provide for air balancing of the mechanical HVAC systems by an independent balancing contractor. Refer to Section 23 05 93, "Testing, Adjusting and Balancing for HVAC" for requirements.

1.04 DEFINITIONS

"Provide" means "furnish and install complete and ready for use".

"Governing codes" means "the applicable provisions of the:

Washington State Energy Code

International Building Codes

NFPA National Fire Codes

Washington State General Safety and Health Standards and all local amendments to these codes.

"Finished Areas" means "areas listed on the architectural drawings as receiving a finish coat of paint".

"As indicated" means "as shown on the drawings and described in the specifications".

"Concealed" means "built into the construction and not exposed to view".

"As required" means "as necessary to form a safe, neat, and complete working installation (or product), fulfilling all the requirements of the specifications and drawings and in compliance with all governing codes".

Abbreviations:

AFF Above Finish Floor

AMCA Air Moving and Conditioning Association

ANSI American National Standards Institute

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
CFM	Cubic Feet per Minute
CISPI	Cast Iron Soil Pipe Institute
HP	Horsepower
IAPMO	International Association of Plumbing and Mechanical Officials
NEMA	National Electric Manufacturers Association
NFPA	National Fire Protection Association
per	in accordance with
PSI	Pound per Square Inch Gage Pressure
PVC	Polyvinyl chloride
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SP	Static Pressure
UL	Underwriter's Laboratories
w.g.	Water Gage (inches of water)
W.P.	Working Pressure

Additional abbreviations are as listed on the drawings or elsewhere in these specifications.

1.05 QUALITY ASSURANCE

- A. All work shall be in accordance with the codes which are defined as making up the "Governing Codes".
- B. It shall be the Contractor's responsibility to acquaint themselves with the requirements of all codes.
- C. On completion of the work, satisfactory evidence shall be furnished to show that all work has been installed in accordance with all codes and that all inspections required have been successfully passed.
- D. Permits and Fees: Refer to the Instructions to Bidders Specification Section.
- E. Contractor shall coordinate with the electrical work provided under Division 26 including coordinated shop drawings.

1.06 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data.
 - 2. Manufacturer's Written Instructions.
 - 3. Shop Drawings.
 - 4. Samples.
 - 5. Sample Warranties: Provide a Sample Warranty for each Warranty required in this section:
 - a. Each Sample Warranty shall be marked 'SAMPLE'.
 - b. Include project-specific information, and proposed exclusions, if any, identified by the manufacturer.
 - c. Statement of Installer Qualifications.
 - d. Manufacturer's Technical Representative Contact Information.
 - e. Engineering Calculations.
 - f. Certified Test Results.
 - g. Sample Warranty.
- C. Quality Assurance Submittals:
 - 1. Provide quality assurance submittals as indicated in the individual Division 23 specifications.
- D. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 92 13, "Operation and Maintenance Manuals."
 - 2. Special Warranties.
- E. Provide submittals for all equipment supplied under the work of this division.
- F. Refer to individual Division 23 specification sections for additional information and shop drawing requirements.

1.07 RECORD DATA

- A. Record Drawings: The contractor will be furnished with a clean, full-size set of construction drawings which shall be used to update project mechanical drawings for submittal to the Project Representative. Contractor identification shall be added to each of the drawings which indicate the name of the responsible contractor for the "Record Drawing" information and the date of the "Record Drawing" submittal. All changes from the original contract drawings shall be delineated with bubbled clouding keyed or flagged to the "Record Drawing" revision. At the completion of the project, the contractor shall deliver to the Project Representative one complete set of redline contract drawings upon which any changes during construction are neatly drafted.

1.08 SPECIAL TOOLS

- A. At the completion of the project this Contractor shall furnish to the Project Representative one complete set of any and all special tools such as odd size wrenches, keys, etc. which are necessary to service or adjust any piece of equipment installed under this contract. Each tool shall be marked or tagged to identify its use.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products by the manufacturers listed as Acceptable Manufacturers are acceptable substitutions for the specified products. Products by these manufacturers used as substitutions shall be equal to or superior to the specified item in function, appearance, and quality.
- B. The approval of a manufacturer as an Acceptable Manufacturer applies to the Manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications. Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any substitutions.

2.02 SUBSTITUTIONS

- A. All substitutions for products under Division 23 shall be reviewed for acceptance by the Project Representative and as indicated herein.
- B. To obtain acceptance of desired substitutions the manufacturer, Contractor or supplier shall submit the following information on the proposed substitution in accordance with Section 01 60 00, "Product Requirements."
 - 1. Differences between proposed substitution and specified item with a summary describing the technical benefit in using the proposed substitution.
 - 2. Changes in building design required to accommodate the proposed substitutions.
 - 3. Effect that the proposed substitution has on other trades.
 - 4. Complete technical data on the proposed substitution.

- C. Proposed substitutions shall match the specified item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Project Representative shall review the proposed substitution for conformance with the plans and specifications in addition to prior technical support experience with the proposed manufacturer and/or local manufacturer's representative and shall make a determination of acceptance or non-acceptance based on this criterion.
- D. The acceptance of a substitution applies to the manufacturer only, and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.
- E. The Contractor shall be responsible for all costs to other trades and all revisions required to accommodate any substitutions.

2.03 MOTORS AND CONTROLS

- A. Where a piece of equipment specified includes an electric motor, the motor shall be furnished and mounted by this Contractor. Motor starter and disconnect switches and wiring from the electrical panel to the motor control devices and to the motor shall be provided under Division 26, unless specified or indicated otherwise.
- B. All electrical work, conduit, boxes and devices in connection with control wiring as required to install the control equipment as specified herein or shown on the drawings shall be furnished and installed complete under this section of the Specifications and shall conform to all applicable portions of the Electrical Section of the Specifications and shall conform to all governing codes.
- C. Motors:
 - 1. Acceptable Manufacturers: General Electric, Westinghouse, Reliance, Allis-Chalmers, Gould, Century, Wagner, Baldor, U.S. Motors, Marathon.
 - 2. Motors serving mechanical equipment shall be open frame, dripproof type, unless otherwise indicated.
 - 3. All motors shall be UL listed and shall be provided with motor overload devices integral with the motor.
 - 4. Motors shall not be smaller than indicated on drawings; however, motors shall be of adequate size to drive the respective equipment when handling the air quantities specified without exceeding the nameplate full load current at any conditions encountered in actual operation. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. This Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter and other accessories as required to serve the larger motor. This Contractor shall bear the cost of such additional work.

PART 3 – EXECUTION

3.01 WORKMANSHIP

- A. This Contractor shall furnish and install all equipment included in the Contract to provide completed systems with a neat and finished appearance. If, in the judgment of the Project Representative any portion of the work has not been installed in accordance with the drawings and specifications in a neat workmanlike manner, the Contractor shall be required to revise the work and comply with the drawings and specifications in an acceptable manner to the Project Representative, at no increase in cost to the Owner.

3.02 CUTTING AND PATCHING

- A. The General Contractor shall provide all required spaces and provisions in structures of new construction for the installation of work of all other contractors or subcontractors who are responsible to coordinate requirements for their equipment, Cutting and Patching of structures in place made necessary to admit work, repair defective work, or by neglect of contractors and subcontractors to properly anticipate their requirements, shall be done by the General Contractor at the expense of the Contractors or subcontractors responsible.
- B. Patching Materials: Patching shall be with materials of like kind and quality of the adjoining surface by skilled labor experienced in that particular trade.
- C. Areas to be Cut and Patched: Wherever floors, walls, ceilings, plates, fire stops, or framing members are cut, openings shall be reinforced as directed to maintain structural integrity and to comply with Building Code requirements.
- D. Cutting of Structural Features: Make no cuts or alterations to any structural framing members without explicit consent of the Project Representative and then only under his direction. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. All required cutting to install material shall be accomplished with the use of saw cutting equipment.

3.03 INSTALLATION

- A. Install mechanical equipment to permit easy access for normal maintenance, so that parts requiring periodic replacement or maintenance can be removed. Relocate items which interfere with access.
- B. Devices which are manually adjusted or operated shall be located so as to be easily accessible. Any such items which are not in the open shall be made accessible through access openings in the building construction.
- C. Gauges, thermometers, instrumentation and other components which are installed to monitor equipment performance, operating conditions, etc., shall be oriented so as to be easily read by a person standing on the floor. Provide necessary brackets and hangers as needed.
- D. If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Project Representative before installing the item in a poor access location.

- E. Belts, pulleys, couplings, projecting setscrews, keys and other rotating parts which may pose a danger to personnel shall be fully enclosed or guarded in accordance with OSHA regulations.

3.04 WATERPROOFING

- A. Where any work pierces waterproofing, method of installation shall be as approved by the Project Representative before work is done. Contractor shall furnish all necessary caulking and flashing required to make openings absolutely watertight.
- B. All equipment or material located outdoors shall be waterproof.

3.05 FINAL INSPECTION AND INSTRUCTION

- A. Prior to acceptance of the Mechanical work, the Contractor shall put all Mechanical systems into operation so that they may be inspected by the Project Representative and the Owner's representatives on the operation and maintenance of all equipment. The contractor shall provide a minimum 4 hour instruction period to review each major item of equipment and provide instructions by the installing sub-contractor. Refer to other sections of Division 23 for additional instruction and training requirements.
- B. The Contractor's Representatives who conduct these instructions and demonstrations shall be qualified foremen or superintendents acquainted with this project and the trades involved.
- C. Instructions: Shall include preliminary discussion on the system's operation and presentation of information from product submittal data with appropriate references to drawings, followed by a tour of the building spaces explaining maintenance requirements, access methods, servicing, and maintenance procedures, temperature settings and available system and equipment adjustments.
- D. Notice of the Contractor's readiness to conduct the instruction and demonstrations shall be given to the owner and Project Representative at least one week prior to proposed periods and mutually agreed upon times arranged.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
- B. Related Sections:
 - 1. 01 33 00, "Submittal Procedures."
 - 2. 01 43 00, "Quality Assurance and Control."
 - 3. 01 42 19, "Reference Standards."
 - 4. 01 60 00, "Product Requirements."
 - 5. 01 77 00, "Closeout Procedures."

1.02 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards;" and as listed herein.

1.03 SYSTEM DESCRIPTION

- A. All Division 23 system equipment shall be identified and labeled as indicated on the drawings, excluding air terminals. Refer to Drawings for equipment identification.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: For each type of product submitted.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.05 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or stainless-steel screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160°F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

2.02 WARNING SIGNS AND LABEL

- D. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- E. Letter Color: White.
- F. Background Color: Red.
- G. Maximum Temperature: Able to withstand temperatures up to 160°F.
- H. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- I. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- J. Fasteners: Stainless-steel rivets or stainless-steel screws.
- K. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- L. Label Content: Include caution and warning information, plus emergency notification instructions.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
 - a. Balancing airflow within distribution systems, including terminals, to indicated quantities according to specified tolerances.
 - b. Adjusting total HVAC systems to provide indicated quantities.
 - c. Measuring electrical performance of HVAC systems. Setting quantitative performance of HVAC equipment.
 - d. Verifying that automatic control devices provided under Section 23 09 00 – HVAC Controls are functioning properly to the extent that is required for the TAB of the system.
 - e. Reporting results of the activities and procedures specified in this section.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Closeout Procedures."
4. 01 77 00, "Product Requirements."
5. 23 09 00, "HVAC Controls."
6. 23 34 00, "HVAC Fans."
7. 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners."
8. 23 83 13, "Electric Heating Equipment."

1.02 DEFINITIONS AND ACRONYMS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to modify fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- I. Test: A procedure to determine quantitative performance of a system or equipment.
- J. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- K. AMCA: Air Movement and Control Association.
- L. NEBB: National Environmental Balancing Bureau.
- M. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
- N. TAB: Testing, Balancing, and Adjusting.

1.03 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards;" and as listed herein. The following is a list of standards referenced in this section:
 - 1. National Environmental Balancing Bureau (NEBB) 2019 – Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
 - 2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) – 1 HVAC Applications Handbook – latest edition.

1.04 ACCEPTABLE CONTRACTORS

- A. Airtest: <https://www.airtest.us>.
- B. Hardin & Sons, Inc.: <https://www.hardin-hvac.com>.
- C. Neudorfer Engineers, Inc.: <https://neudorferengineers.com>.
- D. Or Approved Equal.

1.05 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. TAB Instrumentation.
 - 2. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit Contract Documents review report as specified in Part 3 of this section.
 - 3. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.
 - 4. Report Forms: Examples of testing, adjusting and balancing report forms.
- C. Quality Assurance Submittals:
 - 1. Comply with provisions of Section 01 43 00, "Quality Assurance and Control" and the provisions of this section.
 - 2. Documentation demonstrating TAB firm qualifications and experience.
 - 3. Initial Construction –Phase Report as defined in Part 3.
 - 4. Status Reports as defined in Part 3.
 - 5. Testing, Adjusting, and Balancing Report.
 - a. Submit completed Report as indicated, including the following:
 - 1) System Diagrams/Floor Plans.
 - 2) Air Apparatus Test Reports.
 - 3) Apparatus Coil Test Reports.
 - 4) Electric Coil/Duct Heater Test Reports.
 - 5) Fan Test Reports.
 - 6) Rectangular and Round Duct Traverse Reports.
 - 7) Air Outlet Test Reports.
 - 8) HVAC Unit Test Reports.
 - b. Submit electronic and hard copies of reports prepared, as specified in this section, on approved forms certified by the testing, adjusting, and balancing agent.
 - 6. Instrumentation type, quantity and accuracy and record of instrumentation calibration.

D. Closeout Submittals:

1. O&M Manual content: Provide O&M manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.06 SEQUENCING/SCHEDULING

- A. Phase in properly with Construction Schedule.

1.07 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a testing, adjusting, and balancing firm certified by NEBB, not affiliated with mechanical contractor. Certified NEBB TAB Professional shall be a full time employee of the TAB contractor.
- B. Experience: Minimum 5 years on projects of similar scope and complexity.
- C. Testing, Adjusting, and Balancing Conference: Meet with the Project Representative upon approval of the testing, adjusting, and balancing Strategies and Procedures Plan to develop a mutual understanding of the details of the TAB work. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time at the project site.
1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. Contract Documents examination report.
 - c. Testing, adjusting, and balancing plan.
 - d. Work schedule and Project site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- D. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- E. Testing, Adjusting, and Balancing Reports: Use standard forms similar to the forms found in the NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

- F. Instrumentation Type, Quantity, and Accuracy: As described in the latest edition of NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- G. Instrumentation Calibration: Calibrate instruments as required by NEBB certification or more frequently if required by the instrument manufacturer.

1.08 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice to Project Representative for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 – PRODUCTS

2.01 TAB INSTRUMENTATION

- A. Furnish materials and equipment necessary to properly measure system capacities, electrical voltage and current, fan speeds, static pressures, air velocities, water pressure drops, refrigeration pressures, and other readings necessary to evaluate system performance and adjust quantities to those indicated.
 - 1. TAB Contractor retains possession of materials and equipment after project is completed.
- B. Instrumentation shall be accurate, with calibration histories available for examination upon request.
- C. Instrumentation shall be used in accordance with manufacturer's instructions.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verify installation conditions as satisfactory to receive work of this section.
- B. Proceed with the Work of this section only after unsatisfactory conditions have been corrected.

3.02 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

- B. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, automatic control dampers and manual volume dampers, are required by the Contract Documents.
 - 1. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- C. Examine approved submittal data of HVAC systems.
- D. Examine project record documents described in Section 01 77 00, "Closeout Procedures."
- E. Examine equipment performance data, including fan curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, and adjusting specified in individual Specification Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- I. Examine air-handling equipment to ensure clean filters provided under Section 23 41 00, "Air Filtration" have been installed and equipment with functioning controls is ready for operation.
- J. Examine equipment for installation and for properly operating safety interlocks and controls.
- K. Examine controlled components to verify the following:
 - 1. Dampers and other controlled devices operate by the intended controller.
 - 2. Dampers are in the position indicated by the controller.
 - 3. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions.
 - 4. Thermostats and are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 5. Sequence of operation for control modes is according to the Contract Documents.
 - 6. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 - 7. Interlocked systems are operating.
 - 8. Changeover from heating to cooling mode occurs according to design values.
 - 9. Verify minimum and maximum outdoor supply air settings.

- L. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.03 PREPARATION

- A. Field verify locations of work prior to commencing work of this section.
- B. Protect surrounding areas and surfaces to preclude damage from work of this section.
- C. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 5. Windows and doors can be closed so design conditions for system operations can be met.
 - 6. Building construction is sealed in areas where specified pressurization of an area is designated on contract documents.
 - 7. Clean permanent filters are installed.

3.04 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in the latest edition of NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this section.
- B. Variable speed drives (SCR Control) shall be field adjusted by TAB Contractor to achieve specified airflow, minimum and maximum.

3.05 TOLERANCES

- A. Set HVAC system airflow within the following tolerances:
 - 1. Supply and Exhaust Fans: Minus 10% to plus 10%.
 - 2. Air Outlets: Plus 10% to minus 10%.

3.06 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices.
 - 1. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing.

2. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures.
 1. Include a list of deficiencies and problems found in systems being tested and balanced.
 2. Prepare a separate report for each system and each building.

3.07 FINAL REPORT

- A. General: Computer generated in letter-quality font in both electronic and hard copy format. Final hard copy shall be on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet at beginning of report signed and sealed by the certified testing and balancing engineer.
 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: Certified field report data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 1. Title page.
 2. Name and address of testing, adjusting, and balancing Agent.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of testing, adjusting, and balancing Agent who certifies the report.
 10. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents Section 23 09 00, "HVAC Controls."

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type, size and model numbers.
13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans and pump performance forms, including the following:
 - a. Settings for outside dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Inlet and outlet and air volume heating coil dry-bulb inlet and outlet conditions and air volume.
 - e. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - f. SCR operating points outside air ventilation equipment between minimum airflow and maximum air flow.
 - g. Other system operating conditions that affect performance.

E. System Diagrams: Include contract drawings.

END OF SECTION

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SECTION 23 07 00
HVAC INSULATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Duct Insulation:

- a. Indoor, outdoor air ducts.
- b. Indoor, supply air to point of connection to duct heater.

2. HVAC Piping Insulation:

- a. Refrigerant liquid and suction line set insulation, indoors and outdoors, shall be provided under Section 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners." Exposed piping connections at connections to equipment shall be provided under this section.

B. Related Sections:

- 1. 01 33 00, "Submittal Procedures."
- 2. 01 42 19, "Reference Standards."
- 3. 01 43 00, "Quality Assurance and Control."
- 4. 01 60 00, "Product Requirements."
- 5. 01 77 00, "Closeout Procedures."
- 6. 23 23 00, "Refrigerant Piping Systems."
- 7. 23 31 13, "HVAC Ductwork."
- 8. 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners."

1.01 REFERENCES

C. Comply with requirements of Section 01 42 19, "Reference Standards" and as listed herein. The following is a list of standards referenced in this section:

- 1. American Society of Testing and Materials (ASTM): www.astm.org
 - a. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

- b. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.
 - c. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - d. ASTM B209 – Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - e. ASTM A240 – Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - f. ASTM C449 – Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - g. ASTM C534 – Standard Specification for Pre-Formed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - h. ASTM C552 – Standard Specification for Cellular Glass Thermal Insulation.
 - i. ASTM C871 – Standard Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate and Sodium Ions.
 - j. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - k. ASTM F1249 – Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
 - l. ASTM C1290 – Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 - m. ASTM D1644 – Standard Test Methods for Nonvolatile Content of Varnishes.
2. Military Specifications: www.wbdg.org.
- a. MIL A 24179A – Adhesive Flexible Unicellular Plastic Thermal Insulation.
 - b. MIL A 3316C – Adhesives, Fire-Resistant, Thermal Insulation.
 - c. MIL PRF 19565 – Coating Compound, Thermal Insulation, Fire- and Water Resistant, Vapor Barrier

1.02 DEFINITIONS AND ACRONYMS

- A. ASJ – All Service Jacket.
- B. CFC – Chlorofluorocarbons.
- C. FSK – Foil Skrim Kraft.

- D. HCFC – Hydrochlorofluorocarbons.
- E. o.c. – On Center.
- F. PVC – Poly Vinyl Chloride.
- G. PVDC – Polyvinylidene Chloride.
- H. VOC – Volatile Organic Compound.

1.03 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, “Submittal Procedures.”
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
 - 2. Manufacturer’s Written Instructions:
 - 3. Statement of Installer Qualifications:
- C. Quality Assurance Submittals:
 - 1. Comply with provisions of Section 01 43 00, “Quality Assurance and Control” and the requirements of this section.
 - 2. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- D. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, “Closeout Procedures.”

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, “Quality Assurance and Control” and the requirements of this section.
- B. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- C. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials

and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements" and the requirements of this section.
- B. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 SEQUENCING

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 31 13, "HVAC Ductwork".
- B. Coordinate clearance requirements with piping Installer for piping insulation application.

1.07 SCHEDULING

- A. Schedule insulation application after ductwork and equipment to be insulated is fully sealed.

PART 2 – PRODUCTS

2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Preinsulated refrigeration piping line sets shall be provided under Section 23 23 00, "Refrigerant Piping Systems."
- D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.

- c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
 - d. Or Approved Equal.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 552, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Owens Corning; SOFTR All-Service Duct Wrap.
 - d. Or Approved Equal.

2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
 - 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.
 - b. Or Approved Equal.

2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of -100 to +200°F.
 - 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 - b. Or Approved Equal.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - e. Or Approved Equal.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints:

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Eagle Bridges - Marathon Industries; 225.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - c. Mon-Eco Industries, Inc.; 22-25.
 - d. Or Approved Equal.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
 - c. Or Approved Equal.
2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - a. Service Temperature Range: -20 to +180°F.
 - b. Solids Content: ASTM D 1644, 58% by volume and 70% by weight.
 - c. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
 - e. Or Approved Equal.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180°F.
4. Solids Content: ASTM D 1644, 44% by volume and 62% by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.

- b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 - d. Or Approved Equal.
- 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
- 3. Service Temperature Range: -50 to +220°F.
- 4. Solids Content: ASTM D 1644, 33% by volume and 46% by weight.
- 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Or Approved Equal.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: -20 to +180°F.
 - 4. Solids Content: 60% by volume and 66% by weight.
 - 5. Color: White.
- F. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.

- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 - d. Or Approved Equal.
- 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 - 4. Service Temperature Range: 0 to +180°F.
 - 5. Color: White.

2.05 SEALANTS

A. Joint Sealants:

- 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - f. Or Approved Equal.

B. FSK and Metal Jacket Flashing Sealants:

- 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Or Approved Equal.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: -40 to +250°F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.06 FIELD-APPLIED JACKETS

A. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

B. Metal Jacket:

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - d. Or Approved Equal.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.

- 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.07 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:

- a. ABI, Ideal Tape Division; 428 AWF ASJ.
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
- c. Compac Corporation; 104 and 105.
- d. Or Approved Equal:
 - 1) Width: 3 inches.
 - 2) Thickness: 11.5 mils.
 - 3) Adhesion: 90 ounces force/inch in width.
 - 4) Elongation: 2%.
 - 5) Tensile Strength: 40 lbf/inch in width.
 - 6) ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:

- a. ABI, Ideal Tape Division; 488 AWF.
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.

- c. Compac Corporation; 120.
 - d. Or Approved Equal.
- 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5%.
 - 6. Tensile Strength: 34 lbf/inch in width.

2.08 SECUREMENTS

A. Bands:

- 1. Products: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
 - c. Or Approved Equal.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240 Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
 - a. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

- 1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of one of the following Manufacturers may be incorporated in the work of this section:
 - a. C & F Wire.
 - b. Or Approved Equal.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.
- C. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigeration liquid and suction piping where exposed piping and fittings occur shall be insulated with .5-inch thick flexible elastomeric insulation.
- B. Where pre-insulated refrigeration piping line sets are provided, see Section 23 23 00, "Refrigerant Piping Systems."

3.03 OUTDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant liquid and suction piping where exposed piping and fittings occur shall be insulated with .5-inch thick flexible elastomeric insulation.
- B. Where pre-insulated refrigeration piping line sets are provided, see Section 23 23 00, "Refrigerant Piping Systems."
- C. Refrigerant piping insulation exposed to weather shall be covered with aluminum metal jacketing to provide moisture and UV protection of insulation.

3.04 INDOOR DUCTWORK

- A. Outside air intake ductwork from the point of penetration through the roof to the point of connection to the indoor ventilation supply fan shall be provided with mineral fiber blanket insulation with a minimum R-value of 7.

END OF SECTION

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SECTION 23 09 00
HVAC CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Complete system of electric/electronic automatic controls of the HVAC systems shown on the Drawings and described herein.
2. Control devices and components.
3. Design and shop drawings of the complete temperature control system shall be provided. The control system is a vendor-designed system to provide the Sequence of Operation as described herein and shown on the drawings. Final design of the system is the Contractor's responsibility subject to review and approval of the Engineer.
4. The work of this section shall include all line voltage components furnished under this section and all low voltage wiring and low voltage components shown on the drawings as required to provide the sequence of operation specified. Line voltage power supply wiring shall be provided by Division 26 with line voltage control component furnished to Division 26 for installation and wiring.
5. Testing and adjustment.
6. Owner Training.

B. Related Work:

1. Section 01 33 00, "Submittal Procedures."
2. Section 23 05 00, "HVAC General."
3. Section 23 05 53, "Identification for HVAC Piping and Equipment."
4. Section 23 05 93, "Testing, Adjusting, Balancing for HVAC."
5. Section 23 34 00, "HVAC Fans."
6. Section 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners."
7. Section 23 83 13, "Electric Heating Equipment."
8. Division 26, "Electrical."

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Provide submittals for all equipment supplied under the work of this section.
- B. The control system shall be a vendor designed and installed system to achieve the Sequence of Operation indicated herein and as shown on the Drawings as provided by the installing mechanical contractor.

2.02 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Submit product information on all control components furnished under this section.
- C. Submit shop drawings showing all components and wiring as required to provide the Sequence of Operation as specified herein and as shown on the Drawings including devices provided under other section of the specification which are necessary to provide the Sequence of Operation.
- D. Control system submittal shall include control components and shop drawings in one package.

2.03 THERMOSTATS

- A. HPCU-1/HPIU-1: Low voltage thermostat provided under Section 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners."
- B. ACCU-1/ACIU-1: Low voltage thermostat provided under Section 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners."
- C. ECH-1, ECH-2, ECH-3, ECH-4, EWH-1 and EWH-2: Line voltage manual and programmable thermostats provided under Section 23 83 13, "Electric Heating Equipment."
- D. Line voltage manual and 7-day programmable thermostats shall be provided to the Division 26 contractor for installation and wiring under Division 26. Work under this section shall include programming of thermostats and verification of functional operation of each thermostat to provide the Sequence of Operation as specified herein and as shown on the Drawings.
- E. Low voltage thermostats provided under Section 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners" shall be installed and wired under this section. Work under this section shall include programming of thermostats and verification of functional operation of each thermostat to provide the Sequence of Operation as specified herein and as shown on the Drawings.

2.04 OCCUPANCY SENSORS

- A. Occupancy sensors for control of line voltage electric heaters shall be furnished under this section and provided to the Division 26 contractor for installation and wiring under Division 26. Work under this section shall include adjusting time delays and verification of functional operation to provide the Sequence of Operation as specified herein and as shown on the Drawings.
- B. Occupancy sensor for control of exhaust fan EF-1 shall be furnish under Section 23 34 00, "HVAC Fans." Work under this section shall include adjusting time delay and verification of functional operation to provide the Sequence of Operation as specified herein and as shown on the Drawings.

2.05 RELAYS

- A. Line voltage relays for start/stop control of supply fan SF-1 and for control system interface of electric duct heater DH-1 shall be provided under this section for installation and line voltage wiring under Division 26. Work under this section shall include low voltage wiring and verification of functional operation to provide the Sequence of Operation as specified herein and as shown on the Drawings.
- B. Line voltage relay to disable electric heat operation during the cooling mode of HPCU-1/HPIU-1 shall be provided under this section for installation and wiring under Division 26. Work under this section shall include verification of functional operation to provide the Sequence of Operation as specified herein and as shown on the Drawings.
- C. Line voltage relays to activate Low Alert and High Alert from the CO/NO2 Gas Monitor shall be provided under this section with a low voltage control transformer to interface with the CO/NO2 Gas Monitor. Relays and control transformer shall be housed in a control panel.
- D. Additional relays necessary to provide the sequence of operation specified shall be provided and installed under this section of the specifications.

2.06 CONTROL DAMPER AND DAMPER OPERATOR

- A. Control damper with line voltage damper operator and damper end switch shall be provided and installed under Section 23 34 00, "HVAC Fans" with line voltage wiring under Division 26. The work under this section shall include low voltage wiring as required for operation of supply fan SF-1 and verification of functional operation to provide the Sequence of Operation as specified herein and as shown on the Drawings.

2.07 SUPPLY FAN SF-1 REMOTE SPEED CONTROL

- A. Supply fan SF-1 is furnished and installed under Section 23 34 00, "HVAC Fans" and is provided with a remote speed control. The work under this section shall include installation and wiring of the remote speed control, verification of functional operation to provide the Sequence of Operation as specified herein and as shown on the Drawings.
- B. Work under Section 23 05 93, "Testing, Adjusting, and Balancing for HVAC" shall include verification of minimum and maximum air flow setting and marking of the fan speed control switch to indicate those settings.

2.08 CO/NO2 GAS MONITOR

- A. Gas Monitor shall be a Brash Model GSE2-NCM-120 CO/NO2 Standalone Gas Detector/Controller for monitoring vehicle exhaust fume infiltration into the Attendant Building Control Room.
- B. Gas Monitor shall include Low Alert and High Alert alarm outputs with front panel LED indicators and high level alarm horn. Wall mount Low Alert and High Alert LED warning lights shall be ESafety Lights Model B1L120 Red 120 VAC LED Non-Flashing Steady-ON Warning Lights.
- C. Alert Levels shall be set as follows:
 - 1. CO Low Alert set at 35 PPM (Switch Position 3), High Alert Factory Set at 100 PPM.
 - 2. NO2 Low Alert set at 1.5 PPM (Switch Position 3), High Alert Factory Set at 5.0 PPM.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Provide and install all control devices as required to provide the Sequence of Operation as described herein. Line voltage wiring shall be provided by Division 26, low-voltage wiring shall be provided under this section.
- B. Thermostats and occupancy sensors shall be mounted where shown, 5 feet above finished floor, unless indicated otherwise.
- C. Gas Monitor remote High and Low Alert warning lights shall be installed where shown above the Control Room entry door and shall be provided with red lettered, 1" high phenolic labels, per Section 23 05 53, "Identification for HVAC Piping and Equipment" reading "LOW ALERT AIR QUALITY WARNING" and "HIGH ALERT AIR QUALITY WARNING".

3.02 SEQUENCE OF OPERATION

- A. Provide the Sequence of Operation as follows:
 - 1. Attendant Building:
 - a. ACCU-1/ACIU-1 shall operate on demand to maintain a space temperature cooling setpoint. Heating is not provided.
 - b. HPCU-1/HPIU-1 shall operate on demand to maintain heating and cooling setpoints with a 7-day programmable thermostat to maintain adjustable heating and cooling setpoints during the occupied mode and during the un-occupied mode. Supply fan SF-1 and duct heater DH-1 shall operate during the occupied mode to open the outside air damper and operate supply SF-1. DH-1 shall be interlocked with SF-1 to maintain a discharge air temperature with manual adjustment of the

temperature at the discharge duct temperature sensor initially set at 70F. Speed control to adjust SF-1 ventilation from a minimum of 200 CFM to a maximum of 500 CFM, manually controlled by attendants in response to poor air equality monitored by the Control Room CO/NO2 gas monitor. During the unoccupied mode SF-1 and DH-1 shall be off and the outside air damper shall be closed.

- c. During occupied mode of HPCU-1/HPIU-1, electric wall heaters EWH-1 and electric cove heaters ECH-3 located at each attendant workstation shall be enabled and controlled by manual thermostats set by each respective operator. Provide labels at each attendant work station electric heater thermostat indicating "WALL HEATER and RADIANT COVE HEATER respectively per Section 23 05 53, "Identification for HVAC Piping and Equipment." During the cooling mode of HPCU-1/HPIU-1 the electric heaters shall be locked out. During the unoccupied mode of HPCU-1/HPIU-1, the electric heaters shall be disabled.
- d. Storage Room electric heater ECH-1 shall be controlled by a manual thermostat to maintain an adjustable temperature setpoint.
- e. Restroom electric heater ECH-2 shall be controlled by a 7-day programmable thermostat to maintain adjustable heating temperature setpoints during the occupied and unoccupied modes.
- f. Restroom exhaust fan EF-1 shall be controlled by a grille mounted occupancy sensor to operate when the restroom is occupied with a 20-minute time delay off after occupancy ends.
- g. Control Room CO/NO2 Gas Monitor shall monitor for CO/NO2 levels within the Control Room to provide warning to Attendants to increase ventilation through manual air volume adjustment through SF-1 and DH-1.

2. LHHW Building:

- a. Warming Room heater ECH-4 shall be controlled by a 7-day programmable thermostat to maintain adjustable heating setpoints during the occupied and unoccupied modes.
- b. Warming Room heater EWH-2 shall be enabled to operate by occupancy sensor. During occupancy, EWH-2 shall maintain the temperature set on the manual thermostat with a 5-minute time delay off after occupancy ends.
- c. Storage Room heater ECH-1 shall be controlled by a manual thermostat to maintain an adjustable temperature setpoint.

3. Operator Warming Station:

- a. Operator Warming Room heater ECH-4 shall be controlled by a 7-day programmable thermostat to maintain adjustable heating temperature setpoints during the occupied and unoccupied modes.

- b. Operator Warming Room heater EWH-2 shall be enabled to operate by occupancy sensor. During occupancy, EWH-2 shall maintain the temperature set on the manual thermostat with a 5-minute time delay off after occupancy ends.
- c. Storage Room heater ECH-1 shall be controlled by a manual thermostat to maintain an temperature setpoint.

3.03 OWNER TRAINING

- A. Owner training and demonstration of the HVAC controls provided under this section shall be provided per Section 23 05 00, "HVAC General" and shall include the following:
 - 1. Demonstrate operation of all controls for each building to include all sequences of operation.
 - 2. Provide instruction on programming of thermostats.
 - 3. Provide instruction on the CO/NO2 Gas Monitor with demonstration of detector calibration utilizing target gases, local alarm indications, remote alarm indications, local buzzer activation/silencing, recommended recalibration and summary of error codes. Demonstrate periodic Self-Test Mode.

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Refrigeration Piping Installation.
2. System Leak Testing and Charging.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 43 00, "Quality Assurance and Control."
3. 01 42 19, "Reference Standards."
4. 01 60 00, "Product Requirements."
5. 23 07 00, "HVAC Insulation."
6. 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners."

1.02 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards;" and as listed herein.

1.03 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."

B. Approval Submittals:

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

C. Quality Assurance Submittals:

1. Comply with provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.

D. Closeout Submittals:

1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.
- B. Refrigeration mechanics installing and charging the system shall be licensed by the State of Washington as a Journeyman Refrigeration Mechanic for work on R454B refrigerant systems.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Refrigerant R454B to match requirements of the manufacturer of the split system heat pump and air conditioning systems provided under Section 23 81 26, "Ductless Split System Heat Pumps and Air Conditioners."
- B. For each refrigeration system, one line set consisting of a preinsulated liquid line and a preinsulated suction line, shall be furnished under Section 23 81 26, "Ductless Split System Heat Pumps" and Air Conditioners.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install one liquid line and one suction line for each refrigeration system at locations shown on drawings.
- B. Where exposed portions of the refrigeration lines sets occur, insulate exposed areas in accordance with Section 23 07 00, "HVAC Insulation."
- C. Connect piping to equipment at locations shown on drawings.

3.03 REFRIGERANT CHARGING AND TESTING

- A. Provide additional refrigerant as required to match the equipment manufacturer's requirements and provide testing of the piping.
- B. If leaks occur, make repairs and recharge and retest until satisfactory testing is achieved.

END OF SECTION

SECTION 23 31 13

HVAC DUCTWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: This specification, in conjunction with the contract documents and design drawings, provides the minimum requirements for materials and operations used in the fabrication, installation, cleaning and testing of ductwork to include the following:

1. Sheet metal ductwork and plenums.
2. Duct sealing.
3. Duct sleeves and collars.
4. Duct Liner.
5. Flexible Duct Connections.
6. Duct cleaning and testing.

B. Related Sections:

1. 01 33 00, "Submittal Procedure."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 77 00, "Closeout Procedures."
5. 23 05 93, "Testing, Adjusting, and Balancing for HVAC."
6. 23 07 00, "HVAC Insulation."
7. 23 34 00, "HVAC Fans."
8. 23 37 00, "Air Outlets and Inlets."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19 "Reference Standards"; and as listed herein. The following is a list of standards referenced in this section:

1. American Society of Civil Engineers (ASCE/SEI) 7 – Minimum Design Loads:
www.seiinstitute.org

2. American Society of Heating, Refrigeration and Air Conditioning Engineers – (ASHRAE) : www.ashrae.org:
 - a. ASHRAE 62.1 – Ventilation for Acceptable Indoor Air Quality.
 - b. ASHRAE 90.1 – Energy Standards for Buildings Except Low-Rise Residential Buildings.
3. American Society of Testing and Material (ASTM) : www.astm.org:
 - a. ASTM A 36 – Standard Specification for Carbon Structural Steel.
 - b. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - c. ASTM A480 – Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - d. ASTM A 492 – Standard Specification for Stainless Steel Rope Wire.
 - e. ASTM A 603 – Standard Specification for Zinc-Coated Steel Structural Wire Rope.
 - f. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated by the Hot Dip Process.
 - g. ASTM A 1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, Solution Hardened and Bake Hardenable.
 - h. ASTM C 916 – Standard Specification for Adhesives for Duct Thermal Insulation.
 - i. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants.
 - j. ASTM C 1071 – Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - k. ASTM D 3363 – Standard Test Method for Film Hardness by Pencil Test.
4. North American Insulation Manufacturers Association (NAIMA)–AH124 Fibrous Glass Duct Liner Standard: www.naima.org.
5. National Fire Protection Association (NFPA) : www.nfpa.org:
 - a. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating.
 - b. NFPA 90B –Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

6. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) : www.smacna.org:
 - a. HVAC Duct Construction Standards – Metal and Flexible.
 - b. IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
7. Underwriters Laboratories (UL) 723 – Test for Surface Burning Characteristics of Building Material.

1.03 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 1. Product Data: For each type of product indicated.
- C. Quality Assurance Submittals:
 1. Comply with the provisions of Section 01 43 00 "Quality Assurance and Control" and the requirements of this section.
- D. Closeout Submittals:
 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.04 QUALITY ASSURANCE

- A. Contractor shall participate in preparation of MEP coordination shop drawing Submittal specified in Section 01 33 00, "Submittal Procedures."
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up".
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation".

1.05 DELIVERY, STORAGE AND HANDLING

- A. Comply with Section 01 60 00, "Product Requirements."
- B. All ductwork shall be cleaned and openings sealed prior to delivery and shall remain sealed at job-site until time of installation. Openings in ducts shall be sealed immediately following installation to maintain cleanliness including sealing of Section 23 37 00, "Air Outlets and Inlets" following connections to ductwork.
- C. Seals shall remain installed until after final building cleaning and installation of filters have been installed. Remove all seals when systems are ready for start-up.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - 1. Accuduct, Inc.
 - 2. Gensco.
 - 3. Lindab, Inc.
 - 4. Sheet Metal Connectors, Inc.
 - 5. Or Approved Equal.

2.02 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. Gensco.
 - b. McGill AirFlow LLC.

- c. Sheet Metal Connectors, Inc.
 - d. Spiral Manufacturing Co., Inc.
 - e. Or Approved Equal.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.04 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653.
- 1. Galvanized Coating Designation: G60 (Z180).
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Stainless Ductwork: Type 316L steel sheet per ASTM A240 and ASTM A480 with a finished surface No. 4 for exposed exterior locations.
- D. Carbon-Steel Sheets: Comply with ASTM A 1008, with oiled, matte finish for exposed ducts.
- E. Reinforcement Shapes and Plates: ASTM A 36, steel plates, shapes, and bars; black and galvanized.
- 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.05 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Manufacturers: Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - a. CertainTeed Corporation; Insulation Group. : www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Or Approved Equal.
 2. Maximum Thermal Conductivity: Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75°F mean temperature.
 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90% adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.

2.06 SEALANTS AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65%.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

- C. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.07 HANGERS AND SUPPORTS – INTERIOR

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.08 FLEXIBLE DUCT CONNECTIONS

- A. Flexible connectors shall be provided at the inlet and outlet of the supply fan where shown on the drawings in compliance with SMACNA's HVAC Duct Construction Standards – Metal and Flexible, Chapter 7.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved by the Project Representative.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- D. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- E. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- F. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- G. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines"

3.03 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Steel fasteners appropriate for construction materials to which hangers are being attached.

- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection, except interior dust collection ductwork and all exterior ductwork shall comply with SMACNA's "Round Industrial Duct Construction Standards".
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at underside of roof for ducts penetrating through the roof.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors where indicated on the drawings.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting sections.

3.07 FIELD QUALITY CONTROL

- A. Perform inspections.
- B. Duct System Sealing Inspection:
 - 1. Visually inspect duct system to ensure that all joints and seams are properly sealed.
 - 2. Operate fan systems and inspect for any signs of leakage. Seal where leakage occurs.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.08 DUCT CLEANING

- A. Clean duct systems before testing, adjusting, and balancing.

B. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply and exhaust fans including fan housings.
3. Outside-air ducts and damper.
4. Supply-air ducts, dampers, actuators, and turning vanes.

3.09 START UP

A. Air Balance: Comply with requirements in Section 23 05 93, "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Supply Ducts:

1. Ducts connected to supply fans:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round: 12.

C. Outside air ducts:

1. Ducts connected to supply fan:
 - a. Pressure Class: Negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - e. Outside air ducts located above the roof level shall be Type 316 Stainless Steel with no-loss stainless steel roof cap.

D. Exhaust Ducts:

1. Ducts connected to exhaust fan:
 - a. Pressure Class: Positive 1-inch wg.

- b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- E. Liner:
- 1. Supply Air Ducts: Fibrous glass, Type I, 1(one) inch thick.
- F. Elbow Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

END OF SECTION

SECTION 23 34 00
HVAC FANS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Centrifugal Square In-Line Fan.
2. Exhaust Fan.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00, "Closeout Procedures."
6. 23 05 53, "Identification for HVAC Piping and Equipment."
7. 23 05 93, "Testing, Adjusting, Balancing for HVAC."
8. 23 09 00, "HVAC Controls."
9. 23 31 13, "HVAC Ductwork."
10. 23 41 00, "Air Filtration."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards"; and as listed herein. The following is a list of standards referenced in this section:

1. American Society for Testing and Materials (ASTM): www.astm.org.
2. Air Movement and Control Association (AMCA): www.amca.org.
3. Institute of Electrical and Electronics Engineers (IEEE) 519 – Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems. www.ieee.org.
4. Underwriters Laboratories (UL) - Standard 1995: www.ul.com.
5. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) – 90.1: www.ashrae.org.
6. National Fire Protection Association (NFPA) 70 – National Electric Code: www.nfpa.org.

1.03 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: Provide manufacturer's technical data for each model indicated, including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping, installed and operating weights; furnished specialties; accessories; and installation and startup instructions.
 - a. Unit dimensions and weight.
 - b. Cabinet material, metal thickness, finishes, insulation, and accessories.
 - c. Fans:
 - 1) Certified fan-performance curves with system operating conditions indicated.
 - 2) Certified fan-sound power ratings.
 - 3) Fan construction and accessories.
 - 4) Motor ratings, electrical characteristics, and motor accessories.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.
- B. Fans shall be listed by Underwriters Laboratories (UL 705) and bear the AMCA Certified Ratings Seal for Sound and Air Performance.
- C. 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.
- D. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of fans and components.
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- F. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- G. Comply with NFPA 70.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of 01 60 00, "Product Requirements" and the requirements of this section.
- B. Deliver fan units as factory-assembled as recommended by the manufacturer.
- C. Coordinate delivery of units in sufficient time to allow movement into building.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - 1. Cook <http://www.lorencook.com>.
 - 2. Greenheck <http://www.greenheck.com>.
 - 3. Penn <http://www.pennfans.com>.
 - 4. Panasonic www.na.panasonic.com.
 - 5. Broan www.Broan-nutone.com.
 - 6. Or Approved Equal.

2.02 CENTRIFUGAL SQUARE IN-LINE FAN

- A. Fan shall be Cook Model SQN-D VF or Approved Equal.
- B. Fan Housing:
 - 1. Minimum 18 gauge galvanized steel.
 - 2. Acoustically insulated.
 - 3. Integral wiring box.
 - 4. Three removable access doors with closed cell neoprene gasketing.
 - 5. Inlet and outlet duct collards.
 - 6. Universal mounting feet.
- C. Fan:
 - 1. Direct driven.
 - 2. Centrifugal.

D. Wheel: All Aluminum.

E. Motor:

1. Mounted in fan housing.
2. Preprogrammed EC Electrically Commutated Vari-Flow motor.
3. Built-in thermal overload protection.

F. Filter Box:

1. Galvanized steel housing.
2. Removable access panel with closed cell neoprene housing.
3. Integral duct collars.
4. Holding frame suitable for MERV 13 pleated filters provided under Section 23 41 00, "Air Filtration."

G. Accessories:

1. Vari-Flow Air Balance Kit for interface with Vari-Flow Motor and controls.
2. External Speed Control.
3. Remote Speed Controller VFRSC.
4. Motorized Low Leakage Class 1A damper, 120 V/1ph.
5. Flexible Inlet and Outlet flexible connectors.
6. Free Standing Spring Isolators – Floor Mounted – Set of 4, with 50% overload capacity.

2.03 BATHROOM FAN

A. Fan shall be Panasonic Model FV-0511VK2 or Approved Equal.

B. Customizable ceiling mount ventilation fan:

1. Energy Star rated with built-in speed selector.
2. HVI certified with less than 0.5 sones at 0.25" w.g.
3. Power consumption no greater than 13.1 watts at 0.25" w.g.
4. ECM motor.
5. Plug 'N Play module with integral motion sensor with time delay off.
6. Fan shall be furnished with Primex WC4 Wall Cap with backdraft damper and screen, color as selected by Project Representative.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.
- C. Examine roof and walls for suitable conditions where fans will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install fans in accordance with applicable codes and regulations, manufacturer's installation instructions and this section.
- B. Install fans level on spring isolators where located in Mechanical Attic and with support attachments where located in ceiling joist space.

3.03 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.
- D. Duct installation requirements and connections to fans are specified in Section 23 31 13, "HVAC Ductwork." Drawings indicate general arrangement of ductwork.
- E. Where piping and ductwork is installed adjacent to fans, allow space for service and maintenance of unit.

END OF SECTION

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Diffusers.
 - 2. Grilles and registers.
 - 3. Door Louver.
 - 4. Barometric Relief Dampers.
 - 5. Louvers.
 - 6. Wall Caps.
 - 7. Globe Vent.
- B. Related Sections:
 - 1. 01 33 00, "Submittal Procedures."
 - 2. 01 43 00, "Quality Assurance and Control."
 - 3. 01 60 00, "Product Requirements."
 - 4. 01 77 00, "Closeout Procedures."
 - 5. 08 11 13, "Hollow Metal Doors and Frames."
 - 6. 23 31 13, "HVAC Ductwork."
 - 7. 23 34 00, "HVAC Fans."

1.02 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, Submittal Procedures.
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
- C. Quality Assurance Submittals:
 - 1. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.

D. Closeout Submittals:

1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures" – Operations and Maintenance Manuals.

1.03 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:

1. Louvers:

- a. Ruskin <http://www.ruskin.com>.
- b. American Warming and Ventilating <http://www.awv.com>.
- c. Greenheck <http://www.greenheck.com>.
- d. Or Approved Equal.

2. Diffusers, Grilles and Registers:

- a. Price Industries: www.priceindustries.com.
- b. Krueger: www.krueger-hvac.com.
- c. Titus: www.titus-hvac.com.
- d. Or Approved Equal.

3. Wall Caps:

- a. Primex: www.primexvents.com.
- b. Or Approved Equal.

4. Globe Vents:

- a. Famco: www.famcomfg.com.
- b. Or Approved Equal.

2.02 ACCEPTABLE PRODUCTS

A. Louvers:

1. Louvers shall be of size and shape indicated on Drawings.
2. Finish: Factory applied "Kynar" finish, color as selected by Project Representative.

B. Air Outlets:

1. Air Outlets shall be of size, type and number of throws as shown on Drawings and shall match appearance and performance of the manufacturer's models scheduled on Drawings.
2. Furnish all necessary screws, clips, duct collars and transitions required to allow for air outlet installation and connection to ductwork.
3. Finish: Shall be factory applied lacquer or enamel finish, color as selected by Project Representative.

C. Ceiling Relief Grilles:

1. Grilles shall be of size and type as shown on Drawings and shall match appearance and performance of the manufacturer's models scheduled on Drawings.
2. Furnish all necessary screws, clips, duct collars and transitions required to allow for air outlet installation and connection to ductwork.
3. Finish: Shall be factory applied lacquer or enamel finish, color as selected by Project Representative.

D. Door Louvers:

1. Door Louvers shall be provided under Section 08 11 13, "Hollow Metal Doors and Frames."

E. Globe Vents:

1. Globe Vents shall be Famco Model GVB12SS fabricated in stainless steel.
2. Low silhouette gravity ventilation air intake.
3. Weather tight construction with stainless steel screen.
4. Furnish all necessary screws, clips, duct collars and transitions required to allow for air inlet installation and connection to ductwork and with stainless steel flashing at roof duct penetration.

2.03 BAROMETRIC RELIEF DAMPERS

A. Barometric relief dampers shall be Ruskin Model NMS2, or Approved Equal with the following features:

1. Frame shall be 16 gauge galvanized steel with windstops to reduce back flow all around.

2. Blades shall be noncombustible neoprene coated fiberglass mechanically locked into blade edge for low-noise operation.
3. Each blade shall operate independently without bearings or linkage.
4. Air leakage shall be no greater than 6.2 CFM/SF when tested at 1.0" w.g. per AMCA Standard 500.
5. Provide access door for observation of barometric relief damper per Section 23 31 13, "HVAC Ductwork."

2.04 WALL CAPS

- A. Wall caps shall be Primex WC Series or Approved Equal.
 1. Made with UV-protected polymer resin.
 2. Include built in bird screen and backdraft damper.
 3. Color as selected by Project Representative from available standard colors.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 INSTALLATION

- A. Install air outlets and inlets in locations shown on Drawings conforming to architectural features and lighting arrangements.
- B. Paint visible ductwork behind air outlets flat black.
- C. Install and flash wall louvers and roof intake globe vent to ensure complete weather-proofness. Installing Contractor shall bear all costs associated with repairing damage to building structure caused by water leakage through louver, louver flashing and globe vent intake duct.

END OF SECTION

SECTION 23 41 00
AIR FILTRATION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Pleated air filters.

B. Related Sections:

1. 01 33 00, "Submittal Procedures."
2. 01 42 19, "Reference Standards."
3. 01 43 00, "Quality Assurance and Control."
4. 01 60 00, "Product Requirements."
5. 01 77 00 "Closeout Procedures."
6. 23 05 93, "Testing, Adjusting, and Balancing for HVAC."
7. 23 34 00, "HVAC Fans."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19 "Reference Standards"; and as listed herein. The following is a list of standards referenced in this section:

1. American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE) <http://www.ashrae.org>:
 - a. ASHRAE Standard 52-2-2017 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
 - b. ASHRAE Standard 62.1-2022, Ventilation and Acceptable Indoor Air Quality.
2. National Fire Protection Association (NFPA): www.nfpa.org:
 - a. NFPA 90A – Standard for Installation of Air-Conditioning and Ventilating Systems.
 - b. NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

1.03 DEFINITIONS

A. MERV – Minimum Efficiency Reporting Value.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: For each type of product indicated.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00. "Closeout Procedures."

1.05 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.
- B. ASHRAE Compliance:
 - 1. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2022.
 - 2. Comply with NFPA 90A and NFPA 90B.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements" and the requirements of this section.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Filter performance: Pleated air filter performance specifications refer to filter test results when tested per ASHRAE Standard 52.2-2017.

2.02 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, Products of one of the following Manufacturers shall be incorporated in the Work of this section:
 - 1. Pleated filters:
 - a. Farr: www.farrfilters.com.
 - b. Airguard: www.airguard.com.
 - c. Or Approved Equal.

2.03 PLEATED AIR FILTERS

- A. Type: Filters shall be class 2, MERV 13 per ASHRAE 52.2-2017, pleated panel type, disposable filters, 2-inch thick as required for the equipment in which installed.
- B. Filter sizes shall be compatible with the Filter Box provided with SF-1 per Section 23 34 00, "HVAC Fans."

2.04 SPARE FILTERS

- A. Provide one set of spare pleated media filters and one spare chemical adsorptive filter in addition to filters installed.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.

3.02 PREPARATION

- A. Field Measurements: Verify on job before beginning Work.

3.03 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.
- B. Provide and install filters as indicated on Drawings.
- C. Install all filters prior to equipment startup and testing per Section 23 05 93, "Testing, Adjusting, and Balancing for HVAC."
- D. Provide spare filters for delivery to Owner with each filter identified by unit designation in which filter is to be installed.
- E. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- F. Install filters in position to prevent passage of unfiltered air.
- G. Do not operate fan system until particulate filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

3.04 CLEANING

After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new particulate filter media.

END OF SECTION

SECTION 23 81 26
DUCTLESS SPLIT SYSTEM HEAT PUMPS AND AIR CONDITIONERS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Ductless split system air conditioner.
 - 2. Ductless split system heat pump.
 - 3. Refrigeration Line Sets.
 - 4. Controllers.
 - 5. Outdoor Condensing Unit Supports.
- B. Related Sections:
 - 1. 01 33 00, "Submittal Procedures."
 - 2. 01 42 19, "Reference Standards."
 - 3. 01 43 00, "Quality Assurance and Control."
 - 4. 01 60 00, "Product Requirements."
 - 5. 01 77 00, "Closeout Procedures."
 - 6. 23 07 00, "HVAC Insulation."
 - 7. 23 09 00, "HVAC Controls."
 - 8. 23 23 00, "Refrigerant Piping Systems."

1.02 REFERENCES

- A. Comply with requirements of Section 01 42 19, "Reference Standards" and as listed herein. The following is a list of standards referenced in this section. Unless otherwise listed, conform to latest edition of code or standard:
 - 1. National Electrical Code (N.E.C.): <https://www.nfpa.org>.
 - 2. Electrical Testing Laboratories (ETL): <https://www.intertek.com>.

3. Air-Conditioning, Heating, and Refrigeration Institute (AHRI): <https://www.ahridirectory.org>.
 - a. AHRI Standard 210/240: Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump.
4. International Standard Organization (ISO): <https://www.iso.org>.
 - a. ISO 9001-2015 Quality Management Systems – Requirements.
 - b. ISO 14001-2015 Environmental Management Systems.
5. American Society for Testing and Materials: <https://www.astm.org>.
 - a. ASTM B117: “Standard Practice for Operating Salt Spray (Fog) Apparatus.

1.03 SYSTEM DESCRIPTION

- A. Provide split system air conditioning system with electric variable speed inverter compressor. System shall consist of wall mounted indoor section with wired, wall mounted controller and pad mounted horizontal discharge, single phase outdoor unit.
- B. Provide split system heat pump system with electric variable speed inverter compressor. System shall consist of wall mounted indoor section with wired, wall mounted 7-day programmable controller and pad mount horizontal discharge, single phase outdoor unit.
- C. Outdoor condensing units shall be installed on concrete housekeeping pads with mounting bases provided under this section.

1.04 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, “Submittal Procedures.”
- B. Approval Submittals: For each type of product indicated.
- C. Quality Assurance Submittals:
 1. Comply with the provisions of Section 01 43 00, “Quality Assurance and Control” and the requirements of this section.
- D. Closeout Submittals:
 1. O & M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, “Closeout Procedures.”

1.05 QUALITY ASSURANCE

- A. Units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.

- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. Units shall be rated in accordance with Air-conditioning Refrigeration Institute's (AHRI) Standard 210/240 and bear the AHRI Certification label.
- D. Units shall be manufactured in a facility registered to ISO 9001 and ISO 14001.
- E. Dry air holding charge shall be provided in the indoor sections.
- F. Outdoor unit shall be precharged with R454B refrigerant for the length of refrigerant tubing provided.
- G. Heat Pump System efficiency shall meet or exceed a SEER rating of 21.8 and an HSPF rating of 9.5.
- H. Air Conditioning System efficiency shall meet or exceed a SEER rating of 21.1.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00, "Product Requirements."
- B. Wired controllers shall be shipped inside the carton with the indoor unit and able to withstand 105° F storage temperatures and 95% relative humidity without adverse effect.

1.07 WARRANTY

- A. Provide manufacturer's written warranty against defects in materials and workmanship and agreeing to repair or replace components that fail during the Warranty Period.
 - 1. The Warranty Period for Work of this section is five (5) years commencing on the date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Mitsubishi Trane www.trane.mylinkdrive.com.
- B. Daikin www.daikincomfort.com.
- C. Lennox www.lennox.com.
- D. Samsung www.samsung.com.
- E. Diversitech www.diversitech.com.
- F. Or Approved Equal.

2.02 ACCEPTABLE PRODUCTS

A. Heat Pump System:

1. Indoor unit: Mitsubishi Trane Model PKA-AK24NL.
2. Outdoor unit: Mitsubishi Trane Model PUZ-AK24NLHZ.
3. Or Approved Equal.

B. Air Conditioning System: Indoor Unit:

1. Indoor unit: Mitsubishi Trane Model PKA-AK24NL.
2. Outdoor Unit: Mitsubishi Model PUY-AH24NL.
3. Or Approved Equal.

C. Indoor Unit:

1. Indoor unit cabinet shall be wall mounted by means of factory supplied mounting plate.
2. Cabinet shall be formed from high strength molded plastic with front panel access for filter.
3. Cabinet shall be white.
4. Indoor unit shall be factory assembled, wired, and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor.
5. Unit in conjunction with wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, auto restart function and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from factory.

D. Indoor Unit Fan:

1. Evaporator fan shall be high-performance, double inlet, forward curve, direct drive sirocco fan with single motor. Fans shall be statically and dynamically balanced and run on motor with permanently lubricated bearings.

E. Indoor Unit Vane:

1. There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. Horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.

F. Indoor Unit Filter:

1. Return air shall be filtered by means of an easily removable washable filter.

G. Indoor Unit Coil:

1. Evaporator coil shall be of nonferrous construction with precoated aluminum strake fins on copper tubing. The multiangled heat exchanger shall have a modified fin shape that reduces air resistance. All tube joints shall be brazed with PhosCopper or silver alloy. Coils shall be pressure tested at factory. Condensate pan and drain shall be provided under the coil.

H. Electrical:

1. Electrical power of unit shall be 230 V, 1 phase, 60 Hz. System shall be capable of satisfactory operation within voltage limits of 198 V to 253 V. Power to the indoor unit shall be supplied from the outdoor unit.

I. Control:

1. Control system shall consist of two microprocessors, one on each indoor and outdoor unit, interconnected by a single nonpolar two-wire cable. Field wiring shall run directly from indoor unit to the wall mounted controller with no splices. For A-Control, a three conductor 14 gauge AWG wire with ground shall provide power feed and bidirectional control transmission between outdoor and indoor units.
2. System shall be capable of automatic restart when power is restored after power interruption. System shall have self-diagnostics ability, including total hours of compressor time. Diagnostics codes for indoor and outdoor units shall be displayed on wired controller panel.
3. Microprocessor located in indoor unit shall have capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from wired controller, providing emergency operation and controlling the outdoor unit.
4. Indoor unit shall be connected to wall mounted wired controller to perform input functions necessary to operate system. Wired controller shall have a large multilanguage DOT liquid crystal display (LCD) presenting contents English.
5. There shall be a built-in weekly timer with up to eight pattern settings per day. Controller shall consist of ON/OFF button, Increase/Decrease Set Temperature buttons, a Heat/Auto/Cool/Dry/Fan mode selector, Vane Position selector, Louver Swing button, Ventilation button, Test Run button and a Check Mode button. Controller shall have built-in temperature sensor. Temperature shall be displayed in Fahrenheit (°F). Temperature changes shall be by increments of 1°F with a range of 67°F to 87°F.
6. Wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures, (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub cooling and discharge super heat.

7. Normal operation of wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room.
8. Control voltage from wired controller to indoor unit shall be 12 V, DC. Control signal between indoor and outdoor unit shall be pulse signal 24 V DC. Up to two wired controllers shall be able to be used to control one unit.
9. Control system shall control continued operation of air sweep louvers as well as provide On/Off and mode switching. Controller shall have capability to provide sequential starting with up to 50 seconds delay.

J. Outdoor Unit:

1. Outdoor unit shall be compatible with PKA wall mounted indoor units. Connected indoor unit must be of same capacity as outdoor unit.
2. Outdoor unit shall be equipped with control board that interfaces with indoor unit to perform all necessary operation functions.
3. Outdoor heat pump unit shall be capable of operating at 0°F (-18°C) ambient temperature without additional low ambient controls.
4. Outdoor cooling only unit provided with an optional wind baffle to provide cooling down to -40°F.
5. Outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.
6. Outdoor unit shall have a maximum refrigerant tubing length between indoor and outdoor units without the need for line size changes, traps or additional oil.
7. Outdoor unit shall be completely factory assembled, piped and wired. Each unit must be test run at the factory.

K. Outdoor Heat Pump Unit:

1. Built-in base pan heater.
2. High Speed Startup: High speed heating at start up. Hyper-Heating Inverter reduces the time for heating at start up.

L. Outdoor Unit Cabinet:

1. Casing shall be constructed from galvanized steel plate, coated and finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a Munsell 3Y 7.8/1.1 finish. The fan grille shall be of ABS plastic.

M. Outdoor Fan:

1. Fan motor shall be of aerodynamic design for quiet operation and the fan motor bearings shall be permanently lubricated. Outdoor unit shall have horizontal discharge airflow. Fan shall be mounted in front of coil, pulling air across it from the rear and dispelling it through the front. Fan shall be provided with a raised guard to prevent contact with moving parts.

N. Outdoor Unit Coil:

1. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. Coil shall be protected with integral metal guard. Refrigerant flow from condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be controlled by a microprocessor controlled step motor.

O. Outdoor Unit Compressor:

1. Compressor shall be driven by inverter circuit to control compressor speed. Compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system. To prevent liquid from accumulating in compressor during off cycle, a minimal amount of current shall be intermittently applied to compressor motor to maintain enough heat. Outdoor unit shall have an accumulator and high pressure safety switch. Compressor shall be mounted to avoid the transmission of vibration.

P. Outdoor Unit Electrical:

1. Electrical power of unit shall be 208 V/240 V, 1 phase, 60 Hz. Unit shall be capable of satisfactory operation within voltage limits of 198 V to 253 V. Outdoor unit shall be controlled by microprocessor located in indoor unit. Control signal between indoor and outdoor unit shall be pulse signal 24 V DC. Unit shall have pulse amplitude modulation circuit to utilize 98% of input power supply.

Q. Refrigeration Piping:

1. Systems shall be provided with refrigeration line sets consisting of one liquid line and one suction line of preinsulated refrigeration piping, precharged with nitrogen for installation under Section 23 23 00, "Refrigerant Piping Systems." Line sets shall be a minimum length of 25 feet to minimize refrigerant noise with excess line length coiled within the building.
2. Refrigeration piping insulation shall comply with the requirements of the Washington State Energy Code Table 403.10.3 Piping Insulation.

R. Outdoor Unit Corrosion Protection:

1. Outdoor unit shall be provided with spray applied coil and cabinet corrosion protection, Heresite VR-500, InsituES² protection system, Gorilla Corrosion Protection system or Approved Equal meeting or exceeding 10,000 hour salt spray test per ASTM-B117.

2.03 CONDENSING UNIT MOUNTING BASES

- A. Condensing unit mounting bases shall be Diversitech Hef-T-Block Model 230-MB17W or Approved Equal.
- B. Mounting bases shall be 17 inches in length and provided with end caps and mounting hardware to secure the condensing units with a sliding rail attachment arrangement.
- C. All mounting hardware shall be stainless steel.
- D. Mounting bases shall be anchored to concrete housekeeping pads with 3/8" stainless steel expansion bolts at each end of mounting base.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive Work of this section. Do not commence Work until unsatisfactory conditions have been corrected.
- B. Beginning Work constitutes acceptance of conditions.

3.02 PREPARATION

- A. Field Measurements: Verify on job before beginning Work.

3.03 INSTALLATION

- A. Install system in accordance with applicable codes and regulations, manufacturer's written instructions, and this section.
- B. Insulate refrigeration piping at points of connection to equipment that is not factory insulated per Section 23 07 00, "HVAC Insulation."
- C. Provide metal jacket on all exterior refrigeration piping per Section 23 07 00, "HVAC Insulation."
- D. Furnish program controllers to control contractor for installation per Section 23 09 00, "HVAC Controls."

END OF SECTION

SECTION 23 83 13
ELECTRIC HEATING EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Electric Wall Heaters.
2. Electric Cove Heaters.
3. Electric Duct Heaters.
4. Electric Line Voltage Thermostats.

B. Related Sections:

1. 23 05 53, "Identification for HVAC Piping and Equipment."
2. 23 05 93, "Testing, Adjusting, and Balancing for HVAC."
3. 23 09 00, "HVAC Controls."
4. 23 34 00, "HVAC Fans."

1.02 REFERENCES

A. Comply with requirements of Section 01 42 19, "Reference Standards"; and as listed herein. The following is a list of standards referenced in this section:

1. American Society for Testing and Materials (ASTM): www.astm.org.
2. Air Movement and Control Association (AMCA): www.amca.org.
3. Institute of Electrical and Electronics Engineers (IEEE) 519 – Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems. www.ieee.org.
4. Underwriters Laboratories (UL) - Standard 1995: www.ul.com.
5. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) – 90.1: www.ashrae.org.
6. National Fire Protection Association (NFPA) 70 – National Electric Code: www.nfpa.org.

1.03 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data: Provide manufacturer's technical data for each model indicated, including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping, installed and operating weights; furnished specialties; accessories; and installation and startup instructions.
 - 2. Quality Assurance Submittals:
 - 3. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.
- C. Closeout Submittals:
 - 1. O&M Manual Content: Provide O&M Manual documentation as required by Section 01 77 00, "Closeout Procedures."

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control" and the requirements of this section.
- B. Fans shall be listed by Underwriters Laboratories (UL 705) and bear the AMCA Certified Ratings Seal for Sound and Air Performance.
- C. 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.
- D. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of fans and components.
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- F. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- G. Comply with NFPA 70.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00, "Product Requirements" and the requirements of this section.
- B. Coordinate delivery of units in sufficient time to allow heating of the buildings.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of the Contract Documents, products of the following manufacturers may be incorporated in the work of this section:
 - 1. King Electrical Manufacturing Company: <http://www.king-electric.com>.
 - 2. Indeeco: <http://www.indeeco.com>.
 - 3. Or Approved Equal.

2.02 ELECTRIC WALL HEATERS

- A. Blower and Motor:
 - 1. Tangential blower delivering 75 CFM.
 - 2. Shaded pole, permanently lubricated, C-frame type motor with impedance protection and sealed bearings.
 - 3. Same voltage as heater elements.
- B. Elements:
 - 1. Three steel sheathed heating tubes in furnace-brazed, plate-fin block design.
 - 2. Each sheathed tube shall contain coiled Ni-Chrome wire embedded in an insulator of Magnesium Oxide.
 - 3. Element assembly shall provide up to seven possible wattage configurations available for selection during field installation.
- C. Thermal Overloads:
 - 1. Thermal overloads shall disconnect elements and motor in event normal operating temperatures are exceeded.
 - 2. Thermal overloads shall remain open once tripped until manually reset by turning heater off for 25 minutes. Automatic reset thermal overloads shall not be permitted.
- D. Grille
 - 1. Grille shall be louvered, one-piece design with rounded edges on all four sides.
 - 2. Grille shall be epoxy powder coated in white or almond.

E. Wall Can:

1. Wall can shall be 20 gauge electro-galvanized steel with a minimum of three electrical knockouts.
2. Wall can shall have a depth gauge indicator, and factory installed, insulated, and stranded copper ground wire.
3. Wall can shall be installed with a minimum 4-inch clearance to floors and 6-inch minimum clearance to sidewalls.
4. Zero clearance to combustibles in the wall.

F. Ratings: 250 W – 2,250 W at 120 V and 240 V.

G. Warranty: 5 year warranty.

H. Approvals: cULus (E41422).

2.03 ELECTRIC COVE HEATERS

A. Construction:

1. Constructed of extruded aluminum.
2. Sawtooth profile to increase radiating surface area.
3. Open on top and bottom for convection heating of room air.
4. Junction box at both ends with .5-inch electrical knockouts on back and top.

B. Elements:

1. Ni-Chrome wire embedded in Magnesium Oxide powder enclosed and sealed in aluminum sheath.
2. Element wattage density of approximately 150 W per linear foot.

C. Casing:

1. Full length back case constructed of 22 gauge electrogalvanized steel and baked enamel finish.

D. Color: Almond or white.

E. Ratings: 250 – 1800 W at 120 V and 240 V.

F. Warranty: 2-year warranty.

G. Approvals: cULus.

2.04 WALL HEATER AND COVE HEATER THERMOSTATS

- A. Wall heater and cove heater thermostats shall be line voltage manual and programmable as scheduled on the drawings.
- B. Thermostats shall be furnished to the Section 23 09 00, "HVAC Controls" contractor for installation and programming.

2.05 ELECTRIC DUCT HEATERS

- A. Duct heaters shall be of the slip-in duct configuration.
- B. Heating Elements:
 - 1. Heating elements shall be open coil, 80% Nickel, 20% Chromium, Grade A resistance wire.
 - 2. Coils shall be machine crimped into stainless steel terminals extending at least 1" into the airstream and all terminal hardware shall be stainless steel.
- C. Heater Frames and Terminal Boxes:
 - 1. Shall be constructed of corrosion resistant steel.
 - 2. Terminal box shall be NEMA 1 type construction and shall be provided with a hinged, latching cover and multiple knockouts for field wiring.
- D. Heater Components:
 - 1. Furnished with disc type, automatic reset thermal cutout for primary over-temperature protection.
 - 2. Furnished with disc type, load carrying manual reset thermal cutouts, factory wired in series for secondary protection.
 - 3. Heaters shall be rated for the voltage, phase and capacity as indicated in the Drawings.
 - 4. Terminal blocks shall be provided for all field wiring and sized for installation of 75°C copper wire rated per NEC requirements.
 - 5. All internal wiring shall be stranded copper with 105°C insulation and shall be terminated in crimped connectors or box lugs.
- E. Control:
 - 1. Heater shall be furnished with Option K SCR control.
 - 2. Provided with thermal cutouts, airflow switch and fan relay, control circuit transformer and built-in snap-acting door interlocked disconnect switch.

3. Heater shall be controlled with proportional electronic duct thermostat with set point adjuster.
4. Heater panel shall display "Low Airflow" and "Heater On" pilot lights.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions are satisfactory to receive work of this section. Do not commence work until unsatisfactory conditions have been corrected.
- B. Beginning of work constitutes acceptance of conditions.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install heaters in accordance with applicable codes and regulations, manufacturer's installation instructions and this section.
- B. Install duct heaters in ductwork. Confirm heater size is compatible with duct size and ductwork is supported to handle the weight of the duct heater.

3.03 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Operational Test: After electrical circuitry has been energized, confirm proper operation and verify all interlocks and safeties operate properly.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.
- D. Duct installation requirements are specified in Section 23 31 13, "HVAC Ductwork." Drawings indicate general arrangement of ductwork.
- E. Allow space for service and maintenance of duct heater.

END OF SECTION

Division 26

Electrical

SECTION 26 05 11
BASIC ELECTRICAL METHODS AND MATERIALS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Provide electrical materials and labor to satisfactorily complete electrical work shown on the Drawings, specified, or neither shown nor specified but necessary for a complete and fully operating facility.
- B. Mounting details of equipment, devices, light fixtures, raceways, junction boxes, etc., are not usually shown or specified, provide per industry standard practice and code requirements as necessary for proper installation and operation, shall be included in the Contractor's estimate, the same as if specified or shown.

1.02 SUBMITTALS

- A. Procedures: See Section 01 33 00, "Submittal Procedures."
- B. Submittal package shall be organized by equipment type. Include separators and tabs or other means of identifying each item.
- C. Shop Drawings: Show dimensions, physical configurations, methods of connecting equipment, mounting details, and wiring schematics. Drawings shall be complete with device numbers, wire numbers, and terminal board numbers. Submit fabrication details and nameplate legends. Include material lists and/or bills of material. Submit manufacturer's catalog cuts for each item for which shop drawings are not required. Manufacturer's catalog cuts, specifications, or data sheets shall be clearly marked to delineate the options or styles to be furnished.
 - 1. Contractor shall submit shop drawings showing conduit installation and routing to Owner for review and approval prior to installing the conduit. Shop drawing shall show as a minimum but not limited to the following: conduit bodies, conduit type, pull boxes, wall penetrations, entry locations to electrical equipment.
 - 2. Contractor shall submit shop drawings for each concrete equipment pad as shown on the Drawings. The shop drawings for the concrete equipment pads shall also include dimensions and means to anchor to concrete foundation.
- D. Bill of Material (BOM): BOM shall include equipment item number, quantity, manufacturer, part number, model number, and descriptions.
- E. Nameplate schedule.
- F. Conduit tag schedule.
- G. Qualifications of testing organization and personnel meeting requirements of NETA ATS-2021, Section 3.

- H. Inspection and acceptance testing reports for new electrical equipment per NETA ATS-2021, Paragraph 5.4 for equipment for which tests are required in this and other Division 26 sections.
- I. Submit field test results specified in Part 3 this section.
- J. Applicable operation and maintenance information on an item-by-item basis in accordance with Division 1. Operation and maintenance information shall be provided at the time of equipment, device, or material site delivery, or at a certain stage of project completion as required by Division 1, whichever is the earlier. Full-size drawings shall be reduced to 11 by 17 inches. Provide electronic copy of all application software with the software comments on a memory stick.
- K. Description of functional checkout procedures, specified in this specification, 30 days prior to performing functional checkout tests.
- L. Nameplate abbreviations, if required.
- M. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.
- N. Record Drawings:
 - 1. Contract Drawings – Upon completion of the work, transfer the Contractor maintained as-built drawings to a clean set of full-size drawings with red ink to indicate additions and green ink to indicate deletions. Submit these full-size drawing markups to the Engineer and copy to the Owner.
 - 2. Equipment manufacturer shop drawings – Upon completion of the work, submit the as-built drawings from the equipment manufacturer with any modifications performed in the field. Submit these drawings in both an Adobe Acrobat [*.PDF] format and an Autodesk AutoCAD [*.dwg] format.

1.03 QUALITY ASSURANCE

- A. Variances: In instances where two or more codes are at variance, the most restrictive requirements shall apply.
- B. Standards: Equipment shall conform to applicable standards of American National Standards Institute (ANSI), Electronics Industries Association (EIA), Institute of Electrical and Electronics Engineers (IEEE), and National Electrical Manufacturers Association (NEMA). The revisions of these standards in effect on the date of issuance of the Contract Documents shall apply.
- C. Electrical equipment, materials, and installation methods shall conform to applicable local and state codes as well as the editions of the following in effect on the date of issuance of the Contract Documents:
 - 1. National Electrical Code (NEC).
 - 2. National Electrical Safety Code (NESC).

- D. Electrical equipment must be listed or labeled by a Nationally Recognized Testing Laboratory (NRTL). An NRTL is recognized by Occupational Safety and Health Administration (OSHA) as being capable of independently assessing equipment for compliance to safety requirements and applicable standards. UL is an example of an NRTL.
- E. Provide equipment with service entrance labels in those cases where the NEC requires such labels.
- F. Series short circuit ratings for protective devices are not allowed.
- G. For new equipment acceptance testing, studies, and reports per NETA ATS-2021 for equipment for which tests are required in this and other Division 26 sections.
 - 1. Testing organization and personnel performing tests shall meet the qualifications of ATS-2021, Section 3 and will be certified per ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel.

1.04 DRAWINGS

- A. The Electrical Drawings are diagrammatic; exact locations of products shall be verified with the Engineer prior to installation. Except where special details are used to illustrate the method of installation of a particular piece or type of equipment or material, the requirements or descriptions in this and other Division 26 sections shall take precedence in the event of conflict.
- B. Field-verify scaled dimensions on Drawings.
- C. Review the Drawings and specification divisions of other trades and perform the electrical work that will be required for the installations.
- D. Submit in writing to the Engineer details of any proposed changes in or departures from these Contract Documents along with the reasons, therefore. Make no changes or departures without the prior written favorable review of the Engineer.

1.05 JOB CONDITIONS

- A. Maintaining Power and Communications:
 - 1. The Silverdale RAGF is an active recycling and garbage facility and will remain operational during construction. Electrical power and communications to the existing small office shall be maintained during construction – as required to maintain operations of the RAGF.
 - a. See the construction sequence specification to schedule for when the existing electrical power and communication to the existing small office can be demolished.

- b. Contractor shall schedule and obtain written approval from Owner when electrical power and communication to the existing small office can be disconnected.
 - 1) Contractor shall coordinate with the utility providers for the disconnecting of the existing service to the existing small office.
 - 2) Contractor shall coordinate with the utility providers for the connection of the service to the new Attendant Building.
- 2. Contractor shall field verify existing wiring and conduit routing at the Silverdale RAGF facility prior to demolition and construction to ensure equipment required during construction work remain operational. Temporary wiring shall be provided to main equipment operational during construction. Temporary wiring shall be removed when permanent wiring is installed or when equipment is removed.

B. Construction Power:

- 1. Contractor is responsible to provide construction power. Contractor shall make arrangements for construction power as follows:
 - a. Contractor can use the existing 120 V receptacles for construction power. Contractor shall be aware that there are few existing 120 V receptacles and that the few existing receptacles are not presently located near construction areas.
 - b. Contractor shall not unplug/disconnect existing equipment from the existing 120 V receptacles.
 - c. Contractor shall notify the Owner of tripped circuit breakers so Owner can confirm other equipment connected to branch circuit has been restored when circuit breaker is reset.
 - d. Contractor's electrical loads shall not exceed the circuit capacity of the Owner's receptacles.
 - e. Contractor shall provide their own temporary power distribution system.
 - 1) Contractor shall provide their own temporary construction power.
 - 2) Contractor shall either provide their own generator or arrange for temporary construction power from Puget Sound Energy at no charge to the Owner.
 - 3) Construction power shall be in compliance with NEC, including the use of 120 V GFCI receptacles.
 - f. The Contractor shall supply any required temporary construction power electrical equipment (cords, circuit breakers, power boxes, transformers, etc.).
- 2. Provide equipment, materials, and wiring in accordance with the applicable codes and regulations.

3. Upon completion of the project, remove temporary construction power equipment, material, and wiring from the site as the property of the Contractor.
 4. Contractor provided temporary generators for construction power shall be in compliance with Kitsap County Code Noise ordinance.
- C. Storage: Provide conditioned storage for equipment and materials per manufacturer's requirements that will become part of the completed facility so that it is protected from weather, dust, water, construction, and facility operations.

1.06 DAMAGED PRODUCTS

- A. Notify the Owner in writing in the event that any equipment or material is damaged.
- B. Obtain prior favorable review by the Owner before making repairs to damaged products.

1.07 MATERIALS

- A. Provide first quality, new materials, free from defects, and suitable for the intended use and space. Where two or more units of the same class of material are required, provide products of a single manufacturer.
- B. Unless otherwise indicated, provide materials and equipment that are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications.

1.08 SEISMIC SUPPORT

- A. Mechanical, instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

1.09 WARRANTY

- A. The electrical equipment and installation shall begin after Substantial Completion of construction.
 1. This warranty is applicable for equipment installed, tested, and commissioned during that phase.
 2. Warranty period shall be a minimum of 1 year, unless otherwise specified.
 3. Warranty shall include repair parts, labor, and travel expenses.

1.10 LOCATIONS

- A. General: Use equipment, materials, and wiring methods suitable for the types of locations in which they are located, as defined in Paragraph B herein.
- B. Definitions of Types of Locations:
 - 1. Dry Locations: Indoor areas which do not fall within the definitions below for Wet, Damp, or Corrosive Locations and that are not otherwise designated on the Drawings.
 - 2. Wet Locations: Locations exposed to the weather, whether under a roof or not, or designated as Wet Locations by applicable codes and regulations, unless otherwise designated on the Drawings.
 - 3. Damp Locations: Location wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, or designated as Damp Locations by applicable codes and regulations, unless otherwise designated on the Drawings.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected for water, rain, dirt, construction debris, and traffic.
- B. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

PART 2 – PRODUCTS

2.01 STANDARD OF QUALITY

- A. It is the intent of these Specifications and Drawings to secure high quality in materials, workmanship, and equipment in order to facilitate operation and maintenance of the facility. Equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product. Equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for stresses that may occur during fabrication, transportation, erection, and continuous or intermittent operation. Equipment shall be adequately stayed, braced, and anchored and shall be installed in a neat and workmanlike manner. Appearance, as well as utility, shall be given consideration in the design of details.
- B. Components and devices installed shall be standard items of industrial grade or better, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile, and commercial grade devices of doubtful durability shall not be used.

2.02 CONSTRUCTION POWER

- A. The existing Silverdale RAGF will remain operational during this construction project. Contractor shall provide temporary construction power as required to power the existing attendant station to maintain the existing attendant station fully operational during construction.
- B. Existing electrical power on site is extremely limited and the contractor shall plan to arrange for temporary construction power with PSE at no cost to the Owner.
 - 1. Or the Contractor shall provide temporary generators for construction power at no cost to the Owner.
 - a. Temporary generators shall be compliant with Kitsap County noise ordinance.
- C. Construction power shall be compliant with NEC and Washington State rules and laws.

2.03 PUGET SOUND POWER (PSE)

- A. Contractor shall provide electrical power for the new service entrance. Contractor shall coordinate with PSE as well as providing assistance to PSE as part of this projects work.
- B. Contractor shall follow the most recent PSE published copy of the Electrical Service Handbook, Non-residential Projects Permanent and Temporary Service for construction for PSE requirements of what are customer responsibilities, and what are PSE responsibilities.
- C. Contractor to coordinate with PSE with construction schedule, for PSE required inspections, PSE equipment delivery and installation dates, equipment locations, scheduling electrical connections dates, energizing, measurements, and functional testing.
- D. Contractor shall provide the excavation to support the following PSE service entrance:
 - 1. Trench from power pole to pad mounted transformer.
 - 2. Vault for pad mounted transformer.
 - 3. Trench from pad mounted transformer to CT enclosure at equipment rack.
- E. Contractor shall provide bollards (guard post) to protect pad mounted transformer as specified in Drawings and as required by PSE.
- F. Primary:
 - 1. Provide PVC, Schedule 40 conduits for PSE Duct Bank from Dickey Road NW power pole to the pad mounted transformer as specified on the Drawings.
 - a. One of the two conduits for the primary duct bank is a spare conduit for future use. This spare conduit shall be routed underground within 10 feet of power pole and within 10 feet of transformer vault with threaded plugs at both ends.

2. PSE will provide the following:
 - a. See the PSE Electrical Service Handbook.
 - b. Pad Mounted Transformer.
 - c. Vault for below the pad mounted transformer.
 - d. Primary medium voltage cables and terminations.

G. Secondary:

1. Provide PVC, Schedule 40 conduits for the PSE Duct Bank from the pad mounted transformer to the CT enclosure on the outdoor equipment rack near the Attendant Building as specified on the Drawings.
2. PSE will provide the following:
 - a. See the PSE Electrical Service Handbook:
 - b. Revenue meter.
 - c. Current Transformers (CTs).
 - d. CT meter wiring.
 - e. Connectors where the service line interconnects with the PSE equipment.
3. Contractor shall provide the following:
 - a. Secondary conductors as specified on the Drawings.
 - b. CT Enclosure.
 - c. Meter base/socket.
 - d. Conduit between CT Enclosure and Meter base/socket.

2.04 LUMEN AND KPUD COMMUNICATIONS

- A. Contractor shall provide underground conduits for communication services as specified on the Drawings.
- B. Contractor shall coordinate with communications providers and provide assistance for pulling in cable and fiber optics to the server room.
- C. Contractor shall provide 4 feet by 8 feet fire resistant plywood in the server room as specified on the Drawings.

2.05 PAINTING AND COATING

- A. Equipment: Refer to each electrical equipment section of these Specifications for painting and coating requirements of equipment and enclosures. Repair any final finish that has been damaged or is otherwise unsatisfactory using touchup materials approved by the manufacturers, to the satisfaction of the Owner.

PART 3 – EXECUTION

3.01 PERMITTING

- A. Electrical Permit: Contractor shall obtain permit from Labor and Industries, coordinate, and pay for electrical permit.

3.02 GENERAL

- A. Work shall be performed by craftsmen skilled in their trade. Work shall present a neat, finished appearance.
- B. Install equipment in strict accordance with the manufacturer's instructions unless directed otherwise. Wherever a conflict occurs between manufacturer's instructions, codes and regulations, or these Contract Documents, follow Engineer's direction. Keep a copy of manufacturer's installation instructions on the job site available for review at times.
- C. Provide protection for materials and equipment against loss or damage. Protect everything from the effects of weather. Prior to installation, store items in indoor locations. In addition, items subject to corrosion under damp conditions, and items containing insulation, such as transformers, motors, and control, shall be stored in indoor, heated, dry locations.
- D. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.
- E. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to original condition using skilled craftsmen of the trades involved at no additional cost to the Owner.
- F. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of devices and equipment. Touch up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

G. Label electrical and control equipment, including electrical panelboards, transfer switches, junction boxes, lighting control panels, generator control panels, communication panels, electrical enclosures, disconnect switches, etc.

1. Labels shall include location (e.g., panelboard) of power source providing power to the electrical and communication equipment.

H. Concrete Equipment Pads: Contractor shall prepare shop drawings detailing the construction method of the concrete equipment pad for the electrical equipment. The Electrical Drawings show the locations of the electrical equipment concrete equipment pads.

1. Shop drawings for concrete equipment pads shall be submitted after the equipment submittals from the equipment manufacturers have been approved by the Owner. Construction for the equipment pads shall not begin until equipment submittals and shop drawings are approved.

3.03 GROUNDING

A. Bond and ground equipment for which a ground connection is required per NEC whether not specifically shown on the Drawings.

3.04 START-UP FIELD SERVICE

A. Contractor shall provide start-up with field services to support start-up, testing, and commissioning of new equipment.

- a. Contractor shall coordinate and assist service providers for power and communications as part of the new construction.

3.05 FIELD TESTS

A. Perform inspection and acceptance testing and submit test reports for the equipment specified in Section 26 08 00, "Electrical Testing and Commissioning," and as specified in all Division 26 sections.

B. Give a 2-week notice to the Engineer and Owner prior to any test to permit witnessing the test.

C. Retesting will be required for unsatisfactory tests after the equipment or system has been repaired. Retest related equipment and systems if required by the Engineer. Repair and retest equipment and systems that have been satisfactorily tested but later fail, until satisfactory performance is obtained.

3.06 FINAL CLEANING

A. Contractor shall provide final cleaning of electrical equipment and work spaces and work areas.

- B. Contractor shall clean all items worked on under this Contract. Contractor shall leave work areas free of stains, damage, or other defects prior to final acceptance.
1. Cleaning shall include wiping, sweeping, and vacuuming to leave work areas and equipment free of dust, debris, and moisture.
 2. Contractor shall clean the exposed concrete equipment pad of all construction debris.
 3. Prior to energizing, the Contractor shall wipe clean the interior of the service entrance disconnect, ATS, panelboards, junction boxes and wireways, lighting control panels, and all electrical enclosures (including all the compartments behind covers and access doors) using a dry, clean cloth. Replace cloth frequently to prevent spreading of debris and lubricating oil.
 4. Contractor shall vacuum all electrical enclosures prior to electrical equipment being energized.
 5. Contractor shall clean and vacuum the following floors:
 - a. Attendant Building Server Room.
 - b. Attendant Building Attic Space Room.
 - c. LHHW Building Warming and Storage Rooms.
 - d. Operator Warming Station (both rooms).
- C. Standby Generator Enclosure:
1. Contractor shall clean the generator interior enclosure of all construction dirt, dust, and debris.
 2. Prior to energizing, the Contractor shall wipe clean the interior of the output circuit breaker enclosure (including all the compartments behind covers and access doors) using a dry, clean cloth. Replace cloth frequently to prevent spreading of debris and lubricating oil.
 3. Contractor shall vacuum all sections of the electrical equipment prior to energizing.

3.07 RECORD DRAWINGS

- A. Maintain a set of as-built drawings on-site that documents changes made to both the Contract Drawings and approved equipment manufacturer shop drawings.
- B. At the completion of the project, Contractor shall submit a set of as-built drawings which include the as-built red-lines from the project. Contractor shall submit red-lines to manufacturer's shop drawings.
- C. Submitted red-line as-built drawings shall be legible, or they will be returned to the Contractor to improve prior to resubmittal.

END OF SECTION

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SECTION 26 05 19
LOW-VOLTAGE WIRE AND CABLE

PART 1 – GENERAL

1.01 SUMMARY

- A. Provide low-voltage wire and cable as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Provide communication wire and cable as shown on the Drawings, and specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

- A. Comply with the following requirements:
 - 1. NFPA 70 National Electrical Code (NEC).
 - 2. UL listed.
 - 3. Local codes and ordinances.

1.03 SUBMITTALS

- A. Shop Drawings: Submit product information/data shop drawings for materials in accordance with Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."
- B. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

1.04 WARRANTY

- A. Manufacturer warrants their product will be free from defects in material or workmanship for a 2-year period. The product warranty shall begin at time of equipment start-up.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected for water, rain, dirt, construction debris, and physical damage.
- B. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Comply with the following standards:
 - 1. UL 83 for thermoplastic insulated wire and cable.
 - 2. UL 44 for rubber or rubber-like and cross-linked thermosetting polyethylene insulated wire and cable.
- B. Provide copper wire only.
- C. No underground splices allowed unless approved by the Owner.
- D. Nomex wire type is not allowed.

2.02 WIRE AND CABLE IN RACEWAY

- A. Building internal lighting and general-purpose receptacles:
 - 1. Insulation: Type THWN-2 rated 600 V.
 - 2. Insulation: Flame-retardant, heat and moisture resistant, polyvinyl chloride (PVC).
 - 3. Jacket: Tough Polyamide (Nylon).
 - 4. UL Standard 83.
 - 5. Use minimum #12 AWG conductors for lighting and general-purpose receptacles.
 - 6. Acceptable Manufacturers: ADC, General Cable, or preapproved equal.
- B. Power feeders and external branch circuits.
 - 1. Insulation: Type XHHW-2 rated for 600 V.
 - a. Cross-Linked Polyethylene (XLPE) Insulation.
 - b. High-Heat and Moisture Resistant:
 - 1) Used in wet and dry locations at temperatures not to exceed 90°C.
 - c. Gas, oil, and UV resistant.
 - 2. Use stranded wire for all power conductors.
 - 3. Use minimum #12 AWG conductors for receptacles and lighting.
 - 4. Acceptable Manufacturers: Southwire, General Cable, or preapproved equal.

C. Twisted Shielded Triad Cable (TST):

1. 600 V Rated (Preferred):

- a. Cable shall be single twisted, shielded triads, cable tray rated (Type TC), 16 AWG, instrumentation cable, UL listed.
- b. Jacket: Jacket shall be suitable for installations in wet or dry locations; resistant to sunlight, moisture, and vapor penetration; PVC per UL Standard 1277.
- c. Conductor Insulations: PVC-nylon or XLP or Okoseal insulation with nylon jacket, 45-mil PVC, 600 V rated.
- d. Conductor: Bare annealed copper or tinned copper, stranded in accordance with ASTM B8.
- e. Conductor Insulation: 15-mil, 90°C, PVC.
- f. Shield and drain wire integral to cable.
- g. Standards: UL 1277, IEEE 383, UL listed as Type TC.
- h. Approved for Use: Indoors or outdoors; wet or dry locations; in cable trays; in raceways; for direct burial; and in Class I, Division 2 location (NEC Article 501).
- i. Acceptable Manufacturers: Belden, Okonite, or preapproved equal.

D. Ethernet Cable:

1. CAT6:

- a. Cable shall exceed Category 6 component transmission requirements specified in ANSI/TIA/EIA-568-C.2 and shall be tested to 100 MHz.
- b. UL 1277 Listed, Type TC (Tray Cable) 600 V, 90°C cable.
- c. Cable shall exceed IEEE 802.3 DTE Power specification to the rated current limits with no degradation of performance or materials.
- d. Cable shall be error free Gigabit Ethernet performance to IEEE 802.3.
- e. Cable shall exceed the requirements of TIA/TSB-155: 1 Gb/s Ethernet Operation over 55 Meters Channel Length.
- f. Cable shall meet or exceed the 4-connector channel performance requirements of Category 6, per the ANSI/TIA/EIA-568-C.2 standard.
- g. Product: Construction shall be four twisted pairs of 22-24 AWG insulated solid conductors.
- h. Overall Cable Insulation Voltage Rating: 600 V.

- i. Connector: 50-micron gold plated RJ-45.
- j. Warranty: Lifetime.
- k. Acceptable Manufacturers: Belden or preapproved equal.

2.03 JOINTS, TAPS, SPLICES, AND TERMINATIONS

- A. Conductors #10 AWG and Smaller: Use twist type insulated wire nut solderless connectors. The twist type insulated wire nut solderless connectors are only allowed for lighting and 120 V receptacles branch circuits.
- B. Conductors #8 AWG and Larger: Use solderless compression type connectors that will not loosen under vibration or normal strains.
- C. Control and Instrumentation Conductors: Use crimp-type spade connectors where control wires are connected to screw terminals of equipment.
- D. Joints, Taps, and Splices Located in Enclosures Subject to Moisture: Use watertight splice kits.
 - 1. Contractor shall obtain written approval for each location where wiring splices are required.
- E. Contractor shall obtain written approval from Owner prior to splicing feeder conductors or instrumentation/control wiring.

2.04 COLOR CODING

- A. General:
 - 1. Multiconductor control cable colors shall be manufacturer's standard.
- B. Control Conductors:
 - 1. Provide conductors with a minimum of five unique insulation colors for the installation of control conductors within the same raceway. Do not use brown, orange, and yellow for control conductor insulation colors. Provide equal distribution of colors.
- C. Power Conductors:
 - 1. Power conductors shall be color coded in accordance with the following table. For multiconductor cables, colored tape may be applied to the ends to provide the required color code.

Use	Cable	Color
Three-phase, 460/277 V power	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow
	Neutral	Gray
	Ground	Green

Use	Cable	Color
Three-phase, 120/208 V power	Phase A	Black
	Phase B	Red
	Phase C	Blue
	Neutral	White
	Ground	Green
Single-phase, 120/240 V power	Line 1	Red
	Line 2	Black
	Neutral	White
	Ground	Green

2. Conductors sized 4 AWG and larger may be black with colored 3/4-inch vinyl plastic tape applied in 3-inch lengths around the cable at each end.
3. Mark the conductor cables at terminations and on cables in pull boxes, handholes, and manholes.
4. Provide identification of the coding scheme at branch circuit distribution equipment in accordance with the requirements of NEC 210.5 and 215.12.

2.05 PERMANENT WIRE MARKERS

- A. Provide permanent wire markers for all new wiring installed.
- B. Wire markers shall be heat shrink type (Raychem, T&B, or approved equal) or self-laminating where conductors are not spliced or terminated. Wire numbers shall be permanently imprinted on the markers.

PART 3 – EXECUTION

3.01 CONTROLS CONDUCTORS

- A. Consult with Owner prior to purchase and installation of controls conductors within raceways to confirm the Owner's requirements.

3.02 INSTALLATION

- A. Install wiring and cable as specified in Conduit and Cable Schedules and as specified on drawings.
- B. Install wiring system in accordance with manufacturer's recommendations.
- C. Install wire and cable in conduit unless otherwise shown on the Drawings.
- D. Maintain barrier, physical separation, or conduit separation between power conductors and communication conductors to avoid magnetic interaction where such conductors enter and pass-through same manhole, handhole, box, electrical trough, or enclosure.

- E. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables, or otherwise abrading them. No grease will be permitted in pulling cables. Only listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling to avoid damage to conductors.
- F. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length.
- G. Provide an equipment-grounding conductor, whether or not it is shown on the Drawings, inside any flexible conduit or any raceway in which all or any portion of a run consists of nonmetallic duct or conduit. External bonding jumpers are not acceptable.
- H. In panels, bundle incoming wire and cables, #6 AWG and smaller; lace at intervals not greater than 6 inches; neatly spread into trees and connect to respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.
- I. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and arrange so that there will be protection from chafing and excess flexing when the hinged member is moved.

3.03 CONDUCTOR SPLICES AND TERMINATIONS

- A. Splices:
 - 1. Install conductors without splices unless necessary for installation, as determined by the Owner. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice or terminate wire and cable as follows:
 - a. Watertight Splices: Splices in concrete pull boxes, for any type of cable or wire, shall be watertight. Make splices in low-voltage cables using epoxy resin splicing kits rated for application up to 600 V.

3.04 CONDUCTOR IDENTIFICATION

- A. Install as specified in Section 26 05 53, "Identification for Electrical Systems."

3.05 FIXTURE OUTLETS

- A. Use minimum AWG #12 wire for conductors supplying power to single fixture.

3.06 FIELD TESTS

- A. Perform inspection and acceptance testing and submit test reports for the equipment specified in this section and other Division 26 sections.
- B. Give a 2-week notice to the Owner prior to any test to permit witnessing the test.

C. Retesting will be required for all unsatisfactory tests after the equipment or system has been repaired. Retest all related equipment and systems if required by the Owner. Repair and retest equipment and systems that have been satisfactorily tested but later fail, until satisfactory performance is obtained.

D. Field Test Report:

1. A field test report shall be prepared and submitted as a single bound submittal package and shall include each test specified in this section and other Division 26 sections. Include separators and tabs, or other means of identification, for each individual test.
2. The test data records shall include the following:
 - a. Identification of the testing technician and organization.
 - b. Equipment identification.
 - c. Description of test method and equipment, including test equipment calibration dates.
 - d. Identification of conditions that may affect the test results such as humidity and temperature.
 - e. Date and time.
 - f. Inspection and test results. For each test, include range of acceptable test values.
 - g. Indication of "as-found" and "as-left" results, as applicable.
 - h. Comments and test summary.

E. Conductor Insulation Test:

1. Perform an insulation resistance test for each conductor with a circuit voltage above 150 V to ground.
2. Test procedure shall conform to NETA ATS.
3. Insulation-resistance test values shall not be less than 100 megohms.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies the system for grounding electrical equipment and for building/structure ground electrode systems.

1.02 REFERENCE STANDARDS

- A. Referenced Standards: This section incorporates by reference the latest revisions of the following documents. In case of conflict between the requirements of this section and the listed documents, the requirements of the Contract Specifications shall prevail.
 - 1. NFPA 70: National Electric Code (NEC).
 - 2. UL 467: Standard for Grounding and Bonding Equipment.

1.03 SUBMITTALS

- A. Shop Drawings: Submit product information/data shop drawings for materials in accordance with Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."
- B. Submit product catalog cut sheets.
- C. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.
- D. Test data.

1.04 QUALITY ASSURANCE

- A. Source Quality Control: Products shall be listed and labeled by an approved Nationally Recognized Testing Lab (NRTL) such as Underwriter's Laboratories, Inc. (UL), ETL, or Canadian Standards Association.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The grounding system shall consist of grounding conductors, ground bus, ground fittings and clamps, and bonding conductors to equipment and structural steel as shown on the Drawings or as required to meet the requirements of the NEC.

2.02 SYSTEM COMPONENTS

A. Ground Conductors:

1. Conductors shall be soft drawn copper.
2. Sizes over #6 AWG shall be stranded.
3. Coat ground connections with electrical joint compound, nonpetroleum type, listed for copper and aluminum applications.
4. Provide ground conductors with either green colored insulation or uninsulated bare copper unless noted otherwise in the Contract Documents.
5. If cable sizes are not specified, the minimum sizes shall be as follows unless otherwise specified on the Drawings:
 - a. 240 V Generator: 1/0 AWG
 - b. Lighting Panels: 2 AWG
 - c. Exposed Metal: 2 AWG
 - d. Control Panels: 12 AWG

B. Ground Connections:

1. Binding Post Connectors:
 - a. Lugs for attachment of cables to steel enclosures shall be of the binding post type with a 1/2-13 NC stud.
 - b. Each post shall accommodate cables from #4 AWG to #4/0 AWG.
2. Compression Connectors:
 - a. Material-pure wrought copper extrusions.
 - b. Irreversible compression connection.
 - c. Acceptable Manufacturer:
 - 1) Thomas and Betts.
 - 2) Burndy.
 - 3) Approved equal.

3. Bolted Connectors:

a. Acceptable Manufacturer:

- 1) Burndy.
- 2) O. Z. Gedney.
- 3) Approved equal.

C. Ground Rods:

1. Copper covered steel, 3/4-inch diameter and 10 feet long.
2. Rods shall have threaded type removable caps so that extension rods of the same diameter and length may be added where necessary.

D. Ground Rod Test Wells:

1. Test well shall be 12-inch diameter concrete well with cast iron cover.
2. Traffic rated for H-20 vehicle traffic.
3. Cover shall have the word "GROUND" visible and shall be permanent to the cover.

E. Ground Bus Bar:

1. Ground bus bars shall be 1/4 inch thick by 4 inches wide by 12 inches long.
2. Ground bus bars shall be provided with insulators, stainless steel brackets, stainless steel mounting bolts, and be UL Listed.
3. Ground bus bars shall be provided with a hole pattern sufficient for terminating the required amount of grounding conductors shown on the Drawings, plus 25% spare.

F. Junction Box Ground Bar:

1. Equipment grounding terminal bar shall have screw terminals listed for #14 AWG through #4 copper conductors.
2. Ground bar shall be large enough to terminate required number of grounding conductors in junction box.

G. Steel Column Ground Bond:

1. Bond building wide flange steel column or steel square tube to ground system by drilling fastener hole in web or center of the tube surface center 12 inches above floor. Fastener hole shall be sized to support bolt connection of compression lug.
 - a. After ground bond bolted connection, apply anti-corrosion finish to bolted connections, both sides of wide flange.

H. Pipe Ground Clamps:

1. Ground Clamps for Steel Pipe:
 - a. High-strength 6061-T6 aluminum alloy.
 - b. Electro tin plated for low contact resistance and protection from corrosion.
 - c. Sized for the pipe size.
2. Conductor termination.
 - a. Hex socket.
3. UL listed.
4. Compatible with stainless steel pipe.
5. Acceptable manufacturers:
 - a. Hubbell.
 - b. Burndy.
 - c. Ilisco.
 - d. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Connection methods:

1. Provide irreversible compression ground connectors for all ground bonding connections.
 - a. Ground conductor compression lugs shall be bolted to ground bus bars.
 - b. Ground conductors for metal water pipe clamps shall be bolted mechanical connections.

B. Route Grounding Electrode Conductor along interior walls and concrete floors/equipment pads protected with polyvinyl chloride (PVC40) conduit when required per NEC or specified on the Drawings:

1. Provide two-hole PVC conduit clamps when supporting PVC conduit.

- C. Where grounding conductors pass through concrete floors, equipment pads, or wall, provide PVC conduits for grounding conductors to pass through.
 - 1. Except where grounding conductors are bonding to reinforcement steel within the concrete.
- D. Ground equipment for which a ground connection is required per NEC whether or not the ground connection is specifically shown on the Drawings.
- E. Prior to making ground connections or bonds, clean metal surface at the point of connection.
- F. Ground rod spacing – ground rods shall not be located within 10 feet of each other.

3.02 RACEWAY GROUND

- A. Metallic Conduits:
 - 1. Assembled to provide a continuous ground path and bonded using insulated grounding bushings.
 - 2. Bond using insulated grounding bushings.
- B. Non-Metallic Conduits: Insulated ground conductor sized in compliance with the NEC.
- C. Grounding Bushings: Connected to the grounding system using conductors sized in compliance with NFPA 70.
- D. Provide a ground wire in every conduit carrying a circuit of over 50 V to ground.

3.03 BUILDINGS OR STRUCTURES SUPPLIED BY A FEEDER OR BRANCH CIRCUIT

- A. Provide grounding and bonding per NEC 250.32.
 - 1. Buildings or Structures:
 - a. Attendant Building.
 - b. LHHW Building.
 - c. Warming Station.
 - d. Refuse Shed A.
 - e. Refuse Shed B.
 - f. Refuse Shed C.
 - g. Refuse Shed D.
 - h. Maintenance Shed.

3.04 EQUIPMENT AND ENCLOSURE GROUND

- A. Connect electrical and distribution equipment to the grounding system. Cables sized as specified.
- B. Connect non-electrical equipment with metallic enclosures to the grounding system.

3.05 JUNCTION BOX GROUND BAR

- A. Provide junction box ground bar in boxes trade size 8-inch by 8-inch or larger.
- B. Ground bars inside junction box shall be attached with self-tapping machine screws.
- C. Junction box shall be rated for the environment and space.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section specifies the furnishing of installation of hangers and supports for electrical systems as indicated on the Contract Drawings and herein specified.

1.02 REFERENCE STANDARDS

- A. This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
 - 1. ASTM A123: Standard specification for zinc coatings on iron and steel.
 - 2. ASTM A193/A193M REV C: Alloy-steel and stainless-steel bolting materials for high-temperature service.
 - 3. NFPA 70: National Electrical Code (NEC).

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Delegated Design: The following systems shall be designed and sealed by a Washington State Registered Professional Structural Engineer to ensure conformance with IBC seismic, building, and load requirements:
 - a. Suspended raceway supports.
 - b. Wall raceway supports.
 - 2. Raceway supporting systems, structures, and elements shall be designed to meet seismic and other building structural requirements and to support the static and dynamic load of the wiring and raceways that they will carry.

1.04 SUBMITTALS

- A. Shop Drawings: Submit product information/data shop drawings for materials in accordance with Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."
- B. Include manufacturer's product information including catalog cuts.
- C. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

- D. Submit sealed structural drawings when raceway support systems require design by a registered engineer.
- E. Submit attachment details for any new support connections to the existing structure.

1.05 SEISMIC SUPPORT

- A. Mechanical, instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

1.06 WARRANTY

- A. Contractor shall ensure electrical equipment warranty shall begin after significant completion of construction.
- B. This warranty is applicable for hangers and supports of electrical equipment installed, tested, and commissioned during that phase.

PART 2 – PRODUCTS

2.01 GENERAL FASTENING AND SUPPORT HARDWARE

- A. Provide fasteners, anchors, clamps, supports, strut, framing channel, threaded rod, plates, posts, and brackets made of the following material in the identified area:
 - 1. Hot-dipped galvanized steel shall be used at all interior and exterior locations, with the following exceptions:
 - a. Attendant Building Interior (Server Room and Attic) use zinc plated unless otherwise specified in Division 26 sections or the Drawings.
- B. Expansion shield and tamperproof pin style anchors are not acceptable. Size anchors to meet load requirements. Minimum size anchor bolt is 3/8 inch.
- C. All equipment fasteners and anchors shall be reversible to allow equipment to be removed or replaced.
- D. All suspended conduit supports shall include braces for seismic loadings.

2.02 RACEWAY SUPPORTS

- A. Conduit Supports:
 - 1. Provide strut channel with end caps to support groups of conduits.
 - 2. Individual conduit supports shall be one-hole pipe straps used with clamp backs and nesting backs where required.

B. Ceiling Hangers:

1. Ceiling hangers shall be adjustable rod hangers as specified. Straps or hangers of plumber's perforated tape are not acceptable.
2. Unless otherwise indicated, hanger rods shall be 1/2-inch all-thread rod and shall meet ASTM A193.

C. Suspended Raceway Supports (Racks):

1. Suspended raceway supports shall consist of concrete inserts, rod hangers, and jamb nuts supporting strut channel or lay-in pipe hangers as required.
2. Unless otherwise indicated, hanger rods shall be 1/2-inch all-thread rod and shall meet ASTM A193.
3. Brace suspended raceway supports at 30-foot intervals (alternating from one side to the other) to meet specified seismic requirements.

PART 3 – EXECUTION

3.01 GENERAL

- A. Treat ferrous metal exposed male threads, cut surfaces, and damaged ends with corrosion-resistant coatings, such as "Zinc-It" prepared by CRC, "Crown Premium 7007" prepared by L. H. Dottie, or "Devcon Z" prepared by ITW Polymers & Fluids, or approved equal. Application shall follow manufacturer's recommendation.

3.02 HANGER AND SUPPORT LOCATIONS

- A. Locate at least one hanger or support within 2 feet from a conduit change in direction, change in elevation, adjacent to flexible joints and couplings, and where shown on the Drawings.
- B. Locate a vertical conduit support within 1 foot above each floor penetration.
- C. Locate hangers and supports to ensure that connections to equipment, panels, etc., are substantially free from loads transmitted by the conduit.
- D. Conduit supports shall not be placed at a location which will cause interference with the operation of equipment or other items that need to be accessed for regular operation and maintenance of the facility. Do not install conduit supports and hangers in equipment access areas.
- E. Maximum Support Spacing: Support spacing shall be designed and sealed by a Washington State Registered Professional Structural Engineer. In no case shall the maximum spans exceed those listed as follows: Support spacing shall not exceed 4 feet for PVC and any other non-metallic piping systems. Support spacing shall not exceed 6 feet for metal conduit systems unless otherwise approved by the Engineer.

3.03 INSTALLATION

- A. Conduit support hangers, brackets, etc. shall be of suitable capacity and shall be appropriate to the individual structural member used to support the conduit.
- B. Conduit may be supported from the nearest structural element (ceiling, wall) as long as these attachments shall not cause the structural member to exceed the design live load criteria shown on the Drawings.
- C. Do not support any conduit from any piping supports.
- D. Brace hanging conduit against horizontal movement by both longitudinal and lateral sway bracing.
- E. Install lateral supports for seismic loads at all changes in direction and where conduit support does not provide adequate lateral support for tributary seismic loads.
- F. Install hangers and supports to allow controlled thermal and seismic movement of conduit systems, to permit freedom of movement between conduit support anchors, and to facilitate action of expansion joints and similar units.
- G. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
- H. Repair mounting surfaces to original condition after attachments are made.
- I. Strut System Installation: Arrange for grouping of parallel runs of conduit and support together on field-assembled struts.
- J. Bolted attachments to the building structural steel shall be in accordance with the equipment manufacturer's installation instructions. Unless otherwise indicated, do not drill or burn holes in the building structural steel.
- K. Do not use hanger components for purposes other than that for which they were designed. Do not use them for rigging and erection purposes.
- L. Finishing hanger and support components in contact with nonmetallic conduit shall be free of burrs and sharp edges.
- M. Prior to grouting, rough finished floor beneath structural attachments and framing channel post bases. Grout between base plate and floor shall be free of voids and foreign material.
- N. Provide plastic or rubber end caps at the exposed ends of all framing channels that are located up to 7 feet above the floor.

3.04 ANCHOR BOLTS

- A. Anchor bolt material and installation requirements shall conform to Specification Section 13 05 41.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

- A. Provide raceway and boxes as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

- A. Comply with the following requirements:
 - 1. NFPA 70 National Electrical Code (NEC).
 - 2. Local codes and ordinances.
 - 3. UL 2515 – Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
 - 4. UL 2420 – Belowground RTRC and Fittings.

1.03 SUBMITTALS

- A. Shop Drawings: Submit product information/data shop drawings for materials in accordance with Section 26 05 11, “Basic Electrical Methods and Materials,” and Section 01 33 00, “Submittal Procedures.”
- B. Contractor shall submit shop drawings showing conduit routing of the numerous conduits within the Refuse Sheds, LHHW Building, Attendant Building, and Warming Station.
 - 1. Conduit shop drawing shall be submitted to the Owner for review and approval prior to the Contractor beginning installation of the conduit.
- C. Contractor to submit shop drawing depicting the internal components and spacing along with enclosure sizing for the terminal box enclosure.
- D. Contractor to submit wire trough product data sheets for each wire trough use. Include the wire trough sizing for each location.
- E. Meter base/socket and current transformer cabinet and mounting base. Submit product information showing compliance to PSE’s requirements.
- F. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.
- G. Woven polyester pull tape product data.

1.04 WARRANTY

- A. Contractor shall ensure electrical equipment warranty shall begin after significant completion of construction.
- B. This warranty is applicable for raceways, boxes, and equipment specified herein as installed, tested, and commissioned during that phase.

1.05 SHIPPING, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected for water, rain, dirt, construction debris, and physical damage.
- B. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide conduit system of the types of conduits as indicated in the Conduit Usage Schedule in Part 3 of this section.
- B. Provide minimum of 3/4-inch trade-size conduit.
- C. Both 90-degree short radius and 90-degree large radius adapter elbows are prohibited, with the exception as follows:
 - 1. Provide 90-degree large radius GRS conduits when required by utility providers for underground service entrance.
- D. Provide junction boxes as necessary to facilitate pulling and/or splicing of wires.
- E. All equipment fasteners and anchors shall be reversible to allow equipment to be removed or replaced.

2.02 METAL CONDUIT AND FITTINGS

- A. Galvanized Rigid Steel Conduit (GRS) and Fittings:
 - 1. Conduit: Comply with ANSI C80.1 and UL 6 standards.
 - 2. Fittings: Comply with UL 514B and NEMA FB1 and FB2.10 standards.
 - 3. Hot-dip galvanized steel.
 - 4. Couplings shall be threaded type. Setscrew-type and compression-type are not acceptable.
 - 5. Union couplings for conduits shall be the three-piece (Erickson) type. Threadless couplings shall not be used.

B. Electrical Metallic Tubing (EMT) and Fittings:

1. Conduit: Comply with ANSI C80.3 and UL 797 standards.
2. Fittings:
 - a. Comply with UL 514B and NEMA FB1 and FB2.10 standards.
 - b. Shall be setscrew-type.

2.03 RIGID NONMETALLIC CONDUIT AND FITTINGS

A. Polyvinyl Chloride Conduit (PVC) and Fittings:

1. Conduit: Comply with NEMA TC2 and UL 651 standards.
2. Fittings: Comply with NEMA TC3 and UL 641 standards.
3. Joints shall be made with standard PVC Couplings.
4. Fittings shall be PVC solvent weld type.
5. PVC conduit shall have bell ends where terminated at walls and boxes.
6. PVC40 – Schedule 40, high-impact polyvinyl chloride conduit.
7. PVC80 – Schedule 80, high-impact polyvinyl chloride conduit.
8. No PVC conduit elbows, no PVC field bends; all elbows are factory RTRC.

2.04 FLEXIBLE CONDUIT AND FITTINGS

A. Liquidtight Flexible Metal Conduit and Fittings:

1. Conduit: Comply with UL 360 standards.
 - a. Galvanized flexible steel core.
 - b. Provide outer liquidtight, PVC sunlight resistant jacket.
2. Fittings: Comply with UL 514B and NEMA FB1 standards.
3. Liquidtight Flexible Metal Conduit shall not be used in corrosive locations.

B. Liquidtight Flexible Nonmetallic Conduit and Fittings:

1. Conduit: Comply with UL 1660 standards.
2. Fittings:
 - a. Shall comply with UL 514B and NEMA FB1 standards.
 - b. Shall be Arlington NMLT three-piece connectors.

2.05 CONDUIT BODIES

- A. Metallic Conduit Bodies: Comply with ANSI C80.4 and C33.84, and UL 514 standards.
 - 1. Use hot-dipped galvanized or cadmium plated malleable iron, or copper-free aluminum material.
- B. Fiberglass Conduit Bodies: Comply with UL 2515.
 - 1. Each conduit body shall have a watertight seal between the cover and the conduit body and are supplied with 316 stainless steel hardware cover screws.
 - a. Conduit body shall be supplied with silicon based watertight and corrosion resistant gasketing system.
 - 2. Fiberglass conduit bodies installation locations shall be preapproved by the Owner prior to installation.
- C. Contractor shall provide conduit bodies which support the NEC conductor bend radius. Contractor shall provide large-bend radius conduit bodies or provide larger size conduit bodies to be in compliance with conductor bend radius.
- D. Provide removable cover with gasket and corrosion-resistant screws.
- E. Contractor shall show location for fiberglass conduit bodies on shop drawings and obtain Owner approval of location prior to installation.

2.06 CABLE GLAND CONNECTORS

- A. Cable gland shall be for nonarmored cables.
- B. Cable glands shall be:
 - 1. Metal glands list for area classification in which they are installed.
 - 2. Stainless Steel and NEMA 4X.
 - 3. UL Listed.
 - 4. Suitable for use in wet locations.
 - 5. Rugged, durable construction protection of cords and cables from damage.
 - a. Provide Stainless Steel wire mesh grips when needed for strain relief.
 - b. Standard neoprene bushing weatherproof seal on outer sheath of cable.
 - 6. Operating temperatures: -25°C to +40°C.

C. Acceptable manufacturers:

1. Eaton (Crouse Hinds).
2. Emerson (Appleton).
3. Or preapproved equal.

2.07 EXPANSION FITTINGS

A. Expansion Fittings: Comply with UL 514 standards.

1. Provide copper grounding strap and clamps.
2. Use Crouse-Hinds Type XJ or approved equal.

B. Expansion/Deflection Fitting:

1. Comply with UL 514 and 467 standards.
2. Use Crouse-Hinds Type XD or preapproved equal.

2.08 INNERDUCT

A. Provide fabric-type innerduct for communication conduits between buildings.

B. Fabric-type innerduct shall have a minimum number of cells:

1. For 1-inch conduit, provide a minimum of two-cell fabric-type innerduct.
2. For 1.5-inch to 2.5-inch conduit, provide a minimum of three-cell fabric-type innerduct.
3. For 3.0-inch conduit and larger, provide a minimum of four-cell fabric-type innerduct.

C. Fabric innerduct shall be:

1. Halogen-Free.
2. Resistant to ground chemicals and petroleum products.
3. Constructed of PET (Polyethylene Terephthalate) and Nylon 6.
4. Shall include preinstalled 600 lb. glide rope in each cell.

D. Acceptable manufacturers:

1. MaxCell.
2. Or preapproved equal.

2.09 DRAINS AND BREATHERS

A. Automatic Drain-Breather:

1. Use Crouse-Hinds or Appleton Type ECD or approved equal.
2. Use Appleton Type CRN (nonhazardous locations) or approved equal.

B. Condensate Drain:

1. Use conduit outlet body, Type T.
 - a. Provide threaded, galvanized plug with 3/16-inch drilled hole through plug.

2.10 WALL AND FLOOR SLEEVES

A. All conduits through floor slabs (above grade [i.e., 2nd floor or elevated floors]) and walls shall be sleeved and link sealed. All wall sleeves shall finish flush with the finish line. The annular space between sleeves and piping passing through concrete floor slabs, walls, and partitions for all piping shall be sealed with nonshrink grout. Seal perimeter of wall sleeve openings with caulk.

1. For floor slabs on grade, the conduit penetration can be encased in the concrete pour of the floor.

B. All sleeves shall be Schedule 40 PVC pipe and shall be set before the conduit is installed. The sleeves shall be fitted with flange or clamp to prevent slipping after forms are removed and piping installed.

C. Link Seals:

1. Use modular mechanical type consisting of interlocking solid rubber links designed for positive hydrostatic pressure of 20 psig.
 - a. Connect each pair of links by a carbon steel zinc phosphate plated bolt and nut, each with a heavy Delrin plastic elongated washer.
 - 1) Acceptable product: "LINK-SEAL" as manufactured by Thunderline Corp. or preapproved equal.

D. Provide integral intermediate water stop wall collars for wall pipes and sleeves.

2.11 CONDUIT PENETRATIONS

A. Enclosures: Provide zinc Myers hub with Viton O-ring and Lexan insuliner (by Cooper Crouse-Hinds or preapproved equal) for termination of conduits to enclosures. Provide ground nut as required.

B. Exterior Walls and Floors: Provide mechanical modular seals and grout over with nonshrink grout.

2.12 WIRE BASKET TRAY

- A. Wire basket tray location specified on Drawings shall have white finish for interior application.
- B. Wire basket tray shall be manufactured from ASTM A510 high-strength steel wires.
- C. Wire basket tray shall have the following dimensions: 4 inches deep and 12 inches wide.
- D. Provide wire basket tray accessories for splicing the wire basket section together, hanger trapeze supports, and wall seismic bracing.

2.13 OUTLET BOXES AND JUNCTION BOXES

- A. Junction boxes as specified on Drawings shall be NEMA 3R.
- B. Flush Mounted: Provide hot-dipped galvanized steel boxes and accessories suitable for application and type construction.
- C. Surface Mounted: Provide corrosion-resistant single or multiple gang malleable iron Type FS or FD cast boxes with threaded hubs, or pressed steel boxes as permitted under Part 3 of this section.
 - 1. Malleable Iron or copper-free aluminum FS or FD boxes.
 - a. Malleable iron shall be hot-dip galvanized.
- D. Weatherproof Boxes: Provide gasketed covers and corrosion-proof fasteners.
- E. Cast Metal Boxes:
 - 1. Box bodies and cover shall be cast or malleable iron with a minimum wall thickness of 1/8 inch at every point, and not less than 1/4 inch at tapped holes for rigid conduit. Bosses are not acceptable.
 - 2. Mounting lugs shall be provided at the back or bottom corners of the body.
 - 3. Covers shall be secured to the box body with #6 or larger brass or bronze flathead screws.
 - 4. Boxes shall be provided with neoprene cover gaskets.
 - 5. Where only cast aluminum is available for certain types of fixture boxes, an epoxy finish shall be provided.
 - 6. Outlet boxes shall be of the FS types. Boxes shall conform to FS W-C-586C, UL 514A, and UL 514C.

F. Pull Boxes and Junction Boxes:

1. Boxes shall be fabricated from carbon steel per UL 50 with the following exception:
 - a. Boxes shall be NEMA 3R.
2. Boxes shall be welded construction with seams or joints closed and reinforced.
3. Finish:
 - a. Wash and phosphate undercoat or galvanized steel.
 - b. ANSI 61 gray acrylic electrocoat finish.
4. Galvanized boxes damaged during construction shall have shall be galvanized after construction.
5. Boxes intended for outdoor use shall be cast metal with threaded hubs and neoprene gasketed covers. Cover retention shall be by corrosion-resistant stainless-steel screws.
6. Covers and doors for exterior boxes for wiring shall be padlockable close.
7. Boxes and cabinets shall be securely fastened to building structural members so as to prevent movement in any direction. Boxes shall not be supported by lighting fixtures, suspended ceiling support wires, or freely hanging rods.
 - a. Covers of boxes and cabinets mounted in horizontal plane (top or bottom) either shall weigh not more than 40 pounds or shall require not more than 40 pounds of force to open or close.
 - b. Covers of boxes and cabinets mounted in vertical plane (front, back, sides) either shall weigh not more than 60 pounds or shall require not more than 60 pounds of force to open or close. Covers over 30 pounds shall be furnished with angle support at bottom to carry weight of cover for assembly.
 - c. Covers of boxes and cabinets weighing more than 30 pounds shall be provided with lifting handles or some means of grasping other than edges.

G. Wiring Troughs:

1. Wire trough shall be used for cable management and to assist with wire pulling.
2. NEMA 1 wire trough shall be:
 - a. Locations:
 - 1) Indoor wire troughs where space is environmentally controlled.
 - 2) Nonclassified spaces.
 - 3) Noncorrosive spaces.

- b. Mounting holes on the back of the enclosure.
 - c. Flat cover fastened with plated steel screws.
 - d. No gasketing.
 - e. Wash and phosphate undercoat or galvanized steel, ANSI 61 gray acrylic electrocoat finish.
3. NEMA 4X stainless steel wire trough shall be:
- a. Locations:
 - 1) Wet, damp, and moist locations.
 - 2) Outdoor wire troughs.
 - 3) Classified spaces.
 - 4) Corrosive spaces.
 - 5) Where specified on Drawings.
 - b. Seams continuously welded and ground smooth, exterior tabs for fastening to wall or equipment rack.
 - c. Captive stainless-steel screw threaded into sealed walls.
 - d. Oil-resistant gasket and adhesive.
 - e. No holes or knockouts.
4. Wire trough dimensions as shown on Drawings.
5. Hoffman wire trough or approved equal.

H. Terminal and Relay Box Enclosures:

- 1. Provide enclosure for terminal box as follows:
 - a. Attendant Building interior shall be NEMA 12 rated enclosure fabricated from with welded seams ground smooth.
 - 1) Exterior shall be NEMA 4X.
 - b. Body and door stiffeners for added rigidity.
 - c. Continuous hinged door with gasket seal.
 - d. Rolled lip around three sides of door and all sides of enclosure opening to exclude liquids and contaminants.

- e. External door clamps.
- f. Door sealed with polyurethane gasket.
- g. Collar studs for mounting back panel.
- h. External mounting feet.
- i. Grounding provisions provided including stud located on door.
- j. Enclosures size as shown on the Drawings.
- k. Back panel.
- l. Provide Aluminum DIN Rail Mounts for Terminal Blocks.
- m. Contractor to provide shop drawings depicting the interior terminal box enclosure components and their layout arrangement.
 - 1) Terminal Box Enclosures which contain power wiring, control wiring, signal wiring shall have physical separation between the power, control, and signal wiring types. Contractor shall use wire management devices (clamps, troughs, and plastic ties, etc.) to physically separate wire types within enclosure.
 - 2) Contractor to depict the size of the enclosure to allow space for internal wiring while maintaining wire separations. Submit terminal box enclosure size.
 - 3) Contractor shall submit shop drawing depicting the interior components configuration and arrangement.
 - 4) Contractor shall size enclosure to fit space on wall as shown on the Drawings. Contractor shall rework existing conduit/wiring if required to place new Terminal Box Enclosure on wall.
- n. Acceptable Manufacturers:
 - 1) Wiegmann, Hoffman, or approved equal.
- I. Terminal Blocks:
 - 1. Provide terminal blocks for terminal box as follows:
 - a. Feed through terminal blocks, DIN Rail mounted.
 - b. Rating: 600 V, 30 A.
 - c. UL Listed.
 - d. Wire Size: 22-10 AWG.

- e. Provide perforated jumper bar as follows:
 - 1) Current rating 32 A.
 - 2) Perforated jumper bar rated for use terminal block.
 - 3) Cut to length.
 - 4) Provide subassembly screw and post.
- f. Provide Separator, End Sections, and End Stops as required.

2.14 PULL BOXES AND SPECIAL PURPOSE OUTLET BOXES

- A. Provide pull boxes with covers held in place by corrosion-resistant machine screws, and of type or NEMA rating as shown on the Drawings.
- B. Provide special purpose outlet boxes furnished with fixtures and devices where standard outlets are not applicable.

2.15 ANTICORROSION PROTECTION TAPE

- A. Provide anticorrosion protection tape around galvanized rigid steel conduit passes through concrete. Outdoors, no galvanized rigid steel conduit shall be in direct contact with concrete where conduit penetrates into concrete wall, floor, ceiling, slab, or etc.
- B. Anticorrosion protection tape shall be:
 - 1. Minimum thickness of 10 mills.
 - 2. Minimum of 2 inches wide.
 - 3. Maximum temperature rating of 176°F.
 - 4. UV resistant.
 - 5. Listed for protecting conduits and fittings.
 - 6. Listed for impact and abrasion resistance.
 - 7. Used for early-warning protection of digging around reinforced concrete duct banks.
- C. Acceptable manufacturers: 3M Scotchrap All-Weather Corrosion Protection Tape or approved equal.

2.16 MANHOLES AND HANDHOLES

- A. General:
 - 1. Communication manholes shall be separated from power manholes.
 - 2. Handholes near site lighting poles shall contain both power and communications. Maintain physical separation between power and communication conductors.

3. Manholes shall have nonmetallic cable tracks and adjustable shelves that connect to the tracks. Conductors shall be supported from the shelves. Conductors shall not be on the bottoms of manholes.
 - a. Acceptable Manufacturer:
 - 1) Underground Devices Inc. or approved equal.
4. Manhole and handhole covers shall be inscribed with equipment identifier. Power vaults shall have "PWR" inscribed, and communication vaults shall have "COMM" inscribed.
5. Manholes and handholes shall have their equipment identifier on the cover – for example, "MH-E4," See Drawings for manhole and handhole equipment identifier number. Identifier shall be mechanically (permanently) attached to the cover.
6. Manholes shall be precast with the following:
 - a. Solid concrete slab bottoms with sloped floors to sump with drain.
 - 1) The drain shall allow accumulated water to drain out to the gravel foundation below the manhole.
 - b. Manhole shall be placed on an 8-inch crushed gravel foundation.
 - c. Precast reinforced concrete, minimum interior space 3 feet 6 inches wide by 5 feet 6 inches long by 3 feet 2 inches deep unless specified on the Drawings.
 - d. Cover with locking hinged galvanized steel door.
 - e. Cover shall have traffic rating, minimum rated H-20 loading.
 - f. Warranty: 5 years.
 - g. Manufacturer: Oldcastle Infrastructure Model 444-LA, 233-LA, 655-LA as shown on the Drawings or preapproved equal.
7. Handholes:
 - a. Precast reinforced concrete or polyolefin blend.
 - b. Minimum size exterior 14 inches wide, 21 inches long, and 18 inches deep unless specified otherwise on the Drawings.
 - c. Nonskid T-Cover with Penta Head hardware and marking plate.
 - d. Handhole and cover shall have ANSI/SCTE-77, Tier 22 (design load 22,500 pounds) performance rating for heavy-duty loading.
8. Warranty: 5 years.
9. Manufacturer: Oldcastle Infrastructure Duralite 1118-18 as shown on the Drawings or approved equal.

2.17 PSE DUCT BANK

A. General:

1. See PSE's Electric Service Handbook for Non-Residential Projects Permanent and Temporary Service for PSE's requirements, installation responsibilities, and who provides material and installation.
 - a. Duct bank trench maximum depth, separations, and minimum cover requires.
2. For shared utility trenches, maintain required separations from other utilities as specified in the PSE Handbook.
3. PSE to inspect the PSE duct banks with the conduits installed prior backfilling.
4. Provide galvanized rigid conduit large radius 90-degree elbows, 48-inch radius for 90-degree turns.
5. Provide conduit plugs to prevent dirt, dust, debris, and rodents from entering conduits.
6. Provide pull tape in the empty conduits to support PSE personnel when they pull the PSE medium voltage cable.

2.18 UNDERGROUND MARKING TAPE

- A. Used for early-warning protection of digging around reinforced concrete duct banks.
- B. Detectable solid aluminum foil backing with clear film laminate, nominally 6 inches wide and 5 mil thickness.
- C. Plastic Color: Red.
- D. Imprinted continuously along the length with message reading similar to "CAUTION – BURIED ELECTRIC LINE BELOW."
- E. Acceptable Manufacturer:
 1. 3-M/SCOTCH.
 2. Services and Materials Buried Underground Tape.
 3. Somerset (Thomas & Betts) Protect-A-Line.
 4. Or approved equal.

2.19 RACEWAY/CONDUIT MARKERS

- A. Provide raceway/conduit markers for new and unlabeled raceways and conduits within the project boundary.
- B. Provide raceway/conduit markups:
 - 1. 316 Stainless Steel.
 - 2. Minimum dimensions 1 inch by 3 inch by 18 gauge thick.
 - 3. Two holes at each end for wire attachment.
 - 4. Lettering: 1/4-inch tall, laser etched with black fill.
 - 5. Attach with 316 stainless steel wire, 16 AWG minimum.

2.20 PSE METER BASE/SOCKET AND CT MOUNTING

- A. Provide meter base/socket.
- B. Meter base/socket shall meet Puget Sound Energy (PSE) requirements as identified in PSE's Meter Socket Catalog Numbers. See Attachment A for PSE's acceptable commercial and industrial sockets.
- C. Provide current transformer (CT) mounting base and enclosure.
- D. CT mounting base and enclosure shall meet PSE's requirements as identified in PSE's Meter Socket Catalog Numbers. See Attachment A for PSE's current transformer applications.

PART 3 – EXECUTION

3.01 INSTALLATION – RACEWAY

- A. Provide furnishing for the installation of hangers and supports as specified in Section 26 05 29.
- B. Provide all spare raceways with 1/2-inch woven polyester pull tape with foot marks.
- C. Install conduit and fittings in accordance with manufacturer's recommendations.
- D. Run exposed conduits parallel to or at right angles with lines of building or structure.
- E. Route conduit runs above suspended panel ceilings so as not to interfere with panel removals.
- F. Keep conduits plugged, clean, and dry during construction.

- G. Install wall sleeves as shown on the Drawings and where conduits pass through foundation walls below grade.
- H. Install expansion fittings in the following locations:
1. Conduit runs crossing structural expansion joint.
 2. Conduit runs attached to two separate structures.
 3. Conduit runs where movement perpendicular to axis of conduit may be encountered.
- I. Conduit runs extending through areas of different temperature or atmospheric conditions, or partly indoors and partly outdoors must be sealed, drained, and installed in a manner preventing drainage of condensed or entrapped moisture into cabinets, boxes, fixtures, motors, or equipment enclosures. The wall, ceiling and/or floor penetrations associated with these conduit runs shall be sealed using a link-seal or equivalent sealing method approved by the Engineer.
- J. Conduits Run in Concrete Structures:
1. Comply with applicable provisions of ACI 318 for conduits embedded in structural frame slab.
 2. Install conduits parallel to each other spaced on center of at least three times conduit trade diameter with minimum 2-inch concrete covering.
 3. Conduits over 1-1/2 inches may not be installed in slab without approval of Engineer.
 4. Apply anti-corrosion tape to galvanized rigid steel conduits run or penetrated into concrete.
 - a. Anti-corrosion tape shall be applied per the manufacturer instructions.
- K. Install bushings with ground lugs and integral plastic linings at equipment with open-bottom conduit entrances.
- L. In precast areas, run conduits in roof insulation space. Use 3/4-inch maximum conduit size.
- M. Exterior Underground Conduit: Provide conduits or ducts terminating below grade with means to prevent entry of dirt or moisture. Provide conduit threaded coupling and threaded plug to protect conduit from debris.
- N. Immediately upon completion of pouring concrete, thoroughly swab conduits on the inside. After the concrete has set, and before backfilling, pull a mandrel having a diameter equal to the nominal conduit inside diameter minus 1/2 inch and not less than 4 inches long, through each conduit. If the mandrel shows signs of protrusions on the inside of the conduit, repair or replace the conduit.
- O. Outdoor underground conduit shall be sloped to drain toward manholes or handholes.

P. Flexible conduit shall be limited to 36 inches in length and used for vibration isolation or where equipment requires flexible connections.

Q. Underground conduit:

1. Duct Bank:

- a. Other underground utilities (i.e., water, storm drains, sewer) are given higher priority over underground electrical conduits. Underground burial depth shall deviate either over or under other underground utilities.
 - b. Provide plugs for each end of conduits to prevent dirt, dust, construction debris, and rodents from entering in each conduit.
 - 1) Provide mechanical expanding plug to seal each end of the conduits to seal the ends of conduits from dirt and debris from entering.
 - a) Mechanical expanding plugs shall be removable.
 - c. Provide pull tape in each conduit.
 - d. Contractor shall provide the following:
 - a) PVC conduits as specified on Drawings.
 - b) Couplings.
 - c) End Bell fittings.
 - d) mechanical expanding plug to seal conduits at each end.
 - e) Threaded plugs as specified on the Drawings.
2. The Contractor shall provide duct bank trenching, conduit spacers, conduits, red dye, marking tape, and backfill as shown on the Drawings.
- a. In addition, for the PSE duct bank (pole to transformer and transformer to CT enclosure) provide CDF for duct bank back fill. Provide CDF to backfill the trench to a height of 12 inches above the primary and secondary conduits. Apply red dye to the top of the wet CDF before the CDF dries.
 - b. After the CDF hardens, apply underground marking tape on top of the CDF and backfill the remainder of the trench with native soil.
3. Duct bank shall have detectable underground buried utility warning tape located 12 inches above conduits.
4. Thoroughly clean conduits before, during construction, and after completion; plug conduit ends to prevent dirt and mud from entering the duct or manholes.
5. Terminate conduits in end bells in manholes and handholes.

6. Change in direction of over 10 degrees shall be with long sweep bends. Manufactured bends shall be used at manholes for runs under 100 feet. Minimum radii for conduit under 3 inches shall be 18 inches. For conduit 3 inches and larger, minimum radii shall be 36 inches.
7. Apply underground utility warning tape 12 inches above underground duct bank conduits.

3.02 INSTALLATION – BOXES

- A. Install boxes in accordance with manufacturer's recommendations.
- B. Pressed sheet metal device boxes shall only be used in locations where EMT is approved or inside environmentally controlled buildings with finished walls.
- C. Use weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- D. Do not install boxes back-to-back or through wall. Off set outlet boxes on opposite sides of wall minimum 12 inches.
- E. Set outlet boxes parallel to construction.
- F. Thoroughly clean boxes prior to installing wiring devices.
- G. Maintain minimum 4-inch separation between exposed power wires and communications wires inside electrical handholes. Provide wire supports to maintain a physical separation.

3.03 INSTALLATION METER BASE SOCKET AND CT MOUNTING BASE

- A. The installation of the meter base and socket along with the CT mounting base with enclosure shall be per PSE requirements.
 1. Reference PSE's Electrical Service Handbook, Non-Residential Projects Permanent and Temporary Service, for installation responsibilities.

3.04 INSTALLATION – MANHOLES AND HANDHOLES

- A. Manholes and handholes shall be placed on a crushed gravel foundation.
 1. The manholes shall be placed on the 8-inch crushed gravel foundation.
 2. The handholes shall be placed on 4-inch crushed gravel foundation.
- B. The top surface of manholes and handholes shall be 2 inches above the surrounding grade.
 1. The surrounding grade shall slope away from the top of the manholes and handholes so that surface water, dirt, and debris drain away from the top of the manholes and handholes.

3.05 CUTTING AND PATCHING

- A. Make provisions for openings, holes, and clearances through walls, floors, ceilings, and partitions in advance of construction.
- B. Core drill through reinforced concrete with approval of Owner.
- C. Cut and patch in accordance with the following:
 - 1. Surface Conditions:
 - a. Inspection:
 - 1) Exterior building walls contain pretension panels. Perform x-ray inspection or similar method to determine location of pretension cables prior to cutting into exterior walls.
 - 2) Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
 - 3) After uncovering the work, inspect conditions affecting installation of new work.
 - b. Discrepancies:
 - 1) If uncovered conditions are not as anticipated, immediately notify the Owner and secure needed directions.
 - 2) Do not proceed until unsatisfactory conditions are corrected.
 - 2. Preparation Prior to Cutting: Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.
 - 3. Performance:
 - a. Perform required excavating and backfilling as required under pertinent other sections of these Specifications.
 - b. Perform cutting and demolition by methods which will prevent damage to other portions of the Work and provide proper surfaces to receive installation of repair and new work.
 - c. Perform fitting and adjusting of products to provide finished installation complying with the manufacturer's recommendations for specified equipment, products, tolerances, and finishes.
 - d. Perform slight alterations needed to make adjustable parts fit to fixed parts to provide a complete installation.
 - e. Refinish surfaces as necessary to match adjacent finishes.

3.06 RESTRICTIONS

- A. Cross high temperature piping or ducts with 12-inch clearance.
- B. Do not route conduit over boiler, incinerator, or other high temperature equipment, piping, or ducts.
- C. Do not route exposed conduit below and parallel to, or adjacent to water piping.
- D. Do not splice power wires, communication, or fiber optic cables in electrical manholes, except where otherwise permitted on Drawings.
- E. Do not cut into pretension cables within the existing exterior building walls.

3.07 EXISTING CONDUIT

- A. The Drawings do not show the location of existing conduit as indicated by available existing records. The proposed work may require crossing, relocating, and, in some cases, connecting to the existing conduits.
- B. Expose carefully the existing conduits throughout the area of proposed work.
 - 1. Existing conduits to remain undisturbed and in uninterrupted use until such time as a change is approved by the Engineer.
- C. Where the conduits are to cross or be connected to existing conduit, make a field check to determine whether any conflict will be encountered in laying the new conduit.
 - 1. Adjust the location of new conduits, if necessary, as authorized by the Engineer, to avoid conflict with existing conduits.
- D. Where new conduits are to connect to existing conduits, provide fittings required to complete the connection, and do the work as expeditiously and carefully as possible.
 - 1. Inspect and clean existing conduit prior to installing new wire.
- E. Remove and replace existing conduits, fittings, boxes, and appurtenances as shown on the Drawings.
 - 1. Do not remove and replace existing items shown to remain unless approved by the Engineer.

3.08 CONDUIT USAGE SCHEDULE

- A. Install GRS in the following locations unless otherwise shown on the Drawings:
 - 1. Concealed in poured concrete walls and floor or roof slabs.
 - 2. Concealed in insulation above poured or precast concrete roof slabs.
 - 3. Exposed.

- B. Install PVC in underground duct banks where conduits are not exposed to physical damage.
 - 1. PVC conduit shall be installed in reinforced concrete duct banks as specified on the Drawings.
 - a. Where PVC duct bank makes 90-degree turns, Contractor shall use RTRC factory elbows 90-degree bends. RTRC conduit and factory elbows can be used with PVC conduits.
- C. Optional: Install RTRC in underground reinforced concrete duct banks where conduits are not exposed to physical damage.
- D. Install EMT only inside the Attendant Building unless shown elsewhere on the Drawings.
- E. Install liquidtight flexible conduit and fittings for connections to motors and equipment subject to vibration and at locations shown on the Drawings.
 - 1. For outdoor environments, install liquidtight flexible nonmetallic conduit and fittings.
 - 2. Liquidtight flexible nonmetallic conduit to be no greater than 36 inches in length in any situation unless prior written approval is provided by the Engineer.

3.09 EXPOSED OUTLET AND JUNCTION BOXES

- A. Use cast boxes unless noted otherwise on the Drawings.
- B. Install weatherproof outlet, switch, and junction boxes outdoors and in any area where Drawings show weatherproof (WP) wiring devices.

3.10 OUTLET BOX ACCESSORIES

- A. Provide outlet box accessories and mounting devices as required for each installation.

3.11 LIGHTING FIXTURE OUTLET BOXES

- A. Securely mount with approved type bar hangers spanning structural members to support weight of fixture.

3.12 OUTLET BOX LOCATIONS

- A. Location of outlets and equipment is approximate. Exact location to be verified and determined by:
 - 1. Conflict with equipment of other trades.
 - 2. Equipment manufacturer's drawings.
 - 3. Owner in field.

- B. Minor modification in location of outlets and equipment is considered incidental up to distance of 10 feet with no additional compensation, providing necessary instructions are given prior to roughing-in of outlet boxes and equipment.
- C. Mounting Heights:
 - 1. Locations of wall outlets shall be measured from the finished floor to the center of the outlet box. Boxes shall be adjusted so that the front edge of the box shall not be further back from the finished wall plane than 1/4 inch. Boxes shall be adjusted so that the box does not project beyond the finished wall. Height above finished floor (AFF) or above finished grade (AFG) shall be as follows unless noted otherwise on the Drawings:
 - a. Data Outlets – Office Areas: 18 inches AFF or AFG.
 - b. Telephone Outlets – Industrial Areas: 60 inches AFF or AFG.
 - c. Duplex Receptacles – Office Areas: 18 inches AFF or AFG.
 - d. Receptacles – Industrial Areas: 36 inches AFF or AFG.
 - e. Toggle Switches: 48 inches AFF or AFG.
 - f. Clock Outlets: 84 inches AFF or AFG.
 - g. Thermostats: 60 inches AFF or AFG.
 - h. Coordinate mounting height with Architectural Drawings to prevent interference.

3.13 INSTALLATION

- A. Outlet Boxes:
 - 1. Provide fixture outlets with proper fixture connectors.
 - 2. Box mounting height shall be dictated by the wiring device enclosed.
 - 3. Blanking covers shall be installed on unused openings.
 - 4. Sheet metal boxes shall be used in dry noncorrosive locations where the conduit system is routed concealed in the walls and ceilings.
 - 5. Cast metal surface-mounted boxes shall be used in exterior and/or in wet locations.
 - 6. Bonding jumpers shall be used around concentric or eccentric knockouts.
 - 7. Boxes shall be securely mounted to the building structure independent of conduits entering or exiting the boxes.

B. Junction Boxes and Pull Boxes:

1. Boxes shall be installed where required and where indicated on the Drawings.
2. Boxes shall be readily accessible.
3. Boxes shall not be installed in finished areas.
4. Pull boxes shall be provided at least every 150 feet on long, straight conduit runs. Spacing shall be reduced by 50 feet for each 90-degree bend.
5. Box dimensions shall be in accordance with size and quantity of conductors and conduits entering and leaving box per NEC Article 370 requirements.
6. Boxes, both new and existing, for medium-voltage systems shall be permanently marked "High Voltage" on surfaces with red letters that are at least 4 inches high.

3.14 UNDERGROUND WARNING TAPE

- A. Install underground warning tape above underground conduits and above underground concrete encased duct banks.

END OF SECTION

ATTACHMENT A

(See the attached PSE document 7517)

SECTION 26 05 33
ATTACHMENT A

The following pages shows acceptable manufacturer's and catalogs for meter base sockets and CT Enclosures to meet the minimum PSE requirements.

Meter socket catalog numbers (FORM 7517)

Table of contents

- Eaton Cooper B-Line, page 2
- Eaton Cooper B-Line Meter Combo Units, page 3
- Milbank, page 4
- Milbank Meter Combo Units, page 5
- Schneider Square-D, page 6
- Schneider Square-D Meter Combo Units, page 7
- Siemens (TALON), page 8
- Siemens (TALON) Meter Combo Units, page 9

Questions?

Please contact your Project Manager.

If you are just starting a project and/or have general questions, call Customer Construction Services at 1-888-321-7779.

General notes

- Meter socket requirements are detailed in the PSE service handbooks. The sockets and CT enclosures listed meet PSE minimum requirements for typical applications.
- Refer to the service handbook for requirements on meter posts and meter pedestals for residential services and mobile homes. Meter pedestals for commercial services must meet EUSERC requirements and require PSE Meter Department review and approval.
- Refer to the service handbook for requirements on services greater than 800 amps (switchboard required) and for multi-meter stacks. PSE Meter Department review and approval is required.
- For products not listed in this document, please contact your Project Manager to arrange for a product review by the PSE Meter Department.
- If you are using a meter/panel combo unit:
In addition to providing manufacturers drawings to PSE for review, please check with your local or municipal inspector to determine if the meter/panel combo unit would meet the new NEC code requirements regarding disconnects on the exterior of the building/residence.

Meter socket catalog numbers

Eaton Cooper B-Line

Residential sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, 120/240V, OH only	011	204	324N	12146	
Single Phase, 120/240V, OH or UG	N/A	U204			
Single Phase, 120/208V, OH only (note 2, 3)	011	204			
Single Phase, 120/208V, OH or UG (note 2, 3)	N/A	U204			
3 Phase, 4 Wire, 120/208V, OH only (note 3)	927 (note 4)	U207 (note 4)		121413	
3 Phase, 4 Wire, 120/208V, OH or UG (note 3)	N/A				

Commercial and industrial sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, Street, Hwy, & Traffic Light (note 2)	114TB	124TB			
Single Phase, 120/240V, OH only	U121314	U264	324N	12146	
Single Phase, 120/240V, OH or UG	N/A				
Single Phase, 120/208V, OH only (note 2)	U121315	U264			
Single Phase, 120/208V, OH or UG (note 2)	N/A				
3 Phase, 4 Wire, 120/208V or 120/240V (note 5)	U121317	U267		121413	
3 Phase, 4 Wire, 277/480V	117TB (note 6)	127TB (note 6)		121413	

Current transformer applications	400 Amp	600/800 Amp
Single Phase CT Cabinet	244811-RTCT or -HRTCT	
Single Phase CT Mounting Base	6019HA 6019HAL	6019HE 6019HEL
3 Phase CT Cabinet, 4 Wire	364811-HRTCT	
3 Phase CT Mounting Base	6067HA 6067HAL	6067HEE 6067HEEL

Socket notes

1. All meter sockets shall have anodized screw-type rings (add B-Line part number 25016D, if not included with socket).
2. Add fifth jaw in 9 o'clock position (add B-Line part number 50365).
3. "House meters" on multi-family residential are commercial services and require the commercial 120/208 volt socket.
4. This is not a block bypass socket. Block bypass sockets are **required** for all Commercial sockets. On residential 3P4W 120/208 volt 200 amp or less, the block bypass is not strictly required, but is still **recommended** (use the commercial socket).
5. 120/240 volt 3P4W service restricted use application; not for new services.
6. Self-contained 277/480 volt meter sockets require a disconnect ahead (line side) of the meter (cold sequence metering).

Meter socket catalog numbers

Eaton Cooper B-Line Meter Combo Units

Residential sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V	U217 MTBL	U2M2R	U4042MCC
		CMBEB200BTS	U40411230MCC (note 1)
		CMBE88B200BTS (note 1)	
		CMBEB200BTF	
		MBE4040B200BTS (note 1)	
Commercial and industrial sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V		U224MTB	U4042MCC
		U214MTBL	U40411230MCC (note 1)
		U214MTBPL	

Socket note

1. Included Panel Load Center.

Meter socket catalog numbers

Milbank

Residential sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, 120/240V, OH only	U7490-RL	U4517-RL-M4	U3548-X	UC3436-XL	
Single Phase, 120/240V, OH or UG	N/A	U4518-XL-W			
Single Phase, 120/208V, OH only (note 2, 3)	U7490-RL	U4517-RL-M4			
Single Phase, 120/208V, OH or UG (note 2, 3)	N/A	U4518-XL-W			
3 Phase, 4 Wire, 120/208V, OH only (note 3)	U1681-RL (note 4)	U3328-RXL (note 4)		UC3433-XL	
3 Phase, 4 Wire, 120/208V, OH or UG (note 3)	N/A				

Commercial and industrial sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, Street, Hwy, & Traffic Light (note 2)	114TB	124TB			
Single Phase, 120/240V, OH only	U3504-XL	U3514-XL	U3548-X	UC3436-XL	
Single Phase, 120/240V, OH or UG	N/A				
Single Phase, 120/208V, OH only (note 2)	U3504-XL	U3514-XL			
Single Phase, 120/208V, OH or UG (note 2)	N/A				
3 Phase, 4 Wire, 120/208V or 120/240V (note 5)	U3507-XL	U3517-XL		UC3433-XL	
3 Phase, 4 Wire, 277/480V	117TB (note 6)	127TB (note 6)		UC3433-XL	

Current transformer applications	400 Amp	600/800 Amp
Single Phase CT Cabinet	CT244811-SC or -HC	
Single Phase CT Mounting Base	K4797	K4729
3 Phase CT Cabinet, 4 Wire	CT364811-HC	
3 Phase CT Mounting Base	K4798	K4722

Socket notes

1. All meter sockets shall have anodized screw-type rings (add Milbank part number MR-4, if not included with socket).
2. Add fifth jaw in 9 o'clock position (add Milbank part number K5T for U4517, U4518, add Milbank part number 5T8K2 for U7490).
3. "House meters" on multi-family residential are commercial services and require the commercial 120/208 volt socket.
4. This is not a block bypass socket. Block bypass sockets are **required** for all commercial sockets. On residential 3P4W 120/208 volt 200 amp or less, the block bypass is not strictly required, but is still **recommended** (use the commercial socket).
5. 120/240 volt 3P4W service restricted use application; not for new services.
6. Self-contained 277/480 volt meter sockets require a disconnect ahead (line side) of the meter (cold sequence metering).

Meter socket catalog numbers

Milbank Meter Combo Units

Residential sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V			U-3251-0-200-CB

Commercial and industrial sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V		U224MTB	U-3251-0-200-CB

Meter socket catalog numbers

Schneider Square-D

Residential sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, 120/240V, OH only	URTRS101B	URTRS213B			
Single Phase, 120/240V, OH or UG	N/A				
Single Phase, 120/208V, OH only (note 2, 3)	URTRS101B	URTRS213B			
Single Phase, 120/208V, OH or UG (note 2, 3)	N/A				
3 Phase, 4 Wire, 120/208V, OH only (note 3)					
3 Phase, 4 Wire, 120/208V, OH or UG (note 3)					

Commercial and industrial sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, Street, Hwy, & Traffic Light (note 2)					
Single Phase, 120/240V, OH only					
Single Phase, 120/240V, OH or UG					
Single Phase, 120/208V, OH only (note 2)					
Single Phase, 120/208V, OH or UG (note 2)					
3 Phase, 4 Wire, 120/208V or 120/240V (note 5)					
3 Phase, 4 Wire, 277/480V					

Current transformer applications	400 Amp	600/800 Amp
Single Phase CT Cabinet		
Single Phase CT Mounting Base		
3 Phase CT Cabinet, 4 Wire		
3 Phase CT Mounting Base		

Socket notes

1. All meter sockets shall have anodized screw-type rings (add Square-D part number 29008W, if not included with socket).
2. Add fifth jaw in 9 o'clock position (add Schneider Square-D part number A5J).
3. "House meters" on multi-family residential are commercial services and require the commercial 120/208 volt socket.
4. This is not a block bypass socket. Block bypass sockets are **required** for all commercial sockets. On residential 3P4W 120/208 volt 200 amp or less, the block bypass is not strictly required, but is still **recommended** (use the commercial socket).
5. 120/240 volt 3P4W service restricted use application; not for new services.
6. Self-contained 277/480 volt meter sockets require a disconnect ahead (line side) of the meter (cold sequence metering).

Meter socket catalog numbers

Schneider Square-D Meter Combo Units

Residential sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V	SC816D150C (note 1)	SC816D200C (note 1)	SU3040D400CB (note 1)
	SC1624M100S	SC2040M200C (note 1)	CU816D400CB (note 1)
		SC816F200PS (note 1)	
		SU816F200PS (note 1)	
Commercial and industrial sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V			SU3040D400CB (note 1)
			CU816D400CB (note 1)

Socket note

1. Included Panel Load Center.

Meter socket catalog numbers

Siemens (TALON)

Residential sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, 120/240V, OH only	SUAT121 (UAT121)	SUAT327 (UAT327)		9837-8215	
Single Phase, 120/240V, OH or UG	N/A	SUAT427 (UAT 427)			
Single Phase, 120/208V, OH only (note 2, 3)	SUAT121 (UAT121)	SUAT327 (UAT327)			
Single Phase, 120/208V, OH or UG (note 2, 3)	N/A	SUAT427 (UAT427)			
3 Phase, 4 Wire, 120/208V, OH only (note 3)					
3 Phase, 4 Wire, 120/208V, OH or UG (note 3)					

Commercial and industrial sockets (note 1)	100 Amp	200 Amp	320 Amp	400 Amp	600/800 Amp
Single Phase, Street, Hwy, & Traffic Light (note 2)	MS14TB	MS24TB			
Single Phase, 120/240V, OH only				9837-8215	
Single Phase, 120/240V, OH or UG					
Single Phase, 120/208V, OH only (note 2)					
Single Phase, 120/208V, OH or UG (note 2)					
3 Phase, 4 Wire, 120/208V or 120/240V (note 5)					
3 Phase, 4 Wire, 277/480V	MS17TB (note 6)	MS27TB (note 6)			

Current transformer applications	400 Amp	600/800 Amp
Single Phase CT Cabinet		
Single Phase CT Mounting Base	RT6019HA	
3 Phase CT Cabinet, 4 Wire		
3 Phase CT Mounting Base	RT6067HA	

Socket notes

1. All meter sockets shall have anodized screw-type rings (add Siemens part number SX001M, if not included with socket).
2. Add fifth jaw in 9 o'clock position (add Siemens part number EC659-0121, EC5J, or UX005B, as appropriate).
3. "House meters" on multi-family residential are commercial services and require the commercial 120/208 volt socket.
4. This is not a block bypass socket. Block bypass sockets are **required** for all commercial sockets. On residential 3P4W 120/208 volt 200 amp or less, the block bypass is not strictly required, but is still **recommended** (use the commercial socket).
5. 120/240 volt 3P4W service restricted use application; not for new services.
6. Self-contained 277/480 volt meter sockets require a disconnect ahead (line side) of the meter (cold sequence metering).

Meter socket catalog numbers

Siemens (TALON) Meter Combo Units

Residential sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V		MM0406L1200ESC (note 1)	MM0404L1400SCS
		MC0816B1200EST (note 1)	MC0816B1400SCS (note 1)
Commercial and industrial sockets	100 Amp	200 Amp	320 Amp
Single Phase, 120/240V			

Socket note

- 1. Included Panel Load Center.

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section specifies products and procedures used to identify electrical system equipment and components.

1.02 REFERENCE STANDARDS

- A. None.

1.03 SUBMITTALS

- A. As specified in Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."
- B. Submit under one submittal the following items:
 - 1. Nameplate schedules.
 - 2. Raceway/conduit schedules.
 - 3. Wire marker schedules.
- C. Provide two physical samples for each marker, tag, or nameplate type per submittal.
- D. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

PART 2 – PRODUCTS

2.01 EQUIPMENT NAMEPLATES

- A. Provide nameplates on equipment.
- B. Nameplates: For equipment such as automatic transfer switches, panelboards, UPS, control panels, electrical equipment enclosures, disconnect switches, equipment, and other electrical items requiring nameplates shall be:
 - 1. Located on the enclosure face.
 - 2. Rectangular screw-on type with self-tapping 316 stainless steel screws.

3. Laminated engraving plastic nameplate.
 - a. White letters on black backgrounds.
 - b. 2.25-inch-tall.
 - c. Length as required.
 - d. 1/16-inch thick.
 - e. UV and scratch resistant.
4. Lettering: 1/4-inch-high lettering for equipment name and tag number.
5. Nameplate text shall include:
 - a. Line 1: Asset number (e.g., "PBD-AB1").
 - b. Line 2: Descriptive tag (e.g., "ATTENDANT BLDG PBD").
 - c. Line 3: Voltage (e.g., "120/240 V").
- C. Nameplate schedule shall be included with equipment submittals.
- D. Equipment shall have "Fed From" identification of power source feeding equipment:
 1. (e.g., FED FROM MDP).
 2. (e.g., MDP IS LOCATED AT THE POWER DISTRIBUTION EQUIPMENT RACK).
- E. If equipment has multiple power sources, contractor shall identify with a label identifying the multiple power sources and their location.

2.02 RACEWAY/CONDUIT MARKERS

- A. Provide raceway/conduit markers for new and unlabeled raceways and conduits within the project boundary.
- B. Provide raceway/conduit markers.
 1. 316 Stainless steel or aluminum.
 2. Minimum dimensions: 1-inch by 3-inch by 18-gauge thick.
 3. Two holes at each end for wire attachment.
 4. Lettering: 1/4-inch tall, laser etched with black fill.
 5. Attach with 316 stainless steel wire, 16 AWG minimum.

2.03 PERMANENT WIRE MARKERS

- A. Wire markers shall be heat shrink type (Raychem, T&B, or approved equal), or self-laminating where conductors are not spliced or terminated. Wire numbers shall be permanently imprinted on the markers.

PART 3 – EXECUTION

3.01 GENERAL

- A. Label electrical and control equipment associated within scope of work.
- B. Equipment containing power distribution equipment 120 V and greater shall have nameplates identifying source of power equipment identification asset number and its location.

3.02 RACEWAY/CONDUIT MARKERS

- A. Neatly attach marker to the raceway with 316 stainless steel wire.
- B. Exposed Conduit:
 - 1. Marker shall be placed within 24 inches of termination or wall penetration.
 - 2. A single marker will be allowed when the entire length of conduit is clearly visible from one location.
- C. In concrete vaults with conduit flush with wall, attach markers to concrete with stainless steel hardware. Markers to be located within 6 inches of conduit. This applies to both existing and new conduits in vaults.
- D. Attach nameplate to equipment with mechanical fastening means.
- E. Locate label inside vault where easily seen from surface with cover removed.

3.03 LOW-VOLTAGE WIRE AND CABLE IDENTIFICATION

- A. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pull box, junction box, handhole, and manhole using numbered and lettered wire markers. Electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer.
- B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.
- C. Provide schedule identifying various power and lighting conductors from power source to equipment or device served.

D. Color Coding:

1. Provide color coding for circuit conductors. Conductors No. 6 and smaller shall be of appropriate color for the entire length. Insulation color shall be green for grounding conductors. Current carrying conductor colors shall be as follows:
 - a. 480Y/277 V, Three-Phase, Power: (A) Brown, (B) Orange, (C) Yellow, and (N) Grey.
 - b. 208Y/120 V, Three-Phase, Power: (A) Black, (B) Red, and (C) Blue, and (N) White.
 - c. 240/120 V, Three-Phase, Power: (A) Black, (B) Orange, and (C) Blue, and (N) White.
 - d. 120/240 V, Single-Phase, Power: (A) Black and (B) Red, and (N) White.
 - e. 120 V, Control: Multi-color.
2. Provide appropriate color-coding electrical tape at terminations on conductors without continuous color-coded insulation. Conductor colors shall be as listed above.

3.04 SIGNAL CABLE IDENTIFICATION

- A. Identify each wire or cable at each termination, in each pull box, and in each handhole using numbered and lettered wire markers. Electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer.
- B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

END OF SECTION

SECTION 26 05 73
SHORT CIRCUIT, COORDINATION, AND ARC FLASH REPORT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Provide the services of a recognized independent testing laboratory or coordination analysis consultant (Consultant) to provide the following power study reports:
 - 1. Short Circuit Report.
 - 2. Protective Device Coordination Report.
 - 3. Arc Flash Report.
- B. Contractor shall use the electrical distribution and loads as specified on the Drawings to the electrical model to prepare the new reports.
- C. The work of the following sections is related to the work of this section. Other sections, not referenced below, may also be related to the proper performance of this work. It is the Contractor's responsibility to perform all the work required by the Contract Documents.
 - 1. Section 26 05 11, "Basic Electrical Methods and Materials."

1.02 REFERENCE STANDARDS

- A. Institute of Electrical and Electronic Engineers (IEEE) Publications (most recent published version):
 - 1. IEEE 141 – Recommended Practice for Electric Power Distribution for Industrial Plants.
 - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 - 3. IEEE 1584 – IEEE Guide for Performing Arc-Flash Hazard Calculations.
- B. National Fire Protection Association (NFPA) Publications (most recent published versions):
 - 1. NFPA 70 – National Electric Code.
 - 2. NFPA 70E – Standard for Electrical Safety Requirements for Employee Workplaces.
- C. Occupational Safety and Health Administration (OSHA) Publication.
 - 1. OSHA 29-CFR – Occupational Safety and Health Standards: Electrical Part 1910 Subpart S.

1.03 SUBMITTALS

- A. Procedures: As specified in Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."

B. Schedule:

1. Submit Short Circuit Coordination and Arc Flash Reports with equipment submittals.
2. Approved report required prior to energizing equipment.
3. Provide and install arc flash labels prior to commissioning.

C. Submit the name and the qualifications of the laboratory or consultant for review by the Owner. Qualifications must include professional registration of proposed personnel as electrical engineers.

D. Certified Short Circuit and Coordination Reports:

1. Final Power Study Report:

- a. Arc flash warning labels.
- b. Protective devices trip settings.
- c. Two paper copies of the of the Short Circuit Coordination and Arc Flash Report.
- d. An electronic copy of the Short Circuit Coordination and Arc Flash Report in PDF format.

E. Electronic copy of the engineering software model, settings, and report.

1. Electronic copy shall be a copy of the software format used to product the Short Circuit Coordination and Arc Flash Report. The electronic copy shall include the SKM model used for the preparing the study.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Prepared by recognized independent testing laboratory or coordination analysis consultant who is regularly engaged in power system studies.

B. Consultant Certification: Short Circuit Coordination and Arc Flash Reports to be stamped and signed by an electrical engineer registered in the State of Washington.

1.05 ENGINEERING SOFTWARE

A. Software used to perform the following power system study shall be SKM Systems Analysis, Inc.

1. Short Circuit Report.
2. Protective Device Coordination Report.
3. Arc Flash Report.

PART 2 – PRODUCTS

2.01 SHORT CIRCUIT COORDINATION AND ARC FLASH REPORTS

A. General:

1. Contractor preparing the report shall coordinate with the Puget Sound Energy to obtain the electrical service entrance and utility transformer information needed to prepare the Short Circuit, Coordination, and Arc Flash Report.
2. Contractor preparing the report shall coordinate with the electrical equipment manufacturers to obtain the electrical information needed to prepare the Short Circuit, Coordination, and Arc Flash Report.
3. Contractor preparing the report shall work with the electrician sub-contractor for information in the field such as wiring lengths, part numbers, equipment information need to prepare the Short Circuit, Coordination, and Arc Flash Report.

B. Scope of Effort:

1. Short circuit and coordination report shall be prepared based on new construction work and not the existing Silverdale RAGF power distribution system.
2. Executive Summary:
 - a. The executive summary shall provide an overall evaluation of the three-section Short Circuit Report, Coordination Study, and Arc Flash Study.
 - b. The executive summary shall list any concerns or problems stated within the individual reports and studies specified within this section.
3. The reports shall include all equipment shown on the one-line diagrams, including but not limited to the following major components:
 - a. Service Entrance Disconnect Switch.
 - b. Standby Generator.
 - c. ATS.
 - d. Main Distribution Panel:
 - e. Attendant Building Panelboard.
 - f. LHHW Building Panelboard.
 - g. Operator Warming Station Panelboard.
 - h. Lighting Control Panel LTG-CP1.
 - i. Lighting Control Panel LTG-CP2.

- j. Refuse Building A Panelboard.
 - k. Refuse Building B Panelboard.
 - l. Refuse Building C Panelboard.
 - m. Refuse Building D Panelboard.
4. Short Circuit Report:
- a. Prepare a report summarizing the short circuit and coordination study and conclusions or recommendations that may affect the integrity of the electric power distribution system.
 - b. As a minimum, include the following in the report:
 - 1) Executive Summary.
 - 2) Equipment manufacturer's information used to prepare the study.
 - 3) Assumptions made during the study.
 - 4) Short circuit calculations listing short circuit levels at each bus.
 - 5) Evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.
 - 6) Time-current curves, including the instrument transformer ratios, model numbers of the protective relays, and relay settings associated with each breaker.
 - 7) Comparison of short circuit duties of each bus to the interrupting capacity of the equipment connected to that bus.
 - 8) Recommendations regarding the grounding of transformer neutral, and neutral grounding resistors for the generator.
 - 9) Tabulation of the circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties.
 - 10) Recommendations for system improvements, where needed.
 - 11) Short circuit/coordination studies software for performing this task shall be PowerTools SKM software.
5. Short Circuit Study:
- a. One-Line Diagram:
 - 1) Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.

- 2) Type designation, current rating, range or adjustment manufacturer's style, and catalog transformers.
- 3) Power, voltage ratings, impedance, and primary and secondary connections of all transformers.
- 4) Nameplate ratings of all motors and generator with their subtransient reactances.
- 5) Transient reactances of generator and synchronous reactances of generator.
- 6) Sources of short circuit elements, such as utility, generator, and induction motors.
- 7) All significant circuit elements, such as transformers, cables, breakers, fuses, reactors, etc.
- 8) Standby as well as normal switching conditions.

b. Impedance Diagram:

- 1) Available MVA or impedance from the utility company, documented by letter from the utility company and included with the submitted report.
- 2) Bus impedance.
- 3) Transformer and/or reactor impedances.
- 4) Cable impedances.
- 5) Equipment impedances.
- 6) System voltages.
- 7) Grounding scheme (resistance grounding, solid grounding, and no grounding).

c. Calculations:

- 1) Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the three-phase and line-to-ground short circuits of each case.
- 2) Calculate the maximum and minimum ground-fault currents.

6. Coordination Study:

- a. Provide an evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.

- b. As a minimum, include the following on five-cycle, log-log graph paper:
 - 1) Time-current curve for each protective relay or fuse showing graphically that the settings will allow protection and selectivity within Industry standards. Identify each curve and specify the tap and time dial setting.
 - 2) Time-current curves for each device to be positioned for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, notify the Owner and Engineer as to the cause.
 - 3) Time-current curves and points for cable and equipment damage.
 - 4) Circuit interrupting device operating and interrupting times.
 - 5) Indicate maximum fault values on the graph.
 - 6) Sketch of bus and breaker arrangement.
- 7. Arc Flash Report:
 - a. Prepare a report summarizing the arc flash study and conclusions or recommendations that may affect the integrity of the electric power distribution system.
 - b. A qualified engineer shall perform arc flash calculations to determine the incident energy, arc flash boundary, and minimum PPE requirements for locations throughout the power system. Arc flash warning labels are produced and attached to the electrical equipment. These labels must indicate approach boundaries, incident energy level, and minimum PPE that is required when servicing the equipment within the arc flash boundary.
 - c. As a minimum, include the following in the report:
 - 1) Equipment manufacturer's information used to prepare the study.
 - 2) Assumptions made during the study.
 - 3) Reduced copy of the one-line drawing.
 - 4) Arc flash evaluations summary spreadsheet as specified within this section.
 - 5) Bus detail sheets as specified within this section.
 - 6) Arc flash analysis and calculations for all voltage levels of the electrical power system.
 - 7) Arc flash warning labels printed in color on adhesive-backed labels.
- 8. Arc Flash Study:
 - a. Perform an arc flash hazard study after the short circuit and protective device coordination study has been completed.

- b. For each major part of the electrical power system, determine the following:
 - 1) Flash hazard protection boundary.
 - 2) Limited approach boundary.
 - 3) Restricted approach boundary.
 - 4) Prohibited approach boundary.
 - 5) Incident energy level.
 - 6) PPE hazard/risk category.
 - 7) Type of PPE required.
- c. Produce arc flash warning labels listing Items b.1) through b.7), above. Also include the bus name and voltage.
 - 1) Provide labeling at each separately derived system indicating calculated available fault current per NEC Article 110.24.
 - 2) Arc flash labeling shall conform to the NFPA 70E and the National Electrical Code (NEC).
- d. Produce bus detail sheets that lists Items b.1) through b.7), above, and the following additional items:
 - 1) Bus name.
 - 2) Upstream protective device name, type, and settings.
 - 3) Bus line to line voltage.
- e. Produce an arc flash evaluation summary sheet listing the following additional items:
 - 1) Bus name.
 - 2) Upstream protective device name, type, settings.
 - 3) Bus line to line voltage.
 - 4) Bus bolted fault.
 - 5) Protective device bolted fault current.
 - 6) Arcing fault current.
 - 7) Protective device trip/delay time.
 - 8) Breaker opening time.

- 9) Solidly grounded column.
 - 10) Equipment type.
 - 11) Gap.
 - 12) Arc flash boundary.
 - 13) Working distance.
 - 14) Incident energy.
 - 15) Required protective fire rated clothing type and class.
- f. Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation. Propose approaches to reduce the energy levels.

PART 3 – EXECUTION

3.01 GENERAL

- A. Perform the power study report in accordance with:
1. IEEE Standards 141, 242, and 1584.
 2. NFPA 70E.
 3. OSHA 29-CFR, Part 1910 Subpart S.
- B. Perform the power studies using actual equipment data.
- C. Provide on-site labor to collect field information and verify record information to prepare the reports.

3.02 PRELIMINARY AND FINAL POWER STUDY REPORTS

- A. Contractor shall provide preliminary power study report:
1. Preliminary power study report shall be provided prior to the energizing of equipment and electrical power circuits.
 2. Preliminary power study report shall provide trip settings to protect equipment and personnel during equipment installation, startup, functional testing, and commissioning.
 - a. Trip settings shall be provided for the circuit breakers with adjustable trip settings:

B. Contractor shall provide final power study report:

1. Final power study report shall be provided after the completion of the project construction.
2. Final power study report shall include equipment in the model which matches the final installed equipment and incorporate changes made during construction.
 - a. Final power study shall also include trip settings for the circuit breakers.

C. Contractor shall provide and apply arc flash warning labels for equipment.

3.03 CONFIRM CONDITIONS

- A. Owner will provide available record information as requested by the Consultant/Contractor.
- B. Consultant preparing the report is responsible to field verify record information and collect additional information for performing the study. Provide a minimum of one 8-hour day to perform this field work.
- C. Contractor shall make field adjustments to the protection devices as specified in the short circuit coordination and arc flash study.

END OF SECTION

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SECTION 26 08 00
ELECTRICAL TESTING AND COMMISSIONING

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies the acceptance testing of electrical materials, equipment, and systems. It is intended to cover the testing of all electrical distribution equipment furnished under this Contract. Electrical tests shall be conducted per the requirements specified in the NETA Acceptance Testing Specifications (NETA ATS, most recent published edition) as described and/or modified within this section.
- B. Testing specified within this section shall include all electrical equipment specified in Division 26, all electrical rotating and any power distribution electrical apparatus specified under other specification sections in this Contract. Where testing in accordance with this section is required, the required tests, including correction of defects and retesting, shall be completed prior to energization of material, equipment, or systems.
- C. Test instruments shall be calibrated to references traceable to the National Institute of Standards and Testing and shall have a current sticker showing date of calibration per manufacturer's specifications, deviation from standard, name of calibration laboratory and technician, and date of recalibration.
- D. Where existing conductors are disconnected from existing equipment, salvaged, and connected to new equipment, electrical test shall be conducted on the existing conductors per the requirements specified in the NETA Maintenance Testing Specification (NETA MTS, most recent published edition).

1.02 SUBMITTALS

- A. Procedures: In accordance with Section 26 05 11, "Basic Electrical Methods and Materials."
- B. Proposed testing procedures, including proposed test report forms and listing of equipment that will be tested.
- C. Test report, including documentation for all tests performed.
- D. Execution plan, including schedule.
- E. Name and qualifications of the independent testing firm that will be performing the testing work. Submitted information shall confirm that qualifications are to NETA ATS requirements.
- F. Inspection and acceptance testing reports for new electrical equipment per NETA ATS, Paragraph 5.4 for equipment for which tests are required in this and other Division 26 sections.
- G. Field test results specified in this section.

1.03 QUALITY ASSURANCE

- A. Referenced Standards: This section incorporates by reference the latest revisions of the following documents. In case of conflict between the requirements of this section and the listed documents, the requirements of the Contract Specifications shall prevail. Specified references within the NETA Acceptance Testing Specifications also shall apply.
 - 1. National Electrical Manufacturers Association (NEMA).
 - 2. International Electrical Testing Association Inc. Acceptance Testing Specifications (NETA).
 - 3. NFPA 70 – National Electrical Code (NEC).
- B. Testing shall be conducted by a NETA accredited testing agency as described in the NETA Acceptance Testing Specifications except as noted elsewhere within this section. Where the testing agency is referred to in this specification, it shall be in reference to this NETA accredited testing firm.

1.04 DAMAGED PRODUCTS

- A. See Section 26 05 11 in the event that any equipment or material is damaged.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 CONSTRUCTION INSPECTIONS

- A. Commissioning of electrical systems will require inspection of individual elements of the electrical systems construction throughout the construction period. The Contractor shall coordinate with the Owner to schedule electrical systems inspections as required to support the commissioning process.

3.02 TESTING PROCEDURES

- A. General:
 - 1. Electrical testing requirements per NETA ATS are to be applied for testing of new electrical equipment provided under this Contract as noted within this section. Where NETA is mentioned in these testing procedures, it is understood that this is a reference to the NETA ATS standards.
 - 2. Existing conductors disconnected from existing equipment, salvaged, and connected to new equipment or replacement equipment shall be electrically tested. Electrical test shall be conducted on the existing conductors per the requirements specified in the NETA Maintenance Testing Specification.
 - 3. Conduct insulation tests and the functional checkouts called for in the following paragraphs on equipment prior to energization.

B. Division of Responsibility:

1. Contractor responsibilities for providing information required by the testing agency that are listed in NETA ATS are as follows:
 - a. The Contractor shall provide an approved copy of the short-circuit analysis, coordination study and protective device setting report that are specified in Section 26 05 73.
 - b. The Contractor shall provide the required equipment instruction manuals requested by the testing agency.
 - c. The Contractor shall provide a copy of the list of equipment that will be tested under this Contract.
 - d. The Contractor shall be responsible for providing suitable power for testing as required by the testing agency.
 - e. The Contractor shall be responsible for coordinating the scheduling of testing with the testing agency, and the Owner and shall be responsible for ensuring that equipment is prepared as required for testing by the testing agency.
 - f. The Contractor shall be responsible for providing the site-specific hazard and safety training called for in NETA ATS.
 - g. The Contractor shall notify the Owner 14 days ahead of planned testing.
2. Testing agency responsibilities shall be as listed in NETA ATS.
3. The Owner will provide a set of up-to-date Contract Documents for the testing agency.

C. Safety, Test Equipment Calibration and Reports NETA ATS:

1. Conform to the safety requirements specified in NETA ATS.
2. Test equipment shall be calibrated to the requirements specified in NETA ATS.
3. Test reports shall include all the requirements listed in NETA ATS. Equipment identification shall include the equipment name and number per project Drawings.

D. Thermographic Surveys: In the following specified testing for bolted connections, a choice is generally given for testing via thermographic means or millivolt drop testing or torque-tightening verification. In such cases, either the millivolt drop test or torque-tightening verification shall be conducted in addition to the thermographic scan. It is acknowledged that thermographic scan testing may be limited in efficacy due to the limited loading that may be available at the time of testing.

1. Thermographic surveys are to be conducted only after all the loads have been connected to the equipment such that the testing can be conducted under loading sufficient to provide indication of the joints that are not properly connected.

- E. Optional Tests: Testing requirements referenced in the Specifications include all the NETA ATS applicable test requirements for the equipment type. Tests identified as optional in the NETA documents are required only where specifically called for in the Specifications.
- F. Communications and Controls: Testing of Modbus, Ethernet, DeviceNet, ControlNet, or Foundation Fieldbus circuits and communications is specified in Division 40.
- G. Test Reports:
 - 1. Provide test reports in conformance with the NETA guidelines for test reports.
 - 2. Use the project full equipment name and equipment number for equipment identification.
 - 3. Provide a copy of the final test report in both electronic Microsoft Word format and PDF. Images in the report may be in JPEG or Adobe Acrobat PDF format.
- H. Testing organization shall perform acceptance tests and inspections. Test methods, procedures, and test values shall be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and the paragraph titled "Field Quality Control" of each applicable specification section.
 - 1. Tests identified as optional in NETA ATS are not required unless otherwise specified.
 - 2. Equipment shall be placed in service only after completion of required tests and evaluation of the test results have been completed.
 - 3. Contractor shall supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing.
 - 4. Owner shall be notified at least 14 days in advance of when tests will be conducted by the testing organization.
- I. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:
 - 1. Section 26 05 19, "Low-Voltage Wire and Cable."
 - 2. Section 26 24 16, "Panelboards."
 - 3. Section 26 27 26, "Wiring Devices."
 - 4. Section 26 33 53, "Uninterruptable Power Supplies (UPS)."
 - 5. Section 26 36 13, "Engine Generator."
 - 6. Section 26 36 26, "Automatic Transfer Switch."
 - 7. Section 26 50 00, "Lighting."

8. Section 28 15 23, "Audio Intercom System."
9. Section 28 31 00, "Fire Alarm System."
- J. Function testing of the process controls related to equipment is specified in Division 40 of these Specifications. Only those devices that are related to the protection of electrical equipment such as interlocks, alarms, fail safe devices will be tested.
- K. Electrical functional testing may be performed by qualified electricians (not required to be done by an independent test agency) or by the independent testing agency under this section.
- L. Perform the functional testing per NETA ATS guidelines for function tests and the requirements of this paragraph prior to energizing of the equipment.
- M. Application-specific electrical functional performance testing of equipment is described in the individual equipment specifications.
- N. System Functional Performance Testing:
 1. The Functional Performance Testing Procedures approved by the Engineer will be used to document the inspection and testing of the equipment and systems. Provide all necessary manpower and have the appropriate subcontractor and/or manufacturer's representative present during the testing and demonstrate, to the Designer's satisfaction, the full operation of all electrical and lighting systems. Coordinate the schedule of the testing so that the Engineer and Owner can be present.
 2. Prior to starting the final testing of the systems, ensure that all equipment and systems were initially started up and initialized as prescribed by the manufacturer's instructions or by the manufacturer's representative and that the Contractor has performed a complete inspection and test of all electrical and lighting equipment and systems.
 3. Demonstrate to the Owner proper operation of the ATS and generator by simulating a utility power outage and a restoration of utility power. Demonstrate generator starts and power is transferred to the generator and the RAGF has power.
 4. Demonstrate to the Owner proper operation of the site exterior lighting system. Demonstrate the following:
 - a. Hand control stations in the Attendant Building.
 - 1) General Public Area.
 - 2) Container Truck Lower Service Road.
 - b. Hand control station near Gate 2.
 - 1) Truck Driver push button switch.

- c. The automatic controls.
 - 1) Photocell control.
 - 2) Timer Relay Control.
- d. The exterior lighting which remains ON all night.
 - 1) Gate 1.
 - 2) Old Gate.
 - 3) Gate 2.
 - 4) Single light north island Attendant Bldg.
 - 5) Single light north-end of Recycle Area.
 - 6) Single light rear of Refuse Shed A and D.
 - 7) Light fixtures at the LHHW single man doors.
 - 8) Light fixtures at the Operator Warming Station warming room door.
- 5. Demonstrate to the Owner the proper operation of the Attendant Call System. Demonstrate the following:
 - a. Master Attendant Call Station.
 - b. The Operator Warming Station Call Station.
 - c. The LHHW Building Call Station.
- 6. Demonstrate to the Owner the proper operation of the following:
 - a. Service Entrance Disconnect Switch.
 - b. Main Distribution Panel (MDP).
 - c. Electrical and lighting at the following locations:
 - 1) Including in the demonstration to the Owner that each duplex receptable is properly wired by using a Klein Tool Receptacle Tester Model RT110.
 - a) Demonstrate the “correct” indicator light sequence are illuminated as showing the receptacle is correctly wired.

- 2) Attendant Bldg.
 - a) Each Room.
 - b) UPS in Server Room.
 - c) Surge Protection in Server Room.
 - d) Fire Alarm Panel including remote annunciator.
 - e) HVAC power controls:
 - i. Heater Relay.
 - ii. Motorized Damper, Supply Fan, & Duct Heater Relay.
- 3) LHHW Bldg.
 - a) Each Room.
- 4) Operator Warming Station.
 - a) Each Room.
- 5) Refuse Shed A.
- 6) Refuse Shed B.
- 7) Refuse Shed C.
- 8) Refuse Shed D.
- 9) Maintenance Shed.

END OF SECTION

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SECTION 26 09 95
PUSH BUTTONS, SELECTOR SWITCHES, AND PILOT LIGHTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Provide push buttons, selector switches, and pilot lights as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

- A. Procedures: Refer to Section 26 05 11, “Basic Electrical Methods and Materials,” and Section 01 33 00, “Submittal Procedures.”
- B. Shop Drawings: Provide shop drawings showing the locations and bill of material for the equipment specified in this section.
- C. Submit the manufacturer’s product information and manufacturer’s detailed specifications for the equipment specified in this section.
- D. Submit a list of spare parts and replacement components recommended being stored at the Project for ready access.
- E. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

1.03 QUALITY ASSURANCE

- A. Comply with the following requirements:
 - 1. NFPA 70, National Electrical Code (NEC).
 - 2. Local codes and ordinances.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with pertinent provisions of Section 26 05 11, “Basic Electrical Methods and Materials.”

1.05 WARRANTY

- A. In addition to the warranty specified in Division 1, the manufacturer’s warranty to Owner shall in no event be for a period of less than 1 year starting from when the equipment and installation are substantially complete.
- B. Warranty shall include repair parts, labor, and travel expenses.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide 30.5 mm oil-tight, heavy-duty UL rated push-button switches, selector switches, and pilot lights.
 - 1. NEMA 4 for indoor locations.
 - 2. NEMA 4X for outdoor locations.
- B. Provide devices with legend plates as follows unless noted otherwise:
 - 1. Material: Nontarnish metal or laminated plastic.
 - 2. Use white or black letters on background of opposite color for laminated plastic.
- C. Use two-circuit contact blocks (one normally open [N.O.] and one normally closed [N.C.] contact set) for push-button switches and selector switches.
- D. Acceptable Manufacturers:
 - 1. Eaton.
 - 2. Allen-Bradley.
 - 3. Or preapproved Equals.

2.02 PUSH-BUTTON SWITCHES

- A. Stop Push-Buttons:
 - 1. Provide nonilluminated momentary operation type operators.
 - 2. Provide red color button.
- B. Start Push-Buttons:
 - 1. Provide nonilluminated momentary operation type operators.
 - 2. Provide black color button.
- C. Emergency Stop (E-Stop) Push-Buttons:
 - 1. Provide nonilluminated maintained operation type operators.
 - 2. Provide red color 63-mm metal push button cap with no legend on cap.
 - 3. Provide behind each E-Stop a yellow legend plate with the wording “EMERGENCY STOP” to comply with NFPA 79.

D. Stop-Hold Switches:

1. Use stop push button as specified above.
2. Provide sliding latch with padlock provision to engage stop button in the OFF position.

E. Provide push buttons for other functions as shown on the Drawings.

2.03 SELECTOR SWITCHES

- A. Provide selector switches including the operating knob, operating cam, and contact block(s).
- B. Use black color operating knob.
- C. Select operating cam and contact block combination to provide operating sequence as required.

2.04 PILOT LIGHTS

- A. Provide pilot lights with colored plastic lens as shown on the Drawings.
- B. Provide 120 V or 24 Vdc, push-to-test type with LED lamp.

2.05 ENCLOSURES

A. Provide for individual remote control or monitor stations the following type enclosure:

1. Indoor Locations:

- a. NEMA 1 is allowed in environmentally controlled areas, such as inside the Attendant Building.
- b. NEMA 4X everywhere else.

2. Outdoor Locations: NEMA 4X stainless steel construction.

B. Provide nameplate on enclosure for device being controlled.

1. Minimum 2.25-inch-tall laminated phenolic plastic nameplate with white letters on black backgrounds. Length as required.
2. 1/4-inch-high lettering for equipment name with 1/2-inch-high lettering for tag number.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install push-button switches, selector switches, and pilot lights in accordance with manufacturer's recommendations.
- B. Verify legend plate matches description and function of the pilot device.

3.02 FUNCTION TEST AND COMMISSIONING

- A. Demonstrate pilot devices operate properly and perform their intended functions.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies low-voltage electrical panelboards with circuit breakers as specified in this section and on the Drawings.

1.02 REFERENCE STANDARDS

- A. Comply with the following requirements:
 - 1. Federal Specifications W-P-115C.
 - 2. NEMA PB1.
 - 3. NFPA 70 National Electrical Code (NEC).
 - 4. UL 50 – Cabinets and boxes.
 - 5. UL 67 – Panelboards.d
 - 6. UL 98 – Fusible Switches.
 - 7. NETA ATS – International Electrical Testing Association Acceptance Testing Specifications.
 - 8. Local codes and ordinances.

1.03 SUBMITTALS

- A. Procedures: Refer to Section 26 05 11, “Basic Electrical Methods and Materials,” and Section 01 33 00, “Submittal Procedures.”
- B. Shop Drawings:
 - 1. Submit product information/data shop drawings for materials.
 - 2. Provide the following information for each panelboard:
 - a. Manufacturer cut sheets (product data sheet).
 - b. Panelboard type.
 - c. Main bus and terminal connection sizes.
 - d. Location of line connections.

- e. Cabinet dimensions.
 - f. Gutter space.
 - g. Gauge of boxes and fronts.
 - h. Finish data.
 - i. Voltage and amp ratings.
 - j. Panel schedule including breaker or fuse types, trip ratings, and interrupting ratings.
 - k. Cable terminal sizes.
 - l. Surge Protection Device (SPD) product information.
 - m. Seismic Certification and equipment anchoring details.
 - n. Factory Test Plan.
 - o. Field Test Plan.
 - p. Certified production test reports.
 - q. Field Test Reports: Indicate test results compared with specified performance requirements and provide justification and resolution of differences if values do not agree.
3. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

1.04 SEISMIC ANCHORAGE AND STRUCTURAL DATA

- A. Mechanical instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

1.05 WARRANTY

- A. In addition to the warranty specified in Division 1, the manufacturer's warranty to Owner shall in no event be for a period of less than 1 year starting from when the equipment and installation are substantially complete.
- B. Warranty shall include repair parts, labor, and travel expenses.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected for water, rain, dirt, construction debris, and physical damage. Storage and handling shall be per the manufacturer's requirements.
 - 1. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

PART 2 – PRODUCTS

2.01 PANELBOARDS

- A. General:
 - 1. Panelboards shall be the automatic-circuit-breaker type as indicated on the Drawings. The number and arrangement of circuits, trip ratings, spares, and blank spaces for future circuit breakers shall be as shown on the Drawings.
 - 2. Each panelboard shall have a nameplate as specified in Section 26 05 53 and giving the panel identification as shown on the Drawings.
 - a. In addition, each panelboard shall have a manufacturer's nameplate showing the voltage, bus rating, number of phases and wires, frequency, and manufactured month/year date.
 - 3. For panelboards used in dry locations, finish of doors and trim shall be ANSI 61 or 49, in accordance with ANSI Z55.1. Boxes of such panelboards shall be galvanized and finished to match the fronts.
 - 4. Where specified, panelboards enclosures shall be as follows:
 - a. NEMA 1 in environmentally controlled spaces, such as inside the Attendant Building or inside the LHHW Building.
 - b. NEMA 3R for outdoor, wet, and damp locations.
 - 5. Panelboards and enclosures shall conform to NEMA PB1 and 250, UL 50, and requirements of relevant codes. Panelboards used as service equipment shall conform to UL 869A, and panelboard shall be UL labeled.
 - 6. Circuit breakers shall be bolt-on type, heavy duty, quick make, quick break, single- and multi-pole circuit breakers of types specified herein; shall be provided for each circuit with toggle handles that indicate when unit has tripped.

B. Construction:

1. Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
2. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three-point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the Owner's option. Installation shall be tamper-resistant with no exposed hardware on the panelboard trim.
3. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
4. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.
5. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
6. All panelboard cylinder locks shall be keyed alike.

C. Bus:

1. Main bus bars shall be tin-plated copper sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65°C above an ambient of 40°C maximum.
2. A system ground bus shall be included in all panels. Ground bus shall be copper.
3. Full-size (100% rated) insulated stand-off neutral bus shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. Two-hundred-percent-rated neutrals shall be supplied for panels designated on the Drawings with oversized neutral conductors. Neutral bus bar shall be copper.

D. Panelboards – Circuit Breaker Type:

1. Panelboards shall be rated 120/240 V, three-wire, with bus ratings as shown on the Drawings. Main circuit breaker and branch circuit breakers shall have minimum interrupting ratings of 42,000 rms symmetrical amperes at 240 V unless otherwise specified on the Drawings. Series rated interruption rating shall not be used.
2. Provide permanently installed lockout means for each individual circuit breaker handle for lockout/tagout procedures.
3. Current ratings, configuration of poles, and number of circuits shall be indicated on the Drawings.

E. Enclosure:

1. Enclosures shall be a minimum of 20 inches wide and made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space.
2. Enclosures shall be wall mounted (surface mounted).
3. Enclosures shall have the ability for the door or cover to be locked in the CLOSED position.
 - a. Prefer padlock hasp to lock panelboard cover in the CLOSED position.

F. Surge Protection Device:

1. Surge protection devices (SPD) shall be provided for panelboards.
 - a. Panelboards shall provide fuses or circuit breaker to connect the panelboard bus to SPD.
 - 1) Provide protection device sized per the manufacturer's recommendation.
2. SPDs shall have indicator LED to indicate protection status.
3. SPDs shall be configured to support the panelboard voltage rating and wiring configuration.

G. Acceptable Manufacturers:

1. Eaton.
2. Schneider Electric.
3. Or preapproved equal.
4. The design was based upon Eaton Panelboards and the space as shown on the Drawings. Other manufacturer's panelboards shall meet the requirements specified within this section and shown on the Drawings.

PART 3 – EXECUTION

3.01 FACTORY TESTING

- A. The standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI, NEMA, and UL standards.
- B. The manufacturer shall submit three certified copies of factory test reports.

3.02 MANUFACTURER'S CERTIFICATION

- A. A certified test report of all standard production tests shall be submitted.

3.03 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's instructions, as indicated on the Drawings and in accordance with the NEC.
- B. Seismic anchorage and bracing as specified in Section 13 05 41.
- C. A directory card shall be typed completed, identifying every circuit. Handwritten not acceptable.
 - 1. Provide a copy of the panelboard schedule for that panelboard from the Drawings into the directory cord holder.

3.04 MOUNTING HEIGHTS

- A. Panelboards shall be mounted with the top of the box 6 feet 6 inches above the floor. Panelboards shall be plumb within 1/8 inch. The highest breaker operating handle shall not be higher than 72 inches above the floor.

3.05 FIELD ADJUSTMENTS

- A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit, coordination, and arc flash study per Section 26 05 73 at no cost to the Owner.
- B. Necessary field settings of devices, adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

3.06 FIELD TESTS

- A. Contractor shall perform manufacturer-submitted Field Test Plan.
- B. Contractor shall perform Visual and Mechanical Inspection as specified in NETA ATS – Section 7.5 for switches and Section 7.6 for molded case circuit breakers.
- C. Contractor shall include the following inspections and related work:
 - 1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
 - 2. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - 3. Check panelboard mounting, area clearances, and alignment and fit of components.
 - 4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.

- D. Insulation-Resistance Tests: Perform insulation-resistance tests on circuits to be energized with a line-to-neutral voltage of 120 V or more. Make these tests after equipment has been connected, except that equipment that may be damaged by the test voltage shall not be connected. Test the insulation with a 500 Vdc insulation-resistance tester with a scale reading 100 megohms. The insulation resistance shall be 20 megohms or more. Submit results for review.
- E. Continuity: Panelboard circuits shall be tested for continuity prior to energizing. Continuity tests shall be conducted using a dc device with a bell or buzzer.

3.07 DEMONSTRATION TO OWNER

- A. Demonstrate to Owner the panelboards and which electrical circuits they protect and control.
 - 1. Demonstrate panelboard directory matches as-built and is typed text and not handwritten text.
- B. Demonstrate panelboard locking ability.
 - 1. Provide keys (Qty 2 for each panelboard) to the Owner for locking each panelboard. Each key shall have heavy duty with metal keyring and key label tag identifying which panelboard the panelboard it locks/un-locks.
 - 2. Provide a wall mounted key cabinet for storing panelboard locking keys. Key cabinet shall have capacity for 60 keys, manufactured with heavy duty welded steel and a lockable cabinet door. Locate the key cabinet inside the Attendant Bldg, Server Room. Coordinate with Owner for mounting location.
- C. Demonstrate panelboard identification labels and demonstrate location of power source feeding panelboard labels.

END OF SECTION

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SECTION 26 27 26
WIRING DEVICES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Work Included:
 - 1. Installation, connection, and furnishing of all single, duplex, GFI, and special purpose receptacles complete with wall plates and/or covers as shown on the Drawings.
 - 2. Installation, connection, and furnishing of all single-pole, three-way, pilot lights, and momentary position toggle switches complete with wall plates and/or handle operators as shown on the Drawings.
- B. Refer to Section 26 05 11, "Basic Electrical Methods and Materials." For quality assurance submittal procedures, and other requirements.

1.02 REFERENCE STANDARDS

- A. ANSI C73: Plugs and Receptacles.
- B. ANSI C73a: Plugs and Receptacles.
- C. FS W-C-596 D and E: General Specifications for Cable Outlet Electrical Connector.
- D. FS W-S-896 D and E: General Specifications for Flush Mounted Toggle and Lock Switches.
- E. NEMA WD 1: General Requirements for Wiring Devices.
- F. NEMA WD 6: Wiring Devices – Dimensional Requirements.
- G. NEMA KS-1: Heavy Duty and Dead-Front Switches (600 V Maximum).
- H. UL 20-11, 20-12: General-Use Snap Switches.
- I. UL 98: Standard for Safety for Enclosed and Dead-Front Switches.
- J. UL 498: Electrical Attachment Plugs and Receptacles.
- K. UL 514A: Metallic Outlet Boxes.
- L. UL 514B: Fittings for Cable and Conduit.
- M. UL 514C: Nonmetallic Outlet Boxes, Flush Device Boxes, and Covers.
- N. UL 514D: Cover Plates for Flush-Mounted Wiring Devices.

- O. UL 943: Ground Fault Circuit Interrupters.
- P. UL 943A, 943B: Leakage Current Protection.
- Q. UL 98: Enclosed and Dead-Front Switches.
- R. UL 1682: Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type.
- S. UL 1686: UL Standard for Safety Pin and Sleeve Configurations.

1.03 SUBMITTALS

- A. Procedures: Refer to Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."
- B. Shop Drawings: Provide shop drawings showing the locations and bill of material for the equipment specified in this section.
- C. Submit the manufacturer's product information and manufacturer's detailed specifications for the equipment specified in this section.
- D. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

1.04 QUALITY ASSURANCE

- A. Source Quality Control:
 - 1. Products shall be listed and labeled by an approved Nationally Recognized Testing Lab (NRTL) such as Underwriter's Laboratories, Inc. (UL), Energy Technology List (ETL), or Canadian Standards Association.

1.05 WARRANTY

- A. In addition to the Warranty specified in Division 1, the manufacturer's warranty to Owner shall in no event be for a period of less than 2 years starting from when the equipment and installation are substantially complete.
- B. Warranty shall include repair parts, labor, and travel expenses.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Individual device types shall be provided from a single manufacturer.
- B. Acceptable Manufacturers:
 - 1. Hubbell.
 - 2. Leviton.

3. Pass & Seymour.
4. Eaton.
5. Mennekes.
6. Or preapproved equal.

2.02 RECEPTACLES

- A. General: Receptacles shall be specification grade, heavy-duty, high-abuse, grounding type conforming to NEMA configurations, NEMA WD1, and UL 498 Standards.
- B. Duplex Receptacles:
 1. Receptacles shall be of back and side wire design utilizing screw-type terminals. Receptacles shall be rated 20 A, two-pole, three-wire, 120 V, NEMA 5-20 configuration, self-grounding. Power contacts shall be a T-type design and shall be brass. Ground contacts shall be brass. Color shall be as follows:
 - a. Ivory in industrial areas:
 - 1) Ivory for receptacles supplied by normal power source.
 - b. Ivory or white in office areas; all shall match.
 2. Devices shall have a nylon or polycarbonate composition face with a nylon or melamine body. Units shall comply with Federal Specification W-C-596E and meet UL 498 test requirements.
- C. Special Purpose Receptacles: Receptacles shall be of the amperage, voltage, and NEMA configuration indicated on the Drawings. Compliance to standards and tests shall be as listed in Item B above.
- D. GFI Receptacles:
 1. Device shall be rated 20 A, two-pole, three-wire, 120 V, conforming to NEMA WD1.10 configuration. Face shall be nylon or polycarbonate composition meeting UL 498 test standards. Unit shall have test and reset push buttons and LED indicator.
 2. GFCI component shall meet UL 943 Class A standards with a tripping time of 1/40 second at 5 mA current unbalance. Operating range shall extend from 31°F to 158°F. Unit shall have transient voltage protection and shall be ceramic encapsulated for protection against moisture.

2.03 NETWORK DATA JACK OUTLET

- A. General: RJ-45 Data Jack outlets shall be specification grade, heavy-duty, high-abuse, grounding type conforming to TIA-568A.
 1. Copper conductor material.
 2. Ivory or white in office areas; all shall match.

2.04 SWITCHES

- A. Line-Voltage Types: Switches shall be rated 20 A at 120 V or 277 V, ac only. Units shall be flush-mounted, self-grounding, quiet-operating toggle devices. Handle color shall be ivory in industrial areas and white or ivory in office and laboratory areas. Units shall conform to Federal Specifications W-S-896 D and E, UL 20-11 and UL 20-2, and NEMA WD1 Standards.
- B. Low-Voltage Types: Switches shall meet all of the requirements listed in Item A above except to be rated at 15 A for switching 24 Vdc. Devices shall be three-position, momentary-contact, spring-return, center “off” configuration.
- C. Manual Motor Starters: For 120 V, single phase motors that require a lockable disconnect, provide a padlockable manual motor starter without overloads.
- D. 120 V controls snap type switches:
 - 1. Provide locking switch position covers so the switch can be locked in either the ON position or OFF position.
 - a. Cantex Part Number 513330.
 - b. Eaton Crouse-Hinds Catalog Number DS185.
 - c. Hubbell Catalog Number HBL1372D.
 - d. Or preapproved equal.

2.05 PLATES AND COVERS

- A. General: Plates shall be of the style and color to match the wiring devices, and of the required number of gangs.
- B. Plates shall conform to NEMA WD1, UL 514, and ANSI C73. Plates on finished walls shall be nonmetallic.
 - 1. Nonmetallic: Plates shall be smooth finish with contoured edges and shall be nylon or fiberglass.
- C. Plates on unfinished walls, on nonenvironmentally controlled spaces, and on fittings shall be of zinc-plated steel or cast metal having rounded corners and beveled edges.
 - 1. Galvanized: Plates shall be galvanized sheet steel raised 1/2 inch, with rounded corners.
 - 2. Cast Metal: Plates shall be cast or malleable iron covers with gaskets so as to be moisture resistant or weatherproof.
- D. Blank Plates: Cover plates for future telephone or television outlets shall match adjacent device wall plates in appearance.

- E. Damp or Wet and Corrosive Locations: Plates shall have weather protective double doors. Material of manufacture shall be die-cast aluminum for metallic plates or nylon for nonmetallic plates.
- F. Cover plate for network data jack outlet shall have RJ45 socket ports wiring plug jack outlets for Ethernet network connection.
 - 1. Network cover plates in Attendant Building work area shall support the quantity of RJ45 socket ports, reference four socket ports per cover plates.
 - 2. Cover plate shall have a placard/label indicating termination address, and the placard shall be visible on exterior surface of cover plate.
- G. Outdoor Locations:
 - 1. Receptacles: While-in-use style weatherproof cover, cast metal, while-in-use cover, padlockable in the closed position.
 - 2. Switches: Locking weatherproof, cast metal, padlockable toggle switch cover.

2.06 240 V FUSED SAFETY DISCONNECT SWITCHES

- A. Provide heavy-duty safety switch as shown on the Drawings with the following ratings:
 - 1. 30 A to 400 A.
 - 2. 240 VAC; 600 VAC.
 - 3. 2 pole.
 - 4. Fusible.
 - 5. Mechanical lugs suitable for copper conductors.
- B. Construction:
 - 1. Switches blades and jaws shall be visible and plated copper.
 - 2. Switches shall have a red handle that is easily padlockable with three 3/8-inch shank locks in the ON or OFF position.
 - 3. Switch shall have quick-make, quick-brake mechanism “snaps” contacts open and closed providing positive ON/OFF indication.
 - 4. Enclosure shall have wide and unobstructed gutter.
 - 5. Coin-proof, defeatable interlock.
 - 6. Spring reinforced fuse clips ensure reliable contact for cool operation. Suitable for Class H, K, J, or R fuses, where applicable.

7. Enclosure NEMA ratings:
 - a. Inside environmental controlled spaces such as Electrical Rooms – NEMA 1.
 - b. Corrosive areas – NEMA 4X, stainless steel.
 - c. Outdoor nonprocess or noncorrosive areas – NEMA 3R.
8. Provide fuse puller on all fused safety switches.

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

- A. Dry Locations: The device shall be installed in flush-mounted boxes with washers as required to bring the device mounting strap level with the surface of the finished wall.
- B. Damp or Wet Exterior Locations: Install only wiring devices approved for outdoor service in these locations.
- C. Damp or Wet Interior Locations:
 1. Install only wiring devices approved for outdoor service.
 2. Adjust boxes so that front edge will be 1/4 inch beyond the rear edge of the finished wall.
 3. Use product listed for use to bring device-mounting straps flush with the front edge of the finished wall.
- D. Receptacles:
 1. Receptacles shall be grounded by a grounding conductor, not by a yoke or screw contact.
 2. Receptacles shall be installed with connections pigtailed (spliced) to the branch circuit wiring so that removal of the receptacle will not lose neutral continuity and branch circuit power will not be lost to other receptacles on the same circuit.
- E. Contractor shall label switches, receptacles, cover plates, and safety disconnect switches with their power source electrical circuit identifier.
 1. Example: "PBD-AB1, CKT 7."

3.02 INSTALLATION OF WALL PLATES

- A. General: Plates shall match the style of the device and shall be plumb within 1/16 inch of the vertical or horizontal.
- B. Interior Dry Locations: Install plates so that all four edges are in continuous contact with the finished wall surfaces. Plaster filling will not be permitted. Do not use oversize plates or sectional plates.

- C. Exterior and/or Wet Locations: Install plates with gaskets on wiring devices in such a manner as to provide a rain-tight weatherproof installation. Cover type shall match box type.
- D. Future Locations: Install blanking cover plates on all unused outlets.
- E. Provide labels on receptacle and light switch wall plates (cover plates) identifying the panelboard and its branch circuit number behind cover plate.

3.03 TESTS

- A. Receptacles:
 - 1. Receptacles shall be tested for blade and ground-plug tension prior to installation. Do not install any receptacle having less than 16-ounce individual blade retention.
 - 2. After installation of receptacles, circuits shall be energized and each receptacle tested for proper ground continuity, reversed polarity, and/or open neutral condition.
- B. GFI receptacles shall be tested with the circuits energized. Devices shall be tested with a portable GFI receptacle tester capable of circulating 7.5 mA of current, when plugged in, between the "hot" line and "ground" to produce tripping of the receptacle. Resetting and tripping shall be checked at least twice at each GFI receptacle.

3.04 DEMONSTRATION

- A. Receptacles:
 - 1. Demonstrate to Owner receptacles are wired correctly.
 - 2. Demonstrate to Owner GFCI receptacle's function test and perform properly.
 - 3. Demonstrate outdoor receptacles have weatherproof with in-use covers and have padlockability.
 - 4. Demonstrate covers for receptacles include correct label indicating power source and branch circuit.
- B. Switches:
 - 1. Demonstrate to Owner switches operate and control equipment/lighting they are designated for.
 - 2. Demonstrate outdoor switches have weatherproof covers.
 - 3. Demonstrate covers for switches include correct label indicating power source and branch circuit.

END OF SECTION

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SECTION 26 28 00
LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies overcurrent protective devices as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 SUBMITTALS

- A. Procedures: Refer to Section 26 05 11, “Basic Electrical Methods and Materials,” and Section 01 33 00, “Submittal Procedures.”
- B. Submit shop drawings, including electrical ratings, physical size, interrupt ratings, trip curves, I²t curves, and manufacturer’s detailed specifications.
- C. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1. Include documentation showing final configuration of each circuit protection device.

1.03 QUALITY ASSURANCE

- A. Comply with the following requirements:
 - 1. NFPA 70 National Electrical Code (NEC).
 - 2. Local codes and ordinances.
 - 3. Provide overcurrent protective devices by same manufacturer for each type of device.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected from water, rain, dirt, construction debris, and physical damage. Storage and handling shall be per the manufacturer’s requirements.
 - 1. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

1.05 SPARE PARTS

- A. Provide the following spare parts to the Owner that match items specified:
 - 1. In Single-Phase Circuits: Two fuses of each type and rating.

1.06 WARRANTY

- A. In addition to the Warranty specified in Division 1, the manufacturer's warranty to Owner shall in no event be for a period of less than 2 years starting from when the equipment and installation are substantially complete.
- B. Warranty shall include repair parts, labor, and travel expenses.

PART 2 – PRODUCTS

2.01 FUSES

- A. General purpose fuses for protection of motors and other electrical devices:
 - 1. Use UL Class RK-1 Fuses:
 - a. Single end rejection or to fit mountings specified.
 - b. 0 to 600 A rating.
 - c. 100,000 A interrupting capacity.
 - d. Dual element, time delay.
 - e. Use Bussman Low Peak LPN-RK, or approved equal: 250 V rating.
 - f. Use Bussman Low Peak LPS-RK, or approved equal: 600 V rating.
 - 2. Use UL Class L Fuses:
 - a. Bolt-in type.
 - b. 601 to 6,000 A rating.
 - c. 100,000 A interrupting capacity.
 - d. Time delay.
 - e. Use Bussman HI-CAP, KRP-C, or approved equal: 600 V rating.
- B. General purpose fuses for protection of motor control circuits, lighting ballasts, control transformers, and street lighting fixtures:
 - 1. Use UL Class CC, fast acting, single element fuses.
 - 2. Rated for 0 A to 30 A.
 - 3. Provide 100,000 A interrupting capacity.
 - 4. Use Bussman Limitron KTK-R, or approved equal: 600 V rating.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. General:

1. Comply with UL 489 requirements.
2. Provide thermal and magnetic protection.

B. Provide permanent trip power panel and MCC circuit breakers as follows:

1. Adjustable electronic trip.
2. Ground fault trip functions shall be applied as required by the NEC.
3. Bolt-on type.
4. 240 V or less Short circuit rating (integrated equipment rating):
 - a. Service Entrance Disconnect Switch Circuit Breaker: 65,000 RMS symmetrical amps minimum to protect the ATS.
 - b. Generator output circuit breaker: 65,000 RMS Symmetrical amps minimum to protect the ATS.
 - c. MDP Main: 42,000 RMS symmetrical amps minimum.
 - d. MDP Feeder: 42,000 RMS symmetrical amps minimum.

C. Provide low-voltage circuit breakers for the generator output circuit breakers as shown on the Drawings.

D. Ground fault trip functions shall be applied as required by the NEC.

E. All Molded Case Circuit Breakers (MCCB) sized 125 A or larger shall be 100% rated MCCB.

F. Provide breaker lock-out devices.

1. Lock-out devices support LOTO safety.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install overcurrent protective devices in accordance with manufacturer's recommendations.

B. Ground/bond protection device enclosure to comply with NEC.

3.02 ADJUSTMENT

- A. Set and record adjustable settings on circuit breakers to provide selective coordination and proper operation.

3.03 PROVIDE SPARE FUSES

- A. For each electrical device which has fuse protection device, Contractor shall provide a spare fuse for each fused used.

3.04 DEMONSTRATION

- A. Demonstrate to Owner circuit breaker pole, amperage, interrupting rating installed matches Drawings.
- B. Demonstrate to Owner the breaker lock-out devices.

END OF SECTION

SECTION 26 33 53
UNINTERRUPTIBLE POWER SUPPLIES (UPS)

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies uninterruptible power supplies (UPS) for maintaining continuity of power supplies to server rack equipment during power system brief outages.

1.02 QUALITY ASSURANCE

- A. Referenced Standards: This section incorporates by reference the latest revision of the following document. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and that of the listed document, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI/NEMA ICS 6	Enclosures for Industrial Controls and Systems
UL 508	Industrial Control Equipment
ANSI C62.41 (IEEE 587)	Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits FCC Part 15 Class A
NEMA PE-1	Uninterruptible Power Systems.
NFPA 70	(National Fire Protection Association) – National Electrical Code.
NFPA 75	Electronic Computer/Data Processing Equipment
UL 1778	Uninterruptible Power Supply Equipment
IEEE 1184	Guide for Selection and Sizing of Batteries for Uninterruptible Power Systems.
NEMA 250	Enclosures for Electrical Equipment
NETA ATS	International Electrical Testing Association Electrical Testing Specifications.

- B. Control Panel assembly shall conform to UL 508.
- C. Listing and Labeling: Provide electrical components, devices, and accessories that are Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authority Having Jurisdiction and marked for intended use for the location and environment in which they are installed.
1. UPS Units: Listed and labeled under UL 1778.

1.03 SUBMITTALS

- A. Procedures: Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."

- B. Catalog cut sheets.
- C. Shop drawings including but not limited to:
 - 1. Layout drawings of the UPS indicating the front and rear equipment arrangement, dimensions, and required working clearances. A list of materials and components shall accompany the layout drawings.
 - 2. Elementary and internal connection diagrams.
 - 3. Layout drawings of the associated power supplies showing dimensions.
 - 4. List of recommended standby and spare components.
- D. Battery Run time calculations at full load and 1/2 load.
- E. Operating and maintenance material in accordance with Division 1.
- F. Factory Test Reports: Comply with specified requirements.
- G. Field Test Plan: Provide a test plan describing how the UPS shall be tested in the field including how the Owner would field test UPS.
- H. Field Test Reports: Indicate test results compared with specified performance requirements and provide justification and resolution of differences if values do not agree. Include manufacturer's written certification verifying proper installation.
- I. Maintenance Data: For UPS units to include in maintenance manuals specified in Division 1. Include the following:
 - 1. Lists of spare parts and replacement components recommended being stored at project site for ready access.
 - 2. Detailed operating instructions covering operation under both normal and abnormal conditions.
- J. Warranties: Special warranties specified in this section.

1.04 CAPACITY UPGRADE CAPABILITY

- A. Systems shall be able to accept additional field-installed external battery modules in server rack to extend run time.

1.05 SPARE PARTS

- A. Local field service organization shall stock extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Provide the following spare parts for the equipment supplied. Also, provide a toll-free direct phone number for parts supplier.

1.06 SEISMIC ANCHORAGE AND STRUCTURAL DATA

- A. Mechanical instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.
- B. Contractor shall store UPS in dry, temperature-controlled location and provided protection from dust, debris, and moisture while electrical equipment is stored before installation.

1.08 WARRANTY

- A. In addition to the warranty specified in Division 1, the manufacturer's warranty to Owner shall in no event be for a period of less than 2 years starting from when the equipment and installation are substantially complete.
- B. Warranty shall include repair parts, labor, and travel expenses.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. APC Smart-UPS On-Line 2200VA, rackmount 2U, 120 V, 6x 5-20R+1x L5-20R NEMA outlets, Network Card, Extended runtime, with rail kit.
- B. Or preapproved equal with similar characteristics and performance as the APC Smart-UPS On-Line 2200VA UPS.

2.02 GENERAL

- A. Provide UPS with external Maintenance Bypass Switch.
 - 1. Maintenance Bypass Switch allows the UPS to be replaced without loss of power to the connected load.
- B. UPS shall have a minimum of 15 minutes run time without normal input power.
 - 1. UPS shall have provisions for batteries to be added in the future should the electrical load increase and additional battery reserve power is needed to achieve the minimum 15-minute run time.
- C. Primary power supply and nominal output ratings shown on the Drawings.

2.03 UPS REQUIREMENTS

- A. APC Smart-UPS.
- B. On-line, double-conversion, topology.
- C. Rack Mounting.
- D. VA Size: 2200 VA (minimum).
- E. Input voltage: 120 V single phase.
- F. Output voltage: 120 single phase.
 - 1. 6 NEMA 5-20R.
 - 2. 1 NEMA L5-20R.
- G. UPS Communications:
 - 1. UPS shall have output relay contact for plant control system to monitor the health and failure of the UPS.
 - 2. UPS shall have Network Communication Card to connect to Ethernet network and the Internet to support real-time monitoring.

2.04 SERVICE CONTACT LABEL

- A. Provide a label affixed to the UPS for who the Owner should contact for maintenance and service. Service contact label shall include business name and phone number.

2.05 UPS SYSTEM FACTORY TESTS

- A. Provide standard factory tests.

PART 3 – EXECUTION

3.01 GENERAL

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the Drawings.
 - 1. Contractor shall arrange start-up and installation services with APC representative (APC Factory Trained Technician).
 - 2. Start up and Installation Services shall consist of the following:
 - a. Installation of new UPS.
 - b. Installation UPS accessories.
 - c. Installation includes mounting and start-up of new UPS, internal batteries, and external batteries.

- B. Hardware to secure the assembly in place shall be provided by the Contractor.
- C. UPS and battery modules to be located in the lowest levels of the server rack located in the Attendant Building Server Room.
 - 1. See Section 40 67 00 for server rack specifications.

3.02 FIELD TESTS

- A. Provide a factory-authorized service representative to field test, verify UPS is fully operational and performing properly.
- B. The factory-authorized service representative shall assist in the equipment commissioning and demonstrating operations of the UPS.
 - 1. Demonstrate the maintenance bypass switch does not cause the connected loads to lose power or require re-booting when switching to UPS power source or switching to utility power source.
- C. Conduct submitted field test plan and submit field test plan report.
- D. Provide manufacturer's written certification verifying proper installation.
- E. After installation, test for loss of utility power source that the UPS maintains the electrical load without a momentary loss of power. Test the UPS double-conversion function and load on UPS battery for 10 minutes.

3.03 TRAINING

- A. Provide a factory-authorized service representative to demonstrate UPS operation and maintenance and provide training as necessary for maintenance and operation staff for maximum of one 2-hour session.
- B. Schedule training and provide notification to Owner at least 15 working days in advance.
- C. In addition, demonstrate to the Owner the following:
 - 1. How to step through the various menus on the UPS control panel and what information they need to know how to obtain.
 - 2. How to check the health of the batteries and when they need to be replaced.
 - 3. How to replace batteries.
 - 4. How to clean dust, dirt, and debris from the UPS including the UPS's air intake.
 - 5. Demonstrate the field test plan to the Owner so they can test the UPS to determine if maintenance or service may be required.
- D. Show label on UPS for who to contact and their phone number for maintenance or service.

END OF SECTION

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SECTION 26 36 13
ENGINE GENERATOR

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies a standby engine drive generator, base fuel tank, weather/sound attenuating enclosure, and related equipment suitable for use in applications where the generator will be used as an NEC 702 Optional Standby System. Provide generator and related hardware as specified herein, and as needed for a complete and proper installation.
- B. The engine driven generator set includes, but not limited to, the following components: Diesel engine; generator, electric starter, starting batteries and battery charger, cooling system equipment; base tank system; critical grade exhaust system, generator control panel, intake air cleaner, lubrication system, engine water jacket heater, and weatherproof sound attenuating enclosure.

1.02 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer sales and service center within 60 miles of project construction site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. NEMA MG1, "Motors and Generators."
- E. Comply with NFPA 37 (Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines).
- F. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 702 "Optional Standby Systems").
- G. Comply with UL 142, Steel Aboveground Tanks for Flammable and Combustible Liquids, listed and labeled.
- H. Comply with UL 2200, Stationary Engine Generator Assemblies, listed and labeled.
- I. IBC seismically certified.

1.03 SUBMITTALS

- A. Product Data: For packaged engine generator specified. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Time-current characteristic curves for generator protective device.
 - 3. Sound test data report, based on a free field requirement.
 - 4. Catalog product information for all panel face instruments, meters, gauges, switches, devices, skid mounted termination boxes, terminal strips, control panel lighting.
- B. Generator sizing report including the itemized electrical loads descriptions as shown on the drawing and which step load is applied.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.
 - 1. Dimensioned outline plan and elevation drawings of engine-generator set, base tank, weather/sound attenuation enclosure, and other components specified.
 - a. Identify locations for anchoring generator assembly to concrete foundation.
 - 2. Wiring Diagrams: Complete wiring diagrams, voltage regulations and excitation circuitry identifying terminals and identified conductors. Control interconnection, Customer connections.
 - 3. Conduit entry locations/stub-out locations.
 - 4. Grounding bonding locations.
 - 5. Structural anchorage locations and mounting to concrete equipment pad instructions.
 - 6. Engine lube oil piping schematic.
 - 7. Engine fuel piping schematic.
 - 8. Engine coolant system schematic.
 - 9. Engine jacket heater product information and wiring schematic.
 - 10. Alternator anti-condensation heater product information and wiring schematic.
 - 11. Battery charging system product information and wiring schematics.
 - 12. Complete details for all safety devices and pressure, temperatures, and level switches.

13. Engine Starting:

- a. Engine cranking voltage.
- b. Number of batteries.
- c. Battery rating of complete bank, amp hour.
- d. Battery dimensions.
- e. Recommended size of battery cables, AWG.

14. Cooling radiator airflow and static pressure (external to radiator).

15. Engine exhaust gas flow rate, in ACFM, and temperature at rated conditions.

16. Exhaust silencer pressure drop versus air flow.

17. Heat rejection to atmosphere from generator engine casing and generator.

18. Generator:

- a. Weight.
- b. Stator and field ratings including temperature rise at full load and overload conditions.
- c. Complete description of insulation system.
- d. Generator impedances: X_d , X_q , X_d' , X_d'' , X_2 , X_o .
- e. Catalog data showing KVA, full load amps, etc.
- f. Available fault current.
- g. Generator nameplate data.

19. Shop drawing showing concrete equipment pad along with sidewalk around generator and base tank sized based upon submitted generator.

D. Base fuel tank shop drawings and bill of material for all components and devices.

- 1. Shop drawing shall show locations for ventilation, fill port, fuel level indicator, leak detection device within the double wall construction, how it should be anchored to the concrete equipment pad, conduit penetrations for generator above, how to secure/lock the fuel filling port, and labeling which include fuel type only label.

E. Weather and sound attenuating enclosure shop drawings and bill of material for all components and devices.

F. Certifications:

1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.
2. Submit statement of compliance which states the proposed product(s) are seismically certified in compliance with local requirements signed and sealed by a qualified professional engineer.

G. Manufacturer Seismic Qualification Certification: Submit certification that the 24 Hour(s) fuel tank, the Weather enclosure, engine-generator set, and components will withstand seismic forces defined in Section 13 05 41, "Seismic Restraint Requirements for Nonstructural Components." Include the following:

1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Source quality-control test reports:

1. Certified summary of prototype-unit test report. See requirements in Part 2, "Source Quality Control," Article Part A. Include statement indicating torsional compatibility of components.
2. Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification.
3. List of factory tests to be performed on unit prior to being shipped to the project construction site.
4. Report of exhaust emissions and compliance statement certifying compliance with applicable regulations.
5. Field Test Plans.
6. Field Test Report.

I. Equipment Operation and Maintenance Manual.

J. Itemized list of recommend spare parts and estimated cost of each.

K. Record drawings showing changes made during construction including as-builts.

1.04 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: -18°C (0.0°F) to 40°C (104°F).
 - 2. Relative Humidity: 0% to 95%.
 - 3. Altitude: Sea level to 700.0 feet (213.0 m).

1.05 SEISMIC ANCHORAGE AND STRUCTURAL DATA

- A. Mechanical, instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

1.06 SHIPMENT, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a secured, safe location, protected for rain, dirt, construction debris, and traffic.
- B. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

1.07 WARRANTY

- A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set, base fuel tank, weather/sound attenuating enclosure, and ancillary devices for a minimum of five years for product from registered commissioning and start-up.
- B. Warranty shall include repair parts, labor, and travel expenses.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. The project is designed based upon Cummins gensets, with the accessories and configuration specified herein. The use of acceptable manufacturers are as follows:
 - 1. Cummins.
 - 2. Caterpillar.
 - 3. Kohler.
 - 4. Generac.

2.02 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 - 1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.
- C. Capacities and Characteristics:
 - 1. The generator electrical output power rating for Standby operation of not less than the following at 80% lagging power factor, 120/240, single-phase, 3-wire, 60 Hz.
 - 2. The generator shall be sized to provide power to the electrical loads shown on Panelboard Schedule MDP.
 - a. The generator manufacturer is responsible to sizing the generator based upon the electrical loads and other parameters in this section and the Drawings.
 - 3. Engine emissions level: EPA Stationary Emergency Applications, Tier 3.
 - 4. Alternator shall be capable of accepting the stepped electrical loads list as shown on Attachment A. No step load shall exceed a 20% voltage dip and 10% frequency dip.
 - 5. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of components. The engine-generator nameplate shall include information of the power output rating of the equipment.
 - 6. The generator, base fuel tank, and weather/sound attenuating enclosure shall be supplied by a single vendor to coordinate performance requirements.
 - 7. Equipment shall be in current production as a standard series. All material and parts in this unit shall be new and unused, of current manufacturer, and free from all defects affecting performance.
 - 8. Generator and base fuel tank shall be factory-assembled and factory-tested.
- D. Generator-Set Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 0.5% of rated output voltage from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20% variation for any step load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 4 seconds. On application of a 100% load step, the generator set shall recover to stable voltage within 10 seconds.
 - 3. Steady-State Frequency Operational Bandwidth: 0.25% of rated frequency from no load to full load.

4. **Steady-State Frequency Stability:** When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. **Transient Frequency Performance:** Not more than 10% variation for 50% step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step, the generator set shall recover to stable frequency within 10 seconds.
6. **Output Voltage Waveform:** At full load, harmonic content measured line to line or line to neutral shall not exceed 5% total and 3% for any single harmonic.
7. **Sustained Short-Circuit Current:** For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300% of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.
8. **Start Time:** Comply with NFPA 110, Level 1, Type 10, system requirements.
9. **Ambient Condition Performance:** Genset shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the genset for enclosed units.

E. Alternator Heater:

1. Provide alternator heater to prevent corrosion damage of electrical and mechanical components in high humidity environments.
 - a. Operating voltage for alternator heater shall be 120 V.
 - b. Alternator heater shall be thermostat controlled.
 - c. Size of alternator heater shall be determined by the generator manufacturer to prevent condensation and corrosion.

2.03 GENSET ENGINE

- A. **Fuel:** ASTM D975 #2 Diesel Fuel.
- B. **Rated Engine Speed:** 1800 RPM.
- C. **Lubrication System:** The following items are mounted on engine or skid:
 1. **Lube oil pump:** Shall be positive displacement, mechanical, full pressure pump.
 2. **Filter and Strainer:** Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
 3. **Crankcase Drain:** Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

- D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions.
1. Fuel system shall have fuel filter.
 - a. Fuel Filter shall be the replaceable type designed for long service life.
- E. Fuel metering system shall be integral with the engine. It shall include fuel filter, transfer pump, injection pumps, lines, and nozzles. The transfer pump shall deliver fuel under lower pressure to individual injection pumps, one for each cylinder. The pumps shall be of variable displacement type to alter the volume of fuel delivered to the spray nozzles according to load demand. Pumps shall ensure adequate primary fuel flow under starting and load conditions.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.
1. Designed for operation on 240 Vac, 60 Hz power connection. Heater voltage shall be shown on the project Drawings. Watts power draw shall be provided with the submittal documentation.
 2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.
 3. Provided with a thermostat, installed at the engine water jacket heater housing. Water jacket heater shall be thermostat controlled.
- G. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the genset. Fuel rate shall be regulated as a function of starting, accelerating to starter disconnect speed, accelerating to rated speed, and operating in various isochronous states.
- H. Cooling System: Closed loop, liquid cooled:
1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 40°C.
 2. Coolant: Solution of 50% ethylene-glycol-based antifreeze and 50% water, with anticorrosion additives as recommended by engine manufacturer.
 3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110% load condition.
 4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gauge glass and petcock.

5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- I. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.
- J. Starting System: 12 V or as recommended by the engine manufacturer; electric, with negative ground.
 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with maximum specified ambient temperature.
 2. Cranking Cycle: As required by NFPA 110 for Level 1 systems.
 3. Battery: As recommended by the engine manufacturer.
 4. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
 5. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
 - a. Battery compartment shall be located and mounted within the secured weatherproof/sound attenuating enclosure.
 6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
 7. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:
 - a. Designed for operation on single-phase 120 Vac, 60 Hz power connection. Charger voltage shall be shown on the project Drawings. Watts power draw shall be provided on the submittal documentation.
 - b. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - c. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from -20°C to +40°C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - d. Battery Charger shall be located within the weatherproof/sound attenuation enclosure.

- e. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to $\pm 10\%$.
- f. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
- g. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA 110.
- h. Battery charger shall be located and mounted within the weatherproof/sound attenuating enclosure.

2.04 FUEL OIL STORAGE

- A. Comply with NFPA 30 and NFPA 37.
- B. Sub Base-Mounted Fuel Tank: Provide a double wall secondary containment type sub base fuel storage tank. The tank shall be constructed of corrosion resistant steel and shall be UL 142 listed and labeled. The fuel tank shall include the following features:
 - 1. Capacity: Fuel for 24 Hour(s) minimum, continuous operation at 100% rated power output.
 - 2. Tank rails and lifting eyes shall be rated for the full dry weight of the tank, genset, and enclosure.
 - 3. Electrical stub up(s).
 - 4. Normal and emergency vents.
 - 5. Lockable fuel fill.
 - 6. Mechanical fuel level gauge.
 - 7. High and low level switches to indicate fuel level.
 - 8. Leak detector signal shall be transmitted to the genset control panel for annunciation.
 - 9. Sub base tank shall include a welded steel containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.
 - 10. Fill port with overfill prevention valve (OFPV).
 - 11. 5 gallon fill/spill dam or bucket.
 - 12. Tank design shall meet the regional requirements for the Project location.

13. Fuel tank shall have a fuel liquid level tank gauge so the operators can read the amount of fuel within the tank.
 - a. Direct read dial.
 - 1) Fractional indicating marks include 1/4, 1/2, 3/4.
 - b. UV resistant lens.
 - c. Low profile which is less susceptible to vandalism.
 - d. UL Listed
14. Fuel tank fuel port used for refueling shall have means (i.e. padlock hasp) to be locked in the closed position with the use of a padlock.

2.05 CONTROL AND MONITORING

- A. Engine generator control shall be microprocessor based controller and provide automatic starting, monitoring, protection and control functions for the unit.
- B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.
- C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.
- D. Configuration: Operating and safety indications, protective devices, system controls, engine gauges and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.
- E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
 1. AC voltmeter (1-phase, line to line and line to neutral values).
 2. AC ammeter (1-phases).

3. AC frequency meter.
4. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
5. Emergency Stop Push button: Push button shall be a red “mushroom head” push-button device complete with lock-out/tag-out provisions. Depressing the push button shall cause the generator set to immediately stop the generator set and prevent it from operating.
 - a. Generator is located in area of public access. Emergency stop push button shall be located on the generator’s control panel within the weatherproof/sound attenuation enclosure.
6. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
7. DC voltmeter (alternator battery charging).
8. Engine-coolant temperature gauge.
9. Engine lubricating-oil pressure gauge.
10. Running-time meter.
11. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.) The voltage and frequency adjustment functions shall be disabled when the paralleling breaker is closed.
12. Fuel tank trouble alarm.
13. Fuel tank low-level alarm.
14. AC Protective Equipment: The control system shall include over/under voltage, reverse kVAR, reverse kW, over load (kW) short circuit, over current, loss of voltage reference, and over excitation shut down protection. There shall be a ground fault alarm for generator sets rated over 1000 A, overload warning, and overcurrent warning alarm.
15. Status LED indicating lamps to indicate remote start signal present at the control, existing shutdown condition, existing alarm condition, not in auto, and generator set running.
16. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.

17. Panel LED lighting system to allow viewing and operation of the control when the Generator Room or enclosure is not lighted.
18. Data Logging: The control system shall log the latest 20 different alarm and shut down conditions, the total number of times each alarm or shutdown has occurred, and the date and time the latest of these shutdown and fault conditions occurred.
19. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).

F. Communications:

1. The generator shall be provided with the following communications for monitoring by the Owner Kitsap County monitoring services:
 - a. Discrete signal via a dry contact (rated for 3A at both 250 Vac and 24 Vdc) normally closed (NC), at the Generator:
 - 1) Generator Alarm.
 - 2) Generator Running.
 - 3) Fuel Low Alarm.
 - 4) Selector switch is not in the AUTO position.
 - b. Ethernet to Owner's Owner Kitsap County monitoring services:
 - 1) Provide provisions for the Modbus Serial to Modbus TCP/IP gateway (Gateway). Install, integrate, and wire into the generator control panel.
 - a) Control Power: 9 to 30 VDC.
 - b) Modbus Connections: TIA-485 with screw terminal connection and Ethernet.
 - 2) At a minimum, the Gateway shall provide access to the full range of registers defined in the Cummins PowerCommand 3.3 Modbus Register Map provided in the Cummins A029X159 (Issue 17) manual.
 - 3) The Gateway will be connected via Ethernet to the Owner's Owner Kitsap County monitoring services system when they decided to connect. The Owner will configure their Kitsap County monitoring services to access the data registers available through the Gateway.

2.06 GENERATOR OUTPUT CIRCUIT BREAKERS

A. Generator Protection:

1. The generator shall be protected from overload to meet NEC 445.12 by identified overcurrent protection means inherent in the design of the generator and control system. Overcurrent protection shall allow operation of the generator set continuously at its rated output and shall be coordinated with the thermal damage curve of the alternator. Damage curve and protection curve shall be submitted to verify performance.
2. The overcurrent protection function shall include arc flash energy reducing maintenance switching.
3. Conductors from generator output to bus gutter shall be rated at 100% of the nameplate current rating meeting the requirement of NEC 445.13 where the design and operation of the generator prevents overloading.
4. Main Circuit Breakers: Generator shall be provided with two 100% rated Main Circuit Breakers as shown on the Drawings.
 - a. Circuit breakers shall be sized as shown on the Contract One-Line Drawings.
 - b. Circuit breaker enclosure shall be equipped with the ability to padlock the output circuit breaker in the off (OPEN) position.

2.07 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H.
- D. Temperature Rise: 125/Class H environment.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125% of rating, and heat during operation at 110% of rated capacity.
- F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.
- G. Enclosure: Dripproof.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, 3-phase true RMS sensing, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.
- I. Windings: Two-thirds pitch stator winding and fully-linked amortisseur winding. Alternators operating at voltage higher than 690 Vac shall be provided with form-wound stator coils.
- J. Subtransient Reactance: 12% maximum, based on the rating of the engine generator set.

2.08 OUTDOOR GENERATOR-SET ENCLOSURE

A. General:

1. Outdoor enclosure shall be a weather resistant and sound attenuating enclosure.
2. The enclosure shall allow access to the generator, battery, and generator ancillary components as well as the base fuel tank for the required maintenance and servicing.

B. Construction:

1. Louvers: Equipped with bird/rodent screen to permit air circulation when engine is not running while excluding birds and rodents.
2. Hinged Doors/Covers: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
 - a. The hinged doors shall be located on opposite sides of the enclosure.
3. Genset Exhaust System:
 - a. Muffler/Silencer: Shall be supplied by the generator manufacturer. Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures, the silencer shall be inside the enclosure.
 - b. Muffler/Silencer shall have sound attenuation for residential areas.
 - c. Exhaust pipe shall be fitted with hinged rain cap at exterior termination.
4. Hardware: All hardware and hinges shall be stainless steel.
5. Mounting Base: Suitable for mounting on sub-base fuel tank or concrete equipment pad.
 - a. Coordinate the concrete equipment pad along with sidewalk around generator shall be sized based upon the submitted generator with its base tank.
 - 1) Submit shop drawing for concrete equipment pad along with sidewalk around generator.
6. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.

C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40°C.

1. Louvers: Fixed-engine, cooling-air inlet and discharge.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 78 dBA measured at any location 7 m from the engine generator in a free field environment.

2.09 VIBRATION ISOLATION DEVICES

- A. Vibration Isolation: Generators installed on concrete equipment pad shall be provided with elastomeric isolator pads integral to the generator, unless the engine manufacturer requires use of spring isolation.
 - 1. IBC Compliance: Isolators shall comply with related IBC requirements.
 - 2. Vibration isolation shall be rated for use in seismic environment specified in Section 13 05 41.

2.10 FINISHES

- A. Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer's standard color or as directed on the Drawings.

2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA 110. Calculations and testing on similar equipment which are allowed under NFPA 110 are not sufficient to meet this requirement.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.
 - 2. Full load run.
 - 3. Maximum power.
 - 4. Voltage regulation.
 - 5. Steady-state governing.
 - 6. Single-step load pickup.
 - 7. Simulated safety shutdowns.
 - 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Comply with packaged engine-generator manufacturer's written installation, application, and alignment instructions and with NFPA 110.
- B. Equipment shall be installed by the Contractor in accordance with final submittals and Contract Documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The Contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- D. Equipment shall be installed on concrete equipment pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.
- F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.
- G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

3.02 ON-SITE ACCEPTANCE TEST

- A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:
 - 1. Document the results of the Field Test Plan.
 - 2. After field testing, submit the Field Test Report.
- B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.
- C. Conduct the generator manufacturer's submitted Field Test Plan.

- D. Installation acceptance tests to be conducted on site shall include a “cold start” test, a 1-hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- E. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 1 hour. Coordinate timing and obtain approval for start of test with site personnel.
1. Contractor shall coordinate with utility provider to simulate a utility power outage for the generator and ATS testing.
 - a. The simulated utility power outage shall demonstrate proper operation of ATS and Generator during a utility power outage. The generator shall provide power to the entire power distribution system:
 - 1) Before loss of power measure voltage on load side of ATS:
 - a) Phase A to Phase B _____.
 - b) Phase A to Neutral _____.
 - c) Phase B to Neutral _____.
 - 2) After simulated loss of power and generator running measure voltage on load side of ATS:
 - a) Phase A to Phase B _____.
 - b) Phase A to Neutral _____.
 - c) Phase B to Neutral _____.
 - b. The simulated utility power outage shall demonstrate proper operation of the ATS and Generator during a single phase loss on the pad mounted transformer primary.
 - 1) Before loss of power measure voltage on load side of ATS:
 - a) Phase A to Phase B _____.
 - b) Phase A to Neutral _____.
 - c) Phase B to Neutral _____.
 - 2) After simulated loss of a primary phase and the Generator not running, measure voltage on Normal Input side of ATS:
 - a) Phase A to Phase B _____.
 - b) Phase A to Neutral _____.
 - c) Phase B to Neutral _____.

3) After simulated loss of a primary phase and the Generator running, measure voltage on load side of ATS:

a) Phase A to Phase B _____.

b) Phase A to Neutral _____.

c) Phase B to Neutral _____.

2. Submit the above voltage measurements with field test report.

3.03 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall not be less than two separate 2-hour training classes in duration and each class size shall be limited to five persons. The training classes shall be held separate days determined by the Owner.
- B. The equipment supplier shall demonstrate operation of the generator including maintenance functions and refueling system.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in startup, testing, and commissioning.

END OF SECTION

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SECTION 26 36 26
AUTOMATIC TRANSFER SWITCHES

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies an open delayed transition automatic transfer switch with number of poles, amperage, voltage, and withstand current ratings as shown on the plans and specified in this section.
- B. Automatic transfer switch shall consist of a mechanically held power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation.

1.02 QUALITY ASSURANCE AND STANDARDS

- A. The automatic transfer switches and accessories shall conform to the requirements of:
 - 1. UL 1008 - Standard for Automatic Transfer Switches.
 - 2. CSA C22.2 No.178 – 2006.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 110 - Emergency and Standby Power Systems.
 - 5. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 6. NEMA Standard ICS10-2020 (formerly ICS2-447) – Electromechanical AC Transfer Switch Equipment.
 - 7. NEC Articles 702.
 - 8. International Standards Organization ISO 9001: 2015.
 - 9. IEC 60947 – 6 – 1:2021.

1.03 SUBMITTALS

- A. Submit Shop Drawings: Submit product information/Shop Drawings and following information in accordance with Section 26 05 11:
 - 1. Outline Drawings and equipment elevations with clearance requirements.
 - 2. Electrical ratings.
 - 3. Wiring schematics – elementary and internal connection diagrams. Complete wiring, panel, elementary and process/instrument diagrams for the ATS showing connection and interconnection of identified terminals and identified conductors to components of the ATS.

4. Single-line diagrams.
 5. NEMA rating.
 6. Manufacturer's detailed specifications including withstand/closing, and continuous current rating of all relevant equipment, components, and devices.
 7. Information needed for electrical systems analyses reports specified in Section 26 05 73.
 8. Documentation of field testing procedures for testing to be performed as specified within this section.
 9. Test results for all specified testing.
 10. Documentation of all programmed functions and features implemented in these switches.
- B. Product information and specifications.
- C. Submit a list of the factory default settings for time delays and for threshold settings for Owner's review and comment on settings.
- D. Submit ATS programmable features and available time settings for the Owner can select and provide guidance to field service technician.
- E. Factory Test Plan.
- F. Submit a Field Test Plan.
- G. Submit operation and maintenance manuals in compliance with pertinent provisions of Section 26 05 11.
- H. Submit Certified Factory Test Report – certified copy.
- I. Submit a Field Test Report.

1.04 SEISMIC ANCHORAGE AND STRUCTURAL DATA

- A. Mechanical, instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

1.05 SHIPMENT, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a secured, safe location, protected for rain, dirt, construction debris, and traffic.
- B. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

1.06 WARRANTY

- A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the ATS assembly and ancillary devices for a minimum of five years for product from registered commissioning and start-up.
- B. Warranty shall include repair parts, labor, and travel expenses.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. This project is designed based upon the ASCO (Schneider) Series 300 (3ADTS) ATS. If other ATS is submitted then the Contractor shall be responsible to ensure the other ATS meets the specified requirements, is compatible, and fits within the allocated space shown on the Drawings.
 - 1. ASCO Schneider - Series 300.
 - 2. Other ATS – same manufacturer is the submitted generator manufacturer. Any alternate shall be submitted to Engineering in writing at least 10 days prior to bid. Each alternative bid must list any deviation from this specification.

2.02 MECHANICALLY HELD TRANSFER SWITCH

- A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include over current disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
- B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- C. All main contacts shall be silver composition. Switches shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.
- D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- F. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.03 CONTROLS

- A. The controller shall be a microprocessor-based controller. The controller shall be hardened against potential problems from transients and surges. Operation of the transfer switch and monitoring of both sources shall be managed by the controller.
- B. Operations of the ATS and adjustments to all the settings shall be made from the ATS control panel behind the control panel.
- C. The controller shall have a real time clock with battery backup.
- D. The controller shall be equipped with self-diagnostics which perform periodic checks of the memory and communication circuits.
- E. The controller shall include power monitor capabilities for monitoring voltage, amps, and frequency for both normal source as well as emergency source.
- F. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
- G. The controller shall have serial communications capability, and the ability to communicate via the Ethernet through optional communications module
- H. A single controller shall provide single phase capability for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to $\pm 1\%$ of nominal voltage. Frequency sensing shall be accurate to $\pm 0.1\text{Hz}$. Time delay settings shall be accurate to $\pm 0.5\%$ of the full scale value of the time delay. Allow password protection for controller adjustments.
- I. The panel shall be capable of operating over a temperature range of -20°C to $+70^{\circ}\text{C}$, and storage from -55°C to $+85^{\circ}\text{C}$.
- J. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance.
- K. Control Display and Keypad:
 - 1. The control display shall be integral part of the controller, UV resistant and backlit.
 - 2. Graphical LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters.
 - 3. Operational parameters shall also be available for viewing and limited control through communications port.
 - 4. The following parameters shall only be adjustable via DIP switches on the controller:
 - a. Nominal line voltage and frequency.

- b. Single phase sensing.
- c. Transfer operating mode configuration, delayed transition.

L. Controller Voltage and frequency Sensing

1. Voltage and frequency sensing on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip settings capabilities (values shown as % of nominal).

Parameter	Sources	Dropout/Trip	Pickup/Reset
Undervoltage	N & E	70 to 98%	85 to 100%
Overvoltage	N & E	102 to 116%	2% below trip
Underfrequency	N & E	85 to 98%	86 to 100%
Overfrequency	N & E	101 to 111%	2% below trip

2. Repetitive accuracy of all settings shall be within 1% at +25°C
3. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
4. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency.

M. Engine Exerciser

1. A fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without load on a daily weekly, biweekly, or monthly basis.

N. Time Delays

1. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals, adjustable 0 to 6 seconds. It shall be possible to bypass the time delay from the controller user interface.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes 59 seconds for controlled timing of transfer of loads to emergency. It shall be possible to bypass the time delay from the controller user interface.
3. A generator stabilization time delay shall be provided after transfer to emergency adjustable 0 or 4 seconds.
4. A time delay shall be provided on retransfer to normal, adjustable 0 to 9 hours 59 minutes 59 seconds. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
5. A cooldown time delay shall be provided on shutdown of engine generator, Adjustable 0 to 60 minutes 59 seconds.
6. All adjustable time delays shall be field adjustable without the use of special tools.

7. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minutes 59 seconds time delay in any of the following modes:
 - a. Prior to transfer only.
 - b. Prior to and after transfer.
 - c. Normal to emergency only.
 - d. Emergency to normal only.
 - e. Normal to emergency and emergency to normal.
 8. All transfer conditions or only when both sources are available.
 9. In the event that the alternate source is not accepted within the configured Failure to Accept time delay, the common alert indication shall become active.
 10. The controller shall also include the following built-in time delay for delayed transition operation.
 - a. A time delay for the load disconnect position for delayed transition operation adjustable 0 to 5 minutes 59 seconds.
- O. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
1. IEC 60947 – 6 – 1 Multiple Function Equipment Transfer Switching Equipment.
 - a. IEC 61000-4 Testing And Measurement Techniques – Overview.
 - b. IEC 61000 – 4 - 2 Electrostatic Discharge Immunity.
 - c. IEC 61000 – 4 - 3 Radiated RF Field Immunity.
 - d. IEC 61000 – 4 - 4 Electrical Fast Transient/Burst Immunity.
 - e. IEC 61000 – 4 - 5 Surge Immunity.
 - f. IEC 61000 – 4 – 6 Conducted RF Immunity.
 2. CISPR 11 – Conducted RF Emissions and Radiated RF Emissions.

2.04 DATA LOGGING

- A. The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a nonvolatile memory.

1. Event Logging:

- a. Data and time and reason for transfer normal to emergency.
- b. Data and time and reason for transfer emergency to normal.
- c. Data and time and reason for engine start.
- d. Data and time engine stopped.
- e. Data and time emergency source available.
- f. Data and time emergency source not available.

2. Statistical Data:

- a. Total number of transfers.
- b. Total number of transfers due to source failure.
- c. Total number of day's controller is energized.
- d. Total number of hours both normal and emergency sources are available.
- e. Total time load is connected to normal.
- f. Total time load is connected to emergency.
- g. Last engine start.
- h. Last engine start up time.
- i. Input and output status.

2.05 RATING

- A. 120/240 V, 400 A, Single phase, 3 Wire, 60Hz.
- B. Phase Poles 2, Solid Neutral.
- C. Transition Type: Delayed
- D. Continuous current rating as shown on the Drawings.
- E. Ground shall be tin-plated copper.

- F. Neutral shall be tin-plated copper and rated full capacity.
- G. UL 1008 Listed.
- H. Contractor shall ensure WCR rating of ATS is in compliance with the Service Entrance Circuit Breaker kAIC and the Generator Circuit Breaker kAIC.
 - 1. Contractor to ensure Short Circuit, Coordination, Arc Flash reports identify the ATS - WCR rating is in compliance with the Service entrance circuit breaker and the Generator output circuit breaker.

2.06 ENCLOSURE

- A. The enclosure is located in a public space and will need to have its controls and indicators secured inside an outer cover where unauthorized person do not have access.
- B. The outer enclosure cover shall be pad-lockable in the closed position.
- C. The ATS shall be furnished in a NEMA type 4 enclosure for outdoor full weather protection.
- D. Front accessible only.
- E. Enclosure is accessible by public. Ensure enclosure's outer door has no controls or indicators exposed on outer surface. Ensure enclosure outer door is pad lockable in the closed position.
- F. Provide 120 V rated strip heater with adjustable thermostat control for the enclosure . Strip heater shall be used to minimize condensation from forming inside the enclosure.

2.07 COMMUNICATIONS

- A. Dry contacts NO and NC (discrete signals):
 - 1. Engine Start Signal.
 - 2. CLOSED ON NORMAL.
 - 3. CLOSED ON EMERGENCY.
 - 4. Optional Relay "OP1".
 - 5. Optional Relay "OP2".
 - 6. Optional Relay "OP3".
- B. Communications Bus RS485 Port:
 - 1. Modbus.

2.08 NAMEPLATE

- A. Provide nameplate and labels per Section 26 05 53.
- B. Provide nameplate identifying “Utility” and “Generator” in lieu of Normal and Emergency.
- C. Provide nameplate identifying electrical load “MDP”.

2.09 SURGE PROTECTION DEVICE

- A. Provide surge protection device (SPD) for the ATS.
 - 1. Locate SPD inside the ATS enclosure.
 - 2. SPD shall be rated for the for the operation of the ATS.
 - 3. SPD shall included LED status indication of the following:
 - a. Normal Operations.
 - b. Under Voltage.
 - c. Power Loss.
 - d. Phase Loss.
 - e. Component failure.
 - 4. SPD shall include a Form C dry contacts for external alarm or monitor.
 - 5. SPD shall be in compliance with UL 1449.

PART 3 – EXECUTION

3.01 PRE-INSTALLATION

- A. Submit the ATS programable settings and time delays for the Owner’s guidance and identifying their preferences.
- B. Manufacturer representative shall program ATS with the Owner’s preferred settings and time delays before testing and commissioning ATS.

3.02 INSTALLATION

- A. Install transfer switches in accordance with manufacturer’s instructions.
- B. Install Automatic Transfer Switch level and plumb.
- C. Seismic anchorage and bracing per Section 13 05 41.

- D. Program the ATS per directions from the Owner. If information is not available, adjust the time delays to the following values:
1. Normal Source Fail/Engine Start: 5 seconds.
 2. Normal to Standby Transfer: 3 seconds.
 3. Standby to Normal Retransfer: 10 minutes.
 4. Engine Cool-down: 4 minutes.
 5. Weekly Engine Exercise: Set to run Monday at 8:00 AM for 20 minutes without load transfer.
- E. Program Engine Exerciser:
1. Enable or disable programable feature as directed by Owner.

3.03 FIELD TESTING

- A. In addition to any testing herein, perform all testing for this project or system consistent with the applicable codes, and the manufacturer's current quality assurance program.
1. Test operation of ATS when normal power is lost.
 2. Verify the time delays as programmed.
 3. Verify transfer of power to standby source and from standby source to preferred power source.
 4. Verify engine diesel generator cool down time delay.
 5. Submit field test report.

3.04 MANUFACTURER'S SERVICES

- A. Provide the factory trained representative at the site for the specified quantity and duration of the following activities:
1. Verify and Validate Installation:
 - a. Factory trained representative shall verify the ATS installations including the programmed settings and validate the installation and settings to be satisfactory and to provide recommendations to the Owner.
 - b. Test ATS in combination with generator. Simulate a utility power outage by opening service entrance disconnect switch. Test ATS automatic starts the generator and the ATS switches over to the generator power source.
 - c. Also test the ATS automatically will switch back onto the utility power source when it is restored. Test delay time work properly. Test generator shut down after cool down timer delay.

B. Customer Training Session:

1. Provide a minimum of 4 hours of training on the Automatic Transfer Switch installation for the Owner. Conduct training session when Owner's staff are available. Notify Owner 14 days in advance of training for scheduling purposes.
2. Provide training on adjustment, operation, and maintenance of the automatic transfer switch.
3. Demonstrate starting generator and placing facility on generator power by switching ATS to generator.
 - a. Automatically.
 - b. Manually.

END OF SECTION

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SECTION 26 50 00
LIGHTING

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies luminaires.
- B. Provide luminaires as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

- A. Comply with the following requirements:
 - 1. NFPA 70 National Electrical Code (NEC).
 - 2. WAC 51-11C-40500, Electrical power and lighting systems.
 - 3. WAC 296-800-210, Workplace lighting.
 - 4. UL Standard 1598, Luminaires.
 - 5. UL Standard 8750, Light Emitting Diode (LED) Equipment for use in Lighting Products.

1.03 SUBMITTALS

- A. Procedures: Refer to Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."
- B. Submit product data for type of luminaire indicated in this specification. Submittal data shall be in compliance with this specification section. Submit the following product data for type of luminaire:
 - 1. Manufacturer's printed data, including photometric data on luminaires.
 - 2. Mounting brackets, chain, cable, and hardware.
 - 3. Fasteners.
 - 4. Seismic restraint system.
 - 5. Luminaire shop drawings in booklet form with index and a separate sheet for each luminaire, assembled in luminaire "type" alphabetical order, with specified luminaire, pole (stanchion), and accessories clearly indicated on each sheet.
- C. Submit photometric curves for each luminaire configuration proposed. Substitutions will not be considered.
- D. Submit shop drawings showing proposed methods for mounting luminaires.

- E. Submit product data for the light poles and their base, including light fixture mounting arrangements.
- F. Submit bird deterrent spikes product information and means to secure bird deterrent in place.
- G. Submit manufacturer's product data for lighting contactors. Submittal data shall be in compliance with this specification section.
 - 1. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.
- H. Precast light pole base product information, including anchor bolts, and sizing data and weight.
- I. Water management utility blocks product information and shop drawings showing installation for:
 - 1. Attendant Building exterior lighting (east and west sides).
 - 2. LHHW Building exterior lighting near man doors.
 - 3. Other buildings as applicable.
- J. Submit outdoor lighting control selector switch and push button for the following:
 - 1. Attendant Building.
 - 2. Gate #2 Container Truck Entrance.

1.04 SEISMIC ANCHORAGE AND STRUCTURAL DATA

- A. Mechanical instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.
- B. Contractor shall store luminaires in dry, temperature-controlled location and provided protection from dust, debris, and moisture while electrical equipment is stored before installation.

1.06 WARRANTY

- A. LED luminaire shall come with 5-year manufacturer's warranty.
- B. Contractor shall complete and provide documentation required for LED Luminaire 5-year manufacturer's warranty coverage.
- C. Light poles shall come with a 1-year manufacturer's warranty.
- D. Warranty for lighting and light poles shall start when the equipment and installation are substantially complete.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide luminaires of type, size, and rating listed in the lighting fixture schedules, complete with, but not necessarily limited to, lamps, lamp holders, drivers, reflectors, starters, wiring, and any other details required for a complete working installation.
- B. Provide proper trim for each luminaire as required for various types of ceiling: plaster rings, fixture ends or caps, suspension units, mounting brackets, and/or other auxiliary parts necessary to make complete luminaire.

2.02 MANUFACTURERS

- A. The use of a luminaire manufacturer's name, model, size, or catalog number is for the sole purpose of establishing the standard of quality and general configuration desired.
 - 1. See Drawing for specified Lighting Fixture Schedule.
- B. Acceptable Manufacturers:
 - 1. Oracle Lighting.
 - 2. Barron Trace Lite.
 - 3. Lithonia.
 - 4. Hubble – Beacon.
 - 5. Lux Dynamics.
 - 6. Or pre-approved equal.

2.03 LED LUMINAIRES

- A. Stainless steel latches.
- B. Stainless steel surface mounting brackets.
- C. Unit packaged.
- D. 5-year warranty.

2.04 LED DRIVER

- A. 0 V-10 V dimming unless otherwise noted.
- B. Universal 120-277 V.

2.05 LED

- A. Color temperature of 4000 K unless otherwise noted.

2.06 EMERGENCY BATTERY PACK

- A. Provide emergency battery pack as shown on the Drawing.

2.07 LIGHTING CONTACTOR

- A. Provide enclosed lighting contactor for lighting control as specified on the Drawings.

1. Enclosure.
 - a. NEMA 4X wall mount.
 - b. Hinged Door, padlock hasp for locking in the closed position.
 - c. Exterior door shall have not control selector switch.
 - d. Enclosure exterior to have indicator lights for the following:
 - 1) Control power is available.
 - 2) Lighting circuits are energized (ON).
2. Lighting Contactor:
 - a. Electrically held.
 - b. Minimum of six poles.
 - c. 120 V, 20 A rated contacts.
 - d. 120 V coil voltage.
3. Control:
 - a. Control panel enclosure interior-mounted control:
 - 1) Manual Hand/Off/Auto (H-O-A) selection.
 - 2) Pilot light indicating control power is ON.

- b. Automatic control via photocontrol (photocell).
 - 1) Photocell control to turn ON lighting at dusk and turn OFF lighting at dawn.
 - a) Turn ON at 1.0 to 5.0 footcandle ambient light.
 - b) Turn OFF at 3.0 to 15 footcandle ambient light.
 - 2) Voltage 120 Vac.
 - 3) Maximum wattage 3,000 W.
 - 4) Weatherproof enclosure.
 - 5) Manufacturer: Intermatic, Tork, or approved equal.
- c. 24-hour time switch:
 - 1) Programmable quartz time switch.
 - 2) Operational Power 120 Vac.
 - 3) SPST Contact rating 120 Vac, 20 A.
 - 4) Manufacturer: Borg General Controls Series 887 or approved equal.

2.08 LUMINAIRE POLE

- A. Provide pole as specified on the Drawings with the following:
 - 1. Anchor bolts.
 - 2. Pole length.
 - 3. Luminaire mounting configuration.
 - 4. Mid-pole brackets located 15 feet up from pole base for future camera installation.
 - 5. Vibration damper.
 - 6. UL Certified.
 - 7. Drill pattern for luminaire.
 - 8. Finish as specified.
 - 9. Fabricated by manufacturer in the business of constructing luminaire poles.

2.09 WALL MOUNTING LUMINAIRE BRACKETS

- A. Provide ShineLED BRT-ACC-PMV-7 wall bracket with standard slip fitter onto a 2-3/8-inch O.D. tenon.
- B. Finish Black Matte.
- C. For use with Beacon/Current Viper luminaire with K-Knuckle mounting arm.

2.10 PRECAST LIGHT POLE BASE

- A. Provide light pole base as specified on the Drawings.
- B. Precast light pole base shall include:
 - 1. Single-piece construction with anti-rotation cavities and oversize sleeve to fit multiple conduits.
 - 2. Adjustable bolt circle with prepackage bolts.
 - 3. Conduit raceway core.
 - 4. Anchor bolts to secure light pole to base.
 - a. Anchor bolts are included with precast pole base – 1-inch diameter.

2.11 WATER MANAGEMENT UTILITY BLOCKS

- A. Provide water management blocks for exterior lighting on east and west sides of Attendant Building.
- B. Water management blocks are designed with channels to divert water from the front of the siding and offer protection from moisture.
- C. Acceptable manufacturers:
 - 1. Mid-America Components.
 - 2. Or preapproved equal.

PART 3 – EXECUTION

3.01 GENERAL

- A. The location, type, and number of luminaires are shown on the Drawings.

3.02 INSTALLATION

A. General:

1. Provide conduit, wiring, and fittings as required.
2. Luminaires shall be clean and operable at the time of acceptance.
3. Align, mount, and level the luminaires uniformly.

B. Coordinate with other trades so luminaires are properly aligned.

1. If necessary, relocate luminaires as directed by Owner to avoid conflict with other equipment and systems.

C. Mounting and Supports:

1. Mounting heights shall be as shown on the Drawings.
2. Mount LED luminaires level and securely support.
 - a. Luminaires shall be supported from the duct support structure trapeze where applicable and hung from the ceiling by chain at other locations.
3. For the exterior lighting used on the rear of the Refuse Shed and the rear of the LHHW Building, use the ShineLED Flood Lighting Bracket specified. See the mounting details shown on the Structural Drawings and requirements on the Electrical Drawings.
4. For the exterior lighting used at the Attendant Building east and west sides along with the exterior lighting used at LHHW man-doors, provide water management blocks for weatherproofing the siding at the exterior lighting installations.

D. Precast Light Pole Base:

1. Follow light pole base manufacturer's installation instructions for installing the light pole base.
2. Install light pole base so that the top surface of concrete base is a minimum of 12 inches higher than surrounding grade or surface.
 - a. If light pole is located where susceptible to vehicle traffic or maintenance vehicles, the top surface of concrete base is a minimum of 24 inches higher than surrounding grade or surface.

3.03 ADJUSTMENT

A. Adjust and plumb luminaires for proper installation.

B. Align adjustable luminaires to satisfaction of Owner.

3.04 FIELD QUALITY CONTROL

- A. At time of Substantial Completion, replace LED luminaires observed with failed LEDs or to be noticeably dimmed after Contractor's use and testing, as judged by Owner.

3.05 TESTING

- A. Test luminaires equipped with emergency battery packs operate in the event of power outage. Simulate a power outage by opening the circuit feeding the equipment and recording battery run time.
- B. Test lighting contactor to operate satisfactorily with manual and automatic control. Testing shall consist of physically covering photocell to simulate after sunset and manually operating contactor.
- C. Set the time switch:
 - 1. Contractor to confirm with Owner the following time settings for time switch:
 - 2. Time switch contact CLOSED (for lighting ON) 1 hour before sunset time till 11:00 PM.
 - 3. Time switch contact OPEN (for lighting OFF) 11:01 PM till 5:00 AM.
 - 4. Time switch contact CLOSED (for lighting ON) 5:01 AM till 1 hour after sunrise time.
 - 5. Time switch contact OPEN (for lighting OFF) 1 hour after sunrise time till 1 hour before sunset time.
 - 6. Testing shall verify time switch control is operating properly.
 - 7. Testing shall verify photocontrol (photocell) control is operating properly.
 - 8. Test the Attendant Building – Site Exterior Lighting Hand Station selector switches for exterior controlled lighting operate properly.
 - 9. Verify both the General Public Area and the Container Truck Lower Service Road selector switches rotate to each position.
 - a. Verify the exterior lighting controlled by the lighting control panels automatically* turn ON lighting control when the selector switch is in the "A" position.
*For automatic control, both the timer switch and the photocell control must be activated to the ON (CLOSED contact) position.
 - b. Verify the exterior lighting controlled by the lighting control panels turn OFF when the selector switch is in the "O" position.
 - c. Verify the exterior lighting controlled by the lighting control panels turn ON lighting control when selector switch is in the "H" position.
 - 1) In the Hand "H" position, the exterior lighting controlled by the lighting control panels shall turn ON during the day or night at any time.

- D. Test lighting motion detectors for proper operation. Demonstrate lighting turns ON when motion is detected, and lighting turns OFF after time limit.
- E. Test lighting photo-cells for proper operation. Demonstrate lighting turns ON upon sunset and lighting turns OFF upon sunrise.
- F. Test lighting manual selector switches for control of lighting fixtures.
 - 1. Test lower road truck entrance Over-Ride push button. Demonstrates lighting turns ON when push button is activated.
 - 2. Test lighting hand station in Attendant Bldg. for Hand, OFF, AUTO operation both during daylight hours and during the night after mid-night (after sunset and before sunrise).
 - 3. Demonstration timer for area lighting functions property and is set to the times specified by the Owner.

3.06 DEMONSTRATION/TRAINING

- A. Demonstrate luminaires equipped with emergency battery packs operate satisfactorily in the presence of the Owner's representative. Demonstration shall consist of opening the circuit feeding the equipment and recording battery run time.
- B. Demonstrate lighting contactor to operate satisfactorily with manual and automatic control in the presence of the Owner's representative. Demonstration shall consist of physically covering photocell and ensuring time switch is ON (closed contact) and the manual operation for the lighting contactor using the lighting control hand station selector switches in the Attendant Building.
 - 1. Demonstrate to the Owner the operation Lighting Hand Station in the Attendant Bldg including how the Hand, OFF, Auto selector switch operates.
 - 2. Demonstrate to the Owner the operation of the East Service Road Early Light Switch (push button) located near Gate 2 for the container truck drivers.

END OF SECTION

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Division 28

Electronic Safety and Security

SECTION 28 15 23
AUDIO INTERCOM SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section specifies the Intercom system for the Attendant Call System as specified in this section and on the Drawings.
- B. Work Included:
 - 1. Design and provide an Intercom System for the following locations:
 - a. Attendant Building (Master Call Station (MCS-1)).
 - b. LHHW Building (Attendant Call Station (ACS-7)).
 - c. Operator Warming Station (ACS-2)).
 - 2. The Master Call Station shall be located inside an environmentally controlled space inside the Attendant Building.
 - 3. The Remote Attendant Call Stations shall be located outdoors at the Operator Warming Station and at the LHHW Building as shown on the drawings.
 - 4. Contractor shall be responsible for a successfully operating intercom system and is responsible to ensure the subcontractors support design, installation, proper operation, and approval by the Owner.
 - a. Audio communications shall be clear and distinguishable.

1.02 REFERENCE STANDARDS

- A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of a listed document, the requirements of this section shall prevail.
 - 1. NFPA 70 – National Electrical Code.
 - 2. UL 60950-1 - Information Technology Equipment - Safety.
- B. Local and State Building Codes.

1.03 SUBMITTALS

- A. Design Drawings: Submit in accordance with the project submittal requirements in Section 26 05 11, "Basic Electrical Methods and Materials," and Section 01 33 00, "Submittal Procedures."
 - 1. A wiring diagram, complete description, and an elementary control diagram of components.
 - 2. An overall interconnection diagram of devices for the intercom system.
 - 3. A dimensioned plan drawing to scale, showing equipment and enclosures, and device connections.
 - 4. A intercom system Bill of Materials (BOM) including item number, item description, manufacturer, model number, catalog number, and number of units required. The BOM shall include provided spare parts.
 - 5. An Electrical Components BOM including item number, item description, manufacturer, model number, catalog number, and number of units required.
 - 6. A complete component riser diagram or block diagram.
 - 7. Submit MCS-JB1 panel BOM, equipment layout drawing, and wiring diagram.
 - 8. Submit Remote Attendant Call Station junction box panel BOM, equipment layout drawing, and wiring diagram.
 - 9. Submit design drawings no later than 45 days after Notice to Proceed.
- B. As-Built Diagrams and Manuals: Upon completion of work and prior to final testing and inspection, furnish as-built drawings showing the exact sequence of initiating devices as they were installed in the circuits.
 - 1. Contractor shall integrate the new drawings into the existing drawing set.
 - 2. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Plans and specifications shall be prepared by the manufacturer of the intercom system which is regularly engaged in audio intercom system design.
 - 2. The audio intercom system shall be manufactured by an ISO 9001 certified company and meet the requirements of AES67, AES70, and VOIP.

1.05 WARRANTY

- A. Work shall be warranted for a period of not less than 2 year from the date of Substantial Completion against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, equipment shipping cost, etc.
 - 1. Defective Emcom equipment/components shall be shipped back to Emcom factory for repair.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Equipment shall be UL listed and tested by a nationally recognized testing laboratory.
- B. Electrical installation shall be in compliance with Division 26 of these Specifications.
 - 1. See Drawings for intercom system block diagram, junction box layouts, and power supplies.
- C. The Master Attendant Call Station is located indoors at the Attendant Building. The Attendant Building is an environmentally controlled space.
 - 1. See Drawing E10.10 for the MCS-JB1 located below the Master Attendant Call Station.
- D. The Remote Attendant Call Station located at the Operator Warming Station is located outdoors. This Remote Attendant Call Station is exposed to outdoor weather environments.
 - 1. See drawing E10.17 for Remote Attendant Call Station junction box located below the Remote Attendant Call Station.
- E. The Remote Attendant Call Station located at the LHHW Building is located outdoors. This Remote Attendant Call Station is exposed to outdoor weather environments.
 - 1. See Drawing E10.17 for Remote Attendant Call Station junction box located below the Remote Attendant Call Station.
- F. The circuitry distance between the Attendant Building and the LHHW Building and Refuse Sheds is substantial. See site plan for determining circuit lengths between buildings and structures.

2.02 COMPONENTS

A. Master Call Station:

1. Two-way communication system using VoIP. Full Duplex.
 - a. Ethernet Interface: 10/100/1000 Mbps.
 - b. Ethernet Ports: 1 Port.
2. Software to route and answer calls.
3. Fault Detection and Notification System which displays the status of a faulty device.
4. Call timers allowing an unanswered call to be forward.
5. Master station can connect with multiple other Master Stations and can be paired with any ADA compliant phone. Connect up to 75 IP endpoints.
6. Windows OS.
7. Caller ID and call recording.
8. Paging Feature.
9. Surface Mount.
 - a. Dimension.
10. Operating Temperature: 32°F to 122°F (0.0°C to 50°C).
11. Power Supply 120 Vac.
12. Acceptable Manufacturer:
 - a. Emcom Systems – Emcom Master Station.
 - b. Or preapproved equal.

B. Master Call Station Junction Box

1. Provide MCS-JB1 to support Master Call Station and as conceptually shown on Drawing E10.10.
 - a. Submit for approval:
 - 1) Bill of material (BOM).
 - 2) Panel layout drawing.
 - 3) Wiring Diagram.

- b. NEMA 1 Enclosure.
- c. 48 V DC power supply, DIN rail mounted.
- d. 24 V DC power supply, DIN rail mounted.
- e. Fuse holders, finger safe, for 120 V power distribution.
- f. 120 V duplex receptacle, DIN rail mounted.
- g. Surge protection device, DIN rail mounted.
- h. Unmanaged network switch.
- i. Ethernet extenders.

C. Remote Attendant Call Stations:

1. Vandal-resistant ADA Compliant, high quality, DSP-based full duplex VOIP hands-free phone with DSL Ethernet extender.
 - a. Full Duplex.
 - b. Built in DSL interface.
2. Utilize digital signal processing (DSP) to manage audio levels and can be set for normal or noisy environments.
 - a. The environment settings and volume are remotely programmable.
 - b. Background noise reduction using DSP.
3. Brushed stainless steel front face plate with sealed speaker, microphone, and activation button for long product life.
 - a. Design and constructed for outdoor use with compatible rugged phone enclosure.
 - b. 1.5-inch metal push button for assistance, "HELP".
 - c. Two visual call indications:
 - 1) CALLING.
 - 2) RECEIVED.
4. For use with direct Ethernet connection for circuit distances less than 328 feet or extended to distance up to 984 feet (with 100 Mbps) with Ethernet Extender over copper wires.
 - a. Greater circuit lengths using the built-in DSL interface.

5. Remote Attendant Call Station is programmed via a web browser or is remotely supervised, tested, and programmed using the manufacturer's system maintenance stations.
6. Operating Temperature: -22°F to 131°F (-30°C to 55°C).
7. Power Supply: 24 – 48 Vdc.
8. Input power: 8 W at full volume.
9. Auxiliary Contact: 120 mA – 250 Vdc (opto-isolated).
10. 3 Port IP Switches for daisy chaining.
11. Acceptable manufacturer:
 - a. Emcom Systems – Model IP6000-2.
 - b. Or preapproved equal.

D. Remote Attendant Call Station Rugged Phone Enclosure:

1. High impact vandal resistant, fully sealed enclosure constructed of thermoplastic, Kydex.
 - a. Color: pewter gray.
 - b. Enclosure rating, when properly installed, shall meet NEMA 4X.
 - c. Thermoplastic shall meet UL94V-0 for plastic flammability standards.
2. Blue polycarbonate LED beacon on top of enclosure.
 - a. Beacon emits light 360 degrees and visible from 4,000 feet.
 - b. LED beacon is driven by Emcom IP6000-2 series VoIP phone.
3. Enclosure shall fit the Emcom IP6000-2 series VoIP phone.
4. Wall mounting with fastener holes on rear surface of enclosure.
5. Acceptable manufacturer:
 - a. Emcom Systems Model H341.
 - b. Or preapproved equal.

E. Remote Attendant Call Station Junction Box:

1. Provide junction box to support Remote Attendant Call Station and as conceptually shown conceptually on Drawing E10.17.
 - a. Submit for approval:
 - 1) Bill of material (BOM).
 - 2) Panel layout drawing.
 - 3) Wiring Diagram.
 - b. NEMA 4X stainless steel Enclosure.
 - c. 48 Vdc power supply, DIN rail mounted.
 - d. Fuse holders, finger safe, for 120 Vac power distribution.
 - e. Fuse holders, finger safe, for 48 Vdc power distribution.
 - f. 120 V duplex receptacle, DIN rail mounted.
 - g. Surge protection device, DIN rail mounted.
 - h. Unmanaged network switch, DIN rail mounted.
 - i. Ethernet extenders, DIN rail mounted.

F. Unmanaged Network Switch:

1. Provide harden unmanaged four-port (minimum) gigabit POE RJ45 Ethernet switch.
2. Ethernet: 5X10/100/1000Base-T(X).
3. LED Indicators per port: Link/Activity, and per unit: Power.
4. Power Input: 48-56 Vdc.
5. Rated for nonventilated and harsh environments:
 - a. -40°C to 75°C (-40°F to 167°F).
 - b. Fanless operation.
 - c. High-impact, thermal shock, electrical noise resistance.
 - d. Casing Material: metal.
 - e. IP Rating: IP30.

G. Ethernet Extenders:

1. Industrial 10/100Base-TX Ethernet Extender.
2. Operating Temperature: 14°F to 140°F (-10°C to 60°C).
3. Relative Humidity: 5% to 95% (noncondensing).
4. Power:
 - a. Input: 12 Vdc (DC Jack), 12 Vdc power adapter.
 - b. Wattage: 4.56 W (maximum), 0.38 A@12 Vdc.
5. Ethernet Port:
 - a. Port: One RJ-45 Port.
 - b. Speed: 10/100 Mbps.
 - c. Distance: 100 meters (328 feet).
 - d. Cable: 10Base-T: UTP Cat. 3,4,5 (2-pair wire); 100Base-TX: UTP Cat. 5 (4-pair wire).
6. Ethernet Extender Port:
 - a. Port: One RJ-11/Terminal Block port.
 - b. Speed: Up to 1000 Mbps.
 - c. Distance: 2600 meters (8,530 feet).
 - d. Cable: Telephone wire 24 AWG (0.5 mm diameter, 1-pair wire) or larger.
7. DIP Switch:
 - a. DIP 1: Auto/Loc.
 - b. DIP 2: SYM/ASM.
 - c. DIP 3: Pref./Std.
8. LED Indicators:
 - a. Per Unit: Power 1.
 - b. Per 10/100TX Port: Link / Activity, full-duplex.
 - c. Line Speed.
 - d. SYM: Symmetric Mode (distance <1000 m).

- e. ASM: Asymmetric Mode.
- f. RMT: Remote Mode.
- g. LOC: Local Mode.
- 9. Acceptable manufacturer:
 - a. EtherWAN Model ED3501 Series.
 - b. Or preapproved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. The Mater Attendant Call Station shall be installed inside the Attendant Building as shown on the Drawings.
- B. Remote Attendant Call Stations shall be installed outside of Operator Warming Station and LHHW Building as shown on the Drawings.

3.02 TESTING

- A. Contractor shall test the audio intercom system for proper and acceptable operation.
 - 1. Testing shall include audible clarity, sound quality, voice volume, etc.
 - 2. Testing shall include all features of the intercom system including the call to and from the Master Call Station and each remote attendant call station.
 - a. Test each function of the Master Call Station and each function of each remote attendant call station.
 - 3. This test of each component of the total system shall be made in the presence of the Owner.
- B. Upon completion, the Owner's maintenance staff shall be instructed in the testing and operation of the Audio Intercom System.
 - 1. Emcom to schedule meetings with Contractor and Owner to provide instructions on testing and operation of the Audio Intercom System.
 - a. Review of equipment user manual with solutions shall be included in the meeting.

3.03 TRAINING

- A. The Contractor shall provide training of the Audio Intercom System to the Owner.
 - 1. Demonstration of calls from each remote attendant call station to the master call station.
 - 2. Demonstration of calls from the Master Call Station to the remote attendant call stations.
 - 3. Demonstration trouble shooting procedures and system reset procedures for supporting equipment (i.e. power supplies, Ethernet Extenders, indicator lights, etc.).

END OF SECTION

SECTION 28 31 00
FIRE ALARM SYSTEM

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section specifies the fire alarm system as specified in this section and on the Drawings.
- B. Work Included:
 - 1. Design and provide a Fire Detection and Alarm (FA) System for the following locations:
 - a. Attendant Building.
 - b. LHHW Building.
 - c. Refuse Shed A.
 - d. Refuse Shed B.
 - e. Refuse Shed C.
 - f. Refuse Shed D.
 - 2. The fire alarm control panel, sensing device, pull stations, horn/strobes, remote annunciator, and communicator to link fire alarm panel with alarm monitoring service shall be new construction and shall be fully addressable fire alarm system.
 - 3. The fire alarm control panel shall have a remote annunciator.
 - 4. The fire alarm system monitoring service shall be Washington Alarm.
 - 5. Contractor shall be responsible for a successfully operating fire alarm system and is responsible to ensure the subcontractors support design, installation, proper operation, and approval by the fire marshal.

1.02 REFERENCE STANDARDS

- A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of a listed document, the requirements of this section shall prevail.
 - 1. NFPA 72 – National Fire Alarm Code.
 - 2. NFPA 70 – National Electrical Code.

3. UL 268 – Smoke Detectors for Fire Protective Signaling Systems.
 4. UL 864 – Control Units for Fire Protective Signaling Units.
 5. UL 268A – Smoke Detectors for Duct Applications.
 6. UL 521 – Heat Detectors for Fire Protective Signaling Systems.
 7. UL 464 – Audible Signal Appliances.
 8. UL 38 – Manually Actuated Signaling Boxes.
 9. UL 1971 – Visual Notification Appliances.
- B. Local and State Building Codes.
- C. Requirements of the Authority having Jurisdiction (AHJ).

1.03 SUBMITTALS

- A. Design Drawings: Submit in accordance with the project submittal requirements in Section 26 05 11, “Basic Electrical Methods and Materials,” and Section 01 33 00, “Submittal Procedures.”
1. A wiring diagram, complete description, and an elementary control diagram of components.
 2. An overall inter-connection diagram of devices and the fire alarm control panel.
 3. A dimensioned plan drawing to scale, showing zones, conduit routing, device locations, mounting heights, and device connections.
 - a. Submitted plan drawings shall show location of fire alarm equipment and wiring not to interfere with the process equipment along with the maintenance and servicing of the process equipment.
 4. A Fire Alarm System Bill of Materials (BOM) including item number, item description, manufacturer, model number, catalog number, and number of units required. The BOM shall include provided spare parts.
 5. An Electrical Components BOM including item number, item description, manufacturer, model number, catalog number, and number of units required.
 6. Submit text message displayed on the remote annunciator for the following events:
 - a. Normal operation.
 - b. Loss of power.
 - c. Maintenance required.

- d. Component failure.
- e. Loss of communication.
- f. Alarm.
- 7. A complete component riser diagram.
- 8. Submit design drawings no later than 45 days after Notice to Proceed.
- 9. Approved design drawings shall be required prior to installation of any fire alarm system components or associated electrical equipment.
- 10. An affidavit demonstrating coordination with and conformance with the requirements of the AHJ.
- 11. Submit Fire Alarm Test Plan for new fire alarm detection system and its integration into existing system.
- B. As-Built Diagrams and Manuals: Upon completion of work and prior to final testing and inspection, furnish as-built drawings showing the exact sequence of initiating devices as they were installed in the circuits.
 - 1. Contractor shall integrate the new drawings into the existing drawing set.
 - 2. Submit operation and maintenance manuals in compliance with pertinent provisions of Division 1.

1.04 QUALITY ASSURANCE

A. Qualifications:

- 1. Plans and specifications shall be prepared by the manufacturer of the fire alarm system or by a fire alarm installation service which is regularly engaged in fire alarm design.
- 2. Fire alarm plans and specifications to be stamped and signed by a fire alarm engineer registered in the State of Washington, or a NICET III, or an ESA/NTS Certified Fire Alarm Designer (CFAD) Level III.
- 3. The installing company shall provide a minimum Level II fire alarm technology technician on-site for installation and final checkout to ensure the integrity of the system.

B. Certification:

- 1. Fire alarm plans and specifications shall be stamped by a fire alarm engineer registered in the State of Washington, or a NICET III (minimum level), or an ESA/NTS Certified Fire Alarm Designer (CFAD) Level III.
- 2. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001.

1.05 WARRANTY

- A. Work shall be warranted for a period of not less than 1 year from the date of Substantial Completion against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Equipment shall be listed by the State Fire Marshal, UL listed, FM listed, and tested by a nationally recognized fire test laboratory.
- B. Electrical installation to be in compliance with Division 26 of these Specifications.
- C. Smoke and heat detection.
- D. As minimum hand pull stations shall be provided at each exterior door.
- E. Horn strobe annunciators shall be provided in each room.
- F. The fire alarm equipment and wiring shall not interfere with operations, service, and maintenance of the recycle and garbage facility.
- G. The Attendant Building is an environmentally controlled space. The attic space is not environmentally controlled.
- H. See Drawing E30.01 for equipment locations.
 - 1. Fire Alarm Control Panel.
 - 2. Fire Alarm RF Communication Panel.
 - 3. Fire Alarm Remote Annunciator.
- I. The four Refuse Sheds are covered outdoor facilities that are not environmentally controlled spaces. Fire alarm equipment shall be rated for this space.
- J. The garage area of the LHHW Building is not an environmentally controlled space. Fire alarm equipment shall be rated for this space. The Operator Room and Storage Room of the LHHW Building are semi-heated spaces.
- K. Substantial distance between the Attendant Building and the LHHW Building, and Refuse Sheds. See site plan for determining circuit lengths between buildings and structures.

2.02 COMPONENTS

- A. The detection system shall be configured so that each room in each building is its own fire detection zone.
- B. Provide any additional components as required for a complete and operational fire detection and alarm system.
- C. The fire monitor module shall connect to the main panel and give directions to the incoming firefighters.
- D. The Refuse Sheds areas are a dirty environment and accumulate dust and debris due to being outdoors. The fire detection system used in these Refuse Shed areas shall be low-maintenance type not susceptible to dust.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. The Fire Alarm Control Panel shall be installed inside the Attendant Building.
- B. Installation shall not begin until the State Fire Marshal Listing for equipment and plans and specifications have been approved by the Fire Marshal.
- C. Installation of wiring and equipment shall conform to Article 760 of NFPA Standard No. 70 and NFPA Standard No. 72.
- D. Minimum conductor size shall be #16 AWG for the alarm-initiating circuits and #14 AWG for output circuits to audio/visual annunciators.
- E. Wiring shall be in galvanized rigid steel conduit in exposed areas, in EMT inside the Attendant Building, and in PVC conduit in underground areas per the requirements in Section 26 05 33 and other Division 26 specifications. Provide red paint finish on exterior of junction boxes and covers used for the fire alarm and detection system.
- F. Provide single and dual gang electrical to install fire alarm manufacturer's equipment per manufacturer's installation instructions.
- G. Terminations in control panels shall be made on terminal strips with a separate point for each conductor.
- H. Mount end-of-line resistor boxes where they will be readily accessible and at 54 inches above the finished floor.
- I. Install no automatic detection equipment on its ceiling mounting plate until the associated room has been painted and cleaned. A minimum of 5% or two (whichever is larger) automatic-detection elements shall be given to the Owner as spares.
- J. Coordinate dial out/communication system to monitoring station with the Owner.

3.02 TESTING

- A. A factory-trained representative of the manufacturer shall supervise final testing of the complete system. This test of each component of the total system shall be made in the presence of the Owner and in the presence of the enforcing fire agency.
- B. Upon completion, the Owner's maintenance staff shall be instructed in the testing and operation of the system by the Manufacturer's representative.

3.03 TRAINING

- A. Factory-trained representative shall demonstrate operation of new fire alarm system to the Owner. The demonstration shall include the signaling and notification at the main fire alarm control panel in the Control Building.
 - 1. Demonstration of fire alarm signal from the new fire signal and the notification the responding fire crew would receive directing them to which area at the RAGF site.
 - 2. Demonstration shall include educating the Owner of all fire alarm system equipment locations and operations in the buildings/structures listed in this section.

END OF SECTION

Division 31

Earthwork

SECTION 31 10 00
SITE CLEARING

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Clearing.
 2. Grubbing.
 3. Chipping and stockpiling of woody material.
 4. Protection of existing trees.
 5. Removal of trees and other vegetation.
 6. Topsoil stockpiling.

1.02 DEFINITIONS

- A. Clearing: Clearing shall include the removal and disposal of vegetative growth such as trees, shrubs, brush and other vegetation, boulders/rocks, down timber, rotten wood, rubbish, and other objectionable materials, except such objects that are designated to remain. It shall include but not be limited to, chipping of woody material less than 6 inches in diameter, stockpiling of wood chips on site for reuse as mulch, the removal of lumber, trash piles, nonpermanent structures, and other obstructions interfering with the construction.
- B. Grubbing: Grubbing shall include the removal and disposal of stumps, roots, vegetative matter, sod, topsoil, and structures in or upon the ground, the removal of which is not prescribed as Clearing.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures":
1. Contractor's plan for handling of material removed during site clearing and grubbing.

1.04 PROJECT CONDITIONS

- A. Protect all section, subdivision, plat, property corner, and any official monuments or benchmarks. In the event any such monument or marker and casing is disturbed as a result of the Contractor's operations, the Contractor shall replace or reset the monument or marker at no additional cost to the County.

- B. Protect existing trees and vegetation outside the Construction Limits and elsewhere as designated for retention.
 - 1. Protect existing trees and other vegetation against cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.
 - 2. Provide temporary guards to protect trees and vegetation to be left standing.
 - 3. Dead snags shall be left standing unless determined by Project Representative to present a safety risk.
 - 4. Provide protection for roots over 1-1/2 inch diameter that are cut during construction operations.
 - a. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues.
 - b. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
- C. Protect wetlands and other critical areas.
 - 1. Install orange safety fencing prior to start of clearing and grubbing, earthwork or any other construction in accordance with Section 31 25 00, "Erosion and Sedimentation Controls."
 - 2. Protect wetland, stream, critical areas and buffers from damage due to Contractor's construction operations.
 - 3. Work required within buffers and wetland areas shall be performed in a manner to minimize impacts to those areas.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Carefully examine site to determine the full extent of work required by this section.
- B. Verify that working conditions are satisfactory.
- C. Unsatisfactory conditions shall be addressed with the Project Representative.
- D. Beginning work constitutes acceptance of site conditions.

3.02 PREPARATION

- A. Construction Limits survey, flagging, fencing and erosion control measures shall be performed per Section 01 50 00, "Temporary Facilities and Controls," and Section 31 25 00, "Erosion and Sedimentation Controls."
- B. During the construction period, do not disturb areas beyond the flagged limits.
- C. Locate utilities in or near the work area.
- D. Take all necessary precautionary measures to protect utilities.
- E. Call for utility locates by calling the Utilities Underground Location Center (1-800-424-5555) a minimum of 2 days before digging.
- F. Provide adequate means of support and protection for utilities to remain in place and operational during clearing operations.
- G. Should uncharted, or incorrectly located, piping or other utilities be encountered during excavation, notify Project Representative immediately for direction.
- H. Cooperate with Project Representative and utility companies in keeping respective services and facilities in operation.
- I. Immediately repair damaged utilities to satisfaction of Project Representative and utility owner without additional cost to County.
- J. Do not interrupt existing utilities serving facilities occupied by County or others, except when permitted in writing by County, and then only after acceptable temporary utility services have been provided if required by County.
 - a. Provide minimum 48-hour notice to Project Representative and utility owner, and receive written notice to proceed before interrupting any utility.
 - b. Coordinate with utility companies for shutoff of services, if lines are active.
- K. Protect all existing facilities and features of the site that are not specifically designated to be altered.

3.03 CONSTRUCTION

- A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions as required to permit installation of new construction. "Removal" includes digging out and disposing of stumps and roots.
- B. Clear identified areas of trees, shrubs and other vegetation within the Construction Limits. Fell trees only in the area to be cleared.
 - 1. Completely remove stumps, roots, and other debris protruding through ground surface.
 - 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 - 3. Cut minor roots and branches of trees not indicated to be removed in a clean and careful manner, where such roots and branches obstruct installation of new construction.

4. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.
5. Chip all woody material less than 6 inches in diameter and stockpile material on site as directed by Project Representative.
 - a. No individual stockpile shall exceed 8 feet high and 10 feet wide.
- C. Clearing for work required within wetland, stream, critical areas and buffers areas shall be performed in a manner to minimize impacts to those areas.
- D. Conduct clearing operations in a manner to prevent pollution of air and water in accordance with Section 31 25 00, "Erosion and Sedimentation Controls."

3.04 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated or regraded, without mixing with foreign materials.
 1. Confer with Project Representative and obtain direction on whether surficial soil is classified as topsoil.
- B. Stockpile in a protected area to a depth not to exceed 8 feet and protect from erosion.

3.05 DISPOSAL OF MATERIAL AND DEBRIS

- A. Materials resulting from the clearing and grubbing operation shall be hauled to an approved off-site waste disposal site, secured by the Contractor and shall be recycled and disposed of in such a manner as to meet the requirements of state, county, and municipal regulations regarding health, safety, and public welfare.
- B. Tree trunks, limbs and branches 6-inches in diameter and smaller shall be chipped and stockpiled on-site.
 1. Chips shall not exceed 2 inches-square by 2-inches-thick.
 2. Tree trunks, limbs and branches larger than 4-inches in diameter shall be removed and disposed of offsite.
 3. Contractor is encouraged to put tree trunks greater than 6-inches in diameter to beneficial use for lumber, chips, or other for other recycled resource uses.
- C. Burning on or off site is not permitted.

3.06 REPAIR/RESTORATION

- A. Vegetation outside the Construction Limits that is damaged shall be removed and replaced in kind by the Contractor as directed by the Project Representative at no additional cost to the County.

END OF CTION

SECTION 31 23 00
EARTHWORK

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Excavation and grading.
 2. Fill, backfill, and compaction.
 3. Importation of soil and aggregates.
 4. Haul and disposal of materials.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein.
- B. The following is a list of standards referenced in this section:
1. American Association of State Highway and Transportation Officials (AASHTO)
 - a. AASHTO T 90 – Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils.
 - b. AASHTO TP 61 – Determining the Percentage of Fracture in Coarse Aggregate.
 2. ASTM International (ASTM):
 - a. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - b. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
 - c. ASTM C150 – Standard Specification for Portland Cement.
 - d. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - e. ASTM D75 – Standard Practice for Sampling Aggregates.
 - f. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.
 - g. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - h. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soils Classification System).

- i. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- 3. Revised Code of Washington (RCW):
 - a. RCW Chapter 46.61.655 Dropping Load, Other Materials – Covering.
 - b. RCW Chapter 70A.200 Waste Reduction, Recycling, Model Litter Control Act.

1.03 DEFINITIONS AND ACRONYMS

- A. Backfill: Suitable soil used to raise previously excavated grades.
- B. Compaction: Application of controlled forces on soils to achieve a prescribed soil density.
- C. CSBC: Crushed surfacing base course.
- D. CSTC: Crushed surfacing top course.
- E. Dangerous Waste: Dangerous Waste: As defined in Section 01 35 29, “Health and Safety.”
- F. Earthwork: Construction operations involving excavation, material classification, processing, hauling, placement, compaction, disposal, and all other work activities required in this section.
- G. Earthwork Plan: Written narrative describing the Contractor's proposed means, methods, and sequencing of the Earthwork operations.
 - 1. The Earthworks Plan shall include the requirements of the Environmental Protection Plan (EPP).
- H. Embankment: Excavated native glacial material suitable for reuse on-site including any required processing to remove over size material.
- I. Excavation: Removal of material.
- J. Export Material: Material being removed from the Project Site.
- K. Fill: Suitable soil used to raise grades.
- L. Final Grade: Project Site elevations required at the end of construction as indicated on the Drawings.
- M. Grading: Redistribution of soils, primarily through the use of motorized construction equipment such as bulldozers, scrapers, graders, loaders and the like, as well as hand work, to create the finished surface elevations and grades indicated on the Drawings.
- N. Hazardous Material:
 - 1. To include the definition contained in Section 01 35 29, “Health and Safety,” which also applies.

O. Import Material: Off-site source material brought into the Project Site by the Contractor.

P. Neat Line:

1. The Neat Line coincides with the mass excavation limits shown or inferred on the Drawings.
 - a. The inferred Neat Line includes subgrade and excavation limits shown on the details and sections in the Drawings.
2. The Contractor is required to include in the Contract Price the extent of the required excavation, fill and backfill corresponding with the Neat Line, plus or minus 6 inches.

Q. Over-excavation: Removal of material outside the Neat Line indicated on the Drawings.

R. Processing: Crushing, screening, washing, blending, removing deleterious material, amending and supplementing soil materials as necessary to produce materials meeting the requirements of the Specifications.

S. Proof-rolling: The act of traversing a suitably heavy piece of equipment across a proposed subgrade for the purpose of identifying any areas which yield and therefore are deemed unsuitable soils.

T. Subgrade: The undisturbed earth or the compacted soil layer defined on the Drawings as the grade upon which Fill, Backfill, structural foundations, or pavement materials are subsequently placed, or the exposed soil layer at the bottom of excavation areas.

U. Suitable Material:

1. Import Material and/or material excavated on-site determined by the Project Representative to be appropriate for use as Fill and/or Backfill.
2. Soil materials complying with ASTM D 2487, Soil Classification Groups GW, GP, GM, SW, SP, and SM; AND free from rocks larger than 12 inches, debris, waste, frozen matter, vegetation, Refuse, and other deleterious matter.

V. TESC: Temporary erosion and sediment control.

W. Unsuitable Material:

1. Materials obtained from on-site excavation not meeting the specified requirements of Embankment, other materials specified for on-site uses, or which yield excessively and unpredictably under load, whether vertical or horizontal.
2. Unsuitable Material may include unstable soils, boulders, rocks, construction debris, metal, organic materials, high silt or clay content materials, concrete rubble, woody debris, refuse.
3. Unsuitable Material may include Suitable Material that is unconsolidated, or loose, or that contains excess moisture which has no immediate effective remedy.

1.04 MEASUREMENT AND PAYMENT

- A. The work of this section shall not be measured and will be included in schedule of value for Lump Sum bid items except for those items of work covered under Unit Price bid items.
 - 1. No adjustments other than for approved Changes shall be made in the payment, even though actual quantities may deviate from the indicated estimated quantity.
 - 2. Refer to Section 01 71 23, "Surveying," for information about how the Contractor is required to accept or propose modification to the Owner-provided survey.
- B. Payment:
 - 1. Payment for Work of this section shall be in accordance with requirements of Section 01 20 00, "Payment Procedures," and as indicated in this section.
 - 1) Monthly tallies shall be the sum of individual load tickets in that month.
 - 2) Individual loads shall be measured and recorded to the 0.1 of a ton.
 - b. Payment shall compensated on the calculated unit price quantities times the corresponding unit prices.
 - c. Payment for authorized over-excavation, if any, shall be on the basis of tons of type of material removed in the current month.

1.05 GENERAL REQUIREMENTS

- A. Excavation, Fill, and Backfill:
 - 1. Establish the required final elevations and grades shown on the Drawings.
 - a. Excavate Embankment and place on site as fill and backfill subject to meeting the requirements for the material use.
 - b. Fill and Backfill using Import Material and available Embankment for surfaces, structures, and utilities.
 - 2. Subgrade preparation (proof-rolling and compaction) shall be applied in all areas.
 - 3. Over-excavate and replace unsuitable soils when directed by Project Representative.
- B. Disposition of Excavation Materials:
 - 1. The Work requires a continuous classification and quality control testing process by the Project Representative to determine disposition of Excavation materials to appropriate use as one of the following:
 - a. Embankment.
 - b. Unsuitable Material.

2. Cooperate with the Project Representative to assist and coordinate continuous material classification (observation/monitoring) processes performed by the Project Representative.
 - a. Classification is required throughout the course of the Contractor's Earthwork excavation operations.
 - b. Classification by the Project Representative shall include inspection for visual and odor indications of material type and field sampling and testing.
 - c. The Project Representative shall utilize classification processes, and shall staff the Project Site in order to minimize delay to the Contractor's Earthwork excavation operations.
 - 1) Contractor should expect some occasional delay or slowdown of excavation work when material types in the active excavation area(s) change.
 - 2) Where feasible Contractor should plan to have multiple excavation areas in progress or available so that operations can be shifted between areas when questions arise and are resolved by the Project Representative regarding the classification of materials encountered.
 - 3) Where feasible Contractor should plan to pothole ahead of the excavation work to allow for advance preliminary classification of material.
 - d. If the classification process identifies potentially Hazardous Materials or Dangerous Waste, the suspect material shall be separated by the Contractor and tested by the Project Representative.
 - e. Delays or slowdown of excavation operations due to material classification processes shall not be cause for adjustment in Contract Time or in Contract Price.

C. Hauling Requirements:

1. Disposition:
 - a. Unsuitable Material (non-Hazardous Material) shall be disposed of at an approved offsite disposal area provided by the Contractor.
 - b. Hazardous Material shall be disposed of at an appropriate regulated disposal facility as determined by the Contractor and acceptable to the Project Representative.
 - c. Proper handling, storage, hauling, transport, safety, and management of Earthwork materials associated with the Project are solely the responsibility of the Contractor.
 - 1) Contractor shall utilize load covers and or secure loads in accordance with the requirements of RCW 46.61.655 and RCW 70A.200.

1.06 SUBMITTALS

A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

B. Approval Submittals:

1. Earthwork Plan:

- a. Within 21 calendar days following the First Notice to Proceed, submit a minimum five page 8.5 by 11-inch paper size) narrative describing the Contractor's proposed means, methods, and sequencing for each phase of the earthwork operations. The prescribed page count does not include drawings, diagrams, or tables.
- b. Drawings and diagrams shall be included which, at a minimum, depict:
 - 1) Progression of work areas.
 - 2) Stockpile areas.
 - 3) Vehicle access.
 - 4) Typical load out configuration (excavators, conveyors, trucks, etc.).
 - 5) Location of haul roads.
 - 6) Methods to be used for protection of the permanent subgrade from disturbance by construction operations including on site hauling traffic.
 - 7) Relation to other Project Site work (buildings construction, retaining wall construction, paving, utilities installation, etc.).
 - 8) Surface water management.
 - 9) Location and certification of truck scales.
 - 10) Identification of potential off-site disposal sites.
 - 11) Proposed disposal facilities for CDL, Hazardous Materials, and Dangerous Waste.

2. Supplier information:

- a. Name of Imported Material suppliers.
- b. Imported Material certificate of conformance with the Specifications for each source of material.
- c. Quantity of Imported Material from each source of material.

- d. Data sheets demonstrating that each source of Imported Material complies with the requirements of the Specifications.
 - e. Source Quality Control Information: Provide in accordance with requirements of this section; see Part 2 – Products, and Section 01 43 00, “Quality Assurance and Control.”
 - f. Samples of proposed Imported Materials of sufficient size to allow for Project Representative confirmation testing of materials.
3. Certified waybills, delivery tickets and bills of lading: In accordance with provisions of this section within 24 hours of each delivery.

C. Quality Assurance Submittals:

- 1. Qualifications of the service providing Contractor’s Source Quality Control with supplier information listed in Paragraph 1.06 C.2.
- 2. Scale Verification Check documentation.
- 3. Truck identification and tare weight documentation.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with Section 01 43 00, “Quality Assurance and Control.”

B. Testing and Inspections:

- 1. The Contractor shall provide testing and inspections for Source Quality Control for materials proposed for incorporation into the Work, in accordance with the requirements of this section.
 - a. Allow sufficient, reasonable time in work schedule for Owner’s testing service to sample, test, and provide test results of source material for verification and Field Quality Assurance.
- 2. Field Quality Assurance at the Project Site shall be provided by the Owner which shall include a qualified soils testing and inspection service during earthwork operations.
 - a. Field Quality Assurance testing shall be the primary source of information for Owner and Contractor verification that Contractor is meeting all design requirements.
 - b. Allow Owner testing service to sample materials and perform field tests of placed materials.
 - c. Allow sufficient, reasonable time in work schedule for results of Owner’s testing services to be reported before proceeding on with subsequent work.

C. Pre-Earthwork Conference:

1. Attendees: Coordinate the meeting time and date with the following individuals, with a minimum 5 calendar days prior notice of conference:
 - a. Contractor: Project manager, field engineer, superintendent.
 - b. Subcontractor: Management, and supervisory personnel, including truck driver supervisor.
 - c. Kitsap County Project Representative.
 - d. A/E Representative.
 - e. Construction Manager.
 - f. Owner's Testing and Inspection Service.
2. Agenda:
 - a. Detailed discussion of Earthwork Plan, having been previously reviewed and commented on by the Project Representative.
 - b. Screening procedures that shall be employed by the Project Representative for identifying the various on-site material types, including documentation.
 - c. Adverse Weather Operations: Wet weather, freezing weather operations.
 - d. Grading Control: Survey, staking, and datum review.
 - e. Field Quality Assurance.
 - f. Public Protection: Street cleaning; noise, odor, and dust mitigation.
 - g. Coordination with ongoing facility operations.
 - h. Roadway and Traffic Management: Flagging and site access control measures in accordance with the Owner-provided Traffic Management Plan indicated on the Drawings.
 - i. Schedule review for earthwork activities.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Obtain permits and licenses required by authorities having jurisdiction for the legal transport of all material to and from the Project Site.

B. Documentation: Provide certified waybills, delivery tickets, and bills of lading as follows:

1. Export Material:

- a. Provide certified waybills and delivery tickets.
- b. Provide bills of lading demonstrating the legal transfer of ownership of Export Material departing the Project Site.

2. Import Material: Provide certified waybills and delivery tickets.

3. Provide certified waybills, delivery tickets and bills of lading paperwork to the Project Representative on a daily basis,

4. Documentation shall contain the following information, complete and accurately recorded:

- a. Date and the time that the material entered or departed the Project Site.
- b. Driver identification.
- c. Vehicle identification, configuration, tare weight.
- d. Material classification.
- e. Material weight in tons to the nearest 1/100 of a ton (20 pounds).

1.09 PROJECT CONDITIONS

A. Protect survey monuments as described in Section 01 71 23, "Surveying."

B. Protect the permanent subgrade from disturbance and degradation by construction operations including on site hauling operations.

C. Contractor is responsible for replacing subgrade that is damaged by its construction operations at no cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Crushed Surfacing: Crushed surfacing shall be manufactured from ledge rock, talus, or gravel.

- 1. The material shall be uniform in quality and substantially free from wood, roots, bark, and other deleterious material, and shall meet the quality test requirements in Table 1, below.

Table 1
Crushed Surfacing Quality Test Requirements

Item	Requirement
Los Angeles Wear, 500 Rev.	35% max.
Degradation Factor – Base Course	25 min.
Degradation Factor – Top Course	15 min.

2. Crushed surfacing shall meet the requirements of Table 2, below, for quality and gradation.

Table 2
Crushed Surfacing Gradation Requirements

Sieve Size	Crushed Surfacing Base Course (CSBC) Percent Passing by Weight	Crushed Surfacing Top Course (CSTC) Percent Passing by Weight
1-1/4 Inch Square	100	
1 Inch Square	80 – 100	
3/4 Inch Square		100
5/8 Inch Square	50 – 80	
1/2 Inch Square		80 – 100
U.S. No. 4	25 – 45	46 – 66
U.S. No. 40	2 – 18	8 – 24
U.S. No. 200	7.5 max.	10.0 max.
% Fracture	75 min.	75 min.
Sand Equivalent	40 min.	40 min.

3. The fracture requirement shall be at least one fractured face and shall apply to the combined aggregate retained on the U.S. No. 4 sieve in accordance with the field operating procedures for AASHTO TP 61.
4. The portion of crushed surfacing retained on a U.S. No. 4 sieve shall not contain more than fifteen-hundredths 0.15% wood waste.
- B. Embankment: Embankment shall be native glacial material, free from Unsuitable Materials and shall have a maximum particle size of 12 inches in any direction.
1. Suitability of on-site excavated material or other materials to be used as Embankment shall be as determined by the Project Representative in accordance with the requirements of this section.
2. Non-Native High Fines Fill Material is not suitable for use as Embankment.

C. Gravel Backfill for Drains:

1. Gravel backfill for drains shall conform to the gradation requirements of Table 3, below.
2. Alkali silica reactivity testing is not required for gravel backfill for drains.

Table 3
Gravel Backfill for Drains Gradation Requirements

Sieve Size	Percent Passing by Weight
1 Inch Square	100
3/4 Inch Square	80 – 100
3/8 Inch Square	10 – 40
U.S. No. 4	0 – 4
U.S. No. 200	0 – 2

D. Gravel Backfill for Foundations or Crushed Rock: Where standard details for manholes and catch basins indicate use of gravel backfill for foundations or crushed rock, pipe bedding shall be used in accordance with Paragraph 2.01H.

E. Gravel Borrow:

1. Gravel borrow, also referred to as “Import Structural Fill” in the geotechnical reports, shall be a granular material, essentially free from various types of wood waste and other deleterious materials.
2. Gravel borrow shall conform to the gradation requirements of Table 4, below.

Table 4
Gravel Borrow Gradation Requirements

Sieve Size	Percent Passing by Weight
4 Inch Square	100
2 Inch Square	75 – 100
U.S. No. 4	50 – 80
U.S. No. 40	30.0 max.
U.S. No. 200	5.0 max.
Sand Equivalent	50 min.

F. Pipe Bedding:

1. Pipe bedding shall be free from various types of wood waste or other deleterious materials.

2. Pipe bedding outside of areas to receive pavement shall consist of crushed, processed, or naturally occurring granular material. The material shall meet the grading and quality requirements of Table 5, below.

Table 5
Pipe Bedding (Non-Paved Areas) Gradation Requirements

Sieve Size	Percent Passing by Weight
1-1/2 Inch Square	100
1 Inch Square	75 – 100
5/8 Inch Square	50 – 100
U.S. No. 4	20 – 80
U.S. No. 40	3 – 24
U.S. No. 200	10.0 max.
Sand Equivalent	35 min.

3. Pipe bedding in areas to receive pavement shall consist of pea gravel. Pea gravel for pipe zone bedding shall consist of screened, rounded sand or gravel. It shall have such characteristics of size and shape that it will compact readily and shall meet the gradation requirements in Table 6, below.

Table 6
Pipe Bedding (Paved Areas) Grading Requirements

Sieve Size	Percent Passing by Weight
3/4 Inch Square	100
3/8 Inch Square	80 – 100
U.S. No. 8	0 – 10
U.S. No. 200	3.0 max.

4. On-site excavated granular material free from wood waste, organic material, and other deleterious materials, not otherwise conforming to Table 5 may be used for pipe bedding for rigid pipes outside of areas to receive pavement, provided the granular material has a maximum dimension of one and 1.5 inches and subject to written acceptance of the Project Representative in advance.

G. Quarry Spalls:

1. Quarry Spalls shall consist of broken stone or broken concrete rubble and shall be free from segregation, seams, cracks, and other defects.
2. Quarry Spalls shall meet the grading requirements in Table 7, below.

Table 7
Quarry Spalls Grading Requirements

Sieve Size	Percent Passing by Weight
6 Inch Square	100
3 Inch Square	30 - 50
3/4 Inch Square	5 - 10

H. Recycled Concrete: Recycled concrete may be used as gravel borrow, pipe bedding, and shoulder ballast (to replace unsuitable material) provided the recycled concrete meets the material requirements for the applicable material.

1. Recycle concrete shall not be used as CSTC or CSBC.
2. Recycled concrete may not be placed within 2 feet of geosynthetics.

I. Sand: Sand shall conform to the gradation requirements of Table 8, below.

Table 8
Sand Gradation Requirements

Sieve Size	Percent Passing by Weight
1/2 Inch Square	90 – 100
U.S. No. 4	57 – 100
U.S. No. 10	40 – 100
U.S. No. 50	3 – 30
U.S. No. 100	0 – 4
U.S. No. 200	0 – 3.0

J. Shoulder Ballast:

1. Shoulder ballast shall consist of crushed, partially crushed, or naturally occurring granular material from sources approved by the Project Representative.
2. Material shall meet the quality test requirements in Table 9.

Table 9
Shoulder Ballast Quality Test Requirements

Item	Requirement
Los Angeles Wear, 500 Rev.	40% max.
Degradation Factor	15 min.

3. Shoulder ballast shall meet the requirements of Table 10 for grading and quality when placed in haul vehicles for delivery to the site, or during manufacturer and placement into a temporary stockpile. The exact point of acceptance shall be determined by the Project Representative.

Table 10
Shoulder Ballast Gradation Requirements

Sieve Size	Percent Passing by Weight
2 1/2" Square	100
2" Square	65 – 100
3/4" Square	40 – 80
U.S. No. 4	5 max.
U.S. No. 100	0 – 2
% Fracture	75 min.

4. The fracture requirement shall be at least one fractured face and shall apply to the combined aggregate retained on the U.S. No. 4 sieve in accordance with the field operating procedures for AASHTO TP 61.
5. The portion of shoulder ballast retained on a U.S. No. 4 sieve shall not contain more than 0.2% wood waste.

K. Topsoil: Topsoil shall be in accordance with Section 32 91 00, "Planting Preparation."

2.02 SOURCE QUALITY CONTROL

- A. The Contractor shall develop, manage, implement, adjust and continuously monitor quality control at the source of materials to be incorporated into the Work of this Project.
- B. The Contractor shall ensure, by means of testing and inspections, that the materials delivered to the Project Site comply with the gradations and material specifications indicated in this section.
1. Sampling of the material source shall be performed by the Contractor in accordance with ASTM D75.
 2. The following materials shall be sampled and tested for gradation per ASTM D422 at a minimum of one per source.
 - a. CSBC.
 - b. CSTC.
 - c. Gravel backfill for drains.
 - d. Pipe bedding (pea gravel).
 - e. Sand.
 - f. Shoulder ballast.

3. Gravel borrow and Preload material shall be sampled and tested for gradation per ASTM D422 at a minimum of one per source, or one per 4,000 cubic yards from one source.
 4. Do not unload material at the Project Site that has not been determined in advance by the Project Representative to be Suitable Material in accordance with the requirements of this section.
- C. Employ a qualified testing and inspection service to provide the necessary quality control testing at the source.
1. The Contractor's testing and inspections subcontractor shall not be the same as any firm employed by the Owner in the capacity of performing testing and inspections for this Project.
- D. The Contractor's testing and inspections shall be conducted in accordance with the standards and methods identified in this section.
- E. Submit source quality control testing and inspection paperwork to the Project Representative not less than 48 hours in advance of earliest proposed delivery.
1. Gradation Analysis: Show conformance of proposed material to the requirements of this section.
 2. Samples:
 - a. Samples shall be representative of the source pit.
 - b. Provide a 0.5 cubic foot clear polyethylene bag of each material proposed for use in accordance with the requirements of this section.
 3. Renewal Procedure:
 - a. Utilize the following renewal procedure for Import Material previously determined to be Suitable Material:
 - b. In order to employ this renewal procedure, the following conditions shall be met:
 - 1) Proposed Import Materials shall be from the exact same source and pit vicinity that have been previously determined to be suitable by the Project Representative in consultation with the Owners testing and inspection service.
 - 2) No prior rejections of material from that source and pit vicinity shall have occurred.
 - c. Gradation Analysis: Show conformance of proposed material to the requirements of this section.
 - d. Samples:
 - 1) Samples shall be representative of the source pit.
 - 2) Provide renewal samples only when directed to do so by the Project Representative.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Prior to the beginning of construction, verify all lines, limits, grades, and survey controls. Provide grade control in accordance with Section 01 71 23, "Surveying."
- B. Locate existing utilities and provide protection where necessary.
- C. Shoring shall be provided as required in Section 31 23 33, "Trench Safety Systems."
- D. Clearing and grubbing shall be provided in accordance with Section 31 10 00, "Site Clearing."
- E. All excavation is unclassified and includes excavation to elevations indicated, regardless of character of materials and obstructions encountered.
- F. Unauthorized excavation, as well as remedial work directed by Project Representative, shall be at Contractor's expense. Backfill and compact unauthorized excavation as specified for authorized excavations, unless otherwise directed by Project Representative.
- G. Excavated material not otherwise classified by Project Representative as Unsuitable Material, may contain oversize material and debris unsuitable for placement as Embankment. Contractor should expect that some processing (screening, sifting, sorting, etc.) of excavated material may be required to remove these unsuitable elements. Unsuitable elements removed from excavation materials shall be hauled off-site and disposed of by Contractor at its own expense.
- H. Protect excavations from surface water run-on and erosion.

3.02 CONSTRUCTION

- A. Excavation:
 - 1. Should the Contractor excavate beyond the Neat Line without prior permission from the Project Representative, Contractor shall replace such excavation with Suitable Materials, in a satisfactory manner and condition, without additional cost to the Owner.
 - 2. The Project Representative shall have complete control over utilization of all excavated material and shall be the final authority in determining the suitability of excavated material to be used as Embankment, fill, backfill, or hauled off-site.
 - 3. Excavation of every description, classification, and of whatever substances encountered within the Neat Line shall be performed to the lines and grades indicated on the Drawings.
 - 4. Excavation into Refuse and Burn Fill shall be required. Contractor shall take appropriate health and safety measures in accordance with Section 01 35 29, "Health and Safety," to protect all personnel from the hazards associated with excavation in a landfill.
 - 5. Contractor shall perform excavation in a manner which minimizes the mixing of material types that require different handling and disposal criteria.

6. During the Earthwork process, the Contractor shall maintain the Project Site in such condition that it shall be drained at all times and install temporary drains and drainage ditches to intercept or direct surface water which may adversely affect the condition of the Work.
7. Conditions of excessive moisture may require that the Contractor temporarily suspend operations until drying weather permits use of the material, or the materials are drained or aerated to optimum moisture content.
 - a. Embankment may be weather sensitive and will be more difficult to excavate, load, haul, and place during wet weather.
 - b. Contractor shall not be entitled to additional compensation for the suspension of work associated with excessive moisture conditions.
8. Excavation of Unsuitable Materials: In cases where Unsuitable Material such as mud, muck, or highly organic material is encountered within the limits of the work, the Project Representative may direct the subgrade to be excavated beyond the Neat Line shown on the Drawings and replaced with Suitable Material. Excavation and replacement with Suitable Materials shall only be performed where directed in writing by the Project Representative.
9. Excavated temporary slopes shall not exceed:
 - a. 1 horizontal to 1 vertical for excavation within native glacial deposits.
 - b. 1.5 horizontal to 1 vertical for excavation within Non-Native High Fines Content Material.

B. Export Material Excavation, Haul, and Disposal:

1. During excavation, the Project Representative shall determine type of material being excavated.
2. Contractor shall be responsible for excavation, haul, and disposal of Unsuitable Material, and potentially Hazardous Materials encountered.
3. Unsuitable shall be disposed of at an approved offsite location provided by the Contractor.
4. Potentially Hazardous Material shall include material that may have been contaminated with petroleum products and other chemicals.
 - a. Indications may include staining, coloration, odor, and chemical storage drums.
 - b. Potentially Hazardous Material shall be identified by the Project Representative and stockpiled on-site at a location designated by the Project Representative or otherwise contained per the direction of the Project Representative.
 - c. Any material identified by the Project Representative as Hazardous Material or Dangerous Waste shall be handled in accordance with state and federal requirements.

- d. Final disposal locations for potentially Hazardous Material shall be appropriately permitted facilities.
 - 5. Potentially Hazardous Material hauling equipment shall be thoroughly cleaned prior to that equipment being used to haul a different material type.
 - a. Hauling equipment type shall ensure no loss of material or leachate during loading and transport.
 - 6. Surplus Embankment material shall be disposed of at an approved off-site facility provided by the Contractor.
- C. Over-excavation:
- 1. Over-excavation below the Neat Line elevations indicated on the Drawings shall be with the approval of the Project Representative.
 - 2. Over-excavated material shall be replaced with gravel borrow, shoulder ballast, Embankment, quarry spalls and/or Geotextile – Type A, at the direction of the Project Representative, placed as specified herein.
 - 3. Over-excavation to prepare subgrade shall not exceed 2 feet in road sections and 18 inches in utility trenches, unless directed otherwise by the Project Representative.
- D. Fill and Mass Backfill:
- 1. Subgrade Preparation:
 - a. Clear, grub and strip areas as required to receive Fill as specified in Section 31 10 00, "Site Clearing."
 - b. Bench existing slope areas that are to receive Fill as shown on the Drawings.
 - c. Proof-roll surface with minimum 10 ton roller equipment, or other equipment approved by the Project Representative to detect soft areas.
 - 1) Where equipment access constraints exist, subgrade probing may be employed to detect soft areas, subject to approval by the Project Representative.
 - d. Over-excavate and Backfill soft areas with compacted Embankment, shoulder ballast, Preload material, quarry spalls, or gravel borrow. Backfill material shall be as directed by the Project Representative.
 - e. Compact Subgrade as specified in Paragraph 3.06.
 - f. The Project Representative shall approve Subgrade prior to filling.
 - 2. Placement of Fills and Mass Backfills:
 - a. Place Fill at the locations and to the lines and grades indicated on the Drawings using specified materials.

- b. Fill material shall not be placed over wet, frozen, or unsuitable Subgrade.
- c. Place Fill in continuous horizontal layers, not exceeding 8 inch loose thickness between compaction cycles. Thinner lifts may be required to achieve compaction requirements.
- d. Moisture condition and compact materials to achieve the requirements of this section. Fill material moisture content shall be maintained within 3% of the optimum moisture content.
- e. Compaction within 5 feet of structures shall be performed with hand operated equipment.
- f. The required number of passes should be determined in the field by means of tests on small experimental embankments. It shall be a minimum of 6 passes of the roller.
- g. Fill slopes shall be over constructed and trimmed to final grade.

E. Stockpile:

- 1. Contractor may create temporary stockpile areas on the Project Site at locations designated by the Contractor and approved by the Project Representative to facilitate Contractor's work sequence.
- 2. Locate temporary stockpile areas so as not to interfere with the surface water drainage system.
- 3. Stockpiles shall not exceed 12 feet in height or have side slopes steeper than 1 horizontal to 1 vertical, and shall be protected from erosion using specified temporary erosion and sediment control measures specified in Section 31 25 00, "Erosion and Sedimentation Controls."
- 4. Clear, grub and strip stockpile areas as required in accordance with Section 31 10 00, "Site Clearing."
- 5. Spread stockpiled soil in loose lifts not exceeding 12 inches thick and compacted to the density specified in Paragraph 3.06.
- 6. Different material types shall be segregated into different stockpiles to prevent cross contamination.

F. Grading:

- 1. Grading shall produce uniform grades or slopes between spot elevations or contours shown on the Drawings.
- 2. Blend graded areas into existing surfaces.
- 3. Surfaces shall be proof-rolled with a fully loaded (10 cubic yard minimum) dump truck or 10-ton roller.

4. Proof-rolling shall be employed to check the Subgrade condition for identification of soft/unstable and Unsuitable Material areas by the Project Representative.
5. Subgrade preparation shall be done with the Subgrade in a suitable moisture condition that shall not create unnecessary Subgrade softening or stability problems.
6. As directed by the Project Representative, provide additional compaction or remove unsuitable Subgrade materials and replace with gravel borrow, shoulder ballast, Embankment, Preload material, quarry spalls, and/or Geotextile – Type A.
7. Repair of any damage to Subgrade caused by Contractor's construction operations shall be the responsibility of the Contractor at no additional cost to the Owner.
 - a. Such damage includes deforming, rutting, softening or otherwise destabilizing the Subgrade caused by hauling vehicles or other operations, failure to maintain TESC measures, or failure to construct and maintain temporary drainage system features.
 - b. Contractor shall regrade, or otherwise repair damaged Subgrade areas to the satisfaction of the Project Representative.
 - 1) Such repair may include removal and replacement of Unstable Material, or placement of Geotextile – Type A.
8. Moisture condition and compact Subgrade to the specified density with heavy compactor equipment.
9. Within 5 feet of structures, compact by hand operated vibratory equipment.
10. Subgrade that is damaged or becomes unstable due to Contractor's continued use of haul equipment shall be repaired at Contractor's expense.

G. Structural Earthwork:

1. Excavate to the depths shown on the Drawings for structural components of work such as gravity retaining walls.
2. It is Contractor's responsibility to coordinate and provide excavation support as required to perform the work accounting for existing structures and other work.
3. Extend excavations laterally a minimum of 2 feet from walls and footings, at base level, to allow clearance for observation and formwork.
4. Proof-roll Subgrade under foundation and slab areas with a fully loaded dump (10 cubic yard minimum) truck, space and access permitting, to locate unsuitable Subgrade materials. Probing of confined subgrade areas may be employed to detect soft spots and unsuitable materials, as approved by the Project Representative.
5. As directed by the Project Representative, remove unsuitable foundation materials and replace with compacted gravel borrow or shoulder ballast.

6. Foundation materials that become unsuitable by Contractor construction operations shall be repaired at Contractor's expense in a method agreed to by the Project Representative.
7. All foundation surfaces shall be approved by the Project Representative prior to placing reinforcement.
8. Backfill materials around structures shall be gravel borrow.
9. Prior to backfilling, remove forms and clean excavation of trash and debris.
10. Do not place Backfill until structure and other buried work has been observed and approved by the Project Representative.
11. If concrete is installed, do not backfill until concrete has reached a compressive strength of 3,000 psi.
12. Place moisture conditioned Backfill in horizontal lifts not exceeding 8 inch loose lifts. Compact to specified density. Raise Backfill evenly around structures.
13. Within 5 feet of earth retaining structures, use hand operated vibratory compactors. Do not use heavy equipment or hydraulic hoe packs within this distance. It may be necessary to reduce lift depths in this area to meet compaction requirements.

H. Utility Trenching and Backfill:

1. Perform trench excavation by open cut.
2. Sawcut and remove asphalt pavement and treated base as required.
3. In areas which allow reuse of native material for Backfill, temporarily stockpile material in an orderly manner a safe distance (at least equal to the trench depth) from the trench.
 - a. Materials that shall not be used for Backfill shall be classified by the Project Representative and handled accordingly by the Contractor.
4. Comply with regulatory requirements for trench safety as specified in Section 31 23 33, "Trench Safety Systems."
5. Excavate the bottom of the trench to the lines and grades shown on the Drawings with allowance for pipe thickness and bedding.
 - a. Minimum trench widths for pipes for surface water drainage, water, and wastewater shall be as follows:
 - 1) For pipes 15 inches and under, trench width = I.D. + 30 inches. Pipe centered in trench.
 - 2) For pipes 18 inches and over, trench width = (1.5 x I.D.) + 18 inches. Pipe centered in trench.
6. Remove rocks and cobbles larger than 3 inches in maximum dimension from the trench bottom.

7. Where in the opinion of the Project Representative, the undisturbed condition of the trench bottom is not adequate for support of the utility, stabilize the trench bottom as directed. Stabilization may consist of removal and replacement of Unsuitable Material and/or placement of Geotextile – Type A. Payment shall not be made for inadequate foundation conditions that are caused by Contractor's failure to provide adequate protection for trench foundations.
 - a. Trench bottoms scarified by excavation process shall be compacted to minimum density requirements of this section.
8. Place bedding on approved trench bottom to a depth shown on the Drawings.
 - a. Place bedding before pipe or conduit is installed.
 - b. Spread bedding so that the pipe is uniformly supported along the barrel. This includes digging for support of pipe bells.
 - c. Do not use blocking to adjust the pipe to grade.
9. Compact bedding to specified density.
10. After pipe or conduit has been properly laid and inspected, place and compact bedding around pipe to spring line. Bring lifts up together on both sides of pipe or conduit and work the initial backfill under the haunches by means of a shovel, haunch tool, vibration, or other approved method.
 - a. Incorporate landfill gas migration stops as shown on the Drawings.
11. Continue placing bedding to a depth over the pipe shown on the Drawings. Place in lifts not exceeding 8 inches loose depth. Compact with hand held vibratory compactors to the specified density.
12. Subsequent Backfill shall be specified material as shown on the Drawings. Place in a maximum of 8 inch loose lifts and compact to the specified density. Use hand held vibratory compactors for depths less than 2 feet clear over the pipe.
13. Gravel borrow shall be used as Backfill over pipe unless otherwise approved by the Project Representative.
14. On-site excavated materials may be used as Backfill over pipe with the approval of the Project Representative. On-site materials to be used as backfill over pipe shall not have any pieces greater than 4 inches across and no wood or wood waste, organic material, or other deleterious material.
15. Manholes and Catch Basins:
 - a. Manholes, catch basins, and inlets shall be constructed on a compacted or undisturbed level foundation.

- b. During insertion of the tongue or spigot, the units shall be partially supported to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.
 - c. Bedding shall be pipe bedding. A minimum of 6 inches of compacted bedding shall be placed below the structure. Bedding shall extend a minimum 12 inches above the vertical outside edge of the structure base.
 - d. Backfill shall be gravel borrow, installed in accordance with Paragraph 3.02.H of this section.
- I. Disposal of Excess Soil and Waste Materials:
- 1. All excess soil and waste material shall be disposed of off-site at approved disposal sites.

3.03 FIELD QUALITY CONTROL

- A. The Project Representative shall perform field quality control testing and inspections as necessary to ensure that quality requirements are met.
- B. Testing shall include compaction density testing of compacted Subgrade, Fill and Backfill in accordance with ASTM 6938 to ensure compliance with the compaction densities specified herein.
- C. Contractor may independently perform field inspection and testing as a check of the quality of the work.
- D. If field tests indicate work does not meet the specified compaction requirement, remove and replace or recompact.
- E. Frequency of field compaction tests: Owner shall perform field tests as necessary to ensure compliance with this section and not less frequently than indicated in Table 11, below.
 - 1. Coordination and scheduling for testing shall be arranged at the Weekly Construction Meeting.

Table 11
Minimum Frequency of Compaction Testing

Material/Location	Test Frequency	Notes
Embankment	One test every 10,000 square feet per lift	One test per 100 feet for narrow (50 feet or less) strips
Trench Subgrade	One test every 100 feet	At least one test for shorter trenches
Trench Bedding/ Backfill	One test every 100 feet per every second lift	At least one test per every second lift for shorter trenches
Subgrade for Structures	One test every 5,000 square feet per lift	At least one test per lift for smaller structures
Fill/Backfill for Structures	One test every 2,500 square feet per lift	Narrow backfill areas behind walls at every 20 lineal feet per every third lift
Subgrade for Roadways	One test every 100 feet	One additional test in poor subgrade areas
Base Courses for Roadways	One test every 100 feet per lift	At least one test per lift for shorter roadways
Gravel Borrow	One test every 50 feet of wall length per geogrid lift	At least one test per geogrid lift for shorter wall lengths

3.04 PROTECTION

- A. Protect existing and new structures, utilities, pavements, and other facilities from damage caused by compaction, settlement, lateral movement, undermining, washout, and other hazards created by Earthwork operations.

3.05 COMPACTION SCHEDULE

- A. Earthwork material compaction shall meet the following criteria. All compaction densities are based on maximum density as determined by ASTM D1557 (Modified Proctor).
- B. Subgrade of Over-excavation areas: Proof-roll areas; 90% compaction.
- C. Subgrade:
 - 1. 90% for Embankment fill areas and landscape areas.
 - 2. 92% for utility trench.
 - 3. 95% for areas to receive pavement or structures including vaults and utility trenches within 3 feet of final grade.
- D. Embankment: Ninety 90%.

E. Gravel borrow: 95%.

F. Crushed Surfacing Base Course and Top Course: 95%.

G. Utility Trench and Surface Water Vault bedding and Backfill: 92%.

END OF SECTION

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SECTION 31 23 33
TRENCH SAFETY SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes shoring of excavations to protect the Work, existing improvements and to provide safe working conditions in accordance with applicable local, state, and federal safety codes.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this Section.
 - 1. Revised Code of Washington (RCW) Section 39.04.180 Trench Excavations - Safety Systems Required.
 - 2. Washington Industrial Safety and Health Act (WISHA), Chapter 49.17 R.C.W.
 - 3. WAC (Washington Administrative Code) 296-155 Safety Standards for Construction Work

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures:"
 - 1. A written Shoring Plan prepared by a professional engineer licensed in the State of Washington for each location where shoring is required.
 - 2. Submit the Shoring Plan a minimum of 21 days prior to the start of any earthwork operations that will require shoring.

1.04 SYSTEM REQUIREMENTS

- A. All cribbing, sheeting, and shoring shall be designed by a licensed professional engineer and meet the requirements of WAC 296-155.
- B. The sheeting and shoring for trench work shall be in strict conformance with the following:
 - 1. Provide all materials, labor, and equipment necessary to shore trenches to protect the Work, existing property, utilities, pavement, and other improvements.
 - 2. Provide safe working conditions in the trench.
 - 3. Contractor may elect to use any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method of accomplishing the Work consistent with applicable local, State, and Federal safety codes.

4. If workers enter any trench or other excavation 4 feet or more in depth that does not meet the requirements for an open pit, it shall be shored.
 5. The Contractor alone shall be responsible for worker safety.
 6. Upon completion of the Work, remove all shoring, unless designated to remain in place.
 7. Shoring to be removed, or moveable trench shields or boxes, shall be located at least 2.5 pipe diameters away from metal or thermoplastic pipe if the bottom of the shoring, shield, or box extends below the top of the pipe, unless a satisfactory means of reconsolidating the bedding or side support material disturbed by the shoring removal can be demonstrated.
 8. Damage resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.
- C. The Contractor is responsible for meeting all of the appropriate Federal, State and local restrictions when operating in the trench or other on-site excavation.

1.05 MEASUREMENT AND PAYMENT

- A. No unit of measurement shall apply to the lump sum price for "Excavation Support and Shoring."
- B. The lump sum price for Cost Item No. 33 - Trench Excavation Safety System Construction shall be full pay for all work as specified including, but not limited to, all labor, material, incidentals, tools, and equipment necessary to satisfactorily complete the work and ensure worker safety as defined in the Contract Documents and in accordance with Chapter 39.04.180 and 49.17 RCW

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

- A. All trenches and excavations more than 4 feet in depth shall be shored or laid back in compliance with applicable Federal and State regulations.
 1. The requirements of the Occupational Safety and Health Act (OSHA) and the Washington Industrial Safety and Health Act of 1973 (WISHA) shall apply to all excavation, trenching, and ditching operations on this project.
- B. Shoring shall be required in all road and street excavation.
- C. Sloping to the angle of repose will be permitted only in non-critical off-street areas.
- D. Providing sheeting, shoring, cribbing, cofferdams, and all aspects involved therein shall be the sole responsibility of the Contractor.

- E. Trench and excavation protection shall comply with the requirements of Chapter 49.17 RCW of the Washington Safety and Health Act, and Part N - Excavation, Trenching, and Shoring of chapter 296-155 WAC.
- F. Install and maintain sheeting, shoring, cribbing, cofferdams, and sloping necessary to support the sides of any excavation to prevent any movement that may damage adjacent facilities, delay the work, or endanger life and health.
- G. The method of shoring shall be according to the Contractor's Shoring Plan.
- H. The design, planning, installation and removal, if required, of sheeting and bracing shall be accomplished in such a manner as to maintain the required excavation or trench section and to maintain the undisturbed state of soils below and adjacent to the excavation.
- I. Use any combination of shoring and over-excavation, tunneling, boring, sliding trench shield, or other method allowed by the applicable local, state, and federal safety codes.
- J. Damages resulting from improper support or from failure to support excavations shall be the sole responsibility of the Contractor.
- K. In trenching operations, the use of horizontal strutting below the barrel of pipe or the use of pipe as support for trench bracing will not be permitted.
- L. Sheet piling and timbers in trench excavations shall be withdrawn in a manner so as to prevent subsequent settlement of the pipe or additional backfill loading that might overload the pipe.
- M. That portion of cribbing or sheeting extending below the spring line of pipe, shall be left in place unless satisfactory means of reconsolidating bedding or side support, disturbed by cribbing or sheeting removal, can be demonstrated.
- N. If a movable trench box is used in lieu of cribbing or sheeting, and the bottom cannot be kept above the spring line of the pipe, the bedding or side support shall be carefully reconsolidated behind the movable box prior to placing initial backfill.
- O. When the construction sequence of structures requires the transfer of bracing to the completed portions of any structure, secure written approval of the Project Representative prior to the installation of such bracing.
- P. Where removal of sheeting would result in damage to adjacent utilities or other property, the Project Representative may order all or a portion of sheeting to be cut off and left in place.
- Q. Do not use the pipe or vault as support for trench bracing.
- R. Damages resulting from improper shoring and failure to shore shall be the sole responsibility of the Contractor.

END OF SECTION

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SECTION 31 24 00 GEOSYNTHETICS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Geotextile for material separation and soil reinforcement.
2. Geotextile drainage mat for drainage at structures.
3. Geogrid for soil reinforcement.
4. Geomembrane for pond lining.
5. Geocells for flexible porous pavement.

1.02 REFERENCES

A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section.

B. ASTM International (ASTM) www.astm.org.

1. ASTM D751 – Standard Test Methods for Coated Fabrics.
2. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
3. ASTM D882 – Test Method for Tensile Properties of Thin Plastic Sheeting.
4. ASTM D1004 – Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
5. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
6. ASTM D1790 – Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact.
7. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
8. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
9. ASTM D4533 – Standard Test Method for Trapezoidal Tearing Strength of Geotextiles.
10. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

11. ASTM D4716 – Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 12. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 13. ASTM D5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
 14. ASTM D5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
 15. ASTM D6241 – Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
- C. Geosynthetics Research Institute (GRI)-GG4 – Determination of the Long-Term Design Strength of Geogrids.
- D. Polyvinyl Chloride (PVC) Geomembrane Institute (PGI) 1104 Specification Revision 1.
- E. Washington State Department of Transportation (WSDOT) Qualified Products List, Appendix D – Geosynthetic Retaining Walls.

1.03 DEFINITIONS AND ACRONYMS

- A. MARV: Minimum average roll value.
- B. HDPE: High-density polyethylene.
- C. PVC: Polyvinyl chloride.
- D. TESC: Temporary erosion and sediment control.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
1. Manufacturer's material specifications, product literature, and material sample not less than 6 inches square, including accessory items and fasteners.
 2. Manufacturer's Instructions for storage, handling, installation, seaming, and repair of proposed materials.
- C. Quality Assurance Submittals:
1. Submit Manufacturer's source quality control test results and written certification that the material meets the requirements of this section, prior to shipping materials to the Project Site.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect geosynthetics in accordance with Section 01 60 00, "Product Requirements."
- B. Supply geotextiles, geotextile drainage mat, and geogrid in rolls wrapped in impermeable and opaque protective covers. Mark or tag each roll with the following information:
 - 1. Manufacturer's name.
 - 2. Product identification.
 - 3. Lot number.
 - 4. Roll dimensions.
- C. Supply geomembrane in panels, accordion folded on pallets, wrapped in impermeable and opaque protective covers. Mark or tag each panel with the following information:
 - 1. Manufacturer's name.
 - 2. Product identification.
 - 3. Lot number.
 - 4. Panel Number.
 - 5. Panel dimensions.
- D. During shipment and storage, protect geosynthetics from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions.
- E. Handle materials in such a manner as to ensure they are not damaged in any way.
- F. The materials shall be stored above the ground surface and beneath a roof or other protective covering.
- G. Immediately repair any damaged protective covering.

PART 2 – PRODUCTS

2.01 GEOTEXTILES

- A. Type A shall be a woven geotextile for separation and soil reinforcement.
- B. Type B shall be a non-woven geotextile for underground drainage.
- C. Geotextiles shall be pervious sheets of polymeric fabric consisting of at least 95% by weight of polyolefins and polyesters.

- D. Geotextiles shall be composed of continuous stable fibers that retain their relative position with respect to each other.
- E. Geotextiles properties shall conform to the minimum average roll values (MARV) in Table 1.

Table 1
Geotextile Requirements

Property	Unit	Type A	Type B	Test Method
Apparent Opening Size	U.S. Sieve	#40 max	#40 max	ASTM D4751
Water Permittivity	sec ⁻¹	0.1 min	0.5 min	ASTM D4491
Grab Strength	lb	315	160	ASTM D4632
Tear Strength	lb	112	50	ASTM D4533
Puncture Resistance	lb	620	310	ASTM D6241
UV Resistance (500 hours)	% Strength Retained	50	50	ASTM D4355

2.02 GEOTEXTILE DRAINAGE MAT

- A. Geotextile drainage mat, or geocomposite, shall consist of a high-density polyethylene (HDPE) core drainage net with a geotextile filter bonded to one side.
- B. Geotextile drainage mat properties shall conform to the minimum average roll values (MARV) in Table 2.

Table 2
Geotextile Drainage Mat Requirements

Property	Unit	Requirement	Test Method
Geotextile Properties			
Apparent Opening Size	U.S. Sieve	#60 max	ASTM D4751
Water Permittivity	sec ⁻¹	0.4 min	ASTM D4491
Grab Strength	lb	100	ASTM D4632
Core Properties			
Width Thickness	in	0.4	ASTM D5199
Compressive Strength at Yield	psi	100	ASTM D1621
In Plane Flow Rate	gal/min/ft		ASTM D4716
Gradient = 0.1, Pressure = 5.5 psi		5.0	
Gradient = 1.0, Pressure = 14.5 psi		15.0	

C. Manufacturers:

1. Mirafi G100W.
2. Or Approved Equal.

2.03 GEOGRID FOR SOIL REINFORCEMENT

- A. Geogrid shall consist of a regular network integrally connected polymer tensile elements with an aperture geometry sufficient to permit mechanical interlock with the surrounding backfill. The long chain polymers in the tensile elements of the geogrid, not including coatings, shall consist of at least 95% by weight of polyolefins and polyesters.
- B. Geogrid long term tensile strength in the direction of maximum load carrying capacity shall conform to the minimum average roll value (MARV) of 1,000 pounds per foot.
- C. Acceptable products shall be products meeting the above requirements, as documented in the WSDOT Qualified Products List, Appendix D – Geosynthetic Retaining Walls.

2.04 GEOMEMBRANE

- A. Geomembrane shall consist of a PVC geomembrane, 20 mils thick. All PVC geomembrane shall be from the same Manufacturer, Fabricator, and lot.
- B. Geomembrane shall conform to the requirements of PGI 1104 and in particular shall have the minimum properties shown in Table 3.

Table 3
PVC Geomembrane Requirements

Property	Unit	Requirement	Test Method
Thickness	mil	20±1.5	ASTM D5199
Specific Gravity	g/cc	1.2	ASTM D792
Tensile Strength at Break	lb/in	48	ASTM D882 (Method A)
Elongation at Break	%	360	ASTM D882 (Method A)
Tear Strength	lb	6	ASTM D1004
Hydrostatic Resistance	psi	68	ASTM D751 (Procedure A)
Low Temperature Impact	Degrees F	-15	ASTM D1790

- C. Welding solvent shall be in accordance with Manufacturer's recommendations.

2.05 SOURCE QUALITY CONTROL

A. By Manufacturer:

1. Test geotextiles, geotextile drainage mat, and geogrid at a minimum, once per lot or once per every one-hundred-thousand (100,000) square feet (which ever results in the greater number of tests) to verify that the geosynthetics meets the material specifications stated herein.
2. Test geomembrane at a minimum, once per lot or once per every 10,000 pounds (which ever results in the greater number of tests) to verify that the geosynthetics meets the material specifications stated herein

B. Reject rolls or Panels from which samples do not satisfy this section.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Prepare surfaces to receive geosynthetics to ensure they are free of irregularities, protrusions, loose soil, and abrupt changes.
- B. Inspect the prepared surfaces to receive geosynthetics to ascertain suitability for installation in compliance with the Manufacturer's written installation instructions and warranty.
- C. Inspect geosynthetics for defects such as rips, holes, deterioration, or other damage. Any material found defective shall be rejected.
- D. Remove sharp stones or other objects from prepared surface that may damage the geosynthetics.
- E. Remove soft areas of Subgrade. Backfill under the provisions of Section 31 23 00, "Earthwork."
- F. Regrade as required to eliminate ruts in the Subgrade.

3.02 INSTALLATION

- A. Install geotextile associated with temporary erosion and sedimentation control (TESC) in accordance with the requirements of Section 31 25 00, "Erosion and Sedimentation Controls."
- B. Geotextile Installation:
 1. Place geotextile at locations as shown on the Drawings.
 2. Roll out geotextile in a manner to keep the geotextile in sufficient tension to preclude folds and wrinkles.
 3. Temporarily anchor edges using sandbags as necessary to keep material in place until first lift of material is placed.

4. On slopes greater than 5 horizontal to 1 vertical, place geotextile with the long dimension perpendicular to the slope.
5. Overlap panels a minimum 24 inches or in accordance with the Manufacturer's recommended minimum lap distance, whichever is greater.
6. Place the first lift of material by end-dumping and spreading with low ground pressure tracked or rubber-tired equipment.
 - a. The minimum lift thickness for the first lift shall be 12 inches.
 - b. Equipment shall not operate over geotextile with less than 12 inches of cover.

C. Geotextile Drainage Mat Installation:

1. Place geotextile drainage mat against retaining walls as shown on the Drawings fully lapping the foundation and/or underdrain.
2. Install geotextile drainage mat in accordance with Manufacturer's written installation recommendations and instructions.
3. For application to concrete wall, place geotextile drainage mat against retaining wall with contact adhesive or double sided tape sufficient to hold in place while soil is being placed.
 - a. The core shall be in contact with the wall, with the geotextile between the core and soil to be placed.
4. For application to wall timber lagging, place geotextile drainage mat against lagging with staples or tacks sufficient to hold in place while concrete wall is being poured.
 - a. The geotextile shall be in contact with the laggings, with the core between the geotextile and concrete.
 - b. A plastic sheet shall be used to separate the core from the concrete pour to prevent intrusion of concrete into the geotextile drainage mat.
5. Lap sections of geotextile drainage mat by overlapping dimples of the upper panel onto the dimples of the lower panel a minimum of two (2) inches.
6. Seal the geotextile with liquid adhesive or duct tape.
7. Seal all exposed edges from soil infiltration with pieces of geotextile.
8. Geotextile drainage mat damaged during installation or soil placement shall be cut out and replaced with a new piece providing overlap on all sides.
9. Place Fill, Backfill, or concrete within 2 weeks of material installation. Geotextile drainage mat shall not remain exposed for a prolonged period to minimize material deterioration.

D. Geogrid Installation for Soil Stabilization:

1. Place geogrid at the locations and to the lines and grades as shown on the Drawings.
2. Install geogrid in accordance with Manufacturer's written installation recommendations and instructions.
3. Geogrid shall be placed with the machine direction (long dimension) down slope.
4. Geogrid shall be installed smooth and free of tension, stress, folds, wrinkles, or creases.
5. Geogrid shall be connected/spliced as required by the manufacturer's recommendations.
6. Place the first lift of material by end-dumping and spreading with low ground pressure tracked or rubber-tired equipment.
 - a. The minimum lift thickness for the first lift shall be 12 inches.
 - b. Equipment shall not operate over geogrid with less than 12 inches of cover.

E. Geomembrane Installation:

1. Place geomembrane at the locations and to the lines and grades as shown on the Drawings
2. Install geomembrane in accordance with Manufacturer's written installation recommendations and instructions.
3. Reposition geomembranes after deployment to remove wrinkles.
4. Each pond or pretreatment cell shall utilize a continuous/seamless panel of geomembrane.
5. All exposed geomembrane shall be weighted against wind uplift with sandbags or equivalent as required to maintain it in the correct location.

F. Geocell Installation for Flexible Porous Pavement:

1. Place geocells at the locations and to the lines and grades as shown on the Drawings.
2. Install geocells in accordance with Manufacturer's written installation recommendations and instructions.

3.03 REPAIR

A. Geotextile:

1. Repair holes or tears in the geotextile immediately per the Manufacturer's instructions.
2. At a minimum, repair by overlaying an additional geotextile layer, providing a two (2) foot minimum overlap from the damaged area.

B. Geotextile Drainage Mat:

1. Replace damaged portion in accordance with the Manufacturer's instructions.
2. At a minimum:
 - a. Remove damaged core material.
 - b. Replace damaged core material with core material, meeting the requirements of this section, creating a flush surface with the existing core material.
 - c. Repair geotextile in accordance with Paragraph 3.03.A.

C. Geogrid:

1. Remove damaged geogrid and replace with geogrid meeting the requirements of this section.
2. Replace damaged portion in accordance with the Manufacturer's instructions.

D. Geomembrane:

1. Remove damaged geomembrane and replace with geomembrane meeting the requirements of this section.
2. Repair Subgrade in accordance with Paragraph 3.01 of this section.
3. Cut a patch of intact geomembrane that extends at least 6 inches beyond the edge of the damaged area in all directions.
4. Clean and dry the repair seam area and patch with a solvent weld, in place, as described below.
 - a. Seaming shall not be performed when ambient temperatures are below 40°F or above 100°F as measured 6 inches above the surface of the geomembrane, or outside the temperature limits recommended by the geomembrane Manufacturer or Fabricator, whichever is more stringent.
 - b. Solvent Welding: Seam in accordance with the Manufacturer's and Fabricator's recommendations to form a continuous and uniform seam free of gaps or any other discontinuities. The solvent welded area shall be a minimum of 2 inches wide at all locations. The surfaces shall be pressed together and rolled so that the adhesive is forced toward the leading edge.
 - c. Wrinkles, fishmouths, and other imperfections in the seam shall be removed or repaired.

3.04 PROTECTION

- A. Place subsequent Fill and Backfill materials and install adjacent materials to ensure:
 - 1. No damage to the geosynthetics.
 - 2. Minimal slippage of the geosynthetics on underlying layers.
 - 3. No excess tensile stresses in the geosynthetics.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Providing, installing, operating, maintaining and removing the temporary erosion and sediment control (TESC) system.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section.
- B. ANSI/NSF Standard 60 Drinking Water Treatment Chemicals-Health Effects.
- C. ASTM International (ASTM) – www.astm.org:
1. ASTM D586 Standard Test Method for Ash in Pulp, Paper, and Paper Products.
 2. ASTM D4355-07 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
 3. ASTM D4397-08 Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
 4. ASTM D4491-99a(2004)e1 Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 5. ASTM D4533-04 Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 6. ASTM D4632-08 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 7. ASTM D4751-04 Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 8. ASTM D5035 - 06(2008)e1 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method).
 9. ASTM D6475 - 06 Standard Test Method for Measuring Mass Per Unit Area of Erosion Control Blankets.
 10. ASTM E1745 - 09 Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- D. Kitsap County Stormwater Design Manual. 2021.
- E. American Public Health Association/American Water Works Association. Standard Methods for the Examination of Water and Wastewater (21st Edition). 2005.

F. State of Washington:

1. State of Washington Department of Agriculture "Rules for Seed Certification," latest edition.
2. Washington Administrative Code (WAC): WAC-173-201A, Water Quality Standards for Surface Waters of the State of Washington.
3. Washington State Department of Ecology. Construction Stormwater General Permit.
4. Washington State Department of Ecology. Stormwater Management Manual for Western Washington. 2024.

1.03 DEFINITIONS AND ACRONYMS

- A. BMP: Best management practice.
- B. CESC: Contractor's Erosion and Sediment Control Plan.
- C. Clean Surface Water: Refer to Section 01 50 00, "Temporary Facilities and Controls."
- D. Construction Runoff: That portion of the water from or flowing through areas disturbed by construction that is not Contaminated Surface and Ground Water.
- E. Contaminated Sediment: Refer to Section 01 50 00, "Temporary Facilities and Controls."
- F. Contaminated Surface and Ground Water: Refer to Section 01 50 00, "Temporary Facilities and Controls."
- G. PAM: Polyacrylamide.
- H. Sediment Laden Surface Water: Refer to Section 01 50 00, "Temporary Facilities and Controls."
- I. SCTP: Stormwater Chemical Treatment Plan.
- J. SWPPP: Stormwater Pollution Prevention Plan.
- K. Wastewater: Refer to Section 01 50 00, "Temporary Facilities and Controls."

1.04 GENERAL REQUIREMENTS

- A. Work of this section includes, but is not limited to:
 1. Plans to be prepared and implemented by Contractor, including:
 - a. Contractor's Erosion and Sediment Control Plan (CESCP).
 2. Orange safety fence.
 3. Stabilized construction entrances.
 4. Temporary tire wash.

5. Street cleaning.
6. Dust control measures.
7. Erosion control matting.
8. Polyacrylamide (PAM) for erosion control.
9. Hydroseed and mulch for erosion control.
10. Wood cellulose fiber, straw mulch covers, and other soil stabilizers.
11. Temporary plastic cover.
12. Temporary slope treatment.
13. Sod and liners for drainage ditches.
14. Protection of stockpiles.
15. Temporary silt fence.
16. Temporary perimeter berms.
17. Check dams.
18. Wattles.
19. Catch basin inserts.
20. Water quality monitoring.
21. Control of stormwater runoff from RAGF operating area during the Contract period.
22. Temporary surface water storage facilities include ponds and portable storage tanks.
23. Water quality treatment system.
24. Pumping for stormwater management during construction.
25. Temporary conveyance including temporary storm drains, culverts, slope drains and ditches.
26. Temporary catch basins.
27. Temporary plug valves.
28. Temporary curbs.
29. Temporarily modifying drainage systems and controls during construction.
30. Off-site disposal of Construction Runoff.

1.05 SYSTEM DESCRIPTION

- A. TESC System: The TESC System consists of the operational and structural best management practices (BMPs) to be used to prevent Sediment Laden Surface Water from leaving the Project Site and to control the release of Construction Runoff from the Project Site.
- B. Temporary Surface Water Storage Facilities: The storage system for Construction Runoff shall, at a minimum, be capable of detaining the runoff associated with the 10 year storm event determined using the methodology described in this section. The storage system shall consist of ponds, portable tanks, vaults, or a combination thereof. The storage system shall remain operational throughout the Contract.
- C. Temporary Water Quality Treatment System: A Contractor-designed system for treating the turbidity and pH of Sediment Laden Surface Water to meet State water quality standards and the requirements of the NPDES Construction Stormwater General Permit, as defined below, prior to discharging from the Project Site.
- D. The permanent stormwater detention and water quality ponds shall be used for managing Construction Runoff. When the Contractor utilizes these ponds for managing Construction Runoff the Contractor will be responsible for ensuring that all water passing through the ponds will meet the requirements for water quality and flow control specified in this section.
- E. The Project Site will have temporary erosion and sedimentation control BMPs in place at the start of construction. For proposal purposes, the Contractor shall assume all of the BMPs shown on the project TESC Plans may need to be upgraded, renewed, or replaced to meet Contractor's assessed need for BMPs as one of the first work items.

1.06 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Provide Manufacturer's certificate of compliance, certified laboratory test reports, catalog cuts, samples, and other information providing adequate description of the following supplies and materials proposed for TESC applications:
 - a. Erosion control matting.
 - b. PAM for erosion control.
 - c. Hydroseed and fertilizer used for erosion control seeding.
 - d. Materials used for temporary soil stabilization (hydraulic mulches, tackifiers, soil binders, bonded fiber matrices, straw mulch, and wood chips).
 - e. Temporary plastic cover.
 - f. Temporary silt fence.

- g. Prefabricated check dams.
 - h. Prefabricated wattles.
 - i. Catch basin inserts.
 - j. Sod for temporary ditches.
 - k. Liners for temporary sediment ponds and traps.
 - l. Products used for temporary storm drain or culverts.
 - m. Precast concrete drainage products used for TESC.
 - n. Geo-textile/geosynthetic products used for erosion and sediment control.
2. CESC:
- a. Submit CESC as specified herein, within 21 calendar days following Notice to Proceed.
 - b. Provide updated CESC to the Project Representative as required to reflect changes and progress in the Work or as required by the Washington State Department of Ecology.
 - c. A preliminary erosion and sediment control plan was developed by Owner to obtain permits. Submit a more detailed CESC to the Project Representative and obtain the Project Representative's review and comment on the plan prior to implementing the plan.
 - d. The CESC shall be developed for construction activities required by this Contract, and include a detailed description of the methods, sequencing, proposed types, and quantities of materials to control erosion and provide for sedimentation. The CESC shall include a schedule of implementation, inspection, and removals of erosion and sediment control measures in accordance with the Specifications.
 - e. The CESC shall be prepared to fulfill the requirements of a project-specific Stormwater Pollution Prevention Plan (SWPPP) (as defined by the project's Construction Stormwater General Permit) and of a Construction Stormwater Pollution Prevention Plan as defined in Volume 1 Chapter 4.2.2 of the 2021 Kitsap County Stormwater Design Manual.
 - f. The CESC submittal shall address or include, but not be limited to:
 - 1) A written narrative, plan sheets, details, and notes that describe the locations and types of all Best Management Practices (BMPs) proposed by the Contractor related to erosion and sediment control, temporary dewatering, on-site water management, and temporary conveyance including the following:
 - a) Identifying staging, storage, stockpiling, work limits, and other construction-related areas; areas beyond the Project Site including laydown areas; transportation facilities including construction traffic routes and access/exit control areas on and off the Project Site.

- b) The existing drainage system of all construction areas including laydown areas. This includes inlets, catch basins, ditches, storm drains and other drainage facilities.
- c) Describe with drawings of sufficient scale and detail the Project Site and the locations and types of temporary erosion and sediment controls, temporary conveyances, and storage facilities for Sediment Laden Surface Water from construction areas.
- d) Describe cover methods to protect erosion throughout the different phases of work.
 - i) Plastic cover is the preferred method for covering temporary stockpiles of materials that will be placed on the Project Site permanently. In limited areas, erosion control seeding will be required per the Drawings. Straw mulch cover, erosion control matting, and/or PAM can be used in limited areas as an interim cover measure.
- e) Describe how areas beyond work limits will be identified and protected.
- f) Provide information and drawings describing methods for managing runoff from the existing transfer station facility where it has the potential to enter construction areas.
- g) Describe the details and continuing maintenance of entrance and exit entrances and temporary tire wash areas.
- h) Show locations (with cross-sections as applicable) and describe existing and proposed ditches, berms, culverts, pipes, sediment basins, storage ponds/tanks, basin outfalls, scour controls, inlets, catch basins, drains, bypasses, subsurface drains and related features.
- i) Calculations for the storage and treatment system to be provided on-site. This system shall be sized to accommodate the 10-year storm event of 1-hour to 72-hour duration (see paragraph 2.02 in this section). The size of the storage and treatment system can account for the outflows from the system based on the design discharge rate proposed by the Contractor in this section.
- j) The design flow rates and storage volumes for each proposed storage and treatment location.
- k) The treatment methods that shall be used to control the pH of and remove the suspended sediment from Sediment Laden Surface Water prior to discharge from the site. This shall include a discussion of the chemical treatment methods that will be used if the pH or settleable solids content exceeds the prescribed limits at the site outfall.
- l) BMPs and construction methods that will be used on-site to reduce the amount of runoff generated from construction activities.

- m) If hauling is a proposed method of disposing of Construction Runoff, then the following information shall be included in the CESC:
 - i) The proposed haul rate from the project site. The design haul rate shall account for water testing requirements, other permit requirements, and travel time.
 - ii) The proposed hauling routes to the approved discharge locations.
 - iii) The methods of designating areas exclusively for tanker truck use at the approved discharge locations.
 - iv) The type, size, and number of tanker trucks that will be solely dedicated for hauling Construction Runoff for the duration of construction. These vehicles shall be kept on-site or at nearby site when not actively hauling construction runoff.
 - v) The type, size, and number of additional tanker trucks and equipment that will be available for hauling Construction Runoff for the duration of construction in the event that additional resources are needed for hauling and disposal of water.
 - vi) The names of all drivers for tanker trucks and the procedure by which drivers will be contacted during rainfall events requiring immediate off-site disposal of Construction Runoff. Procedures shall require drivers to be responsive to contacts 24 hours a day, 7 days a week.
 - n) Contingency measures that will be in place to deal with accumulated Construction Runoff from rainfall events exceeding the design storm events.
 - o) Provide calculations for determining the size of conveyance piping and pumps that will be used to convey Construction Runoff to the temporary storage tanks, ponds, vaults, and other locations, if applicable. Design calculations shall be prepared and signed by a Professional Engineer with expertise in drainage design and who is licensed in the State of Washington.
 - p) Describe covering practices for muck, refuse, burn fill, and related deposits.
 - q) Describe covering practices for stockpiles.
 - r) Describe the controls to prevent sediment, debris, and other pollutants from entering surface waters and drainage features.
 - s) Provisions for meeting overall allowable release rate to Stream E from the Project Site.
- 2) Detailed plans for implementing control of Construction Runoff during emergency situations. Emergency situations include, but are not limited to extreme or unseasonable weather conditions, equipment failure, failure of conveyance system, power outage, and human error. The plan shall clearly describe which materials and equipment will be maintained in good working order on site in order to convey, store, treat, haul, and dispose of Construction

Runoff during emergency situations. Contractor is required to stage these materials and equipment on-site throughout the duration of work to allow a prompt response to any emergency situation. At a minimum, the emergency plan will entail the following elements to prevent Construction Runoff from leaving the project site:

- a) Procedures to protect disturbed areas from erosion and to reduce the amount of runoff when extreme or hazardous weather conditions are forecast by the National Weather Service.
 - b) The necessary truck and trailer equipment for hauling collected Construction Runoff to an approved disposal location or other means of disposing of water that exceeds the design capacity of the water quality treatment system.
 - c) Pump systems for pumping to supplemental storage areas, a dispersion system or, if hauling is proposed, directly to haul vehicles.
- 3) The name of the Contractor's appointed On-Site Erosion and Sediment Control Lead (ESC Lead), qualifications, experience, and certifications directly related to temporary erosion and sediment control, and other information as the Contract and the Work may require, including how to contact in a timely manner.
- a) At a minimum, the ESC Lead must meet the standards for a Certified Erosion and Sediment Control Lead that are set by the Washington State Department of Ecology (Ecology).
 - b) If the Work is of such a magnitude that it requires additional help, describe the qualifications of additional help, any on-site training that may be necessary, and frequency and type of reporting to the ESC Lead.
- 4) Schedule of typical inspections ensuring timely maintenance and repair.
- 5) Identify and provide timelines for submitting any additional required permits or related documentation.
- 6) A project-specific Stormwater Chemical Treatment Plan (SCTP) shall be prepared to cover any proposed water treatment method that utilizes chemical dosing and/or pressure filtration prior to discharge to receiving water bodies. The SCTP shall include the following elements at a minimum:
- a) Project Site information pertinent to the design of collection and treatment components of the chemical treatment system.
 - b) Chemical treatment system design and layout.
 - c) Information on the minimum required storage volumes and treatment flow rates have been included in the Drawings.
 - d) The system shall incorporate the storage pond and pre-treatment cells locations and sizes as shown in the Drawings at a minimum.

- e) The chemical treatment system design and layout shall include the following information:
 - i) The size of the storage pond and pre-treatment cells to hold water requiring treatment.
 - ii) Pipe and pump sizing associated with the chemical treatment system.
 - iii) Sand filter sizing and treatment rate calculations.
 - iv) Backwash design.
 - v) pH adjustment methodology (if applicable).
- f) Chemical treatment system operation, maintenance, and contingency plans.
- g) Special procedures for operation during cold weather (daily high temperature below 35°F).
- h) Step-by-step procedures if influent pH requires adjustment prior to treatment by the chemical treatment system.
- i) Step-by-step procedures that describe actions to be taken when pH or turbidity of the effluent is outside dischargeable limits.
- j) Alternative strategies in the event the system becomes inoperable.
- k) On-site requirements to allow proper functioning of the chemical treatment system, which could include:
 - i) Limiting use of PAM or other polymers on-site that could interfere with proper operation of the chemical treatment system.
 - ii) Methods to limit Construction Runoff such that incoming flows to the chemical treatment collection and storage system are within functional limits of the system.
 - iii) Supplementing system with additional storage such as portable tanks.
- l) Flow and water quality monitoring and reporting.
- m) Operator training.
- n) Calibration of instruments.
- g. Contractor shall maintain available copies of the current CESC on the Project Site. The current CESC, and permits, letters, inspection forms, and water quality monitoring logs required under the project's Construction Stormwater General Permit from the Washington State Department of Ecology shall be kept together on-site.
- h. The Project Representative's review and any comments of the CESC will be only regarding conformance with the requirements of this section. Contractor is solely responsible for the completeness and adequacy of the CESC.

C. Quality Assurance Submittals:

1. Evidence of professional registration of Professional Engineer who prepares the CЕСP.

1.07 QUALITY ASSURANCE

A. Comply with the requirements of this section and any other applicable federal, state, and Owner permits, licenses, and authorizations including:

1. Kitsap County Stormwater Design Manual 2021.
2. Washington State Department of Ecology Construction Stormwater General Permit.
3. Washington State Department of Fish and Wildlife's Hydraulic Permit Approval.
4. Washington Administrative Code (WAC).

B. The Contractor shall be responsible for implementing the CЕСP and for fulfilling the objectives stated in the Construction Stormwater General Permit issued by the Washington State Department of Ecology.

C. All Contractor changes to the temporary and/or permanent ESC features shall be reviewed by the Project Representative prior to implementation, and must thereafter be reflected in the CЕСP used for compliance on-site.

D. The Project Representative may request changes to these Plans.

1. Contractor shall implement these changes without delay.

E. Substantial penalties may be levied by the Washington State Department of Ecology for failure by the Owner to implement the provision of the Washington State Department of Ecology Construction Stormwater General Permit.

1. Fines up to \$10,000.00 per day can be levied for infractions.
2. Any such fines or penalties incurred by the Owner, as permittee, which are due to the actions or lack thereof by the Contractor, shall be deducted from the Contract payments.
3. Any deductions from Contract payments will be made at the time of the next progress payment.

F. Performance Requirements: ESC features shall be provided and maintained to ensure that discharges from the site comply with project's Construction NPDES permit and Washington State water quality standards identified in WAC 173-201A.

1. The water quality standards for any Construction Runoff that is discharged from the Project Site are:
 - a. The turbidity of project discharges to off-site watercourses shall not exceed 25 NTU.

- b. There shall be no visible sheen of petroleum product on the receiving waters as a result of this Project.
 - c. The pH of discharges shall be between 6.5 and 8.5. A change of no more than 0.5 units in the receiving body shall result from project discharges.
 - d. Washington State Department of Ecology Construction Stormwater General Permit standards.
2. Concentrated flow discharges from the site into Strawberry Creek shall meet the following:
- a. If the release rate requirements for the Project Site cannot be met with on-site storage, then the Contractor shall be required to haul Construction Runoff to an off-site discharge location for which the Contractor has obtained all of the necessary approvals. This hauling work and any related operational costs shall be incurred at the Contractor's own expense.
 - b. During periods of dry weather, the Contractor shall release water from storage vaults, tanks, and ponds in a controlled manner to ensure that the maximum storage volume is available for Construction Runoff prior to the onset of a storm event.
 - c. It is expected that Construction Runoff will be managed in such a manner that typical releases from the Project Site are well below the allowed peak discharges
- G. In addition to the Water Quality Monitoring to be performed by the Contractor in accordance with paragraph 3.03, the Project Representative will perform periodic water quality monitoring to provide quality assurance of Contractor's work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00, "Product Requirements."
- B. All chemicals shall be stored and handled in accordance with manufacturer's recommendations and relevant material safety data sheets.
- C. Storage of chemicals used for erosion control or water treatment shall be provided within lockable covered containers unless authorized otherwise by the Project Representative.
 - 1. These chemicals include but are not limited to tire wash chemicals, polyacrylamide, coagulants for enhancing settlement, CO2 for pH control, and soil stabilization chemicals.

1.09 SEQUENCING

- A. Refer to Drawing C038 for a suggested construction sequence.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Orange Safety Fence:

1. Fence: Fence material shall be Tenax Beacon Safety fence or approved equal.
2. Posts: 2 inch by 2 inch wood posts, standard or better, or metal fence posts.

B. Stabilized Construction Entrance:

1. Geotextile shall be construction geotextile for soil stabilization meeting the specifications in the following table.

Geotextile Property	ASTM Test Method	Geotextile Property Requirements			
		Separation		Soil Stabilization	
		Woven	Nonwoven	Woven	Nonwoven
AOS	D 4751	U.S. No. 30 max.		U.S. No. 40 max.	
Water Permittivity	D 4491	0.02 sec ² min.		0.10 sec ² min	
Grab Tensile Strength, in machine and x-machine direction	D 4632	250 lb min.	160 lb min.	315 lb min.	200 lb min.
Grab Failure Strain, in machine and x-machine direction	D 4632	< 50%	≥ 50%	< 50%	≥ 50%
Seam Breaking Strength	D 4632	220 lb min.	140 lb min.	270 lb min.	180 lb min.
Puncture Resistance	D 6241	495 lb min.	310 lb min.	620 lb min.	430 lb min.
Tear Strength, in machine and x-machine direction	D 4533	80 lb min.	50 lb min.	112 lb min.	79 lb min.
Ultraviolet (UV) Radiation Stability	D 4355-07	50% strength retained min., after 500 hours in xenon arc device			

2. Bedding shall consist of crushed surfacing top course as specified in Section 31 23 00, "Earthwork."
3. Top course shall consist of quarry spalls as specified in Section 31 23 00, "Earthwork."

C. Erosion Control Matting:

1. Erosion control matting shall consist of a 100% coconut fiber matrix covered on the top and bottom with 100% biodegradable woven, natural, organic fiber netting.
2. The blanket shall be sewn together on 1.50 inch centers with biodegradable material.
3. The mass per unit area of the matting shall be at least 8 oz. per sq. yd. (ASTM D6475).
4. The minimum tensile strength in the machine direction shall be 100 lb/ft based on the minimum average roll value (ASTM D5035/ECTC).
5. The coconut fiber matting (coir) may be obtained from North American Green, 14649 Highway 41 North, Evansville, IN 47725, phone (800) 772-2040 or Approved Equal.
6. Stakes shall be used to secure the coconut fiber matting.

- a. The stakes shall be a minimum 15 inches long, cut from new, sound, untreated 2 inch x 4 inch timbers.
- b. One end of the stake shall be cut diagonally, beginning 1/8 inch to 1/4 inch from the edge, so that each stake has a 1/8-inch to 1/4-inch tip.
- c. Each stake shall have a nail placed on both sides approximately 1/2 inch from the top to secure matting.

D. PAM for Erosion Control:

1. Polyacrylamide (PAM) products shall meet ANSI/NSF Standard 60 for drinking water treatment with an acrylamide (AMD) content not to exceed 0.05%.
2. PAM shall be anionic and shall be linear, and not cross-linked. The minimum average molecular weight shall be greater than 5 Mg/mole.
3. The product shall contain at least 80% active ingredients and have a moisture content not exceeding 10% by weight.
4. Purchase drinking water grade PAM from reputable agricultural and drinking water chemical suppliers.
5. Manufacturer's include:
 - a. Applied Polymer Systems, Inc. – Woodstock, GA.
 - b. Agrivestment, Ltd. – Tacoma, WA.
 - c. Or Approved Equal.

E. Hydroseed and Mulch for Erosion Control:

1. Grass seed for erosion control shall conform to the standards for "Certified" grade seed or better as outlined by the State of Washington Department of Agriculture "Rules for Seed Certification," latest edition. Seeds shall be certified "Weed Free," indicating there is no noxious or nuisance weed in the seed.
2. Seed of the following composition, proportion, and quality shall be applied at a rate of at least 80 pounds per acre on areas requiring seeding and mulching for erosion control:

Kind and Variety of Seed in Mixture	% By Weight	% Pure Seed	Minimum % Germination
Colonial Bentgrass (<i>Agrotis tenuis</i>)	10	9.80 (min)	85
Red Fescue (<i>Festuca rubra</i>)	40	39.20 (min)	80
Perennial Rye (<i>Lolium perenne</i>)	40	39.20 (min)	90
White Dutch Clover (<i>Trifolium repens</i>) (preinoculated)	10	9.80 (min)	85
Inert and Other		2.50 (max)	
Total		100	

3. Sufficient quantities of fertilizer shall be applied to supply the following amounts of nutrients to areas of erosion control grass seeding:
 - a. Total Nitrogen as N – 135 pounds per acre.
 - b. Available Phosphoric Acid as P₂O₅ – 60 pounds per acre.
 - c. Soluble Potash as K₂O – 60 pounds per acre.
4. At least 90 pounds of nitrogen applied per acre shall be derived from isobutylidene diurea (IBDU). IBDU shall be supplied in a coarse particle size ranging from 0.7 mm to 2.5 mm in diameter.
5. Fertilizer shall be standard commercial grade of organic or inorganic fertilizer. All fertilizers shall be furnished in standard unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with State and Federal laws.
6. Mulch for hydroseeding shall be wood cellulose fiber or straw mulch.

F. Wood Cellulose Fiber Mulch:

1. Fiber shall be produced from natural or recycled (pulp) fiber. The fibers shall not contain any rock, metal, or plastic. It shall be treated with a green dye nontoxic to plant and animal to facilitate inspection after placement of material. When hydraulically sprayed on the ground, the material shall allow for the absorption and percolation of moisture.
2. A letter of certification shall be provided during the submittal process which certifies that the product contains less than 250 parts per million boron, and shall be otherwise nontoxic to plants and animals. The organic matter content shall be at least 90% on an oven-dry basis as determined by ASTM D586. The moisture content shall be no more than 15% as determined by oven dried weight.

G. Straw Mulch:

1. Straw mulch shall be in an air-dried condition free of noxious weeds, seeds, and other materials detrimental to plant life.

2. Hay is not acceptable.
3. Straw mulch should be suitable for spreading with mulch blower equipment.

H. Plastic Sheeting:

1. Plastic sheeting shall be minimum 6-mil thick, polyethylene sheeting and meet the requirements of the ASTM D4397.
2. Plastic sheeting shall be UV-stabilized.
3. Plastic sheeting used for long-term soil cover (greater than 1 month) shall be minimum 8 mil, scrim reinforced low density polyethylene laminated film with polyester string reinforcement meeting ASTM E1745 Class C.
 - a. Acceptable products include:
 - 1) Tuff-Scrim Poly TS8FR, Americover, 2067 Wineridge Pl., #F, Escondido, CA 92029, phone (800) 747-6095.
 - 2) Equivalent products by Dura-Skrim or Americover.
 - 3) Or Approved Equal.

I. Temporary Silt Fence:

1. Filter Fabric:
 - a. Filter fabric fence shall meet the following requirements:
 - 1) Provide filter fabric composed of rot-proof woven or non-woven polymeric fibers oriented into a stable network such that the fibers retain their relative positions with respect to each other.
 - 2) Provide filter fabric free of any chemical treatment or coating which may significantly reduce permeability and flaws and defects which could significantly alter its physical properties.
 - 3) Provide filter fabric with ultraviolet ray inhibitors and stabilizers.
 - 4) Slit film woven fabric will not be allowed.
 - 5) Provide filter fabric that meets the following physical property requirements (values indicated are minimum average roll values):

Geotextile Property	ASTM Test Method	Geotextile Property Requirements	
		Unsupported Between Posts	Supported Between Post with Wire or Polymeric Mesh
AOS	D 4751	U.S. No. 30 max. for slit wovens, U.S. No. 50 for all other geotextile types, U.S. No. 100 min	
Water Permittivity	D 4491	0.02 sec-1 min.	
Grab Tensile Strength, in machine and x-machine direction	D 4632	180 lb min. in machine direction, 100 lb min. in x-machine direction	100 lb min.
Grab Failure Strain, in machine and x-machine direction	D 4632	30% max. at 180 lb or more	
Ultraviolet (UV) Radiation Stability	D 4355	70% strength retained min., after 500 hours in xenon arc device	

2. Posts: 2 inch x 4 inch wood posts, standard or better; or steel fence posts.

3. Wire Mesh Fabric: 2 inch x 2 inch x 14 gauge.

J. Check Dams:

1. Check dams shall be constructed as shown in the Drawings.

K. Wattles:

1. Wattles shall consist of cylinders of biodegradable plant material such as straw, coir, compost, or wood shavings encased a biodegradable or photodegradable netting.

2. Wattles shall be at least 5 inches in diameter.

3. Encasing material shall be clean, evenly woven, and free of encrusted concrete or other contaminating materials.

4. Encasing material shall be free from cuts, tears, or weak places and shall have an installed lifespan of greater than 6 months.

L. Catch Basin Inserts:

1. Catch basin inserts shall be prefabricated units specifically designed for inlet protection and shall remain securely attached to the drainage structure when fully loaded with wet sediment and debris.

2. Acceptable catch basin inserts include:

a. Dandy-Bag by Ten Cate (Mirafi), Pendergrass, GA.

b. StreamGuard by Bowhead Mfg, Seattle, WA.

- c. Gullywasher Filtersacks by Aqua Treatment Systems, Kent, WA.
- d. Exert or Exert II by Seacor Environmental Products LLC, Seattle, WA.
- e. Storm Sentinel 1341 by Enpac Corp., Auburn, WA.
- f. Or Approved Equal.

M. Portable Storage Tanks:

- 1. Portable storage tanks shall be provided by BakerCorp (branch office in Woodinville, Washington), Rain for Rent (branch office in Arlington, Washington), or Approved Equal.

N. Hauling and Disposal of Construction Runoff:

- 1. All haul vehicles shall be maintained in good working order and shall be approved for highway use.
- 2. All haul vehicles shall be equipped with proper appurtenances to allow filling from portable storage tanks and discharging into all of the approved disposal locations for construction runoff.

O. Temporary Conveyances:

- 1. Pipe and fittings for temporary storm drain shall meet the requirements of Section 33 40 00, "Storm Drainage Utilities," unless approved otherwise by the Project Representative.

P. Sod for Drainage Ditches:

- 1. Prior to installation sod shall be free of weeds and grass shall be of a uniform height (approximately 1 inch).
- 2. Sod shall be field-grown 1 calendar year or longer and have a well-developed root structure for strength.
- 3. The sod shall have been cut with a minimum of 1 inch of soil adhering.

Q. Temporary Curbs:

- 1. Temporary extruded asphalt curb shall be installed in accordance with the Drawings.
- 2. Temporary extruded curb shall only be placed on pavement.
- 3. Temporary curbs, other than extruded curbs, may consist of asphalt, concrete, sandbags, compost socks, or geotextile/plastic encased berms of soil, sand, or gravel or as approved by the Project Representative.
- 4. Temporary curbs shall be at least 4 inches in height.

R. Liner for Temporary Storage Ponds:

1. Liners for temporary storage ponds and pre-treatment cells shall meet the requirements of PVC Geomembrane for pond lining in Section 31 24 00, "Geosynthetics."

S. Plug Valves:

1. Temporary plug valves used for TESC shall be selected for the anticipated head conditions and duration of the project.

2.02 TEMPORARY SURFACE WATER STORAGE FACILITIES

A. The sizing criteria for the temporary surface water storage facilities are:

1. The required storage volume shall be not less than the runoff volume generated by the 10-year 24-hour storm event for the Project Site.
 - a. The required storage volume shall be adjusted as necessary to account for changes in area and surface conditions on the Project Site as the Work progresses.
 - b. The required storage volume may take into account the discharge rate from the water quality treatment system to the Stream E outfall.
2. The cumulative release rate from temporary storage facilities, the permanent surface water treatment and detention ponds, and other sources of concentrated flows from the Project Site shall not exceed the rates described in paragraph 1.07F of this section.
3. The Contractor is responsible for providing any additional storage to that of the existing temporary sediment traps and ponds that is required to meet project requirements for water quality and release rates to Strawberry Creek.

B. The temporary surface water storage facilities shall include all the conveyances, piping, valves, connections, pumps, tanks, ponds, power supply, and controls required for the working system.

1. At a minimum, ponds shall meet the requirements for sediment trap and ponds in the 2024 Ecology Stormwater Management Manual for Western Washington (SWMMWW).

C. All permanent facilities and conveyances that are used for management of Construction Runoff and that have collected debris or sediment shall be cleaned and restored to good working order prior to completion of work.

2.03 WATER QUALITY TREATMENT SYSTEM

A. If Contractor designed water quality treatment system is utilized it shall be designed and operated to treat turbidity and pH of Sediment Laden Surface Water.

B. Water leaving the system shall meet water quality standards of the project's Construction Stormwater General Permit.

C. The system shall meet the following minimum requirements:

1. Provides treatment of Sediment Laden Surface Water to allow direct discharge of Clean Surface Water to Strawberry Creek.
2. Provides for recirculation of water and additional treatment if initial treatment does not bring water up to discharge standards for turbidity and pH.
 - a. The system shall include automatic sensors and controls that test water quality and recirculates water back to system for additional treatment if necessary.
 - b. A visual and audible alarm shall be installed to warn system operator if water requires recirculation.
3. Release rates from the water quality treatment system shall be managed such that overall releases to Strawberry Creek do not exceed the flow rates described in paragraph 1.07F of this section.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General:

1. During the construction period, do not disturb areas beyond the flagged construction limits.
2. Maintain flagging for the duration of the construction.
3. Construct the TESC facilities and features in the reviewed CESC in conjunction with clearing and grading activities, and in such a manner as to ensure that Sediment Laden Surface Water does not enter the drainage system or violate water standards.
4. Follow the construction sequence shown on the Drawings or the Contractor developed sequence reviewed and commented on by the Project Representative.
5. Temporary Cover Measures may include but not limited to plastic sheeting, hydroseeding, PAM, or straw mulch.
6. Temporary Cover Measures shall be compatible with the water quality treatment system and earthwork operations.
7. Establish permanent vegetative cover in each area of Work at the earliest possible date in accordance with Section 32 91 00, "Planting Preparation."
8. Inspect the erosion and sedimentation control facilities per the CESC and maintain as necessary to ensure their continued functioning.
9. Regularly inspect tanks and remove sediment to ensure that storage tank volume is not reduced due to sediment deposition.

B. Orange Safety Fence:

1. Use wood or metal posts spaced at a maximum of 6 feet to support the fence.
2. Leave the fence in place, fully functional until directed to remove it by the Project Representative.

C. Stabilized Construction Entrances:

1. Stabilized Construction Entrances: Stabilized pads of quarry spalls at entrances to the Project Site shall be constructed as indicated on the Drawings, to help eliminate the amount of mud, dirt, and rocks transported onto public roads by construction traffic.
 - a. Stabilized construction entrances shall be constructed in accordance with the Drawings, prior to beginning clearing, grubbing, earthwork, or excavation in the area to be served by the entrance.
 - b. Maintain stabilized construction entrance pads at least 12 inches thick over crushed surfacing and geotextile, at least 100 feet in length (unless otherwise shown on the Drawings) and the full width of the vehicle ingress/egress, with a minimum width of 15 feet.
 - c. The minimum length and width can be adjusted at the discretion of the Project Representative.
 - d. Maintain proper function of the stabilized construction entrance pad by periodically adding quarry spalls, and crushed surfacing, as necessary.
 - e. Remove construction entrance materials that are loosened from the pad and transported into the surrounding roads and streets.
 - f. All dirt, mud and debris tracked or dropped onto the roadway shall immediately be swept and removed using vacuum-type street sweeper equipment. A vacuum-type street sweeper shall be maintained on the Project Site at all times.
 - g. Sweeping dirt to the side of the road will not be an acceptable method of cleaning.

D. Temporary Construction Access Roads:

1. Contractor shall be responsible for controlling runoff from temporary construction access roads to prevent both erosion and turbid runoff from leaving Project Site.
2. Where new storm drains and inlets are available along construction access roads, temporary curbing and check dams shall be installed by Contractor to route construction runoff into the storm drain system for collection and treatment.

E. Hydroseed and Mulch for Erosion Control:

1. All erosion control grass seeding shall be by a hydro seeder unless approved otherwise by the Project Representative. The hydro seeder shall utilize water as the carrying agent, and maintain continuous agitation through paddle blades. It shall have an operating capacity sufficient to agitate, suspend, and mix into a homogeneous slurry the specified amount of seed and water and other material. Distribution and discharge

lines shall be large enough to prevent stoppage and shall be equipped with a set of hydraulic discharge spray nozzles that will provide a uniform distribution of slurry.

2. A tracer shall be added to visibly aid uniform application. The tracer shall not be harmful to plant and animal life. If wood cellulose fiber is used as a tracer only, the application rate shall not exceed 250-pounds per acre.
3. Fertilizer for erosion control seeding may be applied with hydro seeder provided the fertilizer is placed in the hydro seeder tank no more than one hour prior to application.
4. When hand seeding is allowed by the Project Representative, seed and fertilizer shall be incorporated into the top 1/4 inch of soil by hand raking. Straw mulch cover shall be applied over top.

F. Wood Cellulose Fiber:

1. Wood cellulose fiber shall be applied at a minimum rate of 1200 pounds (dry) per acre when used as a mulch cover.

G. Straw Mulch:

1. Straw mulch may be used as a temporary measure to control erosion on exposed slopes.
2. The straw mulch shall be evenly spread a minimum of 2 inches thick, 4 inches thick during wet season construction (October 1 through April 30).
3. Hand methods may be used to place the straw mulch.

H. Plastic Cover:

1. Use plastic sheeting to control erosion on exposed slopes as indicated in the Drawings or as directed by the Project Representative.
2. Use scrim-reinforced plastic cover in any area where the cover will be in use for 30 days or more.
3. Covering shall be installed and maintained tightly in place as shown on the Drawings.
4. Secure the top edge of the top sheets along its full length in an anchor trench as shown on the Drawings.
5. All seams shall be taped or weighted down full length and have at least a 5-foot overlap. Taped seams shall be weighted down along the entire seam length at a 10-foot maximum spacing.
6. Equipment, tools, and materials shall not be stored on plastic covering slopes.
7. Vehicles and workers shall remain off of plastic covering to the maximum extent possible.

8. Sheeting applied over seeded slopes should be removed as soon as possible after vegetation is well grown to prevent burning the vegetation through the plastic sheeting.
9. Check regularly for rips and places where the plastic may be dislodged. Maintain contact between the plastic and the ground. Air pockets under plastic should be removed immediately to prevent ripping during winds.
10. Resecure and replace plastic as necessary.
11. Plastic covering that is removed to access underlying soils shall be restored to original condition unless approved otherwise by the Project Representative.

I. Temporary Silt Fence:

1. Install temporary silt fences as indicated on the Drawings.
2. Purchase filter fabric in continuous roll cut to the length of the barrier to avoid use of joints.
3. When joints are necessary, splice filter fabric together only at a support post, with a minimum 6-inch overlap, and both ends securely fastened to the post.
4. Install temporary silt fence to follow ground contours, where feasible.
5. Do not side cast spoils on the downhill side of the fence.
6. When standard strength filter fabric is used, provide a wire mesh support fence fastened securely to the upslope side of the posts using heavy duty wire staples at least 1 inch long, tie wires, or hog rings.
7. Extend wire into the trench a minimum of 4 inches and not more than 36 inches above the original ground surface.
8. Do not staple filter fabric to existing trees.
9. When extra-strength filter fabric and 6-foot maximum fence post spacing are used, the wire mesh support fence may be eliminated, subject to the approval of the Project Representative. Staple or wire extra-strength filter fabric directly to the posts while complying with all other provisions of this section.
10. Backfill the trench as indicated on the Drawings.
11. Inspect immediately after each rainfall and at least daily during prolonged rainfall and remove accumulated sediment.

J. Perimeter Berms:

1. Perimeter berms may be used to supplement or in lieu of silt fence or wattles if approved by the Project Representative to reduce sediment transport by sheet flows from disturbed ground.
2. The longest flow path length to perimeter berm shall not exceed 100 feet.

3. Perimeter berms shall be at least 18 inches high above existing ground.
4. Perimeter berms shall consist of compost, ground brush, or earthen material.
5. Perimeter berms of earthen material shall be seeded with the erosion control grass seed mixture.

K. Check Dams:

1. Check dams shall be installed per the Drawings.

L. Wattles:

1. If used, wattles shall be installed per the detail on the Drawings.

M. Catch Basin Inserts:

1. Install in accordance with manufacturer's recommendations.
2. Once insert fills with sediment remove, backflush and reinstall.
3. If damaged, replace with a new insert.
4. Install catch basin inserts in all catch basins and inlets (existing and new) within the Construction Limits and downstream of the Project Site that may receive Sediment Laden Surface Water from the Site.
5. Simply placing a piece of geotextile under the grate is not acceptable.

N. Portable Storage Tanks:

1. Tanks shall be configured to maximize the potential for settling of suspended material within the tank and reduce the chance for resuspension of settled material.

O. Hauling and Disposal of Construction Runoff:

1. Obtain and follow all necessary permits necessary for hauling and disposal of Sediment Laden Surface Water and other water at an off-site location.
2. The Owner will be responsible for payment of applicable local fees associated with each of the approved discharge locations.
3. Haul routes on the Project Site shall be maintained to allow hauling to occur during nighttime and extreme rain and snow events.

P. Erosion Control Matting:

1. Use erosion control matting on exposed slopes where shown on the Drawings or required by Project Representative.
2. Unroll erosion control matting for slope protection parallel to the flow of water.

3. Grade the surface smooth before placement for proper soil contact.
4. Bury matting at least 6 inches at the top and bottom ends of installation. Overlap side edges of rolls a minimum of 4 inches.
5. Overlap ends of rolls a minimum of 6 inches.
6. Install fasteners per manufacturer's recommendations.
7. If hand seeding is to be used, apply seed and fertilizer before installing matting.
8. If hydroseeding, apply hydroseed before installing the matting.

Q. PAM for Erosion Control:

1. The manufacturer or supplier shall provide written application methods for anionic PAM and anionic PAM mixtures based on site conditions.
2. Store, mix and apply PAM in accordance with requirements in Volume II of the Washington State Department of Ecology's Stormwater Management Manual for Western Washington. These shall prevail over manufacturer's recommendations.
3. Keep granular PAM supply out of direct sunlight.
4. PAM shall be applied on bare soil completely dissolved and mixed in water or applied as a dry powder.
5. Dissolved PAM shall be applied at a rate of not more than 2/3 pound per 1,000 gallons of water per acre.
6. A minimum of 200 pounds per acre of cellulose fiber mulch treated with a non-toxic dye shall be applied with the dissolved PAM.
7. Dry powder applications may be at a rate of 5 pounds per acre using a hand-held fertilizer spreader or a tractor-mounted spreader.
8. PAM shall not be applied during rainfall or to saturated soils.
9. PAM shall be applied only to areas that drain to completed sedimentation control BMPs in accordance with the Contractor's erosion and sediment control plan.
10. PAM shall not be applied to the same area more than once in a 48-hour period, or more than 7 times in a 30-day period.
11. Application rates may be adjusted based on observation of site-specific soil erosion patterns.
12. A trained person experienced in the use of PAM shall perform application. Notify Project Representative 48 hours prior to first application.
13. Do not add PAM to water discharging from the Project Site.

14. Prior to applying PAM in any area draining to the water quality treatment system, consult with the operator of the water quality treatment system to ensure PAM application is compatible with system operation.

R. Plug Valves:

1. Install per manufacturer's recommendations.
2. Plug valves shall be installed to allow their safe removal by workers under high head conditions in the storm drain system.
3. Chains, ropes, or rods attached to plug valves should be clearly labeled for worker use under high head conditions.

S. Temporary Drainage Ditches:

1. Sod temporary drainage ditches as called for in the notes on the Drawings to establish permanent turf for immediate erosion control and to stabilize drainageways.
 - a. Overexcavate the drainage ditch 4 to 6 inches below the final elevation to allow room for placing soil amendment and sod.
 - b. Amend 4 inches (minimum) of compost into the top 8 inches of the soil.
 - c. Shape and smooth the surface of ditch.
 - d. Fertilize according to Section 32 91 00, "Planting Preparation," using a nonphosphorous fertilizer.
 - e. Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow.
 - f. Wedge strips securely into place.
 - g. Square the ends of each strip to provide for a close, tight fit.
 - h. Stagger any joints at least 12 inches.
 - i. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.
 - j. Inspect sodded ditches frequently.
 - k. If the grass is unhealthy, the cause shall be determined and appropriate action taken to re-establish a healthy groundcover.
 - l. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with erosion control matting.

2. All temporary ditches will be repaired to original condition within 24 hours of any damage.

T. Temporary Curb:

1. Where shown on the Drawings, temporary curbs shall be installed along pavement edges to prevent runoff from flowing onto erodible slopes.
2. The redirected water shall flow to a conveyance designed for concentrated flow. This requires having curb breaks and/or smooth transitions to allow gutter flow to enter storm drainage system.
3. If concentrated flows can continue past the end of curb run, runoff should enter a stabilized conveyance system via a smooth transition.
4. Curbing shall be placed and maintained as to not cause erosion nor concentrated discharges across unstabilized work areas.

3.02 WATER QUALITY MONITORING

- A. The quality of the surface water runoff as it exits the Project Site shall be monitored for effluent pH and turbidity by the Contractor to ensure it is meeting the water quality performance requirements specified in this section.
- B. To monitor project discharges a portable turbidity meter and pH meter are required. The portable turbidity meter shall be calibrated and maintained in accordance with the manufacturer's recommendations and have a sealed optical chamber that is kept free of dust. Turbidity readings shall be reported in Nephelometric Turbidity Units (NTUs). The pH meter shall be calibrated and maintained in accordance with the manufacturer's recommendations.
- C. Where water quality requirements are described in relation to receiving water quality, Contractor shall be responsible for collecting such data on receiving water quality as is required, at no additional cost to Owner.
- D. If at any time the sampled surface water runoff deviates from the water quality performance requirements specified in this section, route flows back to the temporary storage system for additional treatment.
- E. The Project Representative will also be monitoring the Project Site and water quality to verify the water quality performance requirements are met.
- F. Water quality from the project site that is discharged to Stream E or other natural receiving body shall meet the following requirements:
 1. Turbidity less than 25 NTU.
 2. pH between 6.5 and 8.5 units.
- G. Water quality and flow monitoring shall occur at the following intervals unless approved otherwise by the Owner:
 1. Every four hours when work is occurring on the Project Site and discharges from the Project Site are occurring.

2. Monitoring shall occur every two hours when rainfall rates are intense (greater than 0.2 inches per hour).
- H. The Contractor shall keep records of water quality and flow monitoring data in good order and retain on-site. Copies of monitoring data shall be submitted to the Owner on a weekly basis.
- I. Any time the water quality exceeds permit requirements take corrective actions and monitor hourly until the water quality is in compliance with the permit requirements.

3.03 TEMPORARY CONVEYANCES

- A. Temporary conveyances not shown on the Drawings shall be designed and installed by the Contractor. This includes pipes, slope drains, ditches, culverts, and related structures.
- B. Conveyances shall fulfill the applicable requirements of Chapter 4 Volume II of the 2021 Kitsap County SDM.

3.04 STREET CLEANING

- A. Self-propelled vacuum street sweepers shall be used to prevent the transport of sediment and other debris tracked off of the entire Project Site throughout the construction period and into the existing site roads and public right-of-way.
- B. Street sweepers shall be designed and operated to meet applicable air quality standards.
- C. Street washing will not be permitted unless wash water is collected for treatment to remove turbidity.
- D. Paved roads that are actively used by construction equipment will be cleaned periodically to control dust and prevent track-out.
- E. At a minimum, these roads should be cleaned daily unless a less frequent cleaning is approved by the Project Representative.

3.05 DUST CONTROL MEASURES

- A. Execute Work by methods to minimize raising dust from construction operations. Dust shall not be allowed to impact safe operation of public roadways.
- B. Minimize the period of soil exposure by implementing temporary ground cover measures.
- C. Provide positive means to prevent air-borne dust, both on and off the Project Site.
- D. Utilize watering trucks to dampen dry soil materials to control dust.
- E. Spray exposed soil areas with a dust palliative.
- F. Do not use oil-based sprays or calcium-based spreads for dust control.
- G. Passive and, if necessary, active dust control shall continue until such time as the bare earth areas have been restored.

3.06 TEMPORARY SLOPE TREATMENT

- A. To reduce erosion and slope damage, at no time shall runoff be permitted to run down unprotected slopes unless confined to a stabilized channel or pipe system.
- B. Use the following methods to control runoff near the top of slopes:
 - 1. Interceptor swales above the top of slope or along contours on the slope.
 - 2. Slope drains constructed in accordance with the Drawings.
 - 3. Grading flat areas above the slope to drain away from slope.
 - 4. Creating temporary sumps and pumping to a stabilized conveyance.
- C. All new cut/fill slopes (excluding stockpiles) with a vertical relief exceeding 10 feet that are to be left unworked for more than 7 days shall be track-walked to leave a pattern of cleat imprints parallel to slope contours.
- D. Prior to disturbing an area exceeding 500 square feet for clearing, grubbing, or earthwork that could result in concentrated runoff, construct temporary conveyances to collect runoff from the disturbed area for conveyance to a storage pond, tank, or vault.

3.07 PROTECTION OF STOCKPILES

- A. Stockpiles shall be protected in accordance with the notes on the Drawings.
- B. Runoff from stockpiles shall be conveyed to storage ponds, tanks, or permanent stormwater system for treatment.

END OF SECTION

Division 32

Exterior Improvements

SECTION 32 12 00
FLEXIBLE PAVING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Hot-mix asphalt pavement.

1.02 REFERENCES

A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section.

1. American Association of State Highway and Transportation Officials (AASHTO) M 17 – Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M 320 – Standard Specification for Performance-Graded Asphalt Binder.
3. AASHTO T 11 – Standard Method of Test for Materials Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing.
4. AASHTO T 27 – Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.
5. AASHTO T 168 – Standard Method of Test for Sampling Bituminous Paving Mixtures.
6. AASHTO T 209 – Standard Method of Test for Theoretical Maximum Specific Gravity and Density of Hot-Mix Asphalt Paving Mixtures.
7. AASHTO T 304 - Standard Method of Test for Uncompacted Void Content of Fine Aggregate.
8. AASHTO T 308 – Standard Method of Test for Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method.
9. AASHTO T 312 – Standard Method of Test for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor.
10. AASHTO TP 61 – Standard method of Test for Determining the Percentage of Fracture in Course Aggregate.
11. American Society for Testing and Materials (ASTM) D3549 – Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
12. Western Alliance for Quality Transportation Construction (WAQTC) TM 8 – In-Place Density of Bituminous Mixtures Using the Nuclear Moisture Gauge.

13. Washington State Department of Transportation (WSDOT) Standard Operating Procedure (SOP) 729 – In-Place Density of Hot Mix Asphalt Using the Nuclear Moisture-Density Gauge.
14. WSDOT SOP 731 – Method for Determining Volumetric Properties of Hot Mix Asphalt Class Superpave.
15. WSDOT Test Method Number 716 – Method of Random Sampling for Location of Testing and Sampling Sites.
16. WSDOT Test Method T 718 – Method of Test for Determining Stripping of Hot Mix Asphalt.

1.03 DEFINITIONS AND ACRONYMS

- A. CSBC: Crushed surfacing base course.
- B. HMA: Hot mix asphalt.
- C. ESAL: Equivalent single axle load.
- D. JMF: Job mix formula.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 1. Mix design:
 - a. The design shall be prepared by the asphalt producer's laboratory and shall conform to the requirements of this section.
 - b. The design shall include test results of the aggregates and proposed batch plant weight and shall be within the specified limits.
- C. Quality Assurance Submittals:
 1. Material certificates signed by material producer certifying that each material complies with specified requirements.
 2. Mix design certification by WSDOT.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Section 01 43 00, "Quality Assurance and Control."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the Project Site in accordance with Section 01 60 00, "Product Requirements."
- B. Store and protect products in accordance with Section 01 60 00, "Product Requirements."

1.07 PROJECT CONDITIONS

- A. Weather Limitations:
 - 1. Apply tack coat when ambient temperature is above 50°F (10°C).
 - 2. Apply tack coat when temperature has not been below 35°F (1°C) for 12 hours immediately prior to application.
 - 3. Do not apply tack coat when base is wet or contains an excess of moisture.
- B. Grade Control: Establish and maintain required lines and elevations shown on the Drawings.
- C. Preparation of Subgrade: Requirements for subgrade and crushed surfacing base course (CSBC) shall be as specified in Section 31 23 00, "Earthwork."
 - 1. Prior to HMA installation, clean previously constructed surface of all foreign substances.
 - 2. Inspect surfaces for the specified compaction and trueness to line and grade.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Base Material: Base material shall be CSBC in accordance with Section 31 23 00, "Earthwork."
- B. HMA:
 - 1. Aggregate:
 - a. General Requirements:
 - 1) Aggregates for HMA shall be manufactured from ledge rock, talus, or gravel.
 - 2) The material shall be uniform in quality and substantially free from wood, roots, bark, and other deleterious material, and shall meet the quality test requirements in Table 1.

Table 1
HMA Aggregate Quality Test Requirements

Item	Requirement
Los Angeles Wear, 500 Rev.	30% max.
Degradation Factor – Wearing Course	30 min.
Degradation Factor – Other Course	20 min.

- 3) It shall be substantially free from adherent coatings.
 - 4) The presence of a thin, firmly adhering film of weathered rock will not be considered as coating unless it exists on more than 50% of the surface area of any size between consecutive laboratory sieves.
 - 5) Aggregate removed from deposits contaminated with various types of wood waste shall be washed, processed, selected, or otherwise treated to remove sufficient wood waste so that the oven-dried material retained on a U.S. No. 4 sieve shall not contain more than 0.1% by weight of material with a specific gravity less than 1.0.
- b. Test Requirements: Aggregate for HMA shall meet the following test requirements.
- 1) The fracture requirements for the combined course aggregate shall apply to the material retained on the U.S. No. 4 sieve and above, when tested in accordance with field operating procedure for AASHTO TP 61 and shall adhere to the requirements in Table 2.

Table 2
HMA Fracture Requirements

Equivalent Single Axial Loads (ESALs) (millions)	# Fractured Faces	% Fracture
<10	1 or more	90
≥10	2 or more	90

- 2) The uncompacted void content for the combined fine aggregate is tested in accordance with AASHTO T 304, Method A. The minimum percent voids shall be as required in Table 3.

Table 3
Minimum Percent Voids

Traffic	HMA Evaluation	
ESALs (millions)	Statistical and Nonstatistical	Commercial
<3	40	40
≥3	44	40

- 3) The minimum sand equivalent for the aggregate shall be 45.
- 4) The mix design shall produce HMA mixtures when combined within the gradation limits set forth in this section and mixed in the laboratory with the designated grade of asphalt binder, using Superpave gyratory compactor in accordance with AASHTO T 312, and at the required gyrations for N initial, N design, and N maximum with the properties in Tables 4 and 5.

**Table 4
HMA Mixture Properties**

	HMA Class 1/2 Inch		HMA Class 1 Inch	
Mix Criteria	Min.	Max.	Min.	Max.
Voids in Mineral Aggregate (VMA), %	14.0		12.0	
Voids Filled with Asphalt (VFA), %				
ESALs (millions)	VFA			
<0.3	70	80	67	80
0.3 to <3	65	78	65	78
3 to <10	65	75	65	75
10 to <30	65	75	65	75
≥30	65	75	65	75
Dust/Asphalt Ratio	0.6	1.6	0.6	1.6
Modified Lottman Stripping Test	Pass		Pass	

**Table 5
HMA Mixture Gyration Requirements**

	ESALs (millions)	N Initial	N Design	N Maximum
%Gmm	<0.3	≤91.5	96.0	≤98.0
	0.3 to <3	≤90.5	96.0	≤98.0
	≥3	≤89.0	96.0	≤98.0
Gyration Compaction (number of gyrations)	<0.3	6	50	75
	0.3 to <3	7	75	115
	3 to <30	8	100	160
	≥30	9	125	205

- 5) The mix criteria VMA and VFA only apply to HMA accepted by statistical evaluation.
- 6) When material is being produced and stockpiled for use, the uncompacted void content, fracture, and sand equivalent requirements shall apply at the time of stockpiling.
- 7) When material is used from a stockpile that has not been tested, as provided above, the requirements for uncompacted void content, fracture, and sand equivalent shall apply at the time of its introduction to the cold feed of the mixing plant.

c. Grading:

1) Gradation:

- a) Contractor may furnish aggregates from multiple stockpiles.
- b) Gradation of the aggregates shall be such that the completed mixture complies in all respects of the pertinent requirements of this section.
- c) Acceptance of aggregate gradation shall be based on samples taken from the final mixture.

2) Recycled Asphalt Pavement and Mineral Aggregate:

- a) Asphalt concrete planings or old asphalt concrete utilized in the production of HMA shall be sized prior to entering the mixer so that a uniform and thoroughly mixed HMA is produced in the mixer.
 - b) If there is evidence of the old asphalt concrete not breaking down during the heating and mixing of the HMA, the Project Representative may elect to modify the maximum size entering the mixer.
 - c) No contamination by deleterious materials will be allowed in the old asphalt concrete used.
- 3) The gradation for the new aggregate used in the production of the HMA shall be the responsibility of the Contractor, and when combined with recycled material, the combined material shall meet the requirements of this section.

d. Blending Sand:

- 1) Blending sand shall be clean, hard, sound material, either naturally occurring sand or crusher fines, and must be material which will readily accept an asphalt coating.
- 2) The exact grading requirements for the blending sand shall be such that, when it is mixed with an aggregate, the combined product shall meet the requirements of this section.
- 3) Blending sand shall have a minimum sand equivalent of 30.

e. Mineral Filler:

- 1) Mineral filler, when used in HMA mix, shall conform to the requirements of AASHTO M 17.

f. HMA Proportions of Materials:

- 1) The materials of which HMA is composed shall be of such sizes, grading, and quantities that, when proportioned and mixed together, they will produce a well graded mixture within the requirements of Table 6.

Table 6
HMA Aggregate Gradation Requirements

Sieve Size	Percent Passing by Weight	
	1/2 Inch	1 Inch
1 1/2 Inch Square		100
1 Inch Square		90 – 100
3/4 Inch Square	100	90 max.
1/2 Inch Square	90 – 100	
3/8 Inch Square	90 max.	
U.S. No. 8	28 – 58	19 – 45
U.S. No. 200	2.0 – 7.0	1.0 – 7.0

2) The aggregate percentage refers to completed dry mix, and includes mineral filler when used.

2. Asphalt Binder:

- a. Performance grade asphalt binder (PGAB) shall meet the requirements of AASHTO M 320, Table 1 for a grade of PG 64-22.

3. Recycled Material:

- a. The Contractor shall have the option of utilizing recycled asphalt pavement (RAP) in the production of HMA. RAP content shall not exceed 20% of total aggregate weight.

C. Tack Coat:

- 1. Tack coat shall be Cationic Emulsified Asphalt, CSS-1 in accordance with the requirements in Table 7.

Table 7
Cationic Emulsified Asphalt, CSS-1 Requirements

Grade	Test Method	Requirements	
		Minimum	Maximum
Viscosity Saybolt Furol S @ 77°F (25°C)	AASHTO T 59	20	100
Storage Stability Test 1 Day %	AASHTO T 59		1
Particle Charge Test	AASHTO T 59	Pos (if inconclusive, material shall have a maximum pH value of 6.7)	
Sieve Test, %	AASHTO T 59		0.10

Cement Mixing Test, %	AASHTO T 59		2.0
Residue, %	AASHTO T 59	57	
Penetration, 77°F (25°C)	AASHTO T 49	100	250
Ductility, 77°F (25°C) 5 cm/min., cm	AASHTO T 51	40	
Solubility in trichloroethylene, %	AASHTO T 44	97.5	

PART 3 – EXECUTION

3.01 PREPARATION

- A. Proof-roll prepared Sub-base (CSBC) surface, in accordance with Section 31 23 00, "Earthwork," to check for unstable areas and areas requiring additional compaction.
- B. Do not begin paving work until deficient Sub-base areas have been corrected and are ready to receive paving.
- C. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into HMA pavement.
 1. Distribute at rate of 0.1 to 0.18 gallon per square yard of surface.
 2. Allow to dry until at proper condition to receive paving.
- D. Exercise care in applying bituminous materials to avoid over spray and smearing of adjoining concrete surfaces. Clean damaged surfaces.

3.02 HMA INSTALLATION

- A. General Requirements:
 1. Construction shall conform to the details, dimensions and grades specified and shown on the Drawings.
 2. HMA mixing plants shall be those having established accurate quality control procedures to ensure that the production of mixes conform to the Specifications consistently throughout the job, and meeting the following requirements.
 - a. Equipment for Preparation of Asphalt Binder:
 - 1) Tanks for the storage of asphalt binder shall be equipped to heat and hold the material at the required temperatures.
 - 2) Heating shall be accomplished by steam coils, electricity, or other approved means.
 - 3) No flame shall be permitted to come in contact with the storage tanks.

- 4) The circulating system for the asphalt binder shall be designed to ensure proper and continuous circulation.
 - 5) An asphalt binder sampling valve shall be located on the storage tank or on the supply line to the mixer.
- b. Thermometric Equipment:
- 1) An armored thermometer, capable of detecting temperature ranges expected in the HMA mix, shall be fixed in the asphalt binder feed line at a location near the charging valve of the mixer unit.
 - 2) The thermometer location shall be convenient and safe for access by the Project Representative.
 - 3) The plant shall be equipped with an approved dial-scale thermometer, a mercury actuated thermometer, an electric pyrometer, or another approved thermometric instrument, placed at the discharge chute of the drier, to automatically register or indicate the temperature of the heated aggregates.
 - 4) The instrument shall be in full view of the plant operator.
- c. Sampling and Testing Mineral Materials:
- 1) The HMA plant shall be equipped with a mechanical sampler for the sampling of mineral materials.
 - 2) The mechanical sampler shall:
 - a) Be automatic or semiautomatic;
 - b) Be able to safely and easily obtain representative samples;
 - c) Be able to convey the samples to ground level;
 - d) Move at an even rate through the full width of the materials stream falling from the discharge end of the belt, gate, or chute;
 - e) Be power driven during material intercept cycle; and
 - f) Be adjustable to take samples of approximately 100 pounds.
 - 3) Contractor shall provide sufficient space for the setup and operation of the field testing facilities.
- d. Sampling HMA:
- 1) The HMA plant shall provide for sampling of HMA by one of the following methods:
 - a) A mechanical sampling device attached to the HMA plant; or
 - b) Platforms or devices to enable sampling from the hauling vehicle without entering the hauling vehicle.

3. Hauling Equipment:

- a. Trucks used for hauling HMA shall have tight, clean, smooth metal beds and shall have a cover of canvas or other suitable material of sufficient size to protect the mixture from adverse weather.
 - 1) Whenever the weather conditions during the work shift include, or are forecasted to include, precipitation or an air temperature less than 45°F, the cover shall be securely attached to protect the HMA.
- b. To prevent HMA adhering to hauling equipment, truck beds shall be sprayed with an environmentally benign release agent.
 - 1) Excess release agent shall be drained prior to filling the hauling equipment with HMA.
 - 2) Petroleum derivatives, or other coating material, that contaminate or alter the characteristics of the HMA shall not be used.
 - 3) For hopper trucks, the conveyor shall be in operation during the process of applying the release agent.

4. HMA Pavers:

- a. HMA pavers shall be self-contained, power-propelled units, provided with an internally heated vibratory screed and shall be capable of spreading and finishing courses of HMA plant mix material in lane widths applicable to the specified typical section and thicknesses shown in the Drawings.
- b. The screed shall be operated in accordance with the manufacturer's recommendations and shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, segregating, or gouging the mixture.
 - 1) A copy of the paver manufacturer's recommendations shall be provided upon request by the Project Representative.
 - 2) Extensions shall be allowed provided they produce the same results, including ride, density, and surface texture as obtained by the primary screed.
 - 3) Extensions without augers and an internally heated vibratory screed shall not be used in the traveled way.
- c. When laying HMA, the paver shall be operated at a uniform forward speed consistent with the plant production rate and roller train capacity to result in a continuous operation.
 - 1) The auger speed and flight gate opening shall be adjusted to coordinate with the operation.

- d. The paver shall be equipped with automatic screed controls with sensors for either or both sides of the paver.
 - 1) The controls shall be capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and providing automatic signals which operate the screed to maintain the desired grade and transverse slope.
 - 2) The sensor shall be constructed so it will operate from a reference line or a mat referencing device.
 - e. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1%. The paver shall be equipped with automatic feeder controls, properly adjusted to maintain a uniform depth of material ahead of the screed.
 - f. Manual operation shall be permitted in the construction of irregularly shaped and minor areas.
 - g. The Contractor shall furnish and install all pins, brackets, tensioning devices, wire, and accessories necessary for satisfactory operation of the automatic control equipment.
5. Rollers:
- a. Rollers shall be of the steel wheel, vibratory, and/or pneumatic tire type, in good condition, capable of reversing without backlash.
 - b. Operation of the roller shall be in accordance with manufacturer's recommendations.
 - c. The number and weight of rollers shall be sufficient to compact the mixture as required in this section.
 - d. The use of equipment which results in crushing of the aggregate shall not be permitted.
 - e. Rollers producing pickup, washboard, uneven compaction of the surface, displacement of the mixture, or other undesirable results shall not be used.

B. Conditioning of Existing Surface:

- 1. When the surface of the existing pavement is irregular, the Contractor shall bring it to a uniform grade and cross-section as shown on the Drawings or approved by the Project Representative.
- 2. Preleveling of uneven or broken surfaces over which HMA is to be placed may be accomplished by using an asphalt paver, a motor patrol grader, or by hand raking, as approved by the Project Representative.

C. Preparation of Existing Surfaces:

1. Before construction of HMA on an existing paved surface:
 - a. The entire surface of the pavement shall be clean;
 - b. All fatty asphalt patches, grease drippings, and other objectionable matter shall be entirely removed from the existing pavement;
 - c. All pavements or bituminous surfaces shall be thoroughly cleaned of dust, soil, pavement grindings, and other foreign matter;
 - d. All holes and small depressions shall be filled with an appropriate class of HMA; and
 - e. The surface of the patched area shall be leveled and compacted thoroughly.
2. A tack coat of asphalt shall be applied to all paved surfaces on which any course of HMA is to be placed or abutted.
 - a. Tack coat shall be uniformly applied to cover the existing pavement with a thin film of residual asphalt free of streaks and bare spots.
 - b. A heavy application of tack coat will be applied to all joints.
 - c. The spreading equipment shall be equipped with a thermometer to indicate the temperature of the tack coat material.
3. Equipment shall not operate on tacked surfaces until the tack has broken and cured.
 - a. If the Contractor's operation damages the tack coat it shall be repaired prior to placement of the HMA.
4. Unless otherwise approved by the Project Representative, the tack coat shall be CSS-1 emulsified asphalt.
 - a. The CSS-1 emulsified asphalt may be diluted with water at a rate not to exceed 1-part water to 1-part emulsified asphalt.
 - b. The tack coat shall not exceed the maximum temperature recommended by the emulsified asphalt manufacturer.

D. Preparation of CSBC Subgrade Surface:

1. The roadway surface shall be shaped to a uniform grade and cross-section as shown in the Drawings.
 - a. The roadway shall be dampened, bladed and rolled until the entire roadway surface shows a uniform grading and conforms to the line, grade, and cross-section shown in the Drawings, or as staked.

- b. During the operation of blading and rolling, water shall be applied, if necessary, in the amount and at the locations designated by the Project Representative.
- c. The entire surface shall be rolled with a smooth-wheeled or pneumatic-tired roller, or both, except that the final rolling shall be accomplished with a smooth-wheeled roller. Rolling shall continue until the entire roadway presents a firm, damp and unyielding surface.

E. Crack Sealing:

- 1. All cracks and joints 1/4 inch and greater in width shall be cleaned with a stiff-bristled broom and compressed air and then shall be filled completely with sand slurry.
- 2. The sand slurry shall consist of:
 - a. Approximately 20% CSS-1 emulsified asphalt;
 - b. Approximately 2% Portland cement;
 - c. Water (if required); and
 - d. The remainder clean U.S. No. 4-0 paving sand.
- 3. The sand slurry components shall be thoroughly mixed and then poured into the cracks and joints until full.
- 4. The following day, any cracks or joints that are not completely filled shall be topped off with additional sand slurry.
- 5. After the sand slurry is placed, the filler shall be struck off flush with the existing pavement surface and allowed to cure.
- 6. The HMA overlay shall not be placed until the slurry has fully cured.

F. Heating of Asphalt Binder:

- 1. The temperature of the asphalt binder shall not exceed the maximum recommended by the manufacturer.
- 2. The asphalt binder shall be heated in a manner that shall avoid local variations in heating.
- 3. The heating method shall provide a continuous supply of asphalt binder to the mixer at a uniform temperature plus or minus 25°F.

G. Preparation of Aggregate:

- 1. The aggregates shall be removed from stockpile(s) in a manner to ensure a minimum of segregation when being moved to the HMA plant for processing into the final mixture.

2. Mix Design:

- a. The mix design shall be WSDOT certified.
- b. Prior to production of HMA, the Contractor shall determine a design aggregate structure and asphalt binder content in accordance with this section.
- c. Once the design aggregate structure and asphalt binder content have been determined, the Contractor shall submit the HMA mix design, demonstrating that the design meets the requirements of this section.
- d. In no case shall paving begin before the determination of anti-strip requirements has been made.
- e. Changes to the aggregate and asphalt binder require approval from the Project Representative and may require a new mix design submittal from the Contractor.
- f. For aggregate, this shall include changes in the source of material or in a change in the percentage of material from a stockpile greater than 5%.
- g. Asphalt binder changes include the source of the crude petroleum supplied to the refinery, the refining process and additives or modifiers in the asphalt binder.

3. Non-statistical Evaluation:

- a. The Contractor shall submit representative samples of the mineral materials that are to be used in the HMA production.
- b. The Owner shall use these samples to determine anti-strip requirements, if any, in accordance with WSDOT Test Method T 718 and will also conduct verification testing of the mix design.
 - 1) Verification testing of HMA mix designs proposed by the Contractor that include RAP will be completed without the inclusion of the RAP. Submittal of RAP samples is not required.
 - 2) A mix design verification report will be provided within 25 calendar days after a mix design submittal has been received in the Owner's testing agency.
 - 3) If the results of the verification testing of the mix design by the Owner are within the tolerances in Table 8 the mix design will be considered verified.

Table 8
Job Mix Formula (JMF) Tolerances

Aggregate (Percent Passing)	Nonstatistical Evaluation
1 Inch Square, 3/4 Inch Square, 1/2 Inch Square, and 3/8 Inch Square Sieves	±6%

U.S. No. 4 Sieve	±6%
U.S. No. 8 Sieve	±6%
U.S. No. 200 Sieve	±2.0%
Asphalt Binder	±0.5%

VMA: 1.5% below minimum value in Table 4.

VFA: Minimum and Maximum as listed in Table 4.

Va: 2.5% minimum and 5.5% maximum.

- c. HMA must have a verified mix design before paving will be allowed.
 - 1) Where HMA mix design did not meet the required tolerances, the Contractor shall have the option to either resubmit a new mix design or proceed to paving an HMA mixture test section.
- d. The mix design will be the initial JMF for the class of mix. Any additional adjustments to the JMF will require the approval of the Project Engineer and may be made per the following.
 - 1) Aggregates: The maximum adjustment from the approved mix design shall be: 2% for the aggregate passing the 1-1/2 Inch Square, 1 Inch Square, 3/4 Inch Square, 1/2 Inch Square, 3/8 Inch Square, and U.S No. 4 sieves; one 1% for the aggregate passing the U.S No. 8 sieve; and 0.5% for the aggregate passing the U.S No. 200 sieve.
 - 2) Asphalt Binder Content: The Project Representative may order or approve changes to asphalt binder content. The maximum adjustment from the approved mix design for the asphalt binder content shall be 0.3%.

H. Mixing:

- 1. After the required amounts of mineral materials and asphalt binder have been introduced into the mixer, the HMA shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the asphalt binder throughout the mineral materials is ensured.
- 2. When discharged, the temperature of the mix shall not exceed the maximum temperature recommended by the asphalt binder manufacturer. A maximum water content of 2% in the mix, at discharge, shall be allowed providing the water causes no problems with handling, stripping, or flushing. If the water in the HMA causes any of these problems, the moisture content shall be reduced as directed by the Project Representative.
- 3. Storing or holding of the HMA in approved storage facilities shall be permitted during the daily operation, but in no event shall the HMA be held for more than 24 hours. HMA held for more than 24 hours after mixing shall be rejected and disposed of by the Contractor at no expense to Owner. The storage facility shall have an accessible device located at the top of the cone or about the third point to indicate the amount of material in storage. No HMA shall be accepted from the storage facility when the HMA in storage is below the top of the cone of the storage facility, except at the end of the work shift.

4. Acceptance Sampling and Testing:

- a. Acceptance of HMA shall be as provided under nonstatistical evaluation.
- b. Samples for acceptance testing shall be obtained by the Contractor as directed by the Project Representative. The Contractor shall sample the HMA mixture in the presence of the Project Representative in accordance with AASHTO T 168.
- c. Definition of Sampling Lot and Sub-lot.
 - 1) For the purpose of acceptance sampling and testing, a lot is defined as the total quantity of material produced for each JMF placed and represented by randomly selected samples tested for acceptance. All of the test results obtained from the acceptance samples shall be evaluated collectively. Only one lot per JMF will be expected to occur.
 - 2) The Contractor may request a change in the JMF. If the request is approved, all of the material produced up to the time of the change shall be evaluated on the basis of tests on samples taken from that material and a new lot will begin.
 - 3) Sampling and testing for nonstatistical evaluation shall be performed on the frequency of one sample per sub-lot. Sub-lots shall be approximately uniform in size with a maximum sub-lot size of 800 tons.
 - 4) The quantity of material represented by the final sub-lot may be increased to a maximum of two times the sub-lot quantity calculated.
- d. Test Results: The Project Representative shall furnish the Contractor with a copy of the results of all acceptance testing performed in the field at the beginning of the next paving shift.
- e. Test Methods: Testing of HMA for compliance of volumetric properties (VMA, VFA, and Va) Shall be by WSDOT SOP 731. Testing for compliance of asphalt binder content shall be by AASHTO T 308. Testing for Compliance of gradation shall be by AASHTO T 27/T 11.

I. Spreading and Finishing:

1. The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. HMA pavers complying with this section shall be used to distribute the mixture.
2. Unless otherwise directed by the Project Representative, the nominal compacted depth of any layer of any course shall not exceed:
 - a. 0.30 foot for HMA Class 1/2 In.
 - b. 0.35 foot for HMA Class 1 In.

3. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the paving may be done with other equipment or by hand.
4. When more than one JMF is being utilized to produce HMA, the material produced for each JMF shall be placed by separate spreading and compacting equipment. Intermingling of HMA produced from more than one JMF is prohibited.

J. Compaction:

1. Immediately after the HMA has been spread and struck off, and surface irregularities have been adjusted, the mix shall be thoroughly and uniformly compacted. The completed course shall be free from ridges, ruts, humps, depressions, objectionable marks, or irregularities and shall conform to the line, grade, and cross-section shown in the Drawings. If necessary, the JMF may be altered to achieve desired results.
2. Compaction shall take place when the mixture is in the proper condition so that no undue displacement, cracking, or shoving occurs. Areas inaccessible to large compaction equipment shall be compacted by mechanical and hand tampers. Any HMA that becomes loose, broken, contaminated, shows an excess or deficiency of asphalt, or is in any way defective shall be removed and replaced with new HMA which shall be immediately compacted to conform with the surrounding area.
3. The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided specified densities are attained. An exception shall be that the pneumatic tired roller shall be used between October 1 and April 1. Coverages with a vibratory or steel wheel roller may precede pneumatic tired rolling.
4. Vibratory rollers shall not be operated in the vibratory mode when the internal temperature of the mix is less than 175°F without permission from the Project Representative. In no case shall a vibratory roller be operated in a vibratory mode when checking or cracking of the mat occurs.

K. Compaction Control:

1. HMA used in traffic lanes, including lanes for ramps, truck climbing, weaving, and speed change, and having a specified compacted course thickness greater than 0.10 foot, shall be compacted to a specified level of relative density.
2. The specified level of relative density shall be a minimum 91.0% of the reference maximum density as determined by AASHTO T 209.
3. The specified level of density attained shall be by statistical evaluation of the tests taken in accordance with WAQTC TM 8 and WSDOT SOP T 729 on the day the mix is placed (after compaction of the finish rolling).
4. Each lot shall be divided into five sub-lots. The sub-lot locations shall be determined by the stratified random sampling procedure conforming to WSDOT Test Method Number 716. The quantity represented by each density lot shall be no greater than a single

day's production or approximately four 400 tons, whichever is less, except the final lot each day may be increased to a maximum of 600 tons.

5. The Project Representative shall furnish the Contractor with a copy of the results of all compaction acceptance testing within 3 working days. Acceptance of HMA compaction shall be based on the statistical evaluation.
6. When cores are taken by the Project Representative at the request of the Contractor, they shall be requested by noon of the next workday after receiving test results. The cores shall be taken at approximately the same locations as the nuclear density gauge tests in the compaction lot being challenged. The cost for the coring expenses, when the core results indicate the specified level of relative density within a lot has not been achieved, shall be deducted from any monies due or that may become due the Contractor under the contract at the rate of \$125 per core.
7. HMA constructed under conditions other than listed above shall be compacted on the basis of a test point evaluation of the compaction train. The test point evaluation shall be performed in accordance with instructions from the Project Representative. The number of passes with an approved compaction train, required to attain the maximum test point density, shall be used on all subsequent paving.
8. HMA for preleveling shall be compacted. HMA that is used for preleveling wheel rutting shall be compacted with a pneumatic tire roller unless otherwise approved by the Project Representative.

L. Reject HMA:

1. Rejection Without Testing: The Project Representative may, without sampling, reject any batch, load, or section of roadway that appears defective in gradation or asphalt binder content. Material rejected before placement shall not be incorporated into the pavement. Any rejected section of roadway shall be removed. No payment shall be made for the rejected materials or the removal of the materials unless the Contractor requests that the rejected material be tested. If the Contractor elects to have the rejected material tested, a minimum of three representative samples shall be obtained and tested. Acceptance of rejected material shall be based on conformance with this section.

M. Joints:

1. Transverse joints:
 - a. The Contractor shall conduct operations such that the placing of top or wearing course is a continuous operation or as close to continuous as possible. Unscheduled transverse joints shall be allowed and the roller may pass over the unprotected end of the freshly laid mixture only when the placement of the course must be discontinued for such a length of time that the mixture will cool below compaction temperature. When the paving is resumed, the previously compacted mixture shall be cut back to produce a slightly beveled edge for the full thickness of the course.

- b. A temporary wedge of HMA constructed on a 50 horizontal to 1 vertical shall be constructed where a transverse joint is open to traffic. The HMA in the temporary wedge shall be separated from the permanent HMA by strips of heavy wrapping paper. The wrapping paper shall be removed and the joint trimmed to a slightly beveled edge for the full thickness of the course prior to resumption of paving.
 - c. The material that is cut away shall be waste and new mix shall be laid against the cut. Rollers or tamping irons shall be used to seal the joint.
- 2. Longitudinal Joints:
 - a. The longitudinal joint in any 1 course shall be offset from the course immediately below by not more than 6 inches nor less than 2 inches.
 - b. All longitudinal joints constructed in the wearing course shall be located at a lane line or edge line of the traveled way.

N. Surface Smoothness:

- 1. The completed surface of all courses shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds.
- 2. The completed surface of the wearing course shall not vary more than 1/8 inch from the lower edge of a 10 foot straightedge placed on the surface parallel to the centerline.
- 3. The transverse slope of the completed surface of the wearing course shall vary not more than 1/4 inch in 10 feet from the rate of transverse slope shown on the Drawings.
- 4. When deviations in excess of the above tolerances are found that result from a high place in the HMA, the pavement surface shall be corrected by one of the following methods.
 - a. Removal of material from high places by grinding with an approved grinding machine,
 - b. Removal and replacement of the wearing course of HMA, or
 - c. By other means as approved by the Project Representative.
- 5. Correction of defects shall be carried out until there are no deviations anywhere greater than the allowable tolerances.
- 6. Deviations in excess of the above tolerances that result from a low place in the HMA and deviations resulting from a high place where corrective action, in the opinion of the Project Representative, will not produce satisfactory results may be accepted with a price adjustment.
- 7. When utility appurtenances such as manhole covers and valve boxes are located in the traveled way, the roadway shall be paved before the utility appurtenances are adjusted to the finished grade.

O. Planing Bituminous Pavement:

1. Planing shall be performed in such a manner that the underlying pavement is not torn, broken, or otherwise damaged by the planing operation. Delamination or raveling of the underlying pavement will not be construed as damage due to the Contractor's operations. Pavement outside the limits shown in the Drawings that is damaged by the Contractor's operations shall be repaired to the satisfaction of the Project Representative, at the Contractor's expense.
2. For mainline planing operations, the equipment shall have automatic controls, with sensors for either or both sides of the equipment. The controls shall be capable of sensing the grade from an outside reference line, or a mat-referencing device. The automatic controls shall have a transverse slope controller capable of maintaining the mandrel at the desired transverse slope (expressed as a percentage) within plus or minus 0.1%.
3. The planings and other debris resulting from the planing operation shall become the property of the Contractor and be disposed of off-site at no cost to the Owner. The planings may be utilized as RAP, within the requirements of this section.

P. HMA Road Approaches:

1. HMA approaches shall be constructed at the locations shown in the Drawings, or where staked by the Project Representative. The Work shall be performed in accordance with this section.

Q. Weather Limitations:

1. Asphalt for prime coat shall not be applied when the ground temperature is lower than 50°F, without written approval of the Project Representative.
2. HMA shall not be placed on any wet surface, or when the average surface temperatures are less than those specified in Table 9, or when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures.

Table 9
Surface Temperature Limitations

Compacted Thickness (Feet)	Wearing Course	Other Course
Less than 0.10	55°F	45°F
0.10 to 0.20	45°F	35°F
0.21 to 0.35	35°F	35°F
More than 0.35	Not Applicable	25°F ¹

¹ Only on dry Subgrade, not frozen and when air temperature is rising.

3. Weather limitations may be modified as approved by the Project Representative.

3.03 REPAIR

- A. The Contractor shall excavate pavement repair areas and shall backfill these areas with HMA.
- B. The Project Representative shall determine the excavation depth, which may vary to a maximum depth of 1 foot. The determination shall depend on the location of material suitable for support of the pavement.
- C. The minimum width of any pavement repair area shall be 3 feet. Before excavation, the existing pavement shall be sawcut or shall be removed by a pavement grinder.
- D. Asphalt for tack coat shall be required as specified in this section. A heavy application of tack coat shall be applied to all surfaces of existing pavement in the pavement repair area.
- E. Excavated materials shall become the property of the Contractor for disposal.
- F. The Contractor shall conduct the excavation operations in a manner that shall protect the pavement that is to remain. Pavement not designated to be removed that is damaged as a result of the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Project Representative at no cost to the Owner.
- G. Placement of HMA backfill shall be accomplished in lifts not to exceed 0.35 foot compacted depth. Each lift shall be compacted by mechanical tamper or a roller to 91% of the reference maximum density as determined by AASHTO T 209.

3.04 FIELD QUALITY CONTROL

- A. General: Testing in-place HMA paving courses for compliance with requirements for compaction, thickness and surface smoothness shall be performed by the Owner's testing laboratory. Repair or remove and replace unacceptable paving as directed by the Project Representative.
- B. Thickness: In-place compacted thickness tested in accordance with ASTM D 3549 shall not be acceptable if variations are greater than plus or minus 1/4 inch.
- C. Surface Smoothness: Test finished surface of each HMA paving course for smoothness, in accordance with this section.
- D. Check surface areas at intervals as directed by the Project Representative.

3.05 PROTECTION

- A. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- B. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

END OF SECTION

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SECTION 32 16 00
CURBS, GUTTERS, AND SIDEWALKS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete curb, gutter, and sidewalk over prepared subgrade.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:
 - 1. US General Services Administration, Federal Standard 595 – Colors Used in Government Procurement.
 - 2. Washington State Department of Transportation (WSDOT) Qualified Products List for Standard Specification 8-14.3(3).

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product data in the form of manufacturer's technical data, specifications, and installation instructions for sidewalk ramp detectable warning pattern.
 - 2. Concrete mix design.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with Section 01 43 00, "Quality Assurance and Control."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00, "Product Requirements."

PART 2 – PRODUCTS

2.01 CONCRETE

- A. Concrete shall be in accordance with 2024 WSDOT SS 8-04.3 and meet the requirements of 6-02.3(2)B

2.02 JOINT FILLER

- A. Joint Filler shall be in accordance with Section 03 30 00, "Cast-In-Place Concrete."

PART 3 – EXECUTION

3.01 PREPARATION

- A. Excavation and grading requirements are specified in Section 31 23 00, "Earthwork."
- B. Crushed Surfacing Base Course: Place 4 inches of compacted crushed surfacing base course under curb, gutter, and sidewalk in accordance with Section 31 23 00, "Earthwork."

3.02 CONSTRUCTION

- A. Curb and Gutter
 - 1. Cement concrete curb and curb and gutter shall be constructed with air entrained concrete per 2024 WSDOT SS 8-04.3(1).
 - 2. The foundation for curbs and gutters shall be thoroughly compacted and required side forms shall rest throughout their length on firm ground.
 - a. Side forms for straight sections shall be full depth of the curb.
 - b. Side forms shall be in accordance with Section 03 30 00, "Cast-In-Place Concrete."
 - c. Forms used more than one time shall be thoroughly cleaned and any forms that have become worn, splintered, or warped shall not be used again.
 - 3. The foundation shall be watered thoroughly before the concrete is placed, and the concrete shall be well tamped and spaded or vibrated in the forms.
 - a. The exposed surfaces shall be finished full width with a trowel and edger.
 - b. Within 24 hours after the concrete is placed, the forms of the roadway face of curbs shall be removed, and the concrete treated with a float finish.
 - c. The top and face of the curb shall receive a light brush finish, and the top of the gutter shall receive a broom finish.
 - 4. Expansion joints in the curb, or curb and gutter, shall be spaced at 15 foot intervals, the beginning and ends of curb returns, drainage structures, bridges, and cold joints with existing curbs and gutters.
 - a. The expansion joint shall be filled to full cross-section with 3/8 inch premolded joint filler.

- b. When curb, or curb and gutter, is placed adjacent to Portland cement concrete pavement, a 1/4 inch thick, 6 inch deep premolded joint filler shall be installed between the two vertical surfaces to prevent cracking.
 - c. When noted in the Drawings, the Contractor shall install the catch basin gutter pan at drainage structures abutting the curb and gutter.
- 5. The concrete shall be cured for 72 hours by one of the methods specified in Section 03 30 00, "Cast-In-Place Concrete."
- 6. At the option of the Contractor, the curb and gutter may be constructed using approved slip-form equipment. The curb and gutter shall be constructed to the same requirements as the cast-in-place curb and gutter.
- 7. A water-reducing admixture conforming to the requirements of Section 03 30 00, "Cast-In-Place Concrete," may be used, provided the finished curb and gutter shall retain its line and shape.
- 8. Provide a smooth transition, both vertically and horizontally, at locations where one curb, or curb and gutter, type transitions to another type.
 - a. Maintain a continuous and smooth flow line.

B. Sidewalk:

- 1. Cement concrete sidewalks shall be constructed with air entrained concrete in accordance with WSDOT 2024 SS 8-14.3 and 6-02.3(2)B.
- 2. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms.
 - a. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown in the Drawings.
 - b. All soft and yielding material shall be removed and replaced with acceptable material.
- 3. Forms shall be in accordance with Section 03 30 00, "Cast-In-Place Concrete," and shall extend for the full depth of the concrete.
 - a. All forms shall be straight, free from warp, and of sufficient strength to resist the pressure of the concrete without springing.
 - b. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.
 - c. After the forms have been set to line and grade, the foundation shall be brought to the grade required and thoroughly wetted approximately 12 hours before placing the concrete.
- 4. The concrete shall be placed in the forms and struck off with an approved straightedge.

- a. As soon as the surface can be worked, it shall be troweled smooth with a steel trowel.
5. After troweling and before installing the contraction joints or perimeter edging, the walking surfaces of the sidewalk and ramps shall be brushed in a transverse direction with a stiff bristled broom. Prepare a sample broom finish for approval by the Project Representative.
6. Expansion and contraction joints shall be constructed as shown in the Drawings and in accordance with Section 03 30 00, "Cast-In-Place Concrete."
 - a. When the sidewalk abuts a cement concrete curb, or curb and gutter, the expansion joints in the sidewalk shall have the same spacing as the curb.
 - b. The expansion joint shall be filled to full cross-section of the sidewalk with 3/8 inch premolded joint filler.
7. Sidewalk ramps shall be as shown on the Drawings.
 - a. The detectable warning pattern shall have the truncated dome shape and may be installed using a manufactured material before or after the concrete has cured, or by installing masonry or ceramic tiles.
 - b. Embossing or stamping the wet concrete to achieve the truncated dome pattern or using a mold into which a catalyst hardened material is applied shall not be allowed.
 - c. Acceptable manufacturers' products are shown on the WSDOT Qualified Products List for Standard Specification 8-14.3(3).
8. When masonry or ceramic tiles are used to create the detectable warning pattern, the Contractor shall block out the detectable warning pattern area to the depth required for installation of the tiles and finish the construction of the concrete ramp.
 - a. After the concrete has set and the forms have been removed, the Contractor shall install the tiles using standard masonry practices.
9. The two (2) foot wide detectable warning pattern area on the ramp shall be yellow and shall match Federal Standard 595a, color number 33538.
10. Concrete sidewalks shall be cured for at least 72 hours in accordance with Section 03 30 00, "Cast-In-Place Concrete."
 - a. Curing shall be by means of moist burlap or quilted blankets or other approved methods.
 - b. During the curing period, all traffic, both pedestrian and vehicular, shall be excluded.
 - c. Vehicular traffic shall be excluded for such additional time as the Project Representative may specify.

3.03 ADJUSTING

- A. Where new work will abut existing site improvements, adjust new work to transition to match existing work.

3.04 REPAIR/RESTORATION

- A. Repair and restore any curb, curb and gutter, or sidewalk damaged or removed during construction, including cracking or excessive settlement, at no additional cost to the Owner.
 - 1. Remove damaged section up to an adjacent expansion joint, or saw cut a neat line.
 - 2. Replacement Work shall be in accordance with the Drawings and this section.
 - 3. Remove and replace sections such that adjacent expansion joint are no closer than 7 feet, or match existing conditions.

END OF SECTION

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SECTION 32 17 00
PAVING SPECIALTIES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes exterior:
 - 1. Pavement markings;
 - 2. Temporary pavement markings;
 - 3. Recycled plastic wheel stops.
 - 4. Flexible Guidepost Surface Mount.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section.
- B. American Association of State Highway and Transportation Officials (AASHTO) – www.aashto.org.
 - 1. AASHTO M 237 – Standard Specification for Epoxy Resin Adhesives for Bonding Traffic Markers to Hardened Portland Cement and Asphalt Concrete, Single User Digital Publication.
 - 2. AASHTO M 247– Standard Specification for Glass Beads Used in Pavement Markings, Single User Digital Publication.
 - 3. AASHTO M 249 – Standard Specification for White and Yellow Reflective Thermoplastic Striping Material (Solid Form), Single User Digital Publication.
 - 4. AASHTO T 49 – Standard Method of Test for Penetration of Bituminous Materials.
 - 5. AASHTO T 51 – Standard Method of Test for Ductility of Asphalt Materials.
 - 6. AASHTO T 53 – Standard Method of Test for Softening Point of Bitumen (Ring-and-Ball Apparatus).
 - 7. AASHTO T 316 – Standard Method of Test for Viscosity Determination of Asphalt Binder Using Rotational Viscometer, Single User Digital Publication.
- C. ASTM International (ASTM) – www.astm.org.
 - 1. ASTM C 882 – Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
 - 2. ASTM D 93 – Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester.

3. ASTM D 476 – Standard Classification for Dry Pigmentary Titanium Dioxide Products.
4. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
5. ASTM D 562 – Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
6. ASTM D 570 – Standard Test Method for Water Absorption of Plastics.
7. ASTM D 792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
8. ASTM D 823 – Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels.
9. ASTM D 969 – Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
10. ASTM D 1210 – Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage.
11. ASTM D 1309 – Standard Test Method for Settling Properties of Traffic Paints During Storage.
12. ASTM D 1475 – Standard Test Method For Density of Liquid Coatings, Inks, and Related Products.
13. ASTM D 1849 – Standard Test Method for Package Stability of Paint.
14. ASTM D 2243 – Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings.
15. ASTM D 2369 – Standard Test Method for Volatile Content of Coatings.
16. ASTM D 2371 – Standard Test Method for Pigment Content of Solvent-Reducible Paints.
17. ASTM D 2486 – Standard Test Methods for Scrub Resistance of Wall Paints.
18. ASTM D 2805 – Standard Test Method for Hiding Power of Paints by Reflectometry.
19. ASTM D 3111 – Standard Test Method for Flexibility Determination of Hot-Melt Adhesives by Mandrel Bend Test Method.
20. ASTM D 3168 – Standard Practice for Qualitative Identification of Polymers in Emulsion Paints.
21. ASTM D 3335 – Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy.

- 22. ASTM D 3718 – Standard Test Method for Low Concentrations of Chromium in Paint by Atomic Absorption Spectroscopy.
- 23. ASTM D 3723 – Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing.
- 24. ASTM D 3924 – Standard Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials.
- 25. ASTM D 3960 – Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
- 26. ASTM D 4563 – Standard Test Method for Determination by Atomic Absorption Spectroscopy of Titanium Dioxide Content of Pigments Recovered From Whole Paint.
- 27. ASTM D 4592 – Standard Specification for Preformed Retroreflective Pavement Marking Tape for Limited Service Life.
- 28. ASTM D 6359 – Standard Specification for Minimum Retroreflectance of Newly Applied Pavement Marking Using Portable Hand-Operated Instruments.
- 29. ASTM E 70 – Standard Test Method for pH of Aqueous Solutions With the Glass Electrode
- 30. ASTM E303 – Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
- D. US General Services Administration, Federal Standard 595 – Colors Used in Government Procurement.
- E. Washington State Department of Transportation (WSDOT) Qualified Products List for Standard Specification 8-14.3(3).
- F. WSDOT Test Method T 426 – Pull-Off Test for Hot Melt Traffic Button Adhesive.

1.03 DEFINITIONS AND ACRONYMS

- A. Horizontal entrance angle shall mean the angle in the horizontal plane between the direction of incident light and the normal to the leading edge of the marker.
- B. Observation angle shall mean the angle at the reflector between observer's line of sight and direction of the light incident on the reflector.
- C. Specific intensity (SI) shall mean candle power of the returned light at the chosen observation and entrance angles for each foot-candle of illumination at the reflector on a plane perpendicular to the incident light.
- D. HMA: Hot mix asphalt.
- E. VOC: Volatile organic compound.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product data, installation instructions, and manufacturers certification that all pavement marking materials meet the Specifications.
 - 2. Product data in the form of manufacturer's technical data, specifications, and installation instructions for sidewalk ramp detectable warning pattern.
 - 3. Product data in the form of manufacturer's technical data, specifications, and installation instructions for the recycled plastic wheel stops.
 - 4. Product data in the form of manufacturer's technical data, specifications, and installation instructions for the recycled plastic delineators.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Section 01 43 00, "Quality Assurance and Control."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00, "Product Requirements."

PART 2 – PRODUCTS

2.01 PAVEMENT MARKINGS

- A. Paint:
 - 1. General:
 - a. White and yellow paint shall comply with the low VOC solvent based paint or low VOC waterborne paint of this section.
 - b. Blue paint for "Access Parking Space Symbol with Background" shall be chosen from a WSDOT QPL listed Manufacturer. The blue color shall match Fed Standard 595, color 15090 and the tolerance of variation shall match that shown in the FHWA "Highway Blue Color Tolerance Chart."
 - 2. Low VOC solvent based paint material requirements are as follows:
 - a. Bleeding over asphalt in accordance with ASTM D 969, modified as follows:
 - 1) The reflectance measurement of the paint over asphalt paper shall be at least 90% of the reflectance measurement of the paint over a taped (nonbleeding) surface.
 - b. Chromium Content shall be less than 50 parts per million (ppm) in accordance with ASTM D 3718.

- c. Yellow Color paint draw-downs shall be prepared in accordance with ASTM D 823 and the following.
 - 1) The paint shall match Federal Standard 595a color number 33538 and the tolerance of color variation shall match that shown in the FHWA "Highway Yellow Color Tolerance Chart (PR Color #1)".
- d. Directional Reflectance in accordance with WSDOT Test Method 314.
 - 1) White paint shall have a minimum reflectance of 80%.
- e. Density shall be eleven and eight tenths (11.8) pounds/gallon minimum in accordance with ASTM D 1475, at seventy 70°F.
- f. Flexibility shall be in accordance with ASTM D 522 and the following.
 - 1) The paint shall be applied at a wet film thickness of 6 mils to a 3 inch by 5-inch panel that has been solvent cleaned and lightly buffed with steel wool.
 - 2) With the panel kept in a horizontal position, the paint shall be allowed to dry for 18 hours at 75°F (plus or minus 5°F) then baked for 3 hours at 140°F (plus or minus 4°F).
 - 3) The panel shall be cooled to 75°F (plus or minus 5°F) for at least 30 minutes, bent over a 0.25 inch mandrel and then examined without magnification.
 - 4) The paint shall show no cracking, flaking, or loss of adhesion.
- g. No Track Time (Dry to No-Pick-Up Time):
 - 1) The paint, when applied in a line at a rate of 15 mils wet film thickness with 7 pounds of glass beads (Paragraph 2.01 C) per gallon of paint added to the paint surface shall "dry to no-pick-up" in 90% seconds maximum.
 - 2) The test line shall be applied over a 30 day old (approximate), nonbeaded state standard paint line.
 - 3) The test line shall be applied using a striper capable of maintaining the 15 mil wet film thickness specified.
 - 4) The glass beads shall be blown onto the line during paint application.
 - 5) The test shall be conducted on dry pavement when the pavement temperature is between 50 and 100°F and the relative humidity is less than 85%.
 - 6) The "dry to no-pick-up" tests shall be performed by having a standard size sedan or equivalent test vehicle coast across the paint line with no turning or accelerating at a speed of approximately forty (40) mph, no more than ninety (90) seconds after the test line is applied to the pavement.

- 7) A successful test shall be considered one in which at least three out of four line crossings show no visible paint from the line tracked onto the adjacent pavement when viewed standing 50 feet from the point where the test vehicle crossed the line.
- h. Lead Content shall be 0.06% maximum in accordance with ASTM D 3335.
- i. Nonvolatile Content shall be 65% minimum in accordance with ASTM D 2369.
- j. Package Stability shall be a 6 rating minimum for all criteria in accordance with ASTM D 1849.
- k. Pigment Content shall be 53% maximum in accordance with ASTM D 2371.
- l. Redissolve:
 - 1) A fifteen 15 mil wet film thickness of paint shall be applied to a glass panel.
 - 2) The paint shall be air dried for 16 hours at 77°F then baked for 4 hours at 140°F.
 - 3) The panel shall be cooled to room temperature and placed in a quart container that is half filled with the same paint being tested.
 - 4) The container shall be sealed and left undisturbed for 18 hours.
 - 5) After removing the panel from the container, a wooden spatula shall be drawn lightly over the painted surface.
 - 6) The immersed portion of the paint film shall be completely dissolved with no evidence of dried paint remaining on the panel.
- m. Retroreflectance:
 - 1) Newly applied pavement markings shall have a minimum initial coefficient of retroreflective luminance of 250 mcd/m²/lux for white and 175 mcd/m²/lux for yellow in accordance with ASTM D 6359 when measured with a 30 meter retroreflectometer.
 - 2) WSDOT will measure retroreflectivity for compliance with a Delta LTL-X retroreflectometer.
- n. Skinning:
 - 1) The paint shall not skin within 48 hours in a 3/4 filled tightly closed container.
- o. Settling properties during storage shall be in accordance with ASTM D 1309 and the following:
 - 1) The sample shall show no more than 0.5 inch of clear material over the opaque portion of the paint and there shall be no settling below a rating of 7.

- p. Titanium Dioxide (Rutile Type II) in accordance with ASTM D 476 and the following:
 - 1) White – 1.0 pounds per gallon minimum (ASTM D 4563).
 - 2) Yellow – 0.2 pounds per gallon maximum (ASTM D 4563).
 - q. Viscosity in accordance with ASTM D 562 and the following:
 - 1) 105 Krebs units maximum at 50°F.
 - 2) 75 to 85 Krebs units at seventy 70°F.
 - 3) 65 Krebs units minimum at 120°F.
 - r. Volatile Organic Compound Content shall be 1.25 pounds per gallon maximum in accordance with ASTM D 3960.
3. Low VOC waterborne paint material requirements are as follows:
- a. Binder shall be 100% acrylic and in accordance with ASTM D 3168.
 - b. Chromium Content shall be less than 50 ppm in accordance with ASTM D 3718.
 - c. Yellow Color paint draw-downs shall be prepared in accordance with ASTM D 823 and the following:
 - 1) The paint shall match Federal Standard 595a color number 33538 and the tolerance of color variation shall match that shown in the FHWA “Highway Yellow Color Tolerance Chart (PR Color #1).”
 - d. Contrast Ratio at 15 mils wet film thickness in accordance with ASTM D 2805.
 - 1) White: 98% minimum.
 - 2) Yellow: 96% minimum.
 - e. Directional Reflectance in accordance with WSDOT Test Method 314.
 - 1) White paint shall have a minimum reflectance of 88% on a 15 mil wet film thickness.
 - f. Fineness of Dispersion shall be 3 minimum (Hegman Scale) in accordance with ASTM D 1210.
 - g. Flash Point shall be 100°F minimum in accordance with ASTM D 93.
 - h. Freeze Thaw shall be five cycles minimum in accordance with ASTM D 2243.
 - i. No Track Time (Dry to No-Pick-Up Time):

- 1) The paint, when applied in a line at a rate of 15 mils wet film thickness with 7 pounds of glass beads (Paragraph 2.01 C) per gallon of paint added to the paint surface, shall “dry to no-pick-up” in 90 seconds maximum.
 - 2) The test line shall be applied over a 30 day old (approximate), nonbeaded state standard paint line.
 - 3) The test line shall be applied using a striper capable of maintaining the fifteen 15 mil wet film thickness specified.
 - 4) The glass beads shall be blown onto the line during paint application.
 - 5) The test shall be conducted on dry pavement when the pavement temperature is between 50 and 100°F and the relative humidity is less than 85%.
 - 6) The “dry to no-pick-up” tests shall be performed by having a standard size sedan or equivalent test vehicle coast across the paint line with no turning or accelerating at a speed of approximately 40 mph, no more than 90 seconds after the test line is applied to the pavement.
 - 7) A successful test shall be considered one in which at least three out of four line crossings show no visible paint from the line tracked onto the adjacent pavement when viewed standing 50 feet from the point where the test vehicle crossed the line.
- j. Lead Content shall be 0.06% maximum in accordance with ASTM D 3335.
- k. Nonvolatile Content shall be 60% minimum in accordance with ASTM D 2369.
- l. Nonvolatile Vehicle:
- 1) Nonvolatile vehicle is calculated from the nonvolatile content as determined in ASTM D2369 and the pigment content as determined in ASTM D 3723.
 - 2) Percent nonvolatile vehicle = $100 - (100\% \text{ nonvolatile content}) - \text{percent pigment}$, shall be 36% minimum by weight.
- m. pH shall be 9.5 minimum in accordance with ASTM E 70.
- n. Retroreflectance:
- 1) Newly applied pavement markings shall have a minimum initial coefficient of retroreflective luminance of 250 mcd/m²/lux for white and 175 mcd/m²/lux for yellow in accordance with ASTM D 6359 when measured with a 30 meter retroreflectometer.
 - 2) WSDOT will measure retroreflectivity for compliance with a Delta LTL-X retroreflectometer.
- o. Scrub Resistance shall be five hundred (500) cycles minimum in accordance with ASTM D 2486.

p. Static Heat Stability:

- 1) A 1 pint lined container shall be filled with approximately 15 fluid ounces of paint.
 - 2) The container shall be sealed with tape and put in an oven maintained at 135°F (plus or minus 1°F) for 7 days.
 - 3) The paint shall be removed from the oven and equilibrated at standard conditions (ASTM D 3924).
 - 4) The paint shall be mixed thoroughly with gentle stirring.
 - 5) The viscosity shall be determined.
 - 6) The paint shall show no increase in viscosity greater than 10 Krebs units over the viscosity at 77°F (see Paragraph 2.01 A.4.q below) nor shall the paint show any coagulation, lumps or coarse particles.
- q. Viscosity shall be 100 Krebs units maximum at 77°F in accordance with ASTM D 562.
- r. VOC content shall be 1.25 pounds per gallon maximum in accordance with ASTM D 3960.

B. Plastic:

1. General:

- a. White and yellow plastic pavement marking materials shall comply with the following:
 - 1) Type A – Liquid hot applied thermoplastic; and
 - 2) Type B – Preformed fused thermoplastic.
- b. Blue plastic pavement marking material for “Access Parking Space Symbol with Background” shall be chosen from a WSDOT QPL listed Manufacturer. The blue color shall match Fed Standard 595, color 15090 and the tolerance of variation shall match that shown in the FHWA “Highway Blue Color Tolerance Chart.”

2. Type A – Liquid Hot Applied Thermoplastic:

- a. Type A material consists of a mixture of pigment, fillers, resins, and glass beads that is applied to the pavement in the molten state by extrusion or by spraying.
- b. The material can be applied at a continuously uniform thickness or it can be applied with a profiled pattern.
- c. Glass beads, intermixed and top dress, shall conform to the manufacturer's recommendations necessary to meet the retroreflectance requirements.

- d. Type A material shall conform to the requirements of AASHTO M 249 and the following:
 - 1) Resin shall be alkyd or hydrocarbon.
 - 2) Retroreflectance:
 - a) Newly applied pavement markings shall have a minimum initial coefficient of retroreflective luminance of 250 mcd/m²/lux for white and 175 mcd/m²/lux for yellow in accordance with ASTM D 6359 when measured with a 30 meter retroreflectometer.
 - b) Measure retroreflectivity for compliance with a Delta LTL-X retroreflectometer.
 - 3) Skid Resistance shall be 45 BPN units minimum in accordance with ASTM E 303.
- 3. Type B – Preformed Fused Thermoplastic:
 - a. Type B material consists of a mixture of pigment, fillers, resins, and glass beads that is factory produced in sheet form.
 - b. The material is applied by heating the pavement and top heating the material.
 - c. The material shall contain intermixed glass beads.
 - d. The material shall conform to AASHTO M 249, with the exception of the relevant differences for the materials being applied in the preformed state and the following:
 - 1) Resin shall be alkyd or hydrocarbon.
 - 2) Retroreflectance:
 - a) Newly applied pavement markings shall have a minimum initial coefficient of retroreflective luminance of 250 mcd/m²/lux for white and 175 mcd/m²/lux for yellow in accordance with ASTM D 6359 when measured with a 30 meter retroreflectometer.
 - b) WSDOT will measure retroreflectivity for compliance with a Delta LTL-X retroreflectometer.
 - 3) Skid Resistance shall be 45 BPN units minimum in accordance with ASTM E 303.

C. Glass Beads:

- 1. Glass beads for traffic paint shall conform to AASHTO M 247 and the following:
 - a. Gradation: AASHTO M 247 Type 1.
 - b. Coating: The glass beads shall be coated with a silicone for moisture resistance and a silane to promote adhesion in both waterborne and solvent base traffic paint.
 - 1) The presence of the coating is to be verified by WSDOT test method T430.

- c. Chemical Make-up and Environmental Protection: Glass beads shall not contain any element in excess of the following established total concentration limits when tested in accordance with the listed test methodology.

Element	Test Method	Maximum ppm
Arsenic	*EPA SW846 6010B	20.0 ppm
Barium	*EPA SW846 6010B	100.0 ppm
Cadmium	*EPA SW846 6010B	1.0 ppm
Chromium	*EPA SW846 6010B	5.0 ppm
Lead	*EPA SW846 6010B	50.0 ppm
Selenium	*EPA SW846 6010B	1.0 ppm
Silver	*EPA SW846 6010B	5.0 ppm
Mercury	**EPA SW846 7471A	0.2 ppm

Test Method:

- * EPA's SW846 6010B, inductively coupled plasma atomic emissions spectrometry (ICP-AES). Reference Concentration Limits.
- ** EPA's Method SW846 7471A, cold-vapor absorption method. Reference Concentration Limits.

D. Field Testing

1. Field testing is required for all pavement marking materials.
2. The material shall be applied in the field by the manufacturer and shall be monitored to determine durability and appearance characteristics.
3. At the Project Representative's discretion, field performance data gained from independent testing may be submitted in lieu of field testing.
4. Acceptance of independent testing shall be the prerogative of the Project

2.02 RECYCLED PLASTIC WHEEL STOPS

A. Recycled plastic wheel stops manufactured from low density polyethylene plastic.

B. Physical Properties:

1. Compressive Strength: 3,200 to 3,800 lbs./square inch.
2. Density: 0.91 to 0.98 g/cc (ASTM D792).
3. Flexural Modulus: 1.6×10 psi.
4. Hardness (Shore D): 65.

5. Tensile Strength: 1,470 to 1,700 psi.
 6. Water Absorption: <0.01% in 24 hours (ASTM D570).
 7. Composition: 97% LDPE and 3% colorant.
 8. Color: Bright Yellow.
- C. Dimensions: 8 feet long by 7 inches high by 10 inches wide at the base.
- D. Installation Hardware: Steel pins, not less than 1/2 inch in diameter by 14 inches long.
- E. Manufacturers: Subject to compliance with requirements of the Contract Documents, Manufacturers offering recycled plastic wheel stops that shall be incorporated in the work include the following:
1. Barco Products - www.barcoproducts.com.
 2. Bedford Technology – www.plasticboards.com.
 3. Or Approved Equal.

2.03 FLEXIBLE GUIDE POSTS – SURFACE MOUNTED

- A. Flexible guideposts shall meet the dimensional, testing, and material requirements of WSDOT Standard Specifications Section 9-17.
- B. Acceptable products shall be products listed in the WSDOT Qualified Products List.
- C. Flexible guideposts shall be installed according to the manufacturer's installation instructions.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Pavement Markings
1. Preliminary Layout:
 - a. The Project Representative will provide necessary control points at intervals agreed upon with the Contractor to assist in preliminary layout of the lines before marking begins.
 - b. The Contractor shall be responsible for preliminary layout of the lines to be marked.
 - c. Approval by the Project Representative is required before marking begins.
 - d. Preliminary layout to guide the striping machine is required for all longitudinal lines except where a clearly visible separation is present.
 - e. Preliminary layout shall be provided at a spacing of 100 feet maximum on tangents and 25 feet maximum on curves.

- f. The color of the material used for layouts shall match the color of the permanent marking.
- 2. Preparation of Roadway Surfaces:
 - a. For the application of paint:
 - 1) The pavement surface temperature and ambient temperature shall be 50°F and rising
 - 2) The temperature requirement may be superseded by the material Manufacturers written installation instructions;
 - 3) New and existing hot mix asphalt (HMA) pavement shall be dry, clean and free of contaminants such as surface oils;
 - 4) Portland cement concrete pavement shall have a minimum compressive strength of 2,500 psi and shall be dry, clean and free of contaminants; and
 - 5) Contaminants shall be removed by approved mechanical means.
 - b. For the application of plastic pavement marking material:
 - 1) The surface temperature and ambient temperature shall be 50°F and rising.
 - 2) New and existing HMA pavement shall be dry, clean, and free of contaminants such as surface oils and existing pavement marking materials.
 - 3) Portland cement concrete pavement shall also be free of contaminants including curing agents.
 - 4) Contaminants shall be removed by approved mechanical means.
 - c. Pavement surfaces shall be prepared for plastic marking application in accordance with the previous Paragraph and the pavement marking material Manufacturer's recommendations.
 - d. Existing pavement marking material shall be removed.
- B. Temporary Pavement Markings:
 - 1. Preliminary Spotting:
 - a. All preliminary layout and marking in preparation for application and the application and removal of temporary pavement markings shall be the responsibility of the Contractor.
- C. Recycled Plastic Wheel Stops:
 - 1. Prepare installation location in accordance with manufacturer's instructions.
- D. Recycled Plastic Delineators:
 - 1. Prepare installation location in accordance with manufacturer's instructions.

3.02 CONSTRUCTION

A. Pavement Markings:

1. Marking Application:

a. Marking colors:

- 1) Lane line and right edge line shall be white in color.
- 2) Center line and left edge line shall be yellow in color.
- 3) Transverse markings shall be white, except as otherwise noted in the Drawings.

b. Line Patterns:

- 1) Solid Line: Continuous line without gaps.
- 2) Broken Line: Line consisting of solid line segments separated by gaps.
- 3) Dotted Line: Broken line with noticeably shorter line segments separated by noticeably shorter gaps.

c. Line Surfaces:

- 1) Flat Lines: Pavement marking lines with a flat surface.
- 2) Profiled Marking: A profiled pavement marking is a marking that consists of a base line thickness and a profiled thickness which is a portion of the pavement marking line that is applied at a greater thickness than the base line thickness.
 - a) Profiles shall be applied using the extruded method in the same application as the base line.
 - b) The profiles may be slightly rounded provided the minimum profile thickness is provided for the length of the profile.
 - c) See the Drawings for the construction details.
- 3) Embossed Plastic Line: Embossed plastic lines consist of a flat line with transverse grooves.
 - a) An embossed plastic line may also have profiles. See the Drawings for the construction details.

d. Line Applications:

- 1) Surface Line: A line applied directly to the pavement surface.
- 2) Two applications of paint will be required to complete all paint markings.
 - a) The second application of paint shall be squarely on top of the first pass.

- b) The time period between paint applications will vary depending on the type of pavement and paint (low VOC waterborne or low VOC solvent) as follows:

Pavement Type	Paint Type	Time Period
Hot Mix Asphalt Pavement	Low VOC Waterborne	4-hours min., 30-days max.
Cement Concrete Pavement	Low VOC Waterborne	4-hours min., 30-days max.
Hot Mix Asphalt Pavement	Low VOC Solvent	40 min. min., 30-days max.
Cement Concrete Pavement	Low VOC Solvent	40 min. min., 30-days max.

- c) Broken line patterns applied to multilane or divided roadways shall be applied in cycle in the direction of travel.

e. Application Thickness:

- 1) Pavement markings shall be applied at the following base line thickness measured above the pavement surface in thousandths of an inch (mils).

Marking Material Application		Hot Mix Asphalt Pavement	Cement Concrete Pavement
Paint – First Coat	Spray	10	10
Paint – Second Coat	Spray	15	15
Type A – Flat/Transverse and Symbols	Extruded	125	125
Type A – Flat/Long Line and Symbols	Spray	90	90
Type A – with Profiles	Extruded	90	90
Type A – Embossed	Extruded	160	160
Type A – Embossed with Profiles	Extruded	160	160
Type B – Flat/Transverse and Symbols	Heat Fused	125	125

- 2) Liquid pavement marking material yield per gallon depending on thickness shall not exceed the following.

Mils Thickness	Feet of 4" Line/Gallon	Square Feet/Gallon
10	483	161
15	322	108
30	161	54
40	125	42
45	107	36
60	81	27
90	54	18
90 with Profiles	30	10
120	40	13

Mils Thickness	Feet of 4" Line/Gallon	Square Feet/Gallon
120 with Profiles	26	9
230	21	7

- 3) Solid pavement marking material (Type A) yield per 50-pound bag shall not exceed the following.

Mils Thickness	Feet of 4" Line/50# Bag	Square Feet/50# Bag
30 – Flat	358	120
145 – Flat	240	80
60 – Flat	179	60
90 – Flat	120	40
90 – Flat with Profiles	67	23
120 – Flat	90	30
120 – Flat with Profiles	58	20
125 - Embossed	86	29
125 – Embossed with Profiles	58	20

2. Glass beads:

- a. Top dress glass beads shall be applied to all spray and extruded pavement marking material:
 - 1) Glass beads shall be applied by a bead dispenser immediately following the pavement marking material application.
 - 2) Glass bead dispensers shall apply the glass beads in a manner such that the beads appear uniform on the entire pavement marking surface with 50 to 60% embedment.
 - 3) Hand casting of beads will not be allowed.
- b. Glass beads shall be applied to 10 or 15 mil thick paint at a minimum application rate of 7-pounds per gallon of paint.
 - 1) For plastic pavement markings, glass beads shall be applied at the rate recommended by the marking material manufacturer.
- c. When two or more spray applications are required to meet thickness requirements for Type A materials, top dressing with glass beads is only allowed on the last application.
 - 1) The cure period between successive applications shall be in accordance with the manufacturer's recommendations.
 - 2) Any loose beads, dirt or other debris shall be swept or blown off the line prior to application of each successive application.
 - 3) Successive applications shall be applied squarely on top of the preceding application.

3. Tolerances for Lines:

a. Allowable tolerances for lines are as follows:

- 1) Length of Line: The longitudinal accumulative error within a 40-foot length of skip line shall not exceed plus or minus 1-inch.
- 2) Width of Line: The width of line shall not vary more than plus or minus 1/4 inch.
- 3) Lane Width: The lane width, which is defined as the lateral width from the edge of pavement to the center of the lane line or between the centers of successive lane lines, shall not vary from the widths shown in the Drawings by more than plus or minus 4 inches.
- 4) Thickness: A thickness tolerance not exceeding plus 10% will be allowed for thickness or yield in paint and plastic material application.
- 5) Parallel Lines: The gap tolerance between parallel lines is 0.5 inches.

4. Plastic Installation Instructions:

- a. Installation instructions for plastic markings shall be provided to the Project Representative.
- b. All materials including glass beads shall be installed according to the manufacturer's recommendations.
- c. A manufacturer's technical representative shall be present at the initial installation of plastic material to approve the installation procedure or the material manufacturer shall certify that the Contractor will install the plastic material in accordance with their recommended procedure.

5. Removal of Pavement Markings:

- a. Pavement markings to be removed shall be obliterated until blemishes caused by the pavement marking removal conform to the coloration of the adjacent pavement.
 - 1) If, in the opinion of the Project Representative, the pavement is materially damaged by pavement marking removal, such damage shall be repaired by the Contractor at no additional cost to the Owner.
- b. Sand or other material deposited on the pavement as a result of removing lines and markings shall be removed as the Work progresses to avoid hazardous conditions.
 - 1) Accumulation of sand or other material which might interfere with drainage will not be permitted.

B. Temporary Pavement Markings:

1. Removal:

- a. Temporary pavement markings consisting of paint or tape may be paved over.
- b. Any temporary pavement markings that are required on the wearing course prior to construction of permanent pavement markings and are not a part of the

permanent markings shall be completely removed concurrent with or immediately subsequent to the construction of the permanent pavement markings.

- c. All damage to the permanent Work caused by removing temporary pavement markings shall be repaired by the Contractor at no additional cost to the Owner.

2. Beading and Tolerances:

- a. Beading and line tolerances shall be in accordance with Paragraphs 3.02 A.2 and 3.02 A.3, respectively.

C. Recycled Plastic Wheel Stops:

- 1. Install in accordance with Manufacturer's Instructions and as shown on the Drawings.
- 2. Field locate wheel stops and obtain Project Representative's approval before drilling concrete slab or asphalt paving for anchor pins.

D. Recycled Plastic Delineators

- 1. Install in accordance with manufacturers written installation instructions and as shown on the Drawings.

END OF SECTION

SECTION 32 31 00
FENCES AND GATES

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes vinyl-coated steel chain link fence and gates.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section.
- B. WSDOT 2024 Standard Specifications Section 8-12.
- C. WSDOT 2022 Standard Plans L-20.10-03 and L-30.10-02.
- D. American Society of Testing and Materials (ASTM) International – www.astm.org.
1. ASTM A 392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 2. ASTM A 446, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural.
 3. ASTM A 569, Specification for Steel, Carbon (0.15%, Maximum), Hot-Rolled Sheet and Strip, Commercial Quality.
 4. ASTM B 117, Test Method of Salt Spray (Fog) Testing.
 5. ASTM F 567, Practice for Installation of Chain-Link Fence.
 6. ASTM F 626, Specification for Fence Fittings.
 7. ASTM F 900, Specification for Industrial and Commercial Swing Gates.
 8. ASTM F 1043, Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.
 9. ASTM F 1083, Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, For Fence Structures.
 10. ASTM F 1664, Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.
 11. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures":
- B. Approval Submittals:
 - 1. Product Data:
 - a. Fence and gate posts, fabric, gates, and accessories.
 - 2. Manufacturer's written installation instructions.
 - 3. Shop drawings showing installation details of each gate, fence panels, hardware, and accessories. Where conflicts between Specification requirements occur, the more stringent requirement shall govern.
- C. Quality Assurance Submittals:
 - 1. Manufacturer's Technical Representative contact Information.

1.04 QUALITY ASSURANCE

- A. All material used in the construction of chain link fence and gates shall be new and free from defects or nonconformities.
- B. Single-Source Responsibility: Obtain chain link fences and gates as complete units, including necessary erection accessories, fittings, and fasteners from a single source or manufacturer.
- C. Preinstallation Meeting: Convene a preinstallation meeting in accordance with the requirements of Section 01 30 00, "Administrative Requirements," prior to beginning Work of this section; the agenda shall include the following:
 - 1. Review examination, installation, field quality control, adjusting, cleaning, protection, and coordination with other work.
 - 2. Review schedule of installation, installation procedures and conditions, and coordination with related work.

1.05 WARRANTY

- A. Fence and gates shall be warranted to be free from defects or non-conformities in workmanship and material for a period of 5 years following Substantial Completion of Milestone 3.
- B. Fusion bonded coating shall be warranted not to fade, peel, crack, craze or fail for a period of ten years following Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements of the Contract Documents, Manufacturers offering products that shall be incorporated in the Work include, but are not limited to, the following:
 - 1. Chain Link Fence and Gates:
 - a. Master Halco, Inc.
 - b. Anchor Fence, Inc.
 - c. BWF Fence Systems.
 - d. Pacific Fence & Wire Co.
 - e. Or Approved Equal.

2.02 FENCE AND GATES

- A. General:
 - 1. Chain link fence shall be 6 feet high with top rail and bottom tension wire as shown on WSDOT Std. Plan L-20.10-03. Gates shall be as shown on WSDOT Std. Plan L-30.10-02.
- B. Fabric:
 - 1. Manufacturer's standard black PVC or polyolefin elastomer coating, 7 mil to 15 mil thickness, thermally fused to 10 gauge minimum galvanized steel wire conforming to ASTM A 392.
 - 2. The wire shall be woven into approximately 2 inch diamond mesh.
- C. Fence Framing:
 - 1. Strength requirements shall conform to ASTM F 1043.
 - 2. Pipe for posts, rails, braces, protective closure and gate frames shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

NPS, Inches	Outside Diameter (OD), Inches	Class I Steel	Type II Steel
1	1.315	1.68	1.35
1-1/4	1.660	2.27	1.84
1-1/2	1.900	2.72	2.28
2	2.375	3.65	3.12
2-1/2	2.875	5.79	4.64
3	3.500	7.58	5.71
3-1/2	4.000	9.11	6.56
4	4.500	10.79	- - -
6	6.625	18.97	- - -
8	8.625	28.55	- - -

- a. Class I Steel: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (schedule 40) with not less than 1.8 ounce zinc per square foot of surface area coated.
 - b. Type II Steel: Manufactured from steel conforming to ASTM A 569 or A 446, Grade D, cold formed, electric welded with minimum yield strength of 50,000 psi and triple coated with minimum 0.9 ounce zinc per square foot after welding, a chromate conversion coating and a clear polymer overcoat. Corrosion protection on inside surfaces shall protect the metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5% Red Rust.
 - c. PVC or polyolefin elastomer coated finish: In accordance with ASTM F 1043, apply color coating of 10 to 15 mils thermally fused in same color to match fabric.
3. Framework:
- a. End, corner and pull posts: 2.5 inch ID Class I or Type II steel pipe.
 - b. Line and brace posts: 2.0 inch ID Class I or Type II steel pipe.
 - c. Brace and top rails: 1.25 inch ID Class I or Type II steel pipe.
 - d. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
 - 1) Up to 6 feet: 2.875 inch OD Class I or Type II steel pipe.
 - 2) Over 6 feet to 18 feet: 6.625 inch OD Class I steel pipe.
 - 3) Over 18 feet: 8.625 inch OD Class I steel pipe.

D. Fittings and Accessories:

1. Material: Comply with ASTM F 626. Mill-finished aluminum or galvanized iron or steel, to suit manufacturer's standards.
 - a. Finish each item to match fabric and framework.
 - b. Zinc Coating: Unless specified otherwise, galvanize steel fence fittings, fasteners, and accessories in accordance with ASTM A 153, with zinc weights per Table I.
2. Bottom Tension Wire: Shall be 7 gauge coil spring steel wire of good commercial quality and shall have a zinc coating averaging 0.8 ounce per square foot of surface area.
 - a. Thermally fused PVC or polyolefin elastomer applied to coated steel wire, per ASTM F 1664 Class 2b.
3. Tie Wires: Shall be 9 gauge aluminum wire complying with ASTM B 211 or 9 gauge galvanized wire meeting the requirements of AASHTO M 279. Class 1 galvanizing.
4. Tension Bands and Stretcher Bars: Fabric tension bands shall be 1/8 inch by 1 inch nominal and stretcher bars 3/16 inch by 3/4 inch nominal.
 - a. Bands and bars shall be hot-dip galvanized in accordance with the requirements of ASTM F 626.
 - b. Bars shall have a minimum length 2 inches less than full height of fabric.
 - c. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.
5. Post and Line Caps: Provide weather-tight closure cap for each post. Formed steel, cast malleable iron, or aluminum alloy.
6. Concrete: Class 3000 in accordance with 2024 WSDOT Std. Spec. 6-02.3(2)B.
7. Nuts and bolts shall be galvanized but not vinyl coated.
8. Use PVC touch up paint to color coat nuts and bolts with fence material.

E. Gates:

1. Fabrication: Fabricate from metal and finish to match fabric and fence framework.
2. Assemble gate frames by welding.
3. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories.
4. Space frame members maximum of 8 feet apart unless otherwise indicated.

5. Fabric: Provide same as for fence unless otherwise indicated. Install fabric with tension bars and bands at vertical edges and at top and bottom edges.
6. Truss Rods: Shall be 3/8 inch diameter round galvanized rods with drop forged turnbuckles or approved type of adjustment to ensure frame rigidity without sag or twist.
7. Swing Gates: Comply with ASTM F 900.
 - a. Frame:
 - 1) 6 feet high and up to 8 feet wide: Fabricate perimeter frames of minimum 1.660-inch OD Class I or Type II steel pipe.
 - 2) 6 feet high and over 8 feet wide: Fabricate perimeter frames of minimum 1.90-inch OD Class I or Type II steel pipe.
 - b. Manually Operated Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:
 - 1) Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide one and 1-1/2 pair of hinges for each leaf over 6 feet nominal height.
 - 2) Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
 - 3) Gate Stops: Provide gate stops for double gates, consisting of mushroom-type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Fence and Gates:

1. General: Install fence in compliance with WSDOT Std Plan L-20.10-03.
2. Do not begin installation and erection before retaining walls and final grading are completed, unless otherwise permitted by Project Representative.
3. Excavation: Drill or hand-excavate (using post-hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
 - a. If not indicated on Drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than four times largest cross-section of post.
 - b. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than post bottom, with bottom of posts set not less than 36 inches below finish grade surface.

4. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation.
5. Space maximum 10 feet o.c., unless otherwise indicated.
 - a. Protect portion of posts above ground from concrete splatter.
 - b. Place concrete around posts and vibrate or tamp for consolidation.
 - c. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 - d. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to a crown to shed water.
6. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
7. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric before stretching fabric and tie to each post with not less than same gauge and type of wire.
 - a. Pull wire taut, without sags.
 - b. Fasten fabric to tension wire with 11 gauge hog rings of same material and finish as fabric wire, spaced maximum 24 inches o.c.
8. Fabric: Leave a maximum of 2 inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.
9. Tension or Stretcher Bars: Thread through or clamp to fabric four inches o.c., and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.
10. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
 - a. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.
 - b. Tie parallel runs of fence fabric to each other along the serpentine sections of fence flanking the main entrance. Locate ties 6 inches o.c. each way.
11. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

12. Gates: Install gates in accordance with WSDOT Std. Plan L-30.10-02.
 - a. Operational direction for swing gates as shown on Drawings.
 - b. Install ground-set items in concrete for anchorage.
 - c. Adjust hardware for smooth operation and lubricate where necessary.
13. Touch up damaged coating on fabric, posts, frames, hardware.

END OF SECTION

SECTION 32 39 13
MANUFACTURED METAL BOLLARDS

PART 1 – GENERAL

1.01 SUMMARY

- A. A. Section Includes.
 - 1. 1. Steel Bollards.

1.02 1.2 SUBMITTALS

- A. General Requirements.

1.03 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years of experience manufacturing similar products.
- B. Installer Qualifications: Minimum 2 years of experience installing similar products.

1.04 1.4 STORAGE AND HANDLING

- A. Deliver and store products in the manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.05 1.5 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's recommended limits.

PART 2 – PRODUCTS

2.01 2.1 SPECIFICATIONS

- A. Bollards Plus(bollardbarrier.com) 6" Inground Bollard.
 - 1. Material: Schedule 40 US Steel.
 - 2. Dome Cap.
 - 3. Diameter: 6".
 - 4. Height: 48" above ground.

- 5. Embed Depth: 24" below ground.
- 6. Painted: Standard Yellow.
- 7. Pipe filled with concrete-aggregate.
- B. Bollard USA (www.bollardsusa.com).
- C. Or approved equal.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Before proceeding with work, notify the Owner's Designated Representative in writing of unsuitable conditions and conflicts.

3.02 INSTALLATION

- A. A. Comply with manufacturer's recommendations for installation.

END OF SECTION

SECTION 32 80 00
IRRIGATION

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies requirements for temporary irrigation for the plant establishment period and permanent irrigation systems.

1.02 QUALITY ASSURANCE

- A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. It is a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM B3	Specification for Soft or Annealed Copper Wire
NEC	National Electrical Code

1.03 SUBMITTALS

- A. Procedures: Section 01 33 00.
- B. Descriptive literature/information for all operating characteristics including operating pressures, pressure losses, materials used in product, test certificates, special features, etc.
- C. Water source and power source.
- D. A complete list of all specified and approved irrigation products, which are proposed for installation.
- E. Shop drawings for review and approval prior to beginning work.
- F. Irrigation system plan for review and approval prior to beginning work showing piping, sprinkler layout, sleeving, pipe sizing, backflow prevention device detail and location, controller location, and additional irrigation system components needed for fully functional irrigation system. See "Irrigation Note" 1 / L10.06.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Protect all PVC materials from direct sunlight until time of installation.

1.05 PROTECTION

- A. Confine work to designated areas:
 - 1. Do not disturb existing vegetation outside of Contract limit lines.
 - 2. Protect all trees within Contract limits not designated to be removed.
 - 3. Repair or replace vegetation damaged as a result of construction activities.
- B. Protection of utility lines and other existing facilities:
 - 1. Verify locations of all utility lines and underground obstructions.
 - 2. Be familiar with all Utility, Irrigation, Mechanical, and Electrical Plans so that digging and drilling operations do not damage lines.
 - 3. Repair or replace any damage to buildings, equipment, underground utilities, irrigation equipment, paving, surfacing, stairs, and/or forms.
- C. Any existing automatic irrigation system shall be maintained in an operational, functional condition as needed. A temporary piping and wiring system shall be constructed and protected to facilitate irrigation during construction.

1.06 GUARANTEES

- A. Provide one-year written guarantee in coordination with the Section 32 93 00 warranty period.
- B. Include complete winterization and one complete de-winterization of the irrigation system.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Pipe and fittings: Per WSDOT SS 9-15.1
- B. Irrigation heads:
 - 1. Shrub spray: 6-inch high pop-up: Toro brass 570 Series-12 and Toro brass 570-15 series, Rainbird 1806-B12 series and Rainbird 1806-B15 series or approved equal.
 - 2. Shrub beds: 12- to 18-inch high irrigation heads.
 - 3. 3-inch pop-up rotor: Toro XP-300-07, Rainbird R-50-2.0, or approved equal.
 - 4. Variable arc nozzle: Toro 570 Series-ADJ, Rainbird 1806-VAN, or approved equal.

C. Valves and valve boxes:

1. Automatic control valve:
 - a. Rainbird EFB-CP-PRS bronze bodied.
 - b. Toro 220 Series, brass valves (see specs attached to paper form).
 - c. Or approved equal.
2. Quick coupling valve:
 - a. Buckner/Royal Coach No. 25015/13LT.
 - b. Rainbird 33DRC.
 - c. Or approved equal, and key coupler to fit.
3. Gate valves: per WSDOT SS 9-15.6
 - a. Kennedy.
 - b. Mueller.
 - c. Hammond.
 - d. Or approved equal.
4. Drain Valves:
 - a. Mueller Mark II Oriseal H-10284.
 - b. Or approved equal.
5. Valves boxes: per WSDOT SS 9-15.5.

D. Controller Acceptable Manufacturer:

1. Rainbird ESP controller and Hunter Node controller can be used to control temporary irrigation zones.
2. Or approved equal.

E. Drain valves and protective sleeves:

1. Unless otherwise specified, enclose all drain valves in protective sleeves with locking caps.
2. Sleeves: 4-inch diameter, PVC.
3. Caps Acceptable Manufacturer: Rainbird, Toro, or approved equal.

F. Valve keys and valve box cover keys:

1. Five sets of all keys required for valves, valve box covers, and valve protective sleeve caps and locking covers.

G. Control wiring:

1. Control wire:

- a. Insulated single strand-copper minimum AWG #14, 600 V. UL approved as Type UF.
 - b. Copper conductor: ASTM B3.
 - c. Red, white, orange and black colors.
 - d. Control wire size: Rainbird, Toro, or approved equal irrigation control wire specifications.
2. Splice: watertight electrical wire splices with either 3M-Scott's Lock Seal tack 3576-78, Pen-Tite PVC socket and sealing plug, or approved equal.
 3. Electrical tape: black plastic, 3/4-inch wide, minimum of 0.007-inch thick, and all-weather type.
 4. Duct tape: all-weather, cloth tape.

H. Drain rock: Shall be Pea Gravel per WSDOT SS 9-03.5.

I. Magnetic tracing tape:

1. Blue detectable tape: 2-inch minimum width, with metallic backing.
2. Imprinted with "Irrigation Water."
3. Inert plastic capable of stretching during direct burial.

PART 3 – EXECUTION

3.01 EXISTING CONDITIONS

- A. Before proceeding with any work, measure all dimensions pertaining to location of walks, vaults, lights, standards, hydrants, all utilities, and any other existing conditions.

3.02 SITE INSPECTION AND LAYOUT

A. Discrepancies in Drawings:

1. Report to the Project Representative any deviations between Drawings and the site. Failure to do so prior to the installation of equipment may result in the replacing, and/or relocating equipment.

B. Pressure verification:

1. Prior to the start of any work, measure static pressure at point of connection and notify Project Representative of pressure available.

C. Plant material:

1. Consider tree locations in the layout of the irrigation system. Irrigation equipment shall be located a minimum of 3 feet from the tree trunks.
2. Field-adjust all existing plant material to avoid irrigation equipment.

3.03 INSTALLATION

A. General:

1. Make no adjustments from the Drawings without approval of the Project Representative.
2. Water service connections: as set forth in the requirements of all codes and the supplying agency.
3. Unless otherwise specified, install all equipment per manufacturer's recommendations.
4. Before starting work, determine that work may proceed without disruption of activities of other trades.

B. Layout of sprinkler irrigation system:

1. Stake the sprinkler irrigation system following the diagrammatic design shown on the Drawings before construction.
2. Contractor is responsible for taking all reasonable investigative actions and precautions when working around all utility systems.
3. The Contractor shall carefully check grades to ensure that area is ready to begin work.
4. Make alterations and changes in the layout in order to conform to the ground conditions and to obtain full and adequate coverage of water.
5. Provide layout for approval of the Project Representative prior to installation. It is understood that corrective measures in the system may become necessary, but no changes or alterations in the system as planned shall be made without the prior written authorization of the Project Representative.

C. Trenching:

1. General:

- a. Excavate pipe trenches to provide a minimum depth of cover below finish grade of 24 inches for live lines (mains) and laterals and 18 inches for all others.
- b. Maximum trench excavation depth: 36 inches.

- c. Trench width: No wider at any point than is necessary to lay the pipe or install equipment.
 - d. Excavate with vertical sides and provide with bracing to be placed as required, straight and without abrupt changes in grade.
 - e. Locate outside of paved areas wherever possible.
 - f. Slope trenches to drain valve locations.
 - g. Remove materials unsuitable for bedding of pipe to a depth 4 inches below trench bottom and backfill with sand per the requirements of WSDOT SS 8-03.3(11).
- 2. Compact trench bottom prior to placing bedding.
 - 3. Suitable bedding material: Sand per the requirements of WSDOT SS 8-03.3(11).
 - 4. Trenching near trees:
 - a. Exercise care when excavating trenches near existing trees.
 - b. Where roots are 2 inches and greater in diameter, except in the direct path of the pipe, hand excavate and tunnel.
 - c. When roots larger than 3 inches in diameter are exposed, wrap with heavy burlap for protection and prevent excessive drying.
 - d. For trenches dug by machines adjacent to trees having roots 2 inches and less in diameter, hand trim the sides making a clean cut of the roots.
 - e. Backfill and compact trenches having exposed tree roots within 24 hours unless protected by moist burlap or canvas.
 - 5. When topsoil exists, keep the top 6 inches of topsoil separate from subsoil, and replace as the top layer.
 - 6. All trenches must be straight, with appropriate pipefittings used to allow pipe to be laid without undue bending and not have abrupt changes in grade.
 - 7. The trench bottom must be free of rocks or sharp-edged objects.
 - 8. For above ground pipe placed as part temporary irrigation system, trench as needed to transition pipe to underground automatic control valves and to sleeving under pavement.

D. Piping:

- 1. Drain locations:
 - a. Install at end points of all mains and all other locations indicated on the Drawing.
 - b. Each drain to terminate in a 1/2-cubic yard drain rock sump unless otherwise noted.

- c. Install drain valves per detail on Drawings.
 - d. Locate sumps outside of paved areas; use offsets if necessary.
 - e. Construct system in a manner that allows winterizing by compressed air blowout through quick coupler.
- 2. Install pipe in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
- 3. Lay pipe so that it slopes to drain valve.
- 4. Keep interior of pipes clean and free from dirt, debris, excess solvent, pipe cuttings or burrs and ream to full diameter.
- 5. Where pipe laying is not in progress, close ends of pipe.
- E. Sleeves: Irrigation and Control Wire:
 - 1. Separate for live lines and control wire under all paving and surfacing and as indicated on Drawings.
 - 2. Schedule 40 steel.
 - 3. Irrigation: unless otherwise specified, twice the diameter of insert pipe.
 - 4. Control wire: unless otherwise specified, 1-inch diameter.
 - 5. Extend sleeve a minimum of 12 inches beyond edge of paving and surfacing.
- F. Jointing:
 - 1. Threaded Joints:
 - a. Seal with Teflon tape, or paste.
 - b. Avoid over-tightening the metal pipe to PVC fittings.
 - 2. PVC pipe:
 - a. The Contractor shall exercise care in handling, loading, unloading and storing to avoid damage. The pipe and fittings shall be stored under cover, and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat, so as not to be subject to undue bending or concentrated external load at any point. Any pipe that has been dented or damaged shall be discarded until such damage has been cut out and the pipe is rejoined with a coupling.
 - b. PVC pipe ends shall be cleaned of all cutting burrs prior to cementing. Use approved reaming tool.
 - c. Use two-step solvent weld: WSDOT SS 8-03.3(8)A.

- d. Do not permit water in pipe until a period of at least ten hours has elapsed for solvent weld setting and curing.
- e. Allow the joints to cure at least 24 hours before pressure is applied to the system.
- f. Only factory threaded Schedule 80 PVC pipe may be connected to a threaded fitting without an adapter.
- g. Use no male PVC adapters, only female PVC adapters 3 inches minimum length.
- h. Street ells only where indicated: schedule 40 high-density polyethylene.

3. Brass Pipe and Fittings:

- a. Brass pipe shall be installed in accordance with the local Plumbing Code and as shown on the Plans and Details.
- b. Teflon tape all male threads to prevent leaks and corrosion.
- c. Wrap all brass pipes with black PVC tape where they pass through grouted openings in concrete vaults.

G. Sprinkler heads/quick coupler:

- 1. Risers for all sprinkler heads and quick coupler valves: As detailed on the Drawings.
- 2. Minimum riser size: equal to the pipe size of the sprinkler head or quick coupler.
- 3. Unless otherwise specified, set perpendicular to finished grades.

H. Valves:

- 1. Enclose all valves and valve boxes including extensions, except manual or drain valves, which are to be enclosed in protective sleeves, with locking caps.
- 2. Install per Drawing detail.
- 3. Install all automatic control valves below grade including valves controlling temporary irrigation zones.
- 4. Valve bonnet packing and bolts: Check and tighten before backfilling.

I. Irrigation controller unit:

- 1. Unless otherwise specified, receive approval from the Project Representative for the location of the controller unit prior to installation.
- 2. Attach wire markers to the ends of control wires inside the controller unit housing.
- 3. Label wires with the identification number of the automatic control valve to which the wire is connected.

4. Program the controller as needed to establish plantings, coordinate with Owner's Representative and submit a watering schedule formatted as shown below:

Valve No	Elapsed Time	Week day	Frequency

J. Control wire:

1. Wiring between automatic controller and automatic control valves:
 - a. Comply with NEC.
 - b. Have a common neutral, white, and separate control conductor for each valve.
2. When more than one automatic controller is required, provide a separate common neutral for each controller and the automatic valves, which it controls.
3. Splices:
 - a. Permitted only at junction boxes, valve boxes, or at control equipment.
 - b. Leave a minimum of 2 feet of excess conductor at all splices, terminal, and automatic control valves to facilitate inspection and future splicing.
 - c. Pigtail free ends of control wiring inside each of the valve boxes before making final connections to automatic control valves.
 - d. Encapsulate all splices with approved sealants.
4. Tape control wires together at 5 foot intervals with electrical tape, then tape this bundle to the bottom of the main (supply) line at 10-foot intervals with at least one full wrap of duct tape.
5. Install the control wires on the bottom of the PVC mainline with duct tape every 10 feet.
6. Tie a loose 20-inch loop in all wiring at changes of direction greater than 30 degrees.
7. Untie all loops after all connections have been made.
8. Run one unconnected continuous spare control wire (orange) through each intermediate valve box between controller and furthest automatic control valve.
9. At Contractor's option, the control wire may be placed to the side of the main rather than below as indicated above, provided that the wire is not installed above the top of the main nor more than 8 inches from the side of the main.
10. Tape the bundle of control wires together at 5-foot intervals as originally specified.

11. Seal conduit to controller watertight.

12. Insert plastic film warning tape 12 inches above wire with the following wording:
"CAUTION: BURIED ELECTRIC LINE BELOW."

K. Flushing:

1. Mains: two full-open flushings; one prior to placement of valves, the second after placement of valves and prior to testing.
2. Laterals: one fully open flushing prior to placement of sprinkler heads and/or drain valves.

L. Backfill:

1. At Contractor's option, the pipe may be partially backfilled and manually compacted as it is laid, keeping all joints and appurtenances exposed for flushing, pressure testing, preliminary inspection, and as-built location.
2. Complete backfill and compaction, after completion of preliminary inspection, flushing and pressure testing of system. Cover all but valve boxes.
3. For above ground pipe placed as part temporary irrigation system, cover pipe with wood chip mulch as detailed in Plans.
4. Backfill when PVC pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be accomplished by operating the system a short time before backfill or by backfilling in the early part of the morning, before the heat of the day.
5. Backfill the first 6 inches above the pipe with sand per WSDOT SS 8-03.3(11).
 - a. Subsequent backfill material to contain no lumps or rocks larger than 2 inches.
 - b. Lay detectable tape 1 foot above the centerline of buried mainline pipes and the centerline of lateral pipes. Lay tape flat with label face up.
 - c. Unless otherwise specified, for the top 6 inches of backfill, use topsoil free from rocks over 1-inch, subsoil, or trash; otherwise, use select fill dirt or sand.
 - d. Thoroughly water-settle trenches; sluicing will not be permitted.
 - e. Backfill trenches uniformly, flush with the surrounding grade, rake and roll with a 260-pound roller.
6. Unless otherwise specified, remove all roots, rocks and surplus excavation from the site.
7. Backfill trenches under roads or paved areas and tamp with a mechanical tamper in successive 6-inch maximum lifts.

3.04 TESTING

A. General:

1. Notify Project Representative 48 hours in advance of testing.
2. If, for any reason, any part of the sprinkler system is backfilled before inspection or testing, it shall be completely uncovered and exposed until successful completion of testing.
3. Gauges:
 - a. Certify within six months prior to use in the testing of water pressures by an independent testing laboratory.

B. Preliminary inspection/pressure testing:

1. Prior to notification for pressure testing, accomplish the following:
 - a. Perform preliminary testing and make any adjustments required.
 - b. Test mains after all mains and laterals have been installed with all pipe and valves, including drain valves and quick couplers, and all other equipment in place, except sprinkler heads.
 - c. Cap all risers.
 - d. Purge all air from main lines.
2. Test mains, laterals, and valves per WSDOT SS 8-03.3(10).

C. Final testing/operation and coverage check:

1. Prior to request for final testing, accomplish the following:
 - a. Final inspection:
 - 1) Complete all work including balancing, adjusting the system (pressure-reducing valves, flow adjustment keys, nozzles, etc.) to provide optimum coverage without fogging.
 - 2) Complete all wiring, adjustments, and set time sequence at irrigation controller unit for entire system.
 - 3) Backfill all except valve boxes.
2. Coverage check: operate each zone of the system to show it meets specified requirements.

3.05 TRAINING

- A. Notify the Project Representative for approval of the date and time of the training session two weeks prior to the planned training and orientation session.
- B. Conduct a training session for County personnel covering the operation, adjustment, locations, and maintenance of the irrigation system.
- C. Review the installation drawings and operations manual and explain all features.

3.06 CLEAN-UP

- A. Upon completion of operations and prior to watering, clean all adjoining areas such as paving, curbs, and lawns of debris caused by the work on this project, or any part of this project. All hard surfaced areas shall be washed clean.

3.07 GUARANTEE

- A. Contractor shall submit a written guarantee, in approved form, stating that all work showing defects in materials or workmanship will be repaired or replaced, paid for by the Contractor, for a period of one year from date of Substantial Completion in coordination with the Section 32 93 00 warranty period.

END OF SECTION

SECTION 32 91 00
PLANTING PREPARATION

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies the planting soils for planting and lawn areas.

1.02 QUALITY ASSURANCE

- A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified in case of conflict between the requirements of this section and those of a listed document, the requirements of this section shall prevail.

Reference	Title
ASTM D1557	Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2,700 kN-m/m ³))

- B. Control: Provide one individual who shall be present at all times during execution of this portion of the work, who is thoroughly familiar with the type of materials being installed, the methods for their installation, and the proper timing for installation.

1.03 SUBMITTALS

- A. Procedures: Section 01 33 00.
- B. Materials List: a complete list of proposed materials demonstrating conformance with the requirements specified. Include names and addresses of all suppliers.
- C. Soil Materials: 0.25 cu. ft. representative samples of imported topsoils and organic amendment.
- D. Fertilizers: manufacturer's analysis.
- E. Certificates.
- F. Laboratory testing documenting soil fertility.

1.04 TIMING OF WORK

- A. Work shall proceed as rapidly as the site becomes available, consistent with specified seasonal limitations for the planting.
- B. Soils shall not be worked in the presence of standing or ponding water.

1.05 PRODUCT HANDLING

A. Delivery and Storage:

1. Furnish products in manufacturer's standard unopened containers bearing original labels showing quantity, analysis, and name or manufacturer.
2. Store products with protection from weather or other conditions that would damage or impair the effectiveness of the product.

PART 2 – MATERIALS

2.01 PLANTING SOIL MIX (FOR LANDSCAPE PLANTING AREAS)

A. General: The Planting Soil Mix shall consist of 67% sandy loam and 33% composted Organic Amendment for planting soil.

1. The Sandy Loam or Loamy Sand component shall consist largely of sand, but with enough silt and clay present to give it a small amount of stability and shall meet the following sieve analysis:

Screen Size	Percent Passing
3/8"	100
1/4"	95-100
#10	85-95
#30	60-75
#60	50-60
#100	10-20
#200	0-10

2. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it shall form a cast that will not only hold its shape when the pressure is released but shall withstand careful handling without breaking. The mixed loam shall meet the following:
 - a. Shall have pH range of 5.5 - 7.5 with dolomite lime, sulfur, or other amendments, added prior to delivery, as necessary to attain this range.
 - b. Free from debris, deleterious material, weeds, weed seeds and foreign matter that is detrimental to plant growth
 - c. The organic amendment component shall consist of composted organic material as described below.

B. Fertilizers:

1. Add fertilizers of the types and quantity as recommended by the accredited soils testing laboratory to bring the planting mix to optimum long-term fertility.
2. Fertilizers shall meet the general requirements of this section and the recommendations of the testing laboratory.

2.02 LAWN OR TURF AREAS SOIL MIX

- A. The Playfield Soil Mix shall consist of 60% Sand and 40% Organic Amendment by volume.

2.03 BIORETENTION SOIL MIX

A. General:

1. Bioretention soil shall consist of two parts organic material (approximately 35 to 40%) by volume and three parts Mineral Aggregate (approximately 60 to 65%), by volume. The mixture shall be well blended to produce a homogeneous mix. Organic material content shall be 8 to 10%, with the final mix to be determined by the Project Representative based on samples and test results submitted.

B. pH:

1. Range of 5.0 to 6.5 with dolomitic limestone added as necessary to attain this range.

2.04 ORGANIC AMENDMENT

A. Compost for turf and groundcover:

1. Acceptable manufacturer: GroCo or approved equal.
2. GroCo containing 100% biosolids, as required by the Washington State Department of Ecology for use as a soil amendment. GroCo is distributed by Sawdust Supply, 6314 7th Avenue S., Seattle, Washington, (206) 622-4321.
3. Composted biosolids have the following general characteristics:
 - a. Organic matter: 85.6%.
 - b. Carbon/Nitrogen ratio: 35.
 - c. pH: 6.8.
 - d. Conductivity (EC): 4.4.
 - e. Stability: 0.06 "very stable."
 - f. Seedling emergence: 100%.
 - g. Seedling vigor: 100%.

h. Major nutrients:

- 1) Total nitrogen: 1.24%.
- 2) Available nitrogen: 0.24%.
- 3) Organic nitrogen (slow release): 1.00%.
- 4) Phosphorus (as P₂O₅): 2.04%.
- 5) Potassium (as K₂O): 0.19%.
- 6) Sulfur: 0.33%.
- 7) Calcium: 0.90%.
- 8) Magnesium: 0.23%.

i. Micronutrients:

- 1) Iron: 5,917 ppm.
- 2) Manganese: 263 ppm.
- 3) Boron: 9 ppm.
- 4) Copper: 136 ppm.
- 5) Zinc: 304 ppm.

j. Particle size: "fine":

- 1) Percent passing 1": 100%.
- 2) Percent passing 5/8": 100%.
- 3) Percent passing 1/4": 96%.

4. Garbage, glass, plastics, sharps, metals: 0.00%.

B. Compost for pocket plantings:

1. 100% GroCo, Cedar Grove, or approved equal.

2.05 SAND

- A. Sand shall meet percent passing for the following sieve sizes within reasonable variations:

Sieve Size	Percent Passing
3/8"	100
1/4"	95-100
No. 10	85-95
No. 30	60-75
No. 60	50-60
No. 100	20-30
No. 200	<5

2.06 MINERAL AGGREGATE

- A. General:

1. Mineral aggregate shall be free of wood, waste, coating, or and deleterious material. All mineral aggregate passing the No. 200 sieve size shall be nonplastic.
2. Mineral Aggregate for rain garden soils shall be analyzed by an accredited lab using the sieve sizes noted below, and shall meet the following gradation:

Sieve Size	Percent Passing
1 inch	100
No. 4	60 - 100
No. 10	40 - 100
No. 40	15 - 50
No. 200	2 - 5

3. Efforts should be made to have the Mineral Aggregate for rain garden soils meet the following gradation coefficients: Coefficient of Uniformity ($C_u = D_{60}/D_{10}$) equal to or greater than 6; and Coefficient of Curve ($C_c = D_{30}^2/D_{60}D_{10}$) greater than or equal to 1 and less than or equal to 3.

2.07 FERTILIZERS

- A. General:

1. Standard commercial grade of organic or inorganic fertilizer containing the amounts of total nitrogen, available phosphoric acid, and water-soluble potash specified below.
2. Furnish in standard unopened containers with weight, name of plant nutrients, and manufacturer's statement of analysis clearly marked, in accordance with state and federal laws.

B. Fertilizer:

1. General:

- a. 6-8-10 complete fertilizer, 50% of the nitrogen to be derived from natural organic sources or ureaform.
- b. Available phosphoric acid shall be from superphosphate, bone, or tankage.
- c. 50% of the potash shall be derived from sulfate of potash-magnesium.
 - 1) 6% nitrogen.
 - 2) 10% phosphoric acid.
 - 3) 8% potash.

2. Additives:

- a. F.T.E: 2%.
- b. Multiracin: 0.5%.

3. Gradation:

- a. No. 4 sieve retains 0%.
- b. No. 20 sieve retains 65%.
- c. No. 80 sieve retains 100%.

2.08 LIME

A. General:

- 1. Agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing No. 65 sieve.

B. Acceptable manufacturer:

- 1. Kaiser Dolomite 65 AG.
- 2. Approved equal.

2.09 PHOSPHORUS

A. Agricultural grade fertilizer providing the amount of available phosphoric acid specified below.

B. Bone Meal (1-23-0), superphosphate (0-20-0), or approved equal.

PART 3 – EXECUTION

3.01 PREPARATION OF SUB-GRADE:

- A. Rip, disc, or scarify sub-grade soils in planting, seeding, and lawn areas to a minimum depth of 12 inches. Sub-grade elevations shall be as follows:
 - 1. For Lawn Areas - Sub-grade elevation 4 inches below finished grade.
 - 2. For Landscape Planting Areas - Sub-grade elevation 12 inches below finished grade.
 - 3. For Bioretention Planting Areas - Sub-grade elevation 18 inches below finished grade.

3.02 SOIL AND ORGANIC AMENDMENT PLACEMENT

A. For Lawns Areas:

- 1. Place 4 inches of Playfield Soil and rototill soil thoroughly into top 6 inches of prepared sub-grade.
- 2. Incorporate specified Lime and Fertilizers by broadcasting over the entire area at an even distribution and rate, then broom rake the fertilizer into the top inch of specified or amended soil at rates as follows.
 - a. Dolomite Lime: Recommended application Rate: Incorporate 50 pounds of Dolomite Lime per 1,000 square feet in direct broadcast application.
 - b. Starter Fertilizer: Recommended Application Rates: For (10-20-20): (Bag size = 50 lbs.).
 - 1) For sod areas apply at 30 lbs. of (N)/1000 s.f. (10 lbs. blended material/ 1000 s.f.) in direct broadcast applications.
 - 2) For Hydroseeding apply at 2 lbs. of (N)/1000 s.f. (20 lbs./1000 s.f. of blended material).
 - c. Maintenance Fertilizer: Recommended Application Rates: For (16-16-16): (Bag size = 50 lbs.).

B. For Landscape Planting Areas:

- 1. Place 12 inches of Planting Soil and thoroughly rototill soil into top 8 inches of prepared sub-grade.
- 2. Broadcast Planting Fertilizer at a rate of one-half pound (1/2#) of nitrogen per 1,000 square feet after placement, but before rototilling in of planting soils.

C. For Bioretention Planting Areas:

- 1. Place 18 inches of Bioretention Soil Mix and thoroughly rototill soil into top 8 inches of prepared sub-grade.

- D. For Landscape Planting Areas above the underground combined sewage storage tank place Planting Soil Mix to establish finished grades as shown in the Drawings.
- E. For temporary wetland restoration areas, place 1-3/4-inch-depth organic amendment and till into the subgrade to a depth of 8 inches.
- F. For planting within tree protection or native growth areas, place 4 inch depth organic amendment in areas to be planted.
 - 1. Hand till and thoroughly mix the 4 inch depth of organic amendment and the fertilizers (at manufacturer's recommended rate for plantings) into the subgrade to a depth of 8 inches.

3.03 COMPACTION

- A. Compact to 85% maximum density per ASTM D1557.

3.04 FINE GRADING

- A. Perform fine grading to attain finish grades as shown on the Plans.
- B. Rake out all rocks, roots, sticks and other debris larger than 2-inch diameter or sticks longer than 4 inches long. Leave surface even and readily able to accommodate lawn or planting installation.

END OF SECTION

SUBSECTION 32 91 10
STORMWATER PLANTING PREPARATION

PART 1 – GENERAL

1.01 SUMMARY

- A. This subsection specifies soil preparation for stormwater planting areas.

1.02 SUBMITTALS

- A. Materials List: a complete list of proposed materials demonstrating conformance with the requirements specified. Include names and addresses of all suppliers.
- B. Soil Materials: 0.25 cu. ft. representative samples of imported topsoils and organic amendment.

1.03 TIMING OF WORK

- A. Work shall proceed as rapidly as the site becomes available, consistent with specified seasonal limitations for the planting.
- B. Soils shall not be worked in the presence of standing or ponding water.

1.04 PRODUCT HANDLING

- A. Delivery and Storage:
1. Store products with protection from weather or other conditions that would damage or impair the effectiveness of the product.

PART 2 – MATERIALS

2.01 TOPSOIL B MIX (FOR STORMWATER PLANTING AREAS)

- A. General: The Planting Soil Mix shall consist of 60% sandy loam and 40% composted Organic Amendment for planting soil.
1. The Sandy Loam component shall consist largely of sand, but with enough silt and clay present to give it stability.
 2. Individual sand grains can be seen and felt readily. On squeezing in the hand when dry, it shall form a cast that will not only hold its shape when the pressure is released but shall withstand careful handling without breaking. The mixed loam shall meet the following:
 - a. Shall have pH range of 5.5 - 7.5 with dolomite lime, sulfur, or other amendments, added prior to delivery, as necessary to attain this range.
 - b. Free from debris, deleterious material, weeds, weed seeds and foreign matter that is detrimental to plant growth
 - c. The organic amendment component shall consist of composted organic material as described below.

2.02 STORMWATER SOIL AMENDMENT

A. Compost:

1. Compost products shall be the result of the biological degradation and transformation of organic materials under controlled conditions designed to promote aerobic decomposition. Compost shall be stable with regard to oxygen consumption and carbon dioxide generation. Compost shall be mature with regard to its suitability for serving as a soil amendment or an erosion control BMP as defined below. The compost shall have a moisture content that has no visible free water or dust produced when handling the material.
2. Compost production and quality shall comply with WAC 173-350.
3. 8.5 when tested in accordance with U.S. Composting Council TMECC 04.11-A, "1:5 Slurry pH".
4. Physical contaminants, defined in WAC 173-350 (e.g. plastic, concrete, ceramics, metal) shall be less than 0.5 percent by weight as determined by U.S. Composting Council TMECC 03.08-A "Classification of Inerts by Sieve Size."
5. Organic matter shall be 40-65 percent by dry weight basis as determined by U.S. Composting Council TMECC 05.07A "Loss-On-Ignition Organic Matter Method (LOI)".
6. Soluble salt contents shall be less than 4.0 mmhos/cm when tested in accordance with U.S. Composting Council TMECC 04.10 "Electrical Conductivity."
7. Maturity shall be greater than 80% in accordance with U.S. Composting Council TMECC 05.05-A, "Germination and Root Elongation."
8. Stability shall be 7-mg CO₂-C/g OM/day or below in accordance with U.S. Composting Council TMECC 05.08-B "Carbon Dioxide Evolution Rate."
9. The compost product shall originate from organic plant-based feedstocks as defined in WAC 173-350 as "Wood waste," "Yard debris," and/or "Preconsumer vegetative waste". The Contractor shall provide a list of feedstock sources by percentage in the final compost product.
10. The Engineer may also evaluate compost for maturity using U.S. Composting Council TMECC 05.08-E "Solvita® Maturity Index". Fine compost shall score a number 6 or above on the Solvita® Compost Maturity Test. Medium and Coarse compost shall score a 5 or above on the Solvita® Compost Maturity Test., Washington, (206) 622-4321.

2.03 SAND

- A. Sand shall meet percent passing for the following sieve sizes within reasonable variations:

Sieve Size	Percent Passing
3/8"	100
1/4"	95-100
No. 10	85-95
No. 30	60-75
No. 60	50-60
No. 100	20-30
No. 200	<5

2.04 MINERAL AGGREGATE

- A. General:

1. Mineral aggregate shall be free of wood, waste, coating, or and deleterious material. All mineral aggregate passing the No. 200 sieve size shall be non-plastic.
2. Mineral Aggregate for shall be analyzed by an accredited lab using the sieve sizes noted below, and shall meet the following gradation:

Sieve Size	Percent Passing
1 inch	100
No. 4	60 - 100
No. 10	40 - 100
No. 40	15 - 50
No. 200	2 - 5

3. Efforts should be made to have the Mineral Aggregate meet the following gradation coefficients: Coefficient of Uniformity ($C_u = D_{60}/D_{10}$) equal to or greater than 6; and Coefficient of Curve ($C_c = D_{30}^2/D_{60}D_{10}$) greater than or equal to 1 and less than or equal to 3.

PART 3 – EXECUTION

3.01 PREPARATION OF SUB-GRADE:

- A. Rip, disc, or scarify sub-grade soils in planting and seeding to a minimum depth of 12 inches or as detailed in Plans.

3.02 SOIL AND ORGANIC AMENDMENT PLACEMENT

A. For Stormwater Planting Areas:

1. Place 12 inches of Topsoil Type B and thoroughly rototill soil into top 8 inches of prepared subgrade.

3.03 COMPACTION

- #### **A. Compact to 85% maximum density per ASTM D1557.**

3.04 FINE GRADING

- #### **A. Perform fine grading to attain finish grades as shown on the Plans.**
- #### **B. Rake out all rocks, roots, sticks and other debris larger than 2-inch diameter or sticks longer than 4 inches long. Leave surface even, with maximum variations in topography of up to 3 IN and readily able to accommodate seeding or planting installation.**

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section specifies lawns and grasses necessary for finish grading, placing, soil preparation and treatment, and maintenance.

1.02 REFERENCED STANDARDS

- A. This Section incorporates by reference the latest revision of the following documents. These references are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of a listed document, the requirements of this Section shall prevail.

Reference	Title
O-F-241D	Federal Specification – Fertilizer, Mixed, Commercial
ANSI Z60.1	Nursery Stock
ASTM D586	Standard Test Method for Ash and Organic Matter Content of Degradable Erosion Control Products
SMMWW	Department of Ecology's Stormwater Management Manual for Western Washington

- B. Plant material: Washington Grade No. 1 as per State of Washington Department of Agriculture Order Numbers 1229, 1230, and 1322. Quality, size, and condition as determined by standards set forth in the aforementioned standards and ANSI Z60.1. Plant names shall conform to latest edition of "Standardized Plant Names" as adopted by American Joint Committee of Horticulture Nomenclature.

- C. Seed: Comply with the standards for:

1. "certified" grade seed or better.
2. drought resistant.
3. weed free.

1.03 SUBMITTALS

- A. Procedures: Section 01 33 00.
- B. Product Data.
- C. Seeding Plan
- D. Seed Mix Certifications

1.04 WARRANTY AND REPLACEMENT

- A. Seeded areas shall have a uniform stand of grass with no bare spots over 12 square inches as determined by the Project Representative at the time of provisional acceptance. Reseed bare spots at the original rate and fertilize with 10-20-20 at the rate of 20 pounds per 1,000 square feet of blended materials. All areas failing to vigorously establish within 90 days after germination or one growing season (whichever is longer), for any reason whatsoever, shall be reseeded at the Contractor's expense.

1.05 JOB CONDITIONS

- A. Protect work and adjacent property, and be responsible for any damage or injury arising due to actions or neglect.
- B. Confine work to areas designated. Do not disturb existing vegetation outside of limit lines. Repair or replace vegetation damaged as a result of Contractor's operation.
- C. Provide necessary safeguards for the protection of planted areas for such time as is required to ensure vigorous establishment of the plant material.

PART 2 – PRODUCTS

2.01 SEEDING

- A. Hydroseed mulch:
 - 1. Wood cellulose fiber mulch:
 - a. Fiber shall be produced from natural or recycled (pulp) fiber, such as wood chips or similar wood materials, or from newsprint, corrugated cardboard, or a combination of these processed materials.
 - b. The fibers shall not contain any rock, metal, or plastic.
 - 2. Treated with a green dye nontoxic to plant or animal life to facilitate inspection of the placement of the material.
 - 3. Manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material will become uniformly suspended to form a homogenous slurry.
 - 4. When hydraulically sprayed on the ground, the material shall allow the absorption and percolation of moisture.
 - 5. Contain less than 250 parts per million (ppm) boron and be nontoxic to plant and animal life.
 - 6. Organic matter content shall be at least 90% on an oven-dry basis as determined by ASTM D586.

7. Moisture content shall be no more than 15% as determined by oven-dried weight.
- B. Temporary and permanent seeding: Shall conform with the seeding standards in the SMMWW.
1. Seed of the following composition, proportion, and quality shall be applied at a rate of at least 80 pounds per acre on areas requiring seeding and mulching for erosion control:

Kind and Variety of Seed in Mixture	% By Weight	% Pure Seed	Minimum % Germination
Colonial Bentgrass (<i>Agrotis tenuis</i>)	10	9.80 (min)	85
Red Fescue (<i>Festuca rubra</i>)	40	39.20 (min)	80
Perennial Rye (<i>Lolium perenne</i>)	40	39.20 (min)	90
White Dutch Clover (<i>Trifolium repens</i>) (preinoculated)	10	9.80 (min)	85
Inert and Other		2.50 (max)	
Total		100	

PART 3 – EXECUTION

3.01 SEEDING

- A. Seeding:
1. Hydroseed all disturbed areas following completion of construction.
 2. Seeding may be accomplished by approved hand methods when impracticable to do by hydroseeding, or when approved by the Project Representative.
 3. Review all disturbed areas prior to the beginning of the Wet Season to identify which ones can be seeded in preparation for the Wet Season.
 4. Seeding shall occur only between the dates of March 1 through May 15 or September 1 through October 1 or as allowed by the Project Representative.
 5. All areas to be seeded shall be cultivated to meet City of Seattle and Department of Ecology requirements.
 6. Cultivation may be accomplished by disking, raking, harrowing, or other acceptable means. Perform all cultivating at right angles to the slope if necessary.
 7. Install surface runoff control measures, such as gradient terraces, interceptor dikes or swales, level spreaders, and sediment basins, prior to seeding.

8. Fertilize all areas that are seeded.
9. If hand seeding is allowed by the Project Representative, straw shall be applied to all hand-seeded areas per Section 31 25 00.
10. Where straw mulch for temporary erosion control is required, it shall be applied at a thickness of 2 to 3 inches per Section 31 25 00.

3.02 MAINTENANCE

- A. Perform maintenance of the lawn materials beginning immediately after the placement.
- B. Keep grass areas watered through the first mowing, after which, fertilize the grass with 33-1/2 pounds of 6-2-4 fertilizer per 1,000 square feet.
- C. Maintain, mow, and water until Final Acceptance.

END OF SECTION

SECTION 32 93 00

PLANTS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies all landscaping except for lawns and grasses Lawns and Grasses, if any, are specified in Section 32 92 00.

1.02 QUALITY ASSURANCE

- A. Referenced Standards: This section incorporates by reference the latest revision of the following documents. These references are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2,700 kN-m/m ³))
IBC	International Building Code

- B. Qualifications:

1. Manufacturer's qualifications: Materials to be provided under this section are to be the product of firms regularly engaged in the cultivation of the specified species or manufacture of a specified material.
2. Installers: by specialists possessing sufficient technical competence, skills, resources and ability to complete the work specified.

- C. Codes and standard specifications: Materials are specified by reference to the number, symbol, or title of a specific standard, such as commercial standard, federal specification, a trade association standard or other similar standard.

1.03 SUBMITTALS

- A. Procedures: Section 01 33 00.
- B. Supplier and supplier's type designation for all fertilizers and commercial products.
- C. Installer's qualifications.
- D. Analysis for soil amendments and topsoil.
- E. Maintenance data.

F. Planting materials and schedule

G. Weed and pest control plan.

1.04 WARRANTY

A. Remove and replace with new plants which are impaired, dead or dying during 1 year from initial acceptance.

B. Replacement materials and methods per original specifications.

C. Plants replaced under warranty will not have a second warranty, except as stated in paragraph D below.

D. If in fall planted material is dead or dying in the spring, replace material during that spring season. If said plants fail again during growing season, replace again in the fall. Every plant must leaf out and be in a healthy condition at beginning of growing season.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Soils and additives: per Section 32 91 00.

B. Plant materials:

1. Species and size indicated.

2. No substitutions without written approval of Landscape Architect.

3. Sound, healthy, vigorous, with normal top and root systems.

4. No substitution of root ball types is to be made without written approval of Landscape Architect.

5. Free from diseases, insect pests or their eggs.

6. Nursery grown stock, freshly dug.

7. No heeled-in, cold storage or collected stock.

8. Grown in same or colder climatic zone as project.

C. Trees:

1. Size and condition as indicated in plant list in the Drawings.

D. Balled and burlapped plants (B&B): Firm, natural balls of soil wrapped with burlap or strong cloth and tied.

E. Container grown plants (CG):

1. Roots well established in soil, but not root bound.
2. Grown in container for at least one growing season.
3. Bare root plants (BR): Intact root system cleaned of earth, wrapped immediately in wet straw, moss or other suitable material.

F. Organic Mulch: Fir/Hemlock bark of approved commercial grade. 3" minus particle or stand size.

G. Inert Mulch:

1. River Rock Cobble: Round, washed river rock; 1/2 to 6 inch in size.

H. Landscape Boulders: Granite Boulders: "High Cascade" Weathered Granite

1. Finish: Smooth.
2. Size: 2-5 "man" rock.
3. Boulders must be smooth and free of cracking, flaking and machine marks.

I. Gravel: Washed, clean, well-graded gravel, crushed gravel or crushed stone; 3/4 to 1-1/2 inch in size.

J. Herbicide: Pre-emergent/Post-emergent: Commercial grade conforming to State and Federal regulations.

K. Weed barrier: Nonwoven, geotextile fabric.

L. Root barrier: DeepRoot UB 18-2 or approved equal.

M. Metal edging:

1. Aluminum.
2. 3/16 x 5.5 inch.
3. 12-18 inch tapered steel stakes.
4. Mill finish.

N. Erosion control material: Heavy duty coir fabric mesh netting anchored with wire staples as per manufacturer's suggested recommendations.

O. Tree stakes: 8 foot, round pine stake with an outer diameter of 2 inches.

P. Guying wire: 12-gauge wire.

Q. Black rubber hose.

R. Dead-man:

1. Pressure treated 4"x4" timber dead-man.
2. 12-gauge guy wire, black rubber hose, eyelet and turnbuckle.

S. Street tree supplemental watering bag:

1. 20 gallon Treegator.

T. Water: Provide clean, fresh water free from impurities injurious to vegetation. Supply water necessary to ensure an adequate supply for healthy growth.

1. Provide necessary hose, equipment, attachments, and accessories for the adequate watering of plant areas as may be required to complete the work as specified.

2.02 PLANT LIST

A. See Drawings for plant list.

PART 3 – EXECUTION

3.01 SITE GRADING AND SOIL PREPARATION

- A. Prepare a consistent subgrade 12 inches below top of adjacent pavement or adjacent finish grade.
- B. Rototill subgrade to a depth of 8 inches, removing rocks, clods, roots, pieces of wood and plastic, pieces of metal or wire and other construction related debris over 2 inches in any dimension.
- C. Supply sufficient topsoil to bring planting bed (holding area) grade even with top of adjacent pavement or finish grade after compaction.
- D. Provide a consistent, smooth planting bed.
- E. Compact subgrade and topsoil fill at 85% maximum density per ASTM D1557.
- F. See Section 32 91 00.

3.02 PLANTING OPERATIONS

A. General:

1. Transport plant materials to their final location with care.
2. Tie down branches, if necessary, and protect bark with burlap bags to prevent damage from chafing by ropes and wires.

3. Do not drag plants on the ground.
4. Properly place in a manner which provides complete protection for the roots and branches.
5. Plant trees during normal periods for such work, as determined by the season, weather, and accepted practice.
6. Remove rejected plants from the site immediately.

B. Pruning:

1. After planting, prune plant material in compliance with the best horticultural practice, appropriate to the type of plant.
2. Top prune to remove damaged twigs and branches, and compensate for loss of roots during planting operation.
3. Unless otherwise indicated, top growth removal to compensate for root loss shall not exceed 1/3 of the top growth.
4. Removal of top growth shall be done in such a manner as to retain the natural growth characteristics of the plant.
5. Treat cuts greater than 3/4-inch in diameter with an approved tree wound dressing.
6. Produce a clean cut without bruising or tearing the bark; living wood shall be left where the wound can heal over properly.
7. Do not prune evergreen plants except to remove dead or broken branches.

C. Inspection and Approval of new plants is required by the Project Representative prior to planting.

D. Planting Season shall be after September 15 and before March 15 or as approved by Project Representative.

E. Planting Time: Planting of trees and shrubs shall be done only during periods that are normal for such work as determined by weather conditions and accepted practice.

1. Do not plant or work soils when there is a presence of ponded water in areas to be worked unless planting emergent herb or live-stake cutting plantings.
2. Do not plant when ground is frozen or temperature is below 32°F.

F. Layout: Stake all plant material locations and layout bed lines prior to beginning installation. The Project Representative may approve layout or make adjustments to plant material locations to meet field conditions.

G. Tree and shrub pits:

1. Wide, saucer shaped bowl.
2. Two times ball diameter or container size; see detail on Drawings.
3. Form hole to allow the root ball to sit on undisturbed or tamped soil.
4. Place top of root mass at or slightly above existing grade (2" max).

H. Massed planting and groundcover beds:

1. Shrubs: Plant in individual holes of required size in prepared soils per Section 32 91 00.
2. Groundcover beds: Plant in prepared soils per Section 32 91 00.
3. Modify soil with sand and/or peat moss if needed, to ensure proper plant growth.

I. Set plants straight or plumb, at such level that after settlement they bear same relationship to finished grade as they did in their former setting.

1. Remove burlap, rope, wires, etc., from balls.
2. If wire and burlap are needed to ensure the integrity of the ball, remove the bottom 1/4 to 1/2 of the wire +/- burlap before placing in prepared hole. When tree is secure, remove remaining wire and burlap.

J. Backfill plants with soil removed from hole.

1. Tamp under and around balls to eliminate voids.
2. Tamp to one-half depth of pit and thoroughly water and puddle before backfilling to proper grade.
3. After planting has been completed, flood pit again so that backfill is thoroughly saturated and settled.

K. After planting is complete, form saucer 4 inches high around each plant extending to limit of plant pit using existing soil.

L. Mulching:

1. Mulch tree planting pit after saucer has been shaped to depth of 4 inch with organic mulch.
 - a. Keep mulch off of tree trunk.
2. In massed plantings, mulch entire area uniformly to depth of 4 inches with organic mulch.
3. If mulching is delayed and soil has dried out, water plants thoroughly before spreading mulch.

M. Inert Mulching:

1. Cover areas with weed barrier.
 - a. Nonwoven, spun bound polyester fabric.
2. Overlap edges minimum 6 inch.
 - a. Install 6 inch uniform layer of inert mulch. Recess area so that top of mulch is flush with grass, walks, curbs, or adjacent planting areas.

N. Staking:

1. Stake trees immediately after planting.
2. Set stakes securely at an angle.
3. For deciduous trees 3 inch and larger and evergreen trees 10 feet and taller: Three stakes spaced equilaterally around tree.
4. For deciduous trees smaller than 3 inches and smaller: Two stakes spaced opposite sides of tree.
5. For evergreen trees within the limits of the combined sewage storage tank footprint provide a dead-man per as detailed in the Drawings.
6. Remove staking and guying outside of the limits of the combined sewage storage tank footprint within one year.

O. Pruning:

1. Remove dead or damaged branches.
2. Remove only dead or damaged branches from conifers.

3.03 MAINTENANCE

A. Preliminary inspection and approval:

1. Request a preliminary inspection of planting work upon completion of all planting.

B. Requirements:

1. Maintain trees and shrubs in a vigorous, thriving condition through watering, pruning, cultivating, spraying, and other necessary operations for the total period of time the plant material is temporarily held.
2. Maintain landscape area in a weed free condition through final inspection.
3. Protect trees and shrubs from damage by erosion or trespassing. Erect proper safeguards.

- C. Cleanup: Maintain landscaped and staging areas in a clean, neat, and orderly manner at all times.
- D. Final cleanup:
 - 1. Remove deleterious material and debris from all areas.
 - 2. Neatly rake planting areas to an even fine grade.
 - 3. Wash and clean hard surfaces.
- E. Final inspection:
 - 1. Final inspection shall determine completion of Contract work. Final inspection will be made by the Project Representative no earlier than two days after receipt of due notice requesting such inspection. Plant warranty will begin after satisfactory inspection.
 - 2. The site shall be thoroughly cleaned and work shall be completed at the time of final inspection.

END OF SECTION

SECTION 32 93 10
STORMWATER PLANTS

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies all stormwater planting and landscaping.

1.02 SUBMITTALS

- A. Procedures: Section 01 33 00.
- B. Installer's qualifications.
- C. Analysis for soil amendments and topsoil.
- D. Maintenance data.
- E. Planting materials and schedule.
- F. Weed and pest control plan.

1.03 WARRANTY

- A. Remove and replace with new plants which are impaired, diseased, dead or dying during 1 year from initial acceptance.
- B. Replacement materials and methods per original specifications.
- C. Plants replaced under warranty will not have a second warranty, except as stated in paragraph D below.
- D. If in fall planted material is dead or dying in the spring, replace material during that spring season. If said plants fail again during growing season, replace again in the fall. Every plant must leaf out and be in a healthy condition at beginning of growing season.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Soils and additives: per Sub section 32 91 10.
- B. Plant materials:
 - 1. Species, stock type, and size indicated.
 - 2. No substitutions without written approval of Landscape Architect or Engineer.

3. Sound, healthy, vigorous, with normal top and root systems. No root bound or plants with “J-roots” shall be accepted.
4. No substitution of root ball types is to be made without written approval of Landscape Architect or Engineer.
5. Free from diseases, insect pests or their eggs.
6. Nursery grown stock, freshly dug.
7. No heeled-in, cold storage or collected stock.
8. Grown in same or colder climatic zone as project.

C. Trees:

1. Size, species, stock type, and condition as indicated in plant list in the Drawings.

D. Container grown plants:

1. Roots well established in soil, but not root bound.
2. Grown in container for at least one growing season.
3. 10 IN plug: Deep rooted plant plugs grown in 10 CU IN deep-rooted plug containers.
4. Bare root plants: Intact root system cleaned of earth, wrapped immediately in wet straw, moss or other suitable material.

E. Organic Mulch: Fir/Hemlock bark of approved commercial grade. 3” minus particle or stand size.

F. Herbicide/Post-emergent: Commercial grade conforming to State and Federal regulations. No pre-emergent herbicides shall be used near stormwater treatment facilities.

G. Black rubber hose.

H. Water: Provide clean, fresh water free from impurities injurious to vegetation. Supply water necessary to ensure an adequate supply for healthy growth.

1. Provide necessary hose, equipment, attachments, and accessories for the adequate watering of plant areas as may be required to complete the work as specified.

I. Seed: Seed mixes shall be provided in sealed containers labeled with the species percentages as shown on the Drawings. Seed shall be procured from Washington State providers of native seed.

2.02 PLANT SCHEDULE

A. See Stormwater Landscape Drawings for plant schedules and seed mixes.

PART 3 – EXECUTION

3.01 SITE GRADING AND SOIL PREPARATION

- A. See Section 32 91 10.

3.02 PLANTING OPERATIONS

- A. General:

1. Transport plant materials to their final location with care.
2. Tie down branches, if necessary, and protect bark with burlap bags to prevent damage from chafing by ropes and wires.
3. Do not drag plants on the ground.
4. Properly place in a manner which provides complete protection for the roots and branches.
5. Plant trees during normal periods for such work, as determined by the season, weather, and accepted practice.
6. Remove rejected plants from the site immediately.

- B. Pruning:

1. Do not prune plants installed within stormwater facility areas.

- C. Inspection and Approval of new plants is required by the Project Representative prior to planting.

- D. Planting Season shall be after October 1 and before February 28 or as approved by Project Representative.

- E. Planting Time: Planting of trees and shrubs shall be done only during periods that are normal for such work as determined by weather conditions and accepted practice.

1. Do not plant or work soils when there is a presence of ponded water in areas to be worked unless planting emergent plants.
2. Do not plant when ground is frozen or temperature is below 32°F.

- F. Layout: Stake all plant material locations and layout bed lines prior to beginning installation. The Project Representative may approve layout or make adjustments to plant material locations to meet field conditions. Landscape Architect or Engineer must approve final plant layout.

G. Tree and shrub pits:

1. Two times ball diameter or container size; see detail on the Drawings.
2. Form hole to allow the root ball to sit on undisturbed or tamped soil.
3. Stormwater plants shall be planted with root collar and root mass at existing grade and not above existing grade.

H. Backfill plants with soil removed from hole.

1. Tamp under and around balls to eliminate voids.
2. Tamp to one-half depth of pit and thoroughly water and puddle before backfilling to proper grade.
3. After planting has been completed, flood pit again so that backfill is thoroughly saturated and settled.

I. Mulching:

1. Mulch entire area uniformly to depth of 3 inches with wood chip mulch.
2. Keep mulch off of tree trunks and base of plant stems.
3. If mulching is delayed and soil has dried out, water plants thoroughly before spreading mulch.

J. Seeding:

1. Notify the Engineer within 7 working days in advance of any seeding operation and shall not begin the Work until areas prepared or designated for seeding have been accepted. Following the Engineer's acceptance, seeding of the accepted ground surfaces shall begin immediately.
2. Seeding shall not be done during windy weather or when the ground is frozen, or excessively wet.
3. To ensure proper application rates, measure and stake seed application area. For maximum performance, apply HP-FGM in a two-step process*:
 - a. Step One: Apply fertilizer with specified prescriptive agronomic formulations and typically 50% of specified seed mix with a small amount of HP-FGM for visual metering. Do not leave seeded surfaces unprotected, especially if precipitation is imminent. Seed shall be applied within less than one hour of being mixed in hydroseeder.
 - b. Step Two: Mix balance of seed and apply HP-FGM at a rate of 50 lb per 125 gallons (22.7 kg/475 liters) of water over freshly seeded surfaces. Confirm loading rates with equipment manufacturer.

4. Best results and more rapid curing are achieved at temperatures exceeding 60°F (15°C). Curing times may be accelerated in high temperature, low humidity conditions with product applied on dry soils.
5. Emergent zone seed mix:
 - a. This area shall be temporarily or permanently inundated. Progressively seed bi-weekly as soils within seeded areas are exposed, moist, but no longer inundated. Do not place seed on rocks or in areas of standing water. Do not re-seed areas that have already been seeded unless the seed has failed to germinate.

3.03 MAINTENANCE

A. Preliminary inspection and approval:

1. Request a preliminary inspection of planting work upon completion of all planting.

B. Requirements:

1. Maintain trees and shrubs in a vigorous, thriving condition through watering, pruning, cultivating, spraying, and other necessary operations for the total period of time the plant material is temporarily held.
2. Maintain landscape area in a weed and trash free condition through final inspection.
3. Protect trees, shrubs, and seeded areas from damage by erosion or trespassing. Erect proper safeguards.

C. Cleanup: Maintain landscaped and staging areas in a clean, neat, and orderly manner at all times.

D. Final cleanup:

1. Remove deleterious material and debris from all areas.
2. Leave un-even surfaces, if no greater than a few inches variation, for stormwater facility planting areas.

E. Final inspection:

1. Final inspection shall determine completion of Contract work. Final inspection will be made by the Project Representative no earlier than two days after receipt of due notice requesting such inspection. Plant warranty will begin after satisfactory inspection.
2. The site shall be thoroughly cleaned and work shall be completed at the time of final inspection.

END OF SECTION

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Division 33

Utilities

SECTION 33 10 00
WATER UTILITY DISTRIBUTION PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Comply with Silverdale Water District 2023 Conditions and Standards for Constructing Improvement to the Water and Recycled Water System (included in the appendices of these Specifications).

1.02 SUMMARY

- A. This section includes water distribution piping and related components outside of the building from a water service source.
- B. Definitions:
 - 1. Domestic water piping: Water piping that has been installed, cleaned, disinfected, flushed and sample-tested satisfactorily for human consumption.
 - 2. Non-potable water piping: Water piping which is isolated from potable water piping by approved backflow prevention devices and is labeled "Non-Potable Water".

1.03 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data for each type of product indicated.
 - 2. Shop Drawings: Detail precast vault/structure assemblies and indicate dimensions, method of field assembly, and components.
- C. Informational Submittals:
 - 1. Coordination Drawings: For piping and specialties, including relation to other utility services in same area, drawn to scale. Show piping and specialty sizes and valves, meter, and specialty locations and elevations.
 - 2. Concurrence Memo: Confirmation from Silverdale Water District (SWD) for any work requiring coordination or SWD's involvement during the work.

3. Relocation Plans: Pothole data for all crossings between the proposed water mains and existing underground utilities. If the pothole data does not validate the designed alignment, plans and coordination with the conflicted utility to resolve the conflicts shall be required.

4. Field quality control test reports.

D. Closeout Submittals:

1. O&M Manual Content: Provide O&M Manual Documentation as required by Section 01 77 00, "Closeout Procedures."

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.

B. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing. Submittals

- C. Piping materials shall bear label, stamp or other markings of specified testing agency as applicable.

1.05 GENERAL REQUIREMENTS

- A. Any items disturbed during construction, including shrubs and lawns, shall be restored by the Contractor upon completion of Work. Grassed areas shall be resodded or seeded and mulched as part of Work per the Contract Documents.
- B. The Contractor shall verify all dimensions of valves, special castings and fittings, pipe, equipment, etc., so that all of the pipe Work performed will fit together properly and will conform to the arrangement as shown on the Contract Drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends and flange faces. Set valves in best position for handling. Set valves closed to prevent rattling.

2. During Storage: Use precautions for valves, including fire hydrants, according to the following: Do not remove end protectors unless necessary for inspection; then reinstall for storage. Protect from weather. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
3. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
4. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture. E. Protect stored piping from moisture and dirt. Elevate above grade.
5. Protect flanges, fittings, and specialties from moisture and dirt.
6. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.07 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 1. Notify Construction Manager, and Owner no fewer than 7 days in advance of proposed interruption of service. Do not proceed with interruption of water-distribution service without Construction Manager's, and Owner's written permission. Coordinate utility shut down with utility Silverdale Water District.
- B. Coordination: Coordinate connection to water main with Silverdale Water District.

1.08 SEQUENCING

- A. Coordinate with all other utility work.
- B. Coordinate with Silverdale Water District to develop a schedule and sequencing for any existing water utilities, services, and associated appurtenances that will be affected by the work. This includes, but is not limited to, tie-ins to existing water mains and abandonment of any water infrastructure. A memo of concurrence from Silverdale Water District, procured by the Contractor, shall be submitted to the Engineer for approval, before beginning of any water utility work.
- C. Pothole all crossings between existing utilities and proposed sanitary sewerage to validate the designed alignment. If there are any utility conflicts, the Contractor shall submit Relocation Plans to the Engineer for approval. The Relocation Plans shall be stamped by an actively licensed Professional Engineer of the State of Washington. Pothole validation and relocation plans shall be submitted to the Engineer for approval, before beginning any water utility work.

PART 2 – PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, ASTM B 88, Type L and ASTM B 251 water tube, annealed temper.
 - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - 2. Copper, Pressure-Seal Fittings:
 - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- B. Bronze Flanges: ASME B16.24 Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- C. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.02 DUCTILE IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern. Gaskets: AWWA C111, rubber
- C. Flanges: ASME 16.1, Class 125 cast iron.

2.03 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, B Cup Series.

2.04 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

- B. Tubular-Sleeve Pipe Couplings: Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
1. Standard: AWWA C219.
 2. Center-Sleeve Material: Manufacturer's standard, Carbon steel, Stainless steel, Ductile iron, or Malleable iron.
 3. Gasket Material: Natural or synthetic rubber. d. Pressure Rating: 200 psig minimum.
 4. Metal Component Finish: Corrosion-resistant coating or material.
- C. Split-Sleeve Pipe Couplings: Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
1. Standard: AWWA C219.
 2. Sleeve Material: Manufacturer's standard, Carbon steel, or Stainless steel.
 3. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 4. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 5. Pressure Rating: 200 psig minimum.
 6. Metal Component Finish: Corrosion-resistant coating or material.
- D. Flexible Connectors:
1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
 2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

2.05 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Non-rising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile iron gate, clockwise closing, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.

- 3) End Connections: As indicated on the Plans.
- 4) Interior Coating: Complying with AWWA C550.

2.06 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, metal or resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER" and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
2. Valve boxes shall be cast iron, 2-piece, and slip type with base corresponding to the size of the valve, equal to Rich Manufacturing Co. or Olympic Foundry Co. The box shall be coal tar painted by the manufacturer using its standard.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.07 CORPORATION VALVES AND CURB VALVES

A. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine. Corporation stops for 1-inch, 1-1/2-inch, and 2-inch services shall be equal to Ford:

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

- B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
- C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
 - 1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.08 FIRE HYDRANTS

A. Dry Barrel Fire Hydrants:

- 1. Hydrants shall be dry barrel type and conform to ANSI/AWWA C502 and shall be Clow Medallion Hydrant or approved equal.
- 2. Hydrants shall have a minimum five-inch (5") main valve opening, two 2.5-inch outlets and a 4.5-inch steamer/pumper port; such outlets and port shall have national standard threads
 - a. The steamer/pumper port shall include a 5-inch Snap-Tite STORZ adaptor and cap equivalent to FSA 50 45 NST STORZ adaptor and FSB 50 blind cap with stainless steel cable, as manufactured by Snap-Tite, Inc.
 - b. A setscrew shall be provided through the NST portion of the adaptor.
- 3. Hydrants shall be traffic type with break flange and stem coupling. O-ring stem seals shall be provided. See Standard Details.
- 4. Hydrants above ground shall be painted with paint equal to Benjamin Moore & Co Industrial Coatings, M22 Urethan Alkyd Gloss Enamel, Safety Yello 15. Tops to be painted by Silverdale Water District according to Kitsap County Fire Flow Ordinance.

Fire Flow	Color
Above 1,500 gallons per minute (gpm)	Safety blue 35
1,000 gpm to 1,500 gpm	Safety green 41
500 gpm to 1,000 gpm	Safety orange 65
below 500 gpm	safety red 21

2.09 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

- 1. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper

for each hose-connection inlet; 18-inch-high brass sleeve; and round escutcheon plate.

- a. Standard: UL 405.
- b. Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.
- c. Inlet Alignment: Inline, horizontal, or Square.
- d. Finish Including Sleeve: Polished bronze.
- e. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."

PART 3 – EXECUTION

3.01 EARTHWORK

- A. Excavating, Backfilling, and Compacting for Utilities shall be per the requirements of Kitsap County Road Standards, Section 7 – Utility Installation and Work in County Right of Way, Silverdale Water District, Silverdale Water District 2023 Conditions and Standard Details, Section 3.4 – Trench Excavation, and Kitsap County Department of Public Works, Division III – Side Sewers & Building Sewers, Section 2.040 Bedding and Backfill. Contractor shall also refer to the applicable County Standard Details as shown in the Contract Drawings.

3.02 UTILITY LOCATION

- A. Prior to any utility installation work commences, Contractor shall verify location of existing and proposed utilities.

3.03 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Refer to Contract Drawings for pipe sizing and material selection.

3.04 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal or resilient-seated gate valves with valve box.
 2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising stem gate valves with indicator post.
 3. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising or rising stem.
 - b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.
 - c. Check Valves: AWWA C508, swing type.
 4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
 5. Relief Valves: Use for water-service piping in vaults and aboveground.
 - a. Air-Release Valves: To release accumulated air.
 - b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
 - c. Combination Air Valves: To release or admit air. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.
 6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.05 PIPING INSTALLATION

A. Water Main Connection:

1. Coordinate with Silverdale Water District for tap of size and in location indicated in water main. Size and type of pipe must be confirmed prior to tapping.
2. Make connections larger than NPS 2 with tapping machine according to the following:
 - a. Install tapping sleeve and tapping valve according to MSS SP-60.
 - b. Install tapping sleeve on pipe to be tapped.
 - c. Position flanged outlet for gate valve.
 - d. Use tapping machine compatible with valve and tapping sleeve; cut hole in main.

- e. Remove tapping machine and connect water-service piping. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
 - f. Work shall be conducted at such a time and in such a manner as to minimize the interruption of service. The District must approve cut-in time.
 - g. Necessary pipe, fittings and gate valves shall be assembled at the site ready for installation prior to the shutting-off water in the existing main. Once the water has been shut off, the work shall be prosecuted vigorously and shall be halted until the line is restored to service. Unless specifically provided for elsewhere in these specifications, the Contractor shall provide at least 48 hours' notice to the Silverdale Water District inspector of intention to disrupt service.
 - h. All materials shall be swabbed with chlorine and washed with clean water.
- B. Comply with NFPA 24 for fire service main piping materials and installation.
 - C. Install ductile iron water service piping according to AWWA C600 and AWWA M41.
 - D. Install underground piping with restrained joints at horizontal and vertical changes in directions. Use restrained joint piping, thrust blocks, anchors, tie-rods and clamps and other supports.

3.06 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
 - 2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 4. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - a. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
 - b. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits or nipples.
 - c. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits

3.07 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks. Locking mechanical joints. Set-screw mechanical retainer glands. Bolted flanged joints. Heat-fused joints. Pipe clamps and tie rods.

- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.
- H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.
- I. Valve Marker Posts: Valve marker posts shall be reinforced concrete posts, 4-inches by 4-inches by 42 inches long, as provided by Fog Tite Meter Seal Co.

3.09 DETECTOR-CHECK VALVE INSTALLATION

- A. Install in vault or aboveground.
- B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written instructions.
- B. Meters shall conform to ANSI/AWWA C700, C701, C702, C703 and C704, as appropriate. Meters shall have sealed register to prevent condensation, atmospheric corrosion and abrasion. Five-eighths-inch, 3/4-inch, and 1-inch meters shall be Sensus SR II (Positive Displacement Water Meter with E-Register). Larger meter shall be Sensus Omni C2. All

meters shall read in cubic feet and programmed to read in 1 cubic foot. See Standard Details for Silverdale Water District.

3.11 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.12 WATER METER BOX INSTALLATION

- A. Install water meter boxes in paved areas flush with surface.
- B. Install water meter boxes in grass or earth areas with top 2 inches above surface.
- C. Concrete Meter Box
 - 1. Concrete meter boxes shall be complete with steel lid equal to Fog Tite No. B-10 for 1", 3/4", and 5/8" meters and Fog Tite No. 2 with hinged steel inspection covers for 1-1/2" and 2" meters
- D. Plastic Meter Box
 - 1. Plastic meter boxes shall be complete with plastic cover with hinged case iron reading lid equal to those manufactured by Carson Industries, Inc.

3.13 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
- C. AWWA Fire Hydrants: Comply with AWWA M17.
- D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.14 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire department connection to mains.
- B. Install protective pipe bollards on two sides of each fire department connection.

3.15 CONNECTIONS

- A. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve or method approved by Silverdale Water District.

3.16 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Hydrostatic/Leakage Tests shall be per Silverdale Water District 2023 Conditions and Standard Details, Section 3.17.
- C. Sterilization and Flushing of Water Mains shall be per Silverdale Water District 2023 Conditions and Standard Details, Section 3.18.
- D. Any leaks or imperfections developing under said pressure shall be remedied by the Contractor before final acceptance of work. The Contractor shall provide all necessary equipment and shall perform all work connected with the tests. Tests shall be made after corporation stops are installed. Insofar as is practical, tests shall be made with pipe joints, fittings, and valves exposed for inspection.
- E. If the static pressure at the service is above 70 PSI, a pressure-reducing valve shall be installed on the customer's side of the meter per the standard detail. The pressure-reducing valve shall be adjusted to 60 PSI at the customer's building as per Silverdale Water District 2023 Conditions and Standard Details Section 3.33.
- F. Prepare reports of testing activities and sterilization and flushing activities.

3.17 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping.

END OF SECTION

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SECTION 33 12 20
UTILITY YARD HYDRANTS

PART 1 – GENERAL

1.01 SUBMITTALS

- A. Product Data: Catalog cut sheets of yard hydrants and appurtenances.

PART 2 – PRODUCTS

2.01 UTILITY YARD HYDRANTS

- A. Yard hydrants shall be anti-freezing and equipped with the following:
1. Double-ball check valve on the drain that is vented to atmospheric air and has Teflon balls for zero percent water absorption.
 2. Vacuum breaker permanently attached to the outlet that prevents unwanted back-siphonage from an attached hose.
- B. Yard hydrants shall be manufactured to the dimensions indicated in the Contract Drawings. Hose connection to yard hydrant shall be identical to that of the wall hydrant of the same size.
1. Minimum 2 feet depth of bury.
 2. Removable bronze valve seat. Replaceable seat washer.
 3. Brass casing and cast aluminum casing guard.
 4. All bronze interior parts.
 5. Female 3/4-inch NPT inlet connection.
 6. Male 3/4-inch threaded hose connection.
 7. Yard hydrant shall include 1/4-turn Tee handle operating key. Wheel handles shall not be allowed.
- C. Materials of construction:
1. Inlet body and lever handle: brass.
 2. Outlet: galvanized steel.
 3. Operating rod and casing: galvanized steel pipe.

2.02 MISCELLANEOUS MATERIALS

- A. Stone: No. 57 Stabilization stone.

2.03 MANUFACTURERS

- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Zurn Industries, LLC.
 - 2. Watts Water Technologies Company.
 - 3. Or approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install yard hydrant in accordance with manufacturer's instructions and recommendations.
- B. Provide thrust blocks as indicated. Backfill with 2 cubic feet of crushed stone around the waste or drip outlet with one-half of the stone below the outlet. Arrange remaining balance of stone around hydrant to prevent damage to the connections from mechanical shock and to insure hydrant stability.

END OF SECTION

SECTION 33 30 00
SANITARY SEWERAGE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Comply with Kitsap County Standards for Sanitary Sewer Construction.

1.02 SUMMARY

- A. This section includes gravity sanitary sewer pipes, manholes, cleanouts, and oil/water separator as required by the Drawings, in accordance with these Specifications and Kitsap County Standards for Sanitary Sewer Construction and Standard Details.
- B. The work commences at a point 5 feet outside the building terminated with the connection to the appropriate sewerage pipe.

1.03 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements of Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product Data for each type of product indicated.
 - 2. Shop Drawings: Detail precast vault/structure assemblies and indicate dimensions, method of field assembly, and components.
 - 3. Concurrence Memo: Confirmation from Kitsap County Public Works (KCPW) for any work requiring coordination or KCPW's involvement during the work.
 - 4. Relocation Plans: Pothole data for all crossings between the proposed sanitary sewerage and existing underground utilities. If the pothole data does not validate the designed alignment, plans and coordination with the conflicted utility to resolve the conflicts shall be required.
- C. Informational Submittals:
 - 1. Coordination Drawings: For piping and specialties, including relation to other utility services in same area, drawn to scale. Show piping and specialty sizes and valves, meter, and specialty locations and elevations.
 - 2. Field quality control test reports.

D. Closeout Submittals:

1. O&M Manual Content: Provide O&M Manual Documentation as required by Section 01 77 00, "Closeout Procedures."

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of Section 01 43 00, "Quality Assurance and Control," and the requirements of this section.
- B. Regulatory Requirements:
 1. Comply with the requirements of Kitsap County Public Works.
 2. Comply with standards of authorities having jurisdiction for sanitary sewerage piping and structures, including materials, installation, testing, and disinfection.
- C. Piping materials shall bear label, stamp or other markings of specified testing agency as applicable.

1.05 GENERAL REQUIREMENTS

- A. Any items disturbed during construction, including shrubs and lawns, shall be restored by the Contractor upon completion of Work. Grassed areas shall be resodded or seeded and mulched as part of Work per the Contract Documents.
- B. The Contractor shall verify all dimensions of valves, special castings and fittings, pipe, equipment, etc., so that all pipe Work performed will fit together properly and will conform to the arrangement as shown on the Contract Drawings.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Check upon arrival; identify and segregate as to types, functions, and sizes.
- B. Store plastic piping, structures, and fittings protected from direct sunlight. Support to prevent sagging and bending. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- C. Protect pipe, pipe fittings, and seals from moisture and dirt.
- D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.07 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and removed or abandoned.

- C. Existing Utilities: Do not interrupt existing utilities serving adjacent facilities except when permitted under the following conditions and then only after arranging to provide acceptable temporary services.
- D. Any proposed utility interruptions shall be coordinated with the City of Silverdale and Kitsap County.
- E. Coordination: Coordinate connect to sanitary sewer main with Kitsap County.

1.08 SEQUENCING

- A. Coordinate work with the Pre-Fabricated Concrete Building Manufacturer/Contractor/Supplier.
- B. Coordinate with all other utility work.
- C. Coordinate with Kitsap County Public Works to develop a schedule and sequencing for any existing sanitary sewerage that will be affected by the work. This includes, but is not limited to, tie-ins to existing sanitary sewer structures or pipes, abandonment of any sanitary sewerage infrastructure. A memo of concurrence from Kitsap County Public Works, procured by the Contractor, shall be submitted to the Engineer for approval, before beginning of any sanitary sewerage work.
- D. Pothole all crossings between existing utilities and proposed sanitary sewerage to validate the designed alignment. If there are any utility conflicts, the Contractor shall submit Relocation Plans to the Engineer for approval. The Relocation Plans shall be stamped by an actively licensed Professional Engineer of the State of Washington. Pothole validation and relocation plans shall be submitted to the Engineer for approval, before beginning any sanitary sewerage work.

PART 2 – PRODUCTS

2.01 PIPE

- A. Polyvinyl Chloride (PVC) Pipe: ASTM D3034, SDR 35, for gasketed joints.
 - 1. Gaskets: ASTM F477, elastomeric seal.
- B. Ductile Iron Pipe: Class 51 or pressure class 250, with Protecto 401 Lining.

2.02 JOINTS

- A. Polyvinyl Chloride (PVC) Sewer Joints: Push-on type with a restrained elastomeric ring gaskets, ASTM D3212. Gaskets are to conform to ASTM F477.
- B. Ductile Iron Pipe: Push-on type with rubber gaskets conforming to AWWA C111.

2.03 FITTINGS

- A. Polyvinyl Chloride (PVC) Sewer Fittings: ASTM D3034, SDR 26.
- B. Ductile Iron Fittings: AWWA C110 or C153.

2.04 MANHOLES

- A. Manholes shall be per the details on the Plans and Kitsap County Standard Details and conform to ASTM C478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
- B. Diameter: 48 inches minimum, unless otherwise indicated.
- C. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section and having separate base slab or base section with integral floor.
- D. Grade Rings: Install a minimum of one 24-inch-diameter reinforced concrete grade ring. Total depth of grade ring adjustment section shall be between 2 inches and 16 inches.
- E. Gaskets: ASTM C443, rubber.
- F. Steps: Shall be polypropylene with anti-slip tread design with two reflectors per step. Steps shall be grouted into the precast concrete wall. Steps shall be uniformly spaced at 12 inches on center vertically, leveled horizontally and aligned along the manhole's centerline.
- G. Frame and Cover: ASTM A536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover with "SEWER" stenciled on the cover and as indicated on the Kitsap County's Standard Details.
- H. Grate: WSDOT Type 1 Grate Inlet grate cut to fit required diameter opening. Hot dip galvanize following cutting.
- I. Manhole manufacturer shall be: Shrope Concrete Products, Hanson Pipe and Precast Inc., or approved equal.

2.05 CLEANOUTS

- A. Cleanouts shall be constructed per the details shown on the plans and Kitsap County Standard Details.

2.06 OIL-WATER SEPARATOR

- A. Oil-water separator shall be pre-cast Oldcastle 264-CPS Oil-Water Separator or approved equal. Vault shall be in accordance with plans and oil-water separator shall include Center Section, Base Assembly, Top Section, baffles and weir, access risers with associated frames and covers, knockouts, and inlet and outlet pipes with sampling tees.
- B. Contractor shall prepare and submit vault plans which are stamped by a structural engineer licensed in the State of Washington. Vault shall be designed for HS-20 traffic loading.
- C. Minimum 4000 psi structural reinforced concrete shall be used. Precast vaults shall have approved rubber gasket system.

- D. Riser pipe and elbows shall be 0.060-inch aluminum, 0.065-inch aluminized steel, or 0.064-inch galvanized steel pipe in accordance with AASHTO M36, M196, M197, and M274. Galvanized steel pipe shall have Treatment 1.
- E. Pipe supports and riser pipe shall be of the same material. Pipe supports shall be 3-inch by 0.075-inch aluminum or 3-inch by 0.079-inch steel.

PART 3 – EXECUTION

3.01 EARTHWORK

- A. Excavating, Backfilling, and Compacting for Utilities shall be per the requirements of Kitsap County Road Standards, Section 7 – Utility Installation and Work in County Right of Way, Silverdale Water District, Silverdale Water District 2023 Conditions and Standard Details, Section 3.4 – Trench Excavation, and Kitsap County Department of Public Works, Division III – Side Sewers & Building Sewers, Section 2.040 Bedding and Backfill. Contractor shall also refer to the applicable County Standard Details as shown in the Contract Drawings.
- B. Oil-water separator excavation shall be unclassified.
- C. In loose or soft soils, perform the excavation at the bottom by equipment that does not have digging teeth. Should the natural or fill foundation soils at the bottom be disturbed or loosened because of the Contractor's operations, re-compact or remove. If material is removed, refill the area with material as specified in Section 31 23 00, "Earthwork."

3.02 UTILITY LOCATION

- A. Prior to any utility installation work commences, Contractor shall verify location of existing and proposed utilities.

3.03 INSTALLATION

- A. Inspection and Certification: The Owner will provide inspection for all new sewer line installations within Owner right-of-way. The Contractor shall notify the Owner's Representative and the Kitsap County Public Works Department a minimum of 48 hours prior to the installation of any of the underground sewer system facilities to coordinate any required inspections.
- B. Piping Applications: Include watertight joints.
- C. General Locations and Arrangements: Drawings (Plans and Details) indicate the general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout consider many design considerations. Install piping as indicated to extent practical.
- D. Install piping beginning at the low point of system, true to grades and alignments indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations.

- E. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reduction of the size of pipe in the direction of flow is prohibited.
- F. Install piping at a constant slope between points and elevations indicated.

3.04 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. Join and install pipe and fittings according to the following:
 - 1. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings: Install and join pipe and gasketed fittings with elastomeric seals in accordance with ASTM D2321 for laying and joining pipe and fittings.
 - 2. System Piping Joints: Make joints using system manufacturer's couplings, except where otherwise specified. Make joints to other pipe materials in accordance with the recommendation of the plastic pipe manufacturer.

3.05 MANHOLE AND CLEANOUT INSTALLATION

- A. General: Install manholes and catch basins, complete with accessories, as indicated.
- B. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches above finished grades elsewhere, unless otherwise indicated.
- C. Place precast manhole sections as indicated and install according to ASTM C891.
- D. Provide rubber joint gasket complying with ASTM C443 at joints of manhole sections.
- E. Install cleanouts and riser extension from sewer pipe to clean out at grade. Cleanouts shall be constructed per the details shown on the plans and per the Kitsap County Standards for Sanitary Sewer Construction.
- F. Set cleanout frames and covers located flush in paved areas and in areas outside of asphalt paving in a cast-in-place concrete block 24-inch by 24-inch by 8-inch deep (min.). Set with tops located 1 inch above surrounding finished grades.

3.06 CONNECTION TO EXISTING MANHOLES

- A. Pipe connections to existing manholes shall be made so that finish work will confirm as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting and shaping.
- B. The connection shall be centered on the manhole.
- C. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe.

- D. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.
- E. The Contractor shall excavate completely around the manhole to prevent unbalanced loading. The manhole shall be kept in operation at all times and the necessary precautions shall be taken to prevent debris or other material from entering the sewer, including a tight pipeline bypass through the existing channel if required.

3.07 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to Section 03 30 00.

3.08 IDENTIFICATION

- A. All plastic pipe and services shall be installed with continuous tracer tape installed 12 inches to 18 inches under the proposed finished subgrade. The marker shall be plastic, non-biodegradable, metal core or backing, marked "SEWER", which can be detected by a standard metal detector.

3.09 OIL-WATER SEPARATOR

- A. Oil-water separator shall be constructed per the manufacturer's recommendation and approved plans.
- B. Pipe and appurtenances shall be installed in the oil water separator as shown in the approved plans.

3.10 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
- B. Place a plug-in end of incomplete piping at end of day and whenever work stops.
- C. All sanitary sewer lines shall be flushed prior to being accepted.
- D. All sewer mains 8 inches and larger shall be pressure tested and mandrel tested prior to being accepted and placed in service. Mandrel and pressure testing shall be done in conformance with WSDOT Standard Specification Sections 7-17.3(2)F and 7-17.3(2)G. The Contractor shall bear all costs associated with the testing.
- E. The Contractor shall notify the Owner's Representative and the Owner a minimum of 48 hours in advance of all proposed testing.
- F. The Contractor shall replace all defective piping or structures discovered because of "non-passing" tests. Testing shall be repeated until results are satisfactory to the Owner.
- G. Contractor shall provide the Engineer with As-Built drawings of the sanitary sewer lines and structures within 7 days of the system being approved and accepted.

END OF SECTION

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SECTION 33 31 12
GENERAL REQUIREMENTS FOR PIPING SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section specifies general requirements for piping systems and shall be used in conjunction with the Piping System Table, Section 33 31 13, and other sections of Divisions 22, which specify piping components.

1.02 DELIVERY AND STORAGE

- A. Inspect materials thoroughly upon arrival. Examine materials for damage. Remove damaged or rejected materials from site.
- B. Observe manufacturer's directions for delivery and storage of materials and accessories.

1.03 HANDLING OF PIPE

- A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.
- B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

1.04 WARRANTIES

- A. Guarantee all materials and its installation as required in the General Conditions.
- B. The materials shall be warranted to be free from defects in workmanship, design, and materials. If any part should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner.
- C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining equipment warranties from each of the respective suppliers or manufacturers for all the equipment specified.

1.05 SUBMITTALS

- A. All submittals shall be in accordance with Sections 01 33 00 unless otherwise noted.
- B. The following submittals shall be provided:
 - 1. General piping layouts showing pipeline locations for all piping systems in that area with respect to structures, other piping and utilities (ductwork, conduits, etc.) and details and location of joints, anchors, supports, fittings, connections, penetrations,

- valves, piping appurtenances, flexible couplings, manholes, and cleanouts as applicable.
2. For all piping, submit pipe, fittings, linings, coatings, and valving to be used for each pipe size category.
 3. Render copies of any manufacturer's written directions regarding material handling, delivery, storage, and installation.
 4. As work progresses and again when work is complete, submit "As-built" or "As constructed" drawings of piping systems in project including project items and preexisting items. Identify complete location, elevation, and description of piping systems. Relate piping systems to identified structures and appurtenances.
 5. Submit written verification of required pressure testing.

PART 2 – PRODUCTS

2.01 PIPE, FITTINGS, AND ACCESSORIES

- A. See Section 33 31 13, "Pipe and Fittings," for product specifications.

PART 3 – EXECUTION

3.01 GENERAL

- A. Location:
 1. Piping shall be provided as specified and shown on the Drawings except for adjustments needed to adapt to existing conditions or intended service.
- B. Pipe Penetrations:
 1. Pipe penetrations shall be as specified and as shown on the Drawings.
- C. Bedding and Backfill:
 1. Unless otherwise specified, bedding and backfill for buried pressure piping shall be in accordance with the detail shown on the Drawings.
- D. Connections to Existing Piping:
 1. Materials of construction shall be cathodically compatible.

3.02 TESTING

- A. Pressures, test durations, and test criteria, shall be as specified in the Pipe Systems Table at the end of Section 33 31 13.

3.03 CLEANING AND FLUSHING

A. General:

1. Piping systems shall be cleaned following completion of testing and prior to connection to operating, control, regulating, or instrumentation equipment.
2. The Contractor may, at their option, clean and test sections of buried or exposed piping systems. Use of this procedure, however, will not waive the requirement for a full pressure test of the completed system.
3. Unless specified otherwise, piping 24 inches in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system. Piping larger than 24 inches in diameter may be cleaned manually or with a cleaning ball or swab.
4. Cleaning and flushing shall be in accordance with Section 33 31 13.

END OF SECTION

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SECTION 33 31 13
PIPE AND FITTINGS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section specifies piping, fittings, and connections. The actual pipe size and fittings shall be as shown on the Plans.

1.02 REFERENCES

- A. Silverdale Water District, Kitsap County Washington 2023 Conditions and Standard for Constructing Improvements to the Water and Recycled Water System.
- B. Kitsap County Department of Public Works, Division III – Side Sewers and Building Sewers.

1.03 QUALITY ASSURANCE

- A. Testing by Manufacturer:
 - 1. Manufacturer shall test all material as required by these Specifications and the standards referenced.

1.04 SUBMITTALS

- A. All submittals shall be in accordance with Section 01 33 00 unless otherwise noted.
- B. Fabrication and/or layout drawings:
 - 1. Exterior yard piping drawings (minimum scale 1 IN equals 10 FT) with information including:
 - a. Plan and profile drawings.
 - b. Dimensions of piping lengths.
 - c. Invert or centerline elevations of piping crossings.
 - d. Acknowledgment of bury depth requirements.
 - e. Acknowledgment of trench, bedding, and backfill requirements.
 - f. Details and dimensioned locations of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, taps, valves, flexible couplings, and related appurtenances.

- g. Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
 - h. Line slopes and vents.
 - C. Submit manufacturers' written installation instructions for buried wastewater pipe and fittings with shop drawings.
 - D. Contractor-prepared piping layout drawings showing the locations, lengths, and elevations for all piping systems in that area with respect to existing structures, other piping, and utilities. Drawings shall contain details and location of all joints, anchors, supports, fittings, connections, penetrations, valves, piping appurtenances, and other items as required.
 - E. For each piping system identified in the Pipe Schedule, submit manufacturer's catalog information for all sizes and types of pipe and fittings to be used for each piping system.
 - 1. Manufacturer's handling, delivery, storage, and installation instructions.
 - 2. Submit written verification of required pressure testing.
 - 3. Details of standard pipe, specials, and fittings.
 - 4. Shop drawings for pipe identification labels.
 - F. Calibration certification of pressure gauges used during pressure testing.
 - G. Pressure test results for all piping systems.

1.05 PIPING SYSTEMS

- A. General:
 - 1. If there are any conflicts in the specifications, use the stronger pipe class. Contractor shall submit calculations with shop drawings where specified.
 - 2. The Contractor shall verify all dimensions of valves, special castings and fittings, pipe, equipment, etc., so that all of the pipe Work performed will fit together properly and will conform to the arrangement as shown on the Contract Drawings.
 - 3. All buried piping shall have a minimum cover of 42 inches for water service per Silverdale Water District Conditions and Standards for Constructing Improvements to the Water and Recycled Water System, and a minimum sewer depth of 4 feet per Kitsap County Department of Public Works, Division III - Side Sewers and Building Sewers III-1.202, unless otherwise shown on the Drawings.

B. Piping Designation:

1. Piping is designated by a two-part code consisting of:
 - a. Pipe diameter in inches.
 - b. An abbreviation indicating the service. For example, the designation 18 PW shall mean an 18-inch-diameter potable water line. Refer to the Piping Systems Table for the services, operating pressures, temperatures, and testing information.

PART 2 – PRODUCTS

2.01 DUCTILE IRON PIPE (DIP) AND FITTINGS

A. Pipe:

1. Water Service: Water mains to be constructed within the Silverdale Water District service area boundary shall be ductile iron unless otherwise specified by the District. The following shall be as follows, per Silverdale Water District 2023 Conditions and Standard for Constructing Improvements to the Water and Recycled Water System, Section 2.5.
 - a. Ductile iron pipe shall be cement-lined standard thickness, unless otherwise specified and shall conform to the standards of ANSI/AWWA C151 / A-21.51 and ANSI/AWWA C104/A-21.4.
 - b. Gasket: Rubber gasket pipe joints to be push-on-joint (Tyton) or mechanical joint (M.J.) in accordance with ANSI/ AWWA C111/A-21.11 unless otherwise specified. All gaskets shall be Field-Lok gaskets or approved restraint systems.
 - c. Pipe Lining: Standard thickness cement lining shall be in accordance with ANSI/AWWA C104/A-21.4.
 - d. Contractor shall furnish certification from the manufacturer of the pipe and gasket being supplied that the inspection and all of the specified tests have been made and the results there of comply with the requirements of this standard.
 - e. Fittings: Ductile iron fittings shall be short body, cement lined, and for pressure rating of 150 psi, unless otherwise noted. Metal thickness and manufacturing process shall conform to applicable portions of ANSI/AWWA C110/A-21.10.
 - 1) Standard cement lining in accordance with ANSI/AWWA C104/A-21.4.
 - 2) Mechanical: AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C151/A21.51. Megalug Mechanical Joint Restraints or approved equal for all mechanical joints.
 - 3) Flange: AWWA C110A21.10 and C153/A21.53.
 - 4) Grooved End: AWWA C606 and C110/A21.10.

- f. Gaskets: All Gaskets shall have a pressure rating equal to or exceeding the system hydrostatic test pressure.
 - 1) Push-On, Mechanical, and Proprietary Restrained Joints: Rubber conforming to AWWA C111/A21.11.
 - 2) Grooved End Joints: Halogenated butyl conforming to ASTM D2000 and AWWA C606.
 - 3) Flanged: 1/8-inch thick, red rubber (SBR), hardness 75 (Shore A), rated to 200 degrees F, conforming to ASME B16.21, AWWA C100/A21.10, and AWWA C115.
- g. Joints:
 - 1) Flanged: AWWA C110/A21.10, ductile iron, faced and drilled; 125 pound flat face.
 - 2) Grooved: Supplied with rigid radius grooves in accordance with AWWA C606 and conforming to AWWA C110/A21.10, ductile iron.
 - 3) Mechanical Joints: Conforming to AWWA C110/A21.10, ductile iron.
- h. Saddles: Pipe saddles shall be malleable iron, ductile iron, bronze or stainless steel, tapped IPS, with stainless steel strap equal to Romac 101S or 202S. Double strap saddles shall be used for 1.5 inch and larger service lines.
- 2. Sewer Service: The following requirements for sewer service shall be as follows, per Kitsap County Department of Public Works Division III – Side Sewers & Building Sewers.
 - a. Ductile iron pipe shall meet the requirements of ANSI/AWWA C150/21.51 and manufactured per ANSI/AWWA C151. Ductile iron pipe shall be AWWA C 151 Class 50 and shall be cement mortar lined, push-on-joint or mechanical joint. Joints for ductile iron pipe shall be rubber gasketed conforming to the requirements of AWWA C111. Pipe shall have nominal laying lengths of 18 or 20 feet. Thickness design shall be in accordance with AWWA C150 and per the Piping Systems Table.
 - b. Fittings: Fittings for ductile iron gravity and pressure pipe shall be the requirements of AWWA C110 or AWWA C154. Fittings shall also be cement mortar lined, meeting the requirements of AWWA C104.
 - c. Cleanouts: Cleanouts shall be constructed of the same material as the side sewer and building sewer and shall conform to the County Standard Details. Cast iron frame and covers for cleanouts shall be two bolt locking type, Olympic Foundry type M1025 or equal. Locking lids will be required on all 8 inch or larger main line cleanouts.

- B. Bolts and Nuts: Corrosion-resistant bolts and nuts for use with ductile iron joints shall be high-strength, low-alloy steel as specified in ANSI/AWWA C111/A21.11.
- C. Pipe Coating:
 - 1. Buried:
 - a. Asphaltic Coating: Where specified, pipe and fittings shall be coated with asphaltic material as specified in AWWA C151.
- D. Couplings:
 - 1. All couplings (buried and exposed) shall be long or short pattern ductile iron pipe sleeves, as indicated on the Drawings.

2.02 COPPER PIPE AND FITTINGS

- A. Pipe shall be hard drawn copper tubing, ASTM B88, type as detailed in the Pipe Systems Table. Copper service pipe shall be Type K, soft annealed copper service pipe, conforming to ASTM B-88.
- B. Fittings shall be flare type compression fittings, conforming to ANSI/AWWA C800, minimum 150 psi.
- C. Copper pipe solder shall meet ASTM B32, Grade SN95, containing 95 percent tin and 5 percent antimony and shall conform to NSF 61.

2.03 PVC DWV PIPE AND FITTINGS

- A. Material: Schedule as indicated on the Pipe Systems Table: Type 1, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785 for PVC gravity side sewer and building sewer pipes per Kitsap County Department of Public Works Division III – Side Sewers and Building Sewers.
- B. PVC Pipe shall conform to the requirements of ASTM D3034, SDR 35 for pipe up to 15 inch diameter.
- C. Fittings: Side sewer and building sewer fittings for PVC pipes shall be made of PVC plastic having a cell classification of 12454-B, 12454-C, or 13343-C, as defined in ASTM D1784. Fittings shall have sufficient strength to withstand handling and load stresses normally encountered.
- D. Joints: Joints for gravity sewer pipe shall be push on types with restrained elastomeric ring gaskets conforming to ASTM D3212. Rubber gaskets shall conform to ASTM F 477.

2.04 HDPE PIPE AND FITTINGS

A. General:

1. Water Service: HDPE Pipe indicated for water service shall meet the requirements below as per Silverdale Water District 2023 Conditions and Standard for Constructing Improvements to the Water and Recycled Water System, Section 2.6.
2. Pipe and fittings shall have a pressure as indicated on the Pipe Systems Table at the end of this specification.
3. Unpigmented areas in the pipe are not visible. Pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids or defects.

B. Pipe:

1. High Density Polyethylene pipe shall conform to material requirements of ASTM D3350 and shall meet or exceed a cell classification of 445474 per ASTM 3350 rated as PE 4710 by the Plastics Pipe Institute TR4, with DE 11 as the Standard Dimension Ratio. PE 4710 compound shall meet or exceed the physical properties shown in the table below:

Property Value	Specification	Unit	Nominal Value
Material Designation	PPI/ASTM	NA	PE 4710 DR 11
Cell Classification	ASTM D3350	NA	445474 or Higher
Density (Natural Compound)	ASTM 1505 or ASTM D792	g/cm ³	0.947-0.955
High Load Melt Index	ASTM D1238	g/10 min	6-18
Flexural Modulus	ASTM D790	Psi	110,000-160,000
Tensile Strength	ASTM D638	Psi	3,500-4,000
Slow Crack Growth (PENT)	ASTM D1473	hrs.	>500
HDB @ 73 F	ASTM D2837 and PPI TR-3	psi	1,600
HDB @ 140 F	ASTM D2837 AND PPI TR- 3	psi	1,000
HDS @ 73 F	PPI TR-4	psi	1,000
UV Stabilizer	ASTM D1603 OR ASTM D4218	%C	2.0-2.5

2. The HDPE pipe shall be iron pipe size (IPS) with blue stripes for potable water.
3. Pipe shall be designed for water at 73 degrees F and lower using a design factor of 0.63. The manufacturer shall also provide temperature factors for pressure ratings at temperatures above 73 degrees F.

C. Fittings: Fitting material and pressure rating shall conform to the HDPE pipe material and pressure rating. Fittings shall conform to the applicable requirements of AWWA C906 for the joining methods specified in this section. Fittings shall contain 2.0 to 2.5 percent carbon black that is well dispersed throughout the fitting wall when tested in accordance to ASTM D1603 or ASTM D4218.

D. Joints:

1. HDPE pipe shall be joined by the butt-fusion process in accordance with pipe manufacturer's directions. Contractor shall provide butt-fusion technicians who are trained and certified by the pipe manufacturer to complete the project. The date of technician certification shall not exceed 12 months before commencing construction.
2. All HDPE pipe joined by butt-fusion shall be made from the same class and type of raw material made by the same raw material supplier.
3. Butt fusion fittings:
 - a. Fittings shall be manufactured in accordance with ASTM D3261 for molded fittings or AWWA C906 for fabricated fittings except PE 4710 compound as specified herein shall be used.
 - b. Butt fusion fittings including flange adapters and backup rings, molded and fabricated fittings (e.g., elbows and tees) shall have at least the same pressure class rating as the pipe. The butt fusion ends shall meet AWWA C906 specifications for OD and minimum wall thickness for the mating pipe.
 - c. The maximum wall thickness of the fitting butt fusion end shall not exceed 1.27 times the mating pipe minimum wall thickness. Fabricated fittings shall be manufactured using data logger that records temperature, fusion, pressure, and provides a graphic representation of the fusion cycle as part of the quality control.
 - d. The internal and external beads resulting from the butt-fusion process shall be visible and examined for penetration 360 degrees around the pipe diameter. The interior of all butt-fusion joints shall be de-beaded.

2.05 SHOP FABRICATION

A. Cast and Ductile Iron Pipe:

1. Fabricate: To field dimensions taken at site, not from Drawings.
2. Flanged Ends: Screwed type, ANSI/AWWA C115/A21.15.
3. Grooved Ends: ANSI/AWWA C606, cut-grooved to manufacturer's specifications for flexible joints unless rigid joints are necessary to meet field conditions.

2.06 QUICK DISCONNECTS (1-1/2 INCH TO 6 INCH)

A. Quick disconnects shall be Dixon Couplings (or approved equal), Camlock type, made of stainless steel with Buna-N seals.

2.07 RESTRAINED DISMANTLING JOINTS WITH TIE RODS

1. Manufacturers and Products:
 - a. Ductile Iron Pipe:
 - 1) Romac Industries, Inc.; DJ400.
 - 2) Or approved equal.

2.08 UTILITY WARNING TAPE AND TRACER WIRE

- A. Provide and install utility warning tape and tracer wire.

PART 3 – EXECUTION

3.01 INSTALLATION OF BURIED PIPE

- A. Excavating, Backfilling, and Compacting for Utilities shall be per the requirements of Kitsap County Road Standards, Section 7 – Utility Installation and Work in County Right of Way, Silverdale Water District, Silverdale Water District 2023 Conditions and Standard Details, Section 3.4 – Trench Excavation, and Kitsap County Department of Public Works, Division III – Side Sewers & Building Sewers, Section 2.040 Bedding and Backfill. Contractor shall also refer to the applicable County Standard Details as shown in the Contract Drawings.
- B. Lines and Grades:
 1. In position and to accurate lines, elevations, and grades as shown on Plans.
 2. Slope to drain where possible.
 3. Lay pipe to grade between control elevations shown on Plans when slope is not indicated.
- C. Securing In Place: By blocking, brackets, clamps, or other approved methods to secure pipe in place to withstand test pressure without movement.
- D. Restrained Joints: All pressure pipe systems shall be provided with restrained joints.

3.02 INSTALLATION AT CONCRETE WALLS AND FOOTINGS

- A. Install wall sleeves in advance of pouring concrete.
- B. Wall Sleeves: Provide steel wall sleeves with integral wall stop and modular mechanical seal for all pipe except concrete.
- C. Flexible Connections: At each exterior wall penetration and at excavation line.

3.03 INSTALLATION OF BELL AND SPIGOT, PUSH-ON AND MECHANICAL JOINT PIPE

A. Push-On Joint Installation:

1. Clean hub and insert gasket.
2. Apply gasket lubricant to spigot and inside of gasket.
3. Drive spigot into gasketed hub with pulling tool or suitable device.

B. Mechanical Joint Installation:

1. Place gland on spigot end.
2. Slip on rubber gasket.
3. Slip on gasket and joint surfaces on the pipe.
4. Thoroughly wet gasket end joint surfaces with soapy solution as recommended by manufacturer.
5. Insert spigot end to full depth with gasket pressed firmly into place in the bell in order to obtain an even “set” all around the joint.
6. Move gland into place, insert bolts, and tighten with fingers.
7. Tighten nuts with wrench, a half turn at a time, moving from one nut to another repeating until all nuts are uniformly tight.
8. Final tightness with torque wrench to manufacturer’s requirements.

3.04 FLANGED PIPE INSTALLATION

- A. Tighten flange bolts so that gasket is uniformly compressed and sealed.
- B. Do not distort flanges.
- C. Leave flange bolts with ends projecting 1/8- to 3/8-inch beyond the face of nut, but in no case less than three complete threads shall remain exposed after tightening.

3.05 THREADED JOINT INSTALLATION

- A. Threads: ANSI B2.1, NPT.
- B. Cut threads full and clean with sharp dies.
- C. Ream ends of pipe after threading and before assembly to remove burrs.
- D. Leave not more than three pipe threads exposed at each connection.
- E. Joint Sealer – Teflon thread tape.

3.06 WELDED JOINT INSTALLATION

- A. Shop fabricated to maximum extent possible.
- B. Use welders certified in accordance with the latest requirements of the American Welding Society "Standard Qualifications Procedures."
- C. Repair protective coating and linings to a condition equivalent to the factory applied coating or lining.
- D. Install coupling at ends of pipe to be welded to provide access for replacing protective lining.

3.07 COPPER PIPE INSTALLATION

- A. Bending Pipe:
 - 1. Bending of pipe not allowed. Use manufactured fittings.
- B. Unions: Use dielectric unions for all connections between copper and ferrous materials.
- C. All copper pipe under buildings, concrete slabs, structures, or buried shall be silver soldered. All other joints shall be soldered with lead-free 95-5 wire solder, ASTM B32, Grade TA.

3.08 PVC PIPE INSTALLATION

- A. All of the connectors, adapters, and fittings required for installation of the PVC piping systems may not be shown on the Drawings. Contractor shall furnish and install all adapters, connectors, and appurtenances required to install the PVC piping to the ends of fittings, valves, and appurtenances shown on the Drawings to provide a complete piping system at no additional cost to the Owner.
- B. Cutting:
 - 1. Cut pipe with a knife or handsaw.
 - 2. Make cuts square with pipe.
 - 3. Remove burrs by smoothing edges with a knife, file, or sandpaper.
 - 4. Bevel plain ends of pipe 1/16 inch to 1/32 inch prior to assembly.
- C. Bell and Spigot Joints:
 - 1. Follow the manufacturer's installation instructions.
- D. Solvent Joints:
 - 1. Clean joint surfaces and apply manufacturer-recommended primer.
 - 2. Coat with solvent cement and join. Immediately after solvent cement application, rotate pipe one-quarter turn (minimum) to ensure an even distribution of cement inside the joint.

3. Hold joint together until cement takes hold.
 4. Use sufficient cement so that a bead of cement is formed between pipe and fitting at socket entrance.
- E. Threaded Joints: Tighten by strap wrench to not more than one full turn beyond hand tight.

3.09 CLEANOUT INSTALLATION

- A. Cleanouts shall be installed per Kitsap County Department of Public Works Section III – 1.040 and County standard details. Cleanouts installed in areas to be paved shall be brought to grade level as per County Standard Details.
- B. The side sewer 6-inch cleanout shall be brought to within 6 inches of finished grade plugged with a threaded plug and enclosed in a cast iron valve box with cover. See County Standard Details.
- C. The building sewer cleanout shall be full building sewer diameter and shall be extended to a point not less than 6 inches or more than 12 inches below the finished ground surface and shall be plugged with a removable threaded watertight plug.

3.10 MARKER BALLS

- A. Install marker balls according to manufacturer's recommendations and as shown or directed and according to the following requirements:
 1. Install marker balls directly above the pipe alignment at a depth no less than 3 feet and no more than 4.5 feet below final surface grade.
 2. Install marker balls during trench backfill operations by placing the marker ball in compacted backfill. Cover marker ball with a minimum of 6 inches of backfill and compact backfill before continuing trench backfill operations.
 3. Install marker balls directly above connection points, termination points, and all fitting locations, and at a minimum spacing of 50 linear feet on sewer and force mains with a straight horizontal alignment.
 4. Install marker balls at a minimum spacing of 25 linear feet directly above sewer mains installed on a radius.
 5. Install marker balls on new or reconstructed sewer service laterals, directly above the centerline of the end of the lateral at the curb, property line, or other end of lateral location, as directed.
 6. Install marker balls directly above every alignment change along sewer and force mains and service laterals and all tees, wyes, and crosses.

3.11 PREPARATIONS PRIOR TO MAKING CONNECTIONS INTO EXISTING PIPING SYSTEMS

- A. Prior to making connections into existing piping systems, the Contractor shall:
 - 1. Field verify location, size, piping, material, and piping system of the existing pipe.
 - 2. Obtain all required piping manufacturer(s) approved fittings (saddles, sleeve type couplings, flanges, tees, etc., as shown).
 - 3. Have installed all temporary components, bracing, and/or pipes in accordance with established connection plans.
 - 4. Have on hand necessary pipe stoppers, pancake flanges, or other items which may be necessary should an existing valve fail to seal properly.
- B. Unless otherwise approved by the Owner's Representative, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.
- C. Connection to existing water service shall meet the requirements of Silverdale Water District 2023 Condition and Standard Details, Section 3.24.

3.12 TESTING

- A. General:
 - 1. The Contractor shall inform the Owner's Representative at least 3 days in advance of the time set for testing the piping system. The Owner's Representative will witness all testing.
 - 2. All pressure pipe and fittings shall be pressure-tested according to ANSI/AWWA C600 and as specified herein. After completion of installation, all piping work installed by Contractor and/or specified herein shall be tested.
 - 3. Gravity and side sewer testing: Unless otherwise specified, gravity lines shall be tested hydrostatically in accordance with the Kitsap County Division III – Side Sewers & Building Sewers Specification, Section III-4.000 Testing.
 - 4. Equipment, which may be damaged by the specified test conditions, shall be isolated.
 - 5. Contractor shall provide for testing the following at no added cost.
 - a. Labor to conduct testing.
 - b. All materials, fittings, valves, and equipment for testing. This shall include stainless steel tapping saddles and corporation stops at each end of sections to be tested. After successful testing, the stops shall be removed and saddles plugged in accordance with Owner's Representative instructions.
 - c. All monitoring equipment and pressure gauges calibrated in accordance with manufacturer's recommendations.

- d. Potable water to conduct testing.
 - e. Written reports of test results to Owner's Representative.
6. Each system shall generally be tested in sections. Each section shall successfully meet the requirements specified herein before acceptance by the Owner's Representative.
 7. Should any defects appear in the pipe or fittings, the necessary repair shall be made, and the line retested until it shall meet the requirements.
 8. The Contractor shall take all necessary precautions to prevent any joints from shifting or loosening while the pipelines and their appurtenances are being tested, and the Contractor shall at their own expense repair any damage to the pipes and their appurtenances or to any other structures resulting from or caused by these tests.
 9. The Contractor shall perform testing after backfilling to grade and compaction, but prior to paving.
 10. Equipment, which may be damaged by the specified test conditions, shall be isolated.
 11. Testing shall be performed using calibrated test gauges and calibrated volumetric measuring equipment to determine leakage rates. Each test gauge shall be selected so that the specified test pressure falls within the upper half of the gauge's range.
 12. Drains: Unless otherwise specified, drain systems, other than pumped drain systems, shall be tested in accordance with UPC.
- B. Sterilizations and Flushing of Water Mains/Pipelines:
1. Flushing shall be performed prior to pressure testing.
 2. Only the Owner's Representative may operate existing valves on the system.
 3. Upon completion of pipe laying and pressure testing, all dirt and foreign matter shall be removed by a thorough flushing. Each section of newly laid pipe between valves or dead ends shall be flushed independently, and other dead end appurtenances shall be flushed simultaneously with the parent line.
 4. The Contractor shall be responsible for rescheduling and organizing their work so as to use flushing water only during off-peak hours and in the most economical manner.
 5. Sterilization of the water mains shall be accomplished by the Contractor in accordance with the requirements of the state health department and in a manner satisfactory to the Silverdale Water District as per Silverdale Water District Conditions and Standard Details, Section 3.18 Sterilization and Flushing of Water Mains.
 6. No flushing shall be performed without the prior approval of the Owner's Representative.

C. Hydrostatic Test for Liquid Filled Pipelines:

1. All pipelines shall be hydrostatically tested.
 - a. All water service lines shall be hydrostatically tested and leakage tested per the requirements of Silverdale Water District Conditions and Standard Details, Section 3.17 Hydrostatic/Leakage Tests.
 - b. Air or pneumatic testing shall not be used. Water for testing must be obtained by the Contractor by arrangement with the Owner's Representative. A positive displacement type pump shall be furnished by the Contractor for testing. Feed for the pump shall be from a clean container, wherein the actual amount of "makeup" water can be measured.
2. The test shall be made by closing valves or providing bulkheads or plugs and filling the pipeline with water. Provisions shall be made for release of all air in the lines. Pipelines may be filled with water sometime before testing to allow for absorption of water by pipe or joint material. After all joints are apparently tight and there is no evidence of leakage. During the test, pipe, fittings, and joints shall be completely tight.
3. Upon completion of a section of the pipe installation, the pipeline shall be subjected to a pressure test. Valves shall be provided to withstand the pressure as outlined herein. Any leakage caused by defective workmanship or materials shall be repaired, and the line shall again be tested to full compliance at the Contractor's expense. Concrete thrust blocking for fittings shall be in place and the concrete "set" sufficiently to withstand the test pressure before starting the test.
4. Pressure tests of the DIP shall be made with a Contractor provided service saddle and corporation stop per Silverdale Water District Conditions and Standard Details Section 3.17. After use, corporation stop shall be completely closed and test piping disconnected. After piping removal from the corporation stop, a bronze cap or plug shall be installed on the outlet side of the corporation stop. The nut on the bottom of the existing corporation stop shall be completely tightened. If the existing corporation stop leaks when fully closed or after being tightened, the existing corporation stop shall be completely plugged as approved by the Owner's Representative. Each section of pipeline shall be individually tested between valves. During testing, the Contractor shall verify and ensure that the pressure differential across the valves does not exceed the rated working pressure of the valves.
5. Prior to calling for the Owner's Representative to witness the pressure test, the Contractor shall first perform a satisfactory pressure test.
6. The test pressure shall be as shown in Piping System Table as measured at the lowest elevation of the pipeline section under test. The test pressure must be maintained a minimum of 2 hours, or sufficiently longer, to permit the Owner's Representative to make an inspection of the system.

7. Acceptance:

- a. Determine actual leakage by measuring the quantity of water necessary to maintain the specified test pressure for the duration of the test, starting after the pipe has been filled with water and air expelled. The Maximum Allowable Leakage for the DIP will be calculated as follows:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

Where:

L = Allowable leakage, in gallons per hours

S = Length of pipe tested, in feet

D = Nominal diameter of pipe in inches

P = Average test pressure during leakage test in pounds per square inch (gauge)

8. Correct leakage greater than allowable, and retest.
9. Test results shall be reported using a form acceptable to the Owner's Representative.
10. Full payment for pipeline will not be made until passing test results are received.

D. Pipeline Contamination Prevention:

1. Pipe, fittings, and valves shall be carefully cleaned of all dirt and foreign material as the items are placed.
2. Open ends of pipe and fittings shall be plugged with a temporary watertight plug whenever work is stopped and/or when water in the trench threatens to enter the pipe.
3. Groundwater shall be excluded from the pipe at all times.
4. Particular care shall be exercised to guard against the entrance of drainage water into the pipeline trench during the course of construction. All subsurface drains should be located prior to excavation. Adequate provision shall be made for the flow of drains and other water courses during construction.
5. The interior of all pipe, fittings, and other accessories stockpiled on the Project shall be kept free of dirt and other foreign matter at all times.
6. Each pipe, fitting or other accessory shall be carefully inspected and thoroughly cleaned of any dirt or foreign matter, which might be present on the inside.
7. Cleaning shall be accomplished prior to lowering the pipe or other accessories into the trench.
8. Care shall be taken to keep materials internally clean after the pipe is placed in the trench.

9. Potable Water Service Connections shall be made in conformance with Silverdale Water District requirements.
 10. Potable Water Contamination: No plumbing fixture, device, equipment, or pipe connection shall be installed that will provide a cross connection or interconnection between a potable water supply and any source of nonpotable water.
- E. Gravity pipe shall be tested in accordance with the Kitsap County Department of Public Works Division III Side Sewers and Building Sewers Standard Specifications, as directed by the Owner's Representative.
1. All side sewer and building sewer installation inspections and test Observations shall be made at Kitsap County Department of Public Works. The County Inspector shall be notified a minimum of two (2) working days in advance of commencing work on a sanitary sewer extension. Prior to final acceptance of all side sewer and building sewer installations in new sewer mains, the County shall conduct an inspection of the sewer mains by the use of television equipment. Final acceptance of side sewer and building sewer installations will not be made until tests and inspections are complete and prove satisfactory.

Piping System Table

Piping System Symbol	Service	Installation	Diameter (in)	Pipe Material, Class/Sch/Type	Joint Type	Working Pressure (psig)	Medium	Pressure Test	
								Pressure (psig) ^A	Duration (minutes)
SD	Drain	BUR/EXP	ALL	PVC, Sch 40 DWV	SW	Gravity	H ₂ O	UPC	120
W	Water Main	BUR	ALL	DIP, CL 52	POJ/MJ	60-90	H ₂ O	200	15
FW	Fire Water Supply	BUR	ALL	DIP, CL 52	POJ/MJ	60-90	H ₂ O	200	15
NPW	Nonpotable Water	BUR	ALL	HDPE	SF	60–90	H ₂ O	150	120
		EXP	ALL	CU	COMP	60–90	H ₂ O	150	120
PW	Potable Water	BUR	ALL	HDPE	SF	60–90	H ₂ O	150	120
		EXP	ALL	CU	COMP	60–90	H ₂ O	150	120
SS	Sanitary Sewer	BUR	ALL	DIP, CL 53; PVC DWV	POJ	Gravity	H ₂ O	4	5

Abbreviations:

COMP	Compression
BUR	Buried
CU	Copper
DIP	Ductile Iron Pipe
DWV	Drain-Waste-Vent
EXP	Exposed (interior or exterior)
FL	Flanged
HDPE	High-Density Polyethylene
MJ	Mechanical Joint

PEX	Cross-Linked Polyethylene
POJ	Push-on Joint
PVC	Polyvinyl Chloride
SF	Socket Fusion
SST	Stainless Steel
SW	Socket Weld
UPC	Test per Uniform Plumbing Code

Table Notes:

in = inches; psig = pounds per square inch.

A Pressure gauges used shall have calibration certified to ISO 17025 and ANSI Z540 within 90 days of pressure testing.

Pipe schedule applies to process piping and plumbing. Pipe schedule is general. Specific details may require variations from table. Where the Drawings show piping that carries two or more service designations, the piping material shall conform to the requirement for the first service listed.

Unless noted, pipe schedule applies to all sizes for a particular service. All pipe sizes within pipe ranks may not be used. Reference Drawings for sizes used.

Operating temperature is ambient or normal water temperature unless otherwise shown.

END OF SECTION

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Work described in this section includes installing the stormwater drain services and appurtenances to serve stormwater detention and treatment at Silverdale Recycling and Garbage Facility. Stormwater utility work in this section includes, but is not limited to, the following:
1. Construction of corrugated polyethylene storm sewer and culvert pipes, cleanouts, underdrains, catch basins, control structures, and castings.
 2. Trench excavation, pipe bedding, controlled density fill (CDF), pond embankment, and bank run gravel backfill.
 3. Bioretention soil media, underdrain aggregate, coarse compost.
 4. Testing the built stormwater conveyance.
 5. Geotextile, erosion control mat, turf reinforcement mat, geomembrane, liners and composite drainage net.
 6. Pond inlet pipe protection, outfall protection, headwall, drain gravel, stormwater maintenance roads and ramps, spillway energy dissipation, and spillways.
 7. Trash racks for headwall and outfall protection.

1.02 REFERENCES

- A. Reference Standards – Current edition at date of bid:
1. Washington State Department of Transportation (WSDOT)/American Public Works Association (APWA).
 - a. Standard Specifications for Road, Bridge, and Municipal Construction.
 - b. Standard Plans for Road, Bridge, and Municipal Construction.
 2. Washington State Department of Ecology's Stormwater Management Manual for Western Washington.
 3. Kitsap County Road Standards.
 4. Kitsap County Municipal Code.
 5. US Composting Council's Test Methods for the Examination of Compost and Composting (TMECC).

1.03 SUBMITTALS

- A. Submit manufacturer's literature and data for all pipe, fittings, castings, catch basins, and other manufactured products.
- B. Submit gradations showing the percent passing, source, and sand equivalent for all aggregates.
- C. For compost used in the bioretention soil media, submit results from the following tests:
 - 1. Source certificate showing compost manufacturer and feedstocks used.
 - 2. TMECC 02.02-B "Sample Sieving for Aggregate Size Classification."
 - 3. TMECC 04.11-A for pH.
 - 4. TMECC 03.08-A "Physical Contaminants."
 - 5. TMECC 05.07-A "Loss on Ignition" for organic matter content.
 - 6. TMECC 04.10-A "Electrical Conductivity, 1:5 Slurry Method, Mass Basis" for soluble salt content.
 - 7. TMECC 05.05-A "Seedling Emergence and Relative Growth."
 - 8. TMECC 05.08-B "Carbon Dioxide Evolution Rate."
 - 9. TMECC 05.02-A "Carbon to Nitrogen Ratio."
- D. For turf reinforcement mat (TRM) submit:
 - 1. Product Data: Manufacturer's product data and installation instructions. Include required substrate preparation, list of materials and application rate.
 - 2. Certifications: A letter of certification that the product meets or exceeds all technical and packaging requirements and is made in the U.S.A.

PART 2 – PART 2 – PRODUCTS

2.01 MATERIALS

- A. Storm sewer pipe shall meet the requirements of Section 7-04 of the WSDOT Standard Specifications.
- B. Slotted bioretention underdrain pipe shall be PVC per ASTM D1785 Schedule 40. Slots shall be cut perpendicular to the long axis of the pipe and shall be 0.04 to 0.069 inches wide by 1 inch long, spaced 0.25 inches apart longitudinally. Slots shall be arranged in 4 rows spaced on 45-degree centers and cover 1/2 of the circumference of the pipe.

- C. Reinforced Concrete Culvert Pipe shall meet the requirements of Section 7-02 of the WSDOT Standard Specifications.
- D. Catch basins and control structures shall meet the requirements of Section 7-05 of the WSDOT Standard Specifications.
- E. Trash racks shall be fabricated with aluminum 6061 in accordance with WSDOT Standard Specification 9-28.14(3).
- F. All metal castings shall meet WSDOT Standard Specification 9-05.15 and 9-06 of the WSDOT Standard Specifications.
- G. Storm sewer cleanouts shall meet the requirements of Section 7-19 of the WSDOT Standard Specifications.
- H. Ductile Iron Gate Valve shall meet the requirements of Section 9-30.3(1) of the WSDOT Standard Specifications.
- I. Controlled Density Fill (CDF) shall meet the requirements of WSDOT Standard Specification 2-09.3(1) E.
- J. Pipe zone bedding shall meet the requirements of Section 9-03.12(3) of the WSDOT Standard Specifications.
- K. Bank run gravel for trench backfill shall meet the requirements of Section 9-03.15 of the WSDOT Standard Specifications outside of paved areas or 9-03.19 of the WSDOT Standard Specifications beneath pavement.
- L. Rip Rap and Quarry spalls shall be well-graded and shall meet the following requirements:
 - 1. Rip rap shall meet the requirements of WSDOT 9-13.1(3).
 - 2. Quarry spalls shall meet the following requirements:

Quarry Spalls Material Gradation Requirements WSDOT 9-13.1(5) – Quarry Spalls	
US Standard Sieve Size	Percent Passing by Weight
8 inch	100
3 inch	40 Max
3/4 inch	10 Max

M. Bioretention Soil Media (BSM) shall meet the requirements of BMP T7.30 in the Ecology Stormwater Manual for Western Washington:

1. Shall consist of 60-65% mineral aggregate, and 35-40% compost by volume.
 - a. Mineral aggregate shall have a minimum coefficient of uniformity of 4, a coefficient of curve from 1 to 3, and meet the following gradation:

Sieve Size	Percent Passing
3/8 inch	100
US No. 4	95-100
US No. 10	75-90
US No. 40	25-40
US No. 100	4-10
US No. 200	2-5

- b. Organic matter content of 5-8% by weight.
- c. Compost shall:
 - 1) Meet the definition of “composted material” in WAC 173-350-100 and complies with WAC 173-350-220.
 - 2) Be produced at a composting facility that is permitted by the jurisdictional health authority.
 - 3) Originate a minimum of 65% by volume from recycled plant waste, and a maximum of 35% by volume of post-consumer food waste.
 - 4) Not contain any biosolids.
 - 5) Meet the following gradation by dry weight based on TMECC 02.02-B:

Sieve Size	Percent Passing
2 inch	100
1 inch	99
5/8 inch	90
¼ inch	75

- a) Have pH between 6.0 and 8.5 when following the procedures of TMECC 04.11-A
- b) Minimum organic matter content of 40% per TMECC 05.07-A
- c) Soluble salt content less than 4.0 dS/m (mmhos/cm) per TMECC 04.10-A
- d) Maturity indicators from a cucumber bioassay greater than 80% for both emergence and vigor per TMECC 05.05-A

e) Stability of 7 mg CO₂-C/g OM/day or below per TMECC 05.08-B

f) Carbon to nitrogen ratio of less than 25:1 per TMECC 05.02-A.

N. Coarse compost shall not contain any biosolids or manures, shall be free of weed seeds, soil, roots, and other deleterious material, and meet the following gradation:

Sieve Size	Percent Passing
2 inch	100
1 inch	90-100
¾ inch	70-100
¼ inch	40-60

O. Bioretention underdrain aggregate shall be washed sand and gravel mineral aggregate, and meet the following requirements:

1. Meet the following gradation:

Sieve Size	Percent Passing
¾ inch	100
¼ inch	28-56
US No. 8	20-50
US No. 50	3-12
US No. 200	0-1

2. Washed sand and gravel shall consist of screened sand and gravel having hard, durable particles free from adherent coatings. The materials shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious substances.

P. Embankment Soil – Embankment soil shall have the following characteristics:

1. Between 20% and 60% silt and clay.
2. Maximum of 60% sand.
3. Negligible amounts of gravel and cobble.

Q. Screened Embankment Requirements for Pond Berm Construction:

1. Surficial topsoil, stumps, other deleterious material should be stripped and removed. Large cobbles and any boulders should selectively be removed.
2. The in-place and undisturbed native glacial till material has a high silt and clay content and will be extremely moisture sensitive when exposed to rainfall. The material should be excavated only during dry weather months of July through October, and work should stop during wet weather.
3. Segregated till that has been approved by the Owner's geotechnical inspector for reuse as berm fill should be placed promptly, and only during dry weather conditions.

The material may need to be sprinkled (moisture-conditioned) to bring its moisture content up toward optimum during placement.

4. Approved segregated till material that is not promptly replaced as berm fill should be stockpiled and covered with heavy plastic sheeting to prevent the material from taking on excessive moisture during any summer rain events.
 5. The approved till-fill material, while at or near its optimum moisture content, should be placed in 12-inch-thick maximum loose lifts and compacted with a large, heavy steel drum vibratory compactor. The entire thickness and extend of the fill berm shall be compacted to at least 95% relative compaction per the requirements stipulated in Section 2-03.3(14)C, Method C, of the Washington State Department of Transportation (WSDOT) Standard Specifications³ (WSDOT, 2024). The Owner's geotechnical inspector should perform in-place density testing to verify soil moisture content and compaction meet this requirement.
 6. In order to achieve the required compaction levels on the berm side slopes, it will be necessary to over-build the slopes and then trim them back to the final 2H:1V (outside) and 3H:1V (inside) configurations.
- R. Geotextile – Type 2 shall be used in ditch applications, and as a separation layer and as shown on the Drawings and in accordance with the following requirements:
1. Geotextile type 2 shall be 12 ounce nonwoven, pervious sheet comprised of fibers held together through needle-punching oriented into a stable network so that the fibers retain their relative position with respect to each other during handling, placement, and long-term service. The fabric shall be composed of continuous or staple fibers held together through needle-punching and shall not be heat burnished. No more than 5 percent by weight of clean recycled polymer shall be allowed.
 2. Geotextile shall provide subgrade separation and stabilization prior to placement of overlying materials indicated on the Drawings.
 3. If the Construction Manager approves that the geotextile be placed with the long dimension parallel to the centerline of the ditch, the lower strip of geotextile shall overlap the next higher strip a minimum overlap of 18 inches.
 4. Care shall be taken during placement of overlying materials to prevent damage to the geotextile. Any damage to the geotextile shall be repaired at the Contractor's sole expense.

5. Geotextile type 2 shall have the following properties:

Property	Unit	Value	Test Method ASTM
Mass/Unit Area, nominal	OZ/YD ²	12	D5261
Apparent Opening Size ^b	U.S. Sieve	100	D4751
Water Permittivity, min.	sec ⁻¹	0.02	D4491
Grab Tensile Strength, min	LBS	200	D4632
Grab Elongation	percent	50	D4632
Trapezoidal Tear Strength	LBS	115	D4533
CBR Puncture, min	LBS	850	D6241
Puncture Resistance	LBS	180	D6241
Burst Strength, min	psi	580	D3786
Water Flow Rate	g/min/sf	75	D4491
UV Resistance (500 hrs)	% strength retained	70	D4355

- S. Geotextile Type 3 for pond maintenance and access roads shall meet the following requirements:

1. Geotextile type 3 shall be a nonwoven, pervious sheet of polyester, polypropylene, polyethylene, or polyamide fibers oriented into a stable network so that the fibers retain their relative position with respect to each other during handling, placement, and long-term service. Geotextiles shall be composed of continuous or staple fibers held together through needle-punching and shall not be heat burnished.

2. Geotextile type 3 shall have the following properties:

Property	Unit	Value	Test Method ASTM
Mass/Unit Area, nominal	OZ/YD ²	16	D5261
Apparent Opening Size ^b	U.S. Sieve	100	D4751
Permittivity, min.	sec-1	0.70	D4491
Grab Tensile Strength, min	LBS	380	D4632
Grab Elongation	percent	50	D4632
Trapezoidal Tear Strength	LBS	145	D4533
CBR Puncture, min	LBS	1080	D6241
Puncture Strength, min	LBS	240	D4833
Burst Strength, min	psi	750	D3786
Water Flow Rate	g/min/sf	50	D4491
UV Resistance (500 hrs)	% strength retained	70	D4355

- T. Erosion control matting for ditch type 2 lining shall meet the following requirements:

1. Shall be woven from machine spun coir twines made of Bristol coir.
2. Have a minimum dry weight of 20 oz. /sq. yd (ASTM D 3776).
3. Have a maximum shear stress of 4.0 lbs. /sq. ft.
4. Maximum C factor of 0.003 using the R.U.S.L.E. equation.

5. Have a wet tensile strength of 1,200 lbs./ft. in the machine direction and 700 lbs./ft. in the cross direction.
6. Maximum Open area of 50%
7. Have a thickness of 0.35 inch (ASTM D1777)
8. Have a minimum roll width of 9 feet.
9. Three products acceptable for this application are as follows:

Product: BioD-Mat 70
 Rolanka Inc.
 155 Andrew Drive
 Stockbridge, GA 30281
 tel: 1-800-760-3215
 e-mail: www.rolanka.com

Product: DeKowe-700
 Belton Industries
 5600 Oakbrook Parkway, Suite 150
 Norcross, GA 30093
 tel: 1-800-851-4029
 e-mail: www.beltonindustries.com

Product: COIR – 700
 Northwest Linings and Geotextile Products Inc.
 21000 77th Ave. So.
 Kent, WA 98032
 tel: (253) 872-0244 1-800-729-6954
 e-mail: www.northwestlinings.com

- U. Linear low density polyethylene (LLDPE) textured geomembrane liner for pond lining shall meet the following requirements:

Property	Units	Value	Test Method ASTM
Color	-	Green	-
Sheet Thickness (nominal) – minimum average value	mil	40	D5994
Sheet Thickness (nominal) – lowest individual reading	mil	36	D5994
Top and Bottom Surfaces	-	Textured	-
Density	g/cc	0.94	D1505
Tensile Strength at Break	lb/in	60	D6693 Type IV
Elongation at Break	%	250	D6693 Type IV
Tear Resistance	lb	22	D1004
Puncture Resistance	lb	44	D4833
Carbon Black Content	%	2 - 3	D1603
Carbon Black Dispersion	-	90% Category 1 or 2	D5596
Asperity Height	mil	18	D7466
Oxidative Induction Time	Minutes	100	D 3895

V. Turf Reinforcement Mat (TRM) shall be manufactured for the purpose of permanent channel lining and turf reinforcement. The TRM shall be made from 100% synthetic material and contain no biodegradable components or materials.

1. The TRM shall be a homogeneous, three-dimensional matrix consisting of continuous monofilament yarns which are thermally fused at the crossover points to provide a structure that will maintain its dimensional stability without laminated or stitched layers. No nettings or stitching shall be permitted. The TRM shall have a minimum 95% open space available for soil, hydromulch and root interaction. The TRM shall not lose its structural integrity and shall not unravel or separate when TRM is cut in the field.
2. The TRM shall exhibit no buoyancy factor (i.e., the specific gravity of the fibers used should be greater than 1.0) so as to allow the TRM to maintain intimate contact with the soil (particularly between fasteners) under low flow or submersed conditions.
3. The TRM, when infilled with hydromulch, shall meet the following property values:

	Test Method	Units	Tested Value
Mechanical Properties			Typical MARV
Mass Per Unit Area	ASTM D 6566	oz/yd ² (g/m ²)	12.0 (407) 11.0 (373)
Thickness (Min)	ASTM D 6525	inches (mm)	0.75 (19) 0.6 (15.2)
Tensile Strength (MD)	ASTM D 6818	lb/ft (kN/m)	240 (3.5) 175 (2.6)
Resiliency (Min)	ASTM D6524	%	85 80
Light Penetration (Min)	ASTM D6567	%	1.0
Ground Cover (Max)	ASTM D6567	%	99
UV Stability (2000 hrs)	ASTM D4355	%	80
Endurance			
Functional Longevity ¹	Observed	Months	> 36
Performance			
C-Factor ² / % Effectiveness ²	Large Scale ³	n/a / %	< 0.01 / > 99
Manning's n Range	ASTM D6460 ⁴	n/a	0.025 – 0.045
Permissible Veg. Velocity	ASTM D6460 ⁴	ft/s (m/s)	20.0 (6.1)
Permissible Veg. Shear	ASTM D6460 ⁴	lb/ft ² (N/m ²)	17.0 (810)
Permissible Unveg. Velocity	ASTM D6460 ⁴	ft/s (m/s)	16.0 (4.9)
Permissible Unveg. Shear	ASTM D6460 ⁴	lb/ft ² (N/m ²)	5.8 (280)
Vegetation Establishment	ASTM D7322	%	800

	Test Method	Units	Tested Value
Physical	Units		Typical Value
Dimensions [width x length]	ft (m)		8.0 x 112.5 (2.4 x 34.3)
Roll Area	yd ² (m ²)		100 (83.6)
Estimated Roll Diameter	ft (m)		2.0 (0.6)
Estimated Roll Weight	lb (kg)		75 (34)
Color	n/a		Black

1. Functional longevity is an estimate of product functionality and is dependent upon moisture, light, microbial and other environmental conditions.

2. Cover Factor is calculated as soil loss ratio of treated surface versus an untreated control surface. % Effectiveness = One minus Cover Factor multiplied by 100%.

3. Large scale testing conducted at Utah Water Research facility using rainfall simulator on 2.5H:1V slope, sandy-loam soil, at a rate of 5" per hour for a duration of 60 minutes.

4. Flume testing performed at Colorado State University – data and details available upon request.

4. The hydromulch used with TRM shall meet the requirements of WSDOT Standard Specifications section 9-14.5(2)A for Long-Term Mulch.

W. Screened Embankment: Material processed from onsite soils or imported materials. Screened Embankment shall be free of Unsuitable Materials and shall exhibit the following characteristics:

1. Maximum particle size shall be 2 inches in any direction.
2. The material shall not contain more than 3% organic matter by weight.
3. The material shall be non-plastic if the soil fraction passing the U.S. No. 40 sieve cannot be rolled, at any moisture content, into a thread as prescribed in Section 4 of AASHTO Test Method T 90. If requested by the Contractor, the plasticity may be increased with the approval of the Construction Manager if the Construction Manager determines that an increased plasticity will be satisfactory for the specified embankment construction.
4. The Contractor shall determine moisture conditioning requirements and perform other testing as required to verify that the material selected for use as Screened Embankment is suitable for the intended use (i.e., can be properly moisture-conditioned and compacted per specification).
5. If onsite materials are used, the Contractor shall determine the appropriate means for screening of onsite materials to generate screened embankment meeting the above specifications.
6. Where topsoil or aggregate is installed over screened embankment, the underlying Screened Embankment placement shall be inspected and accepted by the Construction Manager before placement of topsoil or aggregate.

PART 3 – EXECUTION

3.01 PREPARATION

- A. All temporary erosion and sediment control measures shall be in place prior to land disturbance.
- B. Prepare areas in which geotextile is to be placed to the lines and grades shown on the Drawings. The surface shall be prepared in accordance with the following:
 - 1. For Road and Ditch applications: Section 31 23 00, "Earthwork."
- C. Prior to installation of geotextiles, erosion control mat, turf reinforcement mat, geomembrane, liners, and/or composite drainage mat: examine underlying surface for conformance with Contract Documents and for anything that may damage the proposed materials.

3.02 TRENCHING AND EXCAVATION

- A. Trenching and excavation for the stormwater conveyance components shall be done in accordance with sections 7-05.3 and 7-08.3 of the WSDOT Standard Specifications.

3.03 PIPE AND CATCH BASIN INSTALLATION

- A. Installation of the stormwater sewer pipe, including CPSSP and RCP, shall be done in accordance with sections 7-08.3 of the WSDOT Standard Specifications.
- B. Installation of the catch basins and control structures shall be done in accordance with sections 7-05.3 of the WSDOT Standard Specifications.
- C. Underdrain pipes shall be connected to CPSSP using Inserta Tee by ADS or approved equal. Connections shall be installed in accordance with manufacturers installation requirements.
- D. Dissimilar pipe connections, if proposed by the Contractor and approved by the Construction Manager, shall be made using Marmac dissimilar pipe couplers or approved equal.

3.04 EMBANKMENT SOIL

- A. Soil that meets the Embankment Soil specification shall be stockpiled during pond excavation for use in embankment construction and shall meet the following requirements:
 - 1. Excavated material that is unsuitable for embankment construction material must be approved by the Engineer prior to removal from the site. Should a shortage of embankment soil occur, and the Contractor has wasted or otherwise disposed of any suitable material without approval by the Engineer, the Contractor shall furnish Embankment Soil at no expense to the Owner. If suitable Embankment Soil is not encountered during excavation, as agreed upon by the Engineer, then imported soil will be paid using a contingent item of work.
 - 2. The Contractor shall prepare the subgrade and excavate the embankment key as shown on the plans for inspection by the Engineer prior to embankment construction. The Engineer shall be given 24 hours' notice prior to any inspection.

3. The Contractor shall place earth embankments in horizontal layers of uniform thickness not exceeding 6 inches. These layers shall run full width from the top to the bottom of the embankment. Slopes shall be compacted using Method C as described in Section 2-03.3(14)C of the WSDOT Standard Specifications.
4. During grading operations, the Contractor shall shape the surfaces of embankments and excavations to uniform cross-sections and eliminate all ruts and low places that could hold water. The Contractor shall raise the center of an embankment above the sides.
5. Embankment density tests shall be performed by the Engineer to confirm compliance as described in the Standard Specifications.

3.05 CLEANING AND TESTING

- A. Cleaning and testing of the stormwater conveyance components shall be done in accordance with sections 7-04.3(1) of the WSDOT Standard Specifications.

3.06 GEOTEXTILE

- A. Installation of geotextile type 3 and type 2 shall be done in accordance with Section 2-12 of the WSDOT Standard Specifications.
 1. Geotextile shall be placed at the locations shown on the Drawings.
 2. Geotextile shall be placed in accordance with the manufacturer's recommendations, standards, and guidelines and the requirements of this specification.
 3. At the time of installation, geotextile shall be rejected if it has defects, ribs, holes, flaws, presence of needles or needle fragments, deterioration, or damage incurred during manufacture, transportation, storage, or placement. Visual review of the geotextile shall be performed once the geotextile has been placed and prior to placement of any overlying materials.
 4. The geotextile shall be placed with the machine direction (long dimension) down slope, unless otherwise approved by the Construction Manager. The placed geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.
 5. Overlap adjacent panels a minimum of 3 in to create prayer fold within the overlap. Sew prayer fold with a 401 two-thread chain stitch.
 6. Cut geotextile using approved cutter only. Take care to protect other in place geosynthetic materials when cutting geotextile.
 7. Securing pins or other methods that may damage the geomembrane shall not be permitted. Sandbags or other methods approved by the Construction Manager shall be used to secure the geotextile during installation and remain until replaced with cover material.

8. The geotextile shall be protected at all times during construction from contamination by surface water runoff or any other means. Do not entrap in geotextile excessive dust, stones, or moisture that could damage or clog drains or filters or hamper subsequent seaming. Any geotextile so contaminated shall be removed and replaced with uncontaminated material at the Contractor's sole expense.
9. When placing soil or other cover materials over geotextile, the Contractor shall ensure that:
 - a. The geotextile is not damaged through puncture, tear, or any other mechanism.
 - b. There is no slippage of the geotextile on underlying layers.
 - c. No excessive tensile stresses are generated in the geotextile.
10. Do not operate machinery directly on the geotextile. If the geotextile is covered with less than a 2 foot thickness of soil or a 1 foot thickness of road material, no equipment with a ground pressure greater than 5 psi shall operate within 2 feet of the area underlain by the geotextile.
11. After deployment, all geotextile shall be covered within 4 weeks to prevent exposure to ultraviolet radiation (sunlight).

B. Seaming:

1. All geotextiles shall be continuously sewn (i.e., spot sewing is not allowed).
2. Areas to be seamed shall be clean and free of foreign material.
3. Sewing shall be done using polymeric thread with chemical resistance properties equal to or exceeding those of the geotextile.
4. All sewing shall be done using a sewing machine which creates a chain stitch. When entering and exiting a seam, the stitches shall be overlapped to prevent unraveling.

C. Protection of Geotextile

1. When placing soil or other cover materials over geotextile, the Contractor shall ensure that:
 - a. The geotextile is not damaged through puncture, tear, or any other mechanism.
 - b. There is no slippage of the geotextile on underlying layers.
 - c. No excessive tensile stresses are generated in the geotextile.
 - d. Any damage to the geotextile shall be repaired at the Contractor's sole expense.
 - e. Do not operate machinery directly on the geotextile. If the geotextile is covered with less than a 2 foot thickness of soil, no equipment with a ground pressure greater than 5 psi shall operate within 2 feet of the area underlain by the geotextile.

D. Repairs:

1. Replace torn or damaged areas and holes by placing an overlay of the same geotextile having dimensions at least 12 inches greater than the tear or hole in all directions.
2. When the maximum dimension of the tear or puncture exceeds 10% of the width of the geotextile roll, the entire sheet shall be removed and replaced with a new sheet.
3. Remove any soil or other material which may have penetrated the torn geotextile and repair any damage to other materials or layers.

E. Quality Control

1. Conformance Testing:

- a. Construction Manager will coordinate conformance sampling from point of manufacture or as delivered to the site.
- b. The Contractor shall allow 10 working days prior to deploying the material, for completion of Conformance Testing.
- c. Conformance sampling will be coordinated by the Construction Manager at the manufacturing facility at a minimum frequency of 1 sample per 100,000 square feet.
- d. Samples shall be taken across the entire width of the roll, excluding the first 3 feet of the roll, unless otherwise approved by the Construction Manager. Sample size shall be 3 feet long by the roll width.
- e. The Construction Manager, will perform, at a minimum, the following tests to determine the geotextile's compliance with this specification:
 - 1) Mass per unit area: ASTM D5261.
 - 2) Grab tensile strength: ASTM D4632.
 - 3) CBR Puncture strength: ASTM D6241 (not required for Type 4 geotextile).
 - 4) Trapezoidal tear strength: ASTM D4533.
- f. Test results that do not achieve the requirements of this specification shall be considered failed. The costs for additional testing required as a result of failed tests, and the cost of the initial failed test, shall be paid by the Contractor.

- g. Geotextile properties not subject to conformance testing, but required by Table 1 of this specification, shall be confirmed by the Construction Manager based on manufacturer certification submitted by the Contractor.
 - 1) If the Conformance Test results fail, the Contractor shall, at its sole expense, replace the rejected material with material that satisfies this specification.
 - 2) If the Contractor chooses to commence placement of the material prior to receipt of the Conformance Test results and the test results fail to achieve the requirements of this specification the Contractor shall, at its sole expense, remove the material from the site and replace it with material that meets this specification.
 - 3) Time associated with retesting and delivery of replacement materials shall not be cause for any time delays for the work.

F. Acceptance

- 1. The Contractor retains all ownership and responsibility for geotextile until acceptance by the Construction Manager.
- 2. The Construction Manager will accept the geotextile when:
 - a. Conformance test results verify that the product requirements of this specification have been achieved.
 - b. Verification of the adequacy of all seams, repairs, including associated testing, is complete.
 - c. Installation and documentation are complete.
 - d. The required written certification documents have been received by the Construction Manager.

3.07 EROSION CONTROL MATTING

- A. Installation of erosion control matting shall be done in accordance with Section 8-01.3(3) of the WSDOT Standard Specifications.

3.08 LLDPE TEXTURED GEOMEMBRANE LINER

A. Geomembrane Subgrade

- 1. Prepare areas in which geomembrane is to be placed to the lines and grades shown on the Drawings. The surface shall be prepared in accordance with Section 31 23 00 "Earthwork" and the following requirements:
 - a. The surface on which the geomembrane is to be installed shall be smooth and free of any angular gravel, rocks, sharp objects, grade stakes or hubs or any other protrusions or deleterious material larger than 3/8 IN.

- b. The Contractor shall be solely responsible for protection of the geomembrane subgrade surface, including the intrusion of surface water beneath the geomembrane. Any damage to the geomembrane subgrade, including damage caused by geomembrane installation, shall be repaired at the Contractor's sole expense. Repair of damaged subgrade shall be completed prior to deployment of geomembrane in that area.
- c. Edges of anchor trenches, other excavations, and grade changes shall be rounded to a minimum 6 IN radius, chamfered to an angle of no less than 135 degrees, or, with the approval of the Construction Manager, cushioned using a geotextile.
- d. Geomembrane shall not be placed in an area which has been softened as a result of precipitation.

B. Examination of Geomembrane Subgrade:

- 1. The Installer shall provide to the Contractor written acceptance of the geomembrane subgrade for each day of geomembrane installation.
- 2. The Construction Manager shall observe the geomembrane subgrade daily to the appropriate lines and grades and the thickness of material.
- 3. Once the geomembrane subgrade is accepted by Installer, it shall be the Installer's responsibility to indicate to the Contractor any change in the condition of the subgrade that may require repair work.

C. Preparation

- 1. Geomembrane material shall only be installed, including deployment and seaming, when the ambient air temperature is between 50°F and 70°F, unless otherwise approved in writing by the Construction Manager.
- 2. If the Installer wishes to use methods that may allow deployment and seaming at ambient temperatures below 50°F or above 70°F the Installer shall demonstrate and certify such methods produce seams that are entirely equivalent to those produced at ambient temperatures above 50°F and below 70°F and the overall quality of the geomembrane is not adversely affected. In addition, a change order to the contract between the County and the Contractor shall be required which specifically states the seaming procedure does not cause any physical or chemical modification to the geomembrane that shall generate any short or long term risk or damage to the geomembrane.
- 3. Geomembrane shall not be placed during precipitation, in presence of excessive moisture (e.g., fog, dew), in area of ponded water, or during excessive winds.
- 4. The Installer shall perform and test trial welds on samples of geomembrane to verify the performance of welding equipment, seaming methods, and conditions.
- 5. No seaming equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial welds.

6. Trial welds shall be performed at the following minimum frequency:
 - a. At least 2 per day per welder and machine, with one prior to the start of work and one at mid shift;
 - b. And as directed by the Construction Manager;
 - c. Every 2 HRS when using a fusion welder to weld across seams;
 - d. At least one per welder per shift; and
 - e. Whenever the ambient temperature changes more than 20°F since the previous trial weld.
7. Trial welds shall be performed in the same surroundings and environmental conditions as the production welds (e.g., in contact with the geomembrane subgrade and similar ambient conditions).
8. All trial welds shall be tested as follows.
 - a. Samples welds shall be made by welding two swaths of LLDPE, each at least 3-feet long and 9-inch wide, with the seam centered lengthwise.
 - b. Five, 1-inch wide test strips shall be cut from the trial weld.
 - c. Each of the 5 specimens shall be quantitatively tested in the field using a tensiometer. The specimens shall be tested first for peel and then for shear in accordance with ASTM D6392.
 - d. The remaining sample shall be retained by the Contractor for future testing. The remaining sample shall be marked with the seamer's initials, date, time and seaming machine identification.
 - e. A trial weld specimen shall pass when the results for both peel and shear tests exceed the requirements of this specification. For double-wedge fusion welding, both welds shall be individually tested and both welds shall be required to pass in peel.
 - f. If a trial weld fails, neither the seaming apparatus nor seamer shall be accepted and shall not be used for seaming until deficiencies are corrected and 2 passing full trial weld samples and tests are achieved consecutively.

D. Installation

1. Installation each day shall not begin until the Contractor has submitted to the Construction Manager the previous working day's quality control documentation.
2. Wherever possible, the Contractor shall complete deployment, trench backfill, and welding at the same temperature or within a narrow a temperature range as practical. The Contractor shall avoid completing these activities during extreme hot or cold conditions.

3. Deployment:

- a. The Contractor shall give careful consideration to the timing and temperature during deployment. The Contractor shall focus on verifying that:
 - 1) There is no bridging or excessive stress in the geomembrane; and
 - 2) There are no wrinkles in the geomembrane that will fold over when covered with soil material and no wrinkles that exceed 4 IN in height.
- b. Panel Identification: Assign an identifying code number to each panel that is consistent with the Contractor's panel layout Drawing. The coding shall be coordinated with the Construction Manager.
- c. Daily Panel Deployment: Deploy no more panels in one day than can be welded during that same day.
- d. Panels shall be oriented perpendicular to the line of the slope crest (i.e., down and not across slope).
- e. Do not damage geomembrane by handling, by equipment trafficking, leakage of hydrocarbons, or any other means.
- f. Unroll geomembrane panels using methods that will not damage, stretch or crimp the geomembrane.
- g. Use deployment methods that minimize wrinkles and differential wrinkles between adjacent panels.
- h. Place sandbags, or some other form of ballast accepted by the Construction Manager, on the geomembrane to prevent uplift from wind.
- i. Visually inspect the geomembrane for imperfections. Mark faulty or suspect areas for repair.
- j. Sufficient geomembrane shall be installed to account for shrinkage and contraction while avoiding wrinkles. Installed geomembrane shall be stress-free with no bridging before it is covered.
- k. Before wrinkles fold over, attempt to push them out. Wrinkles that cannot be pushed out shall be cut out and the cuts repaired prior to burial.
- l. Remove wrinkled or folded material.
- m. Personnel walking on the geomembrane shall not engage in activities or wear types of shoes that could damage the geomembrane.
- n. Smoking shall not be permitted while working on the geomembrane.
- o. The geomembrane surface shall not be used as a work area, for preparing patches, storing tools and supplies, or other uses.

- p. Protect the geomembrane in areas of heavy traffic by placing a protective cover that is compatible with and shall not damage the geomembrane.
 - q. Do not allow any vehicular traffic directly on geomembrane. If the geomembrane is covered with less than 2 foot thickness of soil, no equipment with a ground pressure of greater than 5 lbs/sq in shall operate within 2 feet (vertical) of the area underlain by the geomembrane.
4. Seam Layout:
- a. Seams shall be oriented perpendicular to the line of the slope crest (i.e., down and not across slope).
 - b. Minimize the number of field seams in corners, odd-shaped geometric locations and exterior corners.
 - c. Keep horizontal seams (seams running approximately parallel to slope contours) at least 6 FT away from the toe or crest of a slope, including a scraper road, unless approved by the Construction Manager.
 - d. Use a seam numbering system that is compatible with the panel numbering system. Coordinate the seam numbering system with the Construction Manager.
 - e. Panels shall be shingled on all slopes such that the upper panel is overlapped above the lower panel.
5. General Welding Procedures.
- a. Do not commence welding with welding apparatus until a trial weld test sample, made by that apparatus, passes the trial weld test.
 - b. During all welding operations, at least one Master Welder shall be present and shall provide supervision over other welders.
 - c. Clean the geomembrane surface of grease, moisture, dust, dirt, debris, or other foreign material.
 - d. Overlap panels a minimum 4 inches for extrusion welding and 4 inches for double fusion welding.
 - e. Solvents or adhesives shall not be used unless the product is approved, in writing, by the Construction Manager.
 - f. Place sandbags, or some other form of ballast approved by the Construction Manager, on the geomembrane to prevent uplift from wind.
 - g. If required, provide a firm substrate by using a flat board, a conveyor belt, or similar hard surface directly under the weld overlap to achieve firm support.
 - h. Provide adequate illumination, if welding operations are carried out at night.

- i. Fishmouths or wrinkles at seam overlaps shall be cut along the ridge of the wrinkle to achieve a flat overlap. The cut fishmouths or wrinkles shall be extrusion welded or patched where the overlap is more than 3 inches. When there is less than 3 inches overlap, an oval or round patch extending a minimum of 6 inches beyond the cut in each direction shall be used.
 - j. Log every 2 HRS:
 - 1) Ambient temperature directly on the geomembrane surface being welded.
 - 2) Extrudate temperatures in the barrel and at the nozzle (for an extrusion welder).
 - 3) Preheat temperature.
6. Extrusion Welding:
- a. Extrusion welding shall be used only for repairs (e.g., patches, caps) and areas not accessible to fusion welding equipment.
 - b. Adjacent panels shall be tack bonded together using procedures that do not damage the geomembrane, allow the required tests to be performed, and are not detrimental to final seaming. Tack welded panels shall not be left overnight.
 - c. Welding apparatus shall be free of heat-degraded extrudate before welding. Purge extruder prior to beginning seam until all heat-degraded extrudate has been removed from barrel.
 - d. The edge of the top sheet of geomembrane shall be beveled to a minimum of 45 degrees and to the full thickness of geomembrane before extrusion welding.
 - e. The geomembrane surface shall be abraded a maximum of 1/4 IN beyond the weld bead area, using a disc grinder, or equivalent, not more than 30 minutes before welding.
 - f. The ends of all seams, which are more than 5 minutes old, shall be grinded when restarting the weld.
 - g. Grinding depth shall not exceed 4 mils. For Green LLDPE, the depth of the grinding shall be just enough to begin to expose the underlying black material.
 - h. Grind across, not parallel to, welds.
 - i. Change grinding discs frequently. Do not use clogged discs.
 - j. Maintain one spare operable extrusion welding apparatus on-site at all times.

k. Extrusion welding will be employed for attaching the LLDPE to existing 60 mil HDPE at the following locations:

- 1) Existing 60 mil HDPE geomembrane bottom liner anchor trench;
- 2) The existing 60 mil HDPE CSW ditch flap; and,
- 3) To the existing Area 6 Stage 2 Closure, 60-mil HDPE geomembrane Final Cover.

l. Inspection:

- 1) Examine all welds and non-weld areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of the examination.
- 2) Repair and non-destructively test each suspect location both in weld and non-weld areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

E. Preparation and Seaming of LLDPE to HDPE

1. Surface Preparation: Carefully expose existing buried 60 mil HDPE liner by hand excavation, then brooming until the buried material is visible.
2. Remove flap where necessary per various cross sections provided in the Drawings and Contractor's Construction Sequencing Plan. Do not disturb any existing welds to bottom liner. Complete the work below the EGC and Final Cover in accordance with the Drawings and Specifications. Upon review by the Construction Manager, EGC material (40 mil LLDPE) and Final Cover (60 mil LLDPE), may be extended to the tie-in location.
3. All connections between proposed lining/cover systems and existing liners/covers shall be surveyed and incorporated into Record Documents.
4. Geomembrane shall continuously slope to drain away from the landfill. During warmer temperatures, the geomembrane may be positioned loosely to allow for ease for colder temperatures; however, ease wrinkles shall not cause the material to fold over and regardless of ease, the material must drain.
5. Sweep clean the surface of any geomembrane prior to welding, including the existing Anchor Trench, ditch flaps, and adjacent existing lining/cover geomembrane; follow with a broom wash-down of mild soapy water, rinse and allow to dry.
6. Seaming Requirements – Use standard extrusion weld procedures, LLDPE extrudate and testing to weld the LLDPE material to the HDPE material. Surface preparation shall include standard grinding procedures to remove oxidation.
7. Wherever possible, use a double wedge weld for seaming and test accordingly.

8. Contractor shall extend LLDPE as required to complete a permanent, watertight, and tested seal between the EGC and existing geomembrane.
9. Seam Performance Requirements - Peel and shear tests shall meet or exceed the requirements for LLDPE.

F. Pipe Penetration Boots

1. Pipe penetration boots shall be made of the same material that is being penetrated by the pipe; in most cases, LLDPE geomembrane. The boot shall form a watertight seal around the protruding pipe and shall incorporate sufficient slack to remain loose fitting at the base during cold weather conditions to prevent tension and separation of the welds. Installer shall complete each boot in such a manner that it will perform as required throughout the warranty period.
2. Pipes and other structures penetrating the cover system shall be sealed to the geomembrane with fabricated boots made of the same material and workmanship as the cover system geomembrane. The flange portion of each boot shall be loose-fitting, flexible and shall match the angle of the slope or bottom, be sealed to the geomembrane, and fit smoothly without folds or stretching of the material.
3. Diameter/width of the geomembrane boot flange shall equal or exceed three pipe diameters. Extreme care shall be taken while seaming around appurtenances because neither non-destructive nor destructive seam testing may be feasible. Do not damage the geomembrane while making connections to appurtenances.
4. Construct penetrations through the geomembrane as shown on the Drawings.
 - a. No wrinkles shall exist in the geomembrane at the location of clamps, penetrations, or other locations.
 - b. Tighten steel clamping bands until neoprene rubber pads are compressed 12 to 15% of total pad thickness.
5. Cut to a continuous 2 inch wide piece of neoprene to form the gasket. Neoprene rubber contact cement recommended by the supplier shall be used to bond butt ends of joined strips and to bond neoprene rubber in position on surface. Butt joints in neoprene strips shall be offset from adjacent joints by at least 6 IN.
6. Boot Seals: Place tightly fitting field-fabricated boots without folds around the penetrations.
 - a. Using like materials seal the boot to the geomembrane in accordance with procedures for a field seam using extrusion welding methods.
 - b. Seal the boot to the penetration using adhesives, Bentonite chips, rubber pads, and stainless steel clamping bands and heat shrink wrap as shown on the Drawings.

G. Sealing Around Precast Concrete Structures.

1. Geomembrane liner around precast structures shall be sealed as follows:
 - a. Geomembrane shall be lapped over the rim of structure.
 - b. 1/8 inch x 2 inch butyl sealant tape shall be placed between the rim of the concrete structure and the geomembrane.
 - c. 1/8 inch x 2 inch neoprene gasket shall be placed over the geomembrane.
 - d. 1/4 inch x 2 inch 316 stainless steel anchor bar shall be placed over the neoprene gasket
 - e. Stainless steal anchor bar shall be fastened to the rim of the concrete structure using 3/8 inch x 4 inch stainless steel anchor bolts spaced every 2 linear feet of anchor bar length or closer. Anchor bolts may be wedge anchor or epoxy set and shall have match stainless steel washer and nut.
 - f. Where geomembrane extends beyond the anchor bar, seal the interface with a bead of Sikaflex sealant or approved equal.

H. Quality Control:

1. General:
 - a. The Contractor and all subcontractors, including the manufacturer and the Installer, shall participate in and conform with all terms and requirements of the quality control specified here-in.
2. Non-Destructive Testing:
3. Non-destructive testing, as specified herein, shall be completed by the Contractor as part of their CQC. The Contractor may undertake non-destructive testing in addition to that specified.
 - a. The Contractor shall pressure test all fusion welded seams. Fusion welded seams that, in the opinion of the Construction Manager, cannot be pressure tested shall be vacuum tested.
 - b. The Contractor shall vacuum test all extrusion welded seams and those fusion welded seams that, in the opinion of the Construction Manager, cannot be pressure tested.
 - c. Both pressure testing and vacuum testing shall be completed as specified over the full length of the seam.
 - d. All testing shall be performed as the seaming progresses and not at the completion of all the field seaming. Complete all required repairs in accordance with this specification.

- e. Pressure testing shall be completed using the equipment specified in Paragraph 2.05 and according to the following procedure.
 - 1) Seal both ends of the seam to be tested.
 - 2) Insert needle or other approved pressure-feed device into the channel created by the double-wedge weld.
 - 3) Energize the air pump to a minimum pressure of 27 lbs/sq in.
 - 4) Close the valve and maintain test pressure for a minimum of 5 minutes.
 - 5) If pressure loss exceeds 3 pounds per square inch in 3 minutes, or does not stabilize in Step d, locate faulty area and repair in accordance with this specification. Repeat the pressure testing procedure on both sides of the repair.
 - 6) Puncture opposite end of the seam to release air. If the pressure was sustained as above and the pressure releases from the open end, the seam can be accepted.
 - 7) If the pressure does not release, there is a blockage present. Locate the blockage, and repeat the testing procedure on both sides of blockage.
 - 8) Remove needle or other approved pressure-feed device and seal penetration holes by extrusion welding.
- f. Vacuum Testing shall be completed using the equipment specified in Paragraph 2.05 for all seams and according to the following procedure.
 - 1) Apply soapy solution to the seam to be tested.
 - 2) Place the box over the wetted seam area ensuring a leak-tight seal is created.
 - 3) Energize the vacuum pump and reduce the vacuum box pressure to approximately 5 lbs/sq in - gauge pressure.
 - 4) Examine the geomembrane through the viewing window for the presence of animated soap bubbles for not less than 15 seconds.
 - 5) All areas where animated soap bubbles appear shall be marked and repaired in accordance with this specification.
 - 6) If no animated bubble(s) appear after 15 seconds, close vacuum valve and open bleed valve, move box over next adjoining area with minimum 3 IN overlap, and repeat the testing process.

4. Seams that the Construction Manager agrees cannot be non-destructively tested shall be treated by the Contractor as follows:
 - a. If the weld is accessible to testing equipment prior to final installation, non-destructively test the weld prior to final installation.
 - b. If the weld cannot be tested prior to final installation, a cap strip shall be provided over the weld. The welding and cap-stripping operations shall be observed by both the Construction Manager and the Contractor's CQC representative to ensure uniformity and for completeness.
5. Destructive Testing:
 - a. Destructive testing, as specified herein, shall be completed by a designated independent laboratory as part of CQA.
 - b. Samples for destructive testing shall be collected by the Contractor, at locations specified by the Construction Manager, at a minimum frequency of one per 500 FT of seam length.
 - c. The Construction Manager will specify test locations based on the minimum frequency or suspicion of excess crystallinity, contamination, offset welds, or suspected defect. The Construction Manager may increase the test frequency based on marginal results in accordance with GRI GM 17.
 - d. Sampling Procedures:
 - 1) The Contractor shall cut samples at locations designated by the Construction Manager as the welding progresses.
 - 2) The sample shall be a minimum of 12 inch wide by 44 inch long with the seam centered lengthwise.
 - 3) The Construction Manager will provide a unique number for each sample. The Contractor shall mark the sample number and location, including dimensions, on their Panel Layout Drawing.
 - e. The Contractor shall immediately repair all holes in the geomembrane resulting from destructive test sampling. Repair in accordance with repair procedures described in this specification. Test the continuity of the repair in accordance with the non-destructive testing requirements of this specification.
 - f. The Contractor shall divide the sample into 4 parts as follows:
 - 1) Cut a 1 inch wide strip from each end of the sample.
 - 2) Cut one 12 x 12 inch portion to be retained by the Contractor.

- 3) Cut one 12 inch x 18 inch portion to be submitted for laboratory testing.
 - 4) Cut one 12 x 12 inch portion, to be retained by the Construction Manager on behalf of the County, for archive storage.
- g. The Contractor shall field test the two, 1 inch wide strips specified above as follows:
- 1) Both samples shall be tested using a tensiometer for peel and shear.
 - 2) Both test strips shall meet the peel and shear requirements for welded seams as per this specification.
 - 3) If any field test sample fails, follow failed test procedures as per this specification.
- h. The designated independent laboratory will perform, at a minimum, the following tests to determine the geomembrane weld compliance with the specification:
- 1) Seam strength: ASTM 6392.
 - 2) Peel Adhesion: ASTM 6392.
 - 3) At least 5 specimens shall be tested for each test method. All specimens shall meet minimum requirements.
 - 4) None of the peel specimens may peel 100%, or the entire sample shall be considered as failing.
 - 5) All tests shall exhibit a Film Tearing Bond type of separation in which the geomembrane material tears before the weld.
 - 6) If any test samples fail to achieve the minimum requirements of this specification, follow the failed test procedures as per this specification.
- i. The Contractor shall allow 2 working days from delivery of the destructive test sample to the designated independent laboratory before the placement of any material over the geomembrane.
- j. If the Contractor chooses to place material over the geomembrane prior to 2 working days from delivery of the sample to the designated independent laboratory, and any of the above tests fail to achieve the requirements of this specification, the Contractor shall, at their sole expense, remove the overlying material and follow the failed test procedures as per this specification.
6. Failed Weld Procedures:
- a. The Contractor shall follow these procedures when there is a destructive test failure. The procedures shall apply to test failures determined by both the Construction Manager, based on laboratory test results, and the Contractor, based on field tensiometer results.

- b. Whenever a sample fails, the Contractor shall provide additional testing for seams that were welded by the same welder and welding apparatus or welded during the same time shift.
 - c. With respect to the seam from which the failed sample was taken, the Contractor shall follow one of the following 2 options.
 - 1) Option 1:
 - a) Reconstruct the seam between any 2 passing test locations. The weld flap shall not be extrusion welded.
 - b) Reconstruction methods shall include cap stripping of seam, or replacing seam with a new 1 foot wide panel and welding in place.
 - 2) Option 2:
 - a) Trace the weld at least 10 feet minimum in both directions from the location of the failed test, or to the end of the weld.
 - b) Obtain a small sample at both locations for an additional field test.
 - c) If these additional test samples pass field tests, then take laboratory samples.
 - d) If the laboratory samples pass, then reconstruct the weld or cap between the 2 test sample locations that bracket the failed test location.
 - e) If any sample fails, then repeat the process to establish the zone in which the weld must be reconstructed.
7. The Construction Manager will accept welded seams only as follows.
- a. Seams that have passed non-destructive testing and that are bracketed by 2 locations from which samples have passed destructive tests.
 - b. For reconstructed seams exceeding 50 feet, a sample taken from within the reconstructed weld shall pass destructive testing.
- I. Repair Procedures
- 1. The Contractor shall remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be repaired to the satisfaction of the Construction Manager.
 - 2. Repair, removal, and replacement shall be at the Contractor's sole expense if the damage results from Contractor, or any of the Contractor's subcontractor activities.
 - 3. The Contractor shall repair any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test.

4. Agreement upon the appropriate repair method shall be reached between the Construction Manager and the Contractor. Repair procedures available to the Contractor and Construction Manager include, but are not limited to, the following.
 - a. Patching: Patching is used to repair large holes (over 3/8 inch DIA), tears, pinholes or other minor localized flaws.
 - b. Abrading and re-welding: Used to repair small sections of seams.
 - c. Spot welding or seaming: Used to repair small tears (less than 2 inch long), pin holes or other minor, localized flaws.
 - d. Capping: Used to repair large lengths of failed seams.
 - e. Removing the seam and replacing with a strip of new material.
5. Repairs shall satisfy the following requirements as indicated.
 - a. For repairs incorporating extrusion welding, abrade the geomembrane surfaces to be repaired no more than one hour prior to the repair.
 - b. For all repairs, clean and dry all surfaces at the time of repair.
 - c. All repair procedures, materials, and techniques shall be accepted in advance of the specific repair by the Construction Manager.
 - d. Repairs incorporating patches or caps shall extend at least 6 inches beyond the edge of the defect. Round all corners of material to be patched and the patches to a radius of at least 4 inches.
 - e. Unless otherwise instructed by Construction Manager, cut the geomembrane below large caps to avoid water or gas collection between the sheets.
6. Verification of Repair:
 - a. The Contractor shall number and log each patch repair. Repair numbering shall be coordinated with the Construction Manager.
 - b. The Contractor shall non-destructively test each repair using methods specified in the specification.
 - c. The Contractor shall complete destructive tests at the discretion of the Construction Manager.
 - d. Repairs shall be reconstructed until non-destructive and destructive (where required) test results achieve the requirements of this specification.

J. Geomembrane Acceptance:

1. The Contractor retains all ownership and responsibility for the geomembrane until acceptance by the Construction Manager.
2. The Construction Manager will accept geomembrane installation when:
 - a. All required documentation from the manufacturer and installer has been received and accepted.
 - b. The installation is complete.
 - c. Conformance test results have been received that verify the product requirements of the specification have been achieved.
 - d. Test reports verifying completion of all field seams and repairs, including associated non-destructive and destructive testing have been received in accordance with this specification.
 - e. The Contractor has submitted to the Construction Manager, all written Certification Documents, Warranty, and Drawings required by this specification.

3.09 TURF REINFORCEMENT MATTING

- A. Turf reinforcement matting shall be installed in the following sequence:
1. Application of seed and up to 10% of hydromulch.
 2. Installation of TRM.
 3. Application of hydromulch.
- B. TRM preparation, installation, cleaning and protection, and inspection and maintenance shall conform to the TRM manufactures requirements.

END OF SECTION

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Division 34

Transportation

SECTION 34 71 13
VEHICLE BARRIERS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes installation of beam guardrail and anchors.

1.02 REFERENCES

- A. Comply with the requirements of Section 01 42 19, "Reference Standards," and as listed herein. The following is a list of standards referenced in this section:
1. American Association of State Highway and Transportation Officials (AASHTO), Associated General Contractors of America (AGC), and American Road and Transportation Builders Association (ARTBA) – A Guide to Standardized Highway Barrier Hardware.
 2. AASHTO M 164, Standard Specification for High-Strength Bolts for Structural Steel Joints.
 3. AASHTO M 180, Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrail-Nineteenth Edition; Revised Per Interim Specifications - Specifications – 1999.
 4. ASTM International (ASTM): www.astm.org.
 - a. ASTM A36, Standard Specification for Carbon Structural Steel.
 - b. ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - c. ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - d. ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
 - e. ASTM A563, Standard Specification for Carbons and Alloy Steel Nuts.
 - f. ASTM A992, Standard Specification for Structural Steel Shapes.
 - g. ASTM F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
 5. Transportation Research Board, National Cooperative Highway Research Program (NCHRP), NCHRP Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 00, "Submittal Procedures."
- B. Approval Submittals:
 - 1. Product data in the form of manufacturer's technical data, specifications, and installation instructions for each product used in the construction of the guardrail system, including rail elements, timber posts and blocks, end sections, hardware, anchors, performance coating, and accessories.
 - 2. Shop drawings showing location of guardrail and each post and end section; and details of rail punching, fittings and assemblies, guardrail, post, and end section installations.

1.04 QUALITY ASSURANCE

- A. All material used in the construction of guardrail shall be new and free from defects or non-conformities.
- B. Single-Source Responsibility: Obtain guardrail as complete units, including necessary erection accessories, fittings, and fasteners from a single source or manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00, "Product Requirements."

PART 2 – PRODUCTS

2.01 BEAM GUARDRAIL

- A. Rail Element:
 - 1. The W-beam rail elements, backup plates, reducer sections, and end sections shall conform to "A Guide to Standardized Highway Barrier Hardware" published by AASHTO, AGC, and ARTBA. All rail elements shall be formed from 12 gauge steel.
 - 2. The rail splices shall have a minimum total ultimate strength of 80,000 pounds at each joint.
 - 3. All fabrication shall be complete before galvanizing.
 - 4. The holes in the plate shall be slotted to facilitate erection and to permit expansion and contraction.
 - 5. The edges of the rail shall be rolled or rounded so they will present no sharp edges.
 - 6. Where the rail is on a curve, the plates at the splice shall make contact throughout the area of splice. When the radius of curvature is less than 150 feet, the rail shall be shaped in the shop.

B. Posts and Blocks:

1. Posts and blocks shall be treated wood except where steel posts are called for on the Drawings which shall be galvanized and coated.
2. Posts and blocks shall be of Forest Stewardship Council (FSC) certified wood.
3. Blocks made from alternate materials that meet the NCHRP Report 350 criteria may be used in accordance with the manufacturer's recommendations.
4. Posts and blocks shall be of the size and length shown in the Drawings and meet the requirements of these Specifications.
5. Posts and blocks may be S4S or rough sawn.
6. Timber posts and blocks shall conform to the grade specified below, except pine lumber No. 1 grade may be used for the blocks:
 - a. Douglas Fir: No. 1 and better, grade (Section 131-b WCLIB) or (Section 80.11 WWPB).
 - b. Hem Fir: Select Structural grade (Section 131-a WCLIB) or (Section 80.10 WWPB).
7. Timber posts and blocks shall be fabricated before being treated.
8. Timber posts and blocks shall be treated by the empty cell process to provide a minimum retention, depending on the treatment used, according to the following:

Table 1	
Timber Post Treatment	
Creosote Oil	12.0 pounds per cubic foot
Pentachlorophenol	0.60 pounds per cubic foot
ACA	0.50 pounds per cubic foot
ACZA	0.50 pounds per cubic foot
CCA	0.50 pounds per cubic foot

9. Steel posts, blocks, and base plates, where used, shall conform to either ASTM A36 or ASTM A992, and shall be galvanized in accordance with AASHTO M 111. Welding shall conform to Section 6-03.3(25). All fabrication shall be completed prior to galvanizing.

C. Galvanizing:

1. Beam rail elements and terminal sections shall be galvanized in accordance with AASHTO M-180, Class A, Type 2, except that the rail shall be galvanized after fabrication, with fabrication to include forming, cutting, shearing, punching, drilling, bending, welding, and riveting.

2. The minimum average mass of zinc coating shall be 2 ounces per square foot of surface.
 - a. The average to be determined on the basis of three individual tests, no one of which may be less than 1.8 ounces per square foot of surface.
 - b. The aluminum content of the zinc bath during actual galvanizing operations shall not exceed 0.01 percent.
3. WF steel posts, and base plates shall be galvanized in accordance with ASTM A123.
4. Bolts, nuts, washers, plates, rods, and other hardware shall be galvanized in accordance with ASTM A153.

D. Hardware:

1. Bolts, unless otherwise specified, shall comply with ASTM A307 Grade A Specifications.
2. High strength bolts shall conform to the requirements of AASHTO M164.
3. Nuts, unless otherwise specified, shall comply with ASTM A563 Grade A Specifications.
4. Washers, unless otherwise specified, shall meet ASTM F844 Specifications.
5. Submit a manufacturer's certificate of compliance for high strength bolts, nuts, and washers prior to installing any of the hardware. A307 Bolts will be accepted by field verification and documentation that bolt heads are stamped 307A.

E. Coating:

1. All galvanized guardrail components shall be coated using a high-performance coating system specified in Section 09 96 00.
 - a. Galvanized steel elements shall be coated using coating system PC-2.
 - b. To the maximum extent practical, the coating systems shall be shop applied and field touched up rather than field applied.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Erection of Posts:

1. Set posts true to line and grade of the adjacent roadway and spaced as shown on the Drawings.
2. When the Drawings require that the ends of a section of guardrail be curved outward or downward, the posts shall be set to accommodate the curve.

3. End treatment shall be as shown in the Drawings.
4. The length of post installed shall be as shown in the Drawings.
5. Posts may be placed in dug or drilled holes. Ramming or driving will not be permitted.

B. Erection of Rail and Terminals:

1. All metal work shall be fabricated in the shop.
2. No punching, cutting, or welding shall be done in the field, except that holes necessary when additional posts are required or for special details in exceptional cases may be drilled in the field when approved by the Project Representative.
3. Rails shall be erected so that the bolts at expansion joints will be located at the centers of the slotted holes.
4. Rail plates shall be assembled with the splice joints lapping in the direction of the traffic.
5. When nested W-beam is specified, two sections of guardrail, one set inside of the other shall be installed. The inside and outside rail elements shall not be staggered.
6. Galvanized steel rail plates shall be fastened to the posts with galvanized bolts, washers, and nuts of the size and kind shown in the Drawings.
7. All bolts, except where otherwise required at expansion joints, shall be drawn tight.
8. Bolts through expansion joints shall be drawn up as tight as possible without being tight enough to prevent the rail elements from sliding past one another longitudinally.
9. Bolts shall be sufficiently long to extend at least 1/4 inch beyond the nuts.
10. Except where required for adjustments, bolts shall not extend more than 1/2 inch beyond the nuts.

3.02 COATING

- A. Rail and all exposed galvanized steel surfaces shall be coated in accordance with Section 09 96 00, "High-Performance Coating."

END OF SECTION

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Division 40

Process Interconnections

SECTION 40 67 00
CONTROL SYSTEM EQUIPMENT PANELS AND RACKS

PART 1 – GENERAL

1.01 SUMMARY

- A. Provide network server rack enclosure and hardware as shown on the Drawings, as specified herein and as needed for a complete and proper installation.

1.02 REFERENCE STANDARDS

<u>Reference</u>	<u>Title</u>
National Electrical Manufacturers Association (NEMA):	
ICS 1	General Standards for Industrial Controls and Systems
ICS 2	Standards for Industrial Control Devices, Controllers and Assemblies
ICS 4	Terminal Blocks for Industrial Control Equipment and Systems
ICS 6	Enclosures for Industrial Controls and Systems
Underwriters Laboratories, Inc. (UL):	
UL 508A	Industrial Control Equipment
UL 60950	Requirement for Information Technology Equipment
Electronic Industries Association:	
EIA-310-D	Specification Standard for Racks and Rack Units

1.01 SUBMITTALS

- A. Submit shop drawings with pertinent provisions, including the server rack enclosure, components, seismic bracing, and manufacturer's detailed specifications (cut-sheets or data sheets).
1. Provide shop drawing showing the mounting location of the UPS, Ethernet switch, patch panel, display/keyboard/mouse console, etc.
- B. Submit product information from server rack enclosure manufacturer.
- C. Submit wiring management equipment submittals for wire routing control.
- D. Submit seismic bracing shop drawing.
- E. Submit operation and maintenance (O&M) manuals.

1.02 ENVIRONMENTAL REQUIREMENTS

- A. The following areas have the following environmental conditions and shall have the following environmentally preferable products:

- 1. Attendant Building:

- a. The space within the Server Room is an environmentally controlled space.

1.03 UL LABEL AND ETL FIELD CERTIFICATION

- A. UL and ETL Labels:

- 1. Server rack enclosure shall bear the UL label.

1.04 QUALITY ASSURANCE

- A. Manufacturer shall have a quality assurance and quality control procedure as part of their manufacturing procedure.

- 1. Manufacturer shall be in compliance with ISO 90000 or equivalent quality control standard.

- B. Provide enclosures, devices, components, etc., which have been listed and labeled by Underwriter's Laboratories.

1.05 WARRANTY

- A. Provide a 2-year warranty from the Substantial Completion that includes material, shipping costs, labor, and travel.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall ensure electrical equipment received is stored in a dry, secured, safe location, protected from water, rain, dirt, construction debris, and traffic. Storage and handling shall be per the manufacturer's requirements.

- 1. Contractor is responsible for electrical equipment until the equipment has been commissioned and successfully demonstrated to the Owner.

1.07 SEISMIC ANCHORAGE AND STRUCTURAL DATA

- A. Mechanical instrumentation and control, electrical, nonstructural systems, components, and elements permanently attached to the structure shall be anchored and braced to resist seismic forces. Contractor shall design the structural components, seismic attachment, braces, and anchors to the structure for all parts or elements of the mechanical and electrical systems in accordance with Section 13 05 41.

PART 2 – PRODUCTS

2.01 CONSTRUCTION

A. Server Rack General:

1. Provide network server rack enclosure cabinet 42U with the following:
 - a. Steel construction.
 - b. Vented perforated doors.
 - c. Locking, removeable, reversible front and rear doors.
 - d. Bottom panels removable for cabling.
 - e. Top panel cable routing ports.
 - f. Adjustable mounting rails.
 - g. 29-inch rail-to-rail usable depth.
 - h. Casters to support enclosure movement.
 - i. Seismic bracing/lanyard to prevent server rack from overturning.

B. Safety Requirements: The electrical supply to each control panel shall be arranged to be disconnected by a single switch or circuit breaker, except for necessary foreign circuits as required by NEC and the AHJ.

C. Nameplates: Provide equipment nameplate as specified in Section 26 05 53. Nameplate shall be mechanically attached to enclosure with fasteners. Nameplate engraving shall be:

SERVER CABINET
SRV-1

D. Finish:

1. After fabrication, all welds shall be ground smooth. The entire unit shall be thoroughly degreased, filed, and sanded. All carbon steel surfaces shall be given a rust-inhibiting treatment.
2. Enclosure shall have a black powder coat finish. All damages to the finish during installation shall be touched up at the jobsite as approved.

E. Size and Supports:

1. Enclosure overall size is 24 inches wide by 36 inches deep by 78 inches high.
2. Accommodate all standard 19-inch rack-mounted equipment for high-density service and IT networking environments.
3. Total weight capacity 700 pounds with casters, 1,700 pounds without casters.

4. Provide rigid supports for all devices. Supports shall not cause warping or bowing sides or mounting plates.

F. Arrangement:

1. Equipment installed into the network server rack enclosure shall be loaded bottom to keep the center of gravity of the assembly lower.

G. Ventilation:

1. Enclosure shall be ventilated with perforations on both doors, bottom, and top panels.
2. Provide provisions for future installation of two ventilation fans to be mounted in the top panel. The future ventilation fans would be used to exhaust heated air up and out from within the enclosure.
 - a. Provisions shall include cut-out and mounting holes for two 10-inch fans.
 - 1) Cut-out and mounting holes to support nVent/Hoffman compact axial fan, Catalog No. A10XFN.

H. Power Distribution Unit (PDU):

1. Provide 2.4 kW single phase 120 V, basic power distribution unit for the server rack enclosure 1U Rack-Mount.
2. PDU shall have a NEMA L5-20P with a minimum 15-foot cord.
3. PDU shall have 13 NEMA 5-15/20R outlets.
4. 20 A circuit breaker protects outlets against overloads.
5. Rear-panel grounding lug.
6. No power switches; prevents accidental shutdowns.
7. Mounts horizontally.
8. Acceptable Manufacturers:
 - a. Eaton Tripp-Lite.
 - b. CDW.
 - c. APC.
 - d. Or preapproved equal.

I. Grounding:

1. Provide ground bond connection between server rack enclosure and Communication System ground bus bar located in Electrical/Communication Room. Provide #6 AWG copper conductor for ground bond.

2.02 SERVER RACK HARDWARE

- A. Provide casters with server rack enclosure to support movement of enclosure.
- B. Provide seismic brace hardware to prevent enclosure from tipping or moving away from the nearest wall.
- C. Provide three flush mounted cantilevered ventilated cabinet shelves, 19-inch, finish black. Included shelf mounting hardware.
- D. Provide two horizontal cable mangers with molded fingers, 3RU. Include the mounting hardware.

2.03 SERVER RACK UPS

- A. Provide rack-mounted UPS in the Server Rack; see Section 26 33 53 for UPS specifications.
- B. UPS system shall be located at the bottom of the server rack.

2.04 ETHERNET SWITCH

- A. The Ethernet switch shall be a managed switch and configured for server rack installation.
- B. The Ethernet switch shall have 48 ports.
- C. The Ethernet switch acceptable manufacturers are as follows:
 - 1. Dell.
 - 2. Cisco.
 - 3. Or preapproved equal.
- D. Submit Ethernet switch equipment for Kitsap County's approval.

2.05 PATCH PANEL

- A. Provide a 48-port 2U rack-mount Cat6/Cat5 110 Patch Panel, 568B, RJ45 Ethernet, TAA.
- B. Acceptable Manufacturers:
 - 1. Tripp-Lite, Model No. N252-048.
 - 2. Or preapproved equal.
- C. Submit patch panel equipment for Kitsap County's approval.

2.06 HORIZONTAL CABLE MANAGEMENT

- A. Provide three horizontal cable managers.
- B. Steel with finger duct 2URM for high capacity.
- C. Cold rolled steel with black finish.
- D. Acceptable Manufacturers:
 - 1. Eaton Tripp-Lite model number SRCABLEDUCT2UHD.
 - 2. CDW – Panduit.
 - 3. RackSolutions.
 - 4. Or preapproved equal.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install network server rack enclosure with manufacturer's recommendation and as follows:
 - 1. Locate as shown on Drawings.
 - 2. Install seismic bracing.
 - 3. Provide ground to bond enclosure to Communication System grounding bar.
 - 4. Coordinate with Owner for locating network, access control, and other equipment.
 - 5. Provide PDU unless already installed at factory.
 - 6. Locate the UPS at the bottom of the of the rack to keep the weight lower in the assembly.
- B. Provide cable management in SRV-1 to control and route wiring within rack enclosure as depicted in Photo 1.

Photo 1. Example of Cable Management inside SRV-1



- C. Install labeling on the enclosure.
- D. Touch-up and clean enclosures after start-up.

END OF SECTION

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