AVIATION FACILITIES AND INFRASTRUCTURE

CIVIL SYSTEMS STANDARDS

January, 2024

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i. PURPOSE

A. GENERAL

These standards include civil system design guideline, installation, and material standards for use at Seattle-Tacoma International Airport, and apply for both Airside and Landside areas of the Airport to 5-feet outside of building footprints. The Aircraft Operations Area (AOA) fence demarcates the Airside and Landside Areas.

These standards are the minimum design standards for the planning and design. Compliance with these standards does not relieve the designer or consultant of the responsibility to apply sound professional judgement. These are minimum standards and are intended to assist, but not substitute for competent work by the consultant or the designer.

Refer to STIA F&I Electrical System Standards for roadway illumination design requirements.

Refer to Seattle-Tacoma International Airport Wayfinding Signage Standards and Guidelines Volume 2: Public Roadways for roadway signage design requirements.

Refer to the Port of Seattle Airport Pedestrian and Bicycle Facility plan, FHWA's Manual on Uniform Traffic Control Devices (MUTCD), and AASHTO Guide for the Development of Bicycle Facilities for bicycle facilities improvements requirements.

ii. DESIGN SUBMITTAL GUIDELINES

A. GENERAL

This section provides guidelines to assist the engineers and designers during the submittal process by establishing standard practices that achieve uniformity and quality designs for utilities.

B. REQUIREMENTS

Survey and Utility Locate Requirements

1. Site survey is required to be completed no later than 30% design. Site survey to include utility base map and topography. Locate all equipment and above ground piping to permit service and meet all maintenance requirements for all components. Indicate service area, access doors and panels locations on drawings.
2. Pothole all utility crossings in accordance with 312333 Utility Trenching and Backfill no later than 60% design. Provide copy of pothole results report with 60% submittal; report shall include location, depth, pipe size, and pipe material type for each pothole.

Phasing Requirements

1. Designer to provide utility phasing plans as required to maintain Airport's 24 hours per day operation. Utility phasing plans that include outages may be allowed only if previously coordinated with the relevant utility owners no later than 90% submittal.
2. Designer to provide traffic phasing plans to maintain traffic flow during construction. Closure of pedestrian, transit, vehicular, tug or aircraft routes shall be coordinated with the Port of Seattle no later than 90% submittal.
3. Designer to provide a pavement restoration plan for approval and acceptance by F&I Representative no later than 90% submittal.

Drawing Requirements

1. Drawings shall be prepared in accordance with Port Design Milestone Requirements. Drawings and specifications will be completed in detail to define installation and operation of all systems.
2. Drawings shall comply with Port of Seattle CAD Standards, Current Edition.
3. The Consultant shall use the latest AutoCAD version indicated in the Port of Seattle CAD Standards.
4. Civil plans shall have a maximum scale of 1" = 40' on 22"x34" sheet.
5. The Port will assign a drawing identification number to this project, which

shall be indicated on all construction drawings prepared by the Consultant. Additionally, all contract documents including the Project Manual shall reference this number.

6. Standard Legends, Symbols, and Abbreviations will be incorporated and edited to suit project.
7. Details will be incorporated as required and edited to suit project.
8. Provide system profile drawings for each civil system (water distribution system, sanitary sewer system, stormwater drainage system, and industrial wastewater system) indicating manhole and catch basin rim elevations and piping system sizes, materials, and inverts. Identify all slopes and utility crossings, including existing crossings, new crossings, and planned to be demolished crossings.
9. Manholes, catch basins, water valves and fire hydrants will be assigned unique identification numbers obtained from Section VI Asset Identification System.

Utility Layout Requirements

1. Existing equipment, piping and components, etc. not being used shall be completely removed (including hangers and supports) and shown on separate demolition drawings. Do not abandon systems or portions of systems in-place unless specifically approved by the Port Facilities and Infrastructure.
2. Underground piping systems shall be abandoned in accordance with the applicable Standard Details (Appendix A).
3. Existing utilities that will be used or extended shall be shown on drawings. Prior to design, existing systems shall be evaluated for capacity, condition, and remaining asset life for review and approval by Facilities and Infrastructure (F&I).
4. Under no circumstances should materials be reused for relocations. All products and materials shall be new including relocated utilities and shall meet current standards and codes. Adjusted structure lids and covers shall be replaced with new lids conforming to F&I Civil System Standards.
5. New and existing infrastructure shall be constructed with maintenance access that is at least 15 ft (wide) by 16.5 ft (height).
6. All existing utilities that are in conflict with new building structures or foundations shall be rerouted a minimum of ten feet away from proposed structures. Contact F&I if there are no viable options.
7. All designed and constructed Airside facilities shall take into account traffic and jet engines blast, and be secured so items would not be dislodged.
8. Contractor shall prevent any debris, silt, or foreign material from entering any

existing utility by installing, at a minimum, protection per Standard Detail SD-123 Minimal Protection of Active Sanitary Sewer. Manholes requiring protection shall be indicated on the drawings. If any debris, silt, or foreign material does enter an existing utility, such material shall be cleaned out by the Contractor, and work shall be performed at the Contractor's expense.

9. The Specifications shall be in accordance with the Port of Seattle Master Guide Specifications and shall be edited to suit project requirements. The Specifications in accordance with other standard specifications is also acceptable with F&I approval or if project requires the use of other standard specifications such as WSDOT Standard Specifications.

Asbuilt Requirements

1. Contractor shall contact the POS F&I Representative 24 hours in advance to locate utilities after installation but before backfilling.
2. At project close-out, construction redlines and as-built survey shall be submitted back to the Engineer of Record to develop the final engineering as-built CAD file and engineering archive plans (in both CAD and PDF format) that reflect the installed condition for POS review and approval. Asset ID table must be filled out on record drawings.

C. APPLICATION FOR CONNECTIONS

Prepare and Submit “Application for Connection” document for connections to the existing industrial waste, sanitary sewer, water distribution, and storm drainage systems. Refer to Section IV below, “Application for Utility Connection Forms”.

D. DESIGN SUBMITTAL REQUIREMENTS

Submittals shall be in accordance with POS Design Milestone Submittal requirements and POS CAD Standards. Design submittal shall include the following requirements for each design phase:

Conceptual Design (15%)

1. Scope of Work (Basis of Design)
2. Industrial Waste, Storm Drainage, Sanitary Sewer, and Water Distribution System Plans
3. Application for Connection Forms
4. Asbestos Assessment
5. Cost Estimate
6. Outline Specifications

Schematic Design (30%)

1. Scope of Work (Basis of Design)
2. Site survey
3. Industrial Waste, Storm Drainage, Sanitary Sewer and Water Distribution System Drawings (Legend, Demolition Plan, System Plan)
4. Table and figure describing unknown or missing existing utility data, utility locate and pothole plan for all utility crossings.
5. Application for Connection Forms – including approximate flows and or demands
6. F&I Civil Design WISE (Water, Industrial Waste System, Storm, Environmental) Approvals
7. Responses to Review Comments
8. Asbestos Assessment
9. Cost Estimate
10. Outline Specifications

Design Development (60%)

1. Design Calculations for Water Distribution System, Industrial Waste System, and Sanitary Sewer System. Storm Drainage System calculations to be submitted as part of the Stormwater Site Plan.
2. Industrial Waste, Storm Drainage, Sanitary Sewer, and Water Distribution System Drawings (Legend, Demolition Plan, Plan View, Profiles, Details, and Standard Details)
3. Application for Connection Forms and Stormwater Site Plan
4. F&I Civil Design (WISE) Approvals
5. Utility Pothole Report
6. Responses to Review Comments
7. Asbestos Assessment
8. Cost Estimate
9. Specifications
10. Submit infrastructure for asset ID assignment.

Construction Documents (90% and 100%)

1. Industrial Waste, Storm Drainage, Sanitary Sewer, and Water Distribution System Drawings (Legend, Demolition Plan, Shutdown and Phasing Plan, Maintenance of Traffic Plan, Plan View, Profiles, Details, and Standard Details), both signed hard copies and electronic CAD files required at 100%.

2. Application for Connection Forms and Stormwater Site Plan
3. F&I Civil Design (WISE) Approvals
4. Responses to Review Comments
5. Asbestos Assessment
6. Cost Estimate
7. Specifications
8. Utilize assigned asset ID numbers and submit Computerized Maintenance Management System (CMMS) Data Form submitted at 90%. CMMS form shall be indicated on construction documents and submitted in MS Excel format.

iii. STANDARDS, CODES AND REGULATIONS

A. GENERAL

- Consult with Port of Seattle's Building Department and/or Authority Having Jurisdiction (AHJ) on adopted codes and amendments.
- The Industrial Waste, Sanitary Sewer, Water Distribution, and Stormwater Drainage Systems Standards are based upon requirements of the latest adopted edition of all applicable standards, codes, regulations, and ordinances including, but not limited to, the following:

B. RELATED STANDARDS (PORT OF SEATTLE – SEATAC INTERNATIONAL AIRPORT): https://www.portseattle.org/Business/Construction-Projects/Airport-Tenants/Pages/Reference-Documents.aspx

1. Mechanical Systems Standard
2. Restroom Design Standards
3. Architectural Design Standards
4. Port Design Milestone Requirements
5. Electrical System Standards
6. Direct Digital Controls (DDC) System Standards
7. CAD Standards

C. CODES

1. International Building Code (IBC)
2. Uniform Mechanical Code (UMC)
3. Uniform Plumbing Code (UPC)
4. Uniform Fire Code (NFC)
5. National Electrical Code (NEC)
6. Washington State Energy Code (WSEC)
7. Washington State Ventilation and Indoor Air Quality Code (WAC 51-13)

D. REGULATIONS, ORDINANCES AND REFERENCES

1. Federal Aviation Administration (FAA)
2. Port of Seattle Fire Department
3. Washington Industrial Safety and Health Act (WISHA)
4. Washington State Department of Transportation (WSDOT)
5. Washington State Department of Ecology (WA DOE)

6. Washington State Department of Health (WA DOH)
7. Puget Sound Air Pollution Control Agency (PSAPCA)
8. Environmental Protection Agency (EPA)
9. Occupational Safety and Health Administration (OSHA)
10. Americans with Disabilities Act (ADA)
11. American Association of State Highway and Transportation Officials (AASHTO)
12. Building Officials and Code Administrators International (BOCA)
13. American Society of Testing and Materials (ASTM)
14. American National Standards Institute (ANSI)
15. American Society of Mechanical Engineers (ASME)
16. American Water Works Association (AWWA)
17. American Gas Association (AGA)
18. National Fire Protection Association (NFPA)

E. CIVIL SYSTEMS DRAWINGS

1. The following Sea-Tac International Airport's standard drawings, schedules and diagrams will be incorporated and edited to suit project.
    a. Legend, Symbols and Abbreviation, see Standard Details.
    b. Control Diagram, Sequence of Operations (DDC Point List), see Mechanical Standard #15900.
    c. Equipment Schedules, see Standard Details.
2. Refer to Port of Seattle CAD Standards Current Edition for additional symbols, abbreviations, schedules, diagrams and details.

iv. APPLICATION FOR UTILITY CONNECTION FORMS

A. PURPOSE

1. The purpose of the "Application for Connection" documents is to formalize the procedure for making connections to the existing industrial waste system, storm drainage system, sanitary sewer system, and water distribution systems, assess the impacts of additional services/loads on the systems, identify the point of connection, reserve the point of connection for the approved service/loads, assess construction impacts, establish and maintain configuration control of the system and plan for the long-term system development to meet the needs of SeaTac International Airport. By providing the information requested for each system, the Facilities and Infrastructure (F&I) Systems group can work with the Project Team to achieve the most effective point of connection for the proposed service/load while maintaining system integrity.
2. No connections to industrial waste, storm drainage, sanitary sewer, and water distribution will be allowed without an approved application.
3. For connection to existing utilities not owned by Port of Seattle, the designer shall seek approval from the utility purveyor having jurisdiction.

B. PORT OF SEATTLE – APPLICATION FOR CONNECTION FORMS

https://www.portseattle.org/page/applications-utilities-connections

1. Application for Connection to the Water Distribution System
2. Application for Connection to the Sanitary Sewer Systems
3. Application for Connection to the Industrial Wastewater System
4. Application for Connection to the Storm Drainage System and Stormwater Site plan per the Stormwater Management Manual

C. PROCEDURES

Forms need to be completed and submitted in a timely matter to impacts to project scope. Utility connection forms to be completed (or updated) prior to each submittal design stage and WISE meetings.

D. FORMS AND RESPONSIBILITY

The Port of Seattle Project Manager is responsible for providing the form to the consultant or contractor and obtaining the required information prior to submitting to F&I. See sample forms at the end of the General Provisions Section.

V. DESIGN VARIANCE PROCEDURES

A. GENERAL

A variance request shall be submitted to the Port of Seattle F&I for review and approval if any design or construction cannot meet the Port of Seattle's standard requirement. This section will identify appropriate circumstances to request a full or partial variance from the standard, how to make that request, and required documentation. The provisions in this standard do not apply to any project with an approved 60% design prior to adoption of these standards.

The variance request process defined in this section applies to variance from various Port of Seattle design standards and guidelines with the Port of Seattle. This process does not apply to nor replace any other deviation, variance or exception process required for other AHJ or organization such as WSDOT, King County, and City of SeaTac. Separate deviation/variance process/procedure is required for AHJ when applicable.

B. CIRCUMSTANCES FOR VARIANCE

Port of Seattle Design Standards and Guideline(s) cannot provide requirements for all situations. Any project that cannot meet the Port of Seattle design standard requirements shall request a variance to the standards by documenting the technical infeasibility, safety hazard, or security concern posed by the standard requirements, and a detailed plan to achieve the intent and goals of this standard in an alternate way.

C. VARIANCE REQUEST

Various groups within the Port of Seattle have decision-making authority to approve a variance to the design standards depending on the nature of the variance or improvements. An applicant may request such approval by submitting a variance request form (available in this section) to the F&I project review staff at Baisch.D@portseattle.org or Shen.P@portseattle.org. F&I project review staff will distribute the variance request to appropriate group for review and approval. Variance requests shall be signed and sealed by a professional engineer.

Variance requests shall be submitted after the 60% design. Variance requests must be approved prior to the approval of the engineering plans for construction. It is the responsibility of the Port of Seattle Engineers to interpret the Standard. There is no guarantee that a proposed request will be approved. The Port of Seattle may grant a variance if applicants are able to demonstrate the following:

1. The variance is in the public interest.
2. Design meets the objectives of safety, function, fire protection,

appearance, and maintainability.

3. Design is based on sound engineering judgement.

D. VARIANCE REQUEST APPLICATION PROCESS

Following shall be submitted for variance request process:

1. A completed **Seattle Tacoma International Airport F&I Civil System Standard Variance Request Form**
   (1) Date of the application
   (2) Request Point of Contact
   (3) Project Name
   (4) Project Number
   (5) Project Address
   (6) Project Manager
   (7) Project Status (e.g. 30% design)
   (8) Variance #
   (9) Description of Variance(s) Request
   (10) Proposed Alternative – Include approach to mitigate impacts created by variance.
   (11) Justification for Variance – Financial costs associated with meeting the standards will not be considered by the Port of Seattle to be sufficient justification for granting a variance.
2. All relevant review information as attachments.
3. For utilities by an entity under a franchise agreement, variance requests must be prepared and submitted by that entity.

vi. ASSET IDENTIFICATION SYSTEM

A. PURPOSE

Identification of assets, including pipelines, structures, equipment, and components for the purpose of maintenance monitoring and record keeping.

B. PROCEDURES

All assets (pipes, valves, hydrants, manholes, catch basins, pumps, etc.) shall be provided with a unique asset ID number and indicated on construction documents. Coordinate asset ID numbers with F&I Representative. Submit infrastructure to POS F&I/POS Mapping at 60% for asset ID assignment. CMMS form shall be submitted at 90%.

C. STIA ASSET IDENTIFICATION SYSTEM CRITERIA

For the Water, Sanitary Sewer, and Industrial Waste Systems, the asset name will be a two-letter system name, followed by a two-letter asset abbreviation, followed by a five-digit asset identification number.

For the Storm Drainage System, the asset name will be a two-letter system name, followed by a two-digit basin name, followed by a two-letter asset abbreviation, followed by a five-digit asset identification number.

System Name	Asset Abbreviation	
WA =Water (Domestic/Fire) Distribution System	**Structures**	**Pipes**
	FC = Fire Department Connection	PM =Pipe Main
	FH = Fire Hydrant	DL =Water Domestic Lateral
	MH = Manhole Water	FL =Water Fire Lateral
	MR = Water Meter	
	VL = Water Valve	
	SP = Service Pit	
	VT = Water Vault	
	BP = Backflow Preventer/Hotbox	
SS = Sanitary Sewer System	**Structures**	**Pipes**
	CO = Cleanout	PM = Pipe Main
	LS = Lift Station	FM = Force Main
	MH = Manhole Sewer	PL = Pipe Lateral
	ST = Stub	

System Name	Asset Abbreviation	
	VT = Grease Interceptor Vault	
IW = Industrial Waste System	**Structures**	**Pipes**
	CO = Cleanout	FG = Flush Gutter
	LS = Lift Station	PM = Pipe Main
	MH = Manhole IWS	RD = Roof Drain
	VL = Valve	WL = Waste Oil Line
	ST = Structure	PP = Subdrain with Perforated Pipe
	OW = MH with Oil Water Separator	
	CB = Catch Basin	
SD = Storm Drainage System	CB = Catch Basin	CU = Culvert
	CO = Cleanout	DD = Drainage Ditch
	MC = Manhole Combination	GU = Gutter
	MH = Manhole Storm	FG = Flush Gutter
	OW = MH with Oil Water Separator	GH = Gutter Half Pipe
	MM = Manhole Metro	RD = Roof Drain
	ST = Structure	PM = Pipe Main
	WS = Level Spreader/Wood Separator	PP = Subdrain with Perforated Pipe

D. EXAMPLES

Example “SSPM00100”:
System: SS = Sanitary Sewer System
Units: PM = Pipe Main
Number Sequence: 00100

Example “SSPL00100”:
System: SS = Sanitary Sewer System
Units: PL = Pipe Lateral
Number Sequence: 00100

Example “SSMH00100”:
System: SS = Sanitary Sewer System
Units: MH = Manhole
Number Sequence: 00100

Example “WAPM00100”:
System: WA = Water System
Units: PM = Pipe Main
Number Sequence: 00100

Example “WADL00100”:
System: WA = Water System
Units: DL = Domestic Lateral
Number Sequence: 00100

Example “WAWV00100”:
System: WA = Water System
Units: WV = Water Valve
Number Sequence: 00100

Example “IWPL00100”:
System: IW = Industrial Waste System
Units: PL = Pipe Lateral
Number Sequence: 00100

Example “SDE4CB00100”:
System: SD = Storm Drainage System
Basin: E4 = Drainage Basin E4
Units: CB = Catch Basin
Number Sequence: 00100

E. STRUCTURES AND PIPES THAT WILL NOT BE NAMED

SYSTEM	CAD CODE	NAME
AIRR	377	COMPRESSED AIR LINE (EXPOSED)
AIRR	387	PRECONDITIONED AIR LINE
AIRR	544	AIR SERVICE PIT
AIRR	551	AIR VENT
AIRR	842	COMPRESSED AIR LOCATES
IRRG	392	IRRIGATION PIPE (EXPOSED)
IRRG	393	SPRINKLER HEAD
IRRG	394	IRRIGATION CONTROL VALVE (SPRINKLER BOX)
IRRG	395	IRRIGATION CONTROL PANEL
IRRG	406	IRRIGATION CONTROL VALVE (ROUND)
IRRG	844	IRRIGATION LOCATES
FIRE	224	FIRE ALARM
FIRE	538	FIRE SPRINKLER LINE (EXPOSED)
SSWR	830	SEWER LOCATES
SSWR	853	SEWER UNKNOWN
SSWR	921	SEWER STRUCTURE UNDERGROUND
SSWR	521	SANITARY SEWER STRUCTURE
WATR	375	SHIP HYDRANT
WATR	401	WATER TANK
WATR	457	WATER WELL
WATR	461	WATERLINE (ABOVE GROUND)
WATR	462	WATER WITNESS POST
WATR	525	WATER STRUCTURE
WATR	838	WATER LOCATES
WATR	858	WATER UNKNOWN
WATR	925	WATER STRUCTURE UNDERGROUND
WATR	448	WATER LINE (EXPOSED)
WATR	460	WATER SPIGOT
	558	TOPO UTILITY STAND PIPE
	862	POTHOLES
IWSS	839	IWS LOCATES
IWSS	854	IWS UNKNOWN
IWSS	923	IWS STRUCTURE UNDERGROUND
STRM	171	UNKNOWN STORM DRAIN
STRM	295	MANHOLE UNKNOWN
STRM	860	STORM UNKNOWN
STRM	922	STORM STRUCTURE UNDERGROUND

vii. WATER DISTRIBUTION, SANITARY SEWER, STORMWATER DRAINAGE, AND INDUSTRIAL WASTEWATER SYSTEM COMMISSIONING

A. SCOPE

1. The commissioning process is to certify to the Port of Seattle that Utilities and other related systems, equipment and controls function together properly to meet performance requirements, acceptance criteria, and design intent in accordance with the contract documents.
2. All project systems requiring mechanical or electrical components will be commissioned using the STIA Mechanical Systems Standards. The level of commissioning will be defined by the contract documents and Port of Seattle Project Manager based on the complexity and critical nature of systems and equipment to sustain operations at the Port. All systems and equipment will be commissioned in accordance with Division 1 - General Requirements, Section 019100 “Commissioning” in the contract documents.

B. DESIGN CRITERIA

System design shall incorporate complete testing of all systems and components prior to commissioning. Design shall incorporate provisions to test and commission at design conditions and in all modes of operation.

C. PERFORMANCE STANDARDS

Performance standards shall be developed by the designer to meet the owner’s requirements as a benchmark to evaluate acceptance criteria and functional testing results to performance standards.

D. ACCEPTANCE CRITERIA

Detailed acceptance criteria will be developed by the designer defining functional testing requirements. Functional testing will be performed by the contractor to prove system and equipment performance meets the acceptance criteria.

E. COMMISSIONING SUBMITTAL REQUIREMENTS

Designer will review with Project Manager Port of Seattle’s submittal checklist to define specific project requirements.

F. COMMISSIONING SUPPORT

Provide Commissioning team with materials & information required for system Commissioning. Inspects & assure contractor installation and system/equipment meet design intent and specified standards. Resolve issues as defined during the

Commissioning process, respond to RFI's or clarifications for design intent & system/equipment performance. Sign off that final system/equipment installation and performance meets design criteria and performance.

viii. FUEL SYSTEM DESIGN APPROACH REQUIREMENTS

A. PIPE SIZING AND FUEL VELOCITY

Fuel quality can be affected by contaminants that have passed through the filtration and water separation process due to failure of filter media, construction, or introduced by regularly scheduled maintenance. Hydrant fueling system piping shall be sized to allow proper flow rates, pipe maintenance, and static relaxation.

Typical design velocities are five (5) to eight (8) feet per second (fps) at peak flow rates to ensure lines are kept clear and any contaminants are swept to the low point drains. Velocities below three (3) fps are not recommended as they do not facilitate the movement of water and contaminants though the piping.

Piping shall be sloped to facilitate removal of air, water, and particulate at the high point vents and low point drains. Fuel piping should slope at a minimum of 0.5%. If a lesser slope is necessary for design purposes, SEA approval is required, and slope shall not go below 0.2%.

Lateral pipe sections should slope at a minimum of 1 percent, sloping towards the main fuel pipe. The distance of the hydrant fueling pit from the main hydrant fueling loop must be considered when sizing the hydrant fueling laterals due to potential surge and pressure loss issues. The minimum lateral pipe size connecting the hydrant fueling pit to the main fuel pipe is six (6) inches, but, for long laterals serving widebody aircraft, an eight (8)-inch diameter lateral may be required. Should an 8-inch lateral be required, it shall be reduced just outside the hydrant fueling pit.

B. LAYOUT AND SPACING

Fuel pipe main lines shall be located to minimize lateral pipe lengths. Fuel pipe mains shall not be located under a building or passenger terminal.

Pipe spacing shall be per applicable codes. Spacing shall allow a minimum of six (6) inches of flowable fill to be placed horizontally and 12 inches vertically between pipes and shall consider cathodic protection requirements. Piping shall be spaced a minimum of 36 inches horizontally and 12 inches vertically to leave room for utilities. If these distances cannot be met, provide insulating material and consider the cathodic protection of the piping and the encroaching utilities.

C. EXCAVATION AND BACKFILL

Pipe bedding material for exterior coated steel pipe shall be flowable fill. Acceptable flowable fill shall be a controlled low-strength material (CLSM); the designer shall utilize the SEA standard CLSM specification or provide a flowable fill mix design developed by an independent testing laboratory for review. The flowable fill shall consist of sand conforming to ASTM C33 or C144, fly ash conforming to ASTM C618, Portland cement conforming to ASTM C150, or other materials approved by the Engineer. The flowable fill shall have a 28-day compressive strength of not less than 25 psi or more than 100 psi. The pH range of the flowable fill shall be 8-10.

Ensure the pavement structure does not encroach into the backfill over lateral piping sections.

The flowable fill resistivity shall be submitted to the Cathodic Protection Engineer to coordinate the design of the cathodic protection system, including confirming that the flowable fill will not shield the cathodic current.

Cathodic protection anodes shall not be buried in flowable fill.

D. FUEL SYSTEM PIPING

The fuel piping shall meet the following requirements:

1. The system piping shall be ASME Class 150 pressure rating unless otherwise required for higher system working pressures
2. Changes in direction shall be accomplished with fittings
3. Pipe Diameter
    a. Pipe 2 inches and smaller shall be seamless Schedule 80
    b. Pipe 2-1/2 inches through 10 inches shall be Schedule 40 (Standard Weight)
    c. Pipe 12 inches or larger shall be 3/8-inch (0.375-inch) wall thickness (Standard Weight)
4. Shall be designed in accordance with ASME B31.3 Process Piping Code
5. Piping in contact with fuel shall be internally coated carbon steel as specified or uncoated stainless steel
6. Copper, zinc, cadmium, lead, and their alloys shall not be used in the system
7. Galvanized piping and fittings shall not be used in the system
8. System pipe shall be ASTM 53 Grade B, ASTM A106 Grade B, or API 5L Grade B
    a. All piping shall be stamped with the specification and grade. If factory coated specification and grade shall be stenciled
    b. Carbon steel piping 2-1/2 inches and larger shall be internally coated
    c. Flanges shall be forged weld neck type
9. Slip-on flanges shall only be used when approved by SEA/Operator

E. WELDING

All connections shall be welded on buried piping. All welding shall be in accordance with applicable welding procedures and specifications, including but not limited to ASME B31.3 and ASME Boiler and Pressure Vessel Code section IX.

F. FITTINGS

Fittings used in the system shall meet the following requirements:

1. Fittings 2-1/2 inches or larger shall be internally coated
2. All buried fittings shall be butt welded and suitable for radiograph inspection
3. Fittings 2-1/2 inches and larger shall be ASTM A234 Grade WPB with wall thickness to match pipe
4. Fittings 2 inches and smaller shall be ASTM A105
5. Elbows shall be a long radius
6. Changes in a direction other than 45 degrees or 90 degrees shall be made by cutting elbows to the proper angle and shop beveling the edges. Lines shall be parallel, perpendicular, or 45 degrees to existing mains.

G. HYDRANT PITS

1. Hydrant Pit Placement

   Hydrant pit placement shall be coordinated with SEA Planning. The placement and number of hydrant pits should be minimized based on aircraft parking plans and aircraft mix.

   Hydrant fueling pits shall optimally be located within a 25-foot horizontal radius from the aircraft fueling points and in front of the wing. Hydrant fueling pits shall not be located directly under the aircraft fuselage, engine cowlings, directly under the fueling connection point of any aircraft, or in areas subject to drive-over by the aircraft landing gear, including both main gear and nosewheel. Locate the hydrant fueling pits as far away from aircraft engine intakes and exhausts as possible, accounting for the above location constraints.

   Two (2) hydrant fueling pits are required for wide-body aircraft for each wing’s fuel connection point. If only one hydrant pit is provided for wide-body aircraft, it shall be located to supply the left-wing fueling connection.

   Locate hydrant fueling pits to minimize the effects of jet blasts from taxiing aircraft on fueling operations. Locate the hydrant fueling pits so that the connection to the hydrant pits does not interfere with aircraft fuel port access, particularly with aircraft types having low wing clearance or low jet engine clearance to the ramp (i.e., Boeing 737 and similar aircraft).

Verify that each hydrant fueling pit position has a clear line of sight to nearby EFSO stations.

Locate hydrant fueling pits a minimum of 50 feet from terminal or concourse buildings in accordance with NFPA 407. Locate hydrant fueling pits and other potential spill points at least 100 feet from the terminal or concourse building glazing where possible. Where hydrant fueling pits and spill points are located less than 100 feet from building glazing, provide an automatic sprinkler system at the face of the building in accordance with NFPA 415.

Locate the hydrant fueling pits away from wing end vents to avoid encountering fuel vapors and promote a more fire-safe condition.

2. Ground Service Equipment
Ground servicing operations shall be considered when selecting a hydrant fueling pit location. Assure that the hydrant fueling pit locations consider the presence of possible aircraft access bridges, catering vehicles, baggage handling, and other potential ramp equipment in the vicinity.

Verify the actual hydrant fueling servicing equipment to be utilized in order to visualize where the servicer must be parked during fueling operations. Determine whether the proposed hydrant fueling pit location accommodates the hydrant fueling servicer in a parked position while accessing the aircraft fuel point without blocking other ramp equipment.

Locate the hydrant fueling pits so there is no interference with the travel way between wings of adjacent aircraft.

3. Drainage
Paving adjacent to hydrant fueling pits and all other fuel pits shall have positive drainage to help shed surface water away from the pits as per NFPA 407, 4.1.12.4.1. Locate the hydrant fueling pits such that the crown will not result in localized high-slope areas.

Verify that hydrant fueling pits are located away from apron drainage storm inlets as well as other utility access lids.

4. Hydrant Pit Requirements:
   a. General Requirements: Assembly to be complete with a shutoff valve, hydrant pit valve, strainer, and piping accessories to be installed in a

concrete pavement apron, suitable for interfacing the fixed fuel system components with the hydrant fueling vehicle

b. Access Cover shall:
   i. dentification, “FUEL” shall be in raised letters on the cover door
   ii. Be water resistant
   iii. Be aircraft-rated cast aluminum
c. Performance: Designed to permit a fueling flow rate of 800 gpm.Liquid to be jet fuel with a specific gravity of 0.81 +0.05.
d. Hydrant lateral taps shall be made 45 degree to the top of the main utilizing a Sweepolet or Vesselet or with a reducing tee.
e. Hydrant pit laterals shall be installed perpendicular, parallel, or at 45 degrees to the existing mains. Line markers shall be installed at a grade above all changes in direction.
f. Pit structures shall be designed as secondary containment and shall be constructed to be watertight.
g. Construction:
   i. Pits shall be side entry.
   ii. Body shall be one-piece molded fiberglass with built-in concrete anchors.
   iii. Valve Pit structure may consist of a prefabricated fiberglass pit with reinforced concrete encasement or a cast-in-place reinforced concrete structure. Pit structure (walls and slabs) shall be designed to handle direct and indirect aircraft wheel loads.
   iv. Pit shall have a sealed interior pipe entry with a steel sleeve encapsulated in fiberglass. Sleeve penetrations shall be suitable for segmented mechanical seals (a total of two per pipe penetration) and installation of heat shrink boot seals on the exterior of the pipe penetration.
h. Internal Coating: Hydrant pits shall be internally coated with a two-part, spray-on polyurea coating. Coating will reduce permeability and enhance fuel resistance of the secondary containment system.

H. HIGH POINT VENT AND LOW POINT DRAIN PITS

High Point Vents and Low Point Drains shall be installed throughout the hydrant system and fuel storage facility in order to fill, drain, vent, and test fuel system lines. The number of high point vents (HPVs) and low point drains (LPDs) shall be minimized while meeting the pipe slope criteria. However, they shall be provided in sufficient numbers to allow for proper draining and filling of the system as well as to allow periodic purging of air in HPVs and drainage of accumulated water, sediment, and debris in LPDs. Where possible, HPVs and LPDs shall be located within isolation valve vaults. When HPVs and LPDs cannot be installed in valve vaults, provide individual or combination HPV/LPD pits.

HPV and LPD locations shall be coordinated with aircraft parking plans such that they are accessible without impeding aircraft and airport operations while performing monthly services. HPV and LPD locations shall not be located in aircraft movement areas. Where possible, isolation valve vaults shall be positioned such that a lid will not be affected by jet blast when in the open position.

Piping from HPVs and LPDs shall be extended up to a level such that they are accessible by maintenance personnel without requiring confined space entry and equipped with a ball valve and camlock connection with a dust cap.

Molded prefabricated fiberglass construction complete with hinged aluminum access cover valves and piping. Piping shall:

1. Be extended up such that confined spaces entry is not required for monthly checks and services
2. Clearly marked as “High Point” or “Low Point.”
3. Be 2-inch diameter
4. Have API 607 Fire Safe lockable ball valve
5. Have camlock connection with dust cap.
6. Access Cover shall:
    a. Be aircraft-rated, cast aluminum
    b. Be water resistant
    c. Have “Jet-A High Point,” “Jet-A Low Point,” or “Jet-A High/Low Point” engraved on the lid

I. SURGE SUPPRESSION

Hydraulic and surge analysis shall be performed as directed by SEA Project Manager using software to model hydraulic steady state friction losses and transient surge pressures. Analyses shall simulate worst case scenarios to determine if emergency fuel shutoff (EFSO) or hydrant fueling valve closures can produce pressures exceeding allowable code and determine whether surge suppression is required.

Suppressors shall be carbon steel or stainless-steel construction with removable top. Suppressor shall have isolation valves installed on inlet to allow for periodic maintenance. Isolation valve shall be DBB if suppressor is installed in section of piping that will be pressure tested. Suppressor shall have a check valve installed on the inlet and a 1" bypass line with a ball valve and ½" drain valve to allow unrestricted flow into the suppressor and restricted flow out. Suppressors shall be nitrogen filled with Buna-N bladders.

Design shall consider the use of thermal relief valves for limiting the pressure of the piping in accordance with code requirements. Design shall also consider access to vaults containing surge suppressors such that access to easily remove and replace suppressor without need of custom tools or excessive maneuvering of products.

J. ISOLATION VALVE VAULTS

IVVs shall be included at strategic locations throughout the hydrant system to provide positive isolation for maintenance operations, emergency operations, and leak detection as required. The number and locations of the IVVs shall be coordinated with the SEA Project Manager.

IVVs shall be installed at a minimum of every four gates in order to minimize the impact on aircraft in case of maintenance or issues with the hydrant system.

Isolation vaults and valves shall be located to optimize the isolation of segments by minimizing the volume of above-ground piping being tested while maximizing test result accuracy. If leak detection is not included in the design, the flexibility to accommodate future leak detection installations shall be discussed and included in the current design, if requested by SEA, to accommodate any future leak detection installations. If leak detection is included in the design, the system shall be designed to accommodate any potential technological advances and upgrades to the system.

IVV locations shall be coordinated with aircraft parking plans such that they are accessible without impeding aircraft and airport operations while performing monthly services per ATA 103. IVVs shall be located such that they are easily accessible in emergency situations. IVVs shall not be located in aircraft movement areas. IVVs shall be positioned so that the lid will not be affected by the jet blast when in the open position.

IVVs shall be equipped with the following:

1. Intermediate platform with removable aluminum grating to allow access to actuators and maintenance items without confined spaces entry
2. Lids for Valve Vaults shall:
    a. Have “Fuel Valve Access” engraved in the lid
    b. Be waterproof
    c. Be aircraft-rated cast aluminum
    d. Have torsion springs or a hydraulic operator for assisted opening
4. Fixed access ladder
5. An 18" X 18" X 12" deep sump with a grating cover in one corner of the vault.

6. A two (2) inch sump pipe routed from the corner sump above the intermediate platform with a camlock connection.
7. Construction: Valve Vaults shall be constructed of a cast-in-place reinforced concrete structure. Vault structure (walls and slabs) shall be designed to handle direct and indirect aircraft wheel loads.
8. Vault structures shall be designed as secondary containment and shall be constructed to be watertight. Provide waterproofing or dampproofing as appropriate on the exterior side of the cast-in-place vault walls. All joints in the walls and slabs in cast-in-place concrete vaults shall be equipped with fuel-resistant water stops.
9. Interior surfaces of these Vaults shall be coated with white-colored epoxy coating. The white-colored coating will aid visibility inside the vaults, while the epoxy coating will reduce permeability and enhance the fuel resistance of the secondary containment system.
10. Vaults below grade shall be designed for buoyancy conditions and provide a minimum factor of safety of 1.10 against buoyancy during construction. The critical design condition during construction shall assume an empty vault (prior to soil backfill) with an exterior water level up to the top of the surrounding grade. The final backfilled installation shall be provided with a minimum factor of safety of 1.50 against buoyancy under a fully submerged condition (with water at grade level).

ix. ROADWAY FUNCTIONAL CLASSIFICATION

A. GENERAL

1. This section presents roadway classification for the SEA roadway system. Classifications are based on SEA's road functions, relationship to adjacent road classifications in the cities of SeaTac and Burien and the Washington State Department of Transportation (WSDOT), and classification systems of other major airports.
2. Refer to Table 1 (Matrix of SEA Roadway Classifications) and Figure 1 (SEA Roadway Classifications Map) for classifications of existing SEA Landside roadways. Refer to Standard Details SD-900 to SD-906 included in these Standards (Appendix A) for typical pavement sections for each roadway classification.

B. CLASSIFICATION OF SEA ROADWAYS

1. A portion of SEA's roadway system is part of the National Highway System (NHS). This includes the southbound lanes of the Northern Airport Expressway from the state right-of-way line to the Arrivals/Departures gore point, and the northbound lanes of the Northern Airport Expressway from International Boulevard (at S 182nd Street) to the state right-of-way line. NHS routes are required to follow the design standards established by the Federal Highway Administration (FHWA). These design standards are specified in Title 23, Section 109, of the United States Code (23U.S.C.109) and includes the latest edition of the following:

   (a) AASHTO's A Policy on Geometric Design of Highways and Streets

   (b) AASHTO's Highway Safety Manual

   (c) FHWA's Manual on Uniform Traffic Control Devices (MUTCD)

2. The roadway classification system for SEA roadways combines the traditional classifications used by local municipality with special classifications specific to airports. The following are the definitions for the seven SEA roadway classifications:

   Limited-Access Principal Arterial – Provides access to the regional highway system. These streets are intended to primarily serve through traffic with limited access to abutting land use. All connections are access-controlled ramps. No direct access intersections or local driveways are allowed. No pedestrian or bicycle access allowed.

Terminal Frontage Road – Provides access to passenger drop-off and pick-up locations at a terminal or similar facility.

Minor Arterial – Connect to Limited-Access Principal Arterials with limited spacing of local street intersections and driveways. Typically includes pedestrian and bicycle facilities.

Collector Arterial – Distributes trips between local streets and arterials. Prioritizes local access over through traffic. Includes pedestrian facilities.

Industrial Access – Primarily provides direct access to abutting industrial land uses, with very low to no through traffic movement. May have high proportion of truck traffic. Typically includes pedestrian facilities.

Parking Access – Primarily provides direct access to abutting parking facilities, with very low to no through traffic movement. May have lower vertical clearance. Typically, does not provide access for pedestrians or bicycles.

Restricted Vehicle Service Road – Local streets that provided access for authorized vehicles only to airport-related functions and not the general public. Typically, does not provide access for pedestrians or bicycles.

Table 1: Matrix of SEA Roadway Classifications

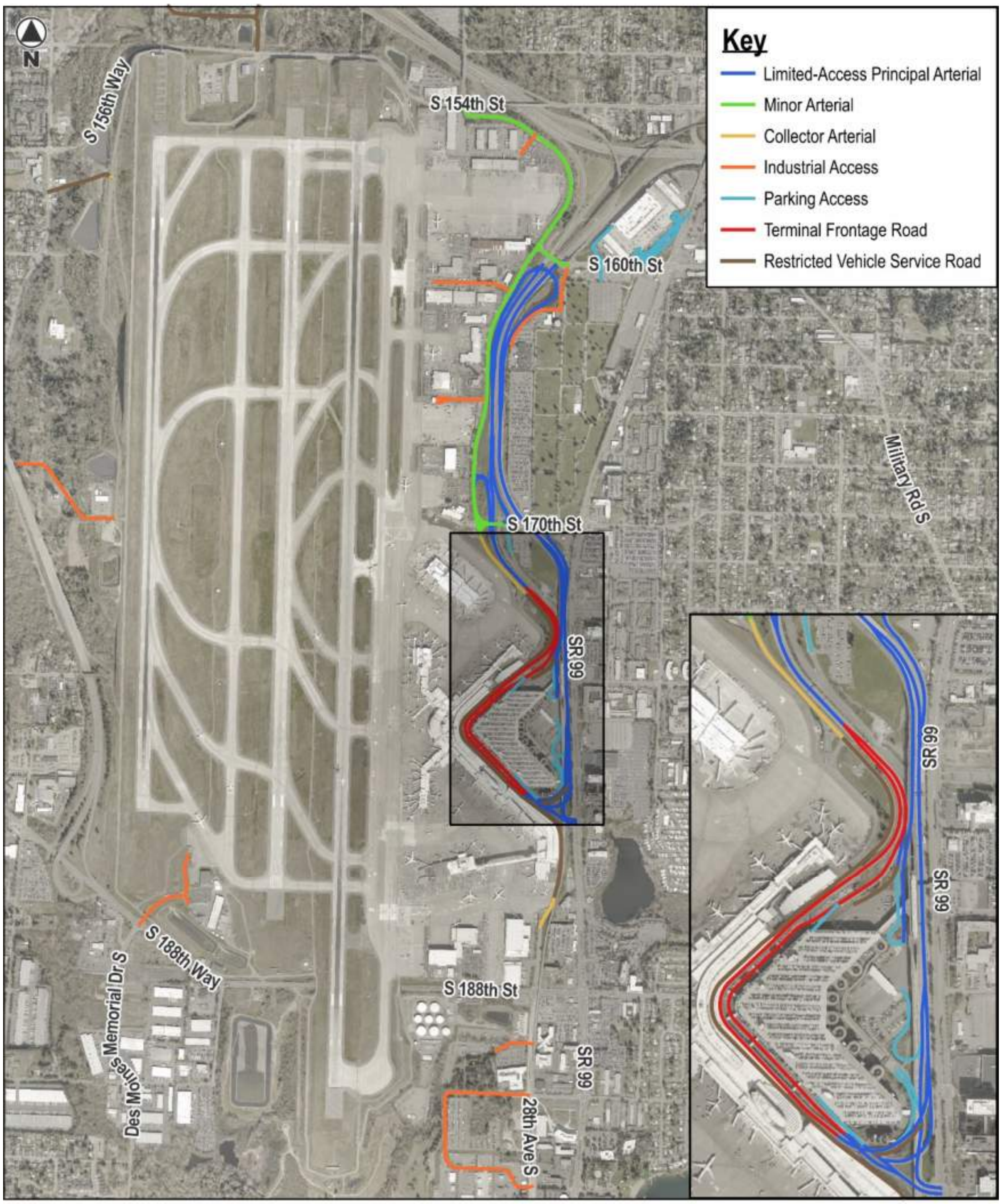
Roadway [a]	Start Point [a]	End Point [a]	Proposed Roadway Classification [b]	NHS [c] or WSDOT Freight [d] Classification
Northern Airport Expressway (southbound)	State Right-of-Way (State Route 518)	Arrivals/Departures Gore Point	Limited-Access Principal Arterial	NHS
Northern Airport Expressway (northbound)	International Blvd. (S 182nd St.)	State Right-of-Way (State Route 518)	Limited-Access Principal Arterial	NHS
Departures	Northern Airport Expressway (southbound)	Northern Airport Expressway Return Ramps	Terminal Frontage Road	
Arrivals	Northern Airport Expressway (southbound)	Northern Airport Expressway Return Ramps/ International Blvd.	Terminal Frontage Road	

Roadway [a]	**Start Point** [a]	**End Point** [a]	**Proposed Roadway Classification** [b]	**NHS** [c] **or WSDOT Freight** [d] **Classification**
Northern Airport Expressway Return Ramps (to northbound)	South end of Arrivals or Departures	Northern Airport Expressway (northbound)	Limited-Access Principal Arterial	
Air Cargo Rd	S 154th St	S 170th St	Minor Arterial	First Last Mile Connector
Air Cargo Rd	S 170th St	North Security Gate Arms	Collector Arterial	
Air Cargo Rd (Service Tunnel)	North Security Gate Arms	South Security Gate Arms	Restricted Vehicle Service Road	
Air Cargo Rd	South Security Gate Arms	SeaTac Right-of-Way (28th Ave S)	Collector Arterial	
S 156th St.	Air Cargo Rd.	Leasehold (Transiplex)	Industrial Access	
S 157th Pl.	SeaTac Right-of-Way (S 157th Pl.)	Perimeter Fence	Restricted Vehicle Service Road	
S 160th St.	Air Cargo Rd.	SeaTac Right-of-Way (Host Rd.)	Minor Arterial	First Last Mile Connector
S 161st St.	Air Cargo Rd.	Perimeter Fence	Industrial Access	
S 166th St.	Air Cargo Rd.	Perimeter Fence	Industrial Access	
S 168th St.	Burien Right-of-Way (S 168th St.)	Perimeter Fence	Industrial Access	
S 170th St.	Air Cargo Rd.	SeaTac Right-of-Way (Cell Phone Lot Road)	Minor Arterial	First Last Mile Connector
S 190th St.	28th Ave S.	Parking Lot Access	Industrial Access	
24th Ave S	S 192nd St	S 194th St	Industrial Access	
S 194th / 196th St	24th Ave S	28th Ave S	Industrial Access	
Starling Dr.	S 188th St.	Perimeter Fence	Industrial Access	

a. *Source:* Port of Seattle, *F&I Civil Roadway Information*, March 2023.
b. Proposed by Heffron Transportation, Inc., May 2023.
c. NHS = National Highway System.
d. *Source:* WSDOT, *Washington State Freight and Goods Transportation System (FGTS) 2021 Update,* December 2021.

Note: There are several access ramps or roadways to and from the Main Garage, the Consolidated Rental Car Facility, the Cooling Towers, the Cell Phone Lot, and runway clear zones that are classified in Figure 1 but are not listed in the table.

Figure 1: SEA Roadway Classifications Map



END OF SECTION

PART 1 - GENERAL

1.01 RELATED WORK

A. The provisions and intent of the Contract, including the General Conditions, Supplementary Conditions and General Requirements, apply to this work as specified in this section.

B. All of the work covered by this Section is to be conducted within the Air Operations Area (AOA) at Sea-Tac International Airport. Restrictions and conditions necessary to maintain airfield and aircraft safety as required by FAA regulations and as required to maintain efficient airport operations may impose limitations upon the Contractor's methods and procedures. Section 01140 – Operational Safety on Airports During Construction lists the applicable conditions, limitations and regulations.

1.02 DESCRIPTION OF WORK:

A. This section covers removal of jet fuel lines, fuel hydrants and related fittings and materials, construction procedures, codes and standards for the complete removal of the fuel lines to the construction limits shown on the drawings. Complete removal shall include, but not be limited to, inerting, cold cutting, slinging, lifting, asbestos handling, and hauling to a specific destination. The fuel lines and fuel hydrants to be removed are as indicated on the drawings.

B. Exterior corrosion coating may be present on fuel lines. Where present, this coating is expected to be Coal Tar Enamel (CTE), which may contain asbestos fibers. If CTE coating is encountered, stop work and notify the Engineer. The Port will test the coating to determine if asbestos-containing fibers are present. If present, the Port will perform abatement activities in accordance with the provisions of Section 01631 - Pollution Prevention Planning and Execution, and the Contractor shall implement the asbestos management provisions contained in the Contractor's approved Fuel Line Removal Plan described in Paragraph 1.04 of this section. The Contractor shall allow 72 hours in each work area for testing and abatement, if required, of fuel lines in each work area.

C. The removal effort under this section shall be accomplished without damage to adjacent facilities and other features to remain. All damage to existing facilities to remain in the final project shall be repaired as directed by the Engineer at the Contractor's expense.

D. Soil excavation, hauling, backfilling, and site restoration is covered under Section 02111 – Soil Handling in Contaminated Areas and Section 02330 – Excavation and Embankment (FAA).

1.03 JOB CONDITIONS

A. The fuel line to be removed under this section is shown on the drawings and may have an exterior coal tar enamel (CTE) coating containing asbestos fibers. Fuel lines are not expected to contain asbestos fibers.

1.04 SUBMITTALS

A. Fuel Line Removal Plan

1. Submit to the Engineer a detailed description of the pipeline removal and abandonment procedures and schedule. This plan shall include but is not limited to the following:

    a. Pipe cutting procedure (Cold Process).

    b. Inerting.

    c. Slinging and lifting methods and equipment.

    d. Hauling equipment.

    e. Spill prevention procedures during draining and slurry installation.

    f. Contractor's plan to respond to the discovery of pipes with asbestos-containing CTE coating. Contractor's plan shall be consistent with the requirements of Section 01631 – Pollution Prevention Planning and Execution.

B. Fuel Line Removal Schedule:

1. Prepare and submit a Fuel Line Removal Schedule a minimum of five working days prior to the start of fuel line removal activities. The schedule shall include detailed scheduling for excavation and fuel line removal activities. The RE must approve the schedule before work can proceed.

1.05 REFERENCE STANDARDS

A. Applicable Standards: Comply with applicable provisions of the following unless otherwise indicated or specified.

1. American Society for Testing and Methods (ASTM): ASTM A234/A234M-15 Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

2. Code of Federal Regulations (CFR)

   a. 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response

   b. 29 CFR 1910.1200 - Hazard Communication

PART 2 - PRODUCTS

2.01 CAPS

A. Buttweld caps shall conform to ASTM A234/A234M-15, grade B and ASME B16.9-2012 of the same wall thickness as the adjoining pipe.

2.02 BACKFILL

A. Backfill of excavations required for demolition of fuel lines shall be control density fill (CDF) meeting the requirements of Section 02330 – Excavation and Embankment.

PART 3 - EXECUTION

3.01 GAS FREE CONDITIONS

A. All operations in the construction area, where fuel or fuel vapor is present in the system, that involve open flames, welding or the possibility of arcing or sparking shall be conducted in a “Gas Free” condition as defined by below 10% LEL (Lower Explosive Level). These operations shall include, but not be limited to, the following:

   1. Use of internal combustion engines equipped with UL approved spark and flame eliminators.

   2. Use of electric motors or electric devices with arcing brushes or sliding contact that could produce arcing or sparking.

   3. Use of tools which may produce impact sparks.

   4. Electric or gas welding.

   5. Use of cutting or other torches or other open flame equipment.

   6. Use of equipment with hot surfaces or glowing elements.

   7. Use of open flame cutting and other equipment or procedure that could create a fire hazard.

3.02 REMOVAL OF FUEL LINES

A. Cut, remove, haul, and dispose of fuel line piping for removal in accordance with the approved Fuel Line Removal Plan.

B. Monitor the use and suitability of the equipment and procedures on the job and maintain a safe noncombustible “Gas Free” condition when necessary during construction.

C. Install a welded pipe cap on the pipe end not removed.

D. Prior to commencing any phase of the work requiring a “Gas Free” condition, perform the following:

1. Verify the condition of fuel pipes content prior to removing caps, or blind flanges. Empty pipes containing fuel and purge of all vapors.

2. Isolate, blank off, and adequately ventilate open piping sections so that no part containing fuel vapors is exposed.

3. The Contractor may use dry nitrogen or dry ice to attain the “Gas Free” condition.

4. Perform all other precautions necessary to insure that these operations are conducted in a safe manner in accordance with all applicable codes.

5. Provide two 150-pound fire-extinguishing bottles on wheeled carts, Type ABC dry chemicals.

6. Utilize an approved combustible gas analyzer or detector to ensure no combustible gas concentrations exist in the construction area when performing these operations.

3.03 CUTTING AND INERTING

A. Cutting, welding, and inerting of the fuel lines shall be in accordance with the approved Fuel Line Removal Plan.

B. The cutting process shall be a cold cut process. No hot-type cutting processes will be accepted.

3.04 DISPOSAL

A. Dispose of all fuel lines removed at an approved offsite facility.

END OF SECTION **335243.14**

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Utilities demolition and abandonments not owned and operated by Port of Seattle shall be executed in accordance with the rules and regulations of the Public Utility District providing service. All utility infrastructure owned and operated by the Port of Seattle shall be demolished and/or abandoned in accordance with requirements included in this section.

B. All utilities, except those to remain in service, shall be demolished and completely removed, not abandoned in place, regardless of depth or size, unless specifically approved by Port Facilities and Infrastructure. Piping shall be removed to the limits of site work and capped or plugged. Piping to be plugged shall be filled with concrete for a minimum of two diameters of pipe. Backfill excavations from demolition with Gravel Borrow meeting the requirements of this Standards Section as described below. Demolition of the existing utilities shall be phased as required to have the storm drain, industrial waste and sanitary sewer systems operational at all times.

C. Where specifically approved for abandonment in place by Port Facilities and Infrastructure, pipes shall be abandoned in place by plugging or capping as described above in paragraph 1.01.B above and by filling the pipe to refusal with Controlled Low Strength Material (CLSM).

D. All existing foundations, inlets, catch basins, manholes, or portions of other items within work limits, except those to remain in service, shall be removed to at least 10 feet below the top of the finished grade. The interior openings of any remaining portion of structures (e.g., manholes or catch basins) shall be completely filled with Controlled Low Strength Material (CLSM) to the removal elevation. The remaining excavation shall be backfilled with Gravel Borrow.

E. Where water main branch lines are demolished, the branch line tee at the main line shall be removed and replaced with a section of pipe matching the main line diameter.

1.02 SUBMITTALS

NOT USED

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

B. American Society for Testing and Materials (ASTM) D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods

C. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 312333 Utility Trenching and Backfill

PART 2 – PRODUCTS

2.01 GRAVEL BORROW

A. Gravel Borrow shall meet the requirements of Section 312333 Utility Trenching and Backfill.

2.02 CONTROLLED LOW STRENGTH MATERIAL

A. Controlled Low Strength Material (CLSM) shall meet the requirements of Section 312333 Utility Trenching and Backfill.

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and backfill in accordance with ASTM D6938 requirements.

B. CLSM Testing: See Section 312333 Utility Trenching and Backfill for CLSM testing requirements.

C. Where pipes are approved to be abandoned in place, the amount of required CLSM to fill the abandoned pipe to refusal shall be calculated and compared to the delivery ticket quantities of the actual CLSM utilized. The two quantities shall be within 10-percent of each other or the pipe shall be removed in its entirety.

END OF SECTION

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 passive cathodic protection systems that use magnesium] [zinc] anodes to protect [iron and steel piping] [and] [tanks] from corrosion.

B. The Work shall consist of design, furnishing, installing and testing of new cathodic protection systems for new or existing underground fuel piping as required per this Section and the project Specifications and Drawings.

C. Section includes passive cathodic protection systems that use magnesium anodes to protect metallic fuel piping. Impressed current systems may be considered for design with approval by SEA Project Manager.

D. The Contractor shall furnish all labor, equipment and materials necessary to complete the installation of the cathodic protection system. Work may include and is not limited to removal of existing cathodic protection systems and providing proper electrical isolation for the pipeline.

E. The galvanic or sacrificial anode system provides protective current to metals by electrically coupling the metal to be protected with another metal that appears higher in the electromotive force series. This sets up a galvanic coupling, because the medium in which both metals are contained acts as an electrolyte. The metal of higher potential becomes the anode, and sacrificially corrodes to protect installations such as piping or tanks that act as the cathode. The return path for current is through an electrical connection between the anode and the cathode. When sufficient current flows through the electrolyte to suppress all local action currents on the protected metal, cathodic protection is complete. This type system requires no external power supply; it uses sacrificial anodes.

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design, supervise, test, and inspect the installation of cathodic protection systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Design cathodic protection for pipelines according to NACE RP0169.

B. Sacrificial anode systems may be used only where current requirements are low. Minimum negative polarized potential between structure and Cu/CuSO4 reference electrode shall be 0.85 volts.

C. Survey site and determine soil or water corrosivity (resistivity), current requirements, potential surveys, stray currents, and water chemistry/corrosivity (pH).

D. Select anodes and accessories relevant to level of protection. Design anodes for an estimated life of twenty (20) years before replacement. Provide a twenty (20) year design life for the deep ground bed system

E. Cathodic protection systems shall provide protective potential that complies with referenced NACE standards. Insulators are required if needed to insulate protected metals from other structures.

F. The drawings are diagrammatic and indicate the general arrangement of electrical work. Locations are approximate and shall be subject to minor modifications as dictated by field conditions and as directed by SEA Project Manager.

G. Deliver sufficient current to the facilities and systems to be protected and distribute this current so that the criterion for cathodic protection is efficiently attained.

H. Minimize the interference currents on neighboring underground structures.

I. Provide adequate allowance for anticipated changes in current requirements with time.

J. Placement of anodes where the possibility of disturbance or damage is minimal.

K. The cathodic protection system shall protect all metallic surfaces presently being installed and providing for expansion capabilities for future installed items.

L. Provide sufficient test stations to check the system's performance.

M. Provide sufficient test stations to check the system's performance.

N. Cathodic protection shall be provided for, but not limited to the following structures:
   1. Metallic pipelines and pipeline appurtenances.

O. All systems protected shall be bonded, and be electrically continuous.

P. All surfaces to be cathodically protected shall be coated in conformance to mechanical standards.

Q. Stray currents will be avoided.

R. Contractor Responsibilities: The function of the cathodic protection system shall include the following:

   1. Recognition of hazardous conditions prevailing at the site and the selection and specification of materials and installation practices in conformance with these standards and which will assure the safe installation and operation of the cathodic protection system.
   2. Perform a pre engineering field survey consisting of determining or measuring the following characteristics of the electrolyte and the structures to be protected:

      a. Collect and compile soil tests with provision for future testing, as required.
      b. Resistivity of the electrolyte.
      c. Structure to electrolyte potential (if new installation, base requirement. on design calculations, field tests can only be run on existing structures).
      d. Cathodic protection current requirements.
      e. Electrolyte characteristics such as variations and water content of soils, salinity and oxygen content of water, and maximum and minimum temperature.
      f. Proximity of structure to be protected to other structures.
      g. Compile characteristics of pipe coatings utilized.
      h. Source of magnitude of stray currents including free electricity from electrical transmission lines and. strong RF fields, if any.

   3. Locations of isolation between the protected structure and other metallic structures.
   4. Electrical continuity test requirements for the metallic structures and lines that are to be protected, if available.
   5. Compliance with specification of materials and installation practices which will assure dependable operation throughout the intended operating life of the cathodic protection system.
   6. Prepare suitable drawings to designate the over all layout of the piping or other structures to be protected and the location of significant items of structure hardware, corrosion control test stations, electrical bonds, electrical insulators, and neighboring buried or

submerged metallic structures.

7. The locations of galvanic anode installations shall be recorded on drawings or in tabular form, with appropriate notes as to anode type, weight, spacing, depth, and backfill.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including manufacturer's name and product number, and materials, apply to this Section.

   1. Manufacturers product data sheet.

   2. Include data substantiating that materials comply with requirements.

B. Shop Drawings and Calculations: For cathodic protection, include plans, evaluations, sections, details, and attachments to other work.

   1. Detail locations of cathodic protection equipment, devices, with characteristics and cross-references to products.
   2. Include cathodic protection design calculations and details of anode designs.
   3. Include labeling and identifying scheme for wires, cables, and test boxes.

C. Delegated-Design Submittal: For cathodic protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified corrosion engineer responsible for their preparation.

   1. Conduct site tests necessary for design, including soil resistivity, close-interval potential surveys and testing during construction.

D. Coordination Drawings: Include plans and sections to show cathodic protection assembly layouts and relationships between components and adjacent structural and mechanical elements.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer. Submit evidence of current license, corporate authorization (if applicable) of the engineering business, and NACE certifications.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Basic system operation, outlining the step-by-step procedures required for cathodic protection survey’s including pipe-to-soil potential measurements and electrical isolation checks.
2. Instructions for dielectric connections, interference and sacrificial-anode bonds; and precautions to ensure safe conditions during repair of pipe or other metallic systems. Instructions shall be neatly bound.
3. Locations of all anodes, test stations, and insulating joints.
4. Structure-to-reference cell potentials as measured during the tests required by "Field Quality Control" Article.
5. Recommendations for maintenance testing, including instructions for pipe-to-reference cell potential measurements and frequency of testing.

B. Post-Installation Report:

1. A report, prepared by the design consultant and contractor, shall be issued to the SEA Project Manager, which will include all data obtained, analysis of data, record drawings, an Operations and Maintenance Manual and any further recommendations. Report shall include but not limited to: electrical isolation testing and pipe-to-soil survey at each test station.

C. As-Built Plans: Submit complete as-built plans of all Work, including interface with other Work, in accordance with requirements as specified in Section 013300 "Submittal Procedures".

1.07 QUALITY ASSURANCE

A. Corrosion Engineer Qualifications: The Contractor shall retain qualified professional engineer who has education and experience in cathodic protection of buried and submerged metal structures and has NACE accreditation or certification as a Corrosion Specialist or Cathodic Protection Specialist.

B. The designer of the cathodic protection system shall be a personnel trained in cathodic protection sciences under a registered Professional Engineer with cathodic protection and corrosion prevention expertise or a NACE certified Corrosion Specialist. The design shall be signed and sealed by a Professional Engineer.

C. Testing Agency Qualifications: Testing agency as a member company of the International Electrical Testing Association that is acceptable to authorities having jurisdiction.

    1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise on-site testing.

D. Source Limitations: Obtain enclosed cathodic protection components through one source from a single manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect anodes from exposure to rain, snow and direct sunlight.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace permanent reference electrodes that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Minimum twenty (20) years for sacrificial anode system.

1.10 CONSTRUCTION WASTE MANAGEMENT

A. Construction waste shall be managed in accordance with provisions of Section 017419 "Construction Waste Management and Disposal". Documentation shall be submitted to satisfy the requirements of that Section.

PART 2 - PRODUCTS

2.01 MAGNESIUM ANODES, TYPE II

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Corrpro Companies, Inc.
   2. Cott Manufacturing Company.
   3. CPMasters, Inc.
   4. ELTECH Systems Corporation USA; Anode Technologies Group.
   5. Farwest Corrosion Control Company.
   6. Loresco International.
   7. MATCOR.
   8. or approved equal.

B. Comply with ASTM B 843.

C. Chemical composition as percent of weight shall be as follows:
   1. Aluminum: 0.010 maximum.

2. Manganese: 0.50 to 1.3.
3. Zinc: 0.05 maximum.
4. Silicon: 0.50 maximum.
5. Copper: 0.02 maximum.
6. Nickel: 0.001 maximum.
7. Iron: 0.03 maximum.
8. Other Impurities: 0.05 each; 0.3 maximum total.
9. Magnesium: Remainder.

D. Anode Core: Galvanized steel with anode wire silver-soldered to the core. Connection shall be recessed and epoxy insulated for 600-V rating. Connection shall be covered with heat-shrinkable tubing, and insulation shall be extended over connection.

E. Anode Wires: Factory-installed cables, with copper conductors, suitable for direct burial; not less than No. 10 AWG with Type THWN insulation according to ASTM D 1248 and NEMA WC 70/ICEA S-95-658; long enough to extend to accompanying junction box without splicing.

F. Anode Backfill: Backfill materials packaged in water-permeable fabric sack or cardboard container. Anodes shall be factory installed in packaged backfill using methods that result in dense packing of fill with factory-installed anode spacers to ensure centering of anode in packaged anode backfill. Backfill material shall have the following chemical composition by weight:

1. Hydrated Gypsum: 75 percent.
2. Bentonite Clay: 20 percent.
3. Anhydrous Sodium Sulfate: 5 percent.

2.02 MAGNESIUM/MANGANESE ALLOY ANODES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Corrpro Companies, Inc.
2. Cott Manufacturing Company.
3. CPMasters, Inc.
4. ELTECH Systems Corporation USA; Anode Technologies Group.
5. Farwest Corrosion Control Company.
6. Loresco International.
7. MATCOR.
8. or approved equal.

B. Chemical composition as percent of weight shall be as follows:

1. Aluminum: 0.01 maximum.
2. Manganese: 0.50 to 1.3.
3. Copper: 0.02 maximum.
4. Nickel: 0.001 maximum.
5. Iron: 0.03 maximum.
6. Other Impurities: 0.05 each; 0.3 maximum total.
7. Magnesium: Remainder.

C. Bare Anode Weight: Anode weight and dimensions based on design calculations.

D. Anode Wires: Factory-installed cables, with copper conductors, suitable for direct burial; not less than No. 10 AWG with Type THWN insulation according to ASTM D 1248 and NEMA WC 70/ICEA S-95-658; long enough to extend to accompanying junction box without splicing.

E. Anode Backfill: Backfill materials packaged in water-permeable fabric sack or cardboard container. Anodes shall be factory installed in packaged backfill using methods that result in dense packing of fill with factory-installed anode spacers to ensure centering of anode in packaged anode backfill. Backfill material shall have the following chemical composition by weight:

1. Hydrated Gypsum: 75 percent.
2. Bentonite Clay: 20 percent.
3. Anhydrous Sodium Sulfate: 5 percent.

2.03 ZINC ANODES FOR BURIED SERVICE, TYPE Z-1

A. Use: Zinc anodes conforming to the following chemical analysis may be considered only if the use of magnesium anodes is completely unworkable in areas of low soil resistivities (less than 900 ohm-centimeter). The use of zinc anodes shall be required to be approved by SEA Project Manager.

B. Retain this article for protection of buried copper pipe and devices.

C. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain first paragraph and list of manufacturers below. See Section 016000 "Product Requirements."

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Corrpro Companies, Inc.
2. Cott Manufacturing Company.
3. CPMasters, Inc.
4. ELTECH Systems Corporation USA; Anode Technologies Group.

5. Farwest Corrosion Control Company.
6. Loresco International.
7. MATCOR.
8. or approved equal.

E. Comply with ASTM B 418, Type II.

F. Chemical composition as percent of weight shall be as follows:

1. Aluminum: 0.005 maximum.
2. Cadmium: 0.003 maximum.
3. Iron: 0.0014 maximum.

G. Zinc: Remainder.Bare Anode Ingot Weight: Anode weight and dimensions based on design calculations.

H. Anode Wires: Factory-installed cables, with copper conductors, suitable for direct burial; not less than No. 10 AWG with Type THWN insulation according to ASTM D 1248 and NEMA WC 70/ICEA S-95-658; long enough to extend to accompanying junction box without splicing.

I. Anode Backfill: Backfill materials packaged in water-permeable fabric sack or cardboard container. Anodes shall be factory installed in packaged backfill using methods that result in dense packing of fill with factory-installed anode spacers to ensure centering of anode in packaged anode backfill. Backfill material shall have the following chemical composition by weight:

1. Hydrated Gypsum: 75 percent.
2. Bentonite Clay: 20 percent.
3. Anhydrous Sodium Sulfate: 5 percent.

2.04 PERMANENT REFERENCE ELECTRODES

A. The system shall be equipped with at one reference electrode for each test station, coper copper sulfate (Cu/CuSO4) suitable for direct burial. Electrode shall be guaranteed by supplier for min. forty (40) years' service in the installed environment. One electrode shall be installed in a location expecting minimum protection and the other in a location expecting maximum protection.

2.05 WIRE AND CABLE

A. Anode Header Cable: Single-conductor, Type HMWPE, insulated cable specifically designed for direct-buried dc service in cathodic protection installations.

1. Conductor: Stranded, annealed, uncoated copper, not less than No. 8 AWG, complying with ASTM B 3 and ASTM B 8.
2. Insulation: High-molecular-weight polyethylene, complying with NEMA WC 70/ICEA S-95-658.
3. Minimum Average Thickness of Insulation: 110 mils (2.8 mm) for Nos. 8 through 2 AWG, and 125 mils (3.2 mm) for Nos. 1 through 4/0 AWG; rated at 600 V.
4. Connectors: Exothermic welds.

B. Conductors and Cables: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

1. Bonding Conductors for Joint and Continuity Bonds: Not less than No. 8 AWG, stranded, Type THWN copper conductors.
2. Flexible Pipe Coupling Bonds: Flexible copper straps with electrical resistance equal to No. 1/0 AWG stranded copper wire and with five holes for five exothermic welds to pipe.
3. Test Wires: No. 12 AWG, Type THWN copper conductors.
4. Resistance Wires: No. 16 or No. 22 AWG nickel-chromium wire.
5. Cables for Installation in Conduit: Type THWN copper conductors.

C. Where several anodes are connected to one header cable, compute the allowable voltage drop in that cable. Select the cable size in accordance with standard electrical engineering practice. Directly buried conductors should be properly insulated to prevent current leakage, and of a sufficient size to prevent mechanical damage.

D. All lead wire conductors shall be exothermic welded at splices and to protected surfaces, and sealed with a protective coating.

E. All cad welded pipeline leads will include two wires to the test stations to allow for the loss of one line during the life of the installation.

F. Splicing underground cables should be avoided where possible. Necessary splices be made with manufactured, UL. approved, splice kits.

G. The DC conductors shall be run in rigid conduits of a size large enough to accommodate 1/0 cable or #8 AWG cable to the anodes to a depth of at least 18" below grade. DC conductors below 18" may be run direct buried. All conduits shall be terminated in the ground with a plastic bushing.

H. The negative DC lead from the rectifier units shall be connected to the protected structure by a exothermic weld connection. The connection shall be coated with a heavy coat of coal tar enamel, or equal with a plastic backfill shield installed over that.

I. All underground pipe joints, except welded joints, shall be electrically bonded using a #2 AWG HMWPE insulated conductor, exothermic welded to each pipe section, and all component parts except bolts.

2.06 TEST STATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Corrpro Companies, Inc.
2. Cott Manufacturing Company.
3. CPMasters, Inc.
4. Cavotec Dabico Inc.
5. or approved equal.

B. Flush-mounted Test Stations: Flush-mounted type for concrete pavement installation, rated for aircraft wheel loads, manufactured of high-impact-resistant PVC or polycarbonate or fiberglass with watertight conduit connections and cover and removable terminal board having at least five terminals. Test Station Mounting Enclosures:
1. Traffic-Area Boxes: Comply with requirements in Section 260543 "Underground Ducts and Raceways for Electrical Systems." Boxes shall have cast-iron covers with a welded bead legend "CP TEST."

C. POTENTIAL STATIONS

1. This subject pertains to those situations where direct and uninterrupted surface contact to the soil surrounding the cathodically protected structure is not available. Examples include piping that is under concrete, piping that is below an environmental geomembrane, piping that is below coarse grade materials (such as gravel) that are not part of the electrolyte body, and above ground storage tank bottoms that have cathodic protection applied. Easy replacement of reference electrodes in the above mentioned location must be addressed in the design of the referenced electrode’s installation. Elimination of the access problem for replacement through the use of test stations that allow access to native soil should be used where possible.

2. Potential stations located in areas with soil surface shall consist of a precast concrete housing, which is open at the bottom and shall be furnished with a cast iron traffic cover marked CP on the top of the cover. The station shall be filled to within 3 inches of its top with clean soil.

2.07 SEALING, POTTING, AND DIELECTRIC COMPOUNDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chase Corporation - Chase Specialty Coatings; Royston Business Group.
2. Chase Corporation - Chase Specialty Coatings; Tapecoat Business Group.
3. Farwest Corrosion Control Company.
4. 3M; Electrical Products Division.
5. or approved equal.

B. Sealing and Dielectric Insulating Compound: Comply with NACE RP0188. Black, rubber based, soft, permanently pliable, tacky, moldable, and unbacked; 0.125 inch (3 mm) thick.

C. Potting Compound: Comply with NACE RP0188. Cast-epoxy, two-package type; fabricated for this purpose and covered with heat-shrinkable tape.

D. Pressure-Sensitive, Vinyl-Plastic Electrical Tape: Comply with UL 510.

2.08 EXOTHERMIC WELDING MATERIALS

A. Exothermic Weld Kits: Specifically designed by manufacturer for welding materials and shapes required.

B. Exothermic Weld Caps: Dome of high-density polyethylene, 10-mil (0.254-mm) minimum thickness, filled with mastic and containing a tunnel portion to separate lead wire from exothermic weld.

2.09 COATING REPAIR MATERIALS

A. Touchup Coating Materials: Comply with requirements in Section 099600 "High-Performance Coatings" for coating systems for touchup of factory-applied coatings.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install at the locations shown on drawings for anodes and provide for symmetrical spacing to obtain uniform current distribution. Low, poorly drained areas are generally good locations for anodes and are highly desirable for efficient anode operation. Locate anodes in areas having the lowest resistance and nearest those points where corrosion has been determined to be the most severe; space anodes not closer than four (4) feet from the protected structure and space a minimum of twenty (20) feet from foreign structures. Place anodes at a depth that is below the bottom of the structure to be protected. For protection of tank interior or other structure where rod type magnesium anodes are not practicable, zinc anodes can be mounted directly on, but separated by an insulating strip form, the surface of the steel to be protected.

B. Comply with ANSI/IEEE C2 and NFPA 70.

C. The cathodic protection equipment installation is to be sequenced and scheduled with other work to reduce possibility of damage and soiling of equipment during the remainder of construction period.

D. Field Measurements: Verify existing dimensions by field measurements. Verify clearances and locate obstructions within manufacturing and installation tolerances of cathodic protection equipment.

E. Make connections to ferrous pipe using exothermic welding.

F. Coat welds with the coating repair material and apply an exothermic weld cap.

3.02 MAGNESIUM ANODE INSTALLATION

A. Install magnesium anodes at locations that clear obstructions. Install at least 36 inches (900 mm) and no more than 10 feet (3 m) from pipe to be protected. Install in augered holes with top of anode 24 inches (600 mm) **below pipe invert elevation**. In soils that will collapse into augered holes, use casing of galvanized sheet steel.

B. Install anodes in a dry condition after plastic or waterproof protective covering has been completely removed from water-permeable permanent container that houses anode metal. Anodes shall be lowered into holes by rope sling or by grasping the cloth gather. Do not use anode-connecting wire for lowering anode into hole.

C. Packaged galvanic anodes shall be wetted and then backfilled with compacted native soil. Where anodes and special chemical backfill are provided separately, anodes shall be centered in special backfill that would be compacted prior to backfilling with native soil. Care should be exercised so that lead wires and connections are not damaged during backfill operations. Sufficient slack should exist in lead wires to avoid strain.

D. Backfill annular space around anode with fine earth in 6-inch (150-mm) layers; compact each layer using hand tools. Do not strike anode or connecting wire during backfilling and compacting. After backfilling and compacting to within 6 inches (150 mm) of finished grade, pour approximately 5 gal. (20 L) of water into each filled hole. After water has been absorbed by earth, complete backfilling to finished level.

E. If rock strata are encountered before achieving specified augured hole depth, install anodes horizontally at depth at least as deep as bottom of pipe to be protected.

F. Install anodes spaced as indicated, **connected through a test station** to the pipeline, allowing slack in connecting wire to compensate for movement during backfill operation.

G. Do not use resistance wires to reduce current output of individual or group anodes.

3.03 ZINC ANODE INSTALLATION

A. Retain this article if retaining zinc anodes in Part 2, and only if approved by SEA Project Manager. This article is typical for protection of domestic copper water tubing of limited lengths, usually under concrete slabs-on-grade, and should be revised to suit other copper piping and applications.

B. Install zinc anode horizontally in a hole at least 3 inches (76 mm) larger than anode. Install anode under new copper water tubing, including service lines, blowoffs, and air releases. Separate piping and anode by at least 24 inches (600 mm), but not more than 60 inches (1520 mm).

C. Install anode midway between both ends of piping. Install anode wire in piping trench and connect to piping at an accessible location. Install anode wire in PVC conduit where rising out of the ground to the aboveground connection.

3.04 INSTALLATION OF REFERENCE ELECTRODES

A. Install directly beneath the buried metallic component being protected or as shown in standard details.

3.05 CABLE AND WIRE INSTALLATION

A. Install conductors, except anode wires, in PVC conduit with waterproof PVC junction boxes. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for conduit and its installation.

B. Anode Wire Installation: Cover trench bottom for the anode wire with 3-inch (76-mm) layer of sand or stone-free earth. Center wire on backfill layer and do not stretch or kink the conductor. Place backfill over wire in layers not exceeding 6 inches (150 mm) deep, and compact each layer. Use clean fill, free from roots, vegetable matter, and refuse. Place cable underground-line warning tape within 18 inches (460 mm) of finished grade, above cable and conduit.

C. Bonding Conductors: Install conductors on metallic pipe, to and across buried flexible couplings, mechanical joints, and flanged joints except at places where insulating joints are specified. Welded and threaded joints are considered electrically continuous and do not require bonding.

1. Install at least two bonds between parts requiring bonding.
2. Bonding conductors must contain sufficient slack for anticipated movement between structures. Bonding conductors across pipe joints shall have not less than a 4-inch (100-mm) slack for pipe expansion, contraction, and soil stress.
3. Connect bonding conductors to pipe, coupling follower rings and coupling middle ring or sleeve. Connect bonding conductors with exothermic welds.

D. For wire splicing, use compression connectors or exothermic welds.

3.06 TEST STATIONS

A. Install test stations as follows:

1. At max. 1000-foot (300-m) intervals.
2. At insulating joints.
3. At both ends of casings when casing material is included in the cathodic protection system.
4. Where pipe crosses within 6" of other metal pipes.
5. Where pipe connects to existing piping system.
6. Where pipe connects to dissimilar metal pipe.
7. At all insulating underground joints (bond site).
8. Where a carrier pipe is used under roads, railroads, etc.
9. For sacrificial anodes added to the fuel system.

B. Test stations will not be required within 300' of a riser pipe or any place where the pipe may be readily accessible.

C. Install test stations on backfill complying with requirements for trench bottom fill for anode wires unless otherwise indicated.

D. Terminate test conductors on terminal boards and install a spare set of test leads at each testing location.

E. Test stations consist of a weatherproof NEMA: terminal box, with removable cover, test lead wires and five terminals, installed approximately 3 feet above surface. Limit above grade test stations to protected areas only.

F. Test station conductors shall be minimum #12 AWG HMWPE insulated, color coded as required.

G. Test stations shall be labeled with coded identification and shall be carefully located.

3.07 PIPE JOINTS

A. Insulating Flange Sets: Cover flanges with sealing and dielectric compound.

B. Insulating Unions: Install electrical isolation at each building entrance and at other locations indicated on approved Delegated-Design Drawings. Cover unions with sealing and dielectric compound.

3.08 DISSIMILAR METALS

A. Underground Dissimilar Piping: Coat insulating joint and pipe at joints of dissimilar piping material with sealing and dielectric compound for a minimum distance of 10 pipe diameters on both sides of joint.

B. Underground Dissimilar Valves: Coat dissimilar ferrous valves and pipe with sealing and dielectric compound for a minimum distance of 10 pipe diameters on both sides of valve.

C. Aboveground Dissimilar Pipe and Valves: If dissimilar metal pipe joints and valves are not buried and are exposed only to atmosphere, coat connection or valve, including pipe, with sealing and dielectric compound for a minimum distance of three pipe diameters on both sides of junction.

3.09 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify anode wires and anode header cables with marker tape.
2. Identify underground wires and cables with underground-line warning tape.
3. Identify text boxes with engraved, laminated acrylic or melamine label, permanently attached to text box.

3.10 FIELD QUALITY CONTROL

A. Comply with NACE RP0169 and NACE RP0285.

B. Testing Agency: Engage a qualified testing agency with NACE Corrosion Specialist or Cathodic Protection Specialist to perform tests and inspections.

C. Perform tests and inspections.

   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:
   1. Insulation Testing: Before anode system is connected to **pipe**, test insulation at each insulating joint and fitting. Demonstrate that no metallic contact, or short circuit, exists between the two insulated sections of **pipe**. Replace defective joints or fittings. Perform electrical isolation testing between pipe and structures (vaults) to ensure pipe is insulated from reinforcing steel at penetrations.
   2. Bonding Tests: Test for electrical continuity across all bonded joints. Repair or add additional bonds until electrical continuity is achieved.
   3. Baseline Potentials: After backfilling of pipe and anodes, but before anodes are connected to **pipe**, measure the static potential of **pipe** to soil. Record initial measurements.
   4. Anode Output: Measure electrical current as anodes or groups of anodes are connected to **pipe**. Use a low-resistance ammeter or high impedance volt meter with a properly sized shunt. Record current, date, time, and location of each measurement.
   5. **Pipe-**to-Reference Electrode Potential Measurements: On completion of installation of entire cathodic protection system, make electrode potential measurements according to NACE RP0169, using a copper/copper-sulfate reference electrode and a potentiometer-voltmeter, or a dc voltmeter with an internal resistance (sensitivity) of not less than 100,000 ohms per volt and a full scale of 1 or 2 V. Make measurements at same locations as those used for baseline potentials. Record voltage, date, time, and location of each measurement, using one of the following two methods:

      a. Passing Criterion - 0.85 V Negative Voltage: With cathodic system in operation, measure a negative polarized voltage of at least minus 0.85 V between **pipe** and a saturated copper/copper-sulfate reference electrode contacting the earth directly over **pipe**.

E. Location of Measurements for Piping: For coated piping or conduit, measure from reference electrode in contact with the earth directly over pipe. Measure at intervals not exceeding 400 feet (120 m). Make additional measurements at each distribution service riser, with reference electrode placed directly over service line.

F. Retain test in first paragraph below if there is a possibility of adverse effects from foreign pipes and tanks.

G. Interference Testing: Test interference with cathodic protection from any foreign pipes and tanks in cooperation with Owner of foreign pipes and tanks. Report results and recommendations.

H. Stray Current Measurements: Perform at each test station. Mitigate stray currents due to lightning or overhead ac power transmission lines as provided for in NACE standards.

I. Inspect coatings; comply with NACE RP0188. Repair imperfections of factory-applied coatings as specified in "Coatings" Article.

1. Use electronic holiday detectors to detect coating imperfections.
2. All damage to the protective coating during transit and handling shall be repaired before installation.
3. Repair factory-applied coatings to have equal or better corrosion resistance than the factory-applied coating system. Field-repair material shall be of the type approved by, and shall be applied as recommended by, manufacturer of the coating material.

3.11 Periodic Inspection

A. During the first year after Substantial Completion, test, and inspect cathodic protection system every three months to ensure its continued compliance with specified requirements.

3.12 DEMONSTRATION

A. Contractor to engage a factory-authorized service representative to assist Contractor and train SEA maintenance personnel to test, operate and maintain cathodic protection system.

B. Schedule training with Owner, through SEA Project Manager, with at least seven (7) days advance notice.

PART 4 - END OF SECTION 264200

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Utility Trenching and Backfill shall conform to the Standard Details (Appendix A) and the below specifications.

B. Trench and excavation safety systems shall meet the following referenced requirements:

1. RCW Chapter 49.17 WISHA.
2. WAC 296-155 Safety Standards for Construction Work.
3. RCW Chapter 39.04.180 Public Works/Trench Excavations - Safety Systems Required.
4. Port of Seattle Master Guide Specification Section 315000 Trench Safety Systems (edited to suit project requirements).

C. Utility trench/excavation shall be as follows:

1. Trench and Excavation Safety System shall be implemented on all other excavations in excess of 4 feet in depth conforming to the referenced requirements.
2. Design process shall incorporate site survey and utility potholing. Site survey shall be completed prior to 30% design. A pothole plan shall be submitted with 30% design, and the pothole survey shall be completed prior to the 60% submittal. All utility crossings shall be potholed to determine the horizontal and vertical location during the design process, no later than 60% design. All potholing shall be by hand digging or vacuum excavation and completed to minimize pavement damage.
3. The Contractor's trench/excavation safety system shall be designed and stamped by a professional engineer licensed in the State of Washington; professional engineer's license shall be current and active at the time of the design and use of the safety system put in place.
4. All excavation not included in trench and excavation safety systems shall also meet the WISHA safety standards.
5. Restoration of surfaces shall be included. This shall include restorations of all paved surfaces per the Port of Seattle standards, such as full panel replacement of concrete panels located within the AOA.

6. Open trenches that will be exposed to cross traffic shall be steel plated in accordance with WSDOT Standard Specification Section 1-07.23(1)B or as directed by F&I or Design Engineer. Steel plates are not allowed over trenches parallel to traffic.

D. Utility Clearances

1. Protect and support existing utilities to remain. Adequate separation shall be provided per Table 1: Vertical and Horizontal Utility Clearance Requirements below, and in accordance with Standard Detail SD-006. When adequate separation between proposed and existing utilities/structures cannot be provided, notify F&I which utilities cannot achieve adequate clearances and submit a variance request for F&I review. If approved by F&I, install Polyethylene plastic foam (Ethafoam) to fill the separation between utilities.

2. Utilities crossing over cathodic protection (i.e. jet fuel) that cannot meet clearances will need cathodic protection per Section 2.05.

Table 1: Vertical and Horizontal Utility Clearance Requirements

<table>
<tr><th colspan="2" rowspan="2">Vertical Utility Minimum Clearance Table*</th><th colspan="11">Top Utility</th></tr>
<tr><th>Water</th><th>Sewer (DI)</th><th>Sewer (non metal)</th><th>IWS/SD (DI)</th><th>IWS/SD (non-metal)</th><th>Gas (HDPE)</th><th>Jet Fuel</th><th>Comm</th><th>Electrical</th><th>Comm (Concrete encased)</th><th>Electrical (Concrete encased)</th></tr>
<tr><th rowspan="11">Bottom Utility</th><td>Water</td><td>1</td><td>prohibited</td><td>prohibited</td><td>prohibited</td><td>prohibited</td><td>1</td><td>prohibited</td><td colspan="4" rowspan="7">1</td></tr>
<tr><td>Sewer (DI)</td><td>1.5</td><td colspan="5" rowspan="5">1</td><td>2</td></tr>
<tr><td>Sewer (non metal)</td><td>2</td><td>1</td></tr>
<tr><td>IWS/SD (DI)</td><td>1.5</td><td>2</td></tr>
<tr><td>IWS/SD (non-metal)</td><td>1.5</td><td>1</td></tr>
<tr><td>Gas (HDPE)</td><td>1</td><td>1</td></tr>
<tr><td>Jet Fuel</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>1</td><td>2</td></tr>
<tr><td>Comm</td><td colspan="6" rowspan="4">1</td><td>2</td><td>1</td><td>1.5</td><td>1</td><td>1.5</td></tr>
<tr><td>Electrical</td><td>2</td><td>1.5</td><td>1</td><td>1.5</td><td>1</td></tr>
<tr><td>Comm (Concrete encased)</td><td>2</td><td>1</td><td>1.5</td><td>1</td><td>1.5</td></tr>
<tr><td>Electrical (Concrete encased)</td><td>2</td><td>1.5</td><td>1</td><td>1.5</td><td>1</td></tr>
<tr><td colspan="13">*All values in feet.</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">Horizontal Utility Minimum Clearance Table*</th><th colspan="11">New Utility</th></tr>
<tr><th>Water</th><th>Sewer (DI)</th><th>Sewer (non metal)</th><th>IWS/SD (DI)</th><th>IWS/SD (non-metal)</th><th>Gas (HDPE)</th><th>Jet Fuel</th><th>Comm</th><th>Electrical</th><th>Comm (Concrete encased)</th><th>Electrical (Concrete encased)</th></tr>
<tr><th rowspan="11">Existing Utility</th><td>Water</td><td>5</td><td>10</td><td>10</td><td>10</td><td>10</td><td colspan="6">5</td></tr>
<tr><td>Sewer (DI)</td><td colspan="11" rowspan="4">10</td></tr>
<tr><td>Sewer (non metal)</td></tr>
<tr><td>IWS/SD (DI)</td></tr>
<tr><td>IWS/SD (non-metal)</td></tr>
<tr><td>Gas (HDPE)</td><td rowspan="6">5</td><td colspan="4" rowspan="6">10</td><td colspan="6" rowspan="6">See Note 1</td></tr>
<tr><td>Jet Fuel</td></tr>
<tr><td>Comm</td></tr>
<tr><td>Electrical</td></tr>
<tr><td>Comm (Concrete encased)</td></tr>
<tr><td>Electrical (Concrete encased)</td></tr>
<tr><td colspan="13">*All values in feet.</td></tr>
</table>

Note 1: Contact F&I for clearance requirements.

E. Utility Trench Restoration

1. Restoration of a trench within an asphalt pavement shall include crushed surfacing material and HMA (the same thickness as the existing asphalt pavement or a minimum of 2 inches, whichever is greater) in accordance with the applicable Standard Details (Appendix A) included in these Standards. Pavement shall then be

overlaid full width with a minimum of 2.0 inches compacted HMA. Exceptions to this overlay requirement will be granted only through variance, subject to approval by the Port of Seattle, after considering the pre-construction condition, damage caused by construction, and rating of the pavement. Any concrete pavement traffic lane affected by the trenching shall have all affected panels replaced.

2. The restoration shall include but is not limited to repairing failures and cracking of the paved surface, repairing damages caused by the construction activity, rebuilding the cross slope to uniformity, and overlaying the area where the pavement was removed.
3. Pavement restoration shall be designed in accordance with the applicable Sections and Standard Details (Appendix A) included in these Standards.

1.02 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, WSDOT QPL Certification and installation instructions for all products.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) B843 Standard Specification for Magnesium Alloy Anodes for Cathodic Protection

B. American Society for Testing and Materials (ASTM) C33 Standard Specification for Concrete Aggregates

C. American Society for Testing and Materials (ASTM) C150 Standard Specification for Portland Cement

D. American Society for Testing and Materials (ASTM) C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

E. American Society for Testing and Materials (ASTM) C989 Standard Specification for Slag Cement for Use in Concrete and Mortars

F. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

G. American Society for Testing and Materials (ASTM) D4832 Standard

Test Method for Preparation and Testing of Controlled Low Strength Material Test Cylinders

H. American Society for Testing and Materials (ASTM) D6103 Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)

I. American Society for Testing and Materials (ASTM) D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods

J. American Society for Testing and Materials (ASTM) G57 Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four Electrode Method

K. American Society for Testing and Materials (ASTM) G187 Standard Test Method for Measurement of Soil Resistivity Using the Two-Electrode Soil Box Method

L. NACE International SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems

M. NACE International SP0286-2007 (formerly RP0286), Electrical Isolation of Cathodically Protected Pipelines

N. Revised Code of Washington (RCW) Chapter 39.04.180 Public Works/Trench Excavations - Safety Systems Required

O. Revised Code of Washington (RCW) Chapter 49.17 Washington Industrial Safety and Health Act

P. Washington Administrative Code (WAC) 296-155 Safety Standards for Construction Work

Q. Washington State Department of Transportation (WSDOT) Standard Specifications (current edition)

PART 2 – PRODUCTS

2.01 PIPE BEDDING

A. Utility bedding material shall be from a source that has WSDOT QPL Aggregate Source Approval, and shall be crushed rock or gravel meeting the following requirements:

Crushed Surfacing Top Course

Sieve Size	Percent Passing
3/4”	99-100
½″	80-100
No. 4	46-66
No. 40	8-24
No. 200	10.0 max.
% Fracture	75 min.
Sand Equivalent	40 min.

1. Pipe bedding shall consist of aggregate base compacted to 95% of maximum density as determined by ASTM D1557.
2. The fracture requirement shall be at least one fractured face and will apply to the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.
3. The portion of pipe bedding material retained on a No. 4 sieve shall not contain more than 0.15 percent wood waste.
4. The pipe bedding material shall be uniform in quality and substantially free from wood, roots, bark, and other extraneous material. Recycled concrete aggregate manufactured from hardened concrete mixtures is not allowed for use as crushed surfacing top course. Recycled concrete aggregate used for crushed surfacing top course is prohibited. Other recycled material such as Hot Mix Asphalt, Recycle Glass, Steel Furnace Glass and others are also prohibited.

2.02 PIPE BACKFILL

A. **Under pavement or within 10 feet of pavement:** backfill to subgrade with Controlled Low Strength Materials (CLSM), also known as controlled density fill (CDF). The CLSM Mix Design shall be as follows:

1. CLSM shall be designed to achieve a 28-day compressive strength between 100 psi to 200 psi for airfield FAA, and between 50 psi to 300 psi for landside, when tested in accordance with ASTM D4832. There should be no significant strength gain after 28 days.

2. The Contractor shall submit, to the Engineer, a mix design including the proportions and source of materials, admixtures, and dry cubic yard batch weights. The mix shall contain a minimum of 50 pounds of cement with the remainder of the volume composed of cementitious materials (fly-ash or ground granulated blast furnace slag), sand, water, and any approved, certified admixtures.
3. The mix shall be flowable, self-leveling and compacting with an unsegregated flow of 6 to 8 inches when tested in accordance with ASTM D6103.
4. Portland cement shall conform to requirements of ASTM C150 - Type I and II or ASTM C595 - Type IP, IS, and IL. If for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.
5. Fly ash shall conform to ASTM C618, Class C or F
6. GGBF Slag cement shall conform to ASTM C989, Grade 100 or Grade 120
7. Fine aggregate (sand) shall conform to requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces performance characteristics of the CLSM specified herein will be accepted, provided the gradation meets the following criteria:

Sieve Size	Percent Passing by Weight
¾ inch	100
No. 200	0-12

8. Water used in mixing shall be potable, free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product. Dyes and other methods of coloring the backfill material may be incorporated if desired.
9. Exceptions to this backfill requirement for landside utilities not located directly underneath pavement but still within 10 feet of pavement will be granted only through variance, subject to approval by the Port of Seattle.

B. **Under non-paved areas and greater than 10 feet from pavement,** trench backfill shall be with fine, readily compactible soil, granular material selected from the pipe excavation, common excavation areas or Gravel Borrow meeting the following requirements:

Gravel Borrow

Sieve Size	Percent Passing
4″	99-100
2″	75-100
No. 4	50-80
No. 40	30 max.
No. 200	7.0 max.
Sand Equivalent	50 min.

1. The material, regardless of origin, shall not contain frozen lumps, stones, chunks of highly plastic clay, or other objectionable material larger than 2 inches. The backfill material shall be compacted in layers not exceeding 12 inches to at least 95% of maximum density as determined by ASTM D1557. Contractor shall submit a WSDOT QPL Certificate for imported backfill material.

2. Recycled material such as Hot Mix Asphalt, Concrete Rubble, Recycle Glass, Steel Furnace Glass and others are prohibited.

2.03 UTILITY WARNING TAPE AND LOCATE WIRE

A. Utility Locate wire shall be:

1. Thermoplastic insulated, nylon sheathed, heat, moisture, oil, and gasoline resistant 600 volt stranded copper type THHN AWG size No. 10.

2. Electrical splicing by 3M Direct Bury Splice Kit DBR/Y, or approved equal.

3. Utility locate wire tag shall be non-corrosive metal or plastic tag with a permanent stamped label reading “Locate.”

B. Underground Marking Tape: Inert polyethylene plastic, 4-millimeter thickness, and impervious to alkalis, acids, chemicals reagents and solvents likely to be encountered in the soil, with metallic foil core to provide most positive detection. Tape width shall be recommended by manufacturer, but must be at least 4-inches in width. Message should convey type of line buried below with the word "CAUTION". Color coding of tape follows:

Utility	Color
Water	Blue
IWS, Sewer and Storm Drain	Green
Electrical	Red
Communication	Orange
Gas, Oil and Jet Fuel	Yellow
Non-potable Water and Irrigation	Purple

2.04 PLASTIC FOAM (ETHAFOAM)

A. Polyethylene plastic foam (Ethafoam) used in underground utility separation must be Dow Ethafoam 220, min 2.5 inch thickness. .

B. The width of the pad used in underground utility separation shall be based on the outside diameter (O.D.) of the larger crossing pipe. The length of the pad used in underground utility separation shall equal the width or as indicated on the plans.

C. Polyethylene plastic foam (Ethafoam) used for separation between new and existing utility structures and their respective frame and cover shall be sized as shown in SD- 111 Utility Structure in Portland Cement Concrete and SD-112 Modification to Existing Utility Structure in PCCP.

2.05 CATHODIC PROTECTION SYSTEM

A. Perform at least one soil resistivity measurement per 1,000 lf of new pipe, and not less than 2 per project. Perform Soil resistivity measurements in accordance with ASTM G57 or ASTM G187.

B. Metallic pipe shall have cathodic protection system when soil resistivity measurements are less than the following thresholds:

1. Steel pipe: 10,000 ohm-cm
2. Ductile iron pipe: 2,000 ohm-cm

C. Design cathodic protection system in accordance with NACE SP0169.

1. Review existing metallic pipes for existing cathodic protection in the vicinity of new metallic pipes

2. Connect anodes to pipelines through flush mounted test stations; anodes shall not be connected directly to pipeline.
3. Flush Mounted Test station
    a. Furnish lid with letters "TS" or words "Test Station" cast into lid.
    b. Test Boards: 1/4-inch thick phenolic panel, NEMA Grade LE for electrical use under wet conditions.
    c. Provide permanent plastic labels with pipe size and type engraved onto label. Attach with adhesive adjacent to each test wire.
    d. Anode Metering Shunts: 0.1 ohm Holloway type, 2 ampere capacity, with 1 percent accuracy.
    e. Utility Box: Shall be below-ground flush-mounted in accessible rated hand hole per Section 334241.
    f. Provide 3-ft erosion control pad around test station if not located in paved area.
4. Anodes shall be pre-packaged; bare anodes shall not be used. Anodes shall be standard potential magnesium, in accordance with ASTM B843, and shall have a minimum design life of 15 years.
    a. Prepackaged backfill shall be composed of:
        i. Ground Hydrated Gypsum: 75 percent.
        ii. Powdered Wyoming Bentonite: 20 percent.
        iii. Anhydrous Sodium Sulfate: 5 percent.
5. Prepackaged Copper-Copper Sulfate Reference Electrodes:
    a. Permanent type, copper-copper sulfate reference electrode suitable for direct burial with a minimum design life of 15 years. Provide wire with sufficient length to extend from reference electrode to test station.

D. Wire Insulation: HMWPE

E. Insulating Flanges:

1. Full-face Type E gaskets with elastomeric sealing element.
2. NEMA G-10 grade insulating sleeves and washers.

F. Insulating blanket:

1. Insulating blanket shall be 1/8" neoprene or butyl insulating material.

PART 3 – EXECUTION

3.01 PREPARATION FOR EXECUTION OF WORK

A. Prior to start of excavation contractor shall have designed, submitted and received approval from the engineer for Trench Safety Systems per Port of Seattle Master Guide Specification Section 315000 Trench Safety Systems (edited to suit project requirements).

B. Trench safety systems shall be installed as required during excavation.

3.02 EXECUTION OF WORK

A. Trench excavation shall be per Port of Seattle Master Guide Specification Section 310000 Earthwork (edited to suit project requirements).

B. Pipe bedding shall be placed per section 2.01 above with an Underground Pipe. Pipe bedding shall be compacted to 95% of maximum density as determined by ASTM D1557.

C. Pipe backfill shall be per section 2.02 above. When non-CDF pipe backfill is used it shall be compacted to 95% of maximum density as determined by ASTM D1557.

D. Utility warning tape and locate wire shall be installed per section 3.04 below.

E. Pavement shall be restored per the plans and the Port of Seattle standards.

F. ACP Trench patching shall be sealed on all sides with a pigmented asphalt sealant approved by the Design Engineer.

3.03 CLSM TRENCH DAMS

A. Install 5 feet of CLSM in lieu of utility bedding and trench backfill at locations indicated on the utility plan sheets. If none are shown, provide at a maximum spacing of 500 feet of pipe length.

3.04 UTILITY WARNING TAPE AND LOCATE WIRE

A. Install utility warning tape and locate wire along the full length of all utilities:

1. Install utility warning tape along the top of the trench per the Pipe

Bedding and Trench Backfill Detail SD-004 in a manner that will avoid damaging the tape during back filling or compaction of the trench.

2. Install utility locate wire along the top of the utility in a manner that will avoid damaging the wire during back filling or compaction of the trench.
3. Splice new utility locate wires into existing utility locate wires at tees or other locations where the utilities connect. Splices or repairs shall be made with pre- manufactured epoxy splice kit suitable for the intended application and installed in accordance with manufacturer's recommendations.
4. Bring the locate wire up inside each manhole, catch basin, vault, valve box, handhole, pull box, clean-out, or similar structure along the route of the utility. Terminate the wire for each utility entering the structure as shown on the standard details.
5. Permanently attach utility locate wire tags between 2 and 6 inches from the end of the wire.
6. Where utilities enter a building, bring locate wire to grade level 5 feet from the building and install in a water valve type box or equal.

3.05 CATHODIC PROTECTION SYSTEM AND TEST STATIONS

A. All metallic pipe shall be installed with test stations.

B. All joints of metallic pipe, except those joints to be welded, threaded, or designated as insulated, shall be electrically bonded as appropriate for joint type per STIA F&I Standard Details (Appendix A). Provide joint bonds of sufficient length such that the bonds are not under tension.

C. Electrically isolate new metallic pipe from existing metallic pipe, existing metallic pipe with cathodic protection system, structures, and electrically grounded equipment using dielectric unions, flanges or couplings per STIA F&I Standard Details (Appendix A).

D. Provide cathodic protection system per STIA F&I Standard Details.

E. Installation locations and spacing to be determined by corrosion engineering professional in accordance with NACE SP0169.

F. The following Cathodic Protection Test Stations shown in STIA F&I Standard Details (Appendix A) shall be located as follows:

1. Determine location of test stations based on actual site conditions. Test station shall be located outside of the traveled way, safely accessible without traffic control.
2. Insulating blanket is required at metallic pipe crossings when one or both pipes have cathodic protection and the separation distance is 24-inches or less.
3. Test Wires: Use thermite weld process for all electrical connections of wires to steel and ductile iron pipe and fittings.
4. Flush Mounted Test Station Type FF-R: At the crossing of two metallic pipes.
5. Flush Mount Test Station Type FT-RA: As required to provide cathodic protection meeting criteria in NACE SP0169.
6. Flush Mounted Test Station Type FC-R: At both ends of cased crossings.
7. Flush Mounted Test Station Type FI-R: At buried insulated joints.

PART 4 – TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and non-CLSM backfill in accordance with ASTM D6938 requirements.

B. Locate Wire: Test wire to verify the installed locate wire is continuous with no breaks.

C. CLSM Shall be tested in accordance with the following requirements:

1. CLSM shall achieve a 28-day compressive strength of 100 minimum to 200 pounds per square inch maximum for airfield FAA, and between 50 psi to 300 psi for landside, tested in accordance with ASTM D4832.
2. Unless otherwise approved by Port, flow shall be between 6 inches and 8 inches when tested in accordance with ASTM D6103.

D. Cathodic Protection System

1. Electrical Continuity Testing
    a. Test electrical continuity on buried joints that are required to be bonded. Test after bonds are installed but before backfilling of pipe.

2. Insulated Joint Testing
    a. Test each joint after assembly with insulator tester in accordance with manufacturer's written instructions. For insulating flanges, test and record insulating values of each bolt in addition to the completed flange. Replace damaged or defective insulating parts.
3. Cathodic Protection
    a. Test cathodic protection system for adherence to protection criteria in accordance with NACE SP0169.

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Pavement Section

1. Following criteria shall be consider when designing pavement section Design:
    a. Roadway Functional Classification
    b. Pavement Type
    c. Pavement Design Life
    d. Volume and Characteristics of Traffic
    e. Subgrade Soils
    f. Frost Action
2. See STIA F&I Civil System Standard General Provision VIII for Roadway Functional Classification designation on SEA's roadway.
3. There are two primary pavement types: flexible pavement/asphalt concrete pavement (ACP) and rigid/Portland cement concrete pavement (PCCP).
4. There are three factors to be consider for pavement type selection: design analysis (expected long-term settlement), life cycle cost analysis, and project specific details.. Pavement type selection process is required if project needs to consider rigid (PCCP) pavement. Refer to WSDOT Pavement Policy Chapter 4 – Pavement Type Selection and WSDOT Pavement Policy Figure 4.1 Pavement Type Selection Flow Chart for pavement type selection procedures.
5. Implementation of porous pavement will be evaluated on a case-by-case basis and approval/acceptance from POS F&I is required.
6. Pavement design life of flexible pavement (ACP) shall be 50-years for Limited-Access Principal Arterial and 20-years for all other roads.
7. Pavement design life of rigid pavement (PCCP) shall be 50-years all Landside roadways.
8. The Standard pavement section shall be per applicable Standard Details SD-900 to SD-906 for standard design parameters with

geotechnical and traffic data confirmation.

9. Standard Details SD-900 to SD-906 are minimum pavement sections.
10. Pavement sections design for other facilities, such as low-impact design, bus stops, and parking lots, shall be prepared by a licensed professional civil or geotechnical engineer registered in the State of Washinton and accordance with the AASHTO Guide for Design of Pavement Structures with geotechnical analysis and design documentations.
11. Custom pavement sections design shall be required in the area that do not meet the standard design parameters specified in Standard Detail SD-900 to SD-906, or that require non-standard design parameters due to unusual conditions. Custom pavement section design shall be prepared by a licensed professional civil or geotechnical engineer registered in the State of Washington. These conditions may include unusual subgrade soil conditions in the Port of Seattle area, extremely weak subgrade soil conditions, high heavy vehicles volume, or heavy traffic volume. The design shall be in accordance with the AASHTO Guide for Design of Pavement Structures and with geotechnical analysis and design documentations.

B. Side Slopes

1. Side slopes shall be constructed no steeper than 2:1 on both fill and cut slopes. Steeper slopes may be approved by the Port of Seattle Engineer upon showing that steeper slopes, based on soil analyses, will be stable.
2. Side slopes shall be stabilized by grass sod, seeding, other planting, or surfacing materials acceptable to the Port of Seattle Engineer.

C. Standard Above Ground Utility Locations within the Right-of-way

1. Utility poles or other approved essential roadside obstacles may be placed within the right-of-way only as follows:
   a. Poles and above ground utility shall be located outside of clear zone and as far back from the traveled way as practicable. See Roadside Design Guide, AASHTO, 2011 for clear zone requirements.

b. If placing poles and above ground utility outside of clear zone is not possible, roadside safety devices, such as traffic barriers, bridge barriers, transitions, impact attenuators, and breakaway devices, may be installed to mitigate the specific roadside condition.

c. Poles and above ground utility may not unreasonably interfere with the use of the right-of-way by the Port of Seattle, the general public, or other authorized person.

d. Poles or above ground utility shall be located behind existing ditches. Placement of barrier between the traveled way and the pole or above ground utility is not acceptable unless the barrier already exists for other purposes and the pole provides a minimum of 5' separation from the barrier or unless allowed by an approved variance. Variances will be considered only when other reasonable alternatives do not exist.

e. On roads with sidewalk, poles or above ground utility shall be placed clear of sidewalks and at least 8.5 feet from face of curb areas. The Port of Seattle Engineer must approve placement of utility poles and other essential roadside obstacles structures within planter strips.

f. No poles or above ground utility shall be located so that it poses a hazard to the general public. Utilities shall place and replace poles with primary consideration given to public safety.

g. Deviations from these pole and above ground utility clearance criteria will only be allowed through an approved variance when justified by engineering study considering traffic safety. For franchised utility permits, the Utility may request a variance from pole and obstacle clearance criteria.

h. Locations of poles and above ground utility shall avoid conflict with driveways, intersections, and other road features. Placement of poles and above ground utility shall not interfere with sight distances, road signing, traffic signals, culverts, etc. To the extent possible, utilities shall share facilities so that a minimum number of poles are needed.

D. Federal Funded Projects

1. Projects funded by federal grant shall meet additional design requirements such as those described in WSDOT Local Agency Guidelines and shall be coordinated with F&I.

E. Bicycle Facility

1. Bicycle facility includes shared use path and bike lanes. Refer to the Port of Seattle Airport Pedestrian and Bicycle Facilities Plan for potential location of bicycle facility.

2. Shared Use Path

   a. The minimum width is 10 feet for all shared use paths.

   b. Asphalt concrete pavement (ACP) is allowed for use as pavement in the design and construction of shared use pathways, and in many cases is preferred. Design Engineer shall coordinate with Port of Seattle F&I to confirm pavement types for shared use pathways.

   c. Prior to finalizing design documents, the Design Engineer shall coordinate with Port of Seattle F&I to assess if any proposed shared use pathway improvements pertaining to a project are expected to experience non-standard loads and/or high pedestrian volumes.

3. Bike Lanes

   a. The minimum width shall be 5 feet for all standard bike lane (not including gutter pan).

   b. Grated storm drainage cover shall be required in bike lane.

1.02 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, WSDOT QPL Certification and installation instructions for all products.

1.03 REFERENCES

A. Washington State Department of Transportation (WSDOT) Design Manual (Chapter 620)

B. Washington State Department of Transportation (WSDOT) Pavement

Policy (Chapter 620)

C. King County Road Design and Construction Standards

D. Washington State Department of Transportation (WSDOT) Standard Specifications (current edition)

E. AASHTO Roadside Design Guide

PART 2 – PRODUCTS – To be provided by Design Engineer

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Base course materials shall conform to the below specifications and placed in accordance with the applicable Standard Details (Appendix A).

B. The Design Engineer shall coordinate the required furnishment and installation procedures for base course materials with pavement design. See Section 321000 Landside Pavement Section Design included these Standards.

1.02 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, WSDOT QPL Certification and installation instructions for all products.

1.03 REFERENCES

A. Washington State Department of Transportation (WSDOT) Standard Specifications (current edition)

PART 2– PRODUCTS

2.01 CRUSHED SURFACING TOP COURSE (CSTC)

A. Crushed surfacing top course shall be from a source that has WSDOT QPL Aggregate Source Approval, and shall be crushed surfacing top course per WSDOT Standard Specification Section 9-03.9(3).

2.02 CRUSHED SURFACING BASE COURSE (CSBC)

A. Crushed surfacing base course shall be from a source that has WSDOT QPL Aggregate Source Approval, and shall be crushed surfacing base course per WSDOT Standard Specification Section 9-03.9(3).

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Cement concrete traffic curbs and gutters shall conform to Standard Detail SD-908 (Appendix A) and the below specifications.

B. Cement concrete pedestrian curbs (vertical curbs) shall conform to Standard Detail SD-908 (Appendix A) and the below specifications.

C. Cement concrete depressed curb and gutter shall conform to Standard Detail SD-908 (Appendix A) and the below specifications.

D. Asphalt extruded curbs shall only be used for temporary installations and/or surface water flow control measures unless approved otherwise by the Port of Seattle.

E. Concrete extruded curbs shall only be used in parking areas unless approved otherwise by the Port of Seattle. See Standard Detail SD-909 (Appendix A).

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M 213 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction

B. American Association of State Highway and Transportation Officials (AASHTO) R 100 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

C. American Association of State Highway and Transportation Officials (AASHTO) T 22 – Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens

D. American Association of State Highway and Transportation Officials (AASHTO) T 152 – Standard Method of Test for Air Content of Freshly Mixed Concrete by Pressure Method

E. American Society for Testing and Materials (ASTM) C39 – Test Method for Compressive Strength of Cylindrical Concrete Specimens

F. American Society for Testing and Materials (ASTM) C260 – Standard Specification for Air Entraining Admixtures for Concrete

G. American Society for Testing and Materials (ASTM) C666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

H. American Society for Testing and Materials (ASTM) C920 - Standard Specification for Elastomeric Joint Sealants

I. American Society for Testing and Materials (ASTM) D5249 – Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints

J. Washington State Department of Transportation (WSDOT) Standard Specifications (current edition)

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, WSDOT QPL Certification and installation instructions for all products including:

1. Concrete Mix Design

PART 2 – PRODUCTS

2.01 CONCRETE

A. Concrete for cement concrete curbs and gutters shall be air entrained concrete Class 4000 per WSDOT Standard Specification Section 6-02, except as otherwise noted in these Standards.

2.02 AGGREGATE

A. Cement concrete curbs and gutters shall be installed over a minimum four-inch section of Crushed Surfacing Top Course (CSTC) meeting the requirements of Section 321100 – Base Course.

B. Aggregate base course for curbs and gutters shall be compacted to 95% of the maximum density.

2.03 JOINTS

A. Cement concrete curbs and gutters shall have expansion joints as shown in Standard Detail SD-907A (Appendix A) included in these Standards.

1. Along terminal frontage roads only, expansion joints shall be sealed with elastomeric joint sealant meeting the requirements of ASTM C-920.

B. Expansion joint material shall be 3/8-inch pre-molded joint filler meeting the requirements of WSDOT Standard Specification Section 9-04.1.

C. Expansion joints in curbs and gutters shall be located to match the expansion joints in the sidewalk whether sidewalk is adjacent to curb or separated by planting strip.

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Cement concrete sidewalks shall conform to the Standard Details SD-907A and SD-907B (Appendix A) and the below specifications.

B. The minimum sidewalk width shall be 6 feet for all standard sidewalks.

C. Width of the sidewalk (or curbside) shall be wider than 6 feet on an as-needed basis to accommodate different levels and types of use. For example, at terminal frontage roads, sidewalks shall be 8 feet minimum and need to accommodate two-way pedestrian flows with luggage/roller bags.

D. Prior to finalizing design documents, the Design Engineer shall coordinate with Port of Seattle F&I to assess if any proposed sidewalk improvements pertaining to a project are expected to experience non-standard loads and/or high pedestrian volumes.

E. Deicer shall not be placed on concrete sidewalks until the concrete has completed its 28-day cure and has reached its specified strength.

F. When a planter strip is provided as a roadway buffer, it should have a minimum width of 3 feet from back of curb to edge of sidewalk.

G. Curb ramps shall be designed in accordance with ADA Standards for Accessible Design and WSDOT Standard Plans.

H. Deviations from sidewalk and curb ramp design requirements due to any site/project constraints will be allowed after proper review and approval in accordance with the design variance procedure described in these Standards.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M 213 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction

B. American Association of State Highway and Transportation Officials (AASHTO) R 100 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

C. American Association of State Highway and Transportation Officials (AASHTO) T 22 – Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens

D. American Association of State Highway and Transportation Officials (AASHTO) T 152 – Standard Method of Test for Air Content of Freshly Mixed Concrete by Pressure Method

E. American Society for Testing and Materials (ASTM) C39 – Test Method for Compressive Strength of Cylindrical Concrete Specimens

F. American Society for Testing and Materials (ASTM) C260 – Standard Specification for Air Entraining Admixtures for Concrete

G. American Society for Testing and Materials (ASTM) C666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

H. American Society for Testing and Materials (ASTM) C920 - Standard Specification for Elastomeric Joint Sealants

I. American Society for Testing and Materials (ASTM) D5249 – Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland Cement Concrete and Asphalt Joints

J. Washington State Department of Transportation (WSDOT) Standard Specifications (current edition)

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 – Submittals. Furnish manufacturers’ technical literature, standard details, product specifications, WSDOT QPL Certification and installation instructions for all products including the following:

1. Concrete Mix Design

PART 2– PRODUCTS

2.01 CONCRETE

A. Concrete for cement concrete sidewalks shall be air entrained concrete Class 4000 per WSDOT Standard Specification Section 6-02, except as otherwise noted in these Standards.

B. Concrete for sidewalks and curb ramps shall have a minimum thickness of 4 inches.

2.02 AGGREGATE

A. Sidewalks and curb ramps shall be installed over a minimum four inch section of Crushed Surfacing Top Course (CSTC) meeting the requirements of Section 321100 – Base Course.

B. Aggregate base course for sidewalks and curb ramps shall be compacted to 95% of the maximum density.

2.03 JOINTS

A. Cement concrete sidewalks shall have expansion and contraction joints as shown in Standard Detail SD-907A (Appendix A) included in these Standards.

1. Along terminal frontage roads only, expansion joints shall be sealed with elastomeric joint sealant meeting the requirements of ASTM C-920.

B. Expansion joint material shall be 3/8-inch pre-molded joint filler meeting the requirements of WSDOT Standard Specification Section 9-04.1.

C. Expansion joints in sidewalk shall be located to match the joints in the curb whether sidewalk is adjacent to curb or separated by planting strip.

2.04 TACTILE WARNING SURFACING

A. Tactile warning surfacing shall be meet the requirements of Section 321726 – Tactile Warning Surfacing.

2.05 CONCRETE REINFORCEMENT

A. The need for sidewalk concrete reinforcement shall be determined by the Design Engineer based on project-specific loading requirements and proposed use. The Design Engineer shall coordinate with Port of Seattle F&I as required.

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Many facilities located on Port of Seattle property have curb-return type entrances that should be designed to allow vehicles to safely turn off intersecting roadways that experience high traffic volumes.

B. Driveways shall be concrete curb-cut type driveways conforming to the below specifications.

1.02 REFERENCES

A. Washington State Department of Transportation (WSDOT) Standard Specifications (current edition)

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, WSDOT QPL Certification and installation instructions for all products including:

1. Concrete Mix Design

PART 2 – PRODUCTS

2.01 CONCRETE

A. Concrete for driveways shall be air entrained concrete Class 4000 per WSDOT Standard Specification Section 6-02, except as otherwise noted in these Standards.

B. Concrete for driveways shall be minimum 6" thick.

2.02 AGGREGATE

A. Concrete driveways shall be installed over a minimum four-inch section of Crushed Surfacing Base Course (CSBC) meeting the requirements of Section 321100 – Base Course.

B. Aggregate base course for driveways shall be compacted to 95% of the maximum density.

2.03 JOINTS

A. The expansion joints between panel segments of cement concrete driveways shall be filled to full cross-section with 3/8-inch pre-molded joint filler.

1. Along terminal frontage roads only, expansion joints shall be sealed with elastomeric joint sealant meeting the requirements of ASTM C-920.

B. Expansion joint material shall be 3/8-inch pre-molded joint filler meeting the requirements of WSDOT Standard Specification Section 9-04.1.

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Tactile Warning Surfacing shall conform to Standard Detail SD-910 (Appendix A) and the below specifications.

B. Prior to designing any tactile warning surfacing not specified below, such as architectural tactile paver blocks, the Design Engineer shall request and be granted approval from Port F&I Architecture and Port of Seattle Airport Building Department Team in accordance with the design variance procedure.

1.02 REFERENCES

A. Washington State Department of Transportation (WSDOT) Standard Specifications (current edition)

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 – Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

PART 2 – PRODUCTS

2.01 PREFABRICATED TACTILE WARNING SURFACING

A. Tactile Warning Surfacing shall be cast-in-place per WSDOT Standard Specification Section 8-14(5)B.

1. Installation by means of fasteners and/or direct surface application of the tactile surfacing onto concrete is prohibited.

B. Tactile Warning Surfacing color and material shall be per WSDOT Standard Specification Section 9-19.2.

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. The extent and location of "Anti-Climb AOA Fence" work is shown in the Contract Documents. The work includes the requirements for furnishing and installing all items and components of a completed fence system in conformance with these specifications and the dimensions and sections indicated on the drawings or as established by the Engineer.

1.02 REFERENCES

A. ASTM A121 Standard Specification for Metallic-Coated Carbon Steel Barbed Wire

B. ASTM A392 Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric

C. ASTM F626 Standard Specification for Fence Fittings

D. ASTM A641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

E. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

F. ASTM F900 Standard Specification for Industrial and Commercial Steel Swing Gates

G. ASTM F1043 Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework

H. ASTM F1083 Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

I. ASTM F2453 Standard Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated) for Meshes of 6 in.^{2} or Less, in Panels or Rolls, with Uniform Meshes

J. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus

1.03 SUBMITTALS

A. Submit materials data in accordance with of Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

B. Submittals shall include the following:

1. Technical data and product data with verification that the product conforms to the required specifications for fence panels, wire mesh, fence posts, tamperproof fasteners, brace rails, gates, wire coatings, fittings, and any other appurtenances.

2. Shop and erection drawings.

PART 2 Products

2.01 MATERIAL REQUIREMENTS

A. Fence Panels

1. The fence shall be welded wire fabric supported on a steel frame, the posts of which are embedded in concrete foundations. Barbed wire supported on brackets above the fabric portion shall be installed as indicated on the drawings. Materials

shall be industrial welded wire fencing in accordance with ASTM F1043, and ASTM F2453 with the additional requirements as follows:

a. Steel wire mesh fence panels shall be welded by resistance welding per ASTM F2453 using pre-galvanized steel wire, welded at each crossing to form rectangles. Vertical 10.5ga. (0.128 inches) minimum diameter wires shall be spaced at 3 inches maximum; horizontal 10.5ga. (0.128 inches) minimum diameter wires shall be spaced at 0.5 inches maximum.

b. The cold rolled wire shall have a tensile strength of at least 74,000 psi and shear strength of at least 68,000 psi.

c. Wire strand shall be galvanized before welded (GBW), 0.30 ounces per square foot zinc coating minimum conforming to ASTM A641.

d. An all-aluminum complete system meeting the performance criteria of the specified steel framed system is an acceptable alternative to the specified system, subject to the requirements of Section 01 33 00 - Submittals and Section 01 25 00 - Substitutions.

e. Finish shall be standard mill finish.

f. All fence framework, gates, fittings and fabric shall have vinyl, PVC, or LDPE fused and adhered onto the core materials after galvanization.

g. Core materials shall be galvanized as specified in this section.

h. Miscellaneous fittings and connections shall be vinyl, PVC, or LDPE coated after galvanization where practicable, otherwise shall be all-aluminum.

i. Hinges, latches shall be manufacturer's standard aluminum.

j. Vinyl, PVC, or LDPE coating shall have a minimum and maximum thickness of 6 mils and 10 mils, respectively, at any point.

k. Coating color shall be black. All coatings used on fence framework, gates, fittings and fabric shall match in color.

l. General: All steel fabric, framework and fittings shall be hot-dipped galvanized after fabrication in accordance with the applicable ASTM specification.

B. Framework:

1. Steel material for fence posts and rails shall be galvanized prior to forming in accordance with the requirements of ASTM A653, with minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653 with a minimum zinc coating weight of 0.90 oz/ft^2, Coating Designation G-90.

2. Framework and coating shall be in accordance with ASTM F1043 and F1083.

3. All tubular framework shall meet the following performance requirements in accordance with ASTM B117.

a. Exterior: 1000 hours with maximum 5% red rust

b. Interior: 650 hours with maximum 5% red rust

4. Tamperproof fasteners shall be used to fasten each wire mesh panel to fencing framework at intervals not exceeding 18 inches.

5. Posts: Fence posts shall be sized to accommodate 12-foot high anti-climb fencing and environmental conditions (e.g., wind loads) at SeaTac airport.

6. Fittings: All fittings, accessories and hardware for welded wire anti-climb fence shall conform to the requirements of ASTM F626 as applicable and other ASTM Designations listed therein.

C. Other Materials

1. Barbed wire shall be 2-strand 12-1/2 gauge zinc-coated wire with 4-point barbs and shall conform to the requirements of ASTM A121, Class II.

2. Concrete used in anchorage of posts shall be 2,500 psi 28-day test, standard ready-mixed concrete from an approved plant.

3. Signs:

a. All signs shall be double sided reflective signs.

b. No Trespassing signs shall be place on the AOA fence every 50 feet, and No Parking signs shall be placed on the AOA fence every 75 feet.

c. All signs shall face the non-AOA side of the fence.

D. Wildlife Deterrent Fence Skirt

1. Wildlife deterrent fence skirt shall be installed in all areas where anti-climb fencing is located over an unpaved surface. Wildlife deterrent fence skirt shall consist of chain link fence fabric that is woven with a 9-gauge galvanized steel wire in a 2 inch (50 mm) mesh and meets the requirements of ASTM A392, Class II.

E. Vertical Wildlife Deterrent Fence Skirt

1. Where shown on the plans or in areas where physical site limitations prohibit the use of the standard wildlife deterrent fence skirt described in Section 2.01.D.1 and as approved by the Engineer, wildlife deterrent fence skirt consisting of chain link fence fabric described in Specification 32 31 15 – Wildlife Deterrent Fence Skirt or anti-climb fence fabric shall be installed vertically to a depth of 3 feet below grade along the base of the anti-climb fence.

2.02 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has at least three years' experience and has completed at least five fence projects with same material and of similar scope to that indicated for this Project with a successful construction record of in-service performance.

B. Contractor shall obtain all the components of the anti-climb fencing, including but not limited to fencing, accessories, fittings, and fastenings, from the same fence manufacturer to ensure consistency in fence appearance and methods used to install and repair fence components.

PART 3 EXECUTION

3.01 PREPARATION FOR EXECUTION OF WORK

A. Clearing of the fence line will be required. Clearing shall consist of the removal and disposal of all vegetation. Clearing shall also include the removal and proper disposal of all trash and/or non-vegetative debris. The clearing width shall be approximately five feet on both sides of the fence line.

B. Grading of the fence line shall be accomplished to eliminate abrupt changes in ground contours. Grubbing incidental to grading shall be accomplished as required. Vegetation resulting from grubbing activities shall be disposed of as cleared material. Boulders, rocks, or excess excavation shall be graded along the fence line or placed adjacent to the clearing on Port of Seattle property as directed by the Engineer. If additional soil is removed during coring, the hole may be completely backfilled and compacted prior to re-excavating the hole, or the additional excavation may be overpoured with foundation concrete.

3.02 EXECUTION OF WORK

A. General

1. The location and alignment of the fence corners shall be installed as shown on the design drawings. The Contractor shall locate all intermediate line posts.
2. The Contractor shall submit shop drawings of fencing and appurtenances. Shop drawings must be approved by the Engineer prior to fabrication or installation.

B. Installation

1. Fence post shall be installed in competent, undisturbed soil.
2. Fencing and appurtenances shall be erected and installed by an organization regularly engaged in this business, employing labor skilled in this type of work to provide a complete security fencing system.
3. Wire fabric shall be fastened to all posts and cross brace rails including top, mid, and bottom rails with manufacturer recommended tamperproof fasteners spaced as indicated on the drawings and the shop drawings.
4. Wildlife deterrent fence skirt shall be fastened to the bottom wire or rail with wire ties spaced as indicated on the drawings.
5. Top rails shall be continuous. The Contractor shall provide for expansion or contraction of the continuous rail. Expansion and contraction spring couplings shall be installed at intervals of 100 feet maximum.
6. Posts shall be installed vertically in the concrete with a minimum depth of embedment indicated on the drawings and at the spacing specified for the type of posts approved for the Project. In unpaved areas, the concrete shall be struck off two inches above the surrounding grade. In paved areas it shall be struck off flush with the paving. The top of the concrete shall be troweled smooth, with a slight slope away from the posts.
7. Surfaces Repair

a. Minor damage to Vinyl, PVC, or LDPE coating shall be repaired using manufacturer's preferred method. If none exists, a method approved by the Engineer shall be used. Upon completion of the fence, the Contractor shall clean the fence of all soiled places and repair marred or abraded areas.

End of Section

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Retaining walls over 3’ in height shall be designed by a Structural Engineer, licensed in the State of Washington.

B. Retaining wall design shall meet the following referenced requirements:

1. WAC 51-50-1807 Foundation Walls, Retaining Walls and Embedded Posts and Poles
2. 2018 IBC 1807.2 Retaining Walls

C. Gabion and rockery walls require approval from the Port of Seattle.

D. When designing a retaining wall, the Design Engineer shall consider the following:

1. Functional classification
2. Highway/roadway geometry
3. Design Clear Zone requirements
4. Amount of excavation required
5. Traffic characteristics
6. Constructability
7. Impact to adjacent environmentally sensitive areas
8. Impact to adjacent structures
9. Potential added lanes
10. Length and height of wall
11. Material to be retained
12. Foundation support and potential for differential settlement
13. Groundwater
14. Earthquake loads
15. Right of way costs
16. Need for construction easements
17. Risk
18. Overall cost

19. Visual appearance

E. If the wall or toe of a reinforced slope is to be located adjacent to the right of way line, the Design Engineer shall consider the space needed in front of the wall/slope to construct it.

F. The design of a retaining wall shall consist of the following principal activities:

1. Develop wall/slope geometry.
   a. Design Engineer shall consider the following:
      i. Geometry of the transportation facility itself
      ii. Design Clear Zone requirements
      iii. Flare rate and approach slope when inside the Design Clear Zone
      iv. Right of way constraints
      v. Existing ground contours
      vi. Existing and future utility locations
      vii. Impact to adjacent structures
      viii. Impact to environmentally sensitive areas
   b. The Design Engineer shall also consider the foundation embedment and type anticipated, which requires coordination between the various design groups involved.
   c. Retaining walls are designed to limit the potential for snagging vehicles by removing protruding objects (such as bridge columns, light fixtures, or sign supports).
   d. Provide a traffic barrier shape at the base of a new retaining wall constructed 12 feet or less from the edge of the nearest traffic lane. The traffic barrier shape is optional at the base of the new portion when an existing vertical-faced wall is being extended (or the existing wall may be retrofitted for continuity). Depending on the application, precast or cast-in-place Single Slope Concrete Barrier with vertical back or Type 4 Concrete Barrier may be used for both new and existing walls except when the barrier face can be cast as an integral part of a new wall. Design analyses may be

considered, but they require approval from Port F&I. A design analysis is not required where sidewalk exists in front of the wall or in other situations where the wall face is otherwise inaccessible to traffic.

2. Provide adequate subsurface investigation.

   a. All retaining wall and reinforced slope structures require an investigation of the underlying soil/rock that supports the structure. A soil investigation is an integral part of the design of any retaining wall or reinforced slope. The stability of the underlying soils, their potential to settle under the imposed loads, the usability of any existing excavated soils for wall/reinforced slope backfill, and the location of the groundwater table are determined through the geotechnical investigation.

   b. The structural elements of the wall or slope and the soil below, behind, and/or within the structure are designed together as a system. The wall/slope system is designed for overall external stability as well as internal stability. Overall external stability includes stability of the slope. The wall/reinforced slope is a part of the local external stability (overturning, sliding, and bearing capacity). Internal stability includes resistance of the structural members to load and, in the case of MSE walls and reinforced slopes, pullout capacity of the structural members or soil reinforcement from the soil.

   c. At any location where a retaining wall or reinforced slope can be in contact with water (such as a culvert outfall, ditch, wetland, lake, river, or floodplain), there is a risk of scour at the toe. This risk must be analyzed. Contact Port F&I to determine whether a scour analysis is required.

3. Evaluate loads and pressures that will act on the structure.

   a. One of the principal causes of retaining wall/slope failure is the additional hydrostatic load imposed by an increase in the water content in the material behind the wall or slope. This condition results in a substantial increase in the lateral loads behind the wall/slope since the material undergoes a possible increase in unit weight, water pressure is exerted on the back of the wall, and the soil shear strength undergoes a possible reduction. To alleviate this, adequate drainage for the retaining wall/slope needs to be considered in the design stage and reviewed by the region Materials Engineer during construction. The drainage features shown in the Standard Plans are the minimum basic requirements. Underdrains behind the wall/slope need to daylight at some point in order to adequately perform their drainage function. Provide positive drainage at periodic intervals to prevent entrapment of water.

   b. Native soil may be used for retaining wall and reinforced slope backfill if it meets the requirements for the particular wall/slope system. In general, use backfill that is free-draining and granular in nature. Exceptions to this can be made depending on the site conditions as determined by the Geotechnical Engineer.

4. Design the structure to withstand the loads and pressures.
5. Design the structure to meet aesthetic requirements.
   a. Retaining walls and slopes can have a pleasing appearance that is compatible with the surrounding terrain and other structures in the vicinity. To the extent possible within functional requirements and cost-effectiveness criteria, this aesthetic goal is to be met for all visible retaining walls and reinforced slopes.
   b. Aesthetic requirements include consideration of the wall face material, top profile, terminals, and surface finish (texture, color, and pattern). Where appropriate, provide planting areas and irrigation conduits. These will visually soften walls and blend them with adjacent areas. Avoid short sections of retaining wall or steep slope where possible.
   c. In higher walls, variations in slope treatment are recommended for a pleasing appearance. High continuous walls are generally not desirable from an aesthetic standpoint, because they can be quite imposing. Consider stepping high or long retaining walls in areas of high visibility. Plantings may be considered between wall steps.

   d. Approval by F&I Architecture is required on all retaining wall aesthetics, including finishes, materials, and configuration.

6. Ensure wall/slope constructability.

   a. Consider the potential effect that site constraints might have on the constructability of the specific wall/slope. Constraints to be considered include but are not limited to site geometry, access, time required to construct the wall, environmental issues, and impact on traffic flow and other construction activities.

7. Coordinate with other design elements.

   a. Retaining wall and slope designs are to be coordinated with other elements of the project that might interfere with or impact the design or construction of the wall/slope. Also consider drainage features; utilities; luminaire or sign structures; adjacent retaining walls or bridges; concrete traffic barriers; and beam guardrails. Locate these design elements in a manner that will minimize the impacts to the wall elements. In general, locate obstructions within the wall backfill (such as guardrail posts, drainage features, and minor structure foundations) a minimum of 3 feet from the back of the wall facing units.

   b. Greater offset distances may be required depending on the size and nature of the interfering design element. If possible, locate these elements to miss reinforcement layers or other portions of the wall system.

   c. Where impact to the wall elements is unavoidable, the wall system needs to be designed to accommodate these impacts. For example, it may be necessary to place drainage structures or guardrail posts in the reinforced backfill zone of MSE walls. This may require that holes be cut in the upper soil reinforcement layers or that discrete reinforcement strips be splayed around the obstruction. This causes additional load to be carried in the adjacent reinforcement layers due to the missing soil reinforcement or the distortion in the reinforcement layers.

d. The need for these other design elements and their impacts on the proposed wall systems are to be clearly indicated in the submitted wall site data so the walls can be properly designed. Contact Port F&I (or Geotechnical Engineer for geosynthetic walls/slopes and soil nail walls) for assistance regarding this issue.

G. Refer to the current WSDOT Design Manual for additional guidelines and recommendations for retaining wall design.

1.02 REFERENCES

A. Washington Administrative Code (WAC) 51-50-1807 Foundation Walls, Retaining Walls and Embedded Posts and Poles

B. Washington State Department of Transportation (WSDOT) Design Manual (Chapter 730)

C. 2018 International Building Code (IBC) 1807.2 Retaining Walls

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 – Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Submit project-specific shop drawings, including engineering calculations as required.

PART 2 – PRODUCTS – To be provided by Design Engineer

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be augmented by Design Engineer

4.01 SPECIAL INSPECTION TESTING

A. Design Engineer shall develop a list of special inspections required during construction of the proposed retaining wall.

END OF SECTION

PART 1 - GENERAL

1.01 CONVEYANCE DESIGN REQUIREMENTS

A. This section covers design standards and requirements for water distribution system requirements only.

B. All water distribution systems shall be designed in conformance with the Washington State Department of Health (DOH) Water System Design Manual (2020) unless otherwise stated.

C. Engineers shall use a hydraulic analysis to determine the minimum size of transmission or distribution mains. All distribution mains shall be at least 12 inches in diameter, unless a hydraulic analysis justifies another size.

D. Distribution system pressure requirements:

1. Distribution pipelines shall be able to deliver the Peak Hourly Demand (PHD) at minimum 30 psi. Engineer shall determine required PHD.
2. Individual pressure reducing valves are required on all potable services inside mechanical rooms refer to F&I Mechanical Section Standards, unless otherwise directed by Port of Seattle (POS) Facilities & Infrastructure (F&I) Utility Department.

E. Fireflow requirements shall be determined by the POS Fire Department.

1. POS Fire Department will determine available fireflow.
2. Minimum system pressure during fireflow analysis is 20 psi at all service connections.

F. Water velocity in mains shall not exceed 5 feet per second under the peak hourly demand conditions, and shall not exceed 10 feet per second during highest demand including fireflow.

G. See STIA F&I Civil Systems Standards General Provision for Design Submittal Guidelines.

H. Pipe restraint and concrete thrust blocking for all horizontal and vertical bends, valves, tees and crosses, and changes in pipe diameter for water and fire mains:

1. Buried water distribution pipe shall be restrained joint pipe in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings.
2. Concrete thrust blocking is required in addition to restrained joint pipe. Thrust blocking shall be in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings and

STIA F&I Civil Systems Standards Appendix A - Standard Details and as directed by the Engineer.

I. Testing, disinfection and cleaning shall be in accordance with the terms of the STIA F&I Water Systems Connection Procedure Requirements and Application for Connection to Water System.

J. All water vaults (backflow assembly, pressure reducing station, water meter vault, air release valve vault, etc.) shall include designs for floor drain piping draining to daylight, or, if daylight is not feasible, to a drainage system as approved by POS F&I.

K. Outside-installed Reduced Pressure Backflow Assemblies (RPBA) shall be installed in pre-manufactured, heated, and insulated above ground enclosures. The following drain requirements shall apply to enclosures. RPBA shall not be installed in vaults. Each enclosure design shall be as approved by the POS. Floor drains for RPBA shall not connect to closed storm drain systems. All RPBA enclosures shall be provided with a bore sighted daylight drain. This bore sighted drain to daylight shall be clearly visible end to end, sized to meet the flow requirements of the RPBA relief vent. Refer to STIA F&I Mechanical System Standards for backflow prevention requirements and for Reduced Pressure Backflow Assemblies located inside a building.

L. Service connections or water distribution system piping shall not be used for grounding of electrical systems or for the maintenance, integrity or continuity of any grounding attachment or connection.

M. Manufacturer's certification of testing and accuracy shall be provided for all commercial meter installations.

N. The standard cover over water main shall be 3 feet below finished grade, except for pipe beneath pavement. Pipe located beneath pavement shall be 3 feet below the top of finished subgrade. Maximum 10 feet of cover for all water mains.

O. Designs shall be submitted to F&I to determine potential impacts to the POS water model evaluated. No installation shall occur without F&I concurrence. Submittal must include design drawings with valve location, type, and size.

P. All water distribution systems shall be designed in conformance with the latest published editions of AASHTO Standards, AWWA Standards and NFPA 24 unless otherwise stated.

Q. Pigging ports shall be required for new projects installing a minimum of 500 LF of pipe 12" or larger. Location of ports to be coordinated with POS F&I beginning at 30% design submittal WISE meeting.

1.02 VALVING DESIGN REQUIREMENTS

A. Water distribution system valves shall be in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings, STIA F&I Civil Systems Standards Section 331216 Water Valves and STIA F&I Civil Systems Standards Section 331216B Water Combination Air Valves.

B. 500-foot maximum distance between valves on distribution mains.

C. Additional valving may be required for area isolation.

D. Combination Air/Vacuum with vacuum check valves shall be installed at local high points in the water main.

E. Valves shall be installed on all legs of a tee or cross.

F. Dismantling joints shall be installed for each valve at a tee or cross. Dismantling joint shall be installed between valve and tee/cross fitting. Dismantling joint shall be sized to match adjacent pipe and appurtenance diameters.

1.03 FIRE HYDRANT DESIGN REQUIREMENTS

A. Fire hydrant number, distribution, and locations shall be in accordance with STIA F&I Section 331110 Water Distribution Systems and Section 331219 Fire Hydrants.

B. Fire hydrants shall be installed as required to provide hydrant flow to new and existing buildings. Minimum pressure at hydrant shall be 30 psi unless otherwise directed by POS Fire Department.

C. 3-foot minimum clearance shall be provided around outside of hydrant for operation. Provide 5 feet horizontal clearance from the outside of the hydrant to concrete walls, structures, utility poles and above grade electrical enclosures.

1.04 WATER STRUCTURE DESIGN REQUIREMENTS

A. Water structures shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110 Water Distribution System and the STIA F&I Standard Details – Appendix A requirements and the following requirements.

B. Aircraft-rated Water structures are required at any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass all of the Air Operations Area (AOA) at STIA, including the aprons, hardstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), and within Perimeter Road.

C. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

D. Metal castings (Frames, Covers, and Grates) for aircraft rated Water structures shall support a minimum proof load of 100,000 pounds and 250 pounds per square inch tire pressure.

E. Metal castings (Frames, Covers, and Grates) for traffic-rated (AASHTO HS-25) Water structures shall meet the requirements of the heaviest vehicles utilizing the site, or AASHTO M306 H-25/HS-25 traffic rating of 20,000 pounds per wheel and support a minimum proof load of 50,000 pounds (20,000 pounds x 2.5) on a 9-inch by 9-inch square in the center of the casting, whichever is greater. Special consideration should be given to areas inside and outside of the AOA but still utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment, and load rating shall be increased as necessary to accommodate the largest loading anticipated.

F. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways, runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration shall be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) dreat STIA have axle loadings that exceed AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology shall be utilized based upon the actual loading encountered at the site.

G. Castings shall be ductile iron. No composite castings shall be allowed.

1.05 UTILITY CLEARANCE REQUIREMENTS

A. Horizontal clearance between water mains and sanitary sewers (SS); industrial waste sewers (IWS), storm drains (SD), and petroleum pipelines shall be a minimum of 10 feet measured edge-to-edge of each pipe. Minimum horizontal clearance between water main and other utilities, including natural gas, power, telephone/fiber optics shall be 5 feet measured edge-to-edge from the pipe to utility.

B. Water services and sewer stubs shall have 10 feet separation measured edge-to-edge of each pipe.

C. Vertical clearance between water mains and other non-potable conveyance piping or utilities shall be a minimum of 18-inches at utility crossings. Water piping shall cross over other non-potable (including but not limited to IWS, Storm, Sewer systems) conveyance piping, with one full length of water pipe centered over the crossing for maximum joint separation. Refer to utility crossing details in STIA F&I Civil System Standard Details – Appendix A. Washington Department of Ecology criteria for separation and clearance will also apply.

   1. If the 18-inches minimum separation cannot be achieved, special approval from the POS F&I is required and special construction techniques to protect each utility will be required as follows:

      a. The water pipe shall be constructed of ductile iron pipe per AWWA C151, or as approved by the POS F&I. The crossings shall occur at the midpoint of full pipe length segment (18 feet minimum) of the utilities to maximize the spacing between joints.

b. The crossing utility shall be encased in CDF or installed with a casing of quarter-inch thick continuous steel, ductile iron, or pressure rated PVC pipe with a dimension ratio of 18 or less, with all voids filled with grout. The length of encasement or casing shall be 18 feet minimum.

c. The crossing utility shall be centered at the point of crossing with longest standard pipe length for maximum pipe joint separation.

D. When the design requires a non-potable conveyance system to pass over a water main, the design must be approved by POS F&I and meet all the following requirements:

1. A minimum vertical separation of 18-inches between the bottom of the non-potable utility and the top of the potable water main.
2. The water main and the non-potable conveyance pipeline must be made of ductile iron pipe meeting AWWA C151 standards.
3. The water main and the non-potable conveyance pipeline shall be encased in a pressure rated casing pipe designed to withstand a minimum static pressure of 150 psi.
4. The casing shall be 18 feet minimum and centered at the crossing to provide the maximum joint separation.
5. Backfill the space between the two casings with CDF.

E. A minimum of 5-foot horizontal clearance is required between concrete thrust blocking and other buried utilities or structures.

F. If the minimum vertical distance between utility pipes is less than 6-inches and such installation is approved by POS F&I, a pad shall be placed between the pipes. The pad dimensions shall be O.D. x O.D. x 2.5 inches thick minimum or as required to protect the pipes. Above O.D. is equal to the outside diameter of the larger pipe. The pad shall be a polyethylene foam plank (Dow Plastics Ethafoam tm 220), or approved equal. Additional measures may be necessary to ensure system integrity and may be required as evaluated by POS F&I on a case by case basis.

G. Vertical and horizontal utility clearance requirements are summarized in table form in Section 322333 Utility Trenching and Backfill.

1.06 SLOPES

A. Maximum design pipe deflection shall not exceed one-half of pipe manufacturer's recommend maximum deflection. Vertical bends shall be used when joint deflection would exceed the design pipe deflection.

B. Concrete thrust blocking is required for vertical bends and shall be in accordance with STIA F&I Civil Systems Standard Details – Appendix A.

C. Concrete anchor blocks designed by the Engineer are required for slopes 20% or greater.

D. Timber baffle/hill holders shall be required on unpaved slopes that exceed 20%, maximum spacing shall be 20' on center.

1.07 CONNECTIONS TO EXISTING SYSTEM

A. Connections to existing mains shall be made by cutting in a tee, unless otherwise approved by POS F&I. Tapping tees are not allowed.

B. When connecting to existing steel pipe, a flange shall be welded to the existing steel pipe, and new or replaced pipe shall be ductile iron pipe and fittings; new steel pipe shall not be installed.

C. Valves at connections to existing mains shall be in accordance with STIA F&I Civil Systems Standards Section 331110 Water Distribution Piping and Fittings, STIA F&I Civil Systems Standards Section 331216 Water Valves and STIA F&I Standard Details – Appendix A.

D. Connections to existing mains with a new tee or cross and connections to existing main ends, stub or end outlet of a tee or cross shall be made by installing two mechanical joint sleeves on the new water pipe segments. The pipe length between the two sleeves shall be cut to fit the required distance. "Wedding ring" or spacer pipe segments installed within sleeves shall not be allowed.

E. Deflect pipe joints of new water main piping as allowed to make connections to existing mains at different elevations. Vertical bend fittings with thrust blocks for connections to existing systems is not allowed without prior approval from POS F&I.

F. Where poured-in-place concrete thrust blocks are required at a point of connection to an existing watermain, the thrust blocking shall be installed prior to connection.

G. Cutting into or connecting pipe materials shall be accomplished without creating a dissimilar corrosion cell due to the pipe material used; insulation or corrosion protection shall be included to prevent corrosion.

H. Designer shall develop a detail at point of connection that shall be submitted as part of the STIA Application for Connection to Water System.

1.08 CROSS-CONNECTION CONTROL

A. Water systems shall be protected from contamination through cross-connections with non-potable water or other liquids conveyed through piping in accordance with Washington State Department of Health (DOH) and Washington Administrative Code (WAC) requirements.

B. Refer to STIA F&I Mechanical System Standards for cross-connection control program information and backflow prevention requirements.

C. Backflow prevention installations must be reviewed and approved by POS F&I prior to construction.

1.09 CATHODIC PROTECTION

A. All metal and steel casing pipes shall be cathodically protected in accordance with STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill Cathodic Protection Requirements.

B. All water pipe crossings with other metallic utilities where clearance between the utilities is 18-inches or less require installation of an insulating dielectric mat between the utilities.

1. Dielectric mat material and sizing shall be determined by the Engineer and shall be based on the sizing of the utilities.
2. Cathodic Protection Test Stations shall be installed at the intersection including test leads to the utilities, a permanent buried electrode and anodes for future mitigation unless otherwise directed by POS F&I. Installations at each utility crossing shall be reviewed and approved on a case-by-case basis by POS F&I.

1.10 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M199 Standard Specification for Precast Reinforced Concrete Manhole Sections

B. American Association of State Highway and Transportation Officials (AASHTO) M306 Standard Specification for Drainage, Sewer, Utility, and Related Castings

C. American Society for Testing and Materials (ASTM) C478 Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

D. American Society for Testing and Materials (ASTM) C497 Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
E. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
F. American Society for Testing and Materials (ASTM) D4101 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
G. American Society for Testing and Materials (ASTM) D4832 Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
H. American Society for Testing and Materials (ASTM) D6103 Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)
I. American Society for Testing and Materials (ASTM) D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
J. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast.
K. American Water Works Association (AWWA) C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In.Through 60 In.
L. FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes
M. National Fire Protection Association (NFPA) 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
N. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Application for Connection to Water System.
O. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Exterior Water System Connection Procedure and Requirements.
P. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 024113.23, Utility Demolition and Abandonment.
Q. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 322333, Utility Trenching and Backfill.
R. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110, Water Distribution Systems.
S. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216, Valves.

T. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216B, Water Distribution Combination Air Valves.
U. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331219, Fire Hydrants.
V. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A - Standard Details.
W. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Mechanical Systems Standards.
X. Water System Design Manual, Washington State Department of Health, December 2009.

PART 2 - PRODUCTS

2.01 GENERAL

A. Aircraft-rated structures shall meet the requirements as stated above in Paragraph 1.04 above, this Section. Concrete and reinforcement design shall be as required to support the loading design of the precast structure.
B. Steps and Ladders: Ductile iron or polypropylene covered rebar, ASTM C478, ASTM C497 and AASHTO M199. Polypropylene, ASTM D4101.
   1. Steps shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall for steps, or 3-inches from the structure wall inside the adjustment section. Steps within precast concrete structures shall be cast into the sides of the structure at the time the of manufacture or set in place after the structure is erected by drilling holes in the concrete and epoxying the steps in place. Steps shall be uniformly spaced at 12 inches and be vertically aligned
   2. Ladders shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall. Ladder shall be set in place after the structure is erected by drilling holes in the concrete and epoxying in place
C. Bedding for structures shall consist of a minimum of 6 inches (or as required for site conditions) of aggregate base compacted to 95% of maximum density as determined by ASTM D1557. The bedding shall extend a minimum of 1-foot past the structure's base in all directions for structures up to 60 inches in diameter and 2-feet past the structure's base in all directions for structures greater than 60 inches in diameter. The aggregate base material shall meet the requirements of Pipe Bedding per Seattle-Tacoma International Airport

Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching and Backfill

D. Backfill of utility structure excavations:
   1. All utility structure excavations within pavement or within 10 feet of pavement shall be backfilled with controlled low-strength material density fill (CLSM) meeting requirements of Section 322333 Utility Trenching and Backfill
   2. All utility structure excavations within unpaved areas at least 10 feet or more from any pavements shall be backfilled with a material meeting the requirements of Pipe Backfill per Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching and Backfill.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and backfill in accordance with ASTM D6938 requirements. See Spec Section 322333.
B. Contractor shall submit testing plan to engineer for review and approval.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for Water Distribution systems piping and fittings are as described in this section. All water systems shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements.

C. Piping shall be installed a minimum of 5-feet away from buildings, structures and associated foundations.

D. In the situation of a new building, structures, and associated foundations conflicting with existing piping; the existing piping system shall be relocated a minimum of 5-feet away from the new building, structures and associated foundations.

E. When construction will impact active water distribution, systems phasing, and bypass plans shall be included. Water shall not be shut off more than 5 hours at night between midnight to 5:00 AM. Any variances require approval by POS F&I and the POS Fire Department.

F. Pipe to be located under taxilanes shall be installed inside a steel casing. Diameter and wall thickness of the casing shall be determined by the design engineer.

1.02 SUBMITTALS

A. Submit materials data in accordance with Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products, including but not limited to pipe, fittings, gaskets, mechanical joint restraints, shackle rods and lugs.

B. Bypass and Phasing Plans when construction will impact active water distribution systems.

C. Calculations for thrust blocks, valve vault and manhole structures, fire flow and fire hydrant flow, and other elements requiring design calculations.

D. Hydrostatic testing plan and results for installed water pipe, valves and accessories.

E. Certification of flushing and sterilization for installed water pipe.

1.03 REFERENCES

A. American National Standards Institute (ANSI) A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
B. American Water Works Association (AWWA) C104 American National Standard for Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
C. American Water Works Association (AWWA) C110 Ductile Iron and Gray Iron Fittings.
D. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
E. American Water Works Association (AWWA) C150 Thickness Design of Ductile Iron Pipe.
F. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast.
G. American Water Works Association (AWWA) C153 Ductile Iron Compact Fittings for Water Service.
H. American Water Works Association (AWWA) C210 Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
I. American Water Works Association (AWWA) C217 Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connection and Fittings for Steel Water Pipelines.
J. National Fire Protection Association (NFPA) 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances
K. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 322333 Utility Trenching, Bedding and Backfill.
L. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216 Valves.
M. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216B Water Distribution Combination Air Valves.
N. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331219 Fire Hydrants.
O. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A – Standard Details

PART 2 - PRODUCTS

2.01 WATER DISTRIBUTION PIPE, JOINTS AND FITTINGS

A. Pipe:

1. Ductile Iron Pipe:
   a. Pipe of 3-inch diameter and larger shall be AWWA C150 and AWWA C151, thickness Class 52 minimum. Pipe class shall be increased for depth and loading conditions exceeding class 52 specifications as per manufacturer recommendations.
   b. Cement mortar lining meeting ANSI/AWWA C104/A21.4.
   c. Asphaltic coating meeting ANSI/AWWA C151/A21.51.
   d. Restrained Joints - bell and spigot push-on type pipe joint with restrained gaskets. Products:
      i. US Pipe - Tyton Joint Pipe
      ii. American - Fastite Joint Pipe
      iii. McWane Ductile - Tyton Joint Pipe
      iv. Or approved equal
   b. Restrained Gaskets rated to 350 psi and meeting requirements of ANSI/AWWA C111/A21.11. Products:
      i. US Pipe - Field Lok 350 Gasket
      ii. Romac – Piranha Restraint Gasket
      iii. American – Black Fast-Grip Gasket
      iv. Or approved equal
2. Copper Pipe:
   a. Pipe under 3-inches in diameter shall be ASTM B88 thickness class Type K Copper.
   b. No joints are allowed. End connections shall be compression couplings or pack joints.
3. HDPE
   a. Pipe under 3-inches in diameter shall be high-density polyethylene PE4710 pressure pipe for water mains meeting ANSI/AWWA C901.
   b. No joints are allowed. End connections shall be butt fused or compression couplings with internal stiffeners.

4. Pipe ends shall be capped and protected when delivered to site up until installation and kept clear of deleterious material.

B. Fittings:

1. Ductile Iron conforming to ASTM A536. Minimum pressure rating of 350 psi for pipe diameter 3 to 24 inches. Minimum pressure rating of 250 psi for pipe diameter 30 to 48 inches. Fittings shall be new and recently manufactured. Refurbished fittings are not acceptable.
2. Mechanical or Flanged Joint. ANSI/AWWA C153/A21.53 Mechanical Wedge Action Type Joint:
    i. All mechanical joints shall be restrained with manufactured bolt-on restraint system. Products:
        1. EBAA Iron Mega-Lug
        2. Romac RomaGrip
        3. Tyler Union TUF Grip
        4. Star Pipe Products Stargrip
        5. Or approved equivalent

    ii. All mechanical or flanged joints shall be pressure rated to meet the requirements listed in ANSI/AWWA C153/A21.53. Flanged fittings shall conform to ANSI B16.1, class 125 drilling pattern.
3. Cement Lining and Asphaltic Coating in accordance with ANSI/AWWA C104/A21.4
4. Rubber Gasket Joints Including Mechanical Joints, and Flanged Joints: In accordance with ANSI/AWWA C111/A21.11. Full faced flanges and gaskets to be used where available.
5. Restrained Dismantling Joints:
    a. Pressure Rating:
        i. Minimum working pressure rating shall not be less than rating of the connecting flange.
        ii. Proof testing shall conform to requirements of AWWA C219 for bolted couplings.

    b. Manufacturers and Products:
        i. Romac Industries; DJ400.
        ii. Baker Coupling Company (actual model number will vary with diameter).

iii. Viking Johnson DN 400 (actual model number will vary with diameter).

iv. Or approved equivalent.

c. Use stainless steel bolting material conforming to ASTM F593, TYP 304 stainless steel, Group 1, Condition SH1, 2, 3, or 4.

2.02 VALVES, VALVE BOXES AND EXTENSION STEMS

A. Combination air valves for water distribution systems shall be in accordance with STIA F&I Civil System Standards Section 331216B Water Combination Air Valves. Gate valves and other valves and valve boxes and extension stems shall be in accordance with STIA F&I Civil System Standards Section 331216 Valves.

B. Tapping sleeves and tapping valves are not allowed.

2.03 FIRE HYDRANTS

A. Standard upright hydrants, flush hydrants and shackle rods and lugs shall be in accordance with STIA F&I Civil System Standards Section 331219 Hydrants.

2.04 THRUST BLOCKS

A. Thrust blocks shall be in accordance with NFPA 24 Section 10.6.1 standards and STIA F&I Civil System Standards Appendix A – Standard Details.

1. Thrust blocks shall be permitted where undisturbed soil is stable and capable of resisting the anticipated thrust forces.
2. Thrust blocks shall be Class 3000 concrete, minimum compressive strength of 3000 psi at 28 days.
3. Thrust blocks shall be located so that the joints are accessible for repair.
4. All poured in place blocking shall have a minimum clearance of five feet from existing utilities or structures.
5. Plastic sheeting at thrust blocks shall be per STIA F&I Civil System Standards Appendix A – Standard Details.

2.05 COATINGS

A. After installation of above grade bolted valves, fittings, and couplings, the Contractor shall coat the bolting materials with high-build polyamide epoxy suitable for potable water piping and conforming to NSF-61 and AWWA C210. Approved epoxy products meeting number of coats, thickness and requirements of AWWA C210 manufactured by Sherwin Williams, Carboline Carboguard, Tnemec or approved equal.

2.06 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY (RPBA)

A. RPBA units must be of a type included in the Washington State Department of Health current listing of "Approved Reduced Pressure Backflow Assemblies."

B. Installation must be according to procedures outlined in the current edition of "Accepted Procedure and Practice in Cross Connection Control Manual" published by the Pacific Northwest Section, American Water Works Association.

C. Inspection of the installation, to ensure proper operation, will be conducted by backflow device testers certified by the Washington State Department of Health.

D. RPBAs must be inspected and tested annually during the life of the contract.

E. RPBAs must not be installed below ground.

2.07 PROTECTIVE INSULATED ENCLOSURE

A. Protective insulated enclosure shall be sized for the RPBA.

B. The drainage opening in the protective insulated enclosure shall be large enough to handle the discharge of a full relief valve opening

C. Protective insulated enclosure shall prevent freezing of the RPBA to at least 0°F.

D. An opened protective insulated enclosure shall allow access to all part of the RPBA assembly.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 FIELD TESTS

A. Testing, flushing and sterilization shall be conducted in accordance with the STIA F&I Exterior Water System Connection Procedure and Requirements.

4.02 CHLORINATED WATER DISPOSAL

A. The Contractor shall be responsible for the final removal and disposal of the chlorinated water used for sterilization. The Contractor is responsible for all permits and costs including conveying, pumping and the hauling required for the water disposal.

B. Chlorinated Water Disposal will be conducted in accordance with the STIA F&I Exterior Water System Connection Procedure and Requirements.

END OF SECTION

Civil Water Distribution System Connection Procedure

Temporary Construction Water Connections:

SEA requires a DOH approved RPBA assemblies for temporary construction water connections.

1) Provide a DOH approved Reduced Pressure Backflow Assembly (RPBA)
2) Obtain F&I Civil and Airport Fire Department approval on use at Fire Hydrant location or blow-off connection to existing watermain.
3) Schedule Aviation Maintenance Operating Engineer (Boiler Shop) to test backflow prevention assembly, witness minimum 1% chlorine disinfection swabbing by Contractor and connection to Fire Hydrant. Schedule Aviation Maintenance Field Crew to open fire hydrant.

Notes:

- The assembly cannot be physically altered (adding hose bibs inside the assembly shut off valves)
- The orientation cannot be altered (turning the valve with discharge facing upward or sideways etc.)
- Device removal will require disinfection and retesting upon reinstall
- Boiler Shop will periodically check temporary installations for compliance
- If the Backflow Assembly Tester (BAT) finds the assembly altered during a check, if egregious, they will isolate source and disconnect device

DOH Cross-Connection Control Rules: https://www.doh.wa.gov/Portals/1/Documents/Pubs/331-355.pdf

"Approved backflow prevention assembly" means an RPBA, RPDA, DCVA, DCDA, PVBA, or SVBA of make, model, and size that is approved by the department. Assemblies that appear on the current approved backflow prevention assemblies list developed by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research or other entity acceptable to the department are considered approved by the department.

USC List: https://fccchr.usc.edu/list.html

SEA Seattle-Tacoma International Airport

WATER MAIN TESTING FORM

HYDROSTATIC PRESSURE TESTING (AWWA C600)

As a minimum, all water mains shall be tested in accordance with the Hydrostatic Pressure Testing Requirements of ANSI/AWWA C600 and NFPA-24. Polyethylene pipe shall follow AWWA C901 for pressure testing.

A. **All thrust restraint fittings and concrete blocking shall be installed, inspected, and approved by SEA Aviation Maintenance Field Crew and Fire Department prior to backfill and performing the pressure tests. The Contractor shall not operate any valves on the existing water mains. All valves shall be operated by AVM Field Crew.**

B. **Test pressure shall be 250 psi for a minimum duration of two hours.** Loss of water pressure during test shall not exceed 5 psi in a 2-hour period. If pressure loss exceeds 5 psi, then the volume of water to refill the line to obtain the starting test pressure shall be measured (this is the allowable leakage). Allowable leakage cannot exceed the standard as determined below.

C. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet. Pressure testing against existing active water system valves is not acceptable. All hydrant valves shall be open so that the hydrants are included in the pressure test.

D. The pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to SEA. When filling from the existing water system, a DOH approved RPBA will be required for the connection. The pump, pipe connection, and all necessary apparatus including the gauges shall be furnished by the contractor. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the contractor shall open fire hydrants at such points so the air can be expelled as the line is filled with water.

E. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the contractor shall repair the joints, retighten the bolts, relay the pipe, or replace the pipe until the leak is eliminated--regardless of total leakage as shown by the hydrostatic test.

F. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the contractor's expense. All pipe and fitting must have a pressure rating higher than the test pressure.

G. Lines which fail to meet test requirements shall be repaired and retested as necessary until test requirements are complied with.

H. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = \frac{\mathrm{SD}\sqrt{\mathrm{P}}}{148{,}000}$$

L = Allowable Leakage (gph)
S = Length of Pipe (ft)
D = Pipe Diameter (in)
P = Test Pressure (psi)

AWWA C600 Table 6A - Allowable Leakage Per 1,000 Feet of Pipeline* in GAL/HR

Avg. Test Pressure psi	**3”**	**4”**	**6”**	**8”**	**10”**	**12”**	**14”**	**16”**	**18”**	**20”**	**24”**	**30”**	**36”**	**42”**	**48”**
250 psi	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56	3.21	3.85	4.49	5.13

DISINFECTION OF WATER MAINS (AWWA C651)

A. All water mains shall be disinfected and tested per ANSI/AWWA C651 – Disinfecting Water Mains and coordinated with SEA Aviation Maintenance (AVM) and F&I Civil Engineering Group.

B. **FILL: Fill main with water chlorinated to a minimum of 25mg/L, which shall remain in the pipe for at least a 24-hour contact time. Test a minimum of 10mg/L of detectable free chlorine after 24-hr holding period**. Contractor to schedule SEA AVM Boiler Room to test and record chlorine levels. Filling from the existing water system requires an approved reduced pressure backflow prevention assembly (RPBA), see SEA temporary water connection requirements.

C. FLUSH: Flush and poly pig with a chlorine saturated foam block 2” larger than pipe diameter at a minimum of 2.5 ft/sec. Flushing shall continue until chlorine residuals level is below 1.5 mg/L. Chlorinated water shall be discharged at a rate that won’t overload the system to the Industrial Wastewater System (IWS), or after dechlorinating to the Sanitary Sewer System. If there is not an approved discharge location, the Contractor is responsible for collecting and disposing of the chlorinated water. Obtain approval from F&I Civil and schedule with Field Crew prior to discharging.

D. SAMPLE: Contractor to schedule AVM Boiler Room to collect water purity samples for Bacteriological Test. Sampling can only be conducted between Monday through Friday, 7:00 AM thru 11:59 AM. Allow 3 to 5 working days for results from purity test to be obtained from SPU Lab. If test passes final connection can be completed, if not disinfection procedures are to be repeated until a passing test result is obtained.

E. FINAL CONNECTIONS TO EXISTING WATERMAINS: If the total length of the connection is less than 20 feet and one length of pipe, the pipe and fittings required for the connection may be spray disinfected or swabbed with a minimum one percent solution of chlorine just before being installed. Contractor to schedule AVM Boiler Room to witness swabbing.

F. INSPECT: Field Crew opens valves to pressurize system and conducts visual inspection for leaks at point of connection prior to backfill.

HYDROSTATIC PRESSURE TEST FORM

TO BE COMPLETED BY SEA AVM FIELD CREW ONLY

Project: __________________________ Contractor:____________________Field Crew:________________________

Date: ____________________________ Location of Mains Tested:____

	SECTION	SECTION	SECTION
DIAMETER (IN)			
LENGTH (FT)			
START TIME & PRESSURE			
END TIME & PRESSURE			
< 5 PSI PRESSURE DROP			
> 5 PSI DROP ALLOWABLE LEAKAGE			
PASS / FAIL			

COMMENTS:

DISINFECTION TEST FORM

Disinfection Start Date/Time: _____________________________ Chlorine Residual:____________mg/L

Disinfection End Date/Time:_______________________________ Chlorine Residual:____________mg/L

Flushed and Sampled By:______________________________________

Sample Date: ____

Bacteriological Results / Date: __________________________________

Date of Connection: ____

COMMENTS:

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. This Section includes the design and selection requirements of general duty valves common to potable water and sewer utility piping systems at Sea-Tac International Airport. Combination air release/air vacuum valves for water distribution systems are included in Section 331216B – Water Distribution Combination Air Valves.

B. Valve Design Information:

1. Locate isolation valves at each branch take off. At water main intersections, valves shall be placed on 4 out of 4 legs at each cross, and 3 out of 3 legs at each tee.
2. On water distribution mains, isolation valves shall be located such that a length of water main no more 500 feet in length can be isolated by closing valves.
3. Grooved Piping System Compatible Valves: Allowed only for temporary piping and selected pumping assemblies with prior approval by Port of Seattle Facilities and Infrastructure.
4. The following valves are not allowed: Butterfly Valves.
5. Provide independent supports as required at concentrated loads from valves and flanges.
6. Valve diameter shall match size of adjacent pipe.
7. Valves in vaults shall be installed with a dismantling joint to allow removal of the valve without cutting adjacent pipe.

C. Valve Vaults or Manholes:

1. When depth from ground surface to top of operating nut for valves exceeds 6 feet, the valve(s) shall be placed in a vault or manhole. In addition to soil, traffic, and other loads required in these standards, vaults and manholes shall be designed to resist the thrust and other loads imposed by pipes and valves.
2. Refer to Standard Details for vault and manhole minimum clearances, layout, and details.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals.

B. Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

D. Submit method for hydrostatic testing and test and inspection results.

E. Submit calculations for thrust blocks, restraints, and pipe supports within vaults and manholes.

F. Submit valve stem and valve extension stem length data, indicating when valve vaults or manholes are required.

1.03 REFERENCES

A. American Society for Mechanical Engineers (ASME) B.1.20.1 Pipe Threads, General Purpose.

B. American Society for Mechanical Engineers (ASME) B.16.1 Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250.

C. American Society for Mechanical Engineers (ASME) B.16.5 Pipe Flanges and Flanged Fittings, General Purpose.

D. American Society for Mechanical Engineers (ASME) B16.24 Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500.

E. American Society for Testing and Materials (ASTM) A276 Stainless Steel Bars and Shapes.

F. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings.

G. American Society for Testing and Materials (ASTM) B138 Standard Specification for Manganese Bronze Rod, Bar, and Shapes.

H. American Society for Testing and Materials (ASTM) B371 Standard Specification for Copper-Sinc-Silicon Alloy Rod.

I. American Society for Testing and Materials (ASTM) D429 Test Methods for Rubber.

J. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

K. American Water Works Association (AWWA) C515 Reduced-Wall Resilient-Seated Gate Valves for Water Supply Service.

L. American Water Works Association (AWWA) C550 Protective Interior Coatings for Valves and Hydrants.
M. Environmental Protection Agency (EPA), Safe Drinking Water Act.
N. NSF International (NSF) NSF/ANSI 61 Drinking Water System Components—Health Effects.
O. NSF International (NSF) NSF/ANSI 372 Drinking Water System Components—Lead Content.
P. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Mechanical Systems Standards.
Q. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 013300-Submittals.
R. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110 – Water Distribution System.
S. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216B – Water Distribution Combination Air Valves.
T. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A – Standard Details.

PART 2 – PRODUCTS

2.01 GENERAL

A. Valves shall have no leakage (drip tight) in either direction at valve rated design pressure, unless otherwise allowed for in this section or in referenced valve standard.
B. Valve to open by turning counterclockwise, unless otherwise specified.
C. Valve materials in contact with or intended for drinking water service shall comply with requirements of NSF/ANSI 61 and other applicable federal, state, and local requirements.
D. Components and Materials in Contact with Water for Human Consumption:
   1. Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.
   2. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 VALVES

A. Manufacturers:

1. Resilient Wedge Gate Valves: Clow (Model 2638), M&H (Style 7000), Kennedy (Model KF-RW), American USA (2500 Series), or approved equivalent.
2. Ball Valves: Stockham, Conbraco-Apollo, Jenkins.
3. Globe or Angle Valves: Stockham, Crane, Jenkins.
4. Swing Check Valves: Stockham, Crane, Jenkins.
5. Non-Slam Check Valves: Stockham, Conbraco-Apollo, Keystone, Mueller.

B. Water Distribution Gate Valves:

1. Gate Valves shall be resilient wedge seat type meeting AWWA Standard C515 covering resilient seated gate valve for water supply service.
2. Rated for 250 psi maximum working pressure and 500 psi static test pressure.
3. The valves shall have a ductile iron body, bonnet, and O-ring plate. The wedge shall be totally encapsulated with rubber.
4. The sealing rubber shall be permanently bonded to the wedge per ASTM D429.
5. Valves shall be supplied with O-ring seals at all pressure retaining joints. No fat gaskets shall be allowed.
6. The operating mechanism shall be a standard 2-inch AWWA square operating nut opening to the left and shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover.
7. Stems shall be cast copper alloy with integral collars in full compliance with AWWA. All stems shall operate with copper alloy stem nuts independent of wedge and of stem (in NRS valves).
8. Stems shall have two O-rings located above thrust collar and one O-ring below. Stem O-rings shall be replaceable with valve fully opened and subjected to full pressure. The stems on 4” – 20” shall also have two low torque thrust bearings located above and below the stem collar to reduce friction during operation.

9. Waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area. Valves 4" and larger shall accept a full size tapping cutter.
10. The body, bonnet and O-ring plate shall be fusion-bond epoxy coated, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 Certified.
11. Each valve shall have maker's name, pressure rating, and year in which it was manufactured cast in the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to the requirements of AWWA C515 (and UL/FM where applicable).
12. Flanged or Mechanical joint ends. Flanged valves shall conform in dimensions and drilling to the standard ANSI B16.1 for cast iron flanges and flanged fittings Class 250. Bolt holes shall straddle the vertical centerline. Mechanical joint ends shall meet AWWA C111 Standard. All mechanical joints shall be restrained.
13. Valves exceeding 72 inches depth from ground surface to operator nut shall be in a vault or manhole.

C. Back-Flow Prevention Assemblies:

1. All backflow prevention assemblies shall be a make, model, and size approved by the Washington State Department of Health (DOH). Assemblies that appear on the current approved backflow prevention assemblies list developed by the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research are considered approved by the department. Assemblies must be installed in the approved orientation and cannot be physically altered.

   https://fccchr.usc.edu/list.html
2. Double check valve assemblies (DCVA) shall be complete assemblies, consisting of two weighted lever check valves, two gate valves and [four] test cocks. Check valves shall be cast iron and loaded to one psi in the direction of flow. Gate valves shall be of a 125-pound range pattern. The entire assembly shall meet the F&I Mechanical Standards and DOH requirements.
3. Reduced pressure backflow assemblies (RPBA) shall be complete assemblies, of bronze construction, including a strainer, shut-off valves, test cocks and a pressure differential relief valve between two check valves. The entire assembly shall meet the F&I Mechanical Standards and DOH requirements.

4. RPBA shall be installed in pre-manufactured, heated, and insulated above ground enclosures Refer to Section 331000 Water Distribution Requirements for additional requirements.
5. Refer to Seattle-Tacoma International Airport Facilities and Infrastructure Mechanical Systems Standards for additional cross connection and backflow prevention requirements.

D. Tapping Sleeves and Tapping Valves:
   1. Tapping sleeves, tapping valves, and corporation stops are not allowed.
E. Valve Marker Posts:
   1. Concrete marker post shall have 4" minimum square section and a minimum length of 42" with beveled edges and containing at least one #4 bar of reinforcing steel. Place markers as directed by the Water Department and set so as to leave 18" exposed above grade. Paint exposed portion of the marker posts with a coat of approved paint and then the size of the valve (for example, 6" G.V.). Stencil with black paint on the face of the post the distance in feet and inches to the valve, using a stencil, which will produce letters two inches high.
F. Valve Boxes:
   1. Valve boxes shall be cast iron with two-piece, adjustable sections with an 18” top section and regular 24” base section or base section as required. Valve boxes for water systems shall have the word “WATER” cast in raised letters. Valve boxes shall be in accordance with STIA F&I Civil System Standards Appendix A – Standard Details.
   2. For curb stop valves, curb boxes shall be either all cast iron parts, or cast iron base and lid with steel upper section, all epoxy coated. Curb box lids shall have the word “WATER” cast in raised letters and have two (2) pick holes.
G. Valve Extension Stems:
   1. Valves shall be installed with extension stems when the operating nut is more than 24 inches below final grade. Operating extension stems shall be provided to bring the operating nut to a point 24 inches below the surface of the valve cover or ground surface. Supports shall be provided on all extension stem sections within vaults to secure the extension section against horizontal movement. Supports shall be anchored to vault walls with stainless steel hardware.
   2. Steel extension stems to operate the valves shall have at their lower end a 2-inch square socket end to fit over the 2-inch AWWA nut operator on the valve. The upper end of the extension stems shall have a 2-inch square operating nut similar to the valve. A guide plate shall be welded to each extension stem just below the 2-inch AWWA operating nut, to maintain the nut centered in the valve box. The

strength and diameter of the extension stem shall be such that the extension stem will withstand 300 foot-pounds of torque.

3. Valve extension stems for curb stop valves shall be stainless steel.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

3.01 FUNCTIONAL AND HYDROSTATIC PRESSURE TESTING

A. Functional Pressure Test:
   1. Test that valves open and close smoothly under operating pressure conditions.
   2. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
   3. Count and record number of turns to open and close valve; account for discrepancies with manufacturer’s data.

B. Hydrostatic Pressure Testing:
   1. Hydrostatic testing of valves shall be performed in accordance with STIA F&I Civil System Standards 331110 Water Distribution System testing requirements.
   2. Valve may be tested while testing pipeline or as a separate step after pipeline has been tested.
   3. Apply test pressure to one side of valve and measure the pressure on the opposite side to determine if there is an increase in pressure caused by leakage. Then apply test pressure to the other side, and measure the pressure on the opposite side.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. A combination Air Valve shall be installed at all high points in the water main.

B. Design Air Valve, piping, and assembly size per the current edition of the Dezurik/APCO Air Valve Guide.

C. Air inlet and discharge vent piping shall be at least 18 inches above finished grade. Vent piping shall have a screened downward-facing vent opening.

D. Combination Air Valves shall be of the single housing style that combines the operating features of both an Air/Vacuum and Air Release Valve.

E. The Air/Vacuum portion shall automatically exhaust air during the filling of the pipeline and prevent air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, power outage, pipeline break, etc.

F. The Air Release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure, and during filling of the pipeline.

G. Combination air release/air vacuum valves shall comply with AWWA C512.

H. Exterior of air valves shall be coated in accordance with AWWA requirements. Interior of air valves shall be coated in accordance with AWWA C550.

I. Air valves shall be factory tested in accordance with AWWA C512.

J. Combination Air Valves shall be designed for operating pressures between 20 psi and 250 psi.

K. Design shall provide vault insulation as required to protect valve and assembly from freezing.

L. Design for air release valve shall have a vent above grade with a goose next vent. Locate valve and vent outside of any traveled way (taxiway, ramp, service road, etc. to prevent vehicular contact.

M. Design for air release vaults shall have a drain to storm drain system.

N. All valves and valve assemblies shall also meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Appendix A – Standard Details.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 – Submittals, including:
   1. Calculations determining assembly size.
   2. Product data sheets for make and model.
   3. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
   4. Maximum recommended test pressure; maximum and minimum recommended working pressures of air valves, isolation valves, flanges, connecting piping, and fittings.
   5. Recommended seating materials for specified operating pressures.
   6. Manufacturers' installation instructions and testing procedures of products specified.
   7. Operations and maintenance data.
   8. Affidavit of Compliance in accordance with AWWA C512 stating valve and all materials used conform to applicable requirements of AWWA C512 and these Specifications, and tests specified have been performed and all requirements have been met.
   9. Affidavit of Compliance that materials comply with the requirements of the EPA Safe Drinking Water Act and other federal, state, and local requirements.

1.03 REFERENCES

A. American Society of Mechanical Engineers (ASME) B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).

B. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings.

C. American Water Works Association (AWWA) C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

D. American Water Works Association (AWWA) C550, Protective Interior Coatings for Valves and Hydrants.

E. ASSE International (ASSE) 1063 Performance Requirements for Air Valve and Vent Inflow Preventer.

F. Environmental Protection Agency (EPA) Safe Drinking Water Act.

G. NSF International (NSF) NSF/ANSI 61, Drinking Water System Components - Health Effects.

H. NSF International (NSF) NSF/ANSI 372, Drinking Water System Components - Lead Content.

I. Seattle-Tacoma International Airport Facilities and Infrastructure Section 013300 – Submittals.

J. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331000 – Water Distribution Requirements.

K. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331110 – Water Distribution System.

L. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331216 –Valves.

PART 2 - PRODUCTS

2.01 GENERAL

A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

   1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 COMBINATION AIR VALVE, WATER SERVICE, 1 INCH TO 16 INCHES

A. Combination Air Valve, Water Service, 1 Inch to 16 Inches:

   1. Manufacturers and Products:

      a. Dezurik/APCO Valve and Primer Corp.; Series 143C to 147C or 1804 to 1816.

      b. Val-Matic Valve; Series 201C to 203C or 104/22 to 116/38.

      c. Crispin UL series

      d. Approved Equivalent.

2. Suitable for water service, combines operating features of air and vacuum valve and air release valve. Air and vacuum portion to automatically exhaust air during filling of system and allow air to re-enter during draining or when vacuum occurs. Air release portion to automatically exhaust entrained air that accumulates in system.
3. Valve single body or dual body, air release valve mounted on air and vacuum valve, isolation valve mounted between the dual valves. 1 inch through 3 inch valves with NPT threaded inlet and outlet, 4 inch and larger valves with ASME B16.1 Class 250 flanged inlet and cover outlet.
4. Rated 300 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
5. Equip 4 inch and larger with antislam device to throttle flow of water into air valve and prevent damage caused by rapid closure.
6. Requirements for 1-inch combined air release and air vacuum valves at landside and unpaved areas shall be in accordance with STIA F&I Standard Details – Appendix A.

2.03 CONNECTION TO MAINLINE

A. No service saddle or corporation stop style connections to mainline are allowed.

B. Connections to mainline shall be made by cut-in-tee installation with 4-inch ductile iron pipe size minimum only. Refer to STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements and STIA F&I Civil Systems Standards Section 331110 Water Distribution Systems for connection to mainline requirements.

C. Flanged outlet or fitting connection shall have flange as required to match drilling pattern of adjoining valve and suitable for test pressure and working pressure.

D. Isolation valves shall be in accordance with the STIA F&I Civil Systems Standards Section 331216 – Valves.

2.04 PIPING BETWEEN MAINLINE AND AIR VALVE AND PIPING FOR AIR VENT

A. Ductile Iron Pipe, 4-inch diameter minimum, in accordance with STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements, STIA F&I Civil Systems Standards Section 331110 Water Distribution Systems.

2.05 VALVE VAULT

A. Precast concrete vault, in accordance with STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements, STIA F&I Civil Systems Standards Section 331110 Water Distribution Systems and STIA F&I Civil Systems Standard Details – Appendix A.

2.06 ACCESSORIES

A. Inflow Prevention Device on Vent Pipe:
   1. Used to provide backflow prevention and prevent nonpotable water from entering the air vent piping.
   2. Inflow preventer shall be designed, manufactured and tested in accordance with ASSE 1063 and rated lead-free in accordance with NSF/ANSI 61, Annex G.
   3. Shall be rated for submergence to 25 psi.
   4. Float checks and trim shall be Type 316 stainless steel. Resilient seats shall be EPDM with fiberglass reinforcement. The upper and lower chambers shall be constructed of ASTM A536, Grade 65 45 12 ductile iron.
   5. Provide Type 304 stainless steel basket screen on device to minimize entrance of debris.
   6. Manufacturer and Product: Val-Matic; FloodSafe.
   7. Provide field test kit to confirm drip-tight closure of backflow prevention device.
   8. Provide all necessary brackets and mounting hardware required and recommended by the manufacturer.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 VALVE TESTING AND INSPECTION

A. Air Valve:
   1. May be either tested while testing pipelines, or as a separate step.
   2. Isolation valves shall be in open position during pipeline test.

B. Isolation Valves: Test that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other.

C. Air and Vacuum Valves: Inspect valves as pipe is being filled to verify venting and seating is fully functional.

D. Verify leak-free performance during testing.

E. Using the test kit provided by the manufacturer of the inflow prevention device, perform inflow prevention test as recommended by the manufacturer.

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Hydrants shall be a standard pattern of a single manufacturer approved by the Engineer. The name or mark of the manufacturer, size of the valve opening, and the year made shall be plainly cast in raised letters and so placed on the hydrant barrel as to be visible after the hydrant is installed.

B. Hydrants shall be designed for a minimum working pressure of 250 psi and 500 psi test pressure. Hydrants shall conform to AWWA C502 and the following requirements stated in this section for workmanship, design, and material.

C. The hydrant body shall be cast iron, fully mounted with approved non-corrodible metals. All wear surfaces shall be bronze or other non-corrodible material. There shall be no moving bearing or contact of iron or steel with iron or steel. All contact surfaces shall be finished or machined and all wearing surfaces shall be easily renewable.

D. The design of the hydrant shall be such that all working parts may be removed through the top of the hydrant.

E. The hydrant stem shall have the AWWA specified number of turns to open the gate and area equal to the area of the valve opening.

F. All upright hydrants shall be provided with collision protection, breakaway devices, and sidewalk flanges. In addition to the protection, hydrants shall be designed to provide a minimum 5 feet clear access directly behind the hydrant. 3-foot minimum clearance shall be provided around outside of hydrant for operation. Provide 5 feet clear horizontal clearance from the outside of the hydrant to concrete walls, structures, utility poles and above grade electrical enclosures. All clearances shall be level.

G. All hydrants shall have two (2) means of restraint with the primary means being thrust blocking. Mega-lug type connections are not approved for installation without additional thrust blocking or rodding.

H. Hydrant locations shall be as approved by the POS Fire Department and in accordance with the following:

1. Hydrants shall be located outside the Runway Object Free Area (ROFA) and the Taxiway Object Free Area (TOFA), and shall be easily accessible.

2. Hydrants shall not be located on dead-end mains.
3. Fire hydrants along access roads shall be located no further than 300 feet apart, measured along the centerline of the road. Hydrants shall have the minimum setback from curb faces in accordance with the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil System Standards Appendix A – Standard Details. Additional hydrants may be required to meet hydrant flow requirements.
4. A fire hydrant shall be located within 50 feet of Fire Department Connections (FDC). Refer to STIA F&I Mechanical System Standards for additional FDC and fire system requirements.
5. Fire hydrants shall be located at low points within the system to provide flushing capacity.

I. Existing hydrants may not be removed or relocated, or otherwise have their capacity impacted, without providing calculations to verify that the required hydrant flow to all potentially affected buildings is maintained.

J. Fire hydrant service lines shall be adequately sized to provide a minimum fire flow and duration in accordance with POS Fire Department requirements and NFPA 24. Fire hydrant service line piping between the water main and the foot valve at the hydrant shall be sized according to the following minimum requirements:

1. Length of service line less than 50 feet: 6” diameter.
2. Length of service line greater than 50 feet: 8" diameter minimum pipe size with reducer to 6" diameter past the foot valve at the hydrant. Foot valve nearest the hydrant shall be installed no less than 4 feet and no more than 10 feet from the base of the hydrant. Hydrants with laterals longer than 50 feet require a second foot valve on the lateral, located at the tee at the main. The maximum allowed distance from the water main to the foot valve at the hydrant is 100 feet.

K. All hydrants shall be painted red with reflectorized silver top in accordance with the requirements of this section.

L. The dimensions of the bell or hub end connection shall conform to the dimensions of AWWA Standard C100. The dimensions of the mechanical joint (if used) shall conform to AWWA C110.

M. Hydrant drain holes for upright hydrants shall be connected by piping and shall terminate above the surface. Hydrant drain holes for flush hydrants shall be connected by piping and shall terminate within the hydrant pit vault. Piping shall be in accordance with the STIA F&I Civil System Standards Appendix A – Standard Details.

N. Flush hydrant vaults shall have a sloped base to drain and shall include a 4” drain piped to a drainage system as approved by STIA F&I.

O. Design requirements for water distribution piping are as described in the STIA F&I Civil Systems Standards Section 331000 Water Distribution Requirements.

P. All fire hydrants shall also meet the requirements of the STIA F&I Civil Systems Standards Appendix A – Standard Details.

Q. Fire hydrants shall meet the requirements of the NFPA 415 – Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways as well as the International Fire Code with Washington State Amendments and as amended in this Section.

1.02 REFERENCES

A. American Society for Testing Materials (ASTM) A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

B. American Water Works Association (AWWA) C100, Cast-Iron Pipe Specifications.

C. American Water Works Association (AWWA) C110, Ductile-Iron and Gray- Iron Fittings.

D. American Water Works Association (AWWA) C502, Dry-Barrel Fire Hydrants.

E. NSF International (NSF) NSF/ANSI 61, Drinking Water System Components - Health Effects.

F. NSF International (NSF) NSF/ANSI 372, Drinking Water System Components - Lead Content.

G. National Fire Protection Association (NFPA) 24 Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

H. National Fire Protection Association (NFPA), NFPA 415 – Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways.

I. International Fire Code (IFC), International Fire Code with Washington State Amendments.

J. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 331000 Water Distribution Requirements.

K. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 312333 Utility Trenching and Backfill.

L. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil System Standards Appendix A – Standard Details

M. Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Mechanical System Standards.

N. Washington State Department of Transportation (WSDOT), M-41 Standard Specifications for Road, Bridge and Municipal Construction, current version.

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 – Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

B. Submit hydrostatic test data. Before the hydrant is painted at the factory, it shall be subjected to an internal hydrostatic test of 500 pounds per square inch with the hydrant valve closed and again with the hydrant valve open. The Contractor shall submit copies of the test reports in accordance with Section 01 33 00 – Submittals.

C. Submit calculations for thrust blocks.

D. Certificate of Compliance: Upon completion of the system installation, verify all fire department hose connections, and check all fire safety devices to ensure their readiness for emergency connection and operation.

PART 2 – PRODUCTS

2.01 GENERAL

A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 UPRIGHT FIRE HYDRANT

A. Products:

1. M&H - 5-1/4" MVO 129S, 3-Way Model
2. Mueller - Super Centurion
3. Kennedy - Guardian
4. Or approved equal

B. Hydrant foot valve to be installed no less than four (4) feet and no more than ten (10) feet from the base of the hydrant.

C. Drain holes shall be connected by piping and shall terminate above ground.

D. Upright hydrants shall be provided with collision protection and reflective markings in accordance with STIA F&I Civil System Standards Appendix A – Standard Details.

E. Hydrant shall have connections per 2.04.A and 2.04.B

2.03 FIRE HYDRANT (FLUSH)

A. Mueller - 5 ¼" Flush Type Fire Hydrant (made to accommodate 250 psi)

1. Hydrant foot valve to be installed no less than four (4) feet and no more than ten (10) feet from the base of the hydrant.
2. Drain holes shall be connected by piping and shall terminate within the vault.
3. Flush hydrant vault to be provided with adequate drainage to keep water from accumulating inside the box.
4. Flush hydrant location to be marked with reflective hydrant signs to match present standards.
5. Hydrant shall have connections per 2.04.A and 2.04.B

B. Flush Hydrant Vault

1. Flush hydrant vault shall consist of a prefabricated pit vault assembly with fiberglass liner, pit cover and all necessary components, including:
    a. Designed to support a minimum of 200,000 lbs wheel load with 250 PSI tire pressure.
    b. Lid shall be lift assist.
    c. Lid shall have tool less entry.
    d. Inside clear space dimensions of 38” by 38”.
    e. Sloped base to 4” drain.
    f. No substitution is permitted

2.04 FIRE HYDRANT CONNECTIONS

A. Hydrant Steamer Adapter

1. Provide a quick connect fitting with blind cap and cable on all fire hydrants.
2. Quick connect fitting shall be 5” Storz to Rigid Rocker Lug Style
    a. 4” Pacific Coast Pumper thread: six (6) threads per inch
    b. Outside diameter: 4.828 inches
    c. Thread root diameter: 4.580 inches
    d. Thread length of male nipple: P.C.P. Standard
    e. No substitution is permitted
3. Material to be hardcoat anodized MIL-A-8625-F, type 3, dark grey of 6061-T6.
4. Aluminum and cap secured to nozzle with 2 stainless screws set 180 degree apart. The cap shall be tethered with a 0.125” vinyl coated aircraft cable.
5. All parts, cables, and levers to be AISI 304/316 stainless steel. Storz gasket shall be BUNA-N.

B. Hydrant Hose Connections

1. Provide 2 side hose nozzle connections with
    a. 2-½” NST, and 7.5 threads per inch at 60 degree V thread. Thread length of 1 inch.

b. Root diameter of thread to be 2.8715 inches.

c. Outside diameter of finished nozzle to be 3.0625 inches.

d. Blind cap and cable

e. No substitution is permitted

C. Fire Department Connection (FDC)

1. All FDC's shall be either:

a. Storz 5" with Blind Cap and Cable per 2.04.A

b. Siamese Connection - 2 side hose nozzle connections with 2-½" NST per 2.04.B

2.05 SHACKLE RODS AND CONNECTIONS

A. Shackle rods (tie rods) shall be ¾-inch diameter ASTM A193 Grade B7 alloy steel all thread rods. Nut and Washers shall be high strength low allow steel per AWWA C111.

B. Connections of shackle rods to the fittings for thrust restraint shall be made using either 90 degree eye bolts or dual flange bolt harness lugs, single flange bolt ductile lugs are not acceptable.

1. 90 degree eye bolts with 3/4" UNC rolled thread, high strength, low alloy steel per AWWA C111 (Corten or Mayari-R)

2. Harness lug shall be ASTM A36 Steel with three holes, two for flange bolts and one for shackle rod. Bolt pattern to match fitting. Fusion bonded epoxy coated.

C. When required, lugs for harnessing the hydrant to the connecting pipe from the main shall be provided on the bell of the elbow or on the hydrant bottom casting. A drawing of the lug construction shall be submitted for approval, on request by the Engineer.

2.06 OPERATING NUTS

A. Hydrant stem and nozzle cap operating nuts shall be the same for all hydrants. Operating nuts shall be patterned to a tapered pentagonal shape, 1.0625 inches high. The nut shall measure 1.35 inches at the base and 1.23 inches at the top measured from point to flat. All hydrant valves and caps shall be opened by turning counterclockwise.

2.07 SIDEWALK FLANGE CONSTRUCTION

A. Provide hydrants with a sidewalk flange. Breakaway devices shall be at the sidewalk flange which will allow the barrel of the hydrant to separate at the break point with a minimal damage. The operating stem shall have a safety stem coupling which will shear or uncouple at the time of impact. All hydrants shall be equipped with 0-Ring stem seals.

2.08 FIRE HYDRANT COATINGS

A. All hydrants shall be painted red with reflectorized silver top.

1. Thoroughly clean and paint all iron parts of the hydrant, both inside and outside. For Airport use, coat all inside surfaces and the outside surfaces below the ground line with two coats of asphalt varnish in accordance with AWWA C502-80.
2. Paint the outside of the hydrant above the ground line in accordance with AWWA C502-80. Paint is based upon Sherwin Williams Fast Dry Acrylic Enamel (F78R27), equivalent by Benjamin Moore, Pittsburgh, Carboline, Tnemec, Kelly-Moore, Parker Paint, or approved equal. This is a water based product used for the red base. The top is based upon Rust-Oleum High Performance Acrylic Enamel (5215) equivalent by Benjamin Moore, Pittsburgh, Carboline, Tnemec, Kelly-Moore, Parker Paint, or approved equal. This is also a water based product. Reflectorized glass beads to be Potter Industries “Highway Safety Spheres”, Brite Blend by Flex-O-Lite, Swarco Beads from Swarco Industries, or approved equal. The beads are to be applied to the silver top only.

2.09 BACKFILL

A. Backfill shall be control density fill (CDF) and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 312333 Utility Trenching and Backfill.

2.10 PIPE BEDDING

A. Pipe bedding material shall be utility bedding and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 312333 Utility Trenching and Backfill.

2.11 CONCRETE FOR THRUST BLOCKS

A. Thrust blocks shall be in accordance to NFPA 24 Section 10.6.1 standards and STIA F&I Civil Systems Standards Appendix A – Standard Details.

1. Thrust blocks shall be permitted where soil is stable and capable of resisting the anticipated thrust forces.
2. Thrust blocks shall be placed and of commercial concrete meeting the requirements of STIA Civil Systems Standards Section 331110 Water Distribution System Piping and Fittings.

2.12 CONSTRUCTION GEOTEXTILE SEPARATION

A. Construction geotextile for separation shall be Subdrain Geotextile Filter Fabric and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334116 Subdrainage.

2.13 CRUSHED DRAIN ROCK

A. Crushed drain rock shall be Porous backfill for subdrains and meet the requirements of the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334116 Subdrainage.

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 GENERAL

1.01 GENERAL DESIGN REQUIREMENTS

A. This section covers design standards and requirements for sanitary sewer conveyance.

1.02 CONVEYANCE DESIGN REQUIREMENTS:

A. Conveyance design shall be performed to verify there is adequate capacity in the proposed sewer and existing sewers downstream of the proposed facilities.

B. Lift stations should be avoided whenever possible. If gravity conveyance cannot be achieved, request for a lift station shall be submitted to the Port for consideration prior to lift station design.

C. Drop connections should be avoided whenever possible. Drop connections shall be submitted to the Port for consideration in order to avoid a conflict with an existing utility, but may not be used to avoid extra excavation.

D. All new sanitary conveyance infrastructure shall be sized to convey the peak flow from the facility without the flow depth exceeding 50% of the pipe diameter.

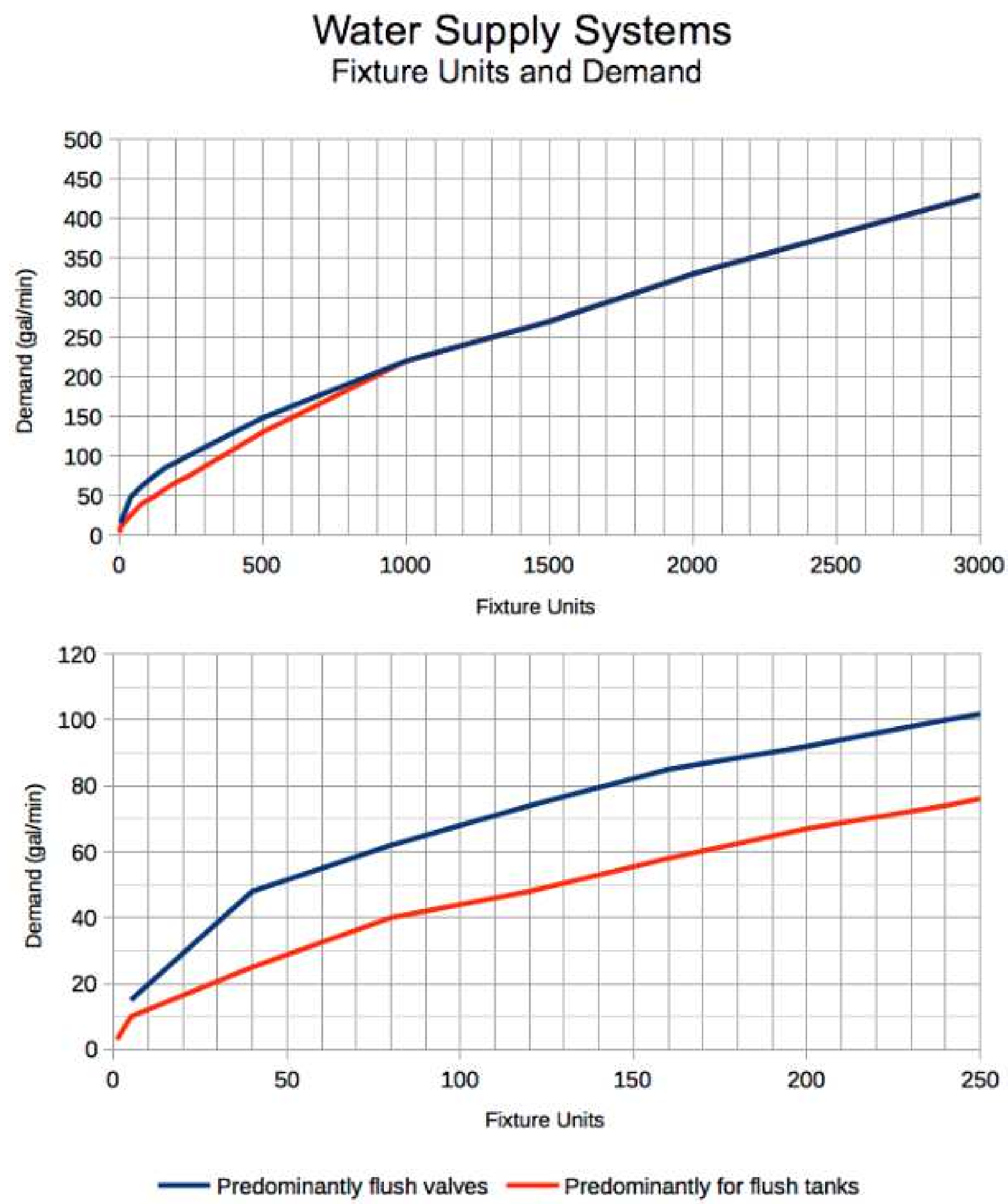
E. All existing sanitary conveyance infrastructure downstream of the new sanitary conveyance infrastructure shall be checked that the proposed increase in flow will not cause the flow depth to exceed 75% of the existing sanitary sewer pipe diameter.

F. Peaks flows shall be determined as follows:

1. First determine the total number of fixture units served by the proposed sanitary sewer using the table below

Fixture	Fixture Units
Water Closet	6
Water Closet <1.6 GPF	3
Urinal	5
Lavatory	1
Sink, bar	2
Sink, kit	3
Sink, mop	3
Sink, service	3
Drinking Fountain	1
Floor Drain	2
Dishwasher	3
Clotheswasher	2
Floor Sink	8
Shower	2

2. Using the chart below convert the number of fixture units to a flow rate. Apply a peaking factor of four (4) to the flow rate.



G. Hydraulic analysis for pipe systems shall meet the requirements of Criteria for Sewage Works Design (Orange Book), section C1-4.

H. Minimum pipe size shall be 8 inches.

1.03 EXTERIOR GREASE INTERCEPTOR REQUIREMENTS:

A. Whenever a commercial and/or retail food preparation operation discharges animal/vegetable fats, oils or grease (F.O.G.) waste to the sanitary sewer, a separate grease waste line to a grease interceptor device shall be required. Fixtures to be connected shall include dishwashers, pot sinks, range woks, janitor's sink and floor sinks. Toilets, urinals, and wash basins shall not flow through the grease interceptor.

B. Effluent discharged from the proposed grease interceptor shall not contain excess of 100 milligrams of F.O.G per liter.

C. Install grease interceptor vaults for any food preparation operation defined in 1.03.A. Proposed grease interceptor capacity shall be determined using the calculations provided in the Uniform Plumbing Code. Minimum capacity shall be 9,000 gallons.

D. When located in the AOA, the maintenance access shall be coordinated with the pavement design and pavement jointing. Pavement openings in the AOA shall be minimized.

E. Grease interceptor located outside shall have clear access and be within ten feet of vehicle driveway for access by maintenance vehicles.

F. Grease interceptor location and access approach shall be a minimum of 15 ft (wide) by 20 ft (height).

G. No grease interceptor shall have a buried grease waste line greater than 100-feet in length.

H. Grease waste line shall have cleanouts positioned to access the downstream pipe. Cleanouts shall be located on the grease waste line as follows:

   1. Where the grease waste line enters the building.
   2. Upstream of all bends.
   3. Spaced 50-feet maximum along the grease waste line.

I. Grease waste line 90-degree bends shall be made using two 45-degree bends.

J. Each cell of the grease interceptor shall be adequately vented.

K. Finished floor of vault shall not exceed 12 ft from finished grade.

L. The inlet and outlet piping shall be visible and can be cleaned from the surface.

M. The design of the grease interceptor shall include the ability to pump out and clean the grease interceptor and baffles without entering the grease interceptor. To achieve this additional cleanouts or maintenance access might need to be added to the roof of the grease interceptor. Pavement openings in the AOA shall be minimized.

1.04 SANITARY SEWER FORCE MAIN REQUIREMENTS:

A. Force mains shall be designed to take into account surge pressures.

1.05 SANITARY SEWER PUMP REQUIREMENTS:

A. All pumping system shall have duplex pumps, where one pump shall be able to pump at peak flow.

B. The STIA F&I Mechanical Systems Standards should be referenced for all applicable portions of force main systems (e.g., pumps, direct digital controls)

1.06 UTILITY CLEARANCE REQUIREMENTS:

A. Horizontal clearance between sanitary sewers and other non-potable piping conveyance or utilities shall be a minimum of 10 feet measured center to center.

B. Vertical clearance between sanitary sewer piping and other non-potable conveyance piping or utilities shall be a minimum of 12-inches at utility crossings. Vertical clearances of between 6-inches and 12-inches may be allowed at crossings in certain circumstances if no other options exist, and if it is specifically approved by Port Facilities and Infrastructure. Sanitary sewer piping at utility crossings shall be as shown in the STIA F&I Civil Systems Standards Appendix A - Standard Details.

C. Horizontal clearance between sanitary sewer piping (non-potable) piping and potable water mains shall be spaced a minimum of 10 feet measured center to center. Non-potable piping shall be laid at a lower invert elevation than potable water mains and maintain an 18-inch vertical clearance at crossings for ductile iron pipe, and 24-inch vertical clearance at crossings for non-metal pipe. These crossings shall occur at the midpoint of full length pipe segments (18 feet minimum) of the utilities to maximize the spacing between joints. Sanitary sewer piping at utility crossings shall be as shown in the STIA F&I Civil Systems Standards Appendix A - Standard Details.

D. When the design requires a non-potable conveyance system (sanitary sewer piping) to pass over a potable water main, the design must be approved by Port Facilities and Infrastructure, and meet all of the following requirements:

1. A minimum vertical spacing of 18-inches between the bottom of the non-potable and the top of the potable water main.
2. The water main and the non-potable conveyance pipeline must be made of ductile iron pipe meeting AWWA C151 standards.

3. The water main and the non-potable conveyance pipeline shall be encased in a pressure rated casing pipe designed to withstand a minimum static pressure of 150 psi.
4. The casing shall utilize a full pipe length (18 feet minimum) at the crossing with the pipe length centered to provide the maximum joint separation.

E. Vertical and horizontal utility clearance requirements are summarized in table form in Section 322333 Utility Trenching and Backfill.

1.07 CIVIL SYSTEMS STANDARDS REFERENCES

A. All sanitary sewer design shall meet the requirements of the following Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Sections:

B. STIA F&I Civil Systems Standards Section 024113.23, Utility Demolition and Abandonment

C. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

D. STIA F&I Civil Systems Standards Section 333111, Sanitary Sewer Piping

E. STIA F&I Civil Systems Standards Section 333120, Grease Interceptor Vaults

F. STIA F&I Civil Systems Standards Section 334216, Storm Drainage, Sanitary Sewer, and IWS Force Main Piping

G. STIA F&I Civil Systems Standards Section 334231, Storm Drainage, Sanitary Sewer and IWS Structures

H. STIA F&I Civil Systems Standards Section 334241, Frames, Covers and Grates for Storm Drainage, Sanitary Sewer and IWS Structures

I. STIA F&I Civil Systems Standards Appendix A - Standard Details

1.08 CIVIL SYSTEMS STANDARDS REFERENCES

A. All sanitary sewer design shall meet the requirements of the latest published editions of the following documents:

B. Criteria for Sewage Works Design (Orange Book), Washington State DOE

C. Various Sewer district codes (Midway, Southwest Suburban, Valley View)

END OF SECTION

GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for Sanitary Sewer Systems gravity conveyance systems are as described in the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 333100 Sanitary Sewage Requirements. All gravity conveyance shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. Refer to STIA F&I Civil System Standards Section 331000 Sanitary Sewage Requirements, Paragraph 1.06 for utility clearance requirements of sanitary sewer conveyance systems.

C. The minimum cover requirements for all pipe except ductile iron shall be 3-feet below finished grade. Where the cover is below 3 feet, the design engineer shall determine the required ductile iron pipe thickness class. The maximum cover for force mains shall be 10 feet. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements of sanitary sewer conveyance systems.

D. Piping less than 8-inches in diameter shall not be utilized for gravity conveyance of sanitary sewer systems.

E. Piping shall be installed a minimum of 5-feet away from buildings, structures and associated foundations.

F. In the situation of a new building, structures, and associated foundations conflict with existing piping; the existing piping system shall be relocated a minimum of 5-feet away from the new building, structures and associated foundations. If there are no viable options to reroute the existing pipe, contact POS F&I Representative.

G. Connection between sanitary sewer mains shall only occur at manholes. No tee connections.

H. Sanitary sewer manholes spacing is a minimum of one manhole per every 300 feet.

I. There shall be no bends in sanitary sewer mains. For sanitary sewer laterals, bends can be used when no other options are possible, 90-degree bends shall be made with two 45-degree bends.

J. Double cleanouts shall be installed immediately upstream and downstream of all sanitary sewer bends and 5-ft from all buildings.

K. No IWS flow or Storm flow shall enter or be connected to the sanitary sewer system.

L. When construction will impact active sanitary sewer facilities phasing and bypass plans shall be included. No closing of bathrooms or concessions will be permitted unless approved by Port operations.

M. Pipe to be located under taxilanes shall be installed inside a steel casing. Diameter and wall thickness of the casing shall be determined by the design engineer.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products.

B. Bypass and phasing plans when construction will impact active sanitary sewer facilities.

C. Testing plan for installed sewer pipe per Part 3.

D. Testing results of installed sewer pipe per Part 3.

E. Submit all updated sanitary sewer data for conveyance modeling, including,

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) applicable provisions

B. American Society for Testing Materials (ASTM) applicable provisions

C. American Society for Testing and Materials (ASTM) A746 Standard Specification for Ductile Iron Gravity Sewer

D. American Water Works Association (AWWA) C104 American National Standard for Cement-Mortar Lining for Ductile iron Pipe and Fittings for Water

E. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

F. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast

G. FAA regulations Air Operations Area (AOA)

H. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching, Bedding and Backfill

I. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewage Requirements

J. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333120 Grease Interceptor Vaults

K. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334231 Storm Drainage, Sanitary Waste and IWS Structures

L. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage, Sanitary Waste and IWS Structures

M. STIA F&I Civil System Standards Appendix A – Standard Details

N. Washington State Department of Transportation Standard Specification Section 7-17.3(2)F Low Pressure Air Test for Sanitary Sewers Constructed of Non Air Permeable Materials

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPE – AIRCRAFT OPERATIONS AREAS

A. Ductile-Iron Sewer Pipe:

1. Class 52 meeting AWWA C151.
2. Joints: Push-on joint meeting AWWA C111.
3. Lining: Protecto 401 Ceramic Epoxy
4. Coating: Asphaltic Coating meeting ANSI/AWWA C151
5. Gaskets: Shall be made of elastomer nitrile (NBR) meeting AWWA C111.
6. Manufacturing quality control testing shall meet the requirements of ASTM A746.
7. Bends shall match pipe material.

B. Polyvinyl Chloride (PVC) Sewer Pipe:

1. AWWA C900-16 DR25.
2. Joints: Push-on joint meeting ASTM D3139.
3. Gaskets: Shall meet the requirements of ASTM F477.
4. Manufacturing quality control testing shall meet the requirements of AWWA C900-16.
5. Bends shall match pipe material.

2.02 SANITARY SEWER PIPE – ALL OTHER AREAS

A. Sanitary sewers located at least 10-feet (horizontal) from paved area shall be either Sewer Pipe per section 2.01 above or rigid polyvinyl chloride (PVC) conforming with the following requirements:

1. Pipe and fittings shall meet the requirements of ASTM D3034.
2. The standard dimension ratio (SDR) of the pipe shall be 35 and have a pipe stiffness of 46 psi.
3. The PVC compound shall be composed of ASTM D1784 Cell Class 12454.
4. Joints for pipes and fittings shall utilize bell and spigot connections with a spun-on, welded or integral bell. Joints shall be watertight and meet or exceed the requirements of ASTM D3212.
5. Gaskets shall meet the requirements of ASTM F477.
6. Bends shall match pipe material.

2.03 INSIDE DROP CONNECTION

A. PVC Pipe for Inside Drop: AWWA C900-16.

B. PVC Fittings: AWWA C907

C. Joints: Shall be push-on joints meeting ASTM D3139.

D. MH structure shall be sized to accommodate inside drop and provide at least 4.5-feet clearance from drop to edge of MH.

2.04 CLEANOUTS

A. Cleanouts shall be constructed as shown on the Drawings and Details.

B. Cleanouts shall be tested for watertightness along with the sewers to which they are connected.

C. Riser shall be Ductile-Iron Sewer Pipe: ASTM A746, Class 52, for push-on joints.

D. Wye shall match adjacent pipe material.

E. Ring and Cover: 12-inch ductile iron locking ring and cover meeting Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage, Sanitary Sewer, and IWS Structures.

F. Double cleanouts shall be used as indicated in Section 1.01 Design Requirements.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 INSPECTION SANITARY SEWERS

A. Pipe shall be cleaned prior to inspection to remove all debris. Cleaning approach shall collect all debris and not flush any debris into existing system.

B. Inspection: Pipe shall be subject to inspection and rejection in accordance with the provisions of ASTM C14. Obtain approval of pipe installation from the Engineer prior to backfilling.

C. Television inspection for pipes is required. Television inspection shall be in accordance with Section 7-17.3(2)H of the WSDOT Standard Specifications.

D. Deflection testing of PVC pipe shall be in accordance with Section 7-17.3(2)G of the WSDOT Standard Specifications.

4.02 TESTING OF SANITARY SEWERS

A. At the engineers option, all installed gravity sanitary sewer shall be subjected to either:

1. Low-pressure air test, in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications.
2. Hydrostatic test, in accordance with Section 7-17.3(2)C of the WSDOT Standard Specifications.

3. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for exterior grease interceptor vault systems are as described in the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 333000 Sanitary Sewer Requirements. All grease interceptor vaults shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Shop drawings and technical data for vaults, including engineering calculations for sizing, structural loads and as required.
2. Shop drawings and technical data for frames, grates, and covers.
3. Shop drawings for steel reinforcement.
4. Aircraft-rated structures shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington for approval by the Port prior to fabrication.
5. Evaluation of the vehicles or aircraft imparting the highest load factors.

B. Bypass and phasing plans when construction will impact active sanitary sewer facilities.

C. Testing plan for installed vault and grease waste pipe per Part 4.

D. Testing results of installed vault and grease waste pipe per Part 4.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) applicable provisions

B. American Society for Testing Materials (ASTM) applicable provisions

C. American Society for Testing and Materials (ASTM) C1613 Standard Specification for Precast Concrete Grease Interceptor Tanks

D. Washington State Department of Transportation Standard Specification Section 7-17.3(2)B Exfiltration Test

E. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

F. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching And Backfill

G. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage Sanitary and IWS Structures

PART 2 PRODUCTS

2.01 GREASE INTERCEPTOR VAULT

A. Grease interceptor vault shall be of the configuration per the plans. The plans show the minimum size and volume for a grease interceptor, the required system sizing shall be verified and increased as needed to treat the expected flow.

B. Pre-cast concrete vault shall consist of a vault with piping, grease retaining baffle(s), access cover(s) and frames. It shall be gas and watertight. All components of the system shall be designed for the expected structural loading as noted below.

C. Aircraft-rated grease interceptor vault is required at any airport location that will be subjected to loading by aircraft, or that is located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass most of the Air Operations Area (AOA) at STIA, including but not limited to the aprons, hardstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), Head of Stand Utility between nose of aircraft and terminal building, and within Perimeter Road.

D. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

E. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways, runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration should be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) operating at STIA have axle loadings that exceed AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology should be utilized based upon the actual loading encountered at the site.

F. All structural calculations for the vault shall include the depth of cover over the vault.

G. Structural calculations for the grease interceptor vault shall be completed by a Washington state licensed engineer.

H. Vault access castings shall meet Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage and IWS Structures

I. Excavation and backfill shall be per STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

J. Finished floor of vault shall not exceed 12-ft from finished grade.

2.02 EXTERIOR GREASE WASTE PIPE

A. Exterior piping that convey the grease waste to the grease interceptor shall be made of a material that does not corrode in the presence of grease.

B. Materials for grease waste:

1. SDR35 PVC Gravity sewer pipe
2. Schedule 40 PVC pipe

C. Double cleanouts shall be installed before and after each bend, every 50-feet along the length of the grease waste line, and at 5-ft from buildings.

2.03 GREASE INTERCEPTOR VENT PIPE

1. Minimum 3 inch galvanized steel pipe.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 GREASE WASTE LINE TESTING

A. At the engineers option, all installed grease waste line shall be subjected to either:

1. Low-pressure air test, in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications.
2. Hydrostatic test, in accordance with Section 7-17.3(2)C of the WSDOT Standard Specifications.

B. Contractor shall submit testing plan to engineer.

4.02 GREASE INTERCEPTOR VAULT TESTING

A. In order to demonstrate water tightness, the entire grease interceptor vault shall be tested prior to acceptance in accordance with *ASTM C1613-17 Standard Specification for Precast Concrete Grease Interceptor Tanks*.

B. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Subdrain systems shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Stormwater Conveyance, the Standard Details (Appendix A) requirements and the below specifications.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M252 Standard Specification for Corrugated Polyethylene Drainage Pipe

B. American Association of State Highway and Transportation Officials (AASHTO) M278 Standard Specification for Class PS46 Polyvinyl Chloride Pipe

C. American Association of State Highway and Transportation Officials (AASHTO) M288 Geotextiles

D. American Society for Testing and Materials (ASTM) F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

E. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance

PART 2 - PRODUCTS

2.01 SUBDRAIN PIPING

A. Piping utilized for subdrain systems shall be one of the following:
   1. PVC Pipe and Fittings: Perforated per AASHTO M278, except that the minimum perforation shall be 0.18-inches in diameter and the maximum perforation shall be 0.25-inches in diameter, spaced approximately 3-inches on-center. The minimum pipe size shall be 6-inches. The maximum pipe diameter shall be 10-inches.
   2. HPDE Pipe and Fittings: AASHTO M252, Type SP with AASHTO M252 Class 2, slotted holes 1.18-inches long and 0.125-inches wide. Water inlet area a minimum of 0.945 square inches per foot of pipe. The minimum pipe diameter shall be 6-inches. The maximum pipe diameter shall be 10-inches.

B. Elastomeric Seals: ASTM F477

C. Porous backfill for subdrains shall be from a source that has WSDOT QPL Aggregate Source Approval, and shall be a gravel material free of clay, humus, or other objectionable matter and shall conform to the following gradings:

SIEVE DESIGNATION	PERCENTAGE BY WEIGHT PASSING
1”	99-100
3/4”	80-100
3/8”	0-40
No. 4	0-4
No. 200	0-2

D. Subdrain Geotextile Filter Fabric: Pervious sheet of polyester, polyethylene, nylon, or polypropylene filaments, non-woven and formed into a uniform pattern. Filter fabric shall be AASHTO M 288 Class 2 and have the following minimum properties when measured in accordance with the referenced standard as shown in the table.

Fabric Property	Test Method	Test Requirement
Grab Tensile Strength, lbs	ASTM D4632	125 min
Grab Tensile Elongation %	ASTM D4632	50 min
Burst Strength, psi	ASTM D3785	125 min
Trapezoid Tear Strength, lbs	ASTM D4533	55 min
Puncture Strength, lbs	ASTM D4833	40 min
Abrasion, lbs	ASTM D4886	15 max loss
Equivalent Opening Size	ASTM D4751	70-100
Permittivity sec^{-1}	ASTM D4491	0.80
Accelerated Weathering (UV Stability) (Strength Retained - %)	ASTM D4355 *(500 hrs exposure)	70

E. Cleanout piping shall be a minimum of 6-inches in diameter, or sized to match the subdrain system, whichever is greater. Cleanouts shall be placed at the end of any subdrain piping system, at all tees, elbows or crosses, and at the transition of any perforated piping to non-perforated conveyance piping. Cleanout frame and covers shall meet the requirements of Section 334241 - Frames, Covers and Grates for Storm Drainage, Sanitary Sewer, and IWS Structures

F. Unless otherwise shown on the Standard Details, a 4-inch bed of porous backfill material shall be spread in the bottom of the trench throughout the entire length under all perforated pipe subdrains.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING – To be provided by Design Engineer.

END OF SECTION

PART 1 – GENERAL DESIGN REQUIREMENTS

This section covers design standards and requirements for stormwater drainage system (SDS) and industrial wastewater system (IWS) conveyance only. Design of detention, flow control and water quality facilities, including the design flow rates for such facilities, should be performed in accordance with the Seattle-Tacoma International Airport (STIA) Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016) and all applicable sections of the Stormwater Management Manual for Western Washington (SWMMWW; Department of Ecology 2014 amended).

A. All gravity conveyance shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. IWS standards, as described in this section, shall apply for conveyance of all runoff originating within the STIA identified IWS basins. Reference the Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016) for locations of the IWS basins.

C. The minimum cover requirements for all pipe shall be 3 feet to top of subgrade. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements of storm drainage and IWS gravity conveyance systems.

D. Piping less than 12-inches in diameter shall not be utilized for gravity conveyance of storm or IWS flow from inlets, catch basins, channel drains, surface drains, manholes, swales or ditches. Piping less than 12-inches in diameter may be utilized, if appropriately sized to convey peak flow, for gravity connections of underdrain systems, roofing downspout (rain leader) systems or electrical and communications vault drains to storm drainage or IWS structures. Piping less than 12-inches in diameter shall be referred to as non-perforated pipe (NPP) and shall meet the requirements of this section.

E. Piping shall be installed a minimum of 5-feet away from buildings, structures and associated foundations.

F. In the situation of a new building, structures, and associated foundations conflict with existing piping; the existing piping system shall be relocated a minimum of 5-feet away from the new building, structures and associated foundations. If there are no viable options to reroute the existing pipe; a sleeve shall be used to isolate piping from concrete.

G. Pipe to be located under taxilanes shall be installed inside a steel casing. Diameter and wall thickness of the casing shall be determined by the design engineer.

1.01 CONVEYANCE DESIGN REQUIREMENTS:

A. Drainage conveyance design shall be performed for all stormwater and IWS piping and drainage structures (inlets, manholes, catch basins, trench drains, etc.). All storm drainage and IWS conveyance design and analysis shall utilize an approved runoff computation method as described in the King County Surface Water Design Manual (2016 or latest edition), as modified herein. This manual provides for the acceptable uses of the various available computation methods. Table 3.2 of the 2016 King County Surface Water Design Manual (SWDM 2016), Chapter 3 – Hydrologic Analysis and Design is applicable as modified herein:

Table 1-Runoff Computation Methods for Peak Flow Conveyance Sizing

Applied to:	Rational Method	TR55/SBUH	King County SWDM 2016 Approved Continuous Models[1] (WWHM2012, MGS Flood, HSPF)
Tributary Area ≤ 1 Acre	REQUIRED, no storage routing to be performed	Not Applicable	Not Applicable
1 Acre < Tributary Area < 10 Acres	OKAY if no storage routing is performed	OKAY if no storage routing is performed	OKAY if using 15-minute time steps and 15-minute rainfall time series. (storage routing allowed)
Tributary Area ≥ 10 Acre	Not Applicable	OKAY if no storage routing is performed	OKAY if using 15-minute time steps and 15-minute rainfall time series (storage routing allowed)

Note 1 – See 2016 King County Surface Water Design Manual Reference 6-D for supplemental modeling guidelines. Note that basin-specific calibrated HSPF parameters have been developed for Des Moines Creek, Miller Creek and Walker Creek and are included in the Stormwater Management Manual for Port Aviation Division Property.

B. All new drainage conveyance infrastructure shall be sized to convey and contain the peak flow for a 25-year design storm, without system surcharge, at Seattle-Tacoma International Airport. Pipe systems may surcharge and structures may overtop for runoff events that exceed the 25-year design capacity, provided the overflow from a 100-year runoff event does not create or aggravate a severe flooding problem or severe erosion problem as described in Core Requirement #2 – Offsite Analysis, Section 1.2.2 of the King County

Surface Water Design Manual (2016, or latest edition). Any overflow occurring onsite for runoff events up to and including the 100-year event must discharge at the natural location for the project site, and must be demonstrated by hydraulic analysis.

C. Hydraulic analysis for pipe systems shall meet the requirements of King County Surface Water Design Manual, Chapter 4 – Conveyance System Analysis and Design, Sections 4.2 and 4.3.

D. Sizing of IWS conveyance piping and surface drainage structures may require additional capacity based on regularly occurring, site-specific runoff generation activities. Such activities may include aircraft de-icing pads, fire department practice areas, or areas designed for containment of petroleum or de-icing products.

E. All projects must incorporate the applicable minimum stormwater management requirements for new development or redevelopment as described in the STIA Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016). As such, all projects are required to prepare and submit a Stormwater Site Plan for Port review and approval. The Stormwater Site Plan is the comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with the minimum stormwater management requirements. The STIA Stormwater Management Manual describes these minimum requirements based on project size and type, describes the content to be included in the Stormwater Site Plan submittal to the Port, and provides preparation instructions. A template for the Stormwater Site Plan is also available from the Port through their Aviation Stormwater Management group.

1.02 SYSTEM LAYOUT REQUIREMENTS

A. Gravity Systems: System layout requirements for gravity industrial waste and storm drainage systems shall meet the requirements of the STIA F&I Civil Systems Standards Section 334211 - Storm Drainage and IWS Gravity Conveyance, the STIA F&I Civil Systems Standards Appendix A - Standard Details, and this Section.

B. Force Main Systems: System layout requirements for industrial waste and storm drainage force main systems shall meet the requirements of the STIA F&I Civil Systems Standards Section 334216 - Storm Drainage, Sanitary Sewer, and IWS Force Main Piping, the STIA F&I Civil Systems Standards Appendix A - Standard Details, and this Section.

1.03 UTILITY CLEARANCE REQUIREMENTS

A. Horizontal clearance between IWS or storm drain piping and other non-potable piping conveyance or utilities shall be a minimum of 10 feet measured center to center. Vertical clearance between IWS or storm drain pipping and other non-potable conveyance piping or utilities shall be a minimum of 12-inches at utility crossings. Vertical clearances of between 6-inches and 12-inches may be allowed at crossings in certain circumstances if no other options exist, and if it is specifically approved by Port Facilities and Infrastructure. IWS or storm drain piping at utility crossings shall be as shown in the STIA F&I Civil Systems Standards Appendix A - Standard Details.

B. Horizontal clearance between IWS or storm drainage (non-potable) piping and potable water mains shall be spaced a minimum of 10 feet measured center to center. Non-potable piping shall be laid at a lower invert elevation than potable water mains and maintain an 18-inch vertical clearance at crossings. These crossings shall occur at the midpoint of full length pipe segments (18 feet minimum) of the utilities to maximize the spacing between joints.

C. When the design requires a non-potable conveyance system (e.g., IWS or storm drain) to pass over a potable water main, the design must be approved by Port Facilities and Infrastructure, and meet all of the following requirements:

1. A minimum vertical spacing of 18-inches between the bottom of the non-potable and the top of the potable water main.
2. The water main and the non-potable conveyance pipeline must be made of ductile iron pipe meeting AWWA C151 standards.
3. The water main and the non-potable conveyance pipeline shall be encased in a pressure rated casing pipe designed to withstand a minimum static pressure of 150 psi.
4. The casing shall utilize a full pipe length (20 feet minimum) at the crossing with the pipe length centered to provide the maximum joint separation.

D. Vertical and horizontal utility clearance requirements are summarized in table form in Section 322333 Utility Trenching and Backfill.

1.04 REFERENCES

A. All drainage design shall meet the requirements of the following Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Sections:

1. STIA F&I Civil Systems Standards Section 024113.23, Utility Demolition and Abandonment
2. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill
3. STIA F&I Civil Systems Standards Section 334116, Subdrainage
4. STIA F&I Civil Systems Standards Section 334211, Storm Drainage and IWS Gravity Conveyance
5. STIA F&I Civil Systems Standards Section 334216, Storm Drainage, Sanitary Sewer, and IWS Force Main Piping
6. STIA F&I Civil Systems Standards Section 334231, Storm Drainage, Sanitary Sewer, and IWS Structures
7. STIA F&I Civil Systems Standards Section 334236, Channel Drains
8. STIA F&I Civil Systems Standards Section 334241, Frames, Covers and Grates for Storm Drainage, Sanitary Sewer, and IWS Structures
9. STIA F&I Civil Systems Standards Appendix A - Standard Details

B. All drainage design shall meet the requirements of the latest published editions of the following documents:
   1. National Fire Protection Associations (NFPA) 415, Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways
   2. Federal Aviation Administration (FAA) Advisory Circulars (AC), including but not limited to:
      a. AC 150/5300-13A Airport Design
      b. AC 150/5200-33B Hazardous Wildlife Attractants On or Near Airports
      c. AC 150/5320-5D Airport Drainage
      d. AC 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes
   3. STIA Wildlife Hazard Management Plan (WHMP; Port of Seattle and United States Department of Agriculture 2004)
   4. STIA’s NPDES Permit No. WA-002465-1
   5. STIA Airport Certification Manual
   6. STIA Stormwater Low-Impact Development Guideline (2016)
   7. Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016 for consistency with the 2014 amended Ecology SWMMWW

8. Stormwater Management Manual for Western Washington (SWMMWW; Ecology 2014 amended)
9. STIA Model Stormwater Management Guidelines for Infrastructure New Development and Redevelopment (Salmon-Safe 2016)
10. Various City Codes (SeaTac, Burien, Des Moines): These local city codes apply to development on airport property outside of the STIA NPDES Permit boundary. The City of SeaTac, City of Burien, and City of Des Moines stormwater programs and discharges are permitted under the NPDES Phase II MS4 Permit. All Phase II Municipalities are required to update their codes to require LID consistent with the SWMMWW (amended 2014) by December 31, 2016.
11. King County Surface Water Design Manual (King County 2016)

END OF SECTION

PART 1 – GENERAL

1.01 GRAVITY STORM DRAINAGE SYSTEM LAYOUT REQUIREMENTS

A. The STIA storm drainage system (SDS) shall be laid out such that the connections of any piping (e.g., laterals, branch lines, roof drains), regardless of size, to the SDS, occurs at a standard SDS manhole or catch basin meeting the requirements of STIA F&I Civil Systems Standards Section 334231 Sewer, Storm and IWS Structures. Direct connection of any type of piping directly to SDS piping, such as through the use of "inserta- tees", fittings, or pipe coring and grouting, is not permitted.

B. Catch basins shall be spaced no greater than 150 feet for grades less than one percent, 200 feet for grades between 1 percent and 3 percent and 300 feet for grades 3 percent and greater.

C. In-line catch basins are permitted on SDS piping provided the SDS catch basin is sized sufficiently to convey and contain the 25-year design storm without surcharge. See STIA F&I Civil Systems Standards Section 334200 Storm and IWS System Requirements.

D. Changes between pipe material along the SDS piping, such as changing from polypropylene to ductile iron piping, shall occur only at standard SDS manholes or catch basins.

E. No IWS flow or piping shall enter or be connected to the SDS.

1.02 GRAVITY INDUSTRIAL WASTE SYSTEM LAYOUT REQUIREMENTS

A. All STIA industrial waste system (IWS) piping and components shall meet the requirements of National Fire Protection Association (NFPA) 415, Chapter 5 – Aircraft Fueling Ramp Drainage.

B. Drainage inlets and other surface drainage collection, where provided, shall be located a minimum of 50 feet from any structures as defined in NFPA 415, Paragraph 5.1.1. In no case shall the design allow fuel to collect on the aircraft fueling ramp or adjacent ground surfaces where it could constitute a fire hazard. NFPA 415, Chapter 5 minimum slope requirements for aprons apply.

C. The IWS shall be laid out such that the connections of any piping to the IWS, regardless of size, occurs at an IWS manhole or catch basin meeting the requirements of STIA F&I Civil Systems Standards Section 334231 Sewer, Storm and IWS Structures. Direct connection of any type of piping directly to IWS piping, such as through the use of "inserta-tees", fittings, or pipe coring and grouting, is not permitted.

D. The IWS shall be designed so that the fuel or its vapor cannot enter into the drainage system of buildings, areas utilized for automobile parking, public or private streets or outdoor passenger areas, the airport terminal or aircraft hangar structures. A catch basin equipped with a vapor trap, as depicted in the STIA F&I Civil Systems Standards Appendix A – Standard Details, shall be utilized in between any drainage collection piping (e.g., from roof drainage, building drains) and the connection to the IWS.

E. Channel drains and catch basins shall be individually drained to the IWS by laterals to an approved IWS structure on the IWS line. For additional channel drain requirements see STIA F&I Civil Systems Standards Section 334236 Channel Drains and NFPA 415, Chapter 5 – Aircraft Fueling Ramp Drainage.

F. Unlike the SDS, in-line catch basins are not permitted in the IWS.

G. IWS flows must be wholly segregated from any other conveyance systems (e.g., SDS or Sanitary Sewer).

H. All IWS piping and components shall be noncombustible and inert to fuel, petroleum products, ethylene glycol, propylene glycol, potassium acetate, and sodium acetate.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement

B. American Society for Testing and Materials (ASTM) A185 Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement

C. American Society for Testing and Materials (ASTM) A276 Standard Specification for Stainless Steel Bars and Shapes

D. American Society for Testing and Materials (ASTM) A496 Standard Specification for Deformed Steel Wire for Concrete Reinforcement

E. American Society for Testing and Materials (ASTM) A497 Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete

F. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings

G. American Society for Testing and Materials (ASTM) A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

H. American Society for Testing and Materials (ASTM) A746 Standard Specification for Ductile Iron Gravity Sewer Pipe

I. American Society for Testing and Materials (ASTM) B21 Standard Specification for Naval Brass, Rod, Bar, and Shapes

J. American Society for Testing and Materials (ASTM) B138 Standard Specification for Manganese Bronze Rod, Bar and Shapes

K. American Society for Testing and Materials (ASTM) B584 Standard Specification for Copper Alloy Sand Castings for General Applications

L. American Society for Testing and Materials (ASTM) C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

M. American Society for Testing and Materials (ASTM) C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

N. American Society for Testing and Materials (ASTM) C655 Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

O. American Society for Testing and Materials (ASTM) C1103 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

P. American Society for Testing and Materials (ASTM) C1417 Standard Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design

Q. American Society for Testing and Materials (ASTM) D1784 Standard Specification for Rigid PolyVinyl Chloride (PVC) Compounds

R. American Society for Testing and Materials (ASTM) D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

S. American Society for Testing and Materials (ASTM) D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

T. American Society for Testing and Materials (ASTM) F477 Standard

Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

U. American Society for Testing and Materials (ASTM) F2306 Standard Specification for 12 to 60 in. Annular Corrugated Profile-Wall Polyethylene Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

V. American Society for Testing and Materials (ASTM) F2376 Standard Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems

W. American Society for Testing and Materials (ASTM) F2487 Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene and Polypropylene Pipelines

X. American Society for Testing and Materials (ASTM) F2562 Standard Specifications for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage

Y. American Society for Testing and Materials (ASTM) F2881 Standard Specification for 12 to 60 in. Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

Z. Association of State Highway and Transportation Officials M170 Standard Specification for Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe

AA. Association of State Highway and Transportation Officials M330 Corrugated Polypropylene Pipe

BB. Association of State Highway and Transportation Officials MP 40 Steel-Reinforced Polyethylene (PE) Ribbed Pipe 1650-mm to 300-mm (66-in. to 120-in.) Diameter

CC. American Water Works Association (AWWA) C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

DD. American Water Works Association (AWWA) C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

EE. American Water Works Association (AWWA) C151 Ductile Iron Pipe, Centrifugally Cast

FF. American Water Works Association (AWWA) C515 Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

GG. American Water Works Association (AWWA) C550 Protective Interior

Coatings for Valves and Hydrants

HH. American Water Works Association (AWWA) C560 Cast-Iron Slide Gates

II. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 312333 Utility Trenching and Backfill

JJ. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Storm and IWS System Requirements

KK. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334231 Sewer, Storm and IWS Structures

LL. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334236 Channel Drains

MM. Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016)

NN. Washington State Department of Transportation (WSDOT) Standard Specification Section 7-17.3(2)F Low Pressure Air Test for Sanitary Sewers Constructed of Non Air Permeable Materials

PART 2 – PRODUCTS

2.01 STORM DRAINAGE PIPE, 12-INCH to 60-INCH DIA. UNDER NON PAVED SURFACES

A. Gravity storm drainage pipe 12-inches to 60-inches in diameter under non-paved surfaces shall be one of the following:

1. Pipe shall be ductile iron pipe meeting the requirements of Paragraph 2.02 below, or:
2. Pipe shall be double-walled with a smooth interior and annular corrugations and shall be manufactured of a polypropylene compound meeting the following material requirements:
    a. Size 12-inch to 30-inch diameter pipe and fittings: ASTM F2376 and AASHTO M330.
    b. Size 36-inch to 60-inch diameter pipe and fittings: ASTM F2881 and AASHTO M330.
    c. Joints for pipes and fittings shall utilize bell and spigot connections with a spun-on, welded or integral bell. Joints shall be watertight and meet or exceed the requirements of

ASTM D3212.

d. All pipes and fittings shall utilize a double-gasketed spigot with gaskets meeting ASTM F477.

e. Manufacturing quality control testing shall meet the requirements of ASTM F2306

2.02 STORM DRAINAGE PIPE, 12-INCH to 60-INCH DIA. UNDER PAVEMENTS

A. Gravity storm drainage pipe 12-inches to 60-inches in diameter under paved surfaces shall be ductile iron pipe meeting the following material requirements:

1. Ductile iron pipe and fittings: AWWA C151, thickness Class 52 minimum (or higher if required for application).
2. Push-on joint: AWWA C111
3. Cement mortar lining: AWWA C104
4. Asphaltic Coated: AWWA C151
5. Rubber gasket: AWWA C111
6. Manufacturing quality control testing shall meet the requirements of ASTM A746

B. Double walled plastic pipe meeting the requirements of section 2.01 above may be used in lieu of ductile iron pipe under paved surfaces for landside (outside of the AOA) in instances where the pipe does not have less than 24” of cover to top of subgrade.

2.03 STORM DRAINAGE PIPE, OVER 60-INCH IN DIA.

A. Gravity storm drainage pipe 60-inches in diameter or larger, regardless of location, shall steel-reinforced polyethylene pipe (SRPE) meeting the following material requirements:

1. Material Properties:

a. SRPE pipe shall be polyethylene pie with a smooth interior wall and an exterior that is reinforced with high strength galvanized steel ribs, and manufactured in accordance with the applicable requirements of ASTM F2562 “Standard Specifications for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage” or AASHTO Designation M335 and MP-40.

b. SRPE pipe and fittings shall be manufactured from virgin high density polyethylene stress-rated resins conforming to the minimum requirements of cell classification 345464C as defined and described in the latest version of ASTM D3350 "Standard Specification for Polyethylene Plastics Pipe and Fittings Materials".

2. Joint Performance: Pipe lengths shall be joined on site using manufacturer's welded coupler joints. Pipe plane ends shall be welded together utilizing exclusive pressure testable extrusion welded couplers. Field welding to be performed by certified HDPE welding technician with a minimum of two years HDPE welding experience. .
3. Fittings: Shall be as recommended by the SRPE pipe manufacturer.

2.04 IWS PIPE, 12-INCH to 60-INCH DIA.

A. Gravity IWS pipe 12-inches to 60-inches in diameter, regardless of location, shall be ductile iron pipe meeting the following material requirements:

1. Ductile iron pipe and fittings: AWWA C151, thickness Class 52 minimum (or higher if required for application).
2. Push-on joint: AWWA C111
3. Cement mortar lining: AWWA C104
4. Asphaltic Coated: AWWA C151
5. Gaskets for IWS pipes shall be made of elastomer nitrile (NBR) and meet the requirements of AWWA C111
6. Manufacturing quality control testing shall meet the requirements of ASTM A746

2.05 IWS PIPE, OVER 60-INCH DIA.

A. Gravity IWS pipe 60-inches in diameter or larger, regardless of location, shall be reinforced concrete pipe meeting the following material requirements:

1. Reinforced concrete pipe, meeting ASTM C76 and AASHTO M170, Class V, or as designed using D-Load strength requirements per ASTM C655
2. Joint Performance: Bell and spigot single offset joint, sealed with elastomeric rubber gasket, watertight, ASTM C443.

3. Material Properties: Min. compressive strength and mix design requirements per ASTM C76, pipe class designation per ASTM C655 and ASTM C1417. Reinforcing steel per ASTM A82, A185, A496 or A497 and bars in ASTM A615.

2.06 NON-PERFORATED PIPE, UNDER 12-INCH DIA. (UNDERDRAINS, ROOF DOWNSPOUTS, AND VAULT DRAINS)

A. Piping less than 12-inches in diameter may be utilized, if appropriately sized to convey peak flow, for gravity connections of underdrain systems, roofing downspout (rain leaders) systems or electrical and communications vault drains to storm drainage or IWS structures. Storm drainage and IWS conveyance piping, piping conveying surface drainage, or piped connections with conveyances requiring diameters larger than 12-inches, shall meet the standards defined above for storm drain or IWS Pipe, as applicable.

B. Piped connections from electrical and communications vault drains shall be sized as required, or a minimum of 4-inches in diameter, and shall connect to an approved IWS or storm drainage structure.

C. Piped connections from subdrain systems or roofing downspout systems shall be a minimum of 6-inches in diameter, and shall connect to an approved storm drainage structure. Connection to IWS structures shall meet the requirements of Paragraph 1.03 above, this Section.

D. Material standards for piping under 12-inches in diameter shall be as follows:

1. Within IWS basins, regardless of location: Piped connections in areas receiving runoff within the STIA identified IWS basins shall utilize the ductile iron pipes and fittings standards for IWS pipe as defined in Paragraph 2.04 above, this Section.
2. Within SDS basins, under PCCP pavement: Piped connections in areas receiving runoff within the STIA identified SDS basins, and under pavement shall utilize the ductile iron pipes and fittings standards for SDS pipe under pavements as defined in Paragraph 2.02 above, this Section.
3. Within SDS basins, under asphalt-paved or non-paved areas: Piped connections in areas receiving runoff within the STIA identified SDS basins, and under non-paved areas shall utilize rigid polyvinyl chloride (PVC) conforming with the minimum requirements:

a. Pipe and fittings shall meet the requirements of ASTM D3034.

b. The standard dimension ratio (SDR) of the pipe shall be 26 and have a pipe stiffness of 115 psi.

c. The PVC compound shall be composed of ASTM D1784 Cell Class 12454

d. Joints for pipes and fittings shall utilize bell and spigot connections with a spun-on, welded or integral bell. Joints shall be watertight and meet or exceed the requirements of ASTM D3212.

e. Gaskets shall meet the requirements of ASTM F477.

2.07 STORM DRAINAGE AND IWS GATE VALVES AND SLIDE GATES

A. Gate valves for use with piped gravity conveyance utilizing ductile iron pipe, such as IWS or storm drainage pipe under pavement, shall be as follows:

1. Gate valves shall be resilient wedge seat type meeting AWWA Standard C515.
2. Gate valves shall be rated for 250 psi maximum working pressure and 500 psi static test pressure.
3. Operating mechanism shall be a standard 2-inch AWWA square operating nut opening to the left and shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover.
4. Ductile iron valve body with interior and exterior epoxy coating meeting all applicable requirements of AWWA C550.
5. Valve may be push-on or mechanical joint ends meeting AWWA C111.
6. Stuffing box shall be ductile iron stuffing box meeting ASTM A536 with rubber O-ring stuffing box seals and brass anti-friction washers. There shall be two O-ring stuffing box seals located above thrust collar and one below.
7. Wedge shall be ductile iron wedge meeting ASTM A536, symmetrical and fully encapsulated with molded SBR or EPDM

rubber and no exposed iron. The sealing rubber shall be permanently bonded to the wedge per ASTM D429. The wedge shall hall be two-faced with parallel seats and wedging devices between them.

8. Valves utilized in conveyance piping that will be regularly exposed to hydrocarbons, fats, oils, greases, chemicals, oils and refined petroleum (Jet Fuel), or that will be utilized for the purpose of fuel spill containment, shall use an approved Nitrile (NBR) wedge encapsulation.
9. Valve stems shall be non-rising type consisting of a non-corrosive manganese-bronze ASTM B138 or 305 stainless steel alloy ASTM A276 with material properties as follows:
   a. 2” to 16” Valves: Tensile 70,000 psi, Min Yield 48,000 psi
   b. 18” to 54” Valves: Tensile 70,000 psi, Min Yield 30,000 psi

B. Slide valves for piped gravity conveyance shall be as follows:

1. Slide (or sluice) gates shall meet AWWA C560, be purpose designed for their application and be capable of controlling the flow of fluid through the opening under the design seating and unseating heads.
2. Design head ratings for slide gates shall be as calculated by Engineer or meet the following minimums, whichever is greater:
   a. Minimum seating head shall be 20-feet.
   b. Minimum unseating head shall be 10-feet
3. Slide gates for use with piping shall be furnished with a round back flange for attaching to pipe flanges, or other mechanical means to provide for a watertight seal when utilized in combination with conveyance piping at the design head rating required. All slide gates installed in new openings should be bolted to a new cast-in-place cast iron wall thimble. Thimbles shall be circular when utilized with pipe openings.
4. Slide gates utilized in-line with piping shall be mounted within structures meeting the requirements of STIA F&I Civil Systems Standards Section 334231 Storm Drainage, Sanitary Sewer, and IWS Structures. Slide gates shall be mounted flush to concrete surfaces of flat headwalls or rectangular storm vaults. Where

mounting inside circular manholes, a cast-in-place, vertical concrete support face tied to the manhole structure shall be utilized to mount the slide gate with a cast-in-place wall thimble. All structures, or structure modifications, shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington.

5. Bronze to bronze seating surfaces are required.
6. High tensile adjustable bronze side, top and bottom wedges are required.
7. Gate operating systems:
    a. Utilize above ground, pad mounted manually operated floor stand style system with removable cranks. A grout pad shall be used under the floor stand to insure proper alignment between hoist and operating stem.
    b. The manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40-pounds on the crank and shall be able to withstand, without damage, an effort of 80-pounds. The crank shall be removable and fitted with a corrosion resistant rotating handle. The maximum crank radius shall be 15-inches. All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings.
    c. Where location dictates a flush mounted or below-grade operating system, a non-rising stem with a 2-inch AWWA square operating nut that can be engaged by a T-handle wrench shall be utilized. The stem shall open to the left and the operating nut shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover. The ductile iron valve box should extend between the finished grade and through the top slab of the structure housing the slide gate. For structures in which the top slab is at finished grade, the valve box may be cast with the top slab.

8. Stems shall be stainless steel shall have a slenderness ratio (length/radius) less than 200 and be designed to withstand a torsional force of twice the maximum effort required to operate the gate. For stems in more than one piece, the different sections shall be joined together by solid bronze couplings.
9. Stem guides shall be stainless steel, be equipped with ultra-high molecular weight polyethylene bushings and be positioned as per the slide gate manufacturers recommendations.

C. Materials for slide gates shall meet the following requirements:

1. Gate frame, wall thimbles, disc and stem guides shall be ductile iron (ASTM A536, Grade 65-45-12)
2. Wedges, thrust nuts, lift nuts and couplings shall be bronze (ASTM B- 584, C86500 or C87300)
3. Seating surfaces shall be bronze (ASTM B-21, C46400 Bronze)
4. Tongue and guide liners shall be bronze (ASTM B-98, C65500 Bronze)
5. Stems and fasteners shall be stainless steel (ASTM A276, Type 304 or 316)

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING

4.01 TESTING AND PERFORMANCE REQUIREMENTS FOR STORM DRAINAGE AND IWS GRAVITY CONVEYANCE PIPING

A. Pipe and structures shall be cleaned prior to inspection. Cleaning approach shall collect all debris and not flush any debris into existing system.

B. All gravity storm and IWS pipes constructed of polyvinyl chloride (PVC), polyethylene (PE) or ductile iron pipe shall be subjected to a low-pressure air test, in accordance with Section 7-17.3(2)F of the WSDOT Standard Specifications. Pipes 30-inches in diameter or less may be tested from manhole, catch basin to catch basin or shorter lengths as determined by the Contractor. Pipes over 30-inches in diameter and above shall be tested at every joint.

C. All gravity storm and IWS pipes constructed of reinforced concrete pipe shall be tested in accordance with ASTM C1103.

D. Deflection test and/or television inspection for pipes may be required at Engineer’s request. Deflection testing shall be in accordance with Section 7-17.3(2)G of the WSDOT Standard Specifications. Television inspection shall be in accordance with Section 7-17.3(2)H of the WSDOT Standard Specifications.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Design requirements for storm drainage and IWS systems are as described in the Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Stormwater Conveyance. All force main conveyance shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

B. IWS standards, as described in this section, shall apply for conveyance of all runoff originating within the STIA identified IWS basins. Reference the Stormwater Management Manual for Port Aviation Division Property (2008, under update 2016) for locations of the IWS basins.

C. Sanitary Sewer standards, as described in this section, shall apply for sanitary sewers. Reference Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 333100 Sanitary Sewer Requirements.

D. Refer to STIA F&I Civil System Standards Section 334200 Stormwater Conveyance, Paragraph 1.03 for utility clearance requirements of storm drainage and IWS gravity conveyance systems.

E. The minimum cover requirements for all pipe shall be 3 feet below finished grade. The maximum cover for force mains shall be 10 feet. Refer to STIA F&I Civil System Standards Section 322333 Utility Trenching, Bedding and Backfill for additional installation requirements of storm drainage, sanitary sewer and IWS conveyance systems.

F. This section describes piping and related material standards for storm drainage, sanitary sewer and IWS force main systems. The STIA F&I Mechanical Systems Standards shall be referenced for all other applicable portions of force main systems (e.g., pumps, direct digital controls).

G. Calculations for the design of thrust blocks and/or joint restraints shall be performed and stamped by a licensed structural engineer in the State of Washington for approval by the Port.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) A276 Stainless Steel Bars and Shapes

B. American Society for Testing and Materials (ASTM) A536 Ductile Iron Castings
C. American Society for Testing and Materials (ASTM) B138 Manganese Bronze Rod, Bar, and Shapes
D. American Society for Testing and Materials (ASTM) D429 Test Methods for Rubber
E. American Water Works Association (AWWA) C104 (ANSI A21.4) Cement mortar lining
F. American Water Works Association (AWWA) C110 Ductile Iron Fittings
G. American Water Works Association (AWWA) C111 Rubber Gasket Joints for Ductile Iron Pressure Pipe
H. American Water Works Association (AWWA) C151 Ductile Iron Pipe and Fittings
I. American Water Works Association (AWWA) C500 Metal Seated Gate Valves
J. American Water Works Association (AWWA) C515 Resilient Seated Gate Valves
K. American Water Works Association (AWWA) C550 Protective Interior Coatings for Valves
L. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching, Bedding and Backfill
M. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance
N. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer Requirements
O. Seattle-Tacoma International Airport Facilities and Infrastructure Mechanical Systems Standards (2015)
P. Washington State Department of Transportation Standard Specification Section 6-02.3(2)B Commercial Concrete

PART 2 - PRODUCTS

2.01 STORM DRAINAGE, SANITARY SEWER AND IWS PIPE FOR FORCE MAINS

A. IWS Pipe for Force Mains (Ductile Iron)
  1. Ductile iron pipe and fittings: AWWA C151, thickness Class 52 minimum (or higher if required for application). All pipe shall be restrained joint pipe.

2. Lining: Cement mortar lining meeting AWWA C104
3. Asphaltic Coated: AWWA C151
4. Gaskets for IWS pipes shall be made of elastomer nitrile (NBR) and meet the requirements of AWWA C111
5. Manufacturing quality control testing shall meet the requirements of ASTM A746
6. Joints:
    a. Restrained Joints - Manufactured proprietary joint that mechanically restrains pipe to adjoining pipe. Manufacturers and Products:
        1. American Cast Iron Pipe; Flex-Ring, Field Flex-Ring, and Lok-Ring.
        2. Pacific States Pipe; Thrust-Lock.
        3. U.S. Pipe; TR Flex and HP Lok.
    b. Mechanical joints, AWWA C110 and AWWA C111.
        1. All mechanical joints shall be restrained with manufactured bolt-on restraint system such as EBAA Iron’s MegaLug, Romac Romagrip, Star Pipe Products Stargrip, or approved equal.
        2. Use only in areas where adjoining to fixed points where laying length is determined in field.
        3. Prior to purchase and installation, type and application of this joint shall be approved by Engineer.
    c. Use of set screws for restraint or field-lock gaskets shall not be allowed.
7. Fittings:
    a. Mechanical or Restrained Joint. Minimum pressure rating of 350 psi for pipe diameter 3 to 24 inches. Minimum pressure rating of 250 psi for pipe diameter 30 to 48 inches. Fittings shall be new and recently manufactured. Refurbished fittings will not be accepted.
    b. Rubber Gasket Joints Including Mechanical Joints, and Flanged Joints: In accordance with AWWA C111/A21.11.
    c. Mechanical Joint Fittings: In accordance with AWWA C110/A21.10 and AWWA C153/A21.53.

B. Storm Drainage and Sewer Pipe for Force Mains (PVC)
    1. PVC pipe and fittings: AWWA C900-16, DR 14. All pipe shall be restrained joint pipe.

2. Rubber gaskets shall conform to ASTM F477.
3. Manufacturing quality control testing shall meet the requirements of AWWA C900-16.
4. Joints:
    a. Joints shall meet the requirements of ASTM D3139.
    b. Restrained Joints - Manufactured proprietary joint that mechanically restrains pipe to adjoining pipe. Manufacturers and Products:
        1. EBAA Iron 1900 Serrated Restraint Harness.
        2. SIGMA Corporation, PV-Lok Serrated Bell Joint Restraint.
    c. Use of set screws for restraint shall not be allowed.
5. Fittings:
    a. Fittings shall meet the requirements of AWWA C900-16.

C. Storm Drainage and Sewer Pipe for Force Mains (HDPE)
1. HDPE pipe and fittings: AWWA C906, DR 9. HDPE shall conform to the outside diameter dimensions of ductile iron pipe (DIOD or DIPS) or iron pipe (IPS).
2. Manufacturing quality control testing shall meet the requirements of AWWA C906.
3. Joints: HDPE joints shall be thermally butt-fused and meet the requirements of ASTM F2620.
4. Fittings:
    a. Solid wall HDPE, shall have a dimension ratio (DR) of 9, conform to the outside diameter dimensions of ductile iron pipe (DIOD or DIPS) iron pipe or (IPS), and conform to the requirements of AWWA C906.
    b. HDPE connections to ductile iron pipe fittings shall be accomplished with an HDPE flange adapter and ductile iron back-up ring per AWWA C906.

D. Thrust blocks shall be in accordance to NFPA Section 10.6.1 standards.
1. Thrust blocks shall be permitted where soil is stable and capable of resisting the anticipated thrust forces.
2. Thrust blocks shall be of commercial concrete meeting the following requirements:

a. Commercial concrete shall have a minimum compressive strength at 28 days of 3,000 psi in accordance with AASHTO T22.
b. Commercial concrete placed above the finished ground line shall be air entrained and have an air content from 4.5 percent to 7.5 percent in accordance with FOP for AASHTO T 152.
c. Commercial concrete does not require mix design or source approvals for cement, aggregate, and other admixtures.

3. Thrust blocks shall be placed between undisturbed earth and the fitting to be restrained and can resist the calculated thrust forces.
4. Wherever possible, thrust blocks shall be located so that the joints are accessible for repair.

E. Sewer force mains shall have a “Pig Launcher” for future assessment and maintenance of the sewer line. Number and location of "Pig Launchers" to be coordinated with L&I Staff.
F. Sewer, Storm, and IWS force main design shall include analyses for if airvac valves are needed. Airvac valves shall be installed at high-points in the force main pipeline.

2.02 GATE VALVES

A. Gate Valves shall be resilient wedge seat type meeting AWWA Standard C515.
B. Rated for 250 psi maximum working pressure and 500 psi static test pressure
C. Operating mechanism shall be a standard 2-inch AWWA square operating nut opening to the left and shall be marked indicating the direction to open with the word “OPEN” and an arrow. The valve stem and operating nut shall be housed in an approved 8-inch diameter ductile iron valve box and cover.
D. Ductile iron valve body with interior and exterior epoxy coating meeting all applicable requirements of AWWA C550.
E. Mechanical joint ends meeting AWWA C111 Standard. All mechanical joints should be restrained. See paragraph 2.01.F. above.
F. Stuffing box shall be ductile iron stuffing box meeting ASTM A536 with rubber O-ring stuffing box seals and brass anti-friction washers. There shall be two O-ring stuffing box seals located above thrust collar and one below.
G. Wedge shall be ductile iron wedge meeting ASTM A536, symmetrical and fully encapsulated with molded SBR or EPDM rubber and no exposed iron.

The sealing rubber shall be permanently bonded to the wedge per ASTM D429. The wedge shall hall be two-faced with parallel seats and wedging devices between them.

H. for the purpose of fuel spill containment, shall use an approved Nitrile (NBR) wedge encapsulation.

I. Valve stem shall be non-rising type consisting of a non-corrosive manganese-bronze ASTM B138 or 305 stainless steel alloy ASTM A276 with material properties as follows:

1. 2 inches to 54 inches Valves: Tensile 80,000 psi, Min Yield 40,000 psi.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING

4.01 TESTING AND REQUIREMENTS FOR STORM DRAINAGE, SANITARY SEWER AND IWS FORCE MAIN PIPING

A. Hydrostatic test, in accordance with Section 7-17.3(2)C of the WSDOT Standard Specifications.

B. All force main piping shall be hydrostatically tested to 1.5 times design working pressure. Test duration shall not be less than 2 hours. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.

C. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Drainage structures shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Storm and IWS System Requirements, Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer System Requirements, STIA F&I Civil Systems Standards Section 334211 Storm and IWS Piping and Valves, the Standard Details (Appendix A) requirements and the below specifications.

B. Aircraft-rated Storm Drainage, Sanitary Sewer and IWS structures are required at any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass most of the Air Operations Area (AOA) at STIA, including but not limited to the aprons, hardstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), Head of Stand Utility between nose of aircraft and terminal building, and within Perimeter Road.

C. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6F Airport Pavement Design and Evaluation, Appendix B – Design of Structures" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

D. Metal castings (Frames, Covers, and Grates) for aircraft rated structures shall meet the requirements of STIA F&I Civil Systems Standards Section 334241 Frames, Covers and Grates.

E. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways, runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration should be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground serv vice equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) operating at STIA have axle loadings that exceed AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology should be utilized based upon the actual loading encountered at the site.

F. Metal castings (Frames, Covers, and Grates) for traffic rated AASHTO HS- 25 Structures shall meet the requirements of STIA F&I Civil Systems Standards Section 334241 Frames, Covers and Grates. All other metal castings shall meet the requirements of paragraph 1.01.D. above.

G. Vapor traps shall be installed where buildings connect to IWS Structures.

1.02 MODIFICATION AND ADJUSTMENT OF EXISTING UTILITY STRUCTURES

A. Where the Engineer wishes to retain an existing utility structure within the limits of a project area, the Engineer shall evaluate that structure to determine its suitability in meeting the loading design criteria for its location.

B. Existing structures falling within any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft (e.g., TSA or RSA), shall be modified to be made aircraft rated or replaced wholly with an aircraft rated structure.

C. Existing structures outside of the AOA, or outside of the operational areas that would require aircraft loading capabilities, should be assessed to determine if the structure meets the loading requirements (with required factors of safety) for the most demanding vehicles utilizing the site and modified or wholly replaced with an appropriately rated structure.

D. The utility structures shall be adjusted as required to meet the new grade, top or orifice opening elevations or other modifications as required.

E. The utility structure modifications shall meet the Paragraph 1.01 Design

Requirements and Part 2 Product Requirements of this Standards Section.

F. Frames, grates, and covers shall be new, rated for their intended location, and meet the requirements of Section 334241 Frames, Covers and Grates.

G. All utility structure modifications shall require drawings stamped by a licensed professional engineer in the State of Washington.

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 – Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Shop drawings and technical data for manholes, including engineering calculations as required.
2. Shop drawings and technical data for frames, grates, and covers.
3. Shop drawings for steel reinforcement.
4. Aircraft-rated, fuel truck rated, and AARF truck rated structures shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington for approval by the Port prior to fabrication.
5. Evaluation of the vehicles or aircraft imparting the highest load factors.

B. Testing plan for installed structures per Part 3.

C. Testing results of installed structures per Part 3.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM) C144 Standard Specification for Aggregate Masonry Mortar

B. American Society for Testing and Materials (ASTM) C150 Standard Specification for Portland Cement

C. American Society for Testing and Materials (ASTM) C478 Standard Specification for Precast Reinforced Concrete Manhole Sections

D. American Society for Testing and Materials (ASTM) C497 Standard Test Methods for Concrete Pipe, Manhole Sections or Tile

E. American Society for Testing and Materials (ASTM) D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

F. American Society for Testing and Materials (ASTM) D4101 Standard Specification for Polypropylene Injection and Extrusion Materials

G. Association of State Highway and Transportation Officials (AASHTO) M199 Standard Specification for Precast Reinforced Concrete Manhole Sections

H. Association of State Highway and Transportation Officials (AASHTO) M306 Drainage, Sewer, Utility, and Related Castings

I. Federal Aviation Administration (FAA) Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes

J. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 312333 Utility Trenching and Backfill

K. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Storm and IWS System Requirements

L. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer System Requirements

M. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers and Grates

PART 2 – PRODUCTS

2.01 PRODUCTS

A. Aircraft-rated structures shall meet the requirements as stated above in Paragraph 1.01 above, this Section. Concrete and reinforcement design shall be as required to support the loading design of the precast structure.

B. Traffic-rated AASHTO HS-25 structures shall meet the requirements of ASTM C478 (AASHTO M199).

C. Concentric or eccentric cone sections are not allowed for storm drainage structures.

D. Structure access shall be sized accordingly:

1. 30” access diameter for catch basins 48-inches to 54-inches in diameter.
2. 36” access diameter for catch basins 60” and larger in diameter.

E. Inlet and Outlet Pipes: Shall extend through the walls of structures for a sufficient distance beyond outside surface to allow for connections but shall be cut off flush with the wall on the inside surface. Mortar shall be placed around pipes to form a watertight, neat connection.

F. All jointing and connections between portions of precast concrete structures shall have rubber gaskets conforming to ASTM C443 in the tongue and groove joints. Handling of the precast units shall be done carefully to avoid disturbing or damaging the gasket or contaminating it with foreign material. Care shall be exercised to attain proper alignment before the joints are entirely forced home. A layer of joint mortar shall be applied to the outside of the joint.

G. Predl Liner manhole bases or approved equal to be installed on new Sanitary Sewer System manholes.

H. Sanitary sewer manholes spacing is a minimum of one manhole per every 300 feet.

I. When installing structures on active existing pipe, construct cast-in-place saddle manhole base in accordance with the plans. The base shall be installed prior to placement of the saddle riser. The manhole base shall be designed by a licensed Professional Engineer in the State of Washington with adequate rebar to meet the expected loading. The Contractor must submit a shop drawing of the reinforcing mat that meets the following minimum requirements:

Saddle MH Depth	**Cast-in-Place MH Base Reinforcing Steel Min Sq In/Ft, Top Face, in Each Direction**
20'	0.89
30'	1.13
40'	1.37

J. Saddle manholes and all new sanitary sewer system manholes that might be located below the groundwater level shall have all interior surfaces (less the Predl Liner manhole base for new manholes) coated and sealed with an approved epoxy based liner system, installed per the manufacturer's specifications. Approved epoxy based lining systems shall be Raven 404, Neopoxy, or an approved equal.

K. Steps and Ladders: Ductile iron or polypropylene covered rebar, ASTM C478, ASTM C497 and AASHTO M199. Polypropylene, ASTM D4101.

1. Steps shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall for steps, or 3-inches

from the structure wall inside the adjustment section. Steps within precast concrete structures shall be cast into the sides of the structure at the time the of manufacture or set in place after the structure is erected by drilling holes in the concrete and epoxying the steps in place. Steps shall be uniformly spaced at 12 inches and be vertically aligned.

2. Ladders shall be a minimum of 13-inches wide and extend a minimum of 6-inches from the structure wall. Ladder shall be set in place after the structure is erected by drilling holes in the concrete and epoxying in place.

L. Bedding: Bedding for structures shall consist of a minimum of 6 inches (or as required for site conditions) of aggregate base compacted to 95% of maximum density as determined by ASTM D1557. The bedding shall extend a minimum of 1-foot past the structure’s base in all directions for structures up to 60 inches in diameter and 2-feet past the structure’s base in all directions for structures greater than 60 inches in diameter. The aggregate base material shall meet the requirements of Pipe Bedding per Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 312333 Utility Trenching and Backfill

M. Backfill of utility structure excavations:

1. All utility structure excavations within pavement or within 10 feet of pavement shall be backfilled with controlled low-strength material density fill (CLSM) meeting requirements of Section 312333 Utility Trenching and Backfill.

2. All utility structure excavations within unpaved areas at least 10 feet or more from any pavements shall be backfilled with a material meeting the requirements of Section 312333 Utility Trenching and Backfill.

3. Backfilling is not allowed until concrete or mortar has thoroughly set and until concrete has attained 90 percent of its specified compressive strength.

N. Fibers for traffic rated pre-cast units

1. Synthetic fibers shall be monofilament or monofilament/fibrillated blend made of polyolefin, polypropylene, or polypropylene/ polyethylene blend, meeting the requirements of ASTM C1116, Section 4.1.3, and ICC ES Acceptance Criteria 32, Sections 4.1.3

and 4.1.2. Additionally, the vendor or manufacturer must furnish an Engineering Report that provides test data in accordance with ASTM C1018 and/or ASTM C1399 from an ICC-qualified commercial laboratory relating to the specification requirements. The vendor or manufacturer shall provide a letter of certification stating compliance with specifications and/or standard codes.

2. The fibers shall be a minimum of 2 inches in length and have an aspect ratio (length divided by the equivalent diameter of the fiber) between 70 and 100 when the fibers are in their final phase.
3. The fibers shall have a minimum tensile strength of 50 ksi and a minimum modulus of elasticity of 600 ksi, when tested in accordance with ASTM D3822.
4. Precast drainage units shall have a minimum dosage rate of 3.75-lbs/cu yd. or more in order to obtain an Average Residual Strength (ARS) of 175 psi when tested in accordance with ASTM C1018 and/or ASTM C1399. The fiber supplier shall submit independent laboratory data to support ARS results.

O. Joint Mortar

1. Mortar for hand mortared joints shall consist of one part portland cement or blended hydraulic cement Type I/II, three parts fine sand, and sufficient water to allow proper workability.
2. Cement shall conform to the requirements of AASHTO M85, Type I or Type II.
3. Sand shall conform to the requirements of AASHTO M45.

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING

4.01 TESTING

A. Compaction: Conduct in-place density tests for all bedding and backfill in accordance with ASTM D6938 requirements.

B. CLSM shall be tested in accordance with the following requirements:

1. CLSM shall achieve a 28-day compressive strength of 100 to 200 pounds per square inch and tested in accordance with ASTM D4832.
2. Unless otherwise approved by Port, flow shall be between 6 inches

and 8 inches when tested in accordance with ASTM D6103.

C. Prior to backfilling, each manhole that might be located below the groundwater level shall be tested using the vacuum testing method specified in ASTM C1244 to ensure that the manhole is watertight.

1. The Contractor shall furnish all equipment and labor required, including necessary piping/hoses, pneumatic plugs, test vacuum equipment (vacuum pump and vacuum plate/head), vacuum gauge, and second timer. The vacuum gauge shall have a maximum range of 0-30 inches of mercury (Hg) and the vacuum gauge intervals shall be in ½ inch increments.
2. If a coating or lining has been applied to the interior of the manhole, the vacuum test must not be performed until the coating or lining has been cured according to the manufacturer's recommendations. In addition, this existing manhole must be structurally sound prior to vacuum testing.
3. Drop connections shall be installed prior to testing.
4. The vacuum test shall include testing of the seal between the cast iron frame and the concrete cone, slab, or grade rings.
5. The vacuum test shall be performed by the Contractor per ASTM C1244 in the presence of the Engineer. The Contractor shall furnish test reports of each test to the Engineer.

D. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Channel drain systems shall conform to Seattle-Tacoma International Airport (STIA) Facilities and Infrastructure (F&I) Civil Systems Standards Section 334200 Stormwater Conveyance, the Standard Details (Appendix A) requirements and the below specifications

B. The channel drain systems shall be located and designed to capture and convey the peak runoff entering the trench drain from the contributing area as generated by the 25-year design storm without surcharge. Calculations demonstrating that the channel drain meets these requirements shall be performed by the Engineer and submitted as part of the SW Site Plan or Project Design Report documentation as specified in STIA F&I Civil Systems Standards Section 334200 Stormwater Conveyance, paragraph 1.01.D.

C. Layout requirements for channel drains on aircraft fueling ramps and other areas of the IWS basin shall meet the requirements of NFPA 415, Chapter 5 and as follows:

1. Channel drains segments shall be no more than 125 feet in length.
2. A minimum interval of 6 feet between channel drain sections is required to act as a fire stop.
3. Each 125-feet section shall be individually drained through underground ductile iron piping to an approved drainage structure.

D. Channel drain systems in the Aircraft Operations Area (AOA) shall be rated for EN-1433 Load Class F of 200,000 pounds or support a minimum proof load of 200 KIPs using 250 pounds per square inch tire pressure.

E. Channel drain systems outside of Aircraft Operations Area (AOA) shall be rated for the most demanding vehicles utilizing the site, or EN-1433 Load Class E, rated for 135,000 pounds, whichever is greater. Special consideration should be given to loading requirements of areas outside of the AOA but still utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment.

1.02 REFERENCES

A. National Fire Protection Association (NFPA) 415 Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways

B. American Society for Testing Materials (ASTM) A536-84 Standard Specification for Ductile Iron Castings
C. American Society for Testing Materials (ASTM) A-36 Standard Specification for Carbon Structural Steel
D. American Society for Testing Materials (ASTM) A123 Standard Specification for Zink (Hot-Dip Galvanized) Coatings on Iron and Steel Products
E. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance

PART 2 - PRODUCTS

2.01 CHANNEL DRAINS SYSTEMS

A. Collection and conveyance channels shall be designed and constructed to be fully compatible with the channel drain grating and frame assembly. Materials for conveyance channels shall be one of the following:
   1. Interlocking prefabricated reinforced polymer concrete units, encapsulated in portland cement concrete pavement as shown on the standard details.
   2. Cast-in-place utilizing the contract specified portland cement concrete pavement.
B. The channel drain system shall be resistant to petroleum products, ethylene glycol, propylene glycol, potassium acetate, and sodium acetate.
C. The system shall comply with NFPA 415 Chapter 5, paragraph 5.1.8: Underground piping and components used in drainage systems shall be noncombustible and inert to fuel. Products using fiberglass, polyester resins, vinyl esters, polyethylene, plastic, powder coatings or painted surfaces are not allowed.
D. If formed concrete is utilized for the surface of the collection and conveyance channel, it shall be finished so as to be smooth and free of voids.
E. The minimum interior width of the collection and conveyance channel shall be 6-inches.
F. Grating shall be ductile iron meeting ASTM A536-84, Grade 65-45-12 or Grade 80-55-06
G. Frames shall be Ductile Iron meeting on of the following:
   1. ASTM A536-84, Grade 65-45-12 or Grade 80-55-06
   2. Hot Dipped Galvanized Structural Steel meeting ASTM A-36, with galvanizing to meet ASTM A123-89a.

H. Channel drain grating shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for an access to the channel drain. Individual grate pieces shall be vertically and horizontally retained with bolt down fasteners at a minimum of all four corners of the grate. Channel grating systems which fasten only at the center of the grates are not allowed.

I. The channel drain system, including grating and frame assembly shall not cross concrete panel joints.
   1. Frame systems integrally cast with the concrete may be pre-cut or cut with the concrete panel provided a minimum of four concrete anchors will be integrally cast within the shortest length of any frame section. Spacing of the frame sections shall be such that that a minimum of 3-inches of separation between the concrete anchors and the nearest PCC panel joint is provided.
   2. If using pre-cast channel drain units, the channel drain unit joint shall be no closer than 1 foot from the pavement joint. Frame and unit shall be cut at panel joint.

J. Channel drain systems in Aircraft Operations Area (AOA) shall be rated for EN-1433 Load Class F, 200,000 pounds, support a minimum proof load of 200,000 pounds on a 9-inch by 9-inch square, shall have a minimum frame bearing with of 2 inches, and be one of the following products or approved equivalent:
   1. ACO PowerDrain Series S200K and S300K
   2. East Jordan 6901 Bolted Extra Heavy Duty Airport Trench Drain Assembly
   3. Neenah Foundry Bolted Extra Heavy Duty Airport Trench Drain Assembly with R-4993 Type T Superior Durability Frame

K. Submittals/Certifications: Submit detailed technical data and drawings, including:
   1. Shop drawings and technical data, including engineering load and flow calculations as required.
   2. Shop drawings and technical data for frames and grates.
   3. Shop drawings for steel reinforcement.
   4. Evaluation of the vehicles or aircraft importing the highest load factors.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING – To be provided by Design Engineer.

END OF SECTION

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. Metal castings (Frames, Covers, and Grates) for aircraft-rated Storm Drainage, Sanitary Sewer and IWS structures shall support a minimum proof load of 100,000 pounds and 250 pounds per square inch tire pressure.

B. Metal castings (Frames, Covers, and Grates) for traffic-rated (AASHTO HS-25) Storm Drainage, Sanitary Sewer and IWS structures shall meet the requirements of the heaviest vehicles utilizing the site, or AASHTO M306 H-25/HS-25 traffic rating of 20,000 pounds per wheel and support a minimum proof load of 50,000 pounds (20,000 pounds x 2.5) on a 9-inch by 9-inch square in the center of the casting, whichever is greater. Special consideration should be given to areas inside and outside of the AOA but still utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment.

C. The Air Operations Area (AOA) is any airport location that will be subjected to loading by aircraft, or that are located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. This includes the aprons, hardstands, taxi lane, taxiways and runways, including the taxi lane/Taxiway Safety Areas (TSA’s) and Runway Safety Areas (RSA’s), and within Perimeter Road.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 01 33 00 - Submittals. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.

B. Certification of proof load testing for castings is required with all construction submittals for Port approval prior to acceptance.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M306 Standard Specifications for Drainage, Sewer, Utility, and Related Castings

B. American Society for Testing and Materials (ASTM) A48 Standard Specification for Gray Iron Castings

C. American Society for Testing and Materials (ASTM) A536 Standard Specification for Ductile Iron Castings
D. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334200 Stormwater Conveyance
E. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 333100 Sanitary Sewer Requirements

PART 2 - PRODUCTS

2.01 METAL FRAMES, COVERS AND GRATES

A. Frames, Covers, and Grates shall consist of castings made from uncoated gray iron meeting ASTM A48, Class 35B or ductile iron meeting ASTM A536 Class 70-50-05 or 80-55-06.
B. All manholes and clean-outs noted on the plans to have solid covers shall be stamped with the appropriate utility identification as identified on the drawings:
   1. “STORM” for structures in the stormwater drainage system
   2. "SEWER" for structures in the sanitary sewer system
   3. “IWS” for structures in the industrial wastewater system
   4. “SDCO”, “SSCO”, or “IWSCO” for cleanout structures

   In addition, all castings shall have a clear and smooth space large enough to accommodate nine ½-inch characters at a minimum to be permanently marked by the Port of Seattle with the structure ID number per the Asset Identification System per Port of Seattle requirements. The marking shall be made by the Port of Seattle with a minimum character height of ½-inches.
C. Each frame and cover or grate unit shall be provided with fastening members (minimum of two per grate or cover) to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure. Bolts associated with installation shall be applied with anti-seize lubricant prior to installation.
D. Metal castings (Frames, Covers, and Grates) shall be rated for the following proof loads:
   1. Within the AOA, metal castings shall support a minimum proof load of 100,000 pounds and 250 pounds per square inch tire pressure.
   2. For all areas outside the AOA, metal castings shall meet the requirements of the heaviest vehicles utilizing the site, or AASHTO M306 and support a minimum proof load of 40,000 pounds whichever is greater.

PART 3 - EXECUTION – To be provided by Design Engineer.

PART 4 - TESTING – To be provided by Design Engineer.

END OF SECTION

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. API Baffle Style Oil Water Separator Vault Systems shall be designed in accordance with the API Publication 421 Design and Operation of Oil/Water Separators and ASTM D6104 Standard Practice for Determining the Performance of Oil/Water Separators Subjected to Surface Run-Off.

B. Coalescing Plate Oil Water Separator Vault Systems shall be designed in accordance with Section BMP T11.11 in the Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington (SWMMWW).

C. All O/W separator vaults shall also meet the requirements of the STIA F&I Civil System Standards Appendix A – Standard Details and the below specifications.

1.02 SUBMITTALS

A. Submit materials data in accordance with of Section 013300 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Shop drawings and technical data for vaults, including engineering calculations for vault sizing, structural loading and as required.
2. Shop drawings and technical data for frames, grates, and covers.
3. Shop drawings for steel reinforcement.
4. Aircraft-rated structures shall require drawings and structural calculations stamped by a licensed structural engineer in the State of Washington for approval by the Port prior to fabrication.
5. Evaluation of the vehicles or aircraft imparting the highest load factors.

B. Bypass and phasing plans when construction will impact active sanitary sewer and other utility facilities.

C. Testing plan for installed vault and piping per Part 4.

D. Testing results of installed vault and piping per Part 4.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) applicable provisions

B. American Society for Testing Materials (ASTM) applicable provisions

C. American Society for Testing and Materials (ASTM) C1613 Standard Specification for Precast Concrete Grease Interceptor Tanks

D. Washington State Department of Transportation Standard Specification Section 7-17.3(2)B Exfiltration Test

E. STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

F. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 322333 Utility Trenching And Backfill

G. Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage Sanitary and IWS Structures

H. API Publication 421 Design and Operation of Oil/Water Separators

I. ASTM D6104 Standard Practice for Determining the Performance of Oil/Water Separators Subjected to Surface Run-Off

J. Washington State Department of Ecology (DOE) 2019 Stormwater Management Manual for Western Washington (SWMMWW) Section BMP T11.11.

PART 2 PRODUCTS

2.01 OIL-WATER SEPARATOR VAULT

A. Oil-water separator vault shall be of the configuration per the plans and shall be either an American Petroleum Institute (API) Baffle style or Coalescing Plate style dependent on project requirements, see standard details. It shall be sized to treat the design flow per section BMP T11.11 of the SWMMWW and manufacturer guidance to treat the quality design flowrate.

B. Pre-cast concrete vault shall consist of a vault with piping, oil retaining baffle(s) or coalescing plates, ventilation pipes, hexagonal flow plates, access cover(s) and frames. It shall be gas and watertight. High flow bypasses shall be installed upstream and downstream of the vault to redirect flows greater than the design flow. A shutoff valve and riser shall be installed downstream of the vault to prevent oil discharges during maintenance and to provide emergency shutoff in case of a spill. All components of the system shall be designed for the expected structural loading as noted below.

C. Aircraft-rated oil-water separator vault is required at any airport location that will be subjected to loading by aircraft, or that is located in areas prescribed by the FAA as being capable of supporting an aircraft in the event of a deviation or overrun from the operational surface. Areas requiring aircraft-rated structures encompass most of the Air Operations Area (AOA) at STIA, including but not limited to the aprons, ha

D. rdstands, taxilane, taxiways and runways, including the Taxilane/Taxiway Safety Areas (TSA's) and Runway Safety Areas (RSA's), Head of Stand Utility between nose of aircraft and terminal building, and within Perimeter Road.

E. Aircraft-rated structures shall meet the FAA requirements for the design of structures as prescribed in "FAA Advisory Circular 150/5320-6E Airport Pavement Design and Evaluation, Appendix 3 – Design of Structures for Heavy Airplanes" (or latest FAA published version). These requirements apply to all components utilized for the structures, including but not limited to any precast barrel sections, risers, grade rings as well as any required cast-in-place bases or foundations. Structures shall be designed to meet the specified loading requirements of the aircraft imparting the highest load factors at the airport, as well as stresses imposed by lifting, transporting, and installing.

F. Structures outside of the AOA or outside of operational areas that would require aircraft loading capabilities (aprons, hardstands, taxilane, taxiways, runways, TSA's and RSA's) may be AASHTO HS-25 rated provided it meets the loading requirements for the vehicles imparting the highest load factors at the site. Special consideration should be given to areas utilized by cargo operators, aircraft rescue fire fighting vehicles, airline ground service equipment, or Port and airline maintenance equipment. Some equipment (e.g., tugs for widebody aircraft) operating at STIA have axle loadings that exceed AASHTO HS-25 and even surpass the loads imparted by many commercial aircraft. Structures shall be designed to meet the specified loading requirements (with required factors of safety) of the vehicles imparting the highest load factors, as well as stresses imposed by lifting, transporting, and installing. An AASHTO Load and Resistance Factor Design (LFRD) methodology should be utilized based upon the actual loading encountered at the site.

G. All structural calculations for the vault shall include the depth of cover over the vault.

H. Structural calculations for the oil-water separator vault shall be completed by a Washington state licensed engineer.

I. Vault access castings shall meet Seattle-Tacoma International Airport Facilities and Infrastructure Civil Systems Standards Section 334241 Frames, Covers, and Grates For Storm Drainage and IWS Structures

J. Excavation and backfill shall be per STIA F&I Civil Systems Standards Section 322333, Utility Trenching and Backfill

K. Finished floor of vault shall not exceed 12-ft from finished grade.

L. Double cleanouts shall be installed before and after the vault.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 OIL-WATER SEPARATOR VAULT TESTING

A. In order to demonstrate water tightness, the entire oil-water separator vault shall be tested prior to acceptance in accordance with *ASTM C1613-17 Standard Specification for Precast Concrete Grease Interceptor Tanks*.

B. Contractor shall submit testing plan to engineer.

END OF SECTION

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. Metal pipe hangers and supports.
2. Metal framing systems.
3. Fastener systems.
4. Pipe stands.
5. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. [**Section 230548 "Vibration and Seismic Controls for HVAC"**] [**Section 230548.13 "Vibration Controls for HVAC"**] for vibration isolation devices.

4. [**Section 233113 "Metal Ducts"**] [**and**] [**Section 233116 "Nonmetal Ducts"**] for duct hangers and supports.

C. Alternates: Refer to Division 01 Section 012300 "Alternates" for description of Work in this Section affected by Alternates.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

B. JFD: Jet Fuel Distribution piping.

C. JVP: Jet Fuel Valve Pit or vault.

D. CCS: (Coated Carbon Steel) Fusion bonded epoxy lined and epoxy coated jet fuel piping. Refer to Sections 335243.13 and 335280.

E. Provide: Furnish and install complete, in place and ready for service.

F. Install: Assembly of fabricated parts and products, correct placement and permanent anchoring of mechanical work, and all mechanical work necessary for the systems and structures of the Contract Documents to be complete, permanent and of safe and satisfactory operation.

G. Piping: Pipe, fittings, flanges, gaskets, hardware, valves, specialties, hanger and like accessories related to piping.

H. Field Coating: Coating and wrapping performed in the field as opposed to coating and wrapping done in the shop of the custom coating applicator.

I. Singular Number: In all cases where a device, piece of equipment, individual, etc., is referred to in the singular number (such as the "valve"), such reference to be intended to apply to as many devices, etc. as required to complete the installation as specified and as shown in the Contract Documents.

1.04 RELATED SECTIONS (Edit to remove unused sections)

A. SECTION 335243 - AVIATION FUELING SYSTEM - GENERAL REQUIREMENTS
B. SECTION 335243.11 - AVIATION FUELING SYSTEM EQUIPMENT

C. SECTION 335243.13 - AVIATION FUELING PIPE, MANUAL VALVES, AND FITTINGS
D. SECTION 335243.14 - AVIATION FUEL SYSTEM CONTROL VALVES
E. SECTION 335243.23 - AVIATION FUEL SYSTEM PUMPS
F. SECTION 335243.28-AVIATION FUEL SYSTEM FILTERS AND FILTER/SEPARATORS
G. SECTION 335280 - LIQUID FUELS PIPE COATING SYSTEMS

1.05 REFERENCES

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable. Refer to Section 325243 for listing of issuing organizations or agencies.

B. Applicable standards:

1. American Welding Society (AWS):
   a. D1.1 - Structural Welding Code - Steel.
   b. D1.3 - Structural Welding Code - Sheet Steel.
   c. D1.4 - Structural Welding Code - Reinforcing Steel.
2. ASME International (ASME):
   a. B31.1 - Power Piping.
   b. B31.3 - Chemical Plant and Petroleum Refinery Piping.
3. Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualification".
4. ASTM International (ASTM):
   a. A36/A37M - Carbon Structural Steel.
   b. A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   c. C1107 - Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
5. International Building Code (IBC) with the [enter city and/or state] Amendments.
6. Manufacturers Standardization Society of The Valve and Fittings Industry Inc. (MSS SP):
   a. 58 - Pipe Hangers and Supports - Materials, Design and Manufacture.

b. 69 - Pipe Hangers and Supports - Selection and Application.

c. 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

d. 90 - Guidelines on Terminology for Pipe Hangers and Supports.

7. Metal Framing Manufacturers Association (MFMA):

   a. 3 - Metal Framing Standards Publication.

   b. 102 - Guidelines for the Use of Metal Framing.

8. The Society for Protective Coatings (SSPC):

   a. PA1 - Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.

1.06 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal framing systems, pipe and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Framing and supports for fuel system piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to [**ASCE/SEI 7**] <**Insert requirement**>.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems and system contents.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

3. Design seismic-restraint supports for piping and equipment **[and obtain approval from authorities having jurisdiction**].

1.07 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including the following:

1. Steel pipe supports.
2. Powder-actuated fastener systems.
3. Pipe positioning systems.
4. Include data substantiating that materials comply with requirements.

B. Shop Drawings: **[Signed and sealed by a qualified professional engineer.]** Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Metal framing systems.
2. Pipe supports and stands.
3. Equipment supports.

C. Delegated-Design Submittal: Design Data: Indicate load carrying capacity of multiple pipe supports.

1.08 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.09 CLOSEOUT SUBMITTALS

A. As-Built Plans: Submit complete as-built plans of all Work, including interface with other Work, in accordance with requirements as specified in Section 013300 "Submittal Procedures".

1.10 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.11 CONSTRUCTION WASTE MANAGEMENT

A. Construction waste shall be managed in accordance with provisions of Section 017419 "Construction Waste Management and Disposal". Documentation shall be submitted to satisfy the requirements of that Section.

PART 2 - PRODUCTS

2.01 STEEL PIPE SUPPORTS

A. Carbon-Steel Pipe MSS SP 58 Supports:

1. Description: MSS SP-58, Types 24, 26, 33, and 35 through 38, and 52 factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 24, 26, 33, and 35 through 38, and 52 factory-fabricated components.

2.02 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.
   c. Flex-Strut Inc.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut Corporation; Tyco International, Ltd.
   g. Wesanco, Inc.
   h. <**Insert manufacturer's name**>.
   i. or approved equal.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Metallic Coating: [**Electroplated zinc**] [**Hot-dipped galvanized**] [**Mill galvanized**] [**In-line, hot galvanized**] [**Mechanically-deposited zinc**].

7. Paint Coating: [**Vinyl**] [**Vinyl alkyd**] [**Epoxy**] [**Polyester**] [**Acrylic**] [**Amine**] [**Alkyd**] <**Insert paint type**>.

8. Combination Coating: <**Insert coating materials in order of application**>.

2.03 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hilti, Inc.
    b. ITW Ramset/Red Head.
    c. or approved equal.

B. Mechanical-Expansion Anchors: Insert-wedge-type, [**zinc-coated**] [**stainless-**] steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. B-Line Systems, Inc.; a division of Cooper Industries.
    b. Hilti, Inc.
    c. ITW Ramset/Red Head.

2.04 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.05 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 SUPPORT INSTALLATION

A. Metal Pipe Support Installation: Comply with MSS SP-69 and MSS SP-89. Install supports, clamps, and attachments as required to properly support piping.

B. Space steel piping supports to permit normal pitch of pipe lines with deflection and bending stress maintained at a minimum. Except as otherwise required by applicable codes, do not exceed the following support spacings:

NOMINAL PIPE SIZE	FUEL SERVICE SUPPORT SPACING
1/2” and Smaller	7-ft.
3/4” through 1-1/4”	7-ft.
1-1/2”	9-ft.
2”	10-ft.
3”	12-ft.
4”	14-ft.
6”	17-ft
8”	20-ft.
10”	21-ft.
12”	23-ft.
14”	25-ft.
16”	27-ft.
18”	28-ft.
20”	30-ft.
24”	32-ft.

30”	33-ft.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2 (DN 65)] <**Insert size**> and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to support equipment above slab or vault floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 335280.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.05 HANGER AND SUPPORT APPLICATIONS AND SCHEDULE

A. Comply with MSS SP-69 for pipe support selections and applications that are not noted or specifically called for in the Drawings.

B. Use carbon-steel pipe supports, metal framing systems and attachments for general service applications.

C. Use stainless-steel pipe supports and stainless-steel or corrosion-resistant attachments for hostile environment applications.

D. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

3. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

4. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

5. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

E. Attachments to Vertical Structure: Where indicated, install the following type:

1. Welded-Steel Brackets: For support of pipes from below, use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).

    b. Medium (MSS Type 32): 1500 lb (680 kg).

    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

F. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following type:

1. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

G. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

H. Use [**powder-actuated fasteners**] [**or**] [**mechanical-expansion anchors**] where required in concrete construction.

END OF SECTION 335229

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. Furnish all labor, equipment and material for the complete aviation fueling system work as indicated and specified in the Contract Documents.

B. Contractor shall obtain and pay for all permits required by this Contract unless specified otherwise.

C. Provide all minor incidental items such as offsets, fittings, and accessories required as part of the work even though not specified or indicated.

D. Consider the Drawings and Specifications as complementary, one to the other; such that materials and/or labor called for or implied by one and not the other, shall be provided as if specifically called for by both.

E. Contractor shall coordinate all work with the overall project sequencing. Coordinate all work requiring access to the existing valve pits with the General Contractor, the fuel system FBO (SWISSPORT) and with SEA Airfield Operations.

F. Contractor shall be responsible for the draining of the fuel from the existing and/or new fuel piping as required for the demolition and new construction work. Contractor shall provide all required temporary connections, piping, hoses, pumps, tank trailers or tank trucks, etc. Return all drained fuel to the fuel farm. Coordinate return of all fuel with the fuel system FBO [(SWISSPORT)].

1.03 DEFINITIONS

A. JFD: Jet Fuel Distribution piping.

B. JVP: Jet Fuel Valve Pit or vault.

C. CCS: (Coated Carbon Steel) Fusion bonded epoxy lined and epoxy coated jet fuel piping. Refer to Sections 335243.13 and 335280.

D. Provide: Furnish and install complete, in place and ready for service.

E. Install: Assembly of fabricated parts and products, correct placement and permanent anchoring of mechanical work, and all mechanical work necessary for the systems and structures of the Contract Documents to be complete, permanent and of safe and satisfactory operation.

F. Piping: Pipe, fittings, flanges, gaskets, hardware, valves, specialties, hanger and like accessories related to piping.

G. Field Coating: Coating and wrapping performed in the field as opposed to coating and wrapping done in the shop of the custom coating applicator.

H. Design Pressure: Maximum coincident pressure in psig.

I. Working Pressure: Operating pressure in psig.

J. Singular Number: In all cases where a device, piece of equipment, individual, etc., is referred to in the singular number (such as the "valve"), such reference to be intended to apply to as many devices, etc. as required to complete the installation as specified and as shown in the Contract Documents.

1.04 **RELATED SECTIONS** (Edit to remove unused sections)

A. SECTION 335229 - LIQUID FUELS PIPING SYSTEM SUPPORTS & ANCHORS
B. SECTION 335243.11 - AVIATION FUELING SYSTEM EQUIPMENT
C. SECTION 335243.13 - AVIATION FUELING PIPE, MANUAL VALVES, AND FITTINGS
D. SECTION 335243.14 - AVIATION FUEL SYSTEM CONTROL VALVES
E. SECTION 335243.23 - AVIATION FUEL SYSTEM PUMPS
F. SECTION 335243.28-AVIATION FUEL SYSTEM FILTERS AND FILTER/SEPARATORS
G. SECTION 335253 - AVIATION FUELING SYSTEM CLEANING, TESTING, AND FLUSHING
H. SECTION 335280 - LIQUID FUELS PIPE COATING SYSTEMS
I. SECTION 335290 - WELDING FOR FUEL SERVICE PIPING
J. SECTION 335292 - AVIATION FUEL SYSTEM MECHANICAL IDENTIFICATION

1.05 REFERENCED ORGANIZATIONS

A. For products or workmanship specified by association, trade, or Federal Standards; comply with requirements of the standard, as of the date of the standard is that in effect as the date of the Contract Documents, (except when a specific date is specified) except when more rigid requirements are specified or are required by applicable Codes.

B. Schedule of Referenced Organizations: The following is a list of the acronyms of organizations referenced in these Specifications:

Acronym	Organization
ABMA	American Bearing Manufacturers Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing of Materials
ANSI	American National Standards Institute
API/EI	American Petroleum Institute/Energy Institute
ATA/A4A	Air Transport Association of America/Airlines for America
AWS	American Welding Society
EPA	Environmental Protective Agency
FM	Factory Mutual Insurance Association
IBC	International Building Code
IFC	International Fire Code
ISA	Instrument Society of America
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NACE	National Association of Corrosion Engineers
NAPCA	National Association of Pipe Coating Applicators
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Science and Technology
SSPC	The Society for Protective Coatings
STI	Steel Tank Institute
UL	Underwriters' Laboratories

1.06 REGULATORY REQUIREMENTS

A. - Comply with latest editions of all applicable Codes, Standards, Ordinances and Regulations in effect as of the date of the Contract Documents adopted by the [xxx] [State of Washington, the Port of Seattle], and [xxx] [Seattle Tacoma International Airport], including but not necessarily limited to the following:

1. NFPA-70 “National Electrical Code”.
2. NFPA-30 “Flammable and Combustible Liquids Code”.
3. NFPA-407 “Standard for Aircraft Fuel Servicing”.
4. IBC “International Building Code”, including any [xxx] [Port of Seattle] Amendments.
5. IFC “International Fire Code”, including any [xxx] [Port of Seattle] Amendments.

B. If discrepancies occur between the Contract Documents and any applicable Codes, Guidelines, Ordinances, Acts, or Standards, the most stringent requirements shall apply.

1.07 REFERENCE STANDARDS (Edit to delete standards not applicable to project)

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents.

B. API/EI Spec 5L - Specification for Line Pipe.

C. API/EI Spec 6D - Specification for Pipeline Valves (Steel Gate, Plug, Ball and Check Valves).

D. API/EI Spec 6FA - Specification for Fire Test for Valves.

E. API/EI Bulletin 1542 - Airport Equipment Marking for Fuel Identification.

F. API Standard 2000 - Venting Atmospheric and Low Pressure Storage Tanks.

G. API Recommended Practice 2003 - Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents.

H. ASME B16.20 - Metallic Gaskets for Pipe Flanges.

I. ANSI/API Standard 607 - Fire Test for Soft-Seated Quarter Turn Valves.

J. ANSI/API Standard 609 - Butterfly Valves, Lug-Type and Wafer-Type.

K. ANSI B16.5 - Steel Pipe Flanges, Flanged Valves and Fittings.

L. ANSI B16.9 - Steel Butt Welding Fittings.

M. ANSI B16.10 - Face-to-Face and End-to-End Dimensions of Ferrous Valves.

N. ANSI B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.

O. ANSI B16.25 – Butt Welding Ends.

P. ANSI B31.1 - Power Piping.

Q. ANSI B31.3 - Chemical Plant and Petroleum Refinery Piping.

R. ASTM A53 - Specification for Pipe.

S. ASTM A105 - Specification for Forgings.

T. ASTM A181 - Specification for Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for General Service.

U. ASTM A216 - Specification for Carbon Steel Castings.

V. ASTM A234 - Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel.

W. ASTM A325 - High-Strength Bolts for Structural Steel Joints.

X. AWS D1.1 - Structural Welding Code.

Y. NFPA 10 - Standard for Portable Fire Extinguishers.

1.08 PRODUCT OPTIONS AND SUBSTITUTIONS

A. [Substitutions: Refer to General Requirements Division 01 - Section 012510 “Substitutions”]

B. Some materials and equipment are specified by Manufacturer and catalog numbers. The Manufacturer and catalog numbers are used to establish a degree of quality and style for such equipment and material.

C. When alternate or substitute materials and equipment are used, Contractor shall be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, electrical changes and other apparatus and trades that may be affected by their use.

D. Electrical Characteristics for Piped Utility Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. When providing a product and/or service under the qualification of “acceptable equal,” Contractor shall be entirely responsible for additional costs incurred due to modifications to the civil, structural, mechanical, and electrical design that may be required to accommodate the "acceptable equal”.

F. Substitute materials and equipment are only allowed to be provided from the Manufacturers listed as approved.

1.09 QUALITY ASSURANCE

A. General:

1. Conform to the Occupational Safety and Health Standards of the U.S. Department of Labor and all applicable ordinances, laws, regulation, and/or codes of the Local Authorities, the [Port of Seattle], the [State of Washington], the National Fire Protection Association, or any other

governmental bodies having jurisdiction.

2. Install mechanical work to the satisfaction of the [SEA] Project Manager and inspecting authorities having jurisdiction.
3. Notify the [SEA] Project Manager in writing of any instances in the Specifications or on the Drawings that are in conflict with any of the aforementioned authorities; required changes to be adjusted before the Contract is awarded. If the Contractor performs any work contrary to such laws, rules, or regulations without notice, he shall bear all costs arising therefrom.
4. Deviations from the Drawings and/or Specifications required for conformance with the applicable codes and/or laws to be corrected immediately but not until such deviations have been brought to the attention of the [SEA Project Manager] [Owner or the Owner's authorized representative].
5. Applicable codes and/or laws to govern the minimum requirements only; where the Drawings and/or Specifications call for materials, vents, piping, sizes, etc., in excess of the code requirements, the Drawings and Specifications to govern.

B. Unless otherwise specifically indicated, equipment and materials to be installed in accordance with the recommendations of the Manufacturer. This includes the performance of tests as recommended by the Manufacturer.

C. Installer Qualifications: All fueling system mechanical construction shall be by companies who have previously installed similar aircraft fueling systems, in both size and complexity, at major installations. In addition, the person in charge of all craft personnel shall have at least two (2) years of experience in installing similar aircraft fueling systems. Provide a listing of a minimum of three previous projects in which the company has successfully completed similar work with bid, and provide a listing of jobs which the person in charge has performed work which would qualify them to perform work under this specification section. These listings shall include job name, cost, location, duration, description of work and person whom the work was performed for, along with their telephone number(s).

D. Welder Qualifications: All welding to be performed by welders qualified to ANSI B31.1 in accord with the standards of American Welding Society. All welders to be qualified to perform any of the welding required irrespective of pressure or position classification. Test position required for each welder to be 6G, inclined groove weld in pipe made by downhill procedures. All pipe welders to be assigned an identification mark. Contractor to secure the services of an Independent Testing Laboratory to certify each welder in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Radiographic Examination. Welders failing to qualify after two unsuccessful attempts not to be retested. Test welds to be radiographed and radiographs to be approved by the Owner's Representative. Each welder to possess a currently approved certificate issued by an Independent Testing Laboratory for this contract; evidence of qualifications and certificate of possession to be presented to the Owner's Representative prior to performing welding under this Contract. Cost of welding certifications and radiographs to be borne by Contractor. Contractor to maintain an accurate, up-to-date list of welder identification marks.

E. Mechanical Work Superintendent: Keep a competent superintendent and any necessary assistant satisfactory to the Project Manager or his authorized representative in charge during the progress of the work; superintendent shall properly coordinate and time mechanical work with the work of other trades and in particular with concrete, masonry and form work to avoid errors and delays; Contractor shall pay cost involved due to failure to comply with these requirements or due to failure to acquaint himself with the work and progress of other trades.

F. Mechanical Work Coordinator:

1. In addition to Contractor's Superintendent, furnish a coordinator for mechanical work. Coordinator shall be knowledgeable in the fabrication, assembly, and operation of the required mechanical systems and equipment, and the engineering essentials, including metallurgy, welding, rigging, and safety requirements. Coordinator shall be capable of reading, interpreting and coordinating the drawings, specifications, and submittal data of the mechanical work.
2. Coordinator shall plan and expedite delivery of mechanical products to the project site, and to schedule labor to meet the progress schedule of the work.
3. Coordinator shall work with mechanical subcontractors and the contractors of other disciplines to coordinate the safe and swift completion of the work.

G. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

H. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

1.10 DELIVERY STORAGE & HANDLING

A. General: Meet requirements of Division-1, in addition to the handling requirements of this section.

1. Provide and pay for all freight, express, trucking, transportation, cartage and handling of equipment and materials; assure materials, etc., be delivered to the jobsite in ample quantities to insure

uninterrupted progress of work; provide and pay for extra handling and shipping expenses incurred in expediting materials, etc., to prevent interruption of the overall job progress.

2. Protect all equipment, materials, specialties, etc., from the elements and other potential causes of damage during shipment, storage, and erection until final acceptance by the Owner and be responsible for damages or losses incurred by these or other causes.
3. Deliver pipe and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
4. Protect flanges, fittings, and piping specialties from moisture and dirt.

B. Jet-A Piping: Segregate aviation kerosene piping from all other steel on the project; follow special handling requirements as stated in Section 335243.13 - Fueling System Piping, Valves and Fittings, Paragraph 3.3 - Handling Pipe.

1.11 SUBMITTALS

A. Product Data:

1. General: Submit manufacturer's specifications, recommendations and installation instructions for mechanical work products required within the applicable Sections of Division 33: Utilities. Include manufacturer's published data or certified laboratory test data indicating that each work product meets the specified requirements. Meet requirements of Sections [013300 – "Submittal Procedures"] [,] 013325 – "Shop and Working Drawings"] and additional requirements of this Paragraph.

2. Data Included: Product data to include the following as applicable:
   a. Product name and model or catalog designation, and manufacturer's name.
   b. Physical description, dimensions and weights.
   c. Product properties, characteristics, capabilities and limitations.
   d. Clear spaces required for handling, installing, operating and maintaining.
   e. Applicable reference standards.
   f. Product specifications, including protective coatings.

3. Certification: When required, product data shall be certified by product manufacturer. Meet requirements of Paragraph-Certified Submittals of this Article.

B. Shop Drawings

1. All documents shall be submitted in electronic format. Each submittal shall be in a single security free PDF document. PDF documents shall

be compatible with Adobe Acrobat X Pro or newer. All as-built documents shall be submitted in AutoCAD 17 or newer format.

2. Presentation: Shop drawings shall indicate plan view layout of mechanical work. Shop drawings indicating mechanical work associated with hydrant pits or other congested areas shall be drawn at minimum scale of 1/4" equals 1'-0". When necessary for clarity shop drawings shall include sections drawn at a minimum scale of 1/4" equals 1'-0".

3. Contractor shall submit fully dimensioned spool drawings for all welded piping work. Drawings shall indicate all weld types, sizes and materials to be used. The spool drawing size shall match the full size contract documents of either 24x36 or 34x44. Spool drawings shall be submitted in either the latest version of AutoCAD (.dwg) or the latest version of Adobe Acrobat (.pdf). Adobe Acrobat files shall not contain security. Other file formats will not be accepted.

C. Inspection and Test Reports

1. General: Submit inspection and test reports for mechanical work required by applicable Sections of Division-33. Meet requirements of this paragraph and applicable requirements of Division-01

2. Definition: Inspection and test reports shall be documented statements of methods, procedures, results and evaluations prepared by Contractor, an installer, manufacturer or supplier, or an Independent Testing Laboratory employed by any of these parties to indicate properties, characteristics and capabilities of a product or portion of the work.

3. Presentation: Inspection and test reports shall identify products or work by designations indicated in the Contract Documents.

4. Data Included: Inspection test reports shall include the following:
    a. Identification of product or work area represented by inspection or test.
    b. Methods, procedures and results of inspections and tests.
    c. Evaluation of Results.
    d. Failed test results and corrective actions to be taken

5. Certification: Inspection and test reports shall be certified by organization who performed inspections, tests and evaluations.

D. Compliance Certificates

1. General: Submit compliance certificates for mechanical work as required by the applicable Sections of Division 33. Meet requirements

of this paragraph [and requirements of the applicable] [Division-01, Sections 013300 and 013325.]

2. Welding Procedures and Certification: Submit qualified welding procedures and welder certifications as applicable for required type welding work.

3. Products not of the manufacturer's standard design, modified to suit these requirements.

4. Equipment bearing UL Listing Mark.

5. Equipment bearing STI-P3 label.

1.12 WARRANTY

A. General: Warranty mechanical work meeting provisions of the Conditions of the Contract, except warranty to include the additional provisions of this Article.

B. Warranty to extend to corrections of the work found to be defective or nonconforming to the Contract Documents at no additional charge to the Owner. Included: Damages resulting from such defects or nonconformance with the Contract Documents. Excluded: Defects resulting from improper maintenance, operation, or normal wear. Corrective work to be performed by original installer.

C. Time Period: Repairs or replacement made to mechanical work within the warranty period to be warranted for one year from date of final acceptance, and/or of each repair or replacement

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 INSPECTION

A. General: Examine the areas and conditions under which mechanical work is to be installed or performed, and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Existing Facilities: Verify existence, location and operation of existing components, material, equipment, piping, etc. to be abandoned, removed or altered.

C. Receive, unload, check, and store in suitable facilities all Equipment and Materials; examine all Equipment and Materials for concealed damage and report any damage to Owner.

D. Be responsible for the safety and protection from loss or damage of all Equipment and Materials received until the Work is complete.

E. Protect all Equipment and Materials during storage and prior to start-up which shall include the coverings of all openings, protection against rust and other damage, and other similar measures. Equipment may be stored outdoors only when approved. Contractor shall protect all coated pipe and fittings from ultraviolet deterioration.

3.02 DEMOLITION

A. - [Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.]

B. - Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed. Bevel and dress remaining piping ends for welded connection of new piping and/or fittings.
2. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

C. - If pipe, fittings, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.03 INSTALLATION

A. Furnish all labor, Materials, and Equipment necessary to make a complete installation as indicated and specified.

B. Install mechanical work, meeting the requirements of the Contract Documents and in accordance with product manufacturer's instructions and recommendations. Meet requirements of final, reviewed submittals for the work. Follow the recommendations and instructions of the product manufacturer, unless otherwise specified or shown on the Drawings.

C. Provide all necessary supports, brackets, or foundations for properly installing all piping and equipment.

D. Coordinate with the other trades before installation of Materials. Extra charges shall not be approved for interferences due to lack of coordination.

E. 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, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Provide fittings for changes in direction and branch connections.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. All Equipment shall be properly aligned, adjusted, and lubricated before final acceptance.

L. Spot paint all Equipment where the shop paint has been damaged or flaked off. Finish painting of all exposed piping and mechanical Equipment is specified in SECTION 335280 unless otherwise specified.

M. Provide steel sleeves for pipes passing through concrete and masonry walls and floor slabs; ASTM A53, Type-E, Grade-B, Schedule 40, galvanized, plain ends.

   1. Cut sleeves to length for mounting flush with both surfaces.

      a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2-inches above finished floor level.

   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

N. WELDING:

   1. When required for safety, properly shield the welding area.
   2. Existing Piping: Positively purge existing piping with dry nitrogen during all hot work.
   3. Jet A Piping Welding: Refer to Section 335243.13 “Aviation Fueling Pipe, Valves and Fittings”, and Section 335290 “Welding for Fuel Service Piping”.
   4. Miscellaneous Welding: Welding procedure to be governed by

applicable service type specification of AWS D1.1 - Structural Welding Code [, and to] [Section 050510 – Welding] [for additional requirements].

O. Furnish all bolts, studs, nuts, and gaskets for makeup of all connections to the Equipment and replace all gaskets damaged during storage, inspection, cleaning, or placing into service.

P. Retighten all threaded and bolted connections after installation. This applies to Owner-furnished equipment as well and shall be accomplished by Contractor at no additional cost to Owner.

Q. Equipment: Refer to Section 335243.11 – Aviation Fueling System Equipment.

R. Piping: Refer to Section 335243.13 – Aviation Fueling Pipe, Manual Valves and Fittings.

S. Identification and Labeling: Provide labels and signs as called for in the Contract Documents and permanently attach or support same; piping identification per API/EI 1542, refer to Section 335292 - Aviation Fuel System - Mechanical Identification.

T. Clean Up: Prior to acceptance tests and inspections, clean the project site. Remove all miscellaneous construction equipment; dispose of all trash and unnecessary excavated material in a manner acceptable to the Owner or his authorized representative. Make the site as safe, clean and completely finished as possible.

U. Inspections and Tests:

a. General: Test all of the equipment and piping installed under this Specification, and in particular Section 335253 - “Aviation Fueling System Cleaning, Testing, and Flushing”, and demonstrate its proper operation to the [Owner] [SEA Project Manager] [or his authorized representative]. Furnish all required labor, testing, instruments and devices required for tests and pay for all expenses involved in conducting such tests. If tests show work or equipment to be defective, immediately make all changes necessary to correct work and performance to the satisfaction of the Owner or his authorized representative. Give 48 hours’ notice, by letter or e-mail telegram, to the [Owner] [SEA Project Manager] [or authorized representative] of all tests and demonstrations. Provide safe access to the test area if the work is in preparation or in progress. Contractor to be given reasonable time to correct defects. If such corrections of defects or performance requirements are neglected, the right is reserved to have defects remedied and to charge the cost of same against the account of the Contractor

b. Covered Equipment: No pipe or equipment to be insulated or covered until hydrostatic or other required tests have been completed and approved. Where the Contractor considers this procedure unfeasible, he shall request a waiver from this requirement in writing which clearly defines the exception to the procedure and the extent of the work involved. Where it is determined that taking exception to the procedure results in an increase in the cost of the project either in the first cost of material and labor or as a result of defects in the pipe or equipment which could have been corrected in a less costly fashion through the required tests prior to covering, the contractor shall bear all costs associated with the exception to the procedure.

2. Inspection: Inspection includes but is not limited to:

   a. Alignment: Check whether equipment has been aligned.
   b. Coupling: Check coupling torque setting.
   c. Tightening: Tighten bolts, cap screws and other fasteners.

3. Start-up: Perform equipment start-up meeting requirements of equipment manufacturer; if manufacturer's representative is required to be present, coordinate with same; start-up to be made without load, except when detrimental to equipment.

4. Final Condition: Before final acceptance, check all connections, and remove all remaining debris.

3.04 WELDING QUALIFICATION AND APPROVAL

A. Procedure: Upon award of the Contract, the Welding Procedure Specification (WPS) that is intended to be used on the job shall be submitted to Engineer.

B. Submit certified copies of the Procedure Qualification Records (PQR) as evidence that the intended procedures have been qualified in accordance with the latest revisions of the following codes:
   1. ASME B31.3 – Process Piping
   2. ASME Boiler and Pressure Vessel Code, Section I and Section IX

C. Design for the conditions of this Contract. Be complete and specific, and where necessary, differentiate between shop and field welding.

D. Welder Performance Qualification (WPQ) Test Certificates:

1. 1Furnish welder performance qualification test certificates for positions 2G and 5G or 6G, made in strict compliance with the above codes.
2. Submit current qualification test records for each welder on the Project and keep record files current. Welder shall have been qualified to the WPS within the last six months.
3. Welder Performance Qualification test certificates shall be submitted to Engineer before the welder shall be permitted to work on the Project.
4. Welders shall be certified for the type of pipe material welded.
5. Submit copies of the Welder Performance Qualification (WPQ) test certificates to Engineer for review as specified for Submittals.
6. Welders and welding operators shall be qualified without the use of backing rings for all welding.

E. Submit WPS, PQR and WPQ on the forms contained within Appendix A of the ASME Boiler and Pressure Vessel Code, Section IX. Stamp all welds with the welders or welding operators' identification number or symbol.

3.05 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the requirements of this Section, and of Sections 335243.13 “Aviation Fueling System Pipe, Manual Valves, and Fittings”, and 335290 “Welding for Fuel Service Piping”.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Keep the interior and ends of all new and existing piping affected by construction operations thoroughly clean of foreign matter and water before and after being installed. Piping system shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water of other foreign substance will enter the pipe or fittings. Piping shall be inspected before placing into position. The interior of each length of pipe shall be cleaned after welding to ensure the interior of the pipe is free of foreign matter when connecter into the system.

D. 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:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
3. Completed threaded fittings shall be seal welded per ASME B31.3

E. Welded Joints: Welding shall be accomplished by the use of the shielded metallic arc process and shall be in strict accordance with ASME B31.3. Refer to Section 335243.13 "Aviation Fuel Pipe, Manual Valves, and Fittings" for additional requirements.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 - PIPING CONNECTIONS

A. - Make connections according to the following, unless otherwise indicated:

1. In piping 2" and smaller, connection to each valve and at final connection to each piece of equipment may be weld-neck flanged, threaded or socket weld. Provide flanged connections where indicated and at equipment with flanged connections. Threaded connections shall be seal welded.
2. Provide weld-neck flanges, in piping 2-1/2" and larger, for connection to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at first above grade connection at transition from underground to above ground piping, and where indicated.
4. All underground piping connections shall be welded regardless of pipe size.

3.7 - EQUIPMENT INSTALLATION

A. - Install equipment level and plumb, unless otherwise indicated.

B. - Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. - Install equipment to allow right of way to piping systems installed at required slope.

3.08 PAINTING

A. Painting and coating of piped utility systems, equipment, and components is specified in Section 335280 "Liquid Fuels Pipe Coating Systems."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.09 IDENTIFICATION

A. Piping Systems: Identification of aviation fuels piping systems is specified in Section 335292 "Aviation Fuel System - Mechanical Identification"

3.10 CONCRETE BASES

Coordinate concrete work in this Article with Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete."

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4-inches larger in both directions than supported unit.
2. 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 base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 4000-psi, 28-day compressive-strength concrete [and reinforcement as specified in] [Section 033000 "Cast-in-Place Concrete." for slabs,] [and] [Section 033053 "Miscellaneous Cast-in-Place Concrete",] for equipment pads.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. [Refer to Sections 050510 “Welding”] [and] [055000 "Metal Fabrications" for structural steel.]

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.12 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION **335243**

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Specifies the following equipment. (Edit to delete items not in project)

1. Prefabricated Hydrant Pits
2. Prefabricated High Point Vent and Low Point Drain Pits
3. Access Covers
4. Vault Access Hatches
5. Surge Arrestors
6. Pressure Gauges and Snubbers
7. Strainers
8. Water Draw-off System (Sump Separator)
9. Millipore Sample Connections
10. Tank Type Air Eliminators
11. Oil/Water Separators
12. Product Recovery Tank
13. Flexible Ball Joints
14. Flow Meters

1.02 RELATED DOCUMENTS

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

1.03 RELATED SECTIONS (Edit to delete unused Sections)

A. SECTION 335229 - LIQUID FUELS PIPING SYSTEM SUPPORTS & ANCHORS
B. SECTION 335243 – AVIATION FUELING SYSTEM - GENERAL

REQUIREMENTS.

C. SECTION 335243.13 – AVIATION FUELING PIPE, MANUAL VALVES AND FITTINGS.
D. SECTION 335243.14 – AVIATION FUEL SYSTEM CONTROL VALVES.
E. SECTION 335243.23 – AVIATION FUEL SYSTEM PUMPS
F. SECTION 335243.28 – AVIATION FUEL SYSTEM FILTERS AND FILTER/SEPARATORS
G. SECTION 335253 – AVIATION FUEL SYSTEM CLEANING, TESTING AND FLUSHING
H. SECTION 335280 – LIQUID FUELS PIPE COATING SYSTEMS
I. SECTION 335290 – WELDING FOR FUEL SERVICE PIPING
J. SECTION 335292 – AVIATION FUEL SYSTEM - MECHANICAL IDENTIFICATION

1.04 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable. Refer to Section 1335243 for listing of issuing organizations or agencies.

1.05 DEFINITIONS

A. JFD: Jet Fuel Distribution piping.

B. JVP: Jet Fuel Valve Pit or vault.

C. CCS: (Coated Carbon Steel) Fusion bonded epoxy lined and epoxy coated jet fuel piping. Refer to Sections 335243.13 and 335280.

D. Provide: Furnish and install complete, in place and ready for service.

E. Install: Assembly of fabricated parts and products, correct placement and permanent anchoring of mechanical work, and all mechanical work necessary for the systems and structures of the Contract Documents to be complete, permanent and of safe and satisfactory operation.

F. Piping: Pipe, fittings, flanges, gaskets, hardware, valves, specialties, hanger and like accessories related to piping.

G. Field Coating: Coating and wrapping performed in the field as opposed to coating and wrapping done in the shop of the custom coating applicator.

H. Design Pressure: Maximum coincident pressure in psig.

I. Working Pressure: Operating pressure in psig.

J. Singular Number: In all cases where a device, piece of equipment, individual, etc., is referred to in the singular number (such as the "valve"), such reference to be intended to apply to as many devices, etc. as required to complete the installation as specified and as shown in the Contract Documents.

1.06 REGULATORY REQUIREMENTS

A. Comply with latest editions of all applicable Codes, Standards, Ordinances and Regulations in effect as of the date of the Contract Documents adopted by the State of Washington, the City of SeaTac, and Seattle - Tacoma International Airport, including but not necessarily limited to the following:

1. NFPA-70 “National Electrical Code”.
2. NFPA-30 “Flammable and Combustible Liquids Code”.
3. NFPA-407 “Standard for Aircraft Fuel Servicing”.
4. IBC “International Building Code”, including any [City of SeaTac] [ ] Amendments.
5. IFC “International Fire Code”, including any [City of SeaTac] [ ] Amendments.

B. If discrepancies occur between the Contract Documents and any applicable Codes, Guidelines, Ordinances, Acts, or Standards, the most stringent requirements shall apply.

1.07 QUALITY ASSURANCE

A. General:

1. Conform to the Occupational Safety and Health Standards of the U.S. Department of Labor and all applicable ordinances, laws, regulation, and/or codes of the Local Authorities, the City of SeaTac, the State of Washington, the National Fire Protection Association, or any other governmental bodies having jurisdiction
2. Install mechanical work to the satisfaction of the Project Manager and inspecting authorities having jurisdiction.
3. Notify the Project Manager in writing of any instances in the Specifications or on the Drawings that are in conflict with any of the aforementioned authorities; required changes to be adjusted before the Contract is awarded. If the Contractor performs any work contrary to such laws, rules, or regulations without notice, he shall bear all costs arising therefrom.
4. Deviations from the Drawings and/or Specifications required for conformance with the applicable codes and/or laws to be corrected immediately but not until such deviations have been brought to the attention of the Owner or his authorized representative.

5. Applicable codes and/or laws to govern the minimum requirements only; where the Drawings and/or Specifications call for materials, vents, piping, sizes, etc., in excess of the code requirements, the Drawings and Specifications to govern.

B. Unless otherwise specifically indicated, equipment and materials to be installed in accordance with the recommendations of the Manufacturer. This includes the performance of tests as recommended by the Manufacturer.

C. Equipment shown in the Contract Drawings are based on a specific manufacturer and model number of equipment. Contractor shall verify that any alternate equipment supplied will fit within the available space, and shall make all necessary piping, electrical, and support modifications required for the alternate equipment at no additional cost to the project.

1.08 DELIVERY STORAGE & HANDLING

A. General: Meet requirements of Division-1, in addition to the handling requirements of Section 335243 - "Aviation Fueling System – General Requirements".

1.09 SUBMITTALS

A. Furnish Product Submittals as specified in Section 335243 - "Aviation Fueling System – General Requirements".

1.10 WARRANTY

A. General: Warranty fueling system equipment and associated work per the requirements of the Conditions of the Contract, except warranty to include the additional provisions of Section 335243 - "Aviation Fueling System – General Requirements".

PART 2 - PRODUCTS (Edit to delete unused equipment paragraphs)

2.01 HYDRANT PITS

A. General: Pits shall be pre-fabricated fiberglass/steel flange pits with double-hinge aluminum frame and door.

B. Pit Covers:

1. Covers shall be No. A356.2 all primary metal cast aluminum per Fed. Spec. QQ-A-601F with a Mil. Spec. H-6088F T-6 heat treat, with no

exceptions. Tested to AASHTO M306 proof load of 200,000 lbs.

2. Service lettering shall be abrasion/corrosion/chemical resistant, color coded, polyester powder coated.

3. Cover access door shall have hand-holes with a minimum 1.75-inch depth and 7.5 cu. in. volume located near edge opposite of hinge side. Cover door shall have one single-motion latch lever without any above-grade protrusions whether in use or not and with a minimum 0.25-inch clearance from latching surface. Cover door and frame shall have a 35-pound maximum lift using non-weight bearing, free floating hinges, and a minimum 0.5-inch diameter hinge pins; providing a minimum 23.5-inch diameter clear opening to allow component access at a 4-inch maximum from cover top.

4. Cover prototype test report shall be submitted and the test shall have been conducted by an independent testing company in the following manner: Cover loading over each 200 sq. in. footprint shall result in a rating of 1,000 psi (740 psi for 11 inch O.D. cover) with a maximum full load deflection of 0.100 inch at center indicators and maximum deflection "rebound" within 0.010 inch after load release.

5. Cover must be free of visual shrink porosity cavity areas, fillers, weldments and paint to hide them. Cover areas painted for safety or colored for information are allowed. Weight bearing mating flange surfaces of the pit and cover shall be machined flat to within 0.010-inch total indicator reading.

6. Spare Parts - Provide 2 sets of hinge kits for pit covers.

C. Pits shall be pre-fabricated per the drawing detail dimensions, and shall be fiberglass with a galvanized steel top flange to be integrally bonded to the fiberglass in a non-bolted arrangement with a minimum overlap of 4 inches. The integral top flange shall require no extraneous corrosive material, weldments or strong backs to support the cover.

D. Manufacturer: Hydrant Pits shall be as manufactured by CAVOTEC-DABICO, Inc., or approved equivalent. (Substitutions under provisions in Section 335243)

E. Internal Coating: Following installation, hydrant pits shall be internally coated with a two-part, spray-on polyurea coating. Refer to Section 335280.

2.02 HIGH POINT VENT AND LOW POINT DRAIN PITS

A. General: Pits shall be pre-fabricated fiberglass/steel flange pits with double-hinge aluminum frame and door.

B. Pit Covers:

1. Covers shall be No. A356.2 all primary metal cast aluminum per Fed. Spec. QQ-A-601F with a Mil. Spec. H-6088F T-6 heat treat, with no exceptions. Tested to AASHTO M306 proof load of 200,000 lbs.

2. Service lettering shall be abrasion/corrosion/chemical resistant, color coded, polyester powder coated.

3. Cover access door shall have hand-holes with a minimum 1.75-inch depth and 7.5 cu. in. volume located near edge opposite of hinge side. Cover door shall have one single-motion latch lever without any above-grade protrusions whether in use or not and with a minimum 0.25-inch clearance from latching surface. Cover door and frame shall have a 35-pound maximum lift using non-weight bearing, free floating hinges, and a minimum 0.5-inch diameter hinge pins; providing a minimum 23.5-inch diameter clear opening to allow component access at a 4-inch maximum from cover top.

4. Cover prototype test report shall be submitted and the test shall have been conducted by an independent testing company in the following manner: Cover loading over each 200 sq. in. footprint shall result in a rating of 1,000 psi (740 psi for 11 inch O.D. cover) with a maximum full load deflection of 0.100 inch at center indicators and maximum deflection "rebound" within 0.010 inch after load release.

5. Cover must be free of visual shrink porosity cavity areas, fillers, weldments and paint to hide them. Cover areas painted for safety or colored for information are allowed. Weight bearing mating flange surfaces of the pit and cover shall be machined flat to within 0.010-inch total indicator reading.

6. Spare Parts - Provide 2 sets of hinge kits for pit covers

C. Cover access door shall have hand-holes with a minimum 1.75-inch depth and 7.5 cu. in. volume located near edge opposite of hinge side. Cover door shall have one single-motion latch lever without any above-grade protrusions whether in use or not and with a minimum 0.25-inch clearance from latching surface. Cover door and frame shall have a 35-pound maximum lift using non-weight bearing, free floating hinges, and a minimum 0.5-inch diameter hinge pins; providing a minimum 23.5-inch diameter clear opening to allow component access at a 4-inch maximum from cover top.

D. Manufacturer: High Point Vent (HPV) and Low Point Drain (LPD) Pits shall be as manufactured by CAVOTEC-DABICO, or approved equivalent. (Substitutions under provisions in Section 335243)

E. Internal Coating: Following installation, hydrant pits shall be internally coated with a two-part, spray-on polyurea coating. Refer to Section 335280.

2.03 ACCESS COVERS

A. General: Vault Access Covers shall be double-hinge aluminum frame and door with pre-fabricated reinforced fiberglass pit liner with a steel top flange vault access pit.

B. Pit Covers:

1. Covers shall be No. A356.2 all primary metal cast aluminum per Fed. Spec. QQ-A-601F with a Mil. Spec. H-6088F T-6 heat treat, with no exceptions. Tested to AASHTO M306 proof load of 200,000 lbs.

2. Service lettering shall be abrasion/corrosion/chemical resistant, color coded, polyester powder coated.

3. Cover access door shall have hand-holes with a minimum 1.75-inch depth and 7.5 cu. in. volume located near edge opposite of hinge side. Cover door shall have one single-motion latch lever without any above-grade protrusions whether in use or not and with a minimum 0.25-inch clearance from latching surface. Cover door and frame shall have a 35-pound maximum lift using non-weight bearing, free floating hinges, and a minimum 0.5-inch diameter hinge pins; providing a minimum 23.5-inch diameter clear opening to allow component access at a 4-inch maximum from cover top.

4. Cover prototype test report shall be submitted and the test shall have been conducted by an independent testing company in the following manner: Cover loading over each 200 sq. in. footprint shall result in a rating of 1,000 psi (740 psi for 11 inch O.D. cover) with a maximum full load deflection of 0.100 inch at center indicators and maximum deflection "rebound" within 0.010 inch after load release.

5. Cover must be free of visual shrink porosity cavity areas, fillers, weldments and paint to hide them. Cover areas painted for safety or colored for information are allowed. Weight bearing mating flange surfaces of the pit and cover shall be machined flat to within 0.010-inch total indicator reading.

6. Spare Parts - Provide 2 sets of hinge kits for pit covers

C. Cover access door shall have hand-holes with a minimum 1.75-inch depth and 7.5 cu. in. volume located near edge opposite of hinge side. Cover door shall have one single-motion latch lever without any above-grade protrusions whether in use or not and with a minimum 0.25-inch clearance from latching surface. Cover door and frame shall have a 35-pound maximum lift using non-weight bearing, free floating hinges, and a minimum 0.5-inch diameter hinge pins; providing a minimum 23.5-inch diameter clear opening to allow component access at a 4-inch maximum from cover top.

D. Manufacturer: Access cover shall be as manufactured by Cavotec-Dabico, Inc, as applicable for the thickness of the vault roof structure.

2.04 VAULT ACCESS HATCHES

A. General: Vault Access Covers shall be counterweighted aluminum with pre-fabricated fiberglass frame (pit).

B. Covers:

1. Covers shall be No. A356.2 all primary metal cast aluminum per Fed. Spec. QQ-A-601F with a Mil. Spec. H-6088F T-6 heat treat, with no exceptions. Tested to AASHTO M306 proof load of 200,000 lbs.

2. Service lettering shall be abrasion/corrosion/chemical resistant, color coded, polyester powder coated.

3. Cover shall have hand holes with a minimum 1.75-inch depth and 7.5 cu. in. volume located near edge opposite of hinge side. Cover shall have single-motion, automatic, non-spring, latch lever without any above-grade protrusions whether in use or not and with a minimum 0.25-inch clearance from latching surface.

4. One-piece counterweight cover shall open 90 degrees with a 35 lb. maximum lift and close, flush with apron grade even if not latched, with a 50 lb. minimum push, without spring shocks, using fixed lead weighted arm and non-weight bearing free floating cover arm with attachment to the cover to include safety through-bolt. Arm set shall be attached to gears within greased packed, totally enclosed gear boxes. Gear ratio shall allow cover to go to a fail-safe automatic open position once lifted beyond 70 degrees. Full pit overhead component access shall be capable from a 5.5-inch maximum from cover top.

5. Cover prototype test report shall be submitted and the test shall have been conducted by an independent testing company in the following manner: Cover loading over each 200 sq. in. footprint shall result in a rating of 1,000 psi with a maximum 0.150-inch full load deflection at center indicators and deflection "rebound" within 0.010 inch after load release.

6. Cover must be free of visual shrink porosity cavity areas, fillers, weldments and paint to hide them. Cover areas painted for safety or colored for information are allowed. Weight bearing matting flange surfaces of the pit and cover shall be machined flat to within

0.010-inch total indicator reading.

C. Pits: Shall be per the plan detail dimensions. Pit shall be fiberglass with reinforcement ribs. The integral top flange shall require no extraneous corrosive material, weldments or strongbacks to support the cover.

D. Manufacturer: Vault Access Hatches shall be as manufactured by Cavotec-Dabico, Inc., as applicable for the thickness of the vault roof structure.

2.05 SURGE ARRESTORS

A. General: Provide hydropneumatic, bladder type surge arrestors which utilize a dry nitrogen gas pre-charge. Surge cushions must fit within the available space.

B. The surge arrestors are designed to limit the system pressure of 180 psig to a maximum of 250 psig upon sudden and complete stoppage of Jet A fuel. Bladder pre-charge shall be as recommended by the manufacturer.

C. Vessel:

1. Vessel to be vertical type, constructed of carbon steel SA515, Grade 70, conforming to ASME Boiler and Pressure Vessel Code, Section VIII, Division-1, and designed for a working pressure of 275-psig at 100° F. ASME Code Stamp is required.

2. Vessel to be equipped with a steel removable top for inspection or replacement of the bladder without removing the vessel from the line. This assembly to be fitted with a charging valve for gas pre-charging and a 1/2 inch threadolet pressure gauge connection.

3. No part of the arrestor in contact with the Jet A fuel to be copper or galvanized material.

4. Flanged Inlet/Outlet Assembly to include the following:

   a. 6-inch ANSI-150 inlet/outlet flange, for 80-gal. units.

   b. Stainless steel screen, sized to prevent both extrusion of the bladder and absorb kinetic energy as flow enters or leaves the vessel.

5. Vessel shall be furnished with lifting lugs.

D. Bladder: Bladder elastomer material shall be as recommended by the manufacturer for Jet-A service at -20°F to +100°F.

E. Pressure Gauge: Vessel shall be provided with a dial pressure gauge which meets the specification requirements for pressure gauges, included in this section.

F. Priming and Painting: All non-machined ferrous metal surfaces shall be primed and painted or coated by the manufacturer. Coatings shall be as specified in Section 335280 Liquid Fuels Pipe Coating Systems

G. Manufacturers: Subject to meeting the requirements of the product specification, acceptable manufacturers are:

1. Parker-Greer
2. Young Engineering

2.06 PRESSURE GAUGES AND SNUBBERS

A. Pressure gauges shall conform to ASME B40.100 with 304 stainless steel cases and nominal 3-inch diameter white dials. Gauges shall be bottom connected and without back flanges. Gauges shall have all parts immersed in silicone oil

B. Range shall be as noted on the drawings, accuracy of ± 0.5%. Where not noted on drawings, select range such that normal operating pressure will be between 25% and 75% of the full scale range. Gauges shall be labeled with the calibration date.

C. Snubber: A pulsation dampener (or snubber), adjustable to the degree of dampening required, shall be provided for each gauge.

D. Gauges shall be provided with two ball valves (one for isolation and one for draining/zeroing).

E. Manufacturers: Subject to meeting the requirements of the product specification, acceptable manufacturers are:

1. Ashcroft
2. Weiss Instruments
3. Weksler
4. WIKA

2.07 BASKET STRAINERS

A. Strainers shall be ANSI Class 150, simple basket type construction of cast carbon steel, ASTM A 216 GR. WCB, with raised face flanges and bolted cover. (Substitutions: Under Provisions in Section 335243).

B. Baskets shall be type 304 stainless steel with 1/8-inch diameter perforations and 40 mesh liner. Free area of basket shall be not less than four times the corresponding pipe size.

C. Basket O-rings gaskets shall be Viton.

D. Manufacturers: Subject to meeting the requirements of the product specification, acceptable manufacturers are:

1. Hayward industrial Products

2. Mueller Steam Specialty

2.08 CONE STRAINERS

A. Provide cone strainers under each hydrant valve.

B. Strainers shall be fabricated from 16 gauge Type 304 stainless steel with an 11 gauge 304SS flange. Perforations shall be 3/16” diameter on ¼” centers. The strainers open area shall be equal to 100% of the cross sectional flow area of schedule 40 pipe.

C. The strainers shall be 4-inch and installed between 150lb WNRF flanges.

2.09 WATER DRAW-OFF SYSTEM (SUMP SEPARATOR)

A. Sump Separator shall be a cylindrical upright vessel with a cone shaped bottom and removable, latchable, flat cover with handles. Interior and exterior of vessel shall be coated by the manufacturer as specified in Section 335280. Separator shall be provided with integral support legs; fuel capacity shall be as noted on the Drawings.

B. Piping Connections:

1. Inlet to vessel: 1” connection, tangential to shell, with stainless steel ball valve.
2. Water Outlet: 1/2” connection at cone bottom, with stainless steel ball valve.
3. Fuel Drain: 1” connection below cone bottom. Fuel drain valve shall be a 1” internal foot valve with O-ring seal and extended handle to top of vessel.

C. Fuel Return Pump: Integral base mounted centrifugal pump, with minimum 10-gpm capacity at minimum 65-ft. TDH, minimum 1” inlet and outlet, or as otherwise indicated on the Drawings. Provide swing check valve at pump discharge. Minimum 3/4-HP (unless otherwise indicated on the Drawings), 120-VAC, XP (Class-1, Div-1, Groups C & D) motor. Provide with NEMA-4/7 Listed, unit mounted, manual motor starter.

D. Sump Separator shall be: Gammon Technical Products, Model 616B-1, or approved equal.

2.10 MILLIPORE SAMPLE CONNECTIONS

A. Millipore sample connections shall be a factory assembled unit specifically designed for obtaining representative samples from fuel pipelines.

B. Each sampling connection shall include:

1. 1/4” MNPT stainless steel sample probe with standard 2-1/4” long tube.
2. 1/4” stainless steel ball valve
3. 1/4” stainless steel quick disconnect coupler with dust cap

C. Approved Product: Gammon Technical Products, Fuel Sampling Kit #1

2.11 TANK-TYPE BULK AIR ELIMINATORS

A. General: Bulk air eliminators shall be a vertical coated carbon steel vessel with ANSI flanged inlet and outlet connections and a float operated air release valve for the removal of entrained air in the fuel. Vessel, pipe, air release valve, and fittings shall be rated for an operating pressure of 150-psig.

B. Vessel size, design flow rate, piping and flange sizes shall be as scheduled and indicated on the design drawings.

C. Vessel and all components shall be internally and externally coated as specified in Section 335280.

D. Approved product: Brodie International, Model RL-24 for design flow rates up through 300-gpm, and Model RL-30 for design flow rates from 301-to-800-gpm.

2.12 OIL/WATER SEPARATOR

A. Certification: The oil/water separator manufacturer shall certify that the surface preparation and tank coating systems are in accordance with the specification. Proof of UL label is required. Independent certification of 10 PPM or less grease or oil effluent is required. Submit manufacturer’s certification of the following:

B. General: Coated carbon steel double-wall flat/corrugated plate gravity displacement oil/water separator for underground installation. Separator shall be pre-fabricated with inclined, parallel, flat/corrugated plate and impingement coalescers. Tank capacities and influent flow rates shall be as scheduled in the drawings.

C. Influent Characteristics: Intermittent and variable flows of water, oil, or any combination of non-emulsified oil-water mixtures up the listed design influent flow rate.

   1. Typical operating influent oil/water mixture temperature range: 40°F to 80°F.

   2. Typical specific gravity of the oils in the operating temperature range: 0.71 to 0.92.

D. Effluent Characteristics: Separator shall remove all free oil droplets equal to or greater than 20-microns. Oil and grease concentration in the effluent shall not exceed 10-PPM.

E. Design Criteria: Separator shall be designed in accordance with Stokes Law, and API Publication-421 “Monographs on Refinery Environmental Control - Management of Water Discharges: Design and Operation of Oil/Water Separators”.

F. Construction: Separator shall include: inlet and outlet connections, non-clogging flow distributor and energy dissipater device, stationary under flow baffle, pre-settling area for solids, sludge baffle, oil coalescing chamber with removable corrugated plates and sectionalized removable polypropylene impingement coalescers, effluent downcomer positioned to prevent discharge of free oil, access manways for coalescers and each chamber, fittings for vent, oil pump-out, sampling, gauging, leak detection and lifting lugs.

   1. Tank dimensions, construction, and plate thickness shall be in strict accordance with Underwriters Laboratories, Subject UL-58 Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids, Double-wall Construction with 360-degree Steel Secondary Containment.

   2. Separator shall comply with NFPA-30 “Flammable and Combustible Liquids Code.

   3. Influent and effluent connections shall be ANSI-150 flanged connections, size as scheduled on the drawings.

   4. Separator shall have the following oil storage capacities:

      a. High Oil Level (Warning) Approx. 20% of static vessel volume.
      b. High-High Oil Level (Alarm) Approx. 43% of static vessel volume.
      c. Emergency Oil Spill Capacity of approx. 80% of static vessel volume.

   5. HighGuard Corrosion Protection System consisting of:

a. External surfaces commercially grit blasted.
b. Coating of 75-mils DFY HighGuard self-reinforcing polyurethane

6. Internal surfaces commercial grit blasted and coated with minimum 15-mils DFT heavy-duty polyurethane.

G. Separator shall be the standard patented product of a steel tank manufacturer regularly engaged in the production of such equipment. Separator shall be fabricated, inspected, and tested for leakage prior to shipment from the factory by Manufacturer as a completely assembled vessel.

H. Accessories:

1. Visual and Audible Alarm System and Control Panel that includes:

a. Visual-only high level alarm
b. Audible and visual high-high level alarm
c. Audible and visual alarm to indicate water and/or oil in the interstitial space.
d. Intrinsically safe level sensors made of stainless steel.
e. Silence control for the audible alarms.
f. Control panel shall be NEMA-4, with [120] [480]-VAC, [1] [3]-Ph. power supply.

2. Tank deadman anchoring system that includes polyester hold-down straps and concrete deadman anchors.

3. [Motorized Influent Valve.]

4. [[Effluent] [and] [Oil] Pump]

I. Warranty:

1. Manufacturer shall warrant the complete oil/water separator to be free from defects in material and workmanship for one year from the date of installation.

2. The tank shall have a 10-year warranty for external corrosion and structural defects.

2.13 PRODUCT RECOVERY TANK

A. Product Recovery Tank shall be a U.L. Labeled, underground double wall steel tank, with an interstitial monitor. The design, fabrication, erection, testing, and inspection of the tank shall conform to the requirements of U.L 58, Standard for Safety, Steel Underground Tanks for Flammable and

Combustible Liquids, Type II. Inner and outer tank walls shall be carbon steel plate, minimum 0.167-inch thickness. The exterior tank walls shall be separated from the inner tank walls with standoffs. A 36-inch diameter round manway with a fiberglass or stainless steel ladder shall be provided for access into the tank. Manway shall have a U.L. Listed gasket with bolted cover.

1. The interior and exterior surfaces of the primary and containment tanks shall have a corrosion protection coating system. Interior surfaces shall be coated in accordance with MIL-DTL-24441, Formulas 150, 151, and 152. The exterior surface shall be coated in accordance with STI 010-50-1000, and the tank shall bear the STI 010-50-1000 Label.

2. Tank capacity, connections, and appurtenances shall be as shown on the drawings.

3. Lifting lugs shall be provided at balance points.

4. Provide anchor straps to attach tank to hold-down slab. Straps shall be separated from the tank by a pad made of an inert insulating material. Metal straps, turnbuckles, and anchors shall be coated to resist corrosion.

B. Leak detection monitor: Provide the tank with a leak detection monitoring system capable of detecting a fuel leak from the inner tank to the interstitial space between the shells, and a ground water leak through the outer tank wall to the interstitial space between the shells. The system shall continuously monitor the interstitial space, and may utilize electronic or hydraulic sensing. All electrical and electronic components shall be listed as explosion proof. Totally flooded interstitial space type leak detection is not acceptable.

C. Provide tank appurtenances and fittings and indicated on the drawings, and as specified herein. Nozzles for appurtenances shall be installed plumb with above grade ANSI flange faces level.

1. Tank shall include a sampling and gauge hatch with a foot-operated hinged cover that includes a flexible sealing ring and a provision for a padlock. The hatch shall be non-sparking and shall have a 4-inch ANSI flange on top of the 4-inch Schedule-40 carbon steel riser pipe. Provide a datum plate beneath the hatch, and stencil reference height on the hatch cover.

2. Fuel Return Connection: 4-inch ANSI insulated flange connection on 4-inch carbon steel riser for a 2-inch Schedule-40 stainless steel inlet pipe with a foot valve and stainless steel screened inlet located 6-inches above striker plate at tank bottom. Refer to Section

335243.23 - "Aviation Fuel System Pumps" for pump specification.

3. Tank Bottom Pump-out Connection: 3-inch ANSI insulated flange on 3" Schedule-40 carbon steel riser connection for a 1-inch Schedule-40 stainless steel inlet pipe with a foot valve and stainless steel screened inlet located 1-inch above striker plate at tank bottom. Refer to Section 335243.23 - "Aviation Fuel System Pumps" for pump specification.

4. Fill Line: 4-inch ANSI insulated flange on 4-inch carbon steel riser and a 2-inch Schedule-40 stainless steel drop tube that terminates 4-inches above a striker plate at the tank bottom. Provide a 2-inch hydraulic, float actuated overfill control valve (OCV) in the fill line above the tank, and a float control remotely mounted in the tank. Refer to Section 335243.14 – "Aviation Fuel System Control Valves" for OCV specification.

5. Liquid Level Transmitter Riser: 4-inch carbon steel riser pipe, MNPT threaded for level transmitter probe connection. Refer to Section 330954 - "Instrumentation and Control for Aviation Fueling Systems" for Product Recovery Tank level gauging specification.

6. Level Switch Riser: 3-inch carbon steel riser pipe with 3-inch ANSI blind flange drilled and tapped for 2-inch MNPT level switch probe fitting. Refer to Section 330954.11 - "Field Devices for Aviation Fueling Control Systems" for level switch specification.

7. Tank Vent: 3-inch Schedule-40 carbon steel vent riser with pressure/vacuum vent installed at 12-ft. above finished grade.

2.14 FLEXIBLE BALL JOINT

A. Flexible ball joints must be [stainless steel] [carbon steel with electroless nickel-plating to a minimum of 0.075 mm 3 mils thickness], capable of 360-degree rotation plus 15-degree angular flex movement, ASME B16.5, Class 150 flanged end connections. Provide either pressure molded composition, PEEK, or polytetrafluoroethylene (TFM) gaskets designed for continuous operation temperature of 135 degrees C 275 degrees F. Joints must be designed for minimum working pressure of ANSI Class 150. Injectable packing will not be allowed.

2.15 FLOW METER

A. Meter must be a one-way flow, temperature compensating, positive displacement type meter designed for a continuous flow of [xxx GPM] at the truck fill stand. Meter must have ANSI Class 150 flanges and body working pressure of not less than 275 psig and must be suitable for hydrostatic testing of 275 psig. Meter must be factory calibrated for [Jet-A][   ] jet fuel and capable of being calibrated in the field. The register must have a non-setback total indicator and a setback type run indicator so that individual runs can be registered without affecting the total of all runs as shown on the indicator. The total indicator must have a minimum of eight figures and the setback run indicator must have a minimum of five figures. The register must read in gallons and the smallest unit of indicated delivery must be 1 gallon. Accuracy must be within +0.3 percent between ten percent and maximum rated flow. Meters must be provided with a suitable drain at the bottom, equipped with a ball valve. Pressure loss through the meter must not exceed 3 psi at [XXX GPM] flow rate.

PART 3 - EXECUTION

3.01 INSPECTION

A. General: Examine the areas and conditions under which mechanical work is to be installed or performed, and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Existing Facilities: Verify existence, location and operation of existing components, material, equipment, piping, etc. to be abandoned, removed or altered.

C. Receive, unload, check, and store in suitable facilities all Equipment and Materials; examine all Equipment and Materials for concealed damage and report any damage to Owner.

D. Be responsible for the safety and protection from loss or damage of all Equipment and Materials received until the Work is complete.

E. Protect all Equipment and Materials during storage and prior to start-up which shall include the coverings of all openings, protection against rust and other damage, and other similar measures. Equipment may be stored outdoors only when approved. Contractor shall protect all coated pipe and fittings from ultraviolet deterioration.

3.02 DEMOLITION

A. [Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.]

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed. Bevel and dress remaining piping ends for welded connection of new piping and/or fittings.
2. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

C. If pipe, fittings, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.03 INSTALLATION

A. Furnish all labor, Materials, and Equipment necessary to make a complete installation as indicated and specified. Refer to Section 335243 “Aviation Fueling System - General Requirements” for additional information.

B. Install mechanical work, meeting the requirements of the Contract Documents and in accordance with product manufacturer's instructions and recommendations. Meet requirements of final, reviewed submittals for the work. Follow the recommendations and instructions of the product manufacturer, unless otherwise specified or shown on the Drawings.

C. Provide all necessary supports, brackets, or foundations for properly installing all piping and equipment.

D. Coordinate with the other trades before installation of Materials. Extra charges shall not be approved for interferences due to lack of coordination.

E. 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, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

F. Install equipment to permit servicing.

G. Select system components with pressure rating equal to or greater than system operating pressure.

H. All Equipment shall be properly aligned, adjusted, and lubricated before final acceptance.

I. Spot paint all Equipment where the shop paint has been damaged or flaked off. Finish painting of all exposed piping and mechanical Equipment is specified in SECTION 335280 – “Liquid Fuels Pipe Coating Systems” unless otherwise specified.

J. WELDING:
   1. When required for safety, properly shield the welding area.
   2. Existing Piping: Positively purge existing piping with dry nitrogen during all hot work.
   3. Jet A Piping Welding: Refer to Section 335243.13 – "Aviation Fueling Pipe, Valves and Fittings", and Section 335290 – "Welding for Fuel Service Piping".
   4. Miscellaneous Welding: Welding procedure to be governed by applicable service type specification of AWS D1.1 - Structural Welding Code, [and to Section 050510 – "Welding"] for additional requirements.

K. Furnish all bolts, studs, nuts, and gaskets for makeup of all connections to the Equipment and replace all gaskets damaged during storage, inspection, cleaning, or placing into service.

L. Retighten all threaded and bolted connections after installation. This applies to Owner- furnished equipment as well and shall be accomplished by Contractor at no additional cost to Owner.

M. Piping: Refer to Section 335243.13 - "Aviation Fueling Pipe, Manual Valves and Fittings."

N. Identification and Labeling: Provide labels and signs as called for in the Contract Documents and permanently attach or support same; piping identification per API 1542, refer to Section 335292 - "Aviation Fuel System - Mechanical Identification".

O. Clean Up: Prior to acceptance tests and inspections, clean the project site. Remove all miscellaneous construction equipment; dispose of all trash and unnecessary excavated material in a manner acceptable to the Owner or his authorized representative. Make the site as safe, clean and completely finished as possible.

P. Inspections and Tests:

   1. General: Test all of the equipment and piping installed under this Specification and demonstrate its proper operation to the Owner or his authorized representative. Furnish all required labor, testing, instruments and devices required for tests and pay for all expenses involved in conducting such tests. If tests show work or equipment to be defective, immediately make all changes necessary to correct work and performance to the satisfaction of the Owner or his authorized representative. Give 48 hours' notice, by letter or e-mail telegram, to the Owner or his authorized representative of all tests and demonstrations. Provide safe access to the test area if the work is in preparation or in progress. Contractor to be given reasonable time to

correct defects. If such corrections of defects or performance requirements are neglected, the right is reserved to have defects remedied and to charge the cost of same against the account of the Contractor. Refer to Section 335253 - "Aviation Fueling System Cleaning, Flushing, and Testing".

2. Covered Equipment: No pipe or equipment to be insulated or covered until hydrostatic or other required tests have been completed and approved. Where the Contractor considers this procedure unfeasible, he shall request a waiver from this requirement in writing which clearly defines the exception to the procedure and the extent of the work involved. Where it is determined that taking exception to the procedure results in an increase in the cost of the project either in the first cost of material and labor or as a result of defects in the pipe or equipment which could have been corrected in a less costly fashion through the required tests prior to covering, the contractor shall bear all costs associated with the exception to the procedure.

3. Inspection: Inspection includes but is not limited to:

    a. Alignment: Check whether equipment has been aligned.
    b. Coupling: Check coupling torque setting.
    c. Tightening: Tighten bolts, cap screws and other fasteners.

4. Start-up: Perform equipment start-up meeting requirements of equipment manufacturer; if manufacturer's representative is required to be present, coordinate with same; start-up to be made without load, except when detrimental to equipment.

5. Final Condition: Before final acceptance, check all connections, and remove all remaining debris.

3.04 WELDING QUALIFICATION AND APPROVAL

A. Welding qualification and approval shall be as specified in Section 335243 - "Aviation Fueling System - General Requirements".

B. Submit certified copies of the Procedure Qualification Records (PQR) as evidence that the intended procedures have been qualified in accordance with the latest revisions of the following codes:
    1. ASME B31.3 – Process Piping
    2. ASME Boiler and Pressure Vessel Code, Section I and Section IX

3.05 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Keep the interior and ends of all new and existing piping affected by construction operations thoroughly clean of foreign matter and water before and after being installed. Piping system shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water of other foreign substance will enter the pipe or fittings. Piping shall be inspected before placing into position. The interior of each length of pipe shall be cleaned after welding to ensure the interior of the pipe is free of foreign matter when connecter into the system.

D. 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:

   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
   3. Completed threaded fittings shall be seal welded per ASME B31.3

E. Welded Joints: Welding shall be accomplished by the use of the shielded metallic arc process and shall be in strict accordance with ASME B31.3. Refer to Section 335243.13 - “Aviation Fuel Pipe, Manual Valves, and Fittings” for additional requirements.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.06 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. in piping 2” and smaller, connection to each valve and at final connection to each piece of equipment may be weld-neck flanged, threaded or socket weld. Provide flanged connections where indicated and at equipment with flanged connections.

2. Threaded connections shall be seal welded.
3. Provide weld-neck flanges, in piping 2-1/2" and larger, for connection to flanged valves and at final connection to each piece of equipment.
4. Install dielectric fittings at first above grade connection at transition from underground to above ground piping, and where indicated.

3.07 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.08 PAINTING

A. Painting and coating of piped utility systems, equipment, and components is specified in [Section 099113 - "Exterior Painting,"] [and] [Section 335280 - "Liquid Fuels Pipe Coating Systems"].

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.09 IDENTIFICATION

A. Piping Systems: Identification of aviation fuels piping systems is specified in Section 335292 - "Aviation Fuel System - Mechanical Identification"

3.10 INSTALLATION OF UNDERGROUND TANKS

A. General: Installation shall be per tank manufacturer's recommendations, API RP 1615, NFPA 30, 40 CFR 280, state and local codes and as specified herein. If recommendations require tank to be filled, only fuel will be allowed in tanks. Water filling is not acceptable. EXCEPTION: Oil/Water Separator Tanks shall be pre-filled with water. Before being placed in service, tank shall be tightness tested in accordance with NFPA 30.

B. Coating Testing: The coating shall be examined for flaws and tested for thickness. Provide the facilities, personnel, and equipment for testing for flaws and thickness. Thickness shall be measured electronically. Coating shall be tested directly before placement of the tank with an electric flaw detector, equipped with a bell, buzzer, or other type of audible signal that operates when a flaw is detected. The detector for the type of coating used shall have an operating voltage of 10,000 to 35,000 volts. Check of the holiday detector potential may be made by the Contracting Officer at any time to determine the suitability of the detector. Damaged areas shall be repaired with materials identical to those used originally, and after drying, shall be retested electrically. Submit test results

C. Steel Tanks:

1. Cover the concrete hold down slab with 150 mm 6 inches of tank bedding backfill evenly graded and thoroughly compacted, prior to tank placement.
2. Each tank is to be unloaded and placed on the sand bed using cranes and the rigging procedures provided by the tank manufacturer. Use the tank lifting lugs for lifting the tank into place. The use of slings around the tank is not permitted, nor is the use of chock blocks of any sort. During handling, carefully inspect the tanks for coating damage and repair any damage whatsoever before proceeding. After placement, check each tank to ensure it is sloped as required. The elevation shall be confirmed.
3. Before proceeding with backfill, install the hold down straps and tighten the turnbuckles securely and evenly throughout the length of the tanks. The bottom and sides of the tanks to be fully and evenly supported by hand shoveling and tamping. Use tank bedding backfill up to 303 mm 12 inches above the top of tank. Hand-guided power equipment can be used to place fill in 150 mm 6-inch layers, compacted to a minimum of 95 percent maximum density, after the bottom quadrant is filled. A minimum of four density tests per tank to be performed. Clean, noncorrosive, well tamped gravel to be used for backfill from a point 12-inches above the tanks to finished grade.
4. Do not fill the tank, even partially, before the bottom quadrant is backfilled. The level of fuel product not to exceed the level of compacted backfill at any time.
5. Coordinate tank installation with installation of cathodic protection.

3.11 INSTALLATION OF FIBERGLASS PITS

A. Submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover.

B. These procedures shall indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, shall be provided.

C. Follow these recommendations and apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner shall be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Reference the Contract drawings for additional installation requirements.

END OF SECTION **335243.11**

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. This Section covers aircraft fueling system piping, fittings, manual valves, motorized and pneumatic valve actuators, welded and screwed connections, qualification procedures, welding procedures, materials, radiographing (and other nondestructive testing) requirements, and construction requirements.

B. Aboveground (and below ground) piping shall be of conventional single wall construction with pipe and fittings as specified herein for "CARRIER PIPE".

C. All materials, items, and components specified herein shall be suitable for use within an aviation jet fuel system with a maximum operating condition of 275 psig at 100ºF and a specific gravity of 0.81 ±0.05.

D. All end connections on piping and fittings to be welded shall be prepared for butt welding, without backing ring. Butt welding end preparation shall conform to ASME B16.25.

E. Contractor or any Subcontractor or Supplier shall not supply, furnish, or install any pipe flanges, fittings, bolts, or nuts of foreign manufacture. All pipe flanges, fittings, bolts, and nuts shall be manufactured in the United States of America and Contractor shall warrant the U.S.A origin of all such items. Pipe flanges and fittings shall bear a stamp attesting to their place of origin. Contractor shall provide written certification from the manufacturer as to the origin of all flanges, fittings, bolts, and nuts installed on the Project. If at any time Owner determines that any flanges, fittings, bolts, or nuts are not of U.S.A. origin, Owner shall be entitled to replace all flanges, and/or fittings, and/or bolts and/or nuts (as the case may be) without the need for individual testing for conformance to technical specifications, or for proof of non- U.S.A. origin of the other items. Contractor shall be responsible for all labor, materials, and consequential costs connected with such replacement.

1.03 DEFINITIONS

A. JFD: Jet Fuel Distribution piping.

B. JVP: Jet Fuel Valve Pit or vault.

C. DBB: Double Block & Bleed type Plug Valve

D. BFV: Butterfly Valve

E. CCS: (Coated Carbon Steel) Fusion bonded epoxy lined and epoxy coated jet fuel piping. Refer to Section 335280 for coating specifications.

F. Provide: Furnish and install complete, in place and ready for service.

G. Install: Assembly of fabricated parts and products, correct placement and permanent anchoring of mechanical work, and all mechanical work necessary for the systems and structures of the Contract Documents to be complete, permanent and of safe and satisfactory operation.

H. Piping: Pipe, fittings, flanges, gaskets, hardware, valves, specialties, hanger and like accessories related to piping.

I. Field Coating: Coating and wrapping performed in the field as opposed to coating and wrapping done in the shop of the custom coating applicator.

J. Design Pressure: Maximum coincident pressure in psig.

K. Working Pressure: Operating pressure in psig.

L. Singular Number: In all cases where a device, piece of equipment, individual, etc., is referred to in the singular number (such as the "valve"), such reference to be intended to apply to as many devices, etc. as required to complete the installation as specified and as shown in the Contract Documents.

1.04 RELATED SECTIONS (Edit to delete unused Sections)

A. SECTION 335243 - AVIATION FUELING SYSTEM - GENERAL REQUIREMENTS
B. SECTION 335242.11 - AVIATION FUELING SYSTEM EQUIPMENT
C. SECTION 335243.14 - AVIATION FUELING SYSTEM CONTROL VALVES
D. SECTION 335243.23 - AVIATION FUEL SYSTEM PUMPS
E. SECTION 335243.28 AVIATION FUEL SYSTEM FILTERS AND FILTER / SEPARATORS
F. SECTION 335253 - AVIATION FUELING SYSTEM CLEANING, TESTING, AND FLUSHING
G. SECTION 335260 - AVIATION FUEL PIPING SYSTEM SUPPORTS & ANCHORS
H. SECTION 335280 - LIQUID FUELS PIPE COATING SYSTEMS
I. SECTION 335290 - WELDING FOR FUEL SERVICE PIPING
J. SECTION 335292 - AVIATION FUEL SYSTEM MECHANICAL IDENTIFICATION

1.05 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section, and with the following references as applicable. Refer to Section 1335243 for a listing of issuing organizations or agencies.

B. American Petroleum Institute (API):

1. Spec 5L - Line Pipe.
2. Spec 6D - Specification for Pipeline Valves (Steel Gate, Plug, Ball and Check Valves).
3. Spec 6FA - Specification for Fire Test for Valves.

C. American Society of Mechanical Engineers (ASME):

1. B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
2. B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
3. B16.20 - Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral-Wound, and Jacketed.
4. B16.25 - Buttwelding Ends.
5. B16.5 - Pipe Flanges and Flanged Fittings.
6. B31.3 - Process Piping.
7. B36.10 – Welded and Seamless Wrought Steel Pipe.
8. BPVC Section IX – Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

D. American Society for Testing and Materials (ASTM):

1. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
2. A105 - Carbon Steel Forgings for Piping Applications.
3. A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
4. A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
5. A194 - Carbon and Alloy Steel Nuts for Bolts for High-Pressure and

High-Temperature Service.

6. A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

7. A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

1.06 REGULATORY REQUIREMENTS

A. Comply with latest editions of all applicable Codes, Standards, Ordinances and Regulations in effect as of the date of the Contract Documents adopted by the State of [Washington] [ ], [Port of Seattle], and [Seattle- Tacoma International Airport, including but not necessarily limited to the following:

1. NFPA-70 “National Electrical Code”.

2. NFPA-30 “Flammable and Combustible Liquids Code”.

3. NFPA-407 “Standard for Aircraft Fuel Servicing”.

4. IBC “International Building Code”, including any [local] [City SeaTac] Amendments.

5. IFC “International Fire Code”, including any [local] [City SeaTac] Amendments.

B. If discrepancies occur between the Contract Documents and any applicable Codes, Guidelines, Ordinances, Acts, or Standards, the most stringent requirements shall apply.

1.07 PRODUCT OPTIONS AND SUBSTITUTIONS

A. [Substitutions: Refer to General Requirements Division 01 - Section 012510 “Substitutions”]

B. Some materials and equipment are specified by Manufacturer and catalog numbers. The Manufacturer and catalog numbers are used to establish a degree of quality and style for such equipment and material.

C. When alternate or substitute materials and equipment are used, Contractor shall be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, electrical changes and other apparatus and trades that may be affected by their use.

D. When providing a product and/or service under the qualification of “acceptable equal,” Contractor shall be entirely responsible for additional costs incurred due to modifications to the civil, structural, mechanical, and electrical design that may be required to accommodate the "acceptable equal".

E. Substitute materials and equipment are only allowed to be provided from the Manufacturers listed as approved.

1.08 QUALITY ASSURANCE

A. Comply with the Quality Assurance requirements specified in Section 335243 "Aviation Fueling System - General Requirements".

1.09 DELIVERY STORAGE & HANDLING

A. Meet requirements of Division-01, in addition to the handling requirements of specified in Section 335243 - "Aviation Fueling System – General Requirements".

1.10 SUBMITTALS

A. Submit as specified in Section 335243 - "Aviation Fueling System-General Requirements".

1.11 WARRANTY

A. General: Warranty mechanical work meeting provisions of the Conditions of the Contract, and the additional provisions of Section 335243 - "Aviation Fueling System – General Requirements".

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products from one of the listed manufacturers.

1. Flange Gaskets:
    a. Flexitalic
    b. Garlok
    c. Lamons
    d. Klinger
2. Flange Insulation Assembly:
    a. Pipeline Seal and Insulator, Inc.
    b. Advance Products & Systems, Inc.

3. Pipe Supports:

    a. Anvil
    b. Cooper B-Line
    c. Piping technology & Products

4. Pipe Sleeve Seal:

    a. Thunderline Corporation
    b. Approved equal

5. Pipe Sleeve Insulators:

    a. Advance Products & Systems, Inc.
    b. Pipeline Seal & Insulator, Inc.

6. Sleeve Boots:

    a. Advance Products & Systems, Inc.
    b. Pipeline Seal & Insulator, Inc.

7. Manual Valves and Valve Actuators: Refer to specific paragraphs.

2.02 PIPING MATERIALS

A. All materials and equipment provided under these specifications shall be new products of manufacturers regularly engaged in production of such equipment. All products shall conform to the applicable code or standard for its manufacturing, fabricating and installation.

B. Certification:

    1. All steel pipe and fittings to be installed for aircraft fuel service, or for conveyance of waste fluids which may contain fuel, shall be tested and certified at the mill for conformance with the appropriate API or ASTM specification.

    2. Mill certification of piping shall be submitted to the [SEA] [ ] [Project Manager] [Owner's Representative] for approval.

    3. Mill identification shall be stamped and clearly visible within 2 inches of the pipe or fitting end. The mill identification on the pipe shall be directly traceable to the mill certification report, in order to specifically identify each piece of pipe or fitting as being fabricated from the steel tested under the mill certification.

C. The ends of the pipe shall be capped at the factory using suitable galvanized metal or plastic caps, secured with a double wrap of 2-inch wide pressure sensitive tape. Plastic caps shall not be used in plugging or capping pipes after installation.

D. All exposed to view aboveground piping, including fittings, valves, supports, and system accessories shall be externally painted or coated in accordance with Section 335280. Internal epoxy lining of piping 2-1/2 inches in size or larger shall be provided for all steel piping conveying fuel in liquid or vapor form, in accordance with provisions of Section 335280 - “Liquid Fuels Pipe Coating Systems”.

E. All piping, fittings and devices located within pits or vaults shall be considered to be above ground.

2.03 PIPING SPECIFICATIONS

A. Piping Design Basis:

Service	Design Conditions (psig ambient)	Test (psig)
Fueling Supply	150	275
Fueling Drain	150	275
Fueling Vent	150	275

B. Steel pipe and fittings shall be as scheduled below:

Item	2 Inch and Smaller	2-1/2 Inch and Larger
Pipe	ASTM A 53 Grade B, or API 5L Grade B Schedule 80, Seamless.	ASTM A 53 Grade B, or API 5L Grade B, Seamless or ERW, Schedule 40 for 2-1/2" to 10", Std. weight for 12" and above.
Joints	Socket weld. Screwed joints are not used except aboveground or in pits as required to connect to valves or equipment with threaded connections.	Butt-weld.
Flanges	150 lb. ANSI, Carbon Steel, ASTM A181, Class	150 lb. ANSI, Carbon Steel, ASTM A181, Class

Item	2 Inch and Smaller	2-1/2 Inch and Larger
	70Socket Weld	70Weld Neck, Raised Face
Fittings	Socket weld, ANSI B16.11, Forged Steel, ASTM A 105, 3000 lb.	Butt weld, ANSI 16.9 Carbon Steel, ASTM A-234 Grade B, Wall thickness to match pipe.
Bolts, Studs, Nuts	Same as 2-1/2 Inch & Larger	Carbon steel, cadmium plated, machine bolts and studs per ASTM A 193 Grade B7. Nuts to be heavy hexagon, ASTM A 194 Grade 2H, Cadmium plated.
Gaskets	Same as 2-1/2 Inch & Larger	Spiral-wound, Flexitallic Style CG.

2.04 FITTINGS FOR WELDED CARRIER PIPE

A. Butt welding type carbon steel, ASTM A234 Grade WPB, ANSI B16.9 for sizes 2-1/2 inches and larger. Wall thickness shall match pipe.

B. Socket welding 3,000-pound forged steel, ASTM A105, conforming to ASME B16.9 and B16.11, for sizes 2 inches and smaller. Butt weld fittings in lieu of socket weld are acceptable.

C. Elbows shall be long radius unless otherwise noted.

D. Changes in direction of pipe other than 45° or 90° shall be made as follows:

1. With long radius weld ells cut to the proper angle and beveled.
2. At the option of the Contractor; with long radius pipe bends. Pipe roundness shall be maintained to factory tolerance. Submit Shop drawings of all proposed bends and bending procedures for approval by the Engineer.
3. Bends of 2-degrees or less may be miter joints.

E. Welded Branch connections:

1. Welded branch connections shall be butt welding tees except as noter herein, or as indicated on the drawings.
2. Fabricated tees shall be insert-type vessolets or sweepolets. Standard weldolets shall not be utilized for underground piping. Fittings and welds shall

provide a 100% smooth and accessible surface for non-destructive weld testing.

3. Insert-type weldolets may be used for welded branch connections in above ground piping. Piping in underground valve vaults is considered to be above ground piping.

4. Standard weldolets may be used for above ground welded branch connections between 2-1/2 and 4-inches in size. Piping in underground valve vaults is considered to be above ground piping.

5. Fabricated branch connections for above ground piping 2” and smaller in size shall be sockolets or threadolets. Piping in underground valve vaults is considered to be above ground piping.

2.05 FLANGES

A. Unless otherwise noted, flanges shall be standard weld neck type 150 pound forged steel, ASTM A181 Class 70, conforming to ANSI B16.5.

B. Finish of the flange surface mating the gasket shall be phonographically serrated.

C. Flange facings shall correspond to the equipment to which the piping is joined and shall, unless otherwise required, be standard 1/16-inch raised face flanges.

D. Flange drilling shall match drilling on pump or equipment flanges.

2.06 INSULATED FLANGE JOINTS

A. Flanged insulating assemblies shall be used for electrostatically isolating catholically protected pipeline from catholically unprotected assemblies, and shall be Linebacker Type “E” as manufactured by Pipeline Seal and Insulator, Inc., or approved substitute.

B. Insulating joint shall consist of a full face insulating gasket, insulating bolt sleeves and double quantity of insulating washers and stainless steel washers.

C. Insulating materials shall be as follows:

1. Gasket: NEMA Grade G10 retainer conforming to ASTM D 229 with Teflon ring seal on each side of the retainer. Minimum dielectric strength shall be 500 volts per mil (VPM). Compressive strength shall be 50,000 psi. Water absorption shall be 0.05 percent (max.).

2. Sleeves: Shall be 1/32-inch wall thickness, length to suit two class

150 lb. weld neck flanges, insulating gaskets and valve body thickness. Sleeve shall provide "full" insulation of studs; minimum dielectric strength shall be 500 VPM. Material shall be NEMA Grade G10.

3. Insulating washers: NEMA Grade G10, 1/8-inch thick (minimum).

D. Install insulating joints at the locations indicated on the Drawings. Where not shown on the Drawings, they shall be installed at the first flange (within the structure) nearest to the structure's wall or the first flange wherever underground piping comes aboveground.

E. Flange assemblies shall provide a minimum resistance of one million ohms measured between each stud and both flanges when tested in the dry condition.

2.07 GASKETS

A. Gaskets shall be resistant to the effects of hydrocarbon fuels and manufactured of fire-resistant materials.

B. Full face gaskets shall be used for flat face steel flanged joints.

C. Ring gaskets shall be used for steel flanged joints with raised face flanges.

D. Gaskets shall be spiral-wound construction with an integral 1/8-inch thick metal gauge ring.

E. Gasket shall be constructed from metal windings and enclosed filler to a thickness of 0.175 inch to compress to 0.125 to 0.135 inch under proper bolt torque.

F. The metal windings shall be type 304 stainless steel.

G. The filler shall be non-asbestos, chlorite mineral paper (Flexite).

2.08 BOLTS AND NUTS

A. Machine bolts shall be cadmium-plated carbon steel, heavy hexagon, conforming to ANSI B18.2.1 and ASTM A193 Grade B7.

B. Nuts shall be cadmium plated carbon steel, heavy hexagon conforming to ANSI B18.2.2 and ASTM A 194 Grade 2H.

C. Cadmium plating shall be electro-deposit in accordance with ASTM B766-86, Coating type TS.

D. Provide washers under bolt head and nuts. Washers to be cadmium plated

ASTM F 436 hardened steel washers.

2.09 PIPE SLEEVES

A. Provide sleeves for all pipes passing through equipment pads, slabs, vault walls, and other concrete or masonry structures.

B. Sleeve sizes through 10-inches shall be Schedule-40 steel pipe. Pipe sleeves 12-inches and larger shall be STD-Weight steel pipe.

C. Sleeves shall have an anchor collar of the same type of steel as the sleeve. The collar shall be located on the sleeve at the midpoint of the structural wall or pad, and continuously welded to the sleeve on both sides of the collar.

D. Sleeves shall be 2-inch nominal pipe size larger than the carrier (or containment) pipe for pipe sizes smaller than 4-inches, and two nominal pipe sizes larger that the carrier (or containment) pipe for pipe sizes 4-inch and larger.

E. Sleeves shall be cast in place in walls, pads, and slabs. Piping shall be centered in the sleeves.

2.10 PIPE SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill the annular space between the pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit the surface of the pipe. Include type and number required for pipe size and material.

C. Pressure Plates: Carbon steel – include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of size and length required to secure pressure plates – include one for each sealing element.

E. Manufacturer:

1. Metraflex Co. MetraSeal
2. Pipeline Seal and Insulator, Inc.
3. PSI-Thundeline/Link-Seal Series 400

2.11 SLEEVE BOOTS

A. Sleeve boots shall be oil, chemical, and water resistant molded double accordion type.

B. Boot shall be a minimum of 3/8” thick, with circumferential ribs molded on the inner surface on each end. The remainder of the boot shall be a minimum of

3/16” thick.

C. Bands shall be minimum 1/2” wide, stainless steel thumb screw type, with rounded edges.

2.12 BUTTERFLY VALVES

A. Butterfly valves shall be High Performance Butterfly Valves, full lug body, rated at 200 psi at 100 degrees F, and meet the following requirements:

1. Valves shall be capable of providing drop-tight shutoff against full differential pressure in either flow direction.

2. Valve seat shall be fire-safe metal-to-metal secondary seal with primary elastomeric seal, conforming to API 607.

3. Valves shall have retained top and bottom low friction bearings.

4. Retainer rings must be recessed in the body so that the line gasket prevents any potential external leakage.

5. Valves shall have internal stop to prevent disc over-travel.

6. Shaft shall be one piece, through disc type or two-piece stem incorporating double offset design, which is drilled on the tangent for disc connection and which is attached to the disc stops to be inherently blow-out proof in accordance with ANSI B16.34.

B. Valves shall be suitable for mounting with valve shaft in the horizontal position with the lower half of disc opening in the same direction as normal flow or offset one bolt hole angle to suit installation clearance.

C. Cap screws for installation of lug bodies shall be carbon steel, cadmium plated, heavy hexagon, conforming to ASTM A 193, Grade B7. Arrange for installation between flanges using cap screws from each side to permit removal of downstream flange.

D. Valves six (6) inches and smaller shall be furnished with spring loaded, squeeze trigger type handle complete with locking device. Valves eight (8) inches and larger shall have gear operators with handwheel and locking device.

E. Valve components shall be manufactured of the following materials:

1. Valve body shall be fabricated from carbon steel conforming to API-609, ASTM A 105 or A 216 GR. WCB through 8 inch; ASTM A 216 GR. WCB 10 inch or larger.

2. Disc shall be fabricated from stainless steel conforming to ASTM A 182 F316 or A 351 GR. CF8M.

3. Shaft shall be fabricated from stainless steel alloy 17-4 PH, ASTM A 564, Type 640H 1150.

4. Seat seal shall be stainless steel/RTFE.

5. Shaft bearings shall be rated for fire-safe application and shall conform to requirements of API-607.

F. Valve assembly shall be specifically designed for use with hydrocarbon fuels.

G. Acceptable Manufacturers:

1. Apollo Series 215
2. Cooper Cameron WKM “Dynacentric”
3. Crane "Flowseal HPBV”.
4. DeZurik “BHP”
5. Approved Equal

2.13 PLUG VALVES - DOUBLE BLOCK AND BLEED

A. Double Block and Bleed valves shall be General Valve Twin - Seal high-integrity positive shut-off valves, Model 8800, manufactured by Cameron, or Dan-Ex Figure 271 manufactured by Western Valve Company and shall meet the following requirements:

B. Valves shall have ANSI 150-pound rating.

1. Valves shall be non-lubricated, resilient seal, plug-type with a mechanical means of freeing the plug before it is rotated from the closed to the open position.

2. Valves shall have a manual body bleed valve to check seal integrity of valve in the closed position.

3. Valves shall have position indicator flag to show the exact plug position.

C. Valves six inches and smaller shall have hand wheel operators. Valves eight inches and larger shall have gear operators.

D. Valve components shall be manufactured of the following materials:

1. Valve body bonnet and plug shall be cast carbon steel ASTM A 216-WCB Chrome plated.

2. Valve O-rings shall be viton.

3. Back-up ring shall be Teflon.

4. Seating slips shall be ductile iron ASTM A 536 GF 80-55-06.

E. Valves installed in pits shall have a manual body bleed valve and drain pipe. Valves installed aboveground shall have an automatic body bleed system.

2.14 BALL VALVES

A. Socket Weld:

1. Valves shall be rated for minimum of 150 psig working pressure.

2. Valves shall be furnished with locking lever operators.

3. Valve components shall be manufactured of the following materials:

   a. Valve body shall be carbon steel.

   b. Ball and trim shall be 316 stainless steel.

   c. Seats and seals shall be RTFE.

   d. Handle shall be vinyl coated, cadmium plated carbon steel.

4. Socket weld ball valves shall be rated fire safe in accordance with API 607.

5. Acceptable Manufacturers:

   a. Flowserve Worcester-Controls Series 608 Ball Valve.
   b. Cooper Cameron WKM "Dynaseal" Ball Valve.
   c. Apollo 73A Series.
   d. Substitutions per General Requirement Section 012510 – Substitutions.

B. Flanged Valves:

1. Valves shall be ANSI Class 150, fire rated in accordance with API 607.

2. Valves shall be rated for minimum of 150 psig working pressure.

3. Valves shall be furnished with locking lever operators.

4. Valve components shall be manufactured of the following materials:

   a. Valve body shall be cast carbon steel conforming to ASTM A 216, Grade WCB.

b. Ball and trim shall be 316 stainless steel.

c. Seats and seals shall be RTFE.

d. Handle shall be vinyl coated, cadmium plated carbon steel.

5. Acceptable Manufacturers:

a. Flowserve Worcester-Controls “Series AF51/52”.
b. Cooper Cameron WKM “Dynaseal”.
c. Apollo 87A Series.
d. Substitutions per General Requirement Section 012510 – Substitutions.

2.15 MULTI-TURN MOTORIZED VALVE ACTUATORS

A. The actuator, controls and accessories shall be the responsibility of the valve-actuator supplier for sizing, assembly, certification, field-testing and any adjustments necessary to operate the valve as specified. The electric valve actuator shall include as an integral unit the electric motor, actuator unit gearing, limit switch gearing, position limit switches, torque switches, drive bushing or stem nut, declutch lever, wiring terminals for power, remote control, indication, connections and handwheel. The electric actuator shall be set to open and close the plug valve completely in 30 to 60 seconds against a differential pressure of [275] [180] PSIG. The actuator settings of torque and limit contacts shall be adjustable. The valve actuator shall be suitable for mounting in a vertical or horizontal position and be rated for 30 starts per hour. The valve actuator shall be capable of functioning in an ambient environment temperature ranging from -38 to +70 °C (-32 to +158 °F).

B. The electrical enclosure shall be specifically approved by UL or Factory Mutual for installation in Class I, Division 1, Group D locations, and shall be listed as weatherproof and corrosion resistant.

C. The actuator power supply shall be [480-VAC, 3-PH] [as indicated on the plans]. An integral control power transformer [and] DC power supply] shall be provided for 120-VAC and/or 24-VDC remote control circuits as required.

D. The electric motor shall be specifically designed for valve actuator service and shall be totally enclosed, non-ventilated construction. The motor shall be capable of complete operation at plus or minus 10 percent of specified voltage. Motor insulation shall be a minimum NEMA Class F. The motor shall be a removable subassembly to allow for motor or gear ratio changes as dictated by system operational requirements. The motor shall be equipped with an embedded thermostat to protect against motor overload and also be equipped with space heaters. It shall de-energize when encountering a jammed valve.

E. The reversing starter, control transformer, and local controls shall be integral with the valve actuator and suitably housed to prevent breathing or condensation buildup. The electromechanical starter shall be suitable for 30 starts per hour. The windings shall have short circuit and overload protection. A transformer, if needed, shall be provided to supply all internal circuits with 24 VDC or 110 VAC may be used for remote controls.

F. The actuator gearing shall be totally enclosed in an oil-filled or grease-filled gearcase. Standard gear oil or grease shall be used to lubricate the gearcase.

G. The actuator shall integrally contain local controls for Open, Close and Stop and a local/remote three position selector switch: Local Control Only, Off, and Remote Control, plus Local Stop Only. A metallic handwheel shall be provided for emergency operation. The handwheel drive must be mechanically independent of the motor drive. The remote control capability shall be to open and close. Rim pull to operate valve manually shall not exceed 28 kg (80 pounds).

H. Position limit switches shall be functional regardless of main power failure or manual operation. Four contacts shall be provided with each selectable as normally open or normally closed. The contacts shall be rated 5A minimum, at 120-VAC and 30-VDC.

I. The actuator shall have a local display of position even when power has been lost.

J. The actuator shall be supplied with a start-up kit comprising installation instruction, electrical wiring diagram and spare cover screws and seals.

K. Each actuator shall be performance tested and a test certificate supplied at no extra charge. The test should simulate a typical valve load with current, voltage, and speed measured.

L. Approved Manufacturer’s:

1. Auma Actuators, Inc.
2. Limitorque
3. Approved Equal

2.16 <u>QUARTER TURN MOTORIZED VALVE ACTUATORS</u>

A. The actuator, controls and accessories shall be the responsibility of the valve/actuator supplier for sizing, assembly, certification, field-testing and any adjustments necessary to operate the valve as specified. The electric valve actuator shall include as an integral unit the electric motor, actuator unit gearing, limit switch gearing, position limit switches, torque switches, worm shaft and segmented worm gear, adjustable mechanical travel stops, wiring terminals for power, remote control, indication, connections and handwheel. The electric actuator shall be set to open and close the butterfly or ball valve completely in [15 to 18] seconds against a differential pressure of [275] [180] PSIG. The actuator settings of torque and limit contacts shall be adjustable. The valve actuator shall be suitable for mounting in a vertical or horizontal position and be rated for 30 starts per hour. The valve actuator shall be capable of functioning in an ambient environment temperature ranging from -40°F to +150°F. Actuator valve flange and accessory mountings shall comply with ISO 5211 and VDI/VDE 3845 (NAMUR recommendations).

B. The electrical enclosure shall comply with NEMA Standard 250, Types 4,4x,7 & 9.

C. Motor: 120 or 220-VAC single phase, permanent split capacitor type, reversible induction motor with built-in bi-metallic, automatic reset type thermal overload switch, set at 275°F. Actuator shall be rated for a 25% Duty Cycle.

D. Spur Gear Train: The actuator shall have a self-locking gear train consisting of a worm and worm gear output drive. The spur gear train shall have precision cut multi-stage gears which will withstand locked rotor conditions. The spur gear train shall be permanently factory lubricated.

E. All travel switches shall be SPDT Form-C type rated 10A at 125/250-VAC, and 0.5A at 125-VDC, UL Listed and CSA Approved. Torque Limiting System shall have two SPDT mechanical switches with factory calibrated adjusting screws.

F. Field Connections: motor power supply, two SPDT limit switches, one for valve open and one for valve closed indication, and all external control connections shall be factory wired to terminal blocks. All external control connections shall be rated for minimum 10A at 125-VAC. Actuator enclosure shall include two ½” FNPT or two ¾” FNPT conduit entries depending on actuator size.

G. Actuator shall include a self-regulated, nominal 15-watt, 120 or 220-VAC anti-condensation heater wired to the terminal bloc.

H. Position Indication: Actuator shall include a target window, with an internal target indicating valve position.

I. Manual Override: All units shall include an aluminum manual override handwheel to operate the valve without electrical power. Manual override shall be engaged by pulling the handwheel. Electrical power shall be cut-off from the motor when the handwheel is engaged. Electrical control is restored when the handwheel is pushed in.

J. Approved Product: Bray Series S70, or approved equal.

2.17 QUARTER TURN PNEUMATIC VALVE ACTUATORS

A. The actuator, controls and accessories shall be the responsibility of the valve/actuator supplier for sizing, assembly, certification, field-testing and any adjustments necessary to operate the valve as specified.

B. Actuator shall be dual-piston rack-and-pinion type, [dual-acting] [or] [normally closed, spring return] [as indicated on the drawings] for operation on a compressed [air] [dry nitrogen] supply at a nominal pressure of 80-to-120 psig. The angle of rotation shall be factory set at 90°, with individually adjustable open and close angles from -3° to +10° closed, and +°80 to + 93° open. Actuator shall be sized to close the valve completely in 10-to-18 seconds, adjustable, against a differential pressure of 225-psig.

C. Actuator bodies and end caps shall be Anodized and polyurethane powder coated aluminum alloy, or stainless steel; the pistons shall be chromated aluminum alloy, [the springs shall be electrophoretic finished spring steel,] and the pinion shall be hard anodized aluminum alloy. Internal moving components shall be factory lubricated with a high-temperature grease. Actuator valve flange and accessory mountings shall comply with ISO 5211 and VDI/VDE 3845 (NAMUR recommendations).

D. Actuator and accessories shall be rated for operation in ambient temperatures from -40°F to +176 °F (-40°C to +80 °C).

E. Solenoid valve: Provide 3-way solenoid valve for spring return actuators and 4-way solenoid for dual-acting actuators. Solenoid shall be directly mounted to the actuator. Solenoid valves shall the UL Listed, with NEMA 4,4X,7 & 9 housings. A manual override shall be located on the solenoid valve body. Air/nitrogen connection shall be 1/4” NPT and the conduit connection shall be 1/2” NPT. Needle valves shall be provided for adjusting the opening and closing speeds.

F. Monitor/Position Indicator: Valve position indicator shall include two DPDT limit switches (one for valve open indication and one for valve closed indication), and local valve position indication throughout the full range of travel. Limit switches shall be UL Listed, with a NEMA 4,4X,7 & 9 enclosure. Limit switches shall be pre-wired to a terminal block within the enclosure.

G. [Nitrogen pressure regulator: For valve actuators operating from a dry nitrogen tank, provide a single stage pressure regulator rated for a maximum 3000-psig input pressure and an adjustable outlet pressure of 10 to 250-psig; factory set at 100-psig, and a flow capacity of 9000-scfm. Outlet connection shall be brass, 1/4”-37° flared. Regulator shall have minimum 0 – 3000 psig inlet pressure gauge, and 0 – 200 psig outlet pressure gauge.

H. Approved Actuator Manufacturer:

1. Bettis
2. FlowTek
3. Valworx
4. Bi-Torq

2.18 CHECK VALVES

A. Swing Check Valves:

  1. Full ductile iron body with stainless steel disc and trim, synthetic seating ring, ANSI-150 flanged ends.

  2. Fully conform to API Spec 6D and API STD 600.

  3. Disc and seating ring shall renewable without removing valve from the line.

  4. Disc shall be guided and controlled to contact the entire seating surface.

  5. Approved Manufacturers:

     a. Mueller Co.
     b. Nibco
     c. Crane
     d. Approved Equal

B. Wafer Check Valves

  1. Wafer type check valves shall be ANSI Class 150, rated for a working pressure of 285-psig, with two spring loaded non-slam plates. Each plate shall have an independent spring or springs.

  2. Valve components shall be manufactured of the following materials:

  3. Valve body and plates shall be carbon steel, ASTM A216 Grade WCB.

  4. Seals shall be Viton A.

  5. End connections shall be raised face.

  6. Hinge pin and springs shall be 316 stainless steel.

  7. Approved Manufacturers:

     a. Mueller Co. “Sure Check”
     b. Crane
     c. Champion Valves

d. Approved Equal

PART 3 - EXECUTION

3.01 CLEAN PIPING REQUIREMENTS

A. The Contractor shall keep the interior of the piping clean of all visible dirt or foreign matter at all times and under all conditions. If, for any reason, the inside of the piping contains dirt or foreign matter, the Contractor shall rectify this condition to the [SEA] [Project Manager's] [ ] satisfaction with all necessary material, labor, and equipment for cleaning being furnished at the Contractor's expense.

B. The pipe shall be delivered to the job site sealed. The seals are not to be removed until the pipe is installed. After each day's work, the open ends of all pipe being installed shall be closed with an expansion type weatherproof seal manufactured for this purpose.

C. All fittings and valves shall be kept in a covered dry storage area until installation.

D. Pipe shall not be installed in trenches containing water or mud.

E. Clean each joint before welding into the system, remove all loose debris.

F. At openings for branches in pipe, all material which falls into the pipe must be removed before welding in the branch fittings.

G. Remove materials such as welding rods, dirt, and similar materials, left inside after completion of the lines. Expense incurred by Owner for removal of such objects shall be reimbursed by Contractor.

3.02 DEMOLITION

A. [Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.]

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

C. If pipe, fittings, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.03 HANDLING PIPE

A. Shipping, delivering, and installing pipe and accessories shall be handled in such manner as to ensure a sound undamaged condition. Particular care shall be taken not to injure pipe coating and containment pipe when storing pipe, lowering it into trench and when backfilling.

B. No other pipe or materials of any kind shall be placed inside a pipe or fitting after the coating has been applied.

C. Storage rack materials shall be 6 inches in bearing width and placed not more than 6 feet apart.

D. Do not rack pipe more than four sections in height.

E. Protect and prevent movement of all racked pipe by use of suitable padded material between sections.

F. All trucks handling coated pipe shall have properly padded bolsters, padded chains, and padded binders so as to not damage the coating.

G. Pipe shall not be dropped or rolled off the truck, but shall be carefully lowered onto skids using padded mechanical equipment.

H. Coated, wrapped, and double-contained sections of pipe must be lifted with nylon slings of approved width and shall not be dragged or pulled into position.

3.04 LAYING UNDERGROUND PIPE

A. Lay, embed, and maintain all underground pipelines to the flow-line elevation and grades shown on the drawings or as directed by the [SEA] [Project Manager] [Owner’s Representative]. Pipelines shall be graded uniformly between invert elevations.

B. Excavation, backfill and compaction shall be in accordance with Volume II – P-152 – Excavation and Embankment. Trench backfill from not less than six inches below the bottom of the pipe to not less than six inches above the top of the pipe shall consist of bedding material as specified.

C. The full length of each section of pipe shall rest solidly upon the bedding material.

D. Any pipe that has the grade or joint disturbed after being laid shall be taken up and re-laid.

E. Do not lay pipe in water or when trench conditions are, in the judgment of the [SEA] [Project Manager] [Owner’s Representative], unsuitable.

F. Anchor pipe, in an approved manner, during installation to prevent flotation prior to backfilling and placing into service.

G. When work is not in progress, securely close open ends of pipe or fittings using approved expanding type watertight plugs to prevent trench water, earth, or other foreign substance from entering the pipe or fittings.

3.05 INSTALLATION OF ABOVEGROUND PIPE

A. Install complete with valves, fittings, and accessories and make all necessary connections.

B. Provide offsets, fittings, and accessories required to eliminate interferences and to match actual equipment connection locations and arrangements.

C. All fabrication and installation shall conform to ASME B31.3.

D. Verify all measurements, and location of existing facilities and underground piping, before commencing Work. Submit discrepancies for clarification before proceeding with the installations.

E. Arrange all piping with proper slopes, true to line, without sags, traps, or pockets, and pitched to drain at the lowest points so that entire systems can be emptied.

F. Provide high point vents, pump outs, and low point drains as required or indicated on the Drawings.

G. Provide threaded unions where indicated and as required elsewhere to permit satisfactory disassembly of small bore piping for threaded valve and equipment maintenance.

3.06 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the requirements of this Section, and of Sections 335243 - “Aviation Fueling System – General Requirements”, and 335290 - “Welding for Fuel Service Piping”.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Keep the interior and ends of all new and existing piping affected by construction operations thoroughly clean of foreign matter and water before and after being installed. Piping system shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water of other foreign substance will enter the pipe or fittings. Piping shall be inspected before placing into position. The interior of each length of pipe shall be cleaned after welding to ensure the interior of the pipe is free of foreign matter when connecter into the system.

D. 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:

 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

 3. Completed threaded fittings shall be seal welded per ASME B31.3

E. Welded Joints: Welding shall be accomplished by the use of the shielded metallic arc process and shall be in strict accordance with ASME B31.3. Refer to Section 335290 “Welding for Fuel Service Piping” for additional requirements.

 1. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.07 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

 1. In piping 2” and smaller, connection to each valve and at final connection to each piece of equipment may be weld-neck flanged, threaded or socket weld. Provide flanged connections where indicated and at equipment with flanged connections. Threaded connections shall be seal welded.

 2. Provide weld-neck flanges, in piping 2-1/2” and larger, for connection to flanged valves and at final connection to each piece of equipment.

 3. Install dielectric fittings at first above grade connection at transition from underground to above ground piping, and where indicated.

3.08 GAS FREE CONDITIONS

A. All operations in the construction area that involve open flames or the possibility of arcing or sparking shall be conducted in a "Gas Free" condition.

B. These operations shall include but not be limited to the following:

 1. Use of internal combustion engines not equipped with Underwriters' approved spark and flame eliminators.

2. Use of electric motors or electric devices with arcing brushes or sliding contacts that could produce arcing or sparking.

3. Use of tools which may produce impact sparks.

4. Electric or gas welding.

5. Use of cutting or other torches or other open flame equipment.

6. Holiday testing.

7. Use of equipment with hot surfaces or glowing elements.

8. Use of any other equipment or procedure that could create a fire hazard.

C. Contractor shall monitor the use and suitability of the equipment and procedures on the job and maintain a safe "Gas Free" condition when necessary during construction.

D. Prior to commencing any phase of the Work requiring a gas free condition, Contractor shall make the following provisions:

1. Empty all pipe containing fuel and positively purge of all vapors with dry Nitrogen.

2. Isolate, blank off, and adequately ventilate open piping sections so that no part of the pipe containing fuel or vapors is exposed.

3. Drain and ventilate fuel tanks prior to work inside tanks or on any of the tank connections.

4. Perform all other safety precautions necessary to ensure that these operations are conducted in a safe manner in accordance with all applicable codes.

E. Use a combustible gas analyzer to make certain no combustible gas concentrations exist in the construction area when performing these operations.

3.09 PERMITS

A. Obtain and pay for any special permits required for any work under this or any related section of these Specifications.

3.10 WELDED JOINTS

A. General: Comply with welding requirements of this section and Sections 335243 “Aviation Fueling System-General Requirements” and 335290 - “Welding for Fuel Service Piping”. If the two sections have conflicting requirements, the more stringent shall apply.

B. Welding shall be accomplished by the use of the shielded metallic arc process and shall be performed in strict accordance with the requirements of ANSI B31.3. Welding process and/or procedures that comply with any other standard will not be accepted. All welding shall be performed downhill.

C. Procedure: Upon award of the Contract, submit for review the welding procedures and qualifications that are intended to be used on the job in accordance with Section 335243 “Aviation Fueling System-General Requirements”, and Section 335290 - “Welding for Fuel Service Piping”.

D. Costs: Costs incident to these procedures and the welder's qualification tests shall be assumed by Contractor.

E. Inspectors: Shop welding and fabrication shall be subject to the right of the [SEA] [Project Manager] [Owner] to maintain one or more inspectors in the shop or to visit the shop at any time this Work is in progress.

F. Identification: Each welder shall identify each weld in accordance with the requirements of Section 335290 “Welding for Fuel Service Piping”.

G. Butt welding end preparation on all pipe shall be in accordance with ASME B16.25, and fully comply with the requirements of Section 335290 “Welding for Fuel Service Piping”.

H. All welds shall have full penetration and fusion, and shall conform to ASME B31.3

I. Backing rings shall not be used.

J. Align pipe joints with pipe clamps prior to welding. Clamps or other alignment devices shall not reduce the internal pipe diameter.

K. Defective welds shall be repaired in accordance with ASME B31.3 at Contractor’s expense.

L. Repairs to defective welds shall not be made prior to authorization. [SEA] [Owner’s] Inspector will determine on the basis of the testing laboratory report if repairs may be made or if the entire joint must be cut out and welded again.

M. No weld metal shall project within the piping at completion of the welding.

3.11 MODIFICATION OF EXISTING FUEL PIPELINES

A. Isolate and drain sections of pipeline requiring modifications utilizing only double block and bleed type plug valves, and verify that positive shut-off has been attained. Promptly notify owner should any leakage past these valves should occur. Should any leakage occur past an existing double block and bleed valve, the owner will make arrangements for necessary repairs to the valve.

   1. Coordinate all isolation and drainage work with [SEA] [Airfield] [Operations], the fuel system operator [(ASIG)] and the prime contractor. Refer to overall project construction sequencing drawings.

B. Contractor shall submit a plan of procedure and sequence of activities to the [SEA] [Project Manager] [Owner’s Representative] 30 days prior to actual work. The following is a suggested sequence only; the Contractor is responsible for the means, methods, sequences, techniques, and procedures of construction and safety precautions and programs.

   1. Test area around pipe with approved combustible vapor indicator to verify a flammable gas-free environment at the time of performing "hot work." Provide fresh air ventilation for all personnel. Obtain "hot work" permit and "gas free" certificate.

   2. Throughout performance of work required, provide and maintain provisions for collection of any fuel spills or leakage, which might occur, along with acceptable provisions for removal and disposal of captured fuel. Include details of provisions as part of required submittal.

   3. To the maximum practicable extent, prefabricate and pre-assemble new work which is to be installed in the section of pipeline being removed, so as to minimize the duration of time requiring isolation of pipeline sections.

   4. For existing hydrant laterals that are to be partially removed for extension to the new hydrant pit location, provide shoring and bracing for the pipe and utilize "machine cold cutting" of the existing fuel line using an air operated cutter with coolant. New assemblies to be butt-welded to ends of existing piping; no underground flanges are permitted.

   5. Taps into concourse header pipes for new hydrant laterals shall be made with butt-welded vesselet fittings.

   6. Purge the piping with dry nitrogen during all cutting and welding work on and adjacent to the existing fuel piping system. Maintain fresh air ventilation for personnel when using nitrogen.

7. After welding is completed and non-destructive testing and radiographic inspection is successfully completed, proceed with hydrostatic testing, coating of pipe joints, and holiday testing as required.

3.12 VALVE INSTALLATION, START-UP AND TESTING

A. Valves and valve actuators shall be installed in accordance with the valve manufacturer's recommendations.

B. Provide the services of a factory trained and certified service engineer authorized/sanctioned/certified by the valve manufacturer to verify that each valve [and actuator] has been properly installed and to verify valves were factory operationally tested, adjusted and set per these specifications. The service engineer shall assist the Contractor in the valve start-up adjustment process [and will remain on site until all valve actuators function as required by the contract documents].

3.13 NDE TESTING

A. The Contractor shall employ a recognized independent testing laboratory to test, by radiography, 10 percent of all aboveground circumferential shop and field butt welds and fabricated branch connection welds. All fillet and seal welds shall be tested by magnetic particle testing method. All NDE Testing shall be in accordance with the requirements of Section 335290 - "Welding for Fuel Service Piping".

B. The Contractor shall cooperate with the Testing Laboratory and shall give the [SEA] [Project Manager] [Owner's Representative] and the Testing Laboratory adequate advance notice of when welds will be available for radiographing and that all the work required by the Contractor in connection with the welding prior to radiographing is properly completed.

C. Testing Laboratory's report shall be submitted, in timely fashion, to the [SEA] [Project Manager] [Owner's Representative] throughout the progress of the work, and the Contractor will be notified of any encountered deficiency.

D. Reports of all radiographing and magnetic particle testing shall be prepared in accordance with the requirements of ANSI B31.3. The reports shall include welder's code, weld identification and description, whether the weld meets the specification requirements, the film type and size, and remarks on imperfections. All subsequent report formats shall be in accordance with the requirements of Section IX of the ASME Code.

E. Radiograph exposure film negatives will be kept on file by the [SEA] [Project Manager] [Owner's Representative]; the record for such radiograph film negative will show the date, location of tested weld (coordinate with weld location as shown on the Contractor's as-built drawings), area, film number, serial number, film combination, time, source-film distance, angulation and other pertinent information for each weld radiographed.

F. A summary of these records along with an expert interpretation of the tests shall be prepared by the testing laboratory and submitted in a report form for each weld, to the SEA Project Manager. Interpretation of negatives shall be by a level 3 radiographic technician certified by examination by the American Society of Non-Destructive Testing.

G. All welds shall be left exposed until all testing (radiographing and magnetic particle) is completed and welds have been accepted by the [SEA] [Project Manager] [Owner's Representative].

H. Acceptance criteria for welds shall be in accordance with ANSI B31.3 requirements for normal cyclic conditions. Welds which do not meet the standards of acceptability will be judged unacceptable and shall be repaired or cut out and re-welded by the Contractor as directed by the [SEA] [Project Manager] [Owner's Representative] at no additional cost to the Owner. Repaired and re-welded joints shall then be re-radiographed. If the same joint, after the second welding and radiographing fails again, then the section(s) of involved pipe shall be removed and replaced at no additional cost to the Project.

I. All costs of the original radiographing and re-radiographing of unacceptable welds and the accompanying reports and interpretation shall be borne by the Contractor.

3.14 LEAK TESTING

A. Provide temporary equipment for testing, including pump, gages and recorders. Subject entire piping systems to leak tests, either as a whole, or in sections; but leave no part untested.

B. Test gauges shall have a range that provide for the test pressure to be in the middle third of the gauge scale.

C. Contractor shall provide written notification to the [SEA] [Project Manager] [Owner's Representative] at least 48 hours before performing leak test. Perform all tests in the presence of the authorized [City] [Airport] representative

D. Pneumatic and Hydrostatic Leak Testing: Perform in accordance with the requirements of Section 335253 - "Aviation Fuels System Cleaning, Flushing and Testing".

E. Testing shall be witnessed by [SEA] [Airport] [city] [state] Mechanical Inspector and Project Manager or Designated Representative.

F. Repair piping systems which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage.

G. Prepare written report of testing procedures and result. Submit in accordance with Section 335243 - “Aviation Fueling System - General Requirements”.

END OF SECTION **335243.13**

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Specifies the following equipment. (Edit to delete items not in project)

1. Hydrant Valves

2. Diaphragm Type Control Valves

   a. Filter/Separator Control Valves
   b. Pressure Reducing Valves
   c. Pressure Relief/Sustaining Valves
   d. Non-Surge Check Valves
   e. Level Control Valves
   f. Truck Loading Control Valves

3. Thermal (Pressure) Relief Valves

4. Automatic Air Vent Valves

1.02 RELATED DOCUMENTS

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

1.03 RELATED SECTIONS (Edit to delete unused Sections)

A. SECTION 335229 – LIQUID FUELS PIPING SYSTEMS SUPPORTS & ANCHORS
B. SECTION 335243 – AVIATION FUELING SYSTEM - GENERAL REQUIREMENTS.
C. SECTION 335243.11 – AVIATION FUELING SYSTEM EQUIPMENT.
D. SECTION 335243.13 – AVIATION FUELING PIPE, MANUAL VALVES AND FITTINGS.
E. SECTION 335243.23 – AVIATION FUEL SYSTEM PUMPS
F. SECTION 335243.28 – AVIATION FUEL SYSTEM FILTERS AND FILTER/SEPARATORS
G. SECTION 335253 - AVIATION FUEL SYSTEM CLEANING, TESTING AND FLUSHING
H. SECTION 335280 – LIQUID FUELS PIPE COATING SYSTEMS
I. SECTION 335290 – WELDING FOR FUEL SERVICE PIPING
J. SECTION 335292 – AVIATION FUEL SYSTEM - MECHANICAL

1.04 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable. Refer to Section 1335243 for listing of issuing organizations or agencies.

1.05 DEFINITIONS

A. JFD: Jet Fuel Distribution piping.

B. JVP: Jet Fuel Valve Pit or vault.

C. CCS: (Coated Carbon Steel) Fusion bonded epoxy lined and epoxy coated jet fuel piping. Refer to Sections 335243.13 - “Aviation Fueling Pipe, Manual Valves and Fittings”, and 335280 - “Welding for Fuel Service Piping”.

D. Provide: Furnish and install complete, in place and ready for service.

E. Install: Assembly of fabricated parts and products, correct placement and permanent anchoring of mechanical work, and all mechanical work necessary for the systems and structures of the Contract Documents to be complete, permanent and of safe and satisfactory operation.

F. Piping: Pipe, fittings, flanges, gaskets, hardware, valves, specialties, hanger and like accessories related to piping.

G. Field Coating: Coating and wrapping performed in the field as opposed to coating and wrapping done in the shop of the custom coating applicator.

H. Design Pressure: Maximum coincident pressure in psig.

I. Working Pressure: Operating pressure in psig.

J. Singular Number: In all cases where a device, piece of equipment, individual, etc., is referred to in the singular number (such as the "valve"), such reference to be intended to apply to as many devices, etc. as required to complete the installation as specified and as shown in the Contract Documents.

1.06 REGULATORY REQUIREMENTS

A. Comply with latest editions of all applicable Codes, Standards, Ordinances and Regulations in effect as of the date of the Contract Documents adopted by the State of Washington, the City SeaTac, and Seattle - Tacoma International Airport, including but not necessarily limited to the following:

   1. NFPA-70 “National Electrical Code”.

2. NFPA-30 “Flammable and Combustible Liquids Code”.
3. NFPA-407 “Standard for Aircraft Fuel Servicing”.
4. IBC “International Building Code”, including any [ ] Amendments.
5. IFC “International Fire Code”, including any [ ] Amendments.

B. If discrepancies occur between the Contract Documents and any applicable Codes, Guidelines, Ordinances, Acts, or Standards, the most stringent requirements shall apply.

1.07 QUALITY ASSURANCE

A. General:

1) Conform to the Occupational Safety and Health Standards of the U.S. Department of Labor and all applicable ordinances, laws, regulation, and/or codes of the Local Authorities, the City of SeaTac, the State of Washington, the National Fire Protection Association, or any other governmental bodies having jurisdiction.

2) Install mechanical work to the satisfaction of the [SEA] [ ] [Project Manager] [Owner’s Representative] and inspecting authorities having jurisdiction.

3) Notify the Project Manager in writing of any instances in the Specifications or on the Drawings that are in conflict with any of the aforementioned authorities; required changes to be adjusted before the Contract is awarded. If the Contractor performs any work contrary to such laws, rules, or regulations without notice, he shall bear all costs arising therefrom.

4) Deviations from the Drawings and/or Specifications required for conformance with the applicable codes and/or laws to be corrected immediately but not until such deviations have been brought to the attention of the Owner or his authorized representative.

5) Applicable codes and/or laws to govern the minimum requirements only; where the Drawings and/or Specifications call for materials, vents, piping, sizes, etc., in excess of the code requirements, the Drawings and Specifications to govern.

B. Unless otherwise specifically indicated, equipment and materials to be installed in accordance with the recommendations of the Manufacturer. This includes the performance of tests as recommended by the Manufacturer.

C. Equipment shown in the Contract Drawings are based on a specific manufacturer and model number of equipment. Contractor shall verify that any alternate equipment supplied will fit within the available space, and shall make all necessary piping, electrical, and support modifications required for the alternate equipment at no additional cost to the project.

1.08 DELIVERY STORAGE & HANDLING

A. General: Meet requirements of Division-1, in addition to the handling requirements of Section 335243 - "Aviation Fueling System – General Requirements".

1.09 SUBMITTALS

A. Furnish Product Submittals as specified in Section 335243 - "Aviation Fueling System – General Requirements".

1.10 WARRANTY

A. General: Warranty fueling system equipment and associated work per the requirements of the Conditions of the Contract, except warranty to include the additional provisions of Section 335243 - "Aviation Fueling System – General Requirements".

PART 2 - PRODUCTS (Edit to delete unused equipment paragraphs)

2.01 HYDRANT VALVES: (Hydrant valves specified below are specific to SEA, revise as required for different airports)

A. The valves shall be actuated by a compressed air operated pilot valve through a dead man control.

B. Adapter flange shall be provided with a dust cover (without locking cams) chained or tied to the valve.

C. Adapter poppet shall be provided with a pressure equalizing device or valve.

D. The valves shall be provided with a 20 mesh screen, furnished by valve manufacturer.

E. Valve closing time shall be adjustable from 2-5 seconds.

F. Materials:

1. Outer housing shall be epoxy coated A536, Grade 60-14-80 ductile iron.

2. Upper Housing shall be one-piece 316 stainless steel.

3. Provide stainless steel strainer at upstream flange, conical type. Ring shall be 0.25" thick. Screen shall be 12 x 12 mesh with 0.023" diameter wire. Open area shall be 150 percent of pipe area.

G. Hydrant valves shall not be installed until all tests and flushing are completed.

H. Provide stainless steel strainer at upstream flange, conical type. Ring shall be 0.25" thick. Screen shall be 12 x 12 mesh with 0.023" diameter wire. Open area shall be 150 percent of pipe area.

2.02 [DIAPHRAGM TYPE CONTROL VALVES – GENERAL]

A. Control valves shall be single-seated globe type, diaphragm actuated, hydraulically operated, pilot controlled valves. Valves shall consist of three major components: the valve body, the valve cover and diaphragm assembly. The diaphragm assembly shall be the only moving part. In the event of diaphragm failure, valve shall fail closed against flow, unless otherwise indicated. The main valve shall be drip-tight when closed. Each valve shall have an external indicator to show the position of the valve disc at all times. Control valves shall be shipped from the factory as a complete assembly with all pilot controls and all pilot auxiliary piping properly installed on the main valve. Materials which come in contact with the fuel shall be resistant to the effects of and not harmful to aircraft engine fuel and shall be stainless steel, or electroless nickel plated ductile iron unless noted otherwise. [High level shut-off valve bodies shall be electroless nickel plated ductile iron.] Materials for control valves, and items to be mounted on the valves shall be as follows:

1. Bodies, Bonnets, and Covers shall be constructed of one of the following materials:

    a. Cast steel conforming to ASTM A216/A216M, Grade WCB internally plated with chromium, nickel or internally electroless nickel plated.

    b. Cast stainless steel conforming to ASTM A743/A743M.

    c. Ductile iron conforming to ASTM A536, electroless nickel plated.

    d. Bodies shall have flanged inlet and outlet connections. Valve shall have a screwed bottom drain plug.

2. Valve seats shall be stainless steel in accordance with ASTM A743/A743M. It shall be possible to remove the valve seat while the valve is connected in the line. Valve seat and upper stem bearing shall be removable and screwed in the body and/or cover. The lower stem bearing must be concentrically contained in the valve seat and shall be exposed to flow on all sides. The diameter of the valve seat

shall be the same size as the inlet and/or outlet flanges of the main valve.

3. Valve discs shall contain a resilient, fluoroelastomer (FKM), commonly referred to as Viton disc conforming to SAE AMS 3216 having a rectangular cross section, contained on 3.5 sides by a disc retainer and a disc guide, forming a drip tight seal against the seat. The disc shall be usable on either side. The disc guide shall be the contoured type capable of holding disc firmly in place during high differential pressure conditions that may develop across the seating surface. The disc retainer shall be capable of withstanding rapid closing shocks.

4. Diaphragm Assembly shall form a sealed chamber in the upper portion of the valve, separating the operating fluid from the line pressure. The diaphragm assembly shall contain a valve stem which is fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. Valve body and cover shall be sealed by the diaphragm. Valve stem shall be stainless steel. The bearing material shall be compatible with the fuel specified and shall not contain zinc coated metals, brass, bronze, or other copper bearing alloys. The diaphragm shall be of a non-wicking material or design, with a minimum of 2 layers of nylon fabric bonded with a minimum of 3 layers of synthetic rubber (Buna-N) (valves 62 mm 2-1/2 inches and smaller one layer of nylon fabric). The edge area of the center hole for the valve stem shall be sealed by vulcanization. Materials to be resistant to aromatics of up to 50 percent in accordance with ASTM D2000 (SAE J200). The diaphragm must have a MULLINS-burst rating according to ASTM D751 of a minimum of 4.14 MPa 600 psi per layer of nylon fabric. All diaphragm sizes must be cycle tested to a minimum of 100,000 cycles, by alternately applying pressure under the diaphragm (main valve pressure) and above the diaphragm (cover chamber pressure). That test shall be certified by the manufacturer.
   The diaphragm shall not be used as a seating surface. The diaphragm must be fully supported by the body and cover in either the open or closed position.

5. Bolts, Screws and Nuts:

   a. For Ductile Iron, and Cast Steel Body Valves; Bolts and Screws, shall be cadmium plated steel in accordance with SAE J429, Grade 5, and Nuts, shall be cadmium plated steel in accordance with ASTM A194/A194M, Grade 2H.

   b. For Stainless Steel Body Valves; Bolts, Screws and Nuts shall be ASTM A320/A320M, Grade B8M C.1.1.

6. Pilot Control System and auxiliary piping shall be stainless steel, seamless, fully annealed tubing conforming to ASTM A269/A269M,

Grade TP316, Rockwell hardness B80 or less. Wall thickness for (13 mm) 1/2-inch tubing to be (1.2 mm) 0.049-inch. Threaded connections shall be used in pilot system piping and shall be o-ring type with FKM o-rings. Tubing connections shall not be welded. A 40-mesh stainless steel wire, self-cleaning strainer shall be provided in the pilot valve supply piping. The opening and closing speeds of all main valves shall be individually adjustable.

7. Pilot valves shall have [stainless steel bodies conforming to ASTM A743/A743M] [aluminum bodies conforming to ASTM B26/B26M Type 356-T6 anodized in accordance with MIL-A-8625] with stainless steel internal working parts. Disc and diaphragm assemblies shall be as specified herein before. The setting of adjustable type pressure operated pilot valves shall be easily adjusted by means of a single adjusting screw. The adjusting screw shall be protected by a threaded cap drilled to accommodate a lead-seal wire and a lock nut shall be provided on the adjusting screw to lock it in position at the desired setting. The lead seal wire shall be installed after final acceptance of the system. Spare wire seals and the "embossing" tool will be turned over to the [SEA] [ ] [Project Manager] [Owner's Representative].

8. Solenoids for operation of pilot valves shall be housed in an explosion-proof case suitable for Class-I, Division-I, Groups C & D within a maximum temperature rating of T2D (216°C / 419°F), hazardous locations as defined in NFPA 70. Solenoids shall operate on [120-VAC, 60-Hz, 1-Ph.] [24-VDC] power. A manual type operator or needle valve to bypass the solenoid valve shall be provided for emergency manual operation.

B. Serviceability of main valve internal parts

1. Main valve movable parts including strainers, valve seat, stem bearings, and control system shall be replaceable without removing the main valve from the line. All nonmetallic parts shall be replaceable.

C. Total Lengths:

1. The total valve length does not include the orifice plate flange when used. If the control valve being supplied has the orifice plate built into its flange, the spacer provided shall bring the valve face-to-face dimension equal to those listed below plus (2.2 mm) 0.0875 inch. The lengths of the valves shall be the same for each valve size for the following valve body materials: cast stainless steel, cast carbon steel, and ductile iron, indicated in the following table:

SIZE inches	VALVE LENGTH inches

1-1/2	8.5
2	9.375
3	12
4	15
6	20
8	25.4
10	29.8
12	34
14	39
16	41.375
Note: Tolerance shall be $\underline{+}$0.03 inch for size 1-1/2 inches through 8 inches and $\underline{+}$0.06 inch for size 10 thru 16 inches.	

D. Flanges:

MATERIAL	SEALING SURFACE
Cast Steel, ASME B16.5, Class 150	Raised Face
Cast Stainless Steel, ASME B16.5, Class 150	Raised Face
Ductile Iron, ASME B16.24 Class 150	Flat Face
Note: The mating flange shall be made the same as above.	

E. Identification:

1. The following shall be cast into the main valve body:

   a. Pressure class
   b. Size
   c. Material
   d. Foundry Heat Number and Identification
   e. Manufacturer
   f. Flow Pattern

2. The following shall be cast into the main valve cover:

a. Size
b. Material
c. Foundry Heat Number and Identification

3. Brass nameplates shall be fastened to the valve, and shall list the following:

a. Size
b. Model Number
c. Stock Number
d. Manufacturer / Supplier
e. Manufacturer's Inspection Stamp

4. The Inlet Nameplate shall list the following:

a. Size
b. "Inlet" marking
c. Assembly Model Number
d. Part Number

5. The valve outlet shall be stamped "Outlet".

6. Pilot valves shall be tag identified. The valve shall have the field adjusted start up setting engraved on a plastic tag, white with black lettering.

2.03 [DIAPHRAGM CONTROL VALVES - SPECIFIC OPERATING REQUIREMENTS]

A. General: Operation, performance, and special features of the individual control valves shall be as specified herein. (Edit to delete valve function types not included in project)

B. Filter/Separator Control Valves: (list FSCV tag numbers)

1. Size: As indicated in the schedule, and/or as indicated on the plans.

2. Operation: Filter/Separator (F/S) Control Valves shall modulate to limit the flowrate to a maximum indicated in the schedule [below] [in the plans]. Rate of flow shall be measured by an orifice plate installed on the valve outlet end. The rate of flow control, and the valve opening and closing speeds shall be manually adjustable.

3. Check Valve Feature: The valve shall close when outlet pressure exceeds inlet pressure.

4. [High Differential Pressure Shut-off: Differential pressure control pilot shall close the valve when the measured differential pressure exceeds setpoint.]

5. Water Slug Shut-off and Tester: The filter/separator housing sump shall be fitted with a stainless steel float control pilot valve that rides on the fuel/water interface in the F/S sump, and is connected to the water slug pilot of the F/S Control Valve. On high water level in the sump, the float valve shall initiate a rapid water slug shut-off of the F/S Control Valve. An integral float control tester shall provide a means of lifting a portion of the float ball ballast allowing the float to rise; verifying operation of the water slug shut-off of the F/S Control Valve, and the integrity of the float ball.

6. [Solenoid Control: Solenoid pilot valve shall enable normally closed F/S Control Valve operation when energized. Refer to Paragraph 2.2.A.8]

7. [Limit Switch: Valve shall include DPDT limit switch activated by the valve stem, with switch changing state when the valve is fully closed. Switch trip point shall be adjustable. Limit switches shall be weatherproof and U.L. Listed for use in Class-1, Division-1, Group C & D hazardous areas; switch contacts shall be rated for minimum 10-amps at 125-VAC.]

8. Approved Product: Cla-Val Series 40, with Model X52E Orifice Plate Assembly and # CFF-21-H2, Float Control Pilot Valve or equal.

9. Filter/Separator Control Valve (FSCV) Schedule:

TAG NUMBERS	SIZE (in)	FLOW RATE (gpm)	HIGH ΔP SHUTOFF (Y/N)	SOLENOID (Y/N)	LIMIT SWITCH (Y/N)
FSCV aaa-thru-nnn					

C. Pressure Reducing Control Valves:

1. Operation: Valve shall modulate to maintain downstream pressure at setpoint listed in the Pressure Reducing Valve Table at the end of this paragraph. Valve setpoint, and valve opening and closing speeds shall be adjustable.

2. Check Valve Feature: The valve shall close when outlet pressure exceeds inlet pressure.

3. [Solenoid Control: Solenoid pilot valve shall enable normally closed

F/S Control Valve operation when energized. Refer to Paragraph 2.2.A.8]

4. [Limit Switch: Valve shall include DPDT limit switch activated by the valve stem, with switch changing state when the valve is fully closed. Switch trip point shall be adjustable. Limit switches shall be weatherproof and U.L. Listed for use in Class-1, Division-1, Group C & D hazardous areas; switch contacts shall be rated for minimum 10-amps at 125-VAC.]

5. Approved Product: Cla-Val Series 90, or equal.

6. Pressure Reducing Control Valve Schedule:

TAG NUMBERS	SIZE (inch)	INLET PRESSURE (psig)	OUTLET PRESSURE (psig)	FLOW RATE (gpm)	SOLENOID (Y/N)	LIMIT SWITCH (Y/N)
PCV 1-thru-n				0-nnn		

D. Back Pressure Control Valves: (Pressure Sustaining)

1. Operation: Valve shall modulate to maintain upstream pressure at setpoint listed in the Back Pressure Control Valve Table at the end of this paragraph. Valve setpoint, and valve opening and closing speeds shall be adjustable.

2. Check Valve Feature: The valve shall close when outlet pressure exceeds inlet pressure.

3. [Solenoid Control: Solenoid pilot valve shall enable normally closed F/S Control Valve operation when energized. Refer to Paragraph 2.2.A.8]

4. [Limit Switch: Valve shall include DPDT limit switch activated by the valve stem, with switch changing state when the valve is fully closed. Switch trip point shall be adjustable. Limit switches shall be weatherproof and U.L. Listed for use in Class-1, Division-1, Group C & D hazardous areas; switch contacts shall be rated for minimum 10-amps at 125-VAC.]

5. Approved product: Cla-Val Series 50, or equal.

6. Back Pressure Control Valve Schedule:

TAG NUMBERS	SIZE (inch)	PRESSURE SETPOINT (psig)	FLOW RATE (gpm)	SOLENOID (Y/N)	LIMIT SWITCH (Y/N)
BPCV 1-thru-n			0 - nnnn		

E. Non-Surge Check Valves

1. Operation: The valve shall gradually open when in inlet pressure exceeds the outlet pressure. If the outlet pressure exceeds the inlet pressure, the valve shall gradually close drip tight.

2. [Solenoid Control Option: Solenoid pilot valve shall enable normally closed check valve to open only when energized. The valve shall gradually close drip tight when the solenoid is de-energized. (Refer to Paragraph 2.2.A.8)]

3. [Flow Limiting Control: Flow limiting non-surge check valves shall modulate to limit the flow through the valve to the flow setpoint. Rate of flow shall be measured by an orifice plate installed on the valve outlet end. The rate of flow control, and the valve opening and closing speeds shall be manually adjustable.]

4. [Limit Switch: Valve shall include DPDT limit switch activated by the valve stem, with switch changing state when the valve is fully closed. Switch trip point shall be adjustable. Limit switches shall be weatherproof and U.L. Listed for use in Class-1, Division-1, Group C & D hazardous areas; switch contacts shall be rated for minimum 10-amps at 125-VAC.]

5. Approved Product: Cla-Val [Series 40], [flow limiting] [and] [Series 81], [non-flow limiting], or equal.

6. Non-Surge Check Valve Schedule:

TAG NUMBERS	SIZE (inch)	SOLENOID (Y/N)	FLOW LIMITING (Y/N)	FLOW RATE (gpm)
CV 1- thru - n				

F. High Level Shutoff Valves

1. Operation: Full Port hydraulically actuated, remote mounted pilot float valve controlled, high level shutoff valve. Main valve shall close on activation of the remote mounted pilot float valve. Pilot float valve shall be mounted within the storage tank or within an external chamber as indicated in the drawings and as specified herein.

2. Check Valve Feature: The valve shall close when outlet pressure exceeds inlet pressure.

3. Float Pilot Valves: For open tanks, and as otherwise noted; float-type pilot valves shall be mounted within the tank to activate at the high level shutoff point [as noted in the table below] [and] [as indicated in the drawings]. For closed tanks, and as otherwise noted; float-type pilot valves shall be housed in an external chamber [as noted in the table below] [and] [as indicated in the drawings]. External chamber shall be mounted to activate the float at the high level shutoff point, and connected to the tank with 1-inch piping, with isolation, vent, and drain valves as indicated on the drawings.

4. Strainer: A 40-mesh stainless steel wire, self-cleaning strainer shall be provided in the pilot valve supply piping.

5. [Solenoid Control Option: Solenoid pilot valve shall enable normally closed check valve to open only when energized. The valve shall gradually close drip tight when the solenoid is de-energized. (Refer to Paragraph 2.2.A.8)]

6. [Limit Switches: Valve shall include two DPDT limit switches activated by the valve stem, with one switch changing state when the valve is fully closed and the second changing state when the valve is fully open. Limit switches shall be weatherproof and U.L. Listed for use in Class-1, Division-1, Group C & D hazardous areas; switch contacts shall be rated for minimum 10-amps at 125-VAC.]

7. Approved Product:

    a. Main Valve: Cla-Val Series-129, or approved equal.
    b. [Internal Mounted Float-Type Pilot: Cla-Val #CFM2, or approved equal.]
    c. External Chamber Mounted Float Pilot: Cla-Val #CFC2, or

approved equal.

8. High Level Shutoff Valve Schedule:

TAG NUMBER	SIZE (in)	FLOW RATE (gpm)	CHECK FEATURE (Y/N)	SOLENOID (Y/N)	LIMIT SWITCH (Y/N)	FLOAT MODEL
HLCV 1-thru-nnnn						

G. Combination Control Valve:

1. Operation: Valves shall be arranged to be combination pressure reducing, surge shutoff, and solenoid operated emergency shutoff and equipped to provide adjustable opening and closing speed. Valve shall be cast steel, 150 lb. class, hydraulically operated diaphragm globe valve equipped with a solenoid control for operation in the Emergency Fuel Shutoff System. Valve body shall be A216 Gr. WCB cast steel. Diaphragm shall be constructed of FKM flouroelastomer in accordance with ASTM D1418. Valve end connections shall be 150 lb. class raised face flanges.

2. Valve shall maintain a constant downstream pressure regardless of varying inlet pressure.

3. Valve shall be equipped with an adjustable opening and closing speed controls. Valve closing speed shall be factory set to close in 8 seconds from full open to full close.

4. Valve shall be equipped with a surge shutdown operated by a pressure relief control. When downstream pressure rises 5 psi above normal set point, the valve shall close.

5. Solenoid shut off (where required) shall close main valve when de-energized and shall be equipped with a manual hold open override device. Solenoid shall be epoxy encapsulated, watertight, and explosion proof 24 VDC.

6. "O"-ring insulating unions, or other acceptable means shall be provided in pilot tubing connections to electrically isolate solenoid valves from main valves and fuel piping.

7. Valve shall be provided with a watertight, explosion proof limit switch

to indicate valve actuation.

H. Truck Loading Control Valves

1. Operation: Two-stage set/stop control valve for filling refueling trucks, under control of a dead-man switch and an electronic loading station meter/controller. On activation of the dead-man switch, energization of the solenoid valves will cause the main valve to slowly open. When the flow rate reaches a nominal [50] [x]-gpm [for Jet-A] [and] [[x]-gpm for AVGAS], the meter/controller will de-energize the second stage solenoid causing the main valve to remain in the low flow position for the first [300] [x]-gallons. On re-activation of the second stage solenoid from the meter/controller, the valve will open to the design flow rate of [300] [x]-gpm for Jet-A [and] [[x]-gpm for AVGAS], at which point the meter/controller will cycle the second stage solenoid to limit the flow to the design flow rate. When the total volume loaded is within [150] [x]-gallons of the total preset load amount, the solenoids will be de-energized and the valve will start to close (within 3-15 seconds, adjustable). When the flow reaches the initial low flow rate, the meter/controller will re-energize the first stage solenoid to hold the main valve at the intermediate position. At the total preset load amount, the meter/controller will de-energize the first stage solenoid and the valve will fully close within 0.5 seconds. If at any time during the load cycle the dead-man switch is de-energized, the main valve will fully close within a maximum of [2] [x]-seconds.

2. Pressure Limiting: Pressure limiting control pilot shall limit the pressure downstream of the valve to an adjustable range of 15-75-psig, factory set at [35] [x]-psig. The pressure limiting pilot shall override the flow control pilots.

3. Check Valve Feature: When the main valve outlet pressure exceeds the main valve inlet pressure, the check pilot shall cause the main valve to close.

4. Thermal Relief: When the main valve outlet pressure exceeds the main valve inlet pressure, and the main valve outlet pressure is above the thermal relief pilot setpoint, the thermal relief pilot valve will open and relieve the main valve outlet pressure to the main valve inlet.

5. Valve Size: [3] [4]-inch [for Jet-A] [and 2-inch for AVGAS].

6. Design Flow Rate: [300] [x]-gpm [for Jet-A] [and [100] [x]-gpm for AVGAS].

7. Approved Product: Cla-Val Model 131-CP.CS.SS.SS or approved equal.

2.04 THERMAL (PRESSURE) RELIEF VALVES

A. Provide thermal relief valves where indicated on the Drawings and on any portion of the system where valve shut-off can isolate fuel which will expand thermally.

B. Valves shall be differential type and shall have carbon steel bodies and bonnets stainless steel trim and Viton seat. Valves shall be equipped with screwed cap over adjusting screw. Valve body shall have NPT screwed connections.

C. Valves shall be differential type and shall have stainless steel bodies and bonnets stainless steel trim and Viton seat. Valves shall be equipped with screwed cap over adjusting screw. Valve body shall have ANSI 150-lb flanged connections.

D. Valves shall be Taylor Tools type 8200/8300 or approved equal.

2.05 AUTOMATIC AIR VENT VALVE

A. Fully sealed, float actuated automatic air vent valve with internal positive lever mechanism.

B. Materials of Construction:

1. Body: type 304L Stainless Steel

2. Valve and Seat: 440F heat treated Chrome Steel

3. Float and Lever: type 304 Stainless Steel

C. Connections: Inlet – 3/4” F-BSPT, Outlet – 1/2” F-BSPT. Provide 3/4” locking ball valve on inlet, and 1/2” check valve in outlet line.

D. Maximum Operating Pressure: [175] [260]-psig at 100°F.

E. Approved Product: Armstrong #050711AV [11] [18], or equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. General: Examine the areas and conditions under which mechanical work is to be installed or performed, and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Existing Facilities: Verify existence, location and operation of existing components, material, equipment, piping, etc. to be abandoned, removed or altered.

C. Receive, unload, check, and store in suitable facilities all Equipment and Materials; examine all Equipment and Materials for concealed damage and report any damage to Owner.

D. Be responsible for the safety and protection from loss or damage of all Equipment and Materials received until the Work is complete.

E. Protect all Equipment and Materials during storage and prior to start-up which shall include the coverings of all openings, protection against rust and other damage, and other similar measures. Equipment may be stored outdoors only when approved. Contractor shall protect all coated pipe and fittings from ultraviolet deterioration.

3.02 DEMOLITION

A. [Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.]

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed. Bevel and dress remaining piping ends for welded connection of new piping and/or fittings.

2. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

C. If pipe, fittings, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.03 INSTALLATION

A. Furnish all labor, Materials, and Equipment necessary to make a complete installation as indicated and specified. Refer to Section 335243 “Aviation Fueling System - General Requirements” for additional information.

B. Install mechanical work, meeting the requirements of the Contract Documents and in accordance with product manufacturer's instructions and recommendations. Meet requirements of final, reviewed submittals for the work. Follow the recommendations and instructions of the product manufacturer, unless otherwise specified or shown on the Drawings.

C. Provide all necessary supports, brackets, or foundations for properly installing all piping and equipment.

D. Coordinate with the other trades before installation of Materials. Extra charges shall not be approved for interferences due to lack of coordination.

E. 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, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

F. Install equipment to permit servicing.

G. Select system components with pressure rating equal to or greater than system operating pressure.

H. All Equipment shall be properly aligned, adjusted, and lubricated before final acceptance.

I. Spot paint all Equipment where the shop paint has been damaged or flaked off. Finish painting of all exposed piping and mechanical Equipment is specified in SECTION 335280 – “Liquid Fuels Pipe Coating Systems” unless otherwise specified.

J. WELDING:

1. When required for safety, properly shield the welding area.

2. Existing Piping: Positively purge existing piping with dry nitrogen during all hot work.

3. Jet A Piping Welding: Refer to Section 335243.13 – “Aviation Fueling Pipe, Valves and Fittings”, and Section 335290 – “Welding for Fuel Service Piping”.

4. Miscellaneous Welding: Welding procedure to be governed by applicable service type specification of AWS D1.1 - Structural Welding Code, [and to Section 050510 – “Welding”] for additional requirements.

K. Furnish all bolts, studs, nuts, and gaskets for makeup of all connections to the Equipment and replace all gaskets damaged during storage, inspection, cleaning, or placing into service.

L. Retighten all threaded and bolted connections after installation. This applies to Owner- furnished equipment as well and shall be accomplished by Contractor at no additional cost to Owner.

M. Piping: Refer to Section 335243.13 - "Aviation Fueling Pipe, Manual Valves and Fittings."

N. Identification and Labeling: Provide labels and signs as called for in the Contract Documents and permanently attach or support same; piping identification per API 1542, refer to Section 335292 - "Aviation Fuel System - Mechanical Identification".

O. Clean Up: Prior to acceptance tests and inspections, clean the project site. Remove all miscellaneous construction equipment; dispose of all trash and unnecessary excavated material in a manner acceptable to the Owner or his authorized representative. Make the site as safe, clean and completely finished as possible.

P. Inspections and Tests:

1. General: Test all of the equipment and piping installed under this Specification and demonstrate its proper operation to the Owner or his authorized representative. Furnish all required labor, testing, instruments and devices required for tests and pay for all expenses involved in conducting such tests. If tests show work or equipment to be defective, immediately make all changes necessary to correct work and performance to the satisfaction of the Owner or his authorized representative. Give 48 hours' notice, by letter or e-mail telegram, to the Owner or his authorized representative of all tests and demonstrations. Provide safe access to the test area if the work is in preparation or in progress. Contractor to be given reasonable time to correct defects. If such corrections of defects or performance requirements are neglected, the right is reserved to have defects remedied and to charge the cost of same against the account of the Contractor. Refer to Section 335253 - "Aviation Fueling System Cleaning, Flushing, and Testing".

2. Covered Equipment: No pipe or equipment to be insulated or covered until hydrostatic or other required tests have been completed and approved. Where the Contractor considers this procedure unfeasible, he shall request a waiver from this requirement in writing which clearly defines the exception to the procedure and the extent of the work involved. Where it is determined that taking exception to the procedure results in an increase in the cost of the project either in the first cost of material and labor or as a result of defects in the pipe or equipment which could have been corrected in a less costly fashion through the required tests prior to covering, the contractor shall bear all costs associated with the exception to the procedure.

3. Inspection: Inspection includes but is not limited to:

    a. Alignment: Check whether equipment has been aligned.

b. Coupling: Check coupling torque setting.

c. Tightening: Tighten bolts, cap screws and other fasteners.

4. Start-up: Perform equipment start-up meeting requirements of equipment manufacturer; if manufacturer's representative is required to be present, coordinate with same; start-up to be made without load, except when detrimental to equipment.

5. Final Condition: Before final acceptance, check all connections, and remove all remaining debris.

3.04 WELDING QUALIFICATION AND APPROVAL

A. Welding qualification and approval shall be as specified in Section 335243 - "Aviation Fueling System - General Requirements".

B. Submit certified copies of the Procedure Qualification Records (PQR) as evidence that the intended procedures have been qualified in accordance with the latest revisions of the following codes:

1. ASME B31.3 – Process Piping

2. ASME Boiler and Pressure Vessel Code, Section I and Section IX

3.05 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Keep the interior and ends of all new and existing piping affected by construction operations thoroughly clean of foreign matter and water before and after being installed. Piping system shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings shall be closed so that no water of other foreign substance will enter the pipe or fittings. Piping shall be inspected before placing into position. The interior of each length of pipe shall be cleaned after welding to ensure the interior of the pipe is free of foreign matter when connected into the system.

D. 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:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3. Completed threaded fittings shall be seal welded per ASME B31.3

E. Welded Joints: Welding shall be accomplished by the use of the shielded metallic arc process and shall be in strict accordance with ASME B31.3. Refer to Section 335243.13 - “Aviation Fuel Pipe, Manual Valves, and Fittings” for additional requirements.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.06 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. in piping 2” and smaller, connection to each valve and at final connection to each piece of equipment may be weld-neck flanged, threaded or socket weld. Provide flanged connections where indicated and at equipment with flanged connections.

2. Threaded connections shall be seal welded.

3. Provide weld-neck flanges, in piping 2-1/2” and larger, for connection to flanged valves and at final connection to each piece of equipment.

4. Install dielectric fittings at first above grade connection at transition from underground to above ground piping, and where indicated.

3.07 VALVE TESTING AND START-UP SUPPORT

A. Provide the services of a factory trained and certified service engineer authorized/sanctioned/certified by the valve manufacturer to verify that each valve has been properly installed and to verify valves were factory operationally tested, adjusted and set per these specifications. The service engineer shall assist the Contractor in the valve start-up adjustment process and will remain on site until all control valves function as required by the contract documents.

3.08 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.09 PAINTING

A. Painting and coating of piped utility systems, equipment, and components is specified in [Section 099113 - "Exterior Painting,"] [and] [Section 335280 - "Liquid Fuels Pipe Coating Systems"].

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.10 IDENTIFICATION

A. Piping Systems: Identification of aviation fuels piping systems is specified in Section 335292 - “Aviation Fuel System - Mechanical Identification”

3.11 INSTALLATION OF UNDERGROUND TANKS

A. General: Installation shall be per tank manufacturer's recommendations, API RP 1615, NFPA 30, 40 CFR 280, state and local codes and as specified herein. If recommendations require tank to be filled, only fuel will be allowed in tanks. Water filling is not acceptable. EXCEPTION: Oil/Water Separator Tanks shall be pre-filled with water. Before being placed in service, tank shall be tightness tested in accordance with NFPA 30.

B. Coating Testing: The coating shall be examined for flaws and tested for thickness. Provide the facilities, personnel, and equipment for testing for flaws and thickness. Thickness shall be measured electronically. Coating shall be tested directly before placement of the tank with an electric flaw detector, equipped with a bell, buzzer, or other type of audible signal that operates when a flaw is detected. The detector for the type of coating used shall have an operating voltage of 10,000 to 35,000 volts. Check of the holiday detector potential may be made by the Contracting Officer at any time to determine the suitability of the detector. Damaged areas shall be repaired with materials identical to those used originally, and after drying, shall be retested electrically. Submit test results

C. Steel Tanks:

1. Cover the concrete hold down slab with 150 mm 6 inches of tank bedding backfill evenly graded and thoroughly compacted, prior to tank placement.

2. Each tank is to be unloaded and placed on the sand bed using cranes and the rigging procedures provided by the tank manufacturer. Use the tank lifting lugs for lifting the tank into place. The use of slings around the tank is not permitted, nor is the use of chock blocks of any sort. During handling, carefully inspect the tanks for coating damage and repair any damage whatsoever before proceeding. After placement, check each tank to ensure it is sloped as required. The elevation shall be confirmed.

3. Before proceeding with backfill, install the hold down straps and tighten the turnbuckles securely and evenly throughout the length of the tanks. The bottom and sides of the tanks to be fully and evenly supported by hand shoveling and tamping. Use tank bedding backfill up to 303 mm 12 inches above the top of tank. Hand-guided power equipment can be used to place fill in 150 mm 6-inch layers, compacted to a minimum of 95 percent maximum density, after the bottom quadrant is filled. A minimum of four density tests per tank to be performed. Clean, noncorrosive, well tamped gravel to be used for backfill from a point 12-inches above the tanks to finished grade.

4. Do not fill the tank, even partially, before the bottom quadrant is backfilled. The level of fuel product not to exceed the level of compacted backfill at any time.

5. Coordinate tank installation with installation of cathodic protection.

3.12 INSTALLATION OF FIBERGLASS PITS

A. Submit recommended installation procedures and setting tolerances from the pit manufacturer/supplier for the fiberglass pit and the aluminum cover.

B. These procedures shall indicate recommended methods of supporting the pit in its proper position in the open excavation prior to and during concrete placement operations. Also, required installation tolerances, especially for flatness/levelness of the fiberglass pit lip, shall be provided.

C. Follow these recommendations and apply other procedures as required to ensure the integrity of the pit liner and cover assemblies in their installed positions. All penetrations through the fiberglass pit liner shall be tightly sealed by suitable means to preclude water infiltration, with consideration for potential relative movements between the penetrating objects and the pit liner. Reference the Contract drawings for additional installation requirements.

END OF SECTION **335243.14**

PART 1 - GENERAL

1.01 SUMMARY

A. This Section Includes:

1. Inspection, cleaning, flushing, and testing of all fuel piping, corrosion protection coatings, and equipment performance demonstration.

2. Testing of fuel piping, performed in accordance with the Chemical Plant and Petroleum Refinery Piping Code, ANSI B31.3, NFPA-30, NFPA-407, and the International Fire Code where and as applicable.

1.02 RELATED DOCUMENTS

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

1.03 RELATED SECTIONS (Delete unused Section References)

A. SECTION 335243 – AVIATION FUELING SYSTEM - GENERAL REQUIREMENTS.
B. SECTION 335243.11 – AVIATION FUELING SYSTEM EQUIPMENT.
C. SECTION 335243.13 – AVIATION FUELING PIPE, MANUAL VALVES AND FITTINGS.
D. SECTION 335243.14 – AVIATION FUELING SYSTEM CONTROL VALVES.
E. SECTION 335243.23 – AVIATION FUEL SYSTEM PUMPS.
F. SECTION 335243.28 – AVIATION FUEL SYSTEM FILTERS AND FILTER/SEPARATORS.
G. SECTION 335280 – LIQUID FUELS PIPE COATING SYSTEMS.
H. SECTION 335290 – WELDING FOR FUEL SERVICE PIPING.
I. SECTION 335292 – AVIATION FUEL SYSTEM - MECHANICAL IDENTIFICATION.

1.04 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable. Refer to Section 1335243 for listing of issuing organizations or agencies.

1. American National Standards Institute (ANSI)

   a. ANSI B31.3 – Chemical Plant and Petroleum Refinery Piping

2. Airlines 4 America (A4A)

a. ATA 103 – Standards for Jet Fuel Quality Control at Airports

3. American Society for Testing and Materials (ASTM)

    a. ASTM D-1655 - Aviation Turbine Fuels

    b. ASTM D-2276 - Particulate Contamination in Aviation Turbine Fuels.

    c. ASTM D4176 - Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels.

4. International Building Code (IBC) with [ ] Amendments

5. International Fire Code (IFC) with [ ] Amendments

6. National Fire Protection Association (NFPA):

    a. NFPA 30 - Flammable and Combustible Liquids Code.

    b. NFPA 407-Standard for Aircraft Fuel Servicing

1.05 DEFINITIONS

A. JFD: Jet Fuel Distribution piping.

B. JVP: Jet Fuel Valve Pit or vault.

C. CCS: (Coated Carbon Steel) Fusion bonded epoxy lined and epoxy coated jet fuel piping. Refer to Sections 335243.13 - “Aviation Fuel Pipe, Manual Valves and Fittings” and 335280 - “Liquid Fuels Pipe Coating Systems”.

D. Provide: Furnish and install complete, in place and ready for service.

E. Install: Assembly of fabricated parts and products, correct placement and permanent anchoring of mechanical work, and all mechanical work necessary for the systems and structures of the Contract Documents to be complete, permanent and of safe and satisfactory operation.

F. Piping: Pipe, fittings, flanges, gaskets, hardware, valves, specialties, hanger and like accessories related to piping.

G. Field Coating: Coating and wrapping performed in the field as opposed to coating and wrapping done in the shop of the custom coating applicator.

H. Design Pressure: Maximum coincident pressure in psig.

I. Working Pressure: Operating pressure in psig.

J. Singular Number: In all cases where a device, piece of equipment, individual, etc., is referred to in the singular number (such as the "valve"), such reference to be intended to apply to as many devices, etc. as required to complete the installation as specified and as shown in the Contract Documents.

1.06 QUALITY ASSURANCE

A. All tests (radiographing, pressure testing, holiday testing, and flushing) shall be performed in accordance with ANSI B31.3, NFPA-30, NFPA-407, and the International Fire Code where and as applicable:

1. Conform to the Occupational Safety and Health Standards of the U.S. Department of Labor and all applicable ordinances, laws, regulation, and/or codes of the Local Authorities, the [Port of Seattle] [ ], the [State of] [Washington] [ ], the National Fire Protection Association, or any other governmental bodies having jurisdiction.

2. Notify the [SEA] [Project Manager] {Owner's Representative] in writing of any instances in the Specifications or on the Drawings that are in conflict with any of the aforementioned authorities; required changes to be adjusted before the Contract is awarded. If the Contractor performs any work contrary to such laws, rules, or regulations without notice, he shall bear all costs arising therefrom.

3. Applicable codes and/or laws to govern the minimum requirements only; where the Drawings and/or Specifications call for materials, vents, piping, sizes, etc., in excess of the code requirements, the Drawings and Specifications to govern.

1.07 SUBMITTALS

A. General: Meet requirements of Division-01, in addition to the Submittal Requirements of Section 335243 - "Aviation Fueling System – General Requirements".

B. Submit detailed procedures for testing methods for approval before proceeding with pipe fabrication. This includes all radiographing, pressure testing, holiday testing, and flushing.

C. Submit examination personnel qualifications before proceeding with any testing method.

D. Submit completed examination procedures with actual testing data (readings) and signatures of examination personnel.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. The Contractor shall furnish all equipment required, including gauges, instruments, connections, air compressors, fuel transport trucks, pipe and hose connections, pumps, and other items specified or required.

B. Compressors and pumps used for testing shall have sufficient capacity to bring the system being tested up to the test pressure in approximately 20 minutes.

PART 3 - EXECUTION

3.01 TESTING PROCEDURE

A. General:

1. Electrically test all insulating flanges and joints.

2. Submit detailed procedures for flushing and testing methods for approval before starting pipe installations. This includes all radiographing, pressure testing, and holiday testing.

3. Hydrostatic pressure testing shall be performed using Jet-A Fuel furnished by the airport. Water shall not be used for testing or flushing jet fuel piping.

4. Sectionalize pipe lines as required to facilitate testing.

    a. Only double block and bleed type plug valves may be used for this purpose.

    b. Responsibility of Contractor:

        1) Notify the proper authorities and the [SEA] [ ] [Project Manager] [Owner’s Representative] that items are ready for inspection and testing. Advance notice of the approximate testing time shall be given to the [SEA] [ ] [Project Manager] [Owner’s Representative] at least seven (7) days in advance of testing followed by not less than forty-eight (48) hours’ notice prior to actual time of performing any inspections and tests. Test results shall be furnished to the [SEA] [ ] [Project Manager] [Owner’s Representative] and the [Port of Seattle] [ ] Fire Department within forty-eight (48) hours after completion of test.

2) Furnish all necessary equipment, materials and personnel, including pumps, compressors, gauges, and valves. Valves shall be suitable to hold test pressure for the specified time without leakage.

3) Conduct the tests of all systems in a safe manner and correct all deficiencies.

4) Apply the specified test pressures by means of a pump or compressor connected to the piping of highest elevation.

5) Be fully responsible for providing qualified and experienced personnel to operate the equipment throughout the testing and flushing operations.

6) Obtain all necessary approvals, acceptances, and permits.

3.02 INSPECTION OF COATINGS

A. Contractor shall make a detailed inspection with a holiday tester of all pipe coating and joint coating preceding the lowering of the pipe.

B. Contractor shall re-inspect pipe and joint coating and all additional joint coatings with a holiday tester following final installation of pipe including additional welded joints.

C. Holiday-tester voltage shall not be higher than the manufacturer's recommended voltage for the coating tested. Testing shall be for holidays only and not to test the dielectric strength of the coating materials.

D. All holidays and damaged or broken places in the coating shall be repaired in a workmanlike manner at Contractor's expense.

E. All holidays shall be patched using the methods specified for field-applied external protective pipe coating and procedure in Section 335280 - "Liquid Fuels Pipe Coating Systems".

3.03 TESTING OF INSULATED FLANGES AND JOINTS

A. Each insulating flange and joint assembly shall be tested with an approved ohmmeter.

B. Ohmmeter used shall have at least 20 megohms, full-scale deflection when using the meter's highest dc resistance multiplier setting.

C. Ohmmeter tests shall be made when flange assembly is dry using the highest multiplier setting and shall indicate infinity measured between each stud and both flanges.

D. Each insulating flange assembly shall be field tested after installation and shall be tested not higher than the manufacturer's recommended voltage.

E. Insulating flanges in the existing hydrant pits within the work area shall be tested by this Contract after installation of hydrant pit valves provided by this Contract.

3.04 CLEANING

A. After all of the new steel fuel piping has been radio graphically inspected and accepted, all accessible supply piping shall be cleaned by hand cleaning with clean fuel (Jet-A).

B. The Contractor shall furnish the necessary materials, equipment, and labor to perform a satisfactory cleaning operation.

C. The cleaning operation shall be continued for each section of the lines until the line is determined clean by the designated [SEA] [   ] Inspector.

3.05 PNEUMATIC TESTING

A. All fuel and piping systems shall be pressure tested with compressed air or nitrogen after all joints are completed, in accordance with ANSI B31.3. Sections of the system may be tested and accepted in order to expedite the work. These sections shall be tagged by the Contractor to indicate compliance with the tests.

B. Install temporary closures or other fittings, including plugs, caps, blind flanges, etc., as necessary for the integrity of the piping system to be tested. Permanent valves and adapters shall be in place for testing.

C. Pneumatic tests shall be made with clean dry filtered and oil free compressed air (minus 20 deg. F pressure dew point) or compressed nitrogen gas, and shall be made in accordance with all applicable codes particularly with regard to safety precautions and the following:

1. A preliminary check at 5 psig shall be made.
2. The pressure shall be increased gradually in steps, providing sufficient time to allow the piping to equalize strains during the test, and checking for leaks. Final test pressure shall be 25 psig.
3. Maintain the required test pressure for a minimum of four (4) hours; continuously record temperature and pressure.
4. Soap each joint and carefully inspect to detect leaks. Pressure shall be maintained, and the pressure and temperature continuously

recorded beyond the minimum four (4) hours until the soap testing has been completed.

5. Repair defective joints and repeat tests until approved by the [SEA] [ ] [Project Manager] [Owner's Representative].

6. Pressure and temperature readings shall be taken as follows:

    a. Temperature readings shall be of the gas (dry air of nitrogen) in the pipe.

    b. Readings shall not be taken during times of rapid atmospheric changes. Rapid changes during test cycle will necessitate retesting.

    c. There shall be no indication of reduction in test pressure after adjustments for temperature have been made according to the relationship $T_1 P_2 = T_2 P_1$ where "T" and "P" are absolute temperatures and pressures and subscripts refer to initial and final readings.

    d. The Contractor shall provide temperature and pressure recording instruments which are acceptable to the SEA Project Manager. Temperature and pressure recording instruments shall be calibrated within 120-days prior to the test. Contractor shall perform all required tests and record all data; and shall furnish the SEA Project Manager with a certified copy of the test results.

    e. Tests shall be witnessed and approved by the [SEA] [ ] Project Manager or designated representative.

3.06 HYDROSTATIC TESTING

A. All jet fuel piping shall be hydrostatic pressure tested using Jet-A fuel after the completion of all pneumatic testing. After filling the piping with Jet-A fuel, dry nitrogen may be used in lieu of Jet-A to pressurize the system. This test shall be conducted just prior to the flushing operations.

B. Water shall not be used for hydrostatic testing.

C. Test pressure for all hydrostatic tests shall be not less than as specified below. Preliminary tests shall provide for ten (10) cycles of pressurization to 150 psig, with each cycle followed by relieving pressure to not more than 25 psig. For each cycle, maintain pressure for length of time necessary to inspect for evidence of leakage.

D. Following successful completion of preliminary tests, conduct final tests, with pressure maintained for at least two 4 hour cycles after pressure has stabilized. Pressure testing shall be performed as follows:

1. The system working pressure at the inlet of the pressure reducing valves located in the applicable JVP-x1 or JVP-x2 valve vault for the applicable concourse shall be verified by ASIG. The system test pressures listed in the following paragraphs are based on 150% of an assumed system working pressure of 150-psig; per the requirements of ANSI/ASME B31.3, NFPA-30, NFPA-407 and the International Fire Code.

2. Starting pressure shall be 50-psig or less. Pressure shall then be gradually increased to 150-psig. Following a 10-minute hold, increase the pressure in 25-psig steps, with a 10-minute hold at each step, to the final test pressure of not less than 150% of the system working pressure, (or 225 psig based on a system working pressure of 150-psig), while checking for leaks at each pressure step. Maintain the final test pressure for a four (4) hour period, with continuous recording of temperature and pressure.

3. Decrease pressure to 50 psig or less by venting at accessible points.

4. Increase pressure again, as specified in Step-2 above; to the final test pressure as determined in Step-2 above; maintain it for another four (4) hour period, continuously recording temperature and pressure.

E. The 4-hour recordings shall start at the 50-psig initial pressure, with the 4-hour time frame starting after temperature and pressure have stabilized at the final test pressure. All pressure tests shall be conducted in accordance with ANSI/ASME B31.3, NFPA-407 and API RP1110.

F. The Contractor shall provide calibrated temperature and pressure instruments and chart recorders to provide continuous temperature and pressure reading variations during the tests. Instruments shall be calibrated for temperature and pressure within 120-days prior to each test. Recorder charts shall be submitted to the [SEA] [ ] [Project Manager] [Owner's Representative] for approval prior to final acceptance of the piping. Calibrated thermocouples may be surface applied by method approved by the [SEA] [ ] [Project Manager] [Owner's Representative].

G. The Contractor shall observe diligent care not to spill or contaminate the test fuel. The Contractor shall be responsible for any and all required soil remediation (produced by leakage or spills) deemed necessary by the [SEA] [ ] [Project Manager] [Owner's Representative] at no additional cost to the Owner.

H. Repair any leaks detected during the preliminary cyclical tests pressure and again after the 4-hour test cycles in a manner approved by the [SEA] [ ]

[Project Manager] [Owner's Representative]. Retest, as described above, after all leaks have been repaired. Repeat the repair and retesting cycles until the system is acceptable to the [SEA] [ ] [Project Manager] [Owner's Representative].

I. Equipment which is not rated by the manufacturer for the test pressure shall be removed prior to hydrostatic testing. Install temporary connections as necessary. All permanent butterfly, plug, and ball valves and equipment which are rated at the test pressure or greater shall be in place during the hydrostatic tests.

J. Tests shall be witnessed and approved by the Owner's authorized representative. Record of the test shall be as follows:

1. Date of Test.
2. Description and identification of piping tested.
3. Test Fluid
4. Test Pressure
5. Remarks to include such items as:
6. Leaks (type, location).
7. Repairs made on leaks.
8. Certification by Contractor and initialed acknowledgment by SEA Project Manager.

3.07 FLUSHING

A. General:

1. After all of the fueling supply piping system has been radiographically inspected, cleaned, pressure tested, and accepted by the [SEA] [ ] [Project Manager] [Owner's Representative], the distribution system piping shall be flushed by the Contractor. Downstream of the system supply pumps, the fuel distribution piping shall be flushed with a minimum velocity of 10 feet per second. Permanent system pumps may be used to obtain this velocity. Flushing for each hydrant pit shall continue until discharged fuel is free of observable contamination as determined by [ASIG] [ ] [the Owner's Designated Representative], per the testing and acceptance criteria specified in the following paragraphs.

2. At least fifteen days prior to the flushing operation the Contractor shall submit a written procedure for flushing with a list of equipment and labor to be used for the operation for approval by the SEA Project Manager.

3. Contractor shall apply all precautions to ensure safe flushing operation. Conform to fire safety requirements of NFPA 30 and 101, all

applicable ordinances, laws, regulations and codes of local and state authorities having jurisdiction.

4. It is the Contractor's responsibility to schedule and coordinate all personnel required for this flushing operation. The Contractor shall provide tank vehicles, and labor to operate pumps and all supplementary equipment used for flushing fuel piping.

5. Contractor shall ensure that no equipment, valves, pumps, and like items are operated beyond their intended design capability or limitations.

6. All needed temporary cross connections, special fabrication, or adapters, required for flushing shall be provided by the Contractor. **CAUTIONARY NOTE:** The Contractor is responsible for taking into account the risk of production of electrostatic charge, at the flushing flow velocity specified, in the fuel; thus yielding possibility of fire or explosion. Refer to NFPA standards for discussion of hazards, and apply safeguards as appropriate.

7. Fuel for filling the system, for hydrostatic testing, and for flushing shall be provided by [SEA] [the Airport]. Upon completion and acceptance of all work, the piping system shall be left in filled condition, containing clean fuel. All fuel utilized in flushing shall be returned to the tank farm, subject to acceptance by fuel system operator [(ASIG)] [(operator’s company name)]. Proper disposal of any fuel rejected by [ASIG] [the system operator] shall be the responsibility of the Contractor.

8. All general service valves and adapters shall be in place throughout the flushing procedure. Contractor shall remove control valves, hydrant valves, and metering assemblies prior to initiating flush.

9. Temporary pipe risers, as indicated in the Drawings, shall be extended from the pit flanges. The temporary pipe risers shall be equipped with shutoff valves and sampling probes. Contractor shall supply any temporary manifolds plus sufficient number of single or multiple compartment tank trucks and hoses to allow the desired flow rates to be achieved in a safe manner. Hoses and couplings shall be aircraft type with a minimum 150 lb. rating and must be hydrostatically tested. Recommend four-inch hose size to achieve flow capacities during flush.

10. Test samples for inspection of discharged flushing fuel cleanliness shall be drawn from a sampling probe installed in the temporary pipe riser.

11. The contractor shall arrange for Millipore, Aqua-Glo, Microsep and gravimetric tests to be taken as specified during the fuel flushing operation. All tests shall be performed by a testing laboratory provided by the Contractor and witnessed by the Project Manager. The Contractor shall continue flushing until the fuel meets or exceeds the acceptance criteria specified herein.

12. A two consecutive acceptable test minimum is required for system acceptance, with all hydrant pits tapped between two adjacent valve pits tested prior to conducting the second test.

13. Any fuel spilled shall be cleaned up and legally disposed of by the Contractor in accordance with federal, state and local regulations. Contractor shall notify [SEA] [ ] [Project Manager] [Owner's Representative] and approval of spilled fuel disposal measures.

14. After flushing has been completed and approved, the Contractor shall remove all temporary cross connections, etc., and install control valves, hydrant valves, metering elements, and other equipment as required.

B. Flushing Sequence:

1. This procedure is intended as a guideline and is not necessarily all inclusive. The [SEA] [ ] [Project Manager] [Owner's Representative] may vary, add to, or delete any of the following steps as are necessary to properly flush system to the cleanliness level required.

C. Flushing into Tank Trucks: CAUTION: All electrical and motorized equipment in area should be shut down in case of a mishap or fuel spill. For safety, all persons not involved in the flushing operation must be kept a minimum of 100 feet away from tank trucks used in the flushing operation:

1. Tank truck internal valves shall be safety wired in an open position.

2. All quick release type couplings shall be safety wired when coupled to the bottom load receptacle and hydrant adapter.

3. Hoses shall be secured in a manner to prevent whipping during flush. Four inch hoses shall be used to achieve flow capacities.

4. Bond and ground truck to system piping.

5. Start product flow slowly before reaching flushing velocity to check for leaks and system tightness.

6. Fire extinguishers shall be kept in readily accessible locations in case of emergency.

7. Location of test personnel:

    a. One person per each single compartment tank truck to monitor fuel level in tank. One person per each two compartments for multi-compartment tank trucks.
    b. One person at each flushing discharge location to control fuel flow into tank truck.
    c. One person at main pump control station to shut down pumps in emergency.
    d. One person at nearest terminal EFSO station to shut down pumps in emergency.
    e. One person manning fire extinguisher.
    f. One person removed from manual tasks in command of flushing operation.

D. Test Requirements:

1. One (1) test kit shall be furnished by the Contractor as described in this paragraph and shall become the property of the fuel system operator after completion of the contract. Test equipment shall be in good working condition when accepted by the fuel system operator. The test kit shall be a Combination Kit, Model GTP-323 as manufactured by Gammon Technical Products.

2. Aviation kerosene shall be tested for contamination per ASTM Standards D-2276 and D-3830 using Millipore test equipment as manufactured by Gammon Technical Products. Millipore tests shall be made at 30 minute intervals during flushing.

3. Aviation kerosene shall be checked for water entrainment per ASTM Standard 3240 using “Aqua-Glo” instrument manufactured by Gammon Technical Products.

E. Acceptance Specifications:

1. Visual - All discharged flushing fuel samples must be clear and bright. Other visual clues must be observed and acted upon accordingly; i.e., feel, color, odor, etc.

2. Solids / Particle Assessment – “B” Scale with One Gallon Sample. Membrane Color #3 Rated Wet with One Gallon Sample.

Note: If color rating exceeds the above limits or is in dispute, a matching weight gravimetric rating not to exceed 0.5 mg/gal shall govern.

3. Water – 5 PPM Maximum.

4. Water Separation (Microsep) Rating – 85 Minimum.

F. Final Acceptance:

1. The contractor shall furnish, after flushing is completed, a written report to the SEA Project Manager describing the flushing of each pipe section and the results of the tests performed in conjunction therewith.

2. It shall be the responsibility of the [SEA] [ ] Fuel Quality Assurance representative [(ASIG)] [(company name)] or another [SEA] [airport] designee to have the final decision on system cleanliness and acceptance before aircraft fuel servicing is permitted.

3.08 PERFORMANCE TESTING

A. The Contractor shall subject the fueling system to such operating tests as required by the [SEA] [ ] [Project Manager] [Owner's Representative] to demonstrate satisfactory functioning and operating performance of the fueling system components installed under this contract.

B. All instruments required to conduct the tests shall be furnished and operated by the Contractor using experienced and qualified personnel.

C. Submit typed copies of test reports to the [SEA] [ ] [Project Manager] [Owner's Representative] for approval.

END OF SECTION **335253**

PART 1 - GENERAL

1.01 SUMMARY

A. Field and shop-applied corrosion protection coatings of exterior and interior surfaces for fuel system piping, pipe supports, valves, fittings, equipment, structural steel, and all materials to be located underground.

B. Coating includes surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment, as applicable.

1.02 RELATED DOCUMENTS

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

1.03 RELATED SECTIONS

A. SECTION 335229 – LIQUID FUELS PIPING SYSTEM SUPPORTS & ANCHORS.
B. SECTION 335243 – AVIATION FUELING SYSTEM - GENERAL REQUIREMENTS.
C. SECTION 335243.11 – AVIATION FUELING SYSTEM EQUIPMENT.
D. SECTION 335243.13 – AVIATION FUELING PIPE, MANUAL VALVES AND FITTINGS.
E. SECTION 335243.14 – AVIATION FUELING SYSTEM CONTROL VALVES.
F. SECTION 335290 – WELDING FOR FUEL SERVICE PIPING
G. SECTION 335292 – AVIATION FUEL SYSTEM - MECHANICAL IDENTIFICATION

1.04 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable. Refer to Section 1335243 for listing of issuing organizations or agencies.

B. Applicable Standards:

1. American Water Works Association (AWWA):

a. AWWA C-210 - Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.

b. AWWA C-213 - Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

2. National Association of Corrosion Engineers:

a. NAPCA 12-78-83 - Application Specifications for Mill Applied Fusion Bonded Epoxy Coatings.

3. National Bureau of Standards (NBS):

a. Certified Coating Thickness Calibration Standards

4. U.S. Government Specification:

a. MIL-PRF-4556F

5. The Society for Protective Coatings (SSPC):

a. SSPC-SP1 - Solvent Cleaning.
b. SSPC-SP5 - White Metal Blast Cleaning.
c. SSPC-SP10 - Near-White Metal Blast Cleaning.

1.05 SUBMITTALS

A. Submit Manufacturer's Product Data and Application Instructions for all coatings and linings in accordance with the requirements of Section 335243.

B. Includes but is not limited to the following:

1. Schedule of products to be used. Schedule shall include the following information:

a. Surfaces for system to be applied.
b. Surface preparation method and degree of cleanliness.
c. Product manufacturer, name, and number.
d. Method of application.
e. Dry film mil thickness per coat of coating to be applied.

2. Color charts for selection and acceptance.

C. Technical and material safety data sheets.

D. Field Applicator SSPC-QP 1 certification.

E. Shop Applicator SSPC-QP 3 certification.

1.06 EXTENT OF WORK

A. All fuel pipe and fittings to be partially or completely buried shall be externally factory coated.

B. Field welded joints in referenced piping systems and underground structures shall be coated and wrapped in accordance with “Field Procedures”.

C. All fuel supply, transfer, drain, and vent piping and fittings 2-1/2 inches and larger shall be internally epoxy coated. Pipes and fittings smaller than 2-1/2 inches need not be internally coated.

D. External painting of all piping, equipment, valves, fittings, flanges, tanks, gauge connections, and other appurtenances aboveground and in pits.

1.07 QUALITY ASSURANCE

A. Include on label of container:

1. Manufacturer's name, product name, and number.

2. Type of paint and generic name.

3. Color name and number.

4. Storage and application temperature limits.

5. Mixing and application instructions, including requirements for precautions which must be taken.

6. Drying or curing time.

B. Shop-Applied Pipe Coatings:

1. Coating applicator shall have a minimum of 5 years of certified experience in the type of coating work required.

2. Certification of quality control procedures during application of external and internal coatings shall be submitted to the Engineer for review. Certification to include: surface preparation, film thickness per coat, curing procedures, and holiday testing.

C. Coating contractor shall certify in writing to Engineer that he has previously applied all the systems in this Specification and has the ability to prepare the surfaces correctly as specified.

   1. A coating report shall be completed daily at each phase of the coating system starting with surface preparation. These will be submitted on the form attached at end of this Section.

D. In the event a problem occurs with coating system, surface preparation, or application, coating contractor and coating manufacturer's technical representative shall promptly investigate the problem and submit results to the [SEA] [XXX] [Project Manager] [Owner’s Representative].

E. Stated VOC shall be unthinned maximum VOC certified by manufacturer. Maximum VOC allowable in this area shall be verified and complied with by coating contractor.

1.08 MAINTENANCE MATERIALS

A. Leave on premises, where directed by the [SEA] [XXX] [Project Manager] [Owner’s Representative], not less than one unopened gallon of each field-applied paint product and color used.

1.09 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

   1. Deliver in sealed containers with labels and information legible and intact.

   2. Allow sufficient time for testing if required.

B. Storage of Materials:

   1. Store only acceptable materials on Project Site.

   2. Provide separate area and suitable containers for storage of coatings and related equipment.

   3. Dispose of used or leftover containers, thinners, rags, brushes, rollers, and related materials in accordance with applicable environmental regulations.

PART 2 - PRODUCTS

2.01 SHOP-APPLIED EXTERNAL PROTECTIVE PIPE COATING

A. All fuel pipe and fittings to be installed underground or in pits, shall have an external coating system applied either in the pipe manufacturer's shop or in the mill of an approved custom applicator.

B. Coating system shall meet the following specifications:

1. Surface preparation, material, application, testing, inspection, handling, storage and field installation shall be in accordance with the applicable requirements of AWWA C213, Fusion Bonded Epoxy Coating, applied at a minimum coating thickness of 15-mils, and a maximum of 20-mils.

2. Coatings shall be applied in accordance with NAPCA Bulletin 12-78-83. Application Specifications Mill Applied Fusion Bonded Epoxy Coatings.

3. Surfaces shall be sandblasted in accordance with SSPC Surface Preparation Specification No. 10, "near-white" metal blast.

4. Sandblasting shall be coordinated with coating application, which shall be applied as soon as possible after blasting. If blasted surface remains uncoated overnight, it shall be re-blasted.

5. Care shall be taken to prevent grease, oil, or other organic matter from contacting the blasted surface prior to application of the prime coat.

6. All burrs and rough protrusions on the outer surface of the pipe shall be ground smooth prior to coating.

7. Dry film thickness shall be spot checked at random on ten percent of the coated surfaces. If film thickness is not found to be uniform and to specification, the Contractor shall apply additional coats at no cost to the Owner until the specified film thickness has been obtained. Dry film thickness shall be checked by the Contractor at his expense.

8. Provide a 3 inch cut-back from each end.

9. Epoxy lining and coating shall meet or exceed the following requirements:

    a. Hardness (Minimum): Barcol 17 (ASTM D 2583)

1) Rockwell 50 (“M” Scale)

b. Abrasion Resistance (Minimum):

1) 1,000 cycles: 0.05 gram removed

2) 5,000 cycles: 0.115 gram removed

3) (ASTM D 1044, Tabor CS-17 wheel, 1,000 gram weight)

c. Adhesion (Minimum):

1) 3000 psi (ASTM D 4551)

d. Penetration:

1) 0 mil (ASTM G 17)

e. Impact (Minimum):

1) 100 in-lbs

f. (Gardner 5/8-inch diameter tup)

C. The coating shall be holiday tested in the shop prior to shipment. Surfaces shall be checked for freedom from defects using a low-pulse electronic holiday detector at 125 volts per mil of coating thickness.

D. The Contractor shall secure the services of an independent testing and inspection laboratory to witness the coating application and testing and to certify that the pipe and fittings were prepared, cleaned, and coated using methods and materials conforming to these specifications

E. Contractor shall perform final holiday test of all coatings prior to backfilling in accordance with the requirements of Section 335253 requirements.

F. Approved Products: Color shall be blue green.

1. Scotchkote 206N

2. Valspar Pipeclad

3. Approved Equal.

2.02 <u>SHOP-APPLIED INTERNAL EPOXY LINING (COATING) FOR PIPING</u>

A. All fuel supply, transfer, drain, and vent piping and pipe fittings 2-1/2 inches and larger in size shall be internally coated in the manufacturer's shop or in the mill of an approved internal epoxy applicator with a two coat high solids amine-cured epoxy system in accordance with Military Specification MIL-PRF-4556F and the following specifications. All materials used shall be lead-free, and shall not contain any more than VOC component quantities permitted by local regulatory authorities, as applied (in thinned state) unless noted otherwise.

B. All applications shall be in accordance with the manufacturer's published instructions.

C. The Contractor shall secure the services of an independent testing and inspection laboratory to witness the lining application and testing and to certify that the pipe and fittings were prepared cleaned and lined using methods and materials conforming to these specifications.

D. The coating system shall be:

1. PPG Amerlock 240
2. Tnemic Series N69 Epoxoline II
3. Approved equal.

2.03 FIELD-APPLIED EXTERNAL PROTECTIVE COATING AND PROCEDURE

A. All field welds of fuel piping, including fittings and areas of thermite welding and where the shop coat has been damaged, valves and equipment in pits, shall receive a field-applied external protective coating using a two-part liquid epoxy coating system in accordance with AWWA C-210.

1. Sandblast surfaces to "near-white" metal, conforming to SPPC Surface Preparation Specification No. 10. No rust preventative coating material or other temporary coating shall be applied after sandblasting and before application of the epoxy coating. Care shall be taken to prevent grease, oil or other organic matter from contacting the blasted surface prior to application of the prime coat. Blasting shall be coordinated with primer application, which shall be applied as soon as possible after blasting. If the blasted surface remains uncoated overnight, it shall be re-blasted.
2. Grind smooth all burrs and sharp protrusions.
3. Surfaces must be dry before application of coating system.
4. Apply primer following manufacturer's recommendations. The thickness of the cured primer shall be not less than 1.5 mils.

5. Apply finish coat(s) of epoxy top coating in accordance with manufacturer's recommendations. The cured thickness of the total system shall be not less than 15 mils, but shall not exceed 25 mils.

6. After the top coat has been cured in accordance with manufacturer's recommendation, the epoxy coating shall be tested electrically using an approved holiday detector and shall be free of missed spots, pinholes or holidays. Apply additional primer and finished coats to areas requiring touch-up.

7. Coatings for piping to be pressure tested shall be applied after testing and acceptance.

8. Application, testing, and inspection shall be in accordance with AWWA C210.

9. Leave welds uncovered until after testing and acceptance.

B. Do not coat manufacture's name tags, identification tags, instruction tag(s) or control mechanisms.

C. Approved Products:

1. PPG: Amercoat 240

2. Chase TC 7100

3. Approved Equal.

D. Holiday test all coatings prior to backfilling in accordance with the applicable requirements of Specifications Section 335253 requirements.

2.04 FIELD-APPLIED POLYUREA HYDRANT PIT COATING

A. Following completion of the installation of the hydrant pits, and prior to starting flushing operations, coat the inside of the hydrant pits with a gray, two-component spray-on polyurea coating meeting NACE 6A198 definition for a polyurea coating. BASF Elastocoat C-6430, Sherwin-Williams EnviroLastic AR425, or approved equal.

B. Clean inside of hydrant pit, including piping and fittings with bio-degradable cleaner/degreaser.

C. Cover pipe, valve, and blind flange to prevent coating during application process.

D. Surfaces must be dry before application of coating system.

E. Apply coating following manufacturer's recommendations. The thickness of the cured primer shall be not less than 0.5 mm.

F. When dry, inspect application and re-coat as required to provide full coverage.

G. Remove protective covering from piping and valve.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Prepare surfaces for each coating system conforming to SSPC or ASTM surface preparations specifications listed:

1. If grease or oils are present, SSPC-SP 1 shall precede any other method specified.

2. Remove surface irregularities such as weld spatter, burrs, or sharp edges, prior to specified surface preparation.

3. Prepare surfaces of field welds, sears, or other damage, and touch up with coating as specified or recommended by manufacturer.

4. Concrete Valve Pit Walls and Floors, following removal of grease and oil as described above, shall be prepared by brush-off blast and vacuumed. All surfaces to be coated shall be dry and clean. Comply with coating manufacturer's recommendations for this specific application.

B. Depth of profile will be as specified for each system, but in no instance shall it exceed one-third of the coating dry film thickness per coat.

C. Prepare only those areas which will receive the first coat of the system on the same day.

3.02 APPLICATION

A. Apply coatings in accordance with coating manufacturer's recommendations.

B. Use properly designed brushes and rollers for all applications. For all work to be performed in close proximity of aircraft and vehicle parking to painting area, all exterior painting shall be limited to brushes and rollers.

C. Dry film thickness of each system shall meet the minimum specified but not exceed it more than 20% or coating manufacturer's requirements if less.

D. On unprimed surfaces apply first coat of the system the same day as surface preparation.

E. Shop painting shall remain 3 inches away from unprepared surface of any substrate such as areas to be welded or bolted.

F. Environmental Conditions:

1. Atmospheric temperature must be 50ºF or higher during application, unless approved by coating manufacturer. Do not apply coatings when inclement weather or freezing temperature may occur within coating curing time requirements.
2. Wind velocities for exterior applications shall be at a minimum and not greater than coating manufacturer's limits.
3. Relative humidity must be less than 85% and the temperature of the surface to be painted must be at least 5º above the dew point.
4. Provide adequate ventilation equipment in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the manufacturer's Material Safety Data Sheets for the specific coatings being applied.

G. Protection:

1. Cover or otherwise protect surfaces not being painted, areas not to be painted, and the work of other trades. Remove protective materials when appropriate.
2. Provide signs to indicate fresh paint areas.
3. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.
4. Provide cover to prevent paints from entering orifices in electrical or mechanical equipment.
5. Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, thinners, and related materials. Dispose of leftover containers, thinners, rags, brushes, rollers, and related materials in accordance with applicable regulations.
6. Do not remove or paint over equipment data plates, code stamps on piping, or UL fire- rating labels.

3.03 CLEANING:

A. Touch up and restore damaged finishes to original condition as required.

B. Remove spilled, dripped, or splattered paint from all surfaces.

3.04 COATING REPAIRS

A. Repair all damages to pipe coating systems before the piping is holiday tested.

B. This includes all cuts, breaks, voids, bruised or scarred spots, or other damage caused prior to delivery, or resulting from handling or installation of the pipe, or from any cause whatsoever.

C. Also included are damaged coatings where new connections are made to existing coated pipes or where existing coated pipes are uncovered or exposed for any reason.

D. Also repair the coating where welds are made and where damaged or broken by the installation of instrumentation or other accessories or appurtenances.

E. Repair all holidays detected during inspection of coatings.

F. Repair coating where field welds are made or where otherwise damaged as follows:

1. Approved initial coating product & procedures.
2. Specified Alternatives for Joint and Fitting Wrapping and Coating.

3.05 QUALITY CONTROL

A. Inspection:

1. Use wet film gauges to check each application about every 15 minutes in order to correct ow or heavy film build immediately.
2. Use dry film gauge to check each coat when dry, and the total system when completed.
3. Use holiday or pinhole detector on metal systems to detect and correct voids as recommended by coating system manufacturer.

4. Furnish a sling psychrometer or calibrated electronic temperature and relative humidity meter and perform periodic checks on both relative humidity and temperature limits.

5. Check temperature of the substrate at regular intervals to be certain surface is 5ºF above the dew point.

6. Complete daily coating reports.

END OF SECTION **335280**

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. Welding is that work defined in American Welding Society (AWS) "Standard Welding Terms and Definitions - AWS A2.4" and as otherwise shown on Drawings.

1. All welding on this project must comply with requirement of this section, and other Contract Documents such as, but not limited to Drawings. If there is a conflict between Project Drawings, codes, and specifications, the more stringent applies.

B. Extent of welding Work for Fuel Service Piping is as specified in the applicable Division-33 Sections noted below.

C. Nothing stated in this section should be interpreted as diminishing or eliminating requirements stated in other sections.

D. Related Sections - Section 335290 "Welding for Fuel Service Piping" applies to all welding performed under all of the following Sections

1. SECTION 335229 LIQUID FUELS PIPING SYSTEM SUPPORTS & ANCHORS
2. SECTION 335243 AVIATION FUELING SYSTEM - GENERAL REQUIREMENTS
3. SECTION 335243.11 AVIATION FUELING SYSTEM EQUIPMENT
4. SECTION 335243.13 AVIATION FUELING PIPE, MANUAL VALVES, AND FITTINGS

E. Related Requirements:

1. Drawings, General and Special conditions, general requirements, and other applicable Technical Specifications apply to Work of this section.

2. [SECTION 050510 WELDING applies to all structural and pipe supports for the fueling system.]

3. IEEE-1992. Only welding machines that have been tested and comply with harmonic distortion requirements of IEEE-1992 are allowed to operate using the [SEA] [XXXX] electrical power system.

1.03 REFERENCE STANDARDS

A. Welding must comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents.

1. AISC - American Institute of Steel Construction.
2. AWS - American Welding Society.
3. API - American Petroleum Institute.
4. AWWA - American Water Works Association.
5. ASME - American Society of Mechanical Engineers.
6. ASTM - American Society for Testing and Materials.
7. ASNT - American Society for Nondestructive Testing.

1.04 SUBMITTALS

A. Product Data: Submit producers or manufacturer's specifications and installation instructions for all products, including, but not limited to those listed below. Include laboratory test reports and other data to show compliance with specifications, including specified standards.

1. Welding Electrodes: Submit manufactures specifications, to include recommended parameters and technique, for each electrode to be used on this project.

2. Include data substantiating that materials comply with requirements.

B. Submit shop drawings as specified under Section [013325 "Shop and Working Drawings”] [and Section] [335243 “Aviation Fueling System - General Requirements”], Product Data and Samples" for all Work specified herein, including complete details and schedules for fabrication, procedures, and diagrams. Shop drawings must indicate how each component is to be welded. If another company manufactures a component to be welded to other parts or pieces to form a larger assembly, then the shop drawings shall include that manufacturer¹s recommended welding procedures for that component. Design Construction Drawings are not to be re-used as bases for submitted shop drawings. Shop drawings, which use reproductions of design plans or details, will not be reviewed. Drawings must be submitted in complete units. Do not submit partial sets.

C. Contractor must submit fully dimensioned Isometric drawings (spool drawings) for all welded piping work. Drawings must indicate all weld types, sizes, and materials to be used. The spool drawing size must match the full-size Contract Documents. Spool drawings must be submitted in in latest format as approved by Owner. Adobe Acrobat files must not contain security. Other file formats will not be accepted.

D. Test Reports: Submit copies of all test reports conducted on shop and field welded connections. Include data on types of tests conducted and test results. Reports must be sequentially numbered and submitted to the [SEA] [XXX] [Project Manager] [Owner's Representative] within 48 hours of completion.

E. Individual Welder Qualifications: Submit Welding Performance Qualification Records (WPQR) for all welders, shop and field, prior to any welding per Paragraph 1.5. B below.

F. Procedures: Submit Welding Procedure Specifications for all shop and field welding prior to any welding per Part 1 of this section.

G. Welding inspectors and NDE personnel qualification certificates.

H. Qualifications of the testing laboratory or the Contractor's quality assurance organization.

1.05 QUALITY REQUIREMENTS

A. Codes and Standards: Comply with provisions of following, as applicable:

1. ASME B31.3 – Process Piping Guide

2. ASME BPVC SECTION-V: Nondestructive Examination

3. American Welding Society (AWS), including but not limited to the most current edition of:
    a. AWS A2.4 – Standard Symbols for Welding, Brazing and Nondestructive Examination.
    b. AWS A3.0M/A3.0 - Standard Welding Terms and Definitions
    c. AWS A5.1/A5.1M - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
    d. AWS A5.18/A5.18M - Carbon Steel Filler Metals for Gas Shielded Arc Welding
    e. AWS A5.22/A5.22M - Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods
    f. AWS A5.32/A5.32M - Specification for Welding Shielding Gases
    g. AWS A5.36/A5.36M – Specification for Carbon and Low-Alloy Steel Flux Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding
    h. AWS D10.10/D10.10M – Recommended Practices for Local Heating of Welds in Piping and Tubing

i. AWS D10.11M/D10.11 – Guide for Root Pass Welding of Pipe Without Backing
j. AWS D10.12M/D10.12 – Guideline for Welding Mild Steel Pipe
k. AWS QC1 – Specification for AWS Certification of Welding Inspectors
l. AWS Z49.1 – Safety in Welding and Cutting, and Allied Processes

4. All welding must be performed in accordance with the latest addition of applicable AWS, API, ASME code, and ASTM Standards.

B. Qualifications for Welding Work:

1. All Welders must be qualified through welding tests in accordance with applicable AWS code per paragraph 1.5.A above within one (1) year prior to welding taking place. Evidence of qualification must be through WPQR.

2. All welder qualifications test must be or must have been administered and witnessed by an Independent Testing Agency (ITA), AWS Certified Welding Inspector (CWI).

3. If recertification of welders is required, delay costs and retesting costs are borne by the Contractor.

4. Welding that is to take place at each type of joint shall be per approved AWS procedure for that type of joint. Evidence of intended procedure shall be through written Welding Procedure Specifications.

5. Any welding done without submission to and approval by the SEA Project Manager of WPQRs of the individual welders doing the welding and Procedure Specifications for the actual welding will be considered defective and subject to the provisions of Title 17 of the SEA General Contract Conditions.

6. All WPS and WPQR qualification testing must be in accordance with this specification and the applicable welding code requirements.

C. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

D. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. The Contractor must periodically review each welders' work quality and take any steps required to insure high quality work. This is in addition to Quality

Control requirements.

F. Fabricator Qualifications: Minimum of three (3) years' experience specializing in fabrication for similar projects.

G. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the Work.

1. Promptly notify SEA Project Manager whenever design of members and connections for any portion of structure are not clearly indicated.

H. Welding and materials must be inspected and tested by an Independent Testing Agency furnished and paid for by the Contractor. The Independent Testing Agency will have authority to reject weldments and materials. Such rejection may be based on visual inspection where, in the Inspector¹s opinion, the weldment or material would not pass more detailed investigation. Reference Article 3.01 below for inspection and testing requirements. SEA's Quality Assurance Inspectors, per the provisions of General Conditions Title 17, will also inspect welding and materials. Inspections by either the Independent Testing Agency or [SEA's] [XXXX] Quality Assurance Inspector may take place in the mill, shop, and field.

1. Promptly remove and replace materials or fabricated components that do not comply with requirements as set forth in the Contract Documents.

1.06 CONSTRUCTION WASTE MANAGEMENT

A. Construction waste must be managed in accordance with provisions of [Section 017419 "Construction Waste Management and Disposal"] [other named section]. Documentation must be submitted to satisfy the requirements of that Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Electrodes for Welding: Comply with AWS Code. Use E70 grade minimum unless otherwise approved. Store all electrodes and welding materials inside and protect from moisture, corrosion, and any other damage. Damaged electrodes cannot be used.

B. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures. All field girth root pass welds shall be made with non-covered electrodes or welding wire. External welds such as pipe supports may be made with covered electrodes or welding wire.

2.02 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble components in shop to greatest extent possible.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

B. Contractor will notify SEA Project Manager or SEA Project Manager's representative at least 48 hours prior to any commencing fabrication. Notification to include starting date and duration of the Work.

2.03 SHOP CLEANING AND COATING

A. Shop cleaning and coating materials and procedures for components to be epoxy coated are as specified in Section 335280 “Liquid Fuels Pipe Coating Systems”.

PART 3 - EXECUTION

3.01 PERMITS

A. Obtain and pay for any special permits required for any work under this or any related section of these Specifications.

3.02 PIPE CLEANING

A. Clean each joint before welding into the system, to remove all loose debris.

B. Remove materials such as welding rods, dirt, and similar materials, left inside after completion of the lines. Expense incurred by Owner for removal of such objects shall be reimbursed by the Contractor.

3.03 GAS FREE CONDITIONS

A. All operations in the construction area that involve open flames or the possibility of arcing or sparking shall be conducted in a "Gas Free" condition.

B. These operations shall include but not be limited to the following:

1. Use of internal combustion engines not equipped with Underwriters' approved spark and flame eliminators.

2. Use of electric motors or electric devices with arcing brushes or sliding contacts that could produce arcing or sparking.

3. Use of tools which may produce impact sparks.

4. Electric arc or gas welding.

5. Use of cutting or other torches or other open flame equipment.

6. Holiday testing.

7. Use of equipment with hot surfaces or glowing elements.

8. Use of any other equipment or procedure that could create a fire hazard.

C. Contractor shall monitor the use and suitability of the equipment and procedures on the job and maintain a safe "Gas Free" condition when necessary during construction.

D. Prior to commencing any phase of the Work requiring a gas free condition, Contractor shall make the following provisions:

1. Drain all piping containing fuel and purge of all vapors.

2. Isolate, blank off, and positively purge open piping sections with dry nitrogen.

3. Ensure that no pipe containing fuel or vapors is exposed.

4. Drain and ventilate fuel tanks prior to work inside tanks or on any of the tank connections.

5. Verify there are no open pools or reservoirs of fuel exposed in the vicinity of the Work.

6. Perform all other safety precautions necessary to ensure that these operations are conducted in a safe manner in accordance with all applicable codes.

E. Use a combustible gas analyzer to make certain no combustible gas concentrations exist in the construction area when performing these operations.

3.04 WELDED JOINTS

A. Process: Welding shall be accomplished by the use of the shielded metallic arc process and shall be in strict accordance with ASME B31.3.

B. Procedure: Upon award of the Contract, submit for review the welding procedures and qualifications that are intended to be used on the job in accordance with Section 335243.

    1. SEA Inspector reserves the right to request qualification tests be performed at the Job Site for each welder and welding operator on the job, such tests being made in strict compliance with the above code.

C. Costs: Costs incident to these procedures and the welder's qualification tests shall be assumed by Contractor.

D. Inspectors: Shop welding and fabrication shall be subject to the right of Owner to maintain one or more inspectors in the shop or to visit the shop at any time this Work is in progress.

E. Identification:

    1. Each welder shall identify each weld with specific code marking signifying the welder's name and assigned number.

    2. Contractor shall maintain a code listing assigned to each welder.

    3. Stamp on the pipe using "low stress" steel stamp, or other approved method, not closer than 4-inches to the weld.

F. Butt Welding End Preparation on all Pipe:

    1. Conform to ASME B16.25.

    2. Shop and field bevels shall be machine cut; manual flame cutting without machine guide is not permitted.

G. All welds shall have full penetration and fusion and shall conform to ASME B31.3.

H. Backing rings shall not be used.

I. Align pipe joints with pipe clamps prior to welding. Clamps or other alignment devices shall not reduce the internal pipe diameter.

J. Defective welds shall be repaired in accordance with ASME B31.3 at Contractor's expense.

K. Repairs to defective welds shall not be made prior to authorization. SEA Inspector will determine on the basis of the testing laboratory report if repairs may be made or if the entire joint must be cut out and welded again.

L. No weld metal shall project within the piping at completion of the welding.

3.05 TESTING AND INSPECTION

A. Independent Testing Agency (ITA):

1. See Division 1 for Independent Testing Agency requirements.

2. The General Contractor must provide the ITA for all subcontractors. Subcontractors cannot contract with a separate ITA.

3. Contractor will engage an Independent Testing Agency to inspect welded connections and to perform tests and prepare test reports. The Contractor's Quality Control Inspector will coordinate the inspections and tests performed by the testing lab inspectors and testing personnel.

    a. The Contractor's Independent Testing Agency and SEA Project Manager's staff will conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom. All reports must be delivered to the SEA Project Manager. Results not complying with requirements are to be brought to the SEA Project Manager¹s attention within 24 hours of discovery. All reports must be sequentially numbered.

    b. Provide access for Independent Testing Agency to places where work is being fabricated or produced so that required inspection and testing can be accomplished.

    c. The Independent Testing Agency must inspect Work at the plant before shipment; however, SEA Project Manager reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

        1) Inspections and tests conducted by the ITA or SEA does not in any way relieve the Contractor of the Contractor's responsibility and obligation to meet all specifications and referenced standards. Employment of the ITA does not relieve the Contractor of providing the required Quality Control Program.

    d. Welding Inspection Personnel Qualifications: All visual welding inspections must be performed by AWS CWI, qualified in accordance with AWS QC1. Inspectors qualified in accordance with the most current edition of the American Society for Nondestructive Testing Recommended Practice No. SNT-TC 1A, must perform all non-destructive inspections other than visual inspections

e. Independent Testing Agency Inspectors working for the Contractor must identify with a distinguishing mark all parts and joints they have inspected and accepted. Marks to be visible from at least 50 feet. SEA Project Manager and the Quality Control Inspectors must mutually agree upon identifying marks.

f. Independent Testing Agency welding inspector must be on job site however much time it takes to guaranty that all requirements of Project Specifications and codes are being met and provide written reports showing specific requirements have been met. Shop inspections by ITA welding inspector must be performed in such a manner as to guaranty that all provisions of Project Specifications and codes are being met and provide written reports showing specific requirements have been met.

4. The Contractor must furnish such facilities and provide such assistance as may be required for carrying out the inspection prescribed herein. The Contractor must notify the Independent Testing Agency and the SEA Project Manager at least two weeks in advance of the start of any qualification testing for welding.

5. The Testing Agency's Inspector will perform the Inspector's duties in such a way that neither fabrication nor erection is unnecessarily delayed or impeded. The Testing Agency must notify the SEA Project Manager of any scheduled inspections at least 48 hours prior to such time. The SEA Project Manager must also be notified as soon as possible prior to any unscheduled inspections. In no case will the inspector recommend or prescribe the method of repair of a defect.

6. Inspection of welding will be such as to assure that all requirements of Project Specifications AWS D1.1, and other applicable welding codes are being complied with. Reports must show the following items as being in conformance, but not be limited to just the items shown:

   a. Verify that electrodes used for welding conform to the requirements Manufacturer, AWS, and other applicable Welding Codes and Standards.

   b. Verify that the approved Welding Procedure Specifications and the approved welding sequence are followed without deviation.

   c. Verify that only welding operators and welders who have been properly qualified will perform the welding. The inspection agency will witness such qualification testing of welding operations and welders, as may be required.

d. Verify that the fit up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements such as but not limited to applicable welding codes, Welding Procedure Specifications, and Drawings.

e. Review Mill Test Reports of material for compliance with Project Specifications, all applicable Codes, and Drawings.

f. ITA inspection reports must list all inspected, nonconforming, repaired, and accepted welds.

7. [SEA] [XXXX] [Project Manager] [Owner's Representative] must be informed at least 48 hours prior to shop and field welding so random inspections can be performed as stipulated in these specifications and General Conditions, TITLE 17.

8. All welders must mark their welds with identifying marks. Contractor must furnish SEA Project Manager with list of welders and their marks. List must be updated each time a welder is added or subtracted.

B. Fuel Piping:

1. 100% visual inspection per acceptance criteria of ASME B31.3.

2. All other requirements of ASME B31.3 as required for the application.

3.06 RADIOGRAPHING

A. Contractor shall coordinate and arrange for radiography by an approved testing laboratory of all welds on all underground carrier pipe or inaccessible fuel lines except as specified in ARTICLE 3.7; and also a minimum of 10% of selected above ground or exposed welded joints. This shall include all circumferential butt welds and all fabricated branch connections.

B. Testing laboratory shall be selected by and employed by Contractor subject to [SEA] [XXXX] [Project Manager's] [Owner's Representative's] approval.

C. The radiographing shall be coordinated by Contractor and conducted at the Project Site such that Owner and the testing laboratory are provided with adequate notice that welds are available for radiographing and all the work required of Contractor in connection with the radiographing is properly completed at no additional cost to Owner. Factory welds of the final carrier pipe shall be radiographed by an approved testing laboratory. Radiography of factory welds may be conducted at the factory site.

D. Reports for both factory and field welds shall be submitted throughout the progress of the Work as described in the following paragraphs.

E. All radiographing and subsequent reports shall be in accordance with the requirements of ASME B31.3.

F. Each weld shall be assigned a number. Contractor shall maintain a marked up copy of piping drawings identifying the location and number of each radiographed weld. Upon completion of the Work, these drawings shall be submitted with as constructed drawings.

G. Radiograph exposure records shall be kept by the testing laboratory which show: date, location, area, film number, serial number, film combination, time, source-film distance, angulation of weld, number and other pertinent information for each weld radiographed.

H. A summary of this record and an expert interpretation by the testing laboratory shall be submitted in report form for each weld to [SEA] [XXXX] [Project Manager], Engineer, and Contractor.

I. All joints shall be left exposed until radiographing and other testing is completed.

J. Welds which do not meet the standards of acceptability as outlined in the above mentioned ASME B31.3, will be judged unacceptable and shall be repaired or cut out and re-welded by Contractor as directed by the testing laboratory, all at no additional cost to [SEA] [XXXX] [The Project]. Repaired and re-welded joints will then be radiographed.

K. Inspection stamps, code symbol stamps, and other required information shall be stamped on the pipe by using "low stress" steel stamps, or other approved method.

L. All the costs of the radiographing at each weld and the accompanying reports and interpretation shall be paid by Contractor and shall be included in the Contract Price. Contractor shall be responsible for coordination and scheduling of the Work.

3.07 MAGNET PARTICLE AND DYE PENETRANT TESTING

A. Contractor shall coordinate and arrange for dye penetrant or magnetic particle testing by an approved testing laboratory of all new buried socket-weld connections, weldolet connections to existing hydrant lines and all welds on Plidco couplings.

B. The dye penetrant or magnetic particle tests shall be conducted on the entire 360-degree circumference of each weldolet or Plidco connection to the existing hydrant system piping.

C. Testing laboratory shall be selected by and employed by Contractor subject to [SEA] [XXXX] [Project Manager's] [Owner's Representative's] approval.

D. The dye penetrant or magnetic particle testing shall be coordinated by Contractor and conducted at the Project Site such that the Owner and the testing laboratory are provided with adequate notice that welds are available for testing and all the Work required of Contractor in connection with the testing is properly completed at no additional cost to the Project.

E. Reports for field welds shall be submitted throughout the progress of the Work as described in the following paragraphs.

F. All dye penetrant or magnetic particle testing and subsequent reports will be in accordance with the requirements of ASME B31.3 and Section V of the ASME Boiler and Pressure Vessel Code.

G. Each weld shall be assigned a number. Contractor shall maintain a marked up copy of piping drawings identifying the location and number of each weld. Upon completion of the Work, these drawings shall be submitted with as built drawings.

H. Dye penetrant or magnetic particle testing records shall be kept by the testing laboratory which show date, location, area, weld number, and other pertinent information for each weld tested.

I. A summary of this record, and an expert interpretation by the testing laboratory shall be submitted in report form for each weld to [SEA] [XXXX] [Project Manager] [XXXX], Engineer, and Contractor.

J. All fittings shall be left exposed until testing is completed.

K. Welds which do not meet the standards of acceptability as outlined in the above mentioned ASME B31.3, will be judged unacceptable and shall be repaired or cut out and re-welded by Contractor as directed by the testing laboratory, all at no additional cost to [SEA] [XXXX] [The Project]. Repaired and re-welded joints will then be retested.

L. Inspection stamps, code symbol stamps, and other required information shall be stamped on the pipe by using "low stress" steel stamps, or other approved method.

M. All the costs of the testing at each weld and the accompanying reports and interpretation shall be paid by Contractor and shall be included in the Contract Price. Contractor shall be responsible for coordination and scheduling of the testing work.

END OF SECTION 335290

PART 1 - GENERAL

1.01 SUMMARY

A. Marking jet fuel and aviation gasoline piping and equipment.

1.02 RELATED DOCUMENTS

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

1.03 RELATED SECTIONS

A. SECTION 335243 – AVIATION FUELING SYSTEM - GENERAL REQUIREMENTS.
B. SECTION 335243.11 – AVIATION FUELING SYSTEM EQUIPMENT.
C. SECTION 335243.13 – AVIATION FUELING PIPE, MANUAL VALVES AND FITTINGS.
D. SECTION 335243.14 – AVIATION FUELING SYSTEM CONTROL VALVES.
E. SECTION 335280 – LIQUID FUELS PIPE COATING SYSTEMS
F. SECTION 335290 – WELDING FOR FUEL SERVICE PIPING

1.04 REFERENCE STANDARDS

A. Materials and workmanship shall conform to the latest issue of all industry standards, publications, or regulations referenced in this section and with the following references as applicable. Refer to Section 1335243 for listing of issuing organizations or agencies.

B. Applicable Standards:

1. American Petroleum Institute (API):
2. API/EI 1542 - Airport Equipment Marking for Fuel Identification.
3. National Fire Protection Association (NFPA):
4. NFPA 704 Identification of the Fire Hazards of Materials.

1.05 SUBMITTALS

A. Submit Shop Drawings and product data under provisions of Sections [013325 - “Shop and Working Drawings”] [,] [013300 - “Submittal Procedures”] [and] [335243 - “Aviation Fueling System - General Requirements”]

B. Submit drawings showing location of all markings for Project Manager's review.

C. Submit manufacturer's data on brass tags.

D. Submit sample of sign materials with proper size and style of lettering.

PART 2 - PRODUCTS

2.01 MARKING

A. Piping identification labeling shall be with paint and stencil. Paint utilized shall be compatible with fuel pipe external epoxy coating system. Refer to Section 335280.

B. All control valves and instruments shall have brass tags, 2-inch minimum diameter, with tag numbers and service stamped on the tag. Tags shall be securely fastened to the valves and instruments with 4-ply Monel wire meter seals. Tags shall be style 300-BL manufactured by Seaton Name Plate Company, New Haven, Ct., or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Jet fuel pipelines and equipment shall be marked in accordance with API Bulletin No. 1542, Airport Equipment Marking for Fuel Identification.

3.02 PIPELINE AND EQUIPMENT MARKING

A. All valves and basket strainers in Jet A piping shall be painted black.

B. All Jet A piping shall be identified with one black band and the letters “Jet A" in white on a black background.

C. All piping shall have black stenciled arrows indicating direction of flow.

3.03 IDENTIFICATION LOCATIONS

A. Jet fuel identification, "Jet A" shall be made at the locations shown on the drawings.

END OF SECTION **335292**

PART 1 GENERAL

1.01 GENERAL BIORETENTION AND BIOFILTRATION DESIGN REQUIREMENTS

A. All bioretention and biofiltration facilities and soil amendments shall be designed in conformance with the Seattle Tacoma International Airport (STIA) Stormwater Management Manual for Port Aviation Division, Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington (SWMMWW), and STIA Low Impact Development (LID) Guideline.

B. All bioretention, biofiltration, and compost-amended BMPs must be sited in conformance with the STIA LID Guideline document.

1.02 BIORETENTION DESIGN REQUIREMENTS

A. Soils and infiltration testing shall be performed by a soil engineer/professional in accordance with the STIA stormwater manual.

B. 3-foot minimum depth between bottom of bioretention and top of groundwater or hydraulically restrictive layer unless approved by the Port.

C. 4-inch max ponding depth

D. Facility must drain within 48 hours

E. Constructed with underdrain

F. Vegetation consistent with STIA Wildlife Hazard Management Plan (WHMP)

G. 6-inch minimum freeboard (measured from the overflow elevation to the top of bioretention facility). Overflow systems will be determined by the Engineer.

H. 1-foot minimum bottom width and 3H:1V max vegetated side slopes.

I. 18-inch bioretention soil mix depth and design mix in accordance with Section BMP T7.30 of the SWMMWW.

J. Use Port-developed models and parameters for areas specified in the STIA stormwater manual in approved continuous models.

K. Follow STIA Low Impact Development (LID) Guideline and Ecology's manual (site suitability, soil/compost mix, curb cuts, sizing, underdrain).

1.03 COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS) BIOFILTRATION DESIGN REQUIREMENTS

A. Compost amended vegetated filter strips (CAVFS) shall be designed using Sections BMP T7.40 and T9.40 of the SWMMWW and extended CAVFS shall be designed following the STIA LID guidelines.

B. 8-inches of compost amended soil in accordance with Section BMP T7.40 of the SWMMWW.

C. In on-airfield areas, plant grass and incorporate only 2 inches of compost into the upper 4 inches of soil for extended CAVFS.

D. For extended CAVFS along runways, lengths are typically 100 feet or greater (3 to 4 times greater than length requirements in Section BMP T9.40 of the SWMMWW).

E. Within air-field areas, soil should be compacted to no less than 95% proctor to meet FAA requirements.

F. 1-inch maximum water depth for all CAVFS.

G. Designed for a 9-minute minimum hydraulic residence time at the water quality design flow rate and 0.5 foot per second maximum velocity per Section BMP T9.40 of the SWMMWW.

H. 5% maximum longitudinal slope, 2% lateral slope, and 150-foot maximum drainage flowpath of the CAVFS contributing area.

1.04 SOIL AMENDMENT AND DEPTH DESIGN REQUIREMENTS

A. All soil areas disturbed or compacted during construction, and not covered by buildings or pavement, must be amended with compost as described below.

B. 8-inches of compost amended soil in accordance with Section BMP T5.13 of SWMMWW.

C. Within one foot of pavement edge, curbs, and sidewalks, soil should be compacted to approximately 90% proctor to ensure a firm surface.

D. Within air-field areas, soil should be compacted to no less than 95% proctor to meet FAA requirements.

1.05 SUBMITTALS

Submit materials data for all product listed below in accordance with of Section 013300 - Submittals.

Submit testing requirement results as defined below.

1.06 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) applicable provisions

B. American Society for Testing Materials (ASTM) applicable provisions

C. Seattle Tacoma International Airport (STIA) Stormwater Management Manual for Port Aviation Division applicable sections

D. Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington (SWMMWW) applicable sections

E. Seattle Tacoma Internal Airport (STIA) Low Impact Development Guideline applicable sections

F. Seattle Tacoma International Airport (STIA) Wildlife Hazard Management Plan (WHMP) applicable sections

PART 2 PRODUCTS

2.01 BIORETENTION

A. Bioretention Soil Mix

Bioretention Soil Mix shall be a well-blended homogeneous mixture of 60 to 65 percent by volume of Bioretention Drain Rock and 35 to 40 percent by volume of Bioretention Compost as detailed below.

The Bioretention Soil Mix shall be tested to confirm that it meets the following criteria:

Parameter	Method	Requirement
Cation Exchange Capacity	EPA 9081	≥ 5 meq CEC/100 g dry soil
Organic Matter Content	ASTM D 2974 or TMECC 05.07A	5-8% (by dry weight)
Permeability Rate	ASTM D 2434 (using 2012 SWMMWW procedure on BSM 85% compacted per ASTM D 1557)	Initial infiltration rate between 6 inches and 12 inches per hour.

1. Drain Rock:

Drain Rock for Bioretention Soil Mix shall be free of wood, waste, coating, or any other deleterious material, and all aggregate passing the No. 200 sieve must be non-plastic. Drain rock shall consist of crushed, processed, or naturally occurring granular material. Drain Rock shall not consist of recycled granular material. It must be analyzed by an accredited lab using the sieve sizes shown below to meet the following gradation using ASTM D 422:

Sieve Size	Percent Passing (By Weight)
3/4”	100
No. 4	28-56
No. 8	20– 50
No. 50	3 – 12
No. 200	0-1
Abrasion (Max.) %	35

2. Compost to Aggregate Ratio, Organic Matter Content, and Cation Exchange Capacity for Default BSM

    1. Compost to aggregate ratio: 60-65 percent drain rock, 35 – 40 percent compost by volume.

    2. Organic matter content: 5 – 8 percent by weight.

    3. Cation Exchange Capacity (CEC) must be > 5 milliequivalents/100 g dry soil Note: Soil mixes meeting the above specifications do not have to be tested for CEC. They will readily meet the minimum CEC.

3. Compost for Default BSM

    1. To ensure that the BSM will support healthy plant growth and root development, contribute to biofiltration of pollutants, and not restrict infiltration when used in the proportions cited herein, the following compost standards are required.

    2. Meets the definition of "composted material" in WAC 173-350-100 and complies with testing parameters and other standards in WAC 173-350-220.

    3. Produced at a composting facility that is permitted by the jurisdictional health authority. Permitted compost facilities in Washington are included in a spreadsheet titled *Washington composting facilities and material types – 2017* at the following web address:

https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Managing-organics-compost

    4. The compost product must originate a minimum of 65 percent by volume from recycled plant waste comprised of "yard debris," "crop residues," and "bulking agents" as those terms are defined in WAC 173-350-100. A maximum of 35 percent by volume of "post-consumer food waste" as defined in WAC 173-350-100, but not including biosolids or manure, may be substituted for recycled plant waste.

    5. Stable (low oxygen use and CO_2 generation) and mature (capable of supporting plant growth) by tests shown below. This is critical to plant success in bioretention soil mixes.

    6. Moisture content range: no visible free water or dust produced when handling the material.

7. Tested in accordance with the U.S. Composting Council "Test Method for the Examination of Compost and Composting" (TMECC), as established in the Composting Council's "Seal of Testing Assurance" (STA) program. Most Washington compost facilities now use these tests.

8. Screened to the following size gradations for Fine Compost when tested in accordance with TMECC test method 02.02-B, Sample Sieving for Aggregate Size Classification."

9. Fine Compost shall meet the following gradation by dry weight

   (1) Minimum percent passing 2": 100%

   (2) Minimum percent passing 1": 99%

   (3) Minimum percent passing 5/8": 90%

   (4) Minimum percent passing ¼": 75%

10. pH between 6.0 and 8.5 (TMECC 04.11-A). "Physical contaminants" (as defined in WAC 173-350-100) content less that 1% by weight (TMECC 03.08-A) total, not to exceed 0.25 percent film plastic by dry weight.

11. Minimum organic matter content of 40% (TMECC 05.07-A "Loss on Ignition)

12. Soluble salt content less than 4.0 dS/m (mmhos/cm) (TMECC 04.10-A "Electrical Conductivity, 1:5 Slurry Method, Mass Basis")

13. Maturity indicators from a cucumber bioassay (TMECC 05.05-A "Seedling Emergence and Relative Growth) must be greater than 80%for both emergence and vigor")

14. Stability of 7 mg CO2-C/g OM/day or below (TMECC 05.08-B "Carbon Dioxide Evolution Rate")

15. Carbon to nitrogen ratio (TMECC 05.02A "Carbon to Nitrogen Ratio" which uses 04.01 "Organic Carbon" and 04.02D "Total Nitrogen by Oxidation") of less than 25:1. The C:N ratio may be up to 35:1 for plantings composed entirely of Puget Sound Lowland native species and up to 40:1 for coarse compost to be used as a surface mulch (not in a soil mix).

B. <u>Underdrain</u>

1. Perforated polyvinyl chloride underdrain pipe and fittings must be either ASTM D2241 SDR 21 (Class 200) or ASTM D1785

Schedule 40. ASTM D2241. There shall be 4 rows of slotted perforations evenly spaced around the circumference of the pipe. The slotted perforations must be 0.064-in wide by 1-in long and spaced 0.3-inches apart on center.

2. The ends of the underdrain pipe, not connected to downstream catch basin, shall be fitted with a removable PVC cap or cleanout.

C. Bioretention Weir

1. Well-mixed 6-8" diameter Streambed Aggregate

D. Bioretention Presettling Zone

1. Class 3000 Cement Concrete

2. Drain Rock

1. Drain Rock for Bioretention Presetting zone consist of crushed, partially crushed, or naturally occurring granular material specified below:

Sieve Size	Percent Passing (By Weight)
3/4"	100
No. 4	28-56
No. 8	20– 50
No. 50	3 – 12
No. 200	0-1
Abrasion (Max.) %	35

3. Well-mixed 6-8" diameter Streambed Aggregate

1. Aggregates for streambed construction shall be washed, naturally formed, round to sub angular hard, strong, sound, durable, fracture free pieces of igneous and metamorphic rock. Aggregate shall be free of soft, weathered materials and seams of soft rock, shall not contain any wood and other waste, and shall be free of any coating.

2. The Contractor shall submit certified test reports indicating streambed aggregate complies with the following requirements:

(1) All sand size aggregate (passing a U.S. No. 4 sieve and retained on a US No. 200 sieve) shall meet the following requirements:

Specific Gravity	AASHTO T84	Minimum 2.65

(2) All gravel (passing a 3 inch sieve and retained on a U.S. No. 4 sieve) and cobble (passing a 12 inch sieve and retained on a 3 inch sieve) aggregate shall meet the same requirements for sand size aggregate and the following additional requirements:

Soundness	ASTM C 88	Not greater than 5% loss
L.A. Abrasion	AASHTO T 96	Max 20% loss at 500 revolutions

3. Gradations:

Streambed Aggregate	
Sieve Size	Percent Passing
8 inch	95-100
3” square	45-60
1 ½” square	30-40
¾” square	10-20
U.S. No. 4	0-3

The portion passing the U.S. No.4 sieve size shall have a minimum sand equivalent of 60

4. Geotextile for Separation

E. Curb cuts shall be constructed as directed by the Engineer. Portland cement shall conform to requirements of ASTM C150 - Type I and II or ASTM C595 - Type IP, IS, and IL. If for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

F. Geotextile for Separation

1. Drainage geosynthetic fabric shall be a non-woven geosynthetic conforming to the requirements in 33 46 16, for Construction Geotextile for Underground Drainage, Moderate Survivability, Class B.

2.02 CAVFS and Extended CAVFS:

2.02.1 Medium Compost

Compost per Section 2.01-A.3

2.02.2 Topsoil A

Topsoil Type A shall meet the following requirements:

1. Cation exchange capacity (CEC) of Topsoil Type A shall be a minimum of 5 milliequivalents CEC/100 g dry soil (U.S. EPA Method 9081).

2. Organic content greater than 8-percent but less than 15-percent as measured on a dry weight basis using AASHTO T 267 Determination of Organic Content in Soils by Loss on Ignition.

Topsoil Type A shall be 60-percent to 70-percent Sandy Loam and 40-percent to 30-percent Fine Compost by volume. Sandy Loam shall be as defined by the US Department of Agriculture Soil Classification System.

The Contractor shall submit a Particle Size Analysis as a Type 1 Working Drawing from an independent accredited soils testing laboratory indicating the Material source and compliance with all Topsoil Type A specifications. The laboratory analysis shall be with a sample size of no less than 2 pounds.

2.03 SOIL AMENDMENT:

1. A topsoil layer with a minimum organic matter content of 10% dry weight in planting beds, and 5% organic matter content in turf areas, and a pH from 6.0 to 8.0 or matching the pH of the undisturbed soil. The topsoil layer shall have a minimum depth of eight inches except where tree roots limit the depth of incorporation of amendments needed to meet the criteria. Subsoils below the topsoil layer should be scarified at least 4 inches with some incorporation of the upper material to avoid stratified layers, where feasible.
2. Mulch planting beds with 2 inches of organic material.
3. Use compost and other materials that meet the following organic content requirements:
    1. The organic content for "pre-approved" amendment rates can be met only using compost meeting the Compost for Default Bioretention Soil Media (BSM) in Section 2.01.A.3 with the exception that the compost may have up to 35% biosolids or manure.

2. The compost must also have an organic matter content of 40% to 65%, and a carbon to nitrogen ratio below 25:1.
3. The carbon to nitrogen ratio may be as high as 35:1 for plantings composed entirely of plants native to the Puget Sound Lowlands region.

PART 3 EXECUTION – To be provided by Design Engineer.

PART 4 TESTING

4.01 SOIL INFILTRATION TESTING

A. In order to demonstrate suitable infiltration capability for bioretention, the underlying soil of bioretention facilities shall be tested according to the STIA stormwater manual. Contractor shall submit testing plan to engineer.

END OF SECTION

PART 1 – GENERAL

1.01 DESIGN REQUIREMENTS

A. Concrete barriers shall be 42-inches tall.

B. Refer to Washington State Department of Transportation (WSDOT) Design Manual and Standard Plans for Traffic Barrier requirements for new projects.

C. If existing concrete barrier to remain is less than 42-inches tall, it shall be retrofitted in conformance with Standard Details SD-911A and SD-911B (Appendix A). Design Engineer shall coordinate with Port F&I as required.

1.02 REFERENCES

A. Washington State Department of Transportation (WSDOT) Design Manual (current edition)

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 – Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions for all products including:

1. Submit project-specific shop drawings, including engineering calculations as required.

PART 2 – PRODUCTS – To be provided by Design Engineer

PART 3 – EXECUTION – To be provided by Design Engineer

PART 4 – TESTING – To be provided by Design Engineer

END OF SECTION

PART 1 GENERAL

1.01 DESIGN REQUIREMENTS

A. General:
   1. Design, size, and locate piping support systems, whether shown in drawings and details or not.
   2. Meet requirements of MSS SP 58 and ASME B31.1 or as modified by this section.

B. Pipe Support Systems:
   1. Design pipe support systems for gravity and thrust loads imposed by weight of pipes or internal pressures, weight of fluid in pipes.
   2. Design pipe support systems for seismic loads in accordance with governing codes and site-specific design criteria.
   3. Design pipe support systems for wind loads in accordance with governing codes and site-specific design criteria.
   4. Maximum Support Spacing and Minimum Rod Size: In accordance MSS SP 58 Table 3 and Table 4.
      a. Ductile-iron Pipe 8 Inches and Under: Maximum span limited to that for standard weight steel pipe for water service.
      b. Ductile-iron Pipe 10 Inches and Larger: Maximum span limited to 20 feet.

C. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.

D. Vertical Sway Bracing: 10-foot maximum centers.

1.02 SUBMITTALS

A. Action Submittals:
   1. Catalog information and drawings of piping support system, locating each support, sway brace, seismic brace, hanger, guide, component, and anchor for piping 6 inches and larger. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number.
   2. Calculations for each type of pipe support, attachment and anchor.

3. Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.
4. Seismic anchorage and bracing drawings, and cut sheets.

B. Informational Submittals:

1. Seismic anchorage and bracing calculations that use site-specific design criteria.
2. Maintenance information on piping support system.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
2. American Society of Mechanical Engineers (ASME): B31.1, Power Piping.
3. Manufacturers' Standardization Society (MSS):
    a. SP 58, Pipe Hangers and Supports—Materials, Design and Manufacture.
    b. SP 127, Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, and Application.

B. Piping support systems shall be designed and Shop Drawings prepared and sealed by a Registered Professional Engineer in the State of Washington.

2 PART 2 PRODUCTS

2.01 GENERAL

A. Pipe supports shall be manufactured from Type 316 stainless steel.

3 PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install support systems in accordance with MSS SP 58, unless shown otherwise.
2. Support no pipe from pipe above it.
3. Support piping connections to equipment or valve by pipe support and not by equipment or valve.

4. A Support large or heavy valves, fittings, and appurtenances independently of connected piping.
5. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
6. Do not use adhesive anchors, and do not attached supports for horizontal pipes to ceiling or walls.
7. Do not install pipe supports in equipment or maintenance access areas.
8. Install lateral supports for seismic loads at changes in direction.
9. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
10. Repair mounting surfaces to original condition after attachments are completed.

B. Standard Pipe Supports:

1. Where pipe support type is not shown on the Drawings, the following pipe supports shall be used wherever possible.
2. Horizontal Piping Supported from Floors:
    a. Saddle Supports:
        i. Pedestal Type, elbow and flange.
        ii. Provide minimum 1-1/2-inch grout beneath baseplate.
    b. Floor Mounted Channel Supports:
        i. Use for pipe smaller than 3-inch running along floors and in trenches at pipe elevations lower than can be accommodated using pedestal pipe supports.
        ii. Attach channel framing to floors with baseplate on minimum 1-1/2-inch nonshrink grout and with anchor bolts.
        iii. Attach pipe to channel with clips or pipe clamps.
    c. Concrete Cradles: Use for pipe larger than 3 inches along floor and in trenches at pipe elevations lower than can be accommodated using stanchion type.
3. Vertical Pipe: Support with wall bracket and elbow support, or riser clamp on floor penetration.

C. Standard Attachments:

1. New Concrete Ceilings: Concrete inserts, concrete attachment plates, or concrete anchors as limited below:

a. Single point attachment to ceiling allowed only for 3/4-inch rod and smaller (8 inches and smaller pipe).
b. Where there is vibration or bending considerations, do not connect a single pipe support hanger rod directly to a drilled concrete anchor (single point attachment) regardless of size.

2. Existing Concrete Ceilings: Channel type support with minimum of two anchor points, concrete attachment plates or concrete anchors as limited below:
   a. Single point attachment to ceiling is allowed only for 3/4-inch rod and smaller (8 inches and smaller pipe).
   b. Where there is vibration or bending considerations do not connect a single pipe support hanger rod directly to a drilled concrete anchor (single point attachment) regardless of size.
3. Concrete Walls: Concrete inserts or brackets or clip angles with concrete anchors.

D. Saddles for Steel or Concrete Pipe: Provide 90-degree to 120-degree pipe saddle for pipe sizes 6 inches and larger when installed on top of steel or concrete beam or structure, pipe rack, trapeze, or where similar concentrated point supports would be encountered.

E. Intermediate and Pipe Alignment Guides:
1. Provide pipe alignment guides, or pipe supports that provide same function, at expansion joints and loops.
2. Guide pipe on each side of expansion joint or loop at 4 pipe and 14 pipe diameters from each joint or loop.
3. Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.

F. Accessories:
1. Dielectric Barrier:
   a. Provide between painted or galvanized carbon steel members and copper or stainless steel pipe or between stainless steel supports and nonstainless steel ferrous metal piping.
   b. Install rubber wrap between submerged metal pipe and oversized clamps.

PART 4 TESTING – To be provided by Design Engineer.

END OF SECTION

SEATTLE-TACOMA INTERNATIONAL AIRPORT

FACILITIES AND INFRASTRUCTURE

CIVIL SYSTEMS STANDARDS

APPENDIX A

STANDARD DETAILS

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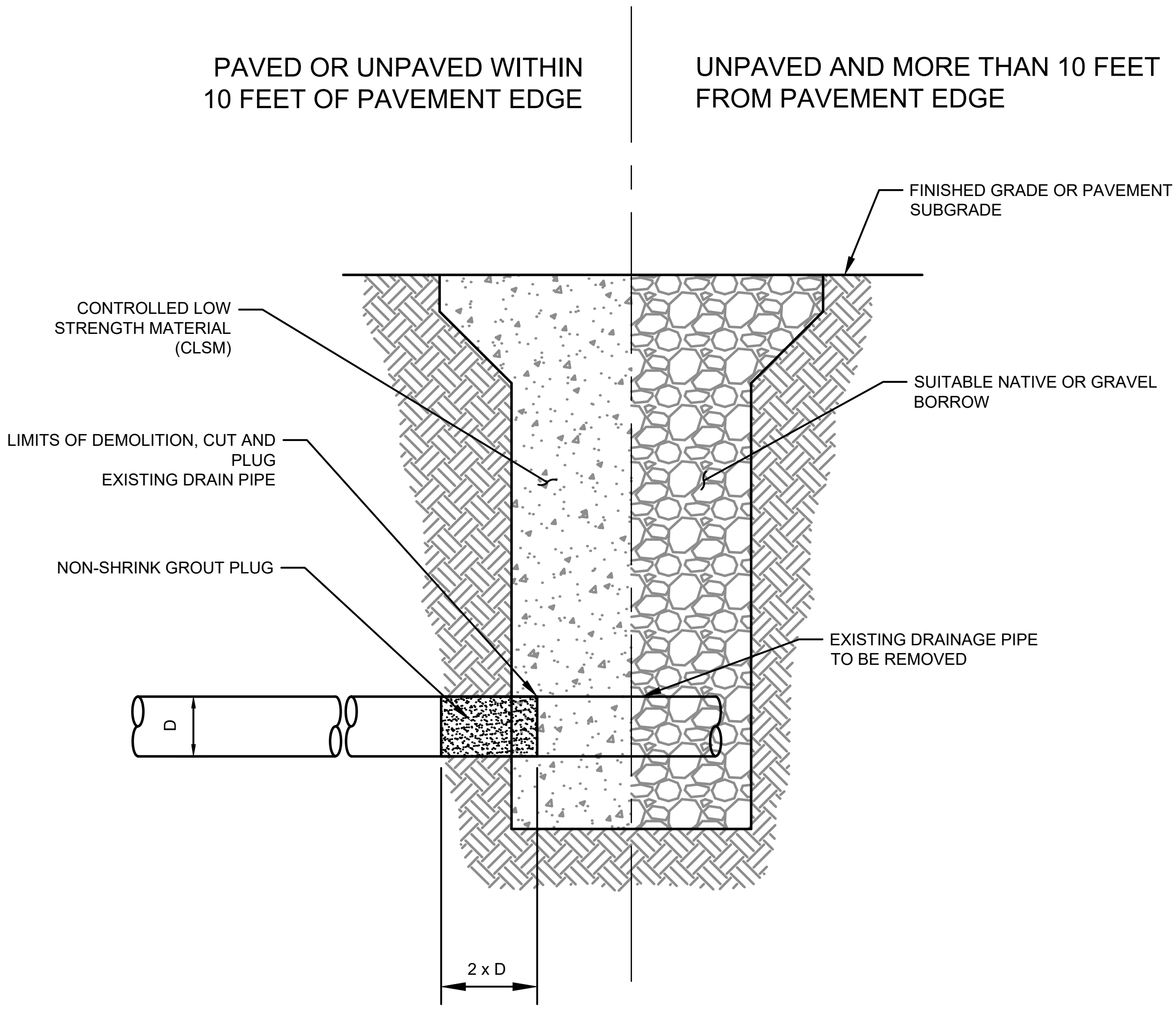


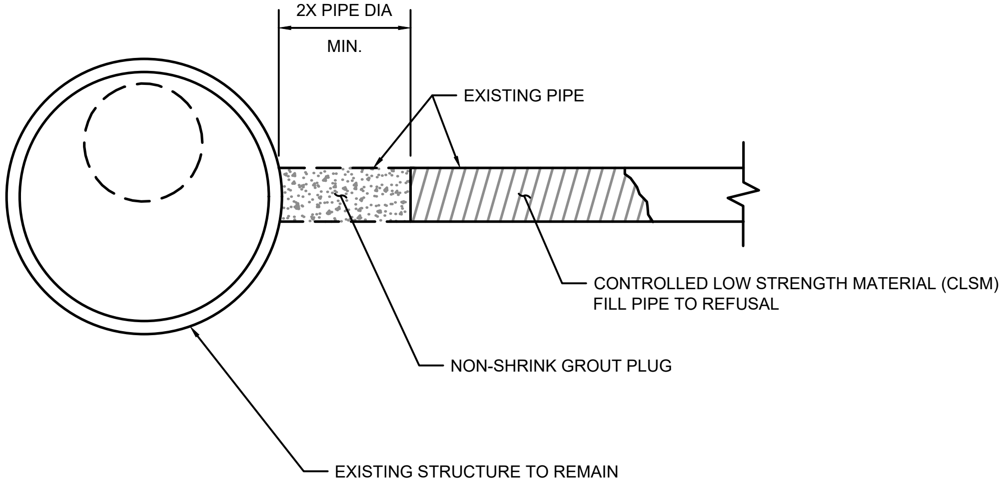
DETAIL
TYPICAL UTILITY DEMOLITION
SCALE: NTS

1
001

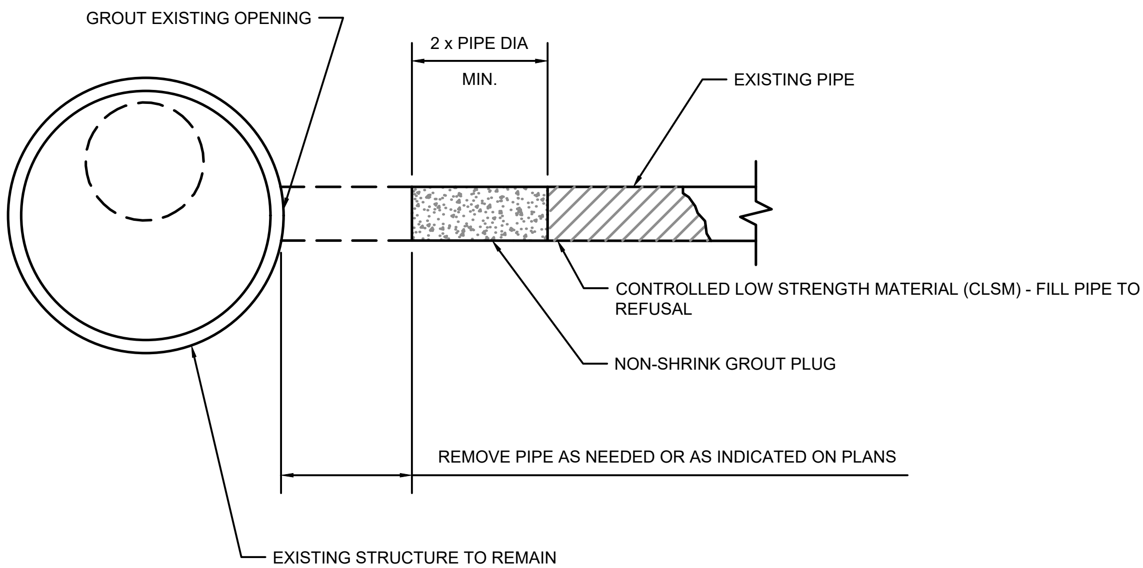
NOTES:

1. BACKFILL MATERIALS SHALL MEET THE REQUIREMENTS OF SECTION 31 23 33 UTILITY TRENCHING AND BACKFILL.
2. SUITABLE NATIVE OR GRAVEL BORROW BACKFILL SHALL BE COMPACTED TO 95% MAX. DENSITY.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	TYPICAL UTILITY DEMOLITION
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 001



PLAN VIEW (OPTION 1)



PLAN VIEW (OPTION 2)

DETAIL

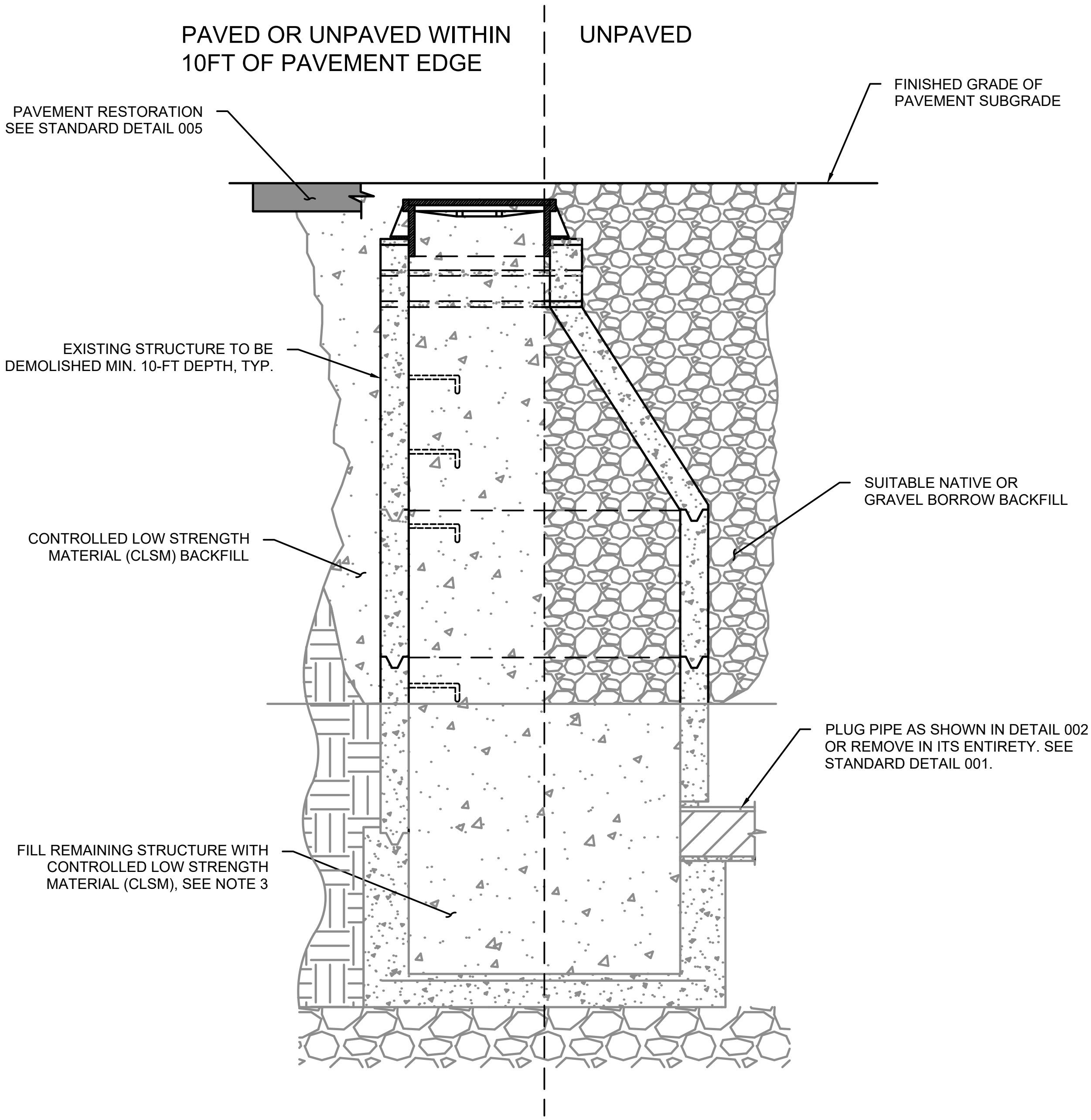
PIPE ABANDONMENT
SCALE: NTS

1
002

NOTES:

1. PIPING SHALL ONLY BE ABANDONED IN PLACE WHERE SPECIFICALLY APPROVED BY PORT FACILITIES AND INFRASTRUCTURE.
2. ABANDONED PIPE SHALL BE MARKED ON AS-BUILT DRAWINGS FOR RECORD KEEPING.
3. PIPE ABANDONMENT OPTION 2 SHALL BE LIMITED TO 6-INCH AND SMALLER ABANDONED PIPE OR TO PROVIDE SPACE FOR NEW PIPE CONNECTION TO THE EXISTING MANHOLE.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE	PIPE ABANDONMENT
	DATE: JAN. 2024	STANDARD DETAIL NO. 002



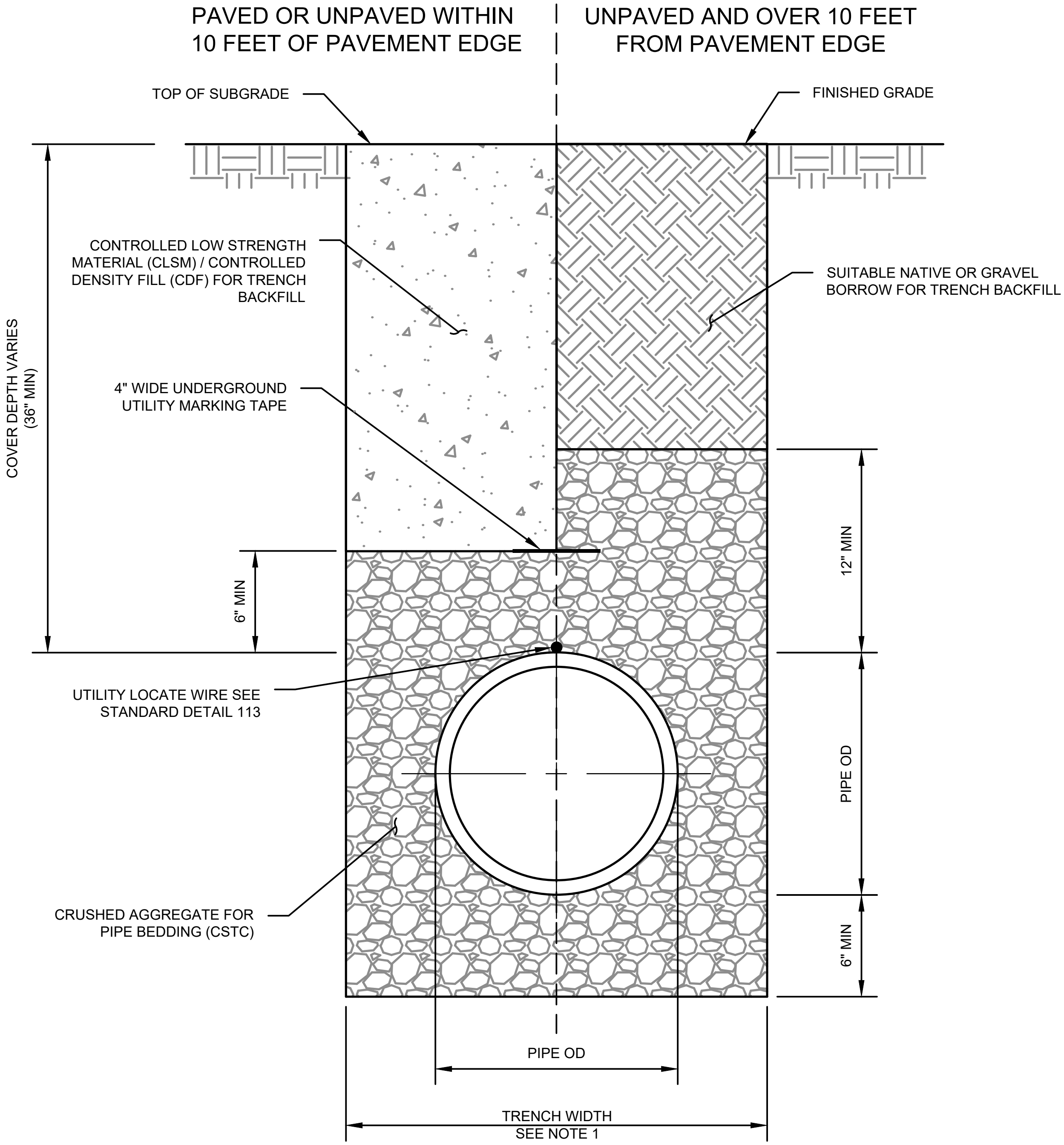
DETAIL 1/003

MANHOLE ABANDONMENT
SCALE: NTS

NOTES:

1. BACKFILL MATERIALS SHALL MEET THE REQUIREMENTS OF SECTION 31 23 33 UTILITY TRENCHING AND BACKFILL.
2. SUITABLE NATIVE OR GRAVEL BORROW BACKFILL SHALL BE COMPACTED TO 95% MAX. DENSITY (MODIFIED PROCTOR).
3. ABANDON-IN-PLACE OF EXISTING STRUCTURE SHALL ONLY BE ALLOWED WITH POS VARIANCE APPROVAL.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	MANHOLE ABANDONMENT
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 003



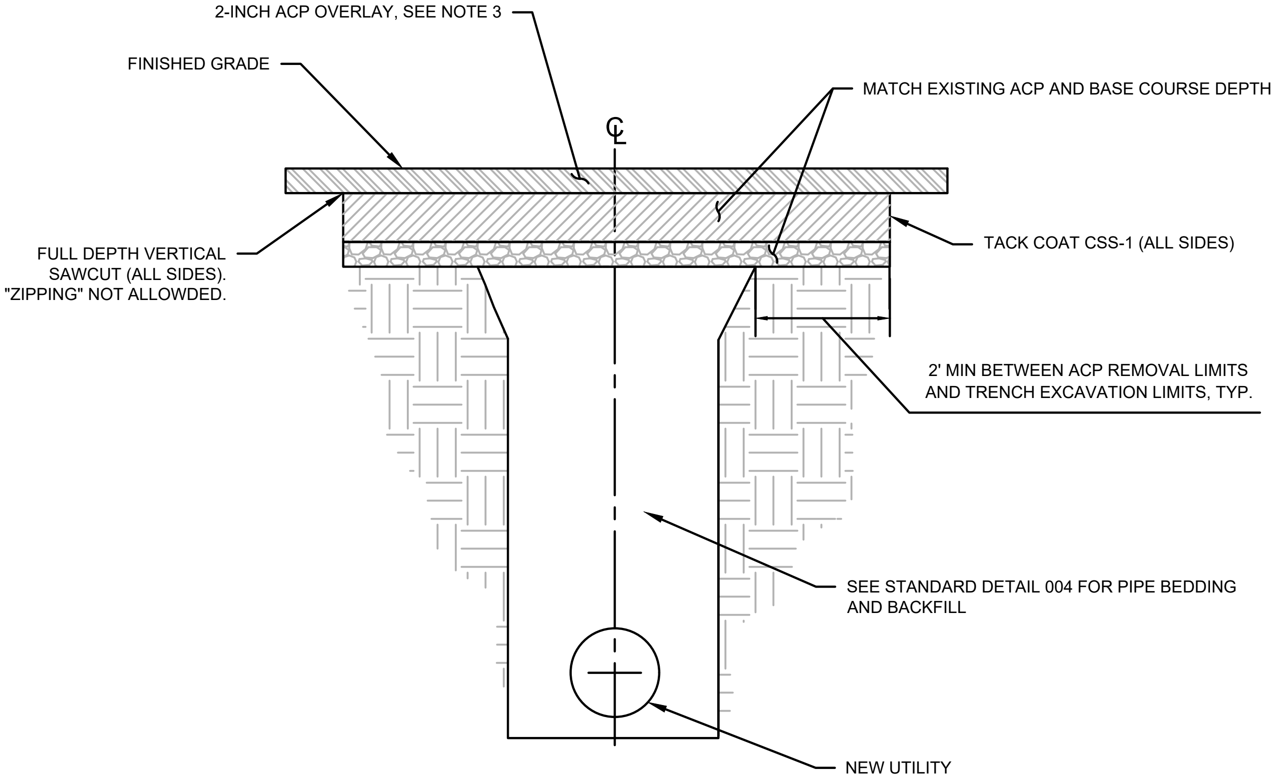
SECTION 1 / 004

PIPE BEDDING AND TRENCH BACKFILL
SCALE: NTS

NOTES:

1. PIPE TRENCH WIDTH SHALL BE: FOR OD >/= 18" : (1.5 X I.D.) + 18" FOR OD < 18": I.D. + 30"
2. CDF TRENCH DAMS (ALL UTILITIES): INSTALL 5' OF CLSM IN LIEU OF UTILITY BEDDING AND TRENCH BACKFILL AT LOCATIONS TO BE INDICATED BY ENGINEER. IF NONE ARE SHOWN, PROVIDE AT A MAXIMUM SPACING OF 500 FEET OF PIPE LENGTH.
3. ALL BACKFILL AND PIPE BEDDING SHALL MEET THE REQUIREMENTS OF SECTION 31 23 33 - UTILITY TRENCHING AND BACKFILL.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	PIPE BEDDING AND TRENCH BACKFILL
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 004

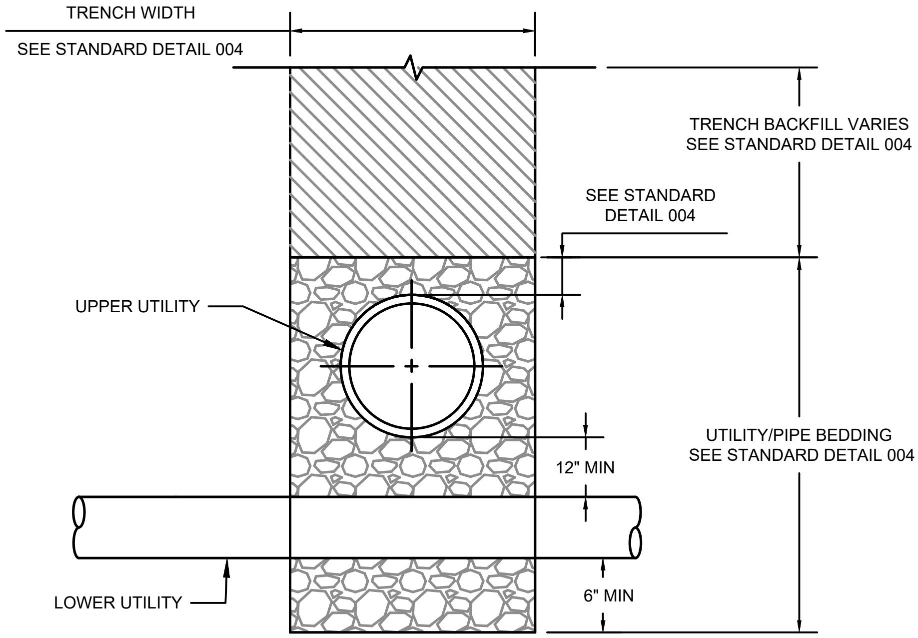


SECTION 1/005
ACP TRENCH PATCH
SCALE: NTS

NOTES:

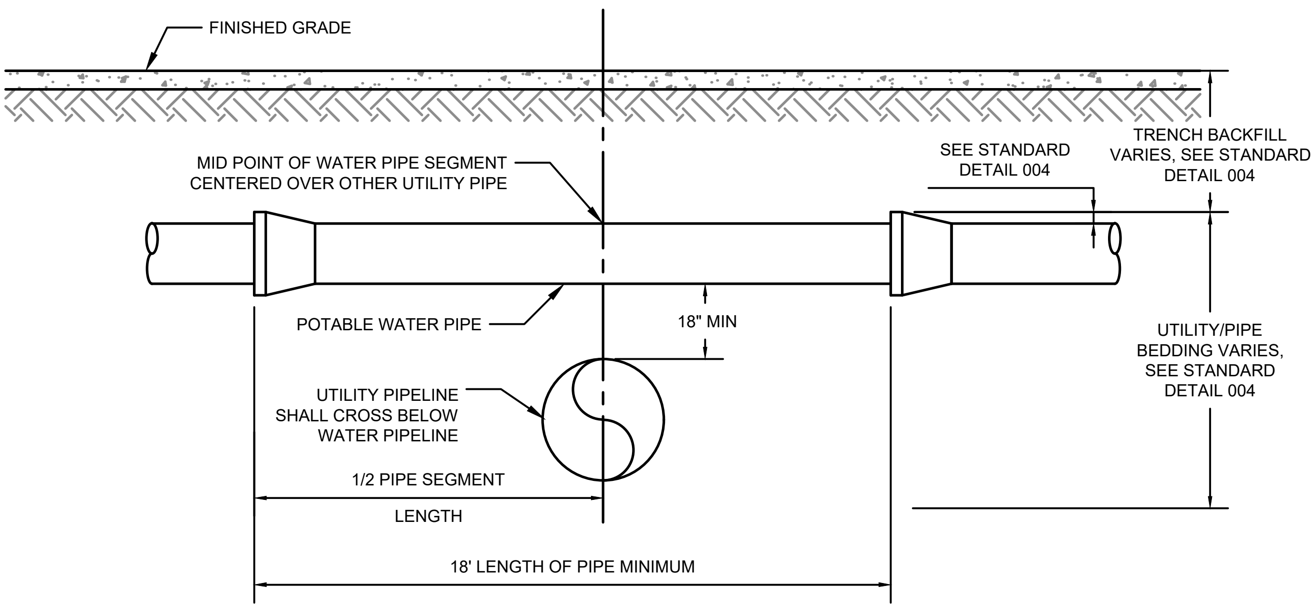
1. ACP SHALL BE HMA CLASS PG 58H-22 COMPACTED TO 92% MAXIMUM DENSITY (MODIFIED PROCTOR).
2. BASE COURSE SHALL BE CRUSHED SURFACING TOP COURSE (3/4"-MINUS) COMPACTED TO 95% MAXIMUM DENSITY (MODIFIED PROCTOR).
3. TRENCH PARALLEL TO ROADWAY SHALL BE REQUIRED OF AT LEAST HALF-WIDTH PAVEMENT OVERLAY FOLLOWING TRENCH PAVEMENT RESTORATION. POS MAY REQUEST FULL-WIDTH OVERLAY ON A CASE BY CASE BASIS DEPEND UPON TRENCH PAVEMENT RESTORATION CONDITIONS.
4. ALL OPEN TRENCHES SHALL BE NON-SKID PLATED, PINNED, SHIMMED (SUITABLE FOR H20 LOADING) OR BACKFILLED AND CAPPED WITH TEMPORARY HMA WHERE AUTHORIZED BY POS AT THE END OF EACH WORK DAY.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	ACP TRENCH PATCH
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 005



DETAIL 1/006

TYPICAL UTILITY CROSSINGS
(EXCLUDING WATER)
SCALE: NTS



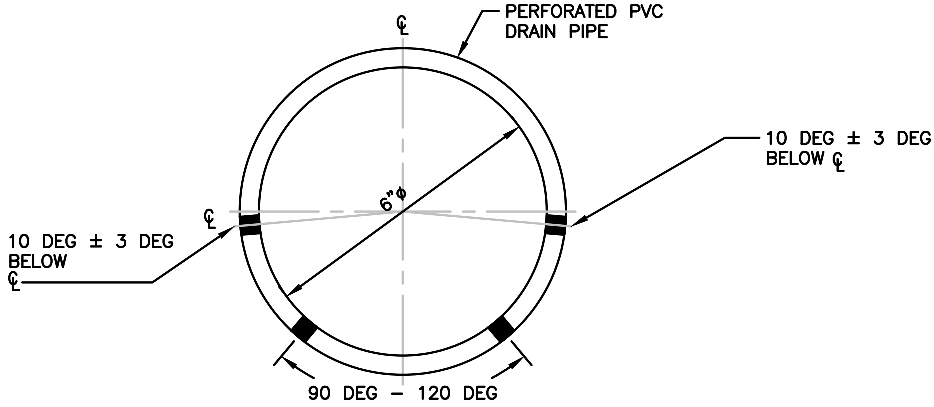
DETAIL 2/006

WATER PIPE CROSSING
SCALE: NTS

NOTES:

1. VERTICAL SEPARATION BETWEEN STORM DRAIN, IWS, SANITARY SEWER, AND OTHER NON-POTABLE WATER CONVEYANCE OR UTILITY SHALL BE 12" OR MORE. VERTICAL SEPARATIONS LESS THAN 12" MUST BE APPROVED BY F&I AND CLSM SHALL BE USED AS BEDDING BETWEEN UTILITIES.
2. FOR ALL WATER MAIN CROSSINGS REFER TO DETAIL 2, THIS SHEET.
3. WHEN CROSSING CATHODIC PROTECTED UTILITY (I.E. JET FUEL), PROVIDE INSULATED BLANKET PER STANDARD DETAIL 700.
4. FOR ALL WATER PIPE CROSSINGS, SEE SECTION 33 10 00 (WATER DISTRIBUTION REQUIREMENTS) PART 1.05, UTILITY CLEARANCE REQUIREMENTS.

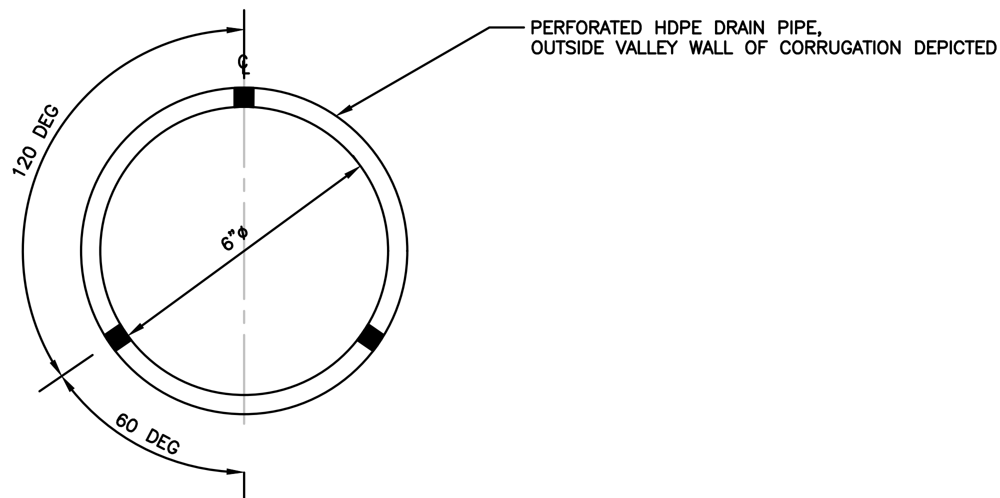
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	TYPICAL UTILITY CROSSINGS
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 006



DETAIL 1/100

TYPICAL PERFORATIONS FOR 6" DIA
PVC DRAIN PIPE
SCALE: NTS

NOTES:
1. PIPE SHALL UTILIZE AASHTO M278 PERFORATION PATTERN AS SHOWN ON DETAIL.
2. SEE SECTION 334116, SUBDRAINAGE.

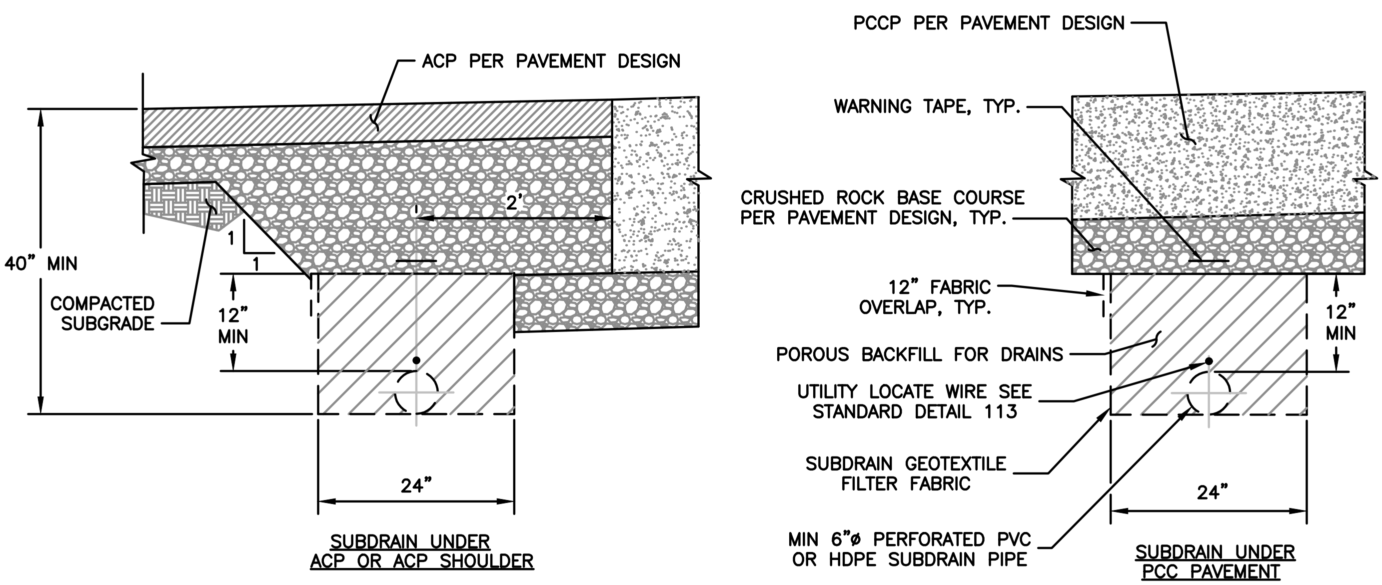


DETAIL 2/100

TYPICAL PERFORATIONS FOR 6" DIA
HDPE DRAIN PIPE
SCALE: NTS

NOTES:
1. PIPE SHALL UTILIZE AASHTO M252 CLASS II PERFORATIONS AS SHOWN ON DETAIL.
2. SEE SECTION 334116, SUBDRAINAGE.

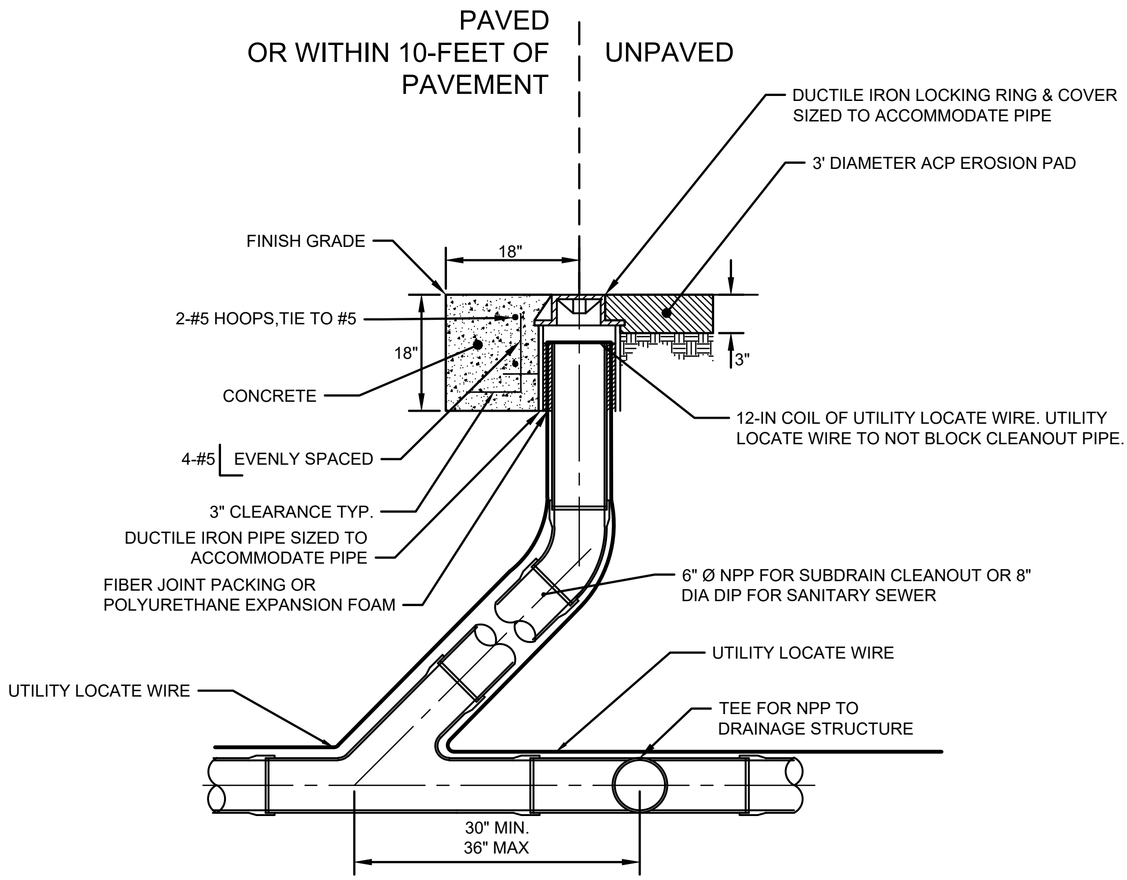
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	SUBDRAIN PIPE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **100**



SECTION 1/101
SUBDRAIN SYSTEM UNDER PAVEMENT
SCALE: NTS

NOTES:
1. SEE STANDARD DETAIL 102 FOR CLEANOUT DETAILS.
2. SEE STANDARD DETAIL 100 FOR SUBDRAIN PIPE.
3. SEE SECTION 334116, SUBDRAINAGE, FOR POROUS BACKFILL FOR DRAINS AND OTHER PIPING REQUIREMENTS.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	SUBDRAIN SYSTEM UNDER PAVEMENT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **101**



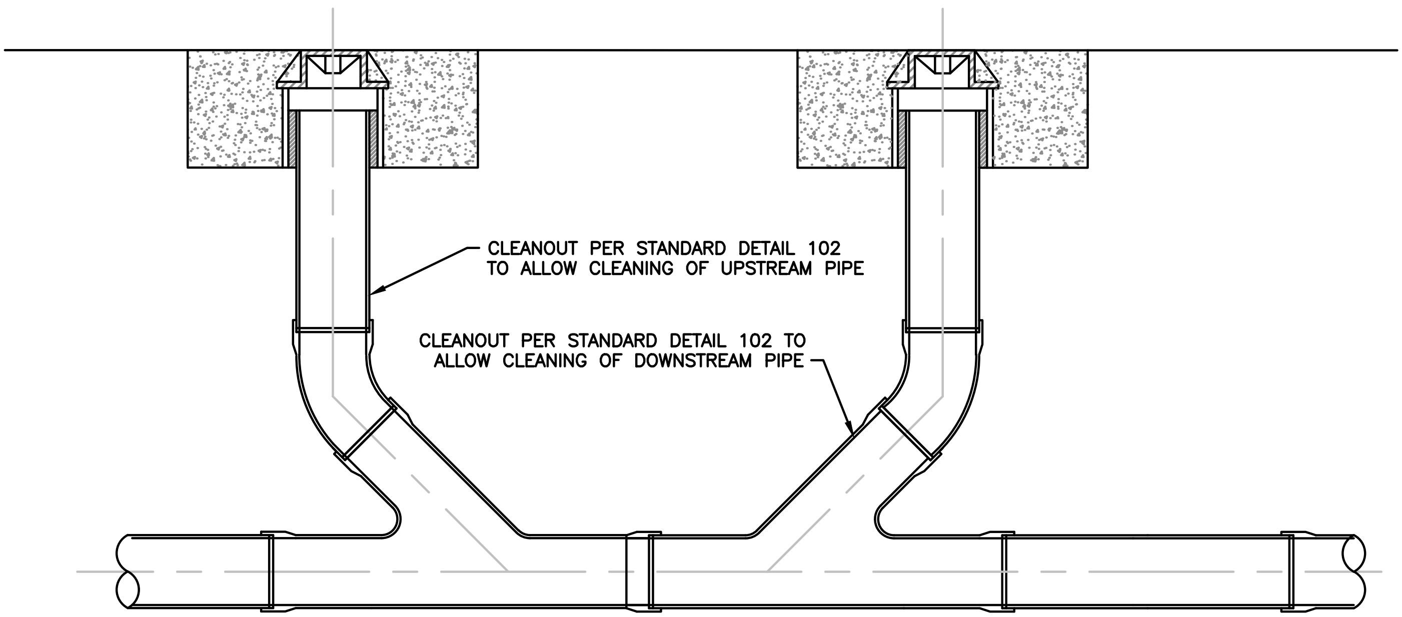
SECTION

1
102

TYPICAL CLEANOUT
SCALE: NTS

NOTES:

1. NPP (NON PERFORATED PIPE) MATERIAL FOR CLEANOUTS SHALL MATCH PIPE MATERIAL STANDARD OF SUBDRAIN SYSTEM OR HORIZONTAL CONVEYANCE PIPING.
2. METAL CASTINGS SHOULD MEET THE LOADING REQUIREMENTS IN SPEC SECTION 334241.
3. UTILITY LOCATE WIRE SHALL BE PER SECTION 32233, UTILITY TRENCHING AND BACKFILL.

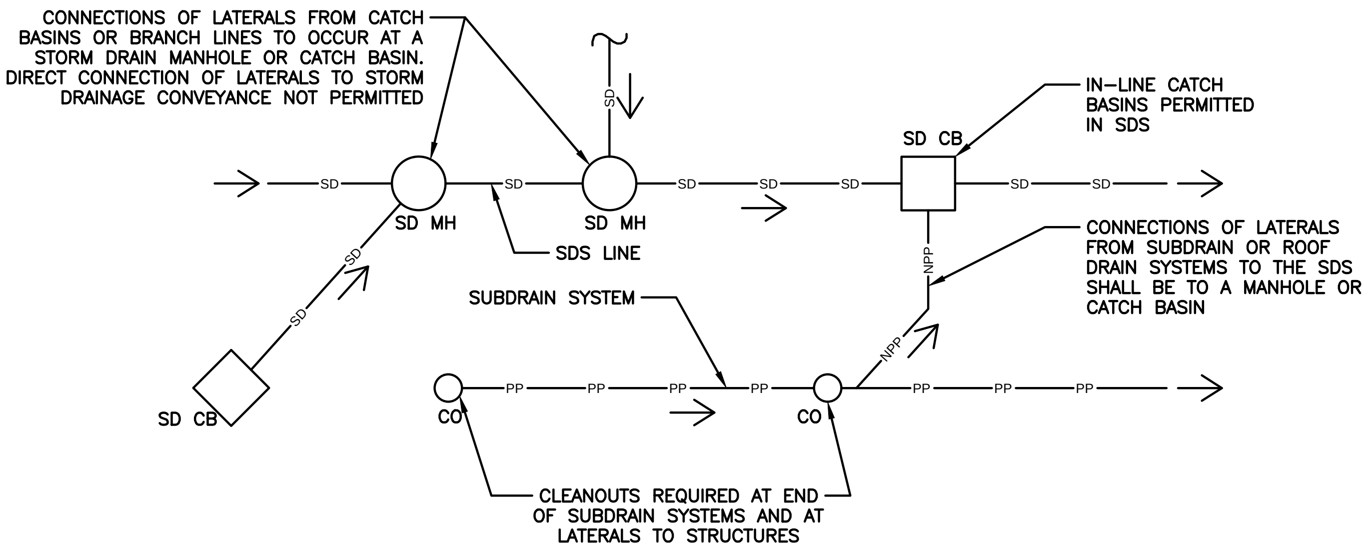


DETAIL 1/103

TYPICAL DOUBLE CLEANOUT
SCALE: NTS

NOTES:
1. SEE STANDARD SPECIFICATION 333111 FOR DOUBLE CLEANOUT REQUIREMENTS.
2. METAL CASTINGS SHOULD MEET THE LOADING REQUIREMENTS IN SPEC SECTION 334241.

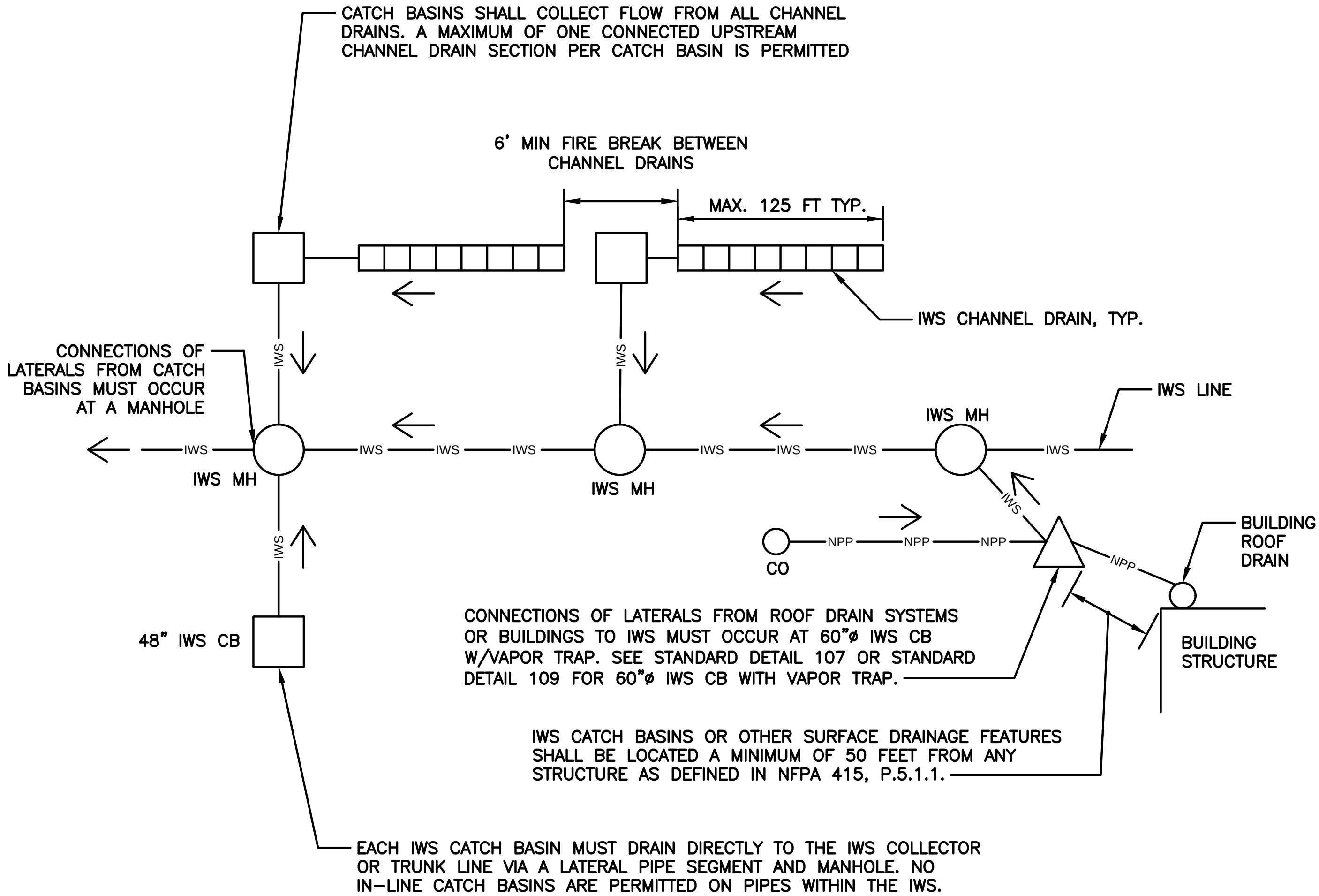
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	TYPICAL DOUBLE CLEANOUT
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **103**



DETAIL 1/104

TYPICAL STORM DRAINAGE SYSTEM (SDS) LAYOUT
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	STORM DRAINAGE SYSTEM CONFIGURATION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **104**

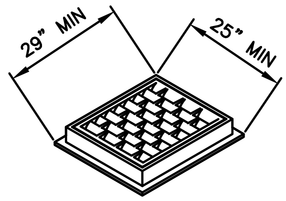


TYPICAL INDUSTRIAL WASTEWATER SYSTEM (IWS) LAYOUT

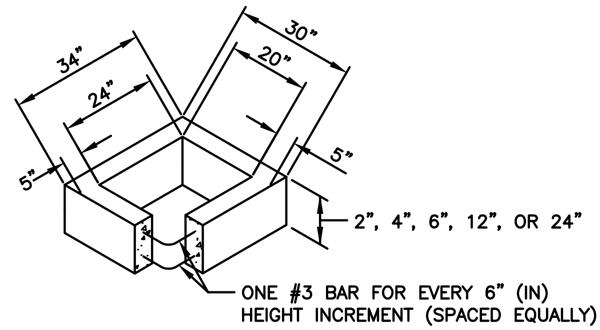
DETAIL 1/105
TYPICAL INDUSTRIAL WASTE SYSTEM (IWS) LAYOUT
SCALE: NTS

NOTE:
1. FOR ADDITIONAL REQUIREMENTS GOVERNING DRAINAGE ON RAMPS WHERE AIRCRAFT FUELING OCCURS, SEE NFPA 415, CHAPTER 5.

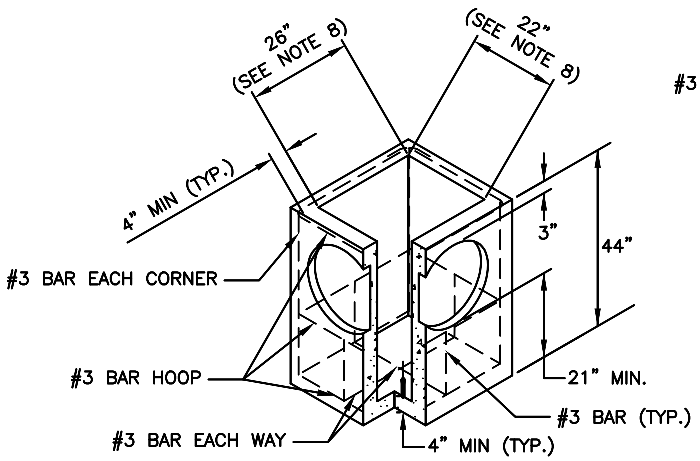
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	INDUSTRIAL WASTE SYSTEM CONFIGURATION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **105**



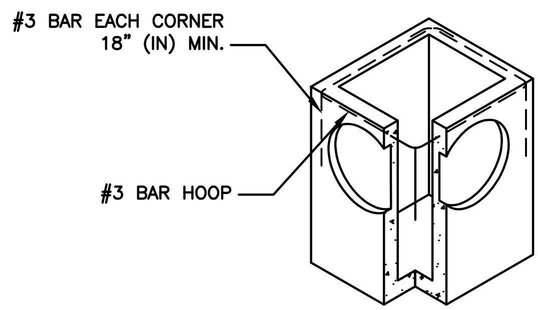
FRAME AND VANED GRATE



RECTANGULAR ADJUSTMENT SECTION



PRECAST BASE SECTION



(SEE NOTE 2)

ALTERNATIVE PRECAST BASE SECTION

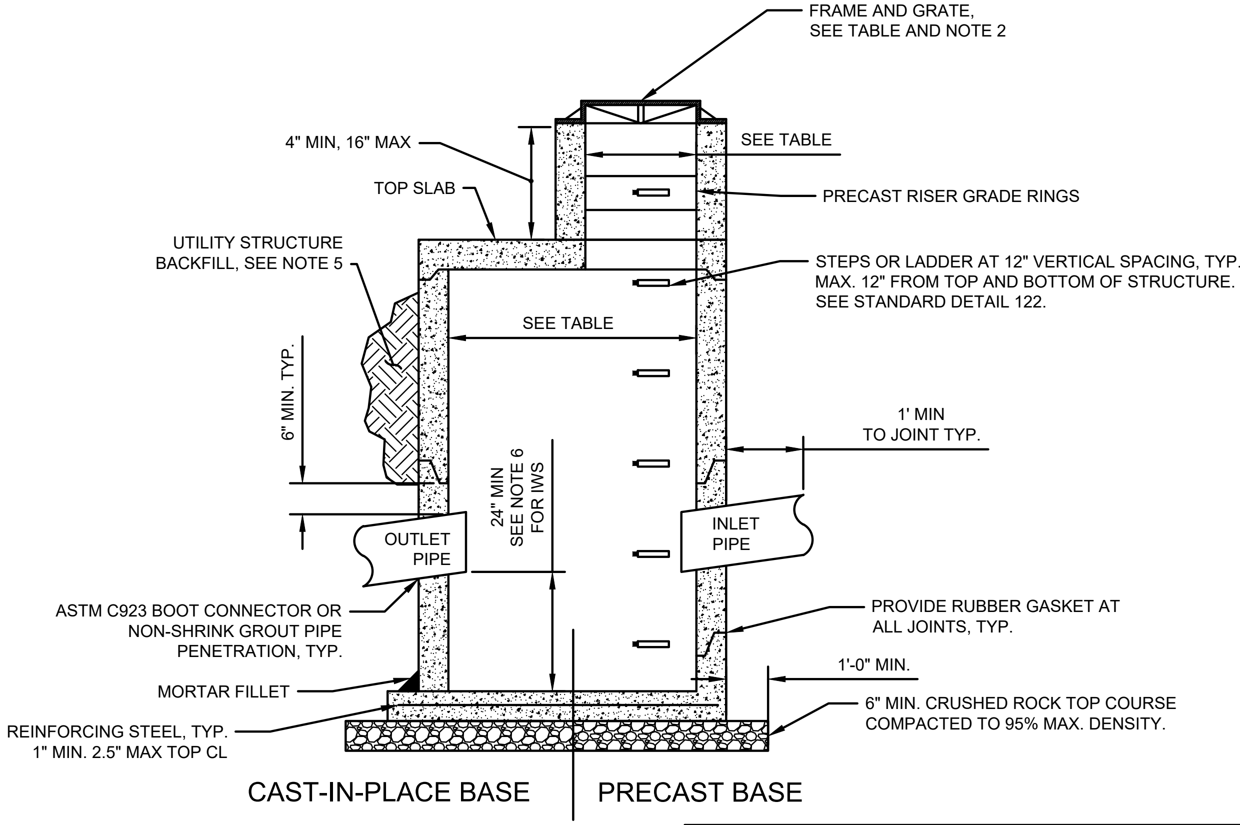
DETAIL
TRAFFIC RATED CATCH BASIN INLET
SCALE: NTS

1
106

NOTES:

1. TRAFFIC RATED CATCH BASIN INLET FOR LANDSIDE APPLICATION ONLY.
2. AS ACCEPTABLE ALTERNATIVES TO THE REBAR SHOWN IN THE PRECAST BASE SECTION, FIBERS (PLACED ACCORDING TO THE SPECIFICATIONS), OR WIRE MESH HAVING A MINIMUM AREA OF 0.12 SQUARE INCHES PER FOOT SHALL BE USED WITH THE MINIMUM REQUIRED REBAR SHOWN IN THE ALTERNATIVE PRECAST BASE SECTION. WIRE MESH SHALL NOT BE PLACED IN THE KNOCKOUTS.
3. THE KNOCKOUT DIAMETER SHALL NOT BE GREATER THAN 20" (IN). KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" (IN) MINIMUM TO 2.5" (IN) MAXIMUM. PROVIDE A 1.5" (IN) MINIMUM GAP BETWEEN THE KNOCKOUT WALL AND THE OUTSIDE OF THE PIPE. AFTER THE PIPE IS INSTALLED, FILL THE GAP WITH JOINT MORTAR IN ACCORDANCE WITH SPECIFICATION SECTION 334231.
4. THE MAXIMUM DEPTH FROM THE FINISHED GRADE TO THE LOWEST PIPE INVERT SHALL BE 5' (FT).
5. THE FRAME AND GRATE MAY BE INSTALLED WITH THE FLANGE DOWN, OR INTEGRALLY CAST INTO THE ADJUSTMENT SECTION WITH FLANGE UP.
6. GRATE SHALL BE BOLTED PER SECTION 334241.
7. THE PRECAST BASE SECTION MAY HAVE A ROUNDED FLOOR, AND THE WALLS MAY BE SLOPED AT A RATE OF 1:24 OR STEEPER.
8. THE OPENING SHALL BE MEASURED AT THE TOP OF THE PRECAST BASE SECTION.
9. ALL PICKUP HOLES SHALL BE GROUTED FULL AFTER THE BASIN HAS BEEN PLACED.
10. TRAFFIC RATED STRUCTURES TO BE DESIGNED FOR AASHTO HS-25 LOADING AND CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199 (ASTM C 478).

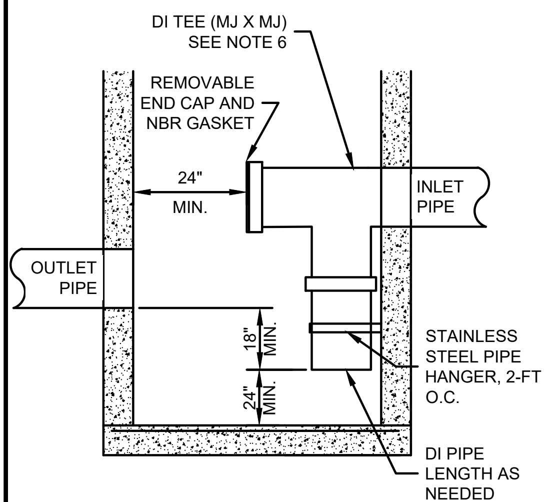
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	TRAFFIC RATED CATCH BASIN INLET
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2020	STANDARD DETAIL NO. **106**



SECTION
TRAFFIC RATED CATCH BASIN
SCALE: NTS

1
107

CATCH BASIN DIMENSIONS					
CATCH BASIN DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"



DETAIL
IWS VAPOR TRAP
SCALE: NTS

2
107

NOTES:

1. TRAFFIC RATED STRUCTURES TO BE DESIGNED FOR AASHTO HS-25 LOADING AND CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199 (ASTM C 478). STRUCTURE RATING SHALL BE INCREASED IN AREAS UTILIZED BY CARGO OPERATORS, AIRCRAFT RESCUE FIRE FIGHTING VEHICLES, AIRLINE GROUND SERVICE EQUIPMENT, OR PORT AND AIRLINE MAINTENANCE EQUIPMENT.

2. METAL CASTINGS SHALL MEET THE REQUIREMENTS IN SPEC SECTION 334241. MINIMUM 2 BOLTED FASTENERS.

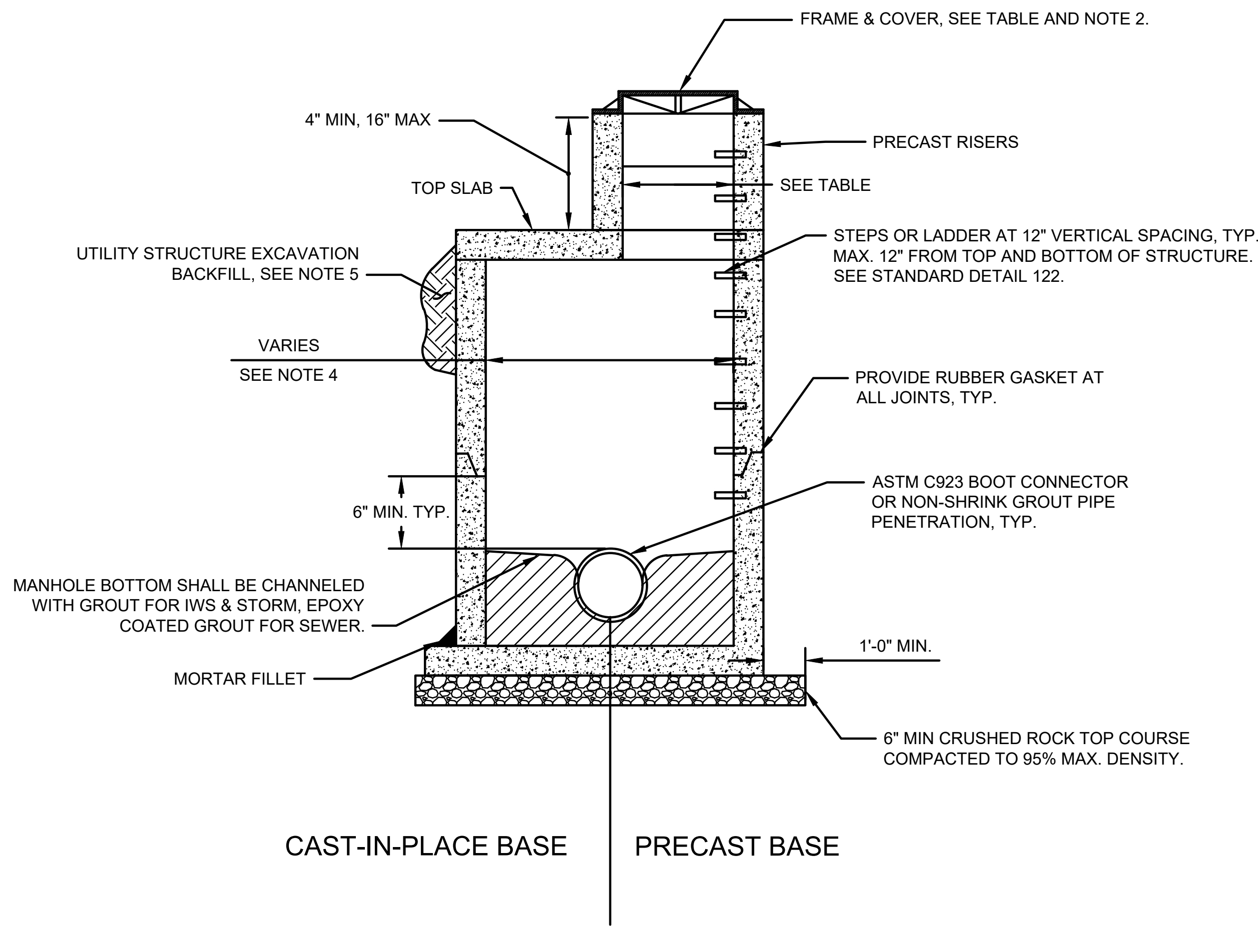
3. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM.

4. SIZES TO BE INDICATED ON PLANS BASED ON DESIGN REQUIREMENTS.

5. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:

   a. UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
   b. UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL PER SPEC SECTION 334231.

6. IWS STRUCTURES RECEIVING INLET PIPES FROM BUILDINGS (I.E., ROOFS, DRAIN PIPES, ETC.) AND ELECTRICAL VAULTS SHALL BE 60-INCH DIAMETER IWS CATCH BASINS WITH A VAPOR TRAP, AS SHOWN IN DETAIL 2 THIS SHEET.

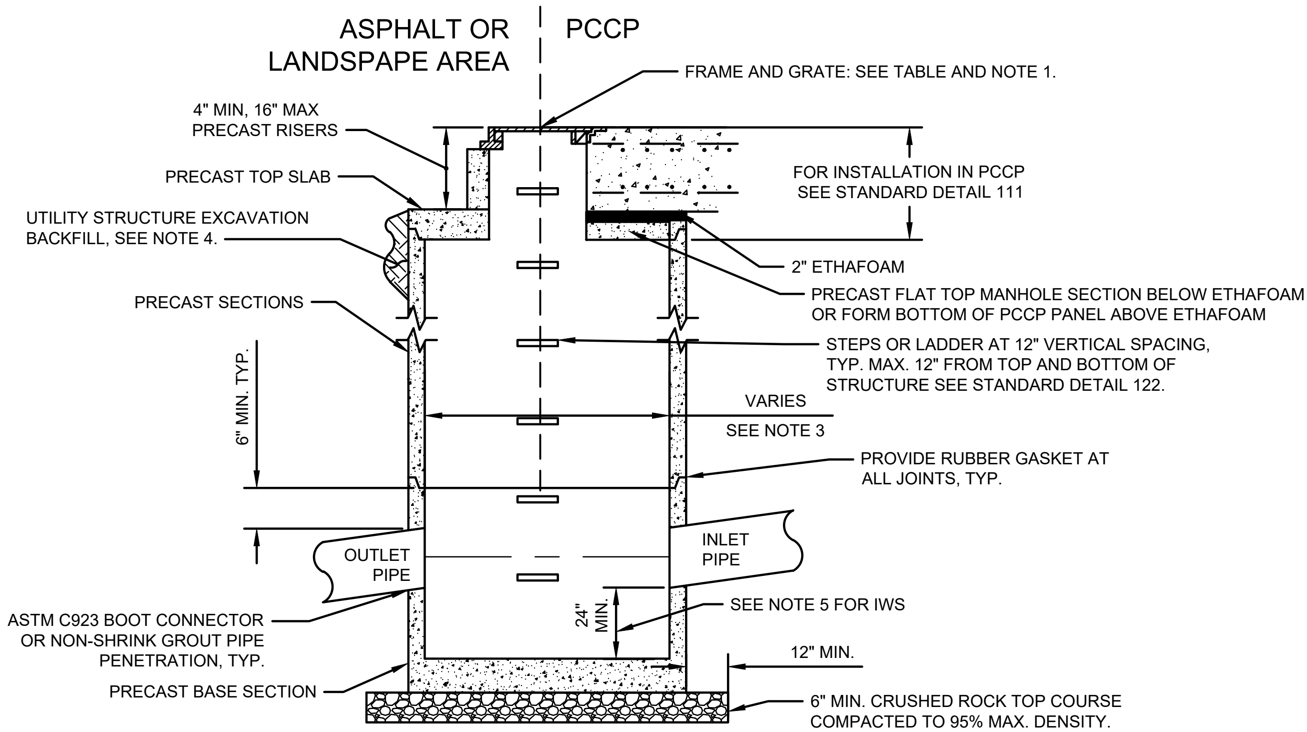


SECTION
TRAFFIC RATED MANHOLE
SCALE: NTS

1
108

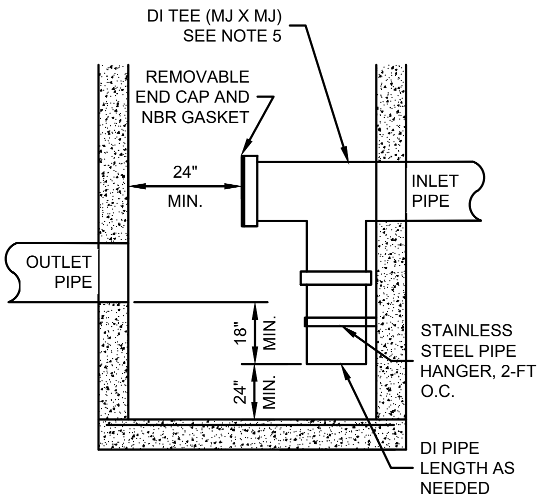
MANHOLE DIMENSIONS					
MANHOLE DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"

NOTES:
1. TRAFFIC RATED STRUCTURES TO BE DESIGNED FOR AASHTO HS-25 LOADING AND CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199(ASTM C 478).
2. METAL CASTINGS SHOULD MEET THE LOADING REQUIREMENTS IN SPEC SECTION 334241. MIN. 2 BOLTED FASTENERS.
3. PRECAST BARREL SECTIONS SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM.
4. SIZES TO BE INDICATED BY THE PLAN BASED ON DESIGN REQUIREMENTS.
5. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE PER STANDARD DETAIL 004



SECTION 1/109
AIRCRAFT RATED CATCH BASIN
SCALE: NTS

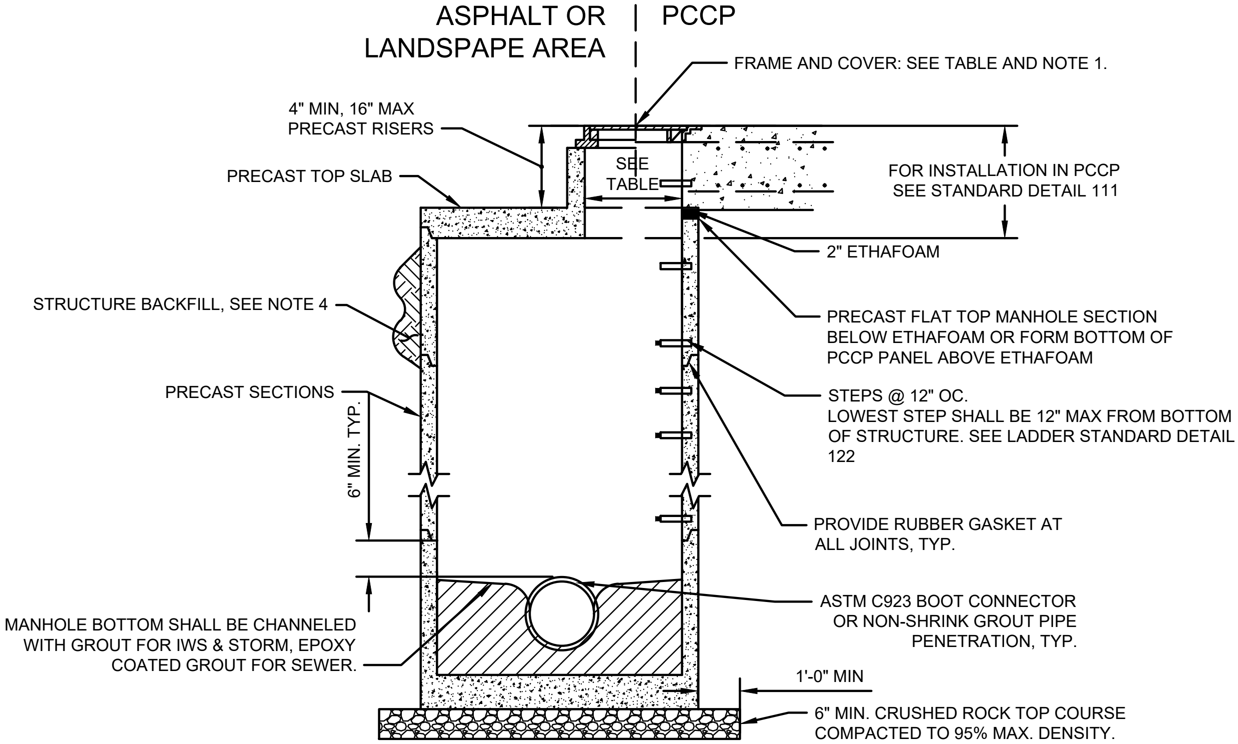
CATCH BASIN DIMENSIONS					
CATCH BASIN DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"



DETAIL 2/109
IWS VAPOR TRAP
SCALE: NTS

NOTES:

1. FRAME & GRATE:
   a. FRAMES AND GRATES SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   b. GRATE SHALL BOLT TO FRAME (MIN. TWO FASTENERS).
   c. PROVIDE CAST PERMANENT LETTERING GRATE, EITHER "STORM" OR "IWS" ON THE GRATE AS DIRECTED BY THE ENGINEER ON ALL CB'S.
2. CATCH BASINS SHALL BE PRECAST AND DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B, DESIGN OF STRUCTURES (OR LATEST EDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION. STRUCTURES BELOW A PCCP PANEL MAY BE DESIGNED FOR HS-20 LOADING.
3. SIZES TO BE INDICATED ON PLANS BASED ON DESIGN REQUIREMENTS.
4. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
   a. UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
   b. UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL PER SPEC SECTION 334231.
5. IWS STRUCTURES RECEIVING INLET PIPES FROM BUILDINGS (I.E., ROOFS, DRAIN PIPES, ETC.) AND ELECTRICAL VAULTS SHALL BE 60-INCH DIAMETER IWS CATCH BASINS WITH A VAPOR TRAP, AS SHOWN IN DETAIL 2 THIS SHEET.



SECTION 1/110
AIRCRAFT RATED MANHOLE
SCALE: NTS

MANHOLE DIMENSIONS					
MANHOLE DIAMETER	ACCESS DIAMETER	MIN. WALL THICKNESS	MIN. BASE THICKNESS	MAX. KNOCKOUT SIZE	MIN. DISTANCE BETWEEN KNOCKOUTS
48"	30"	4"	6"	36"	8"
54"	30"	4.5"	8"	42"	8"
60"	36"	5"	8"	48"	8"
72"	36"	6"	8"	60"	12"
96"	36"	8"	12"	84"	12"

NOTES:

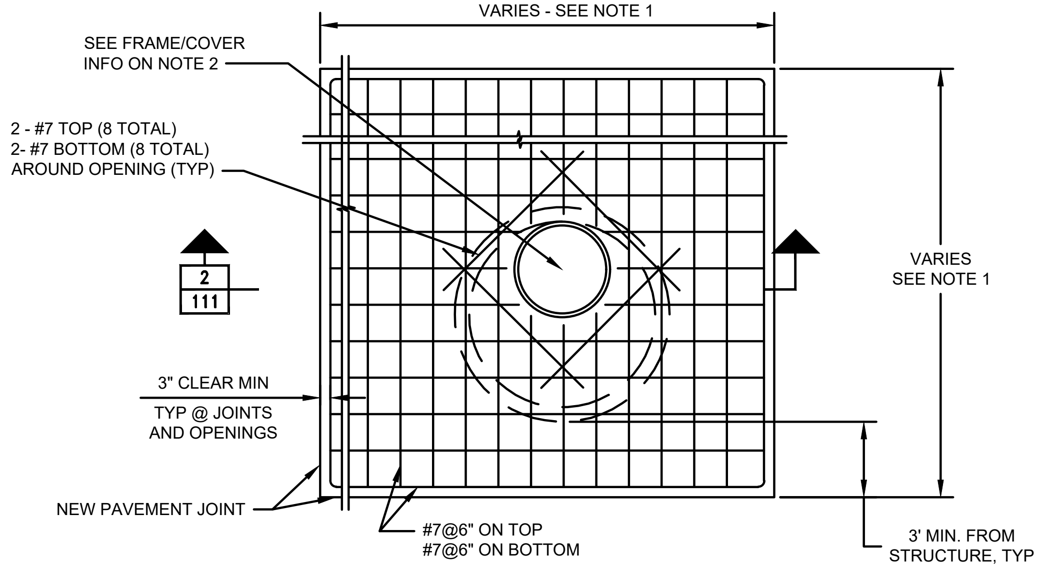
1. FRAME AND COVER:
   a. PROVIDE CAST PERMANENT LETTERING ON COVER, EITHER "SEWER," "STORM," OR "IWS," AS DIRECTED BY THE ENGINEER ON ALL MH'S.
   b. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   c. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   d. SEAL SD MH COVER/FRAME JOINT AND PICK HOLES OF ALL SDS MH'S WITHIN IWS AREA USING SILICONE JOINT SEALANT.
   e. 36" FRAME AND COVER SHOULD INCLUDE LID LIFT-ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.

2. MANHOLES SHALL BE PRECAST AND DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B - DESIGN OF STRUCTURES" (OR LATEST ADDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION. STRUCTURES BELOW A PCCP PANEL MAY BE DESIGNED FOR HS-20 LOADING.

3. SIZES TO BE INDICATED BY THE PLANS BASED ON DESIGN REQUIREMENTS.

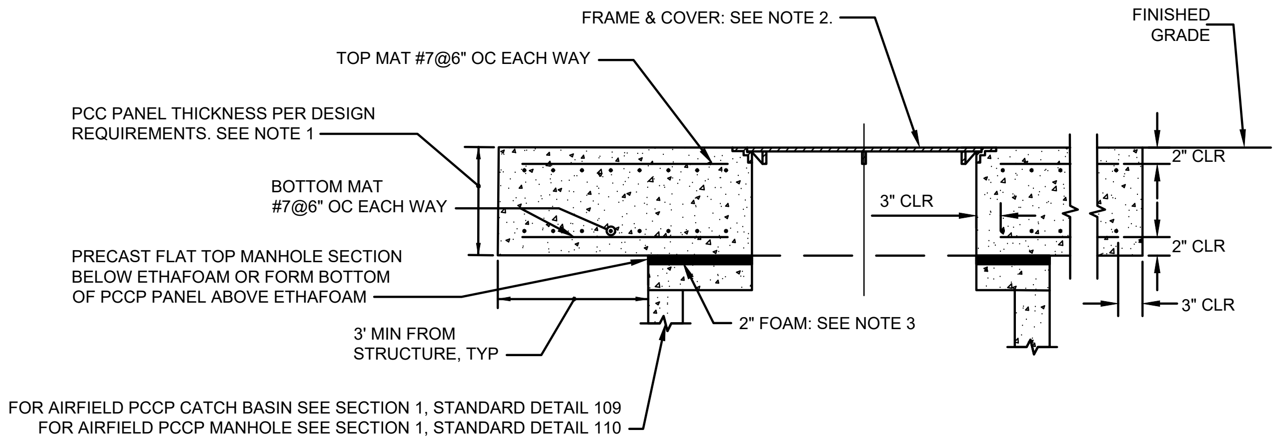
4. BACKFILL FOR ALL UTILITY STRUCTURE EXCAVATION SHALL BE ONE OF THE FOLLOWING:
   a. UNDER PAVEMENTS OR WITHIN 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL ALL UTILITY STRUCTURES WITH CLSM.
   b. UNDER NON-PAVED AREAS AT LEAST 10-FEET OR MORE FROM ANY PAVEMENTS, BACKFILL WITH "GRAVEL BORROW" (PER SPEC SECTION 334231).

5. IWS STRUCTURES RECEIVING INLET PIPES FROM BUILDINGS (I.E., ROOFS, DRAIN PIPES, ETC.) AND ELECTRICAL VAULTS SHALL BE 60-INCH DIAMETER IWS CATCH BASINS WITH DUCTILE IRON, NBR GASKETED REMOVABLE TEES, AS SHOWN IN STANDARD DETAIL 109.



DETAIL (1/111)

UTILITY STRUCTURE IN PCCP
SCALE: NTS



SECTION (2/111)

UTILITY STRUCTURE IN PCCP
SCALE: NTS

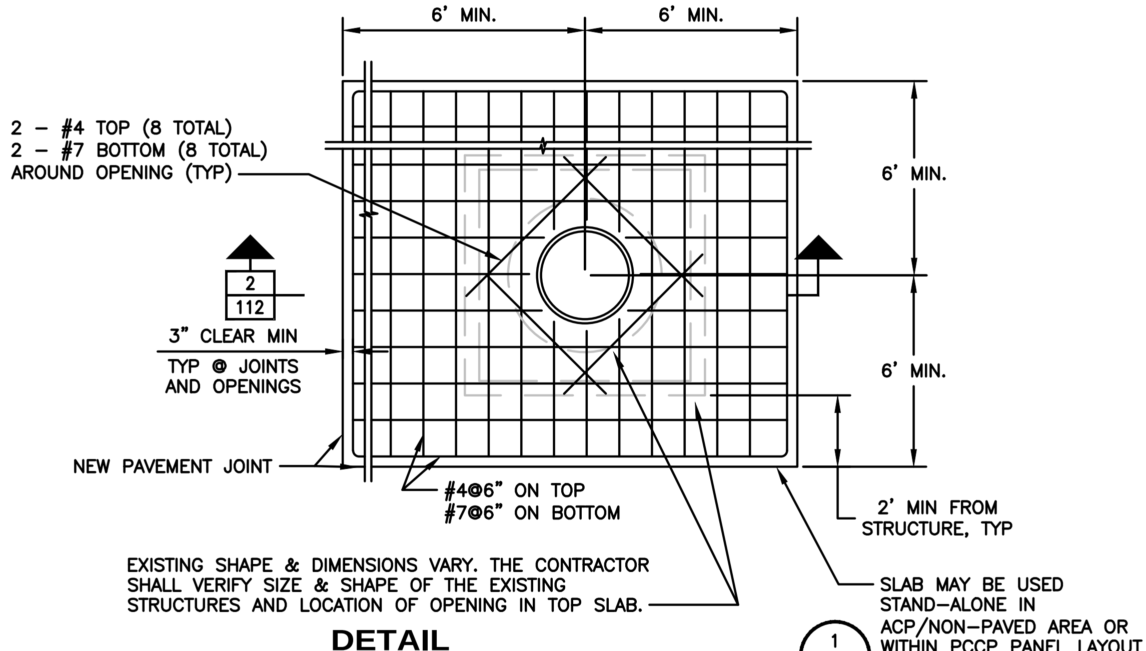
NOTE:

1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MINIMUM PCC THICKNESS. PCC THICKNESS, PANEL SIZE, AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

2. FRAME AND COVER:
   a. FOR 48" DIA/54" DIA. MH'S, PROVIDE 30" DIAMETER FRAME AND COVER.
   b. 60" DIA AND LARGER MH'S, PROVIDE 36" DIAMETER FRAME AND COVER.
   c. PROVIDE CAST PERMANENT LETTERING ON COVER, EITHER "STORM", "SEWER," OR "IWS," AS DIRECTED BY THE ENGINEER ON ALL MH'S.
   d. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   e. GRATE SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   f. SEAL SD MH COVER/FRAME JOINT AND PICK HOLES OF ALL SD MH'S WITHIN IWS AREA USING SILICONE JOINT SEALANT.
   g. FRAME AND COVER SHALL INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.

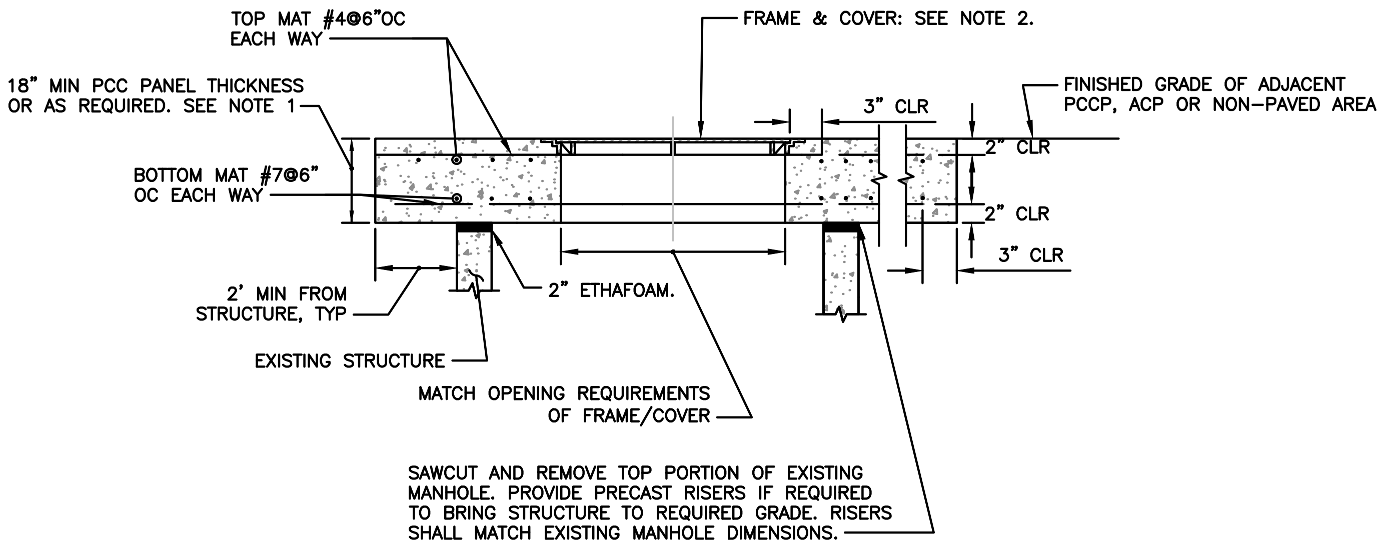
3. FOAM SHALL BE CAPABLE OF SUPPORTING THE CONCRETE DURING CONSTRUCTION BUT SHALL HAVE A COMPRESSIVE STRENGTH LESS THAN THE ALLOWABLE LOAD ON THE BURIED STRUCTURE. CONTRACTOR SHALL DETERMINE REQUIRED FOAM STRENGTH BASED ON EXPECTED CONSTRUCTION LOADS AND METHODS.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	UTILITY STRUCTURE IN PCCP
F&I CIVIL STANDARDS	REVISION DATE: MAY 2023	STANDARD DETAIL NO. 111



DETAIL (1/112)

MODIFICATION TO EXISTING UTILITY STRUCTURE IN PCCP
SCALE: NTS



SECTION (2/112)

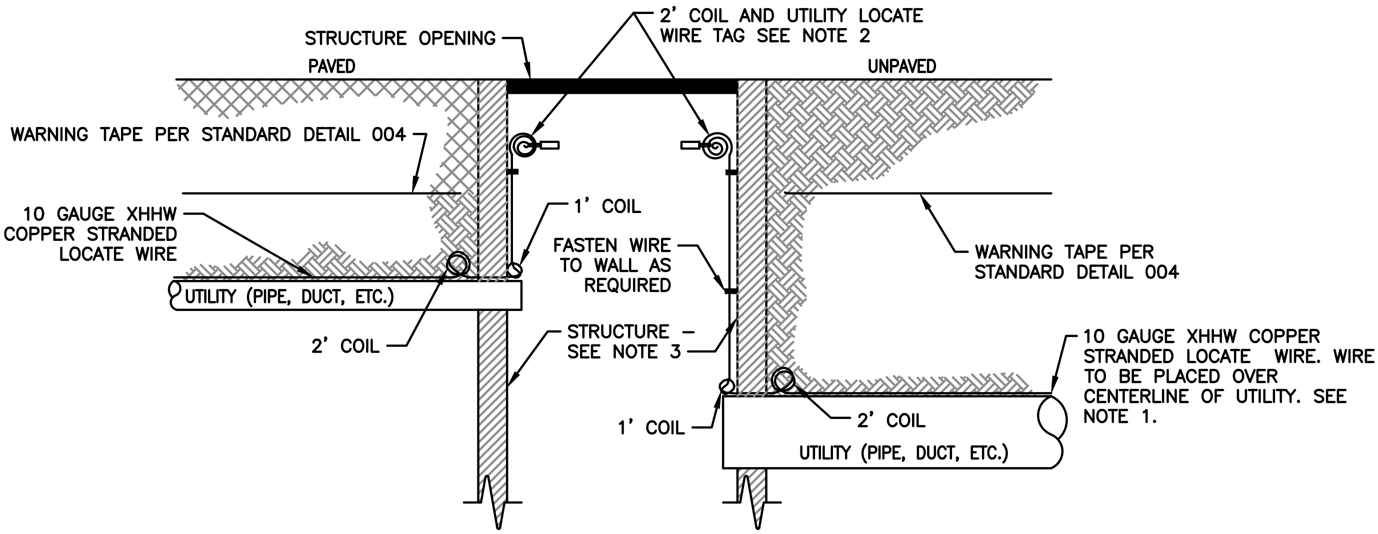
MODIFICATION TO EXISTING UTILITY STRUCTURE IN PCCP
SCALE: NTS

NOTE:

1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MINIMUM PCC THICKNESS. PCC THICKNESS, PANEL SIZE, AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

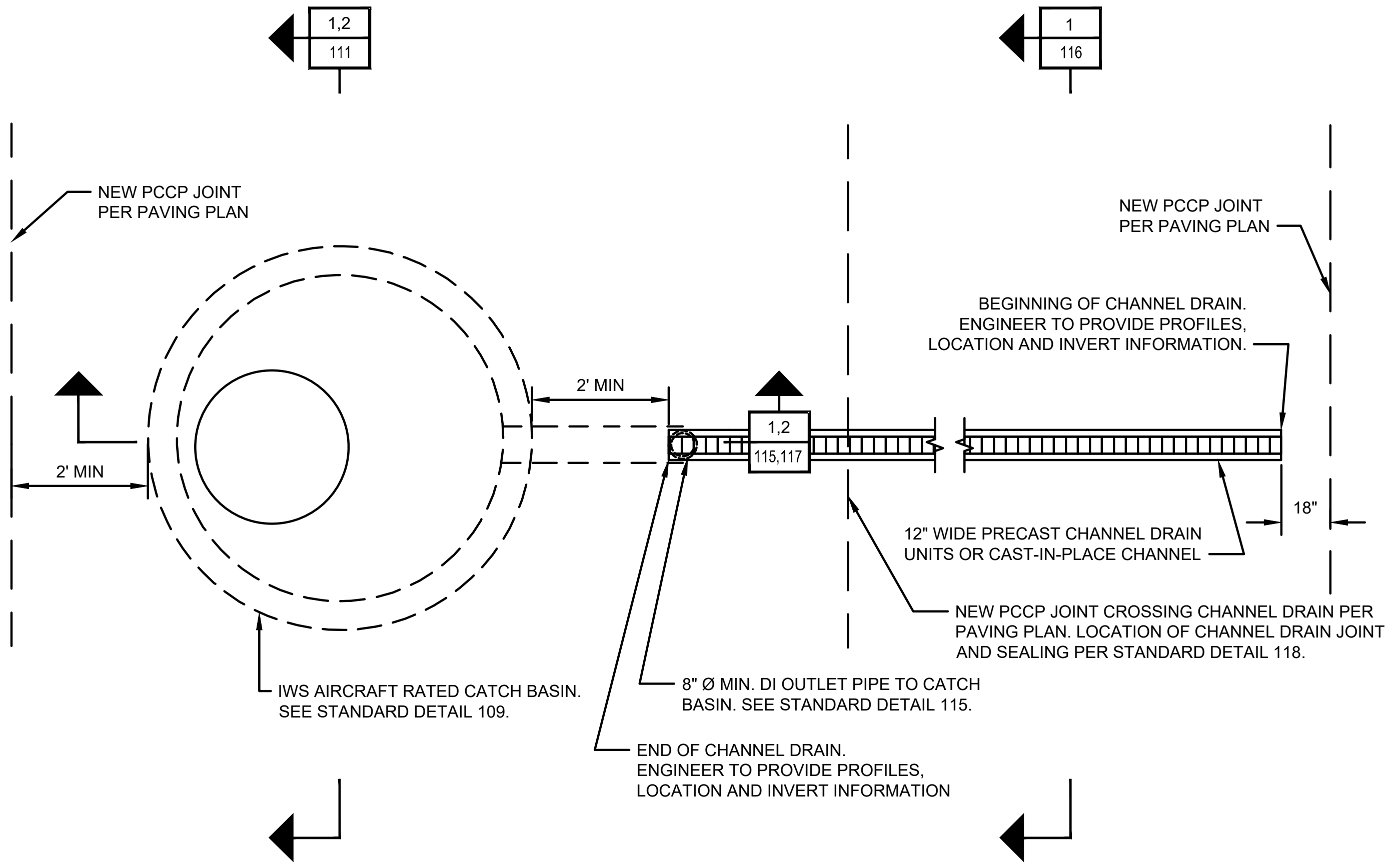
2. FRAME AND COVER:
   a. FOR 48" DIA/54" DIA. MH'S, PROVIDE 30" DIAMETER FRAME AND COVER.
   b. 60" DIA AND LARGER MH'S, PROVIDE 36" DIAMETER FRAME AND COVER.
   c. PROVIDE CAST PERMANENT LETTERING ON COVER, EITHER "STORM," "SEWER," OR "IWS," AS DIRECTED BY THE ENGINEER ON ALL MH'S.
   d. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   e. GRATE SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   f. SEAL SD MH COVER/FRAME JOINT AND PICK HOLES OF ALL SD MH'S WITHIN IWS AREA USING SILICONE JOINT SEALANT.
   g. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	MODIFICATION TO EXISTING UTILITY STRUCTURE IN PCCP
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **112**



DETAIL 1/113
TYPICAL UTILITY LOCATE DETAIL
SCALE: NTS

NOTES:
1. FASTEN LOCATE WIRE TO UTILITY (TOP CENTERLINE) USING NON-CONDUCTING TIES OR OTHER SUITABLE MEANS. FASTEN AT SUFFICIENT NUMBER OF LOCATIONS TO ENSURE WIRE WILL REMAIN IN PLACE DURING BACKFILLING OPERATIONS.
2. LOCATE COIL WITHIN ONE FOOT OF OPENING. LABEL COIL "LOCATE".
3. STRUCTURE REFERS TO INLETS, CATCH BASINS, MANHOLES, HEAD WALLS, VALVE BOXES, VAULTS, HAND HOLES, JUNCTION AND PULL BOXES, AND SIMILAR ACCESS DEVICES.



PLAN

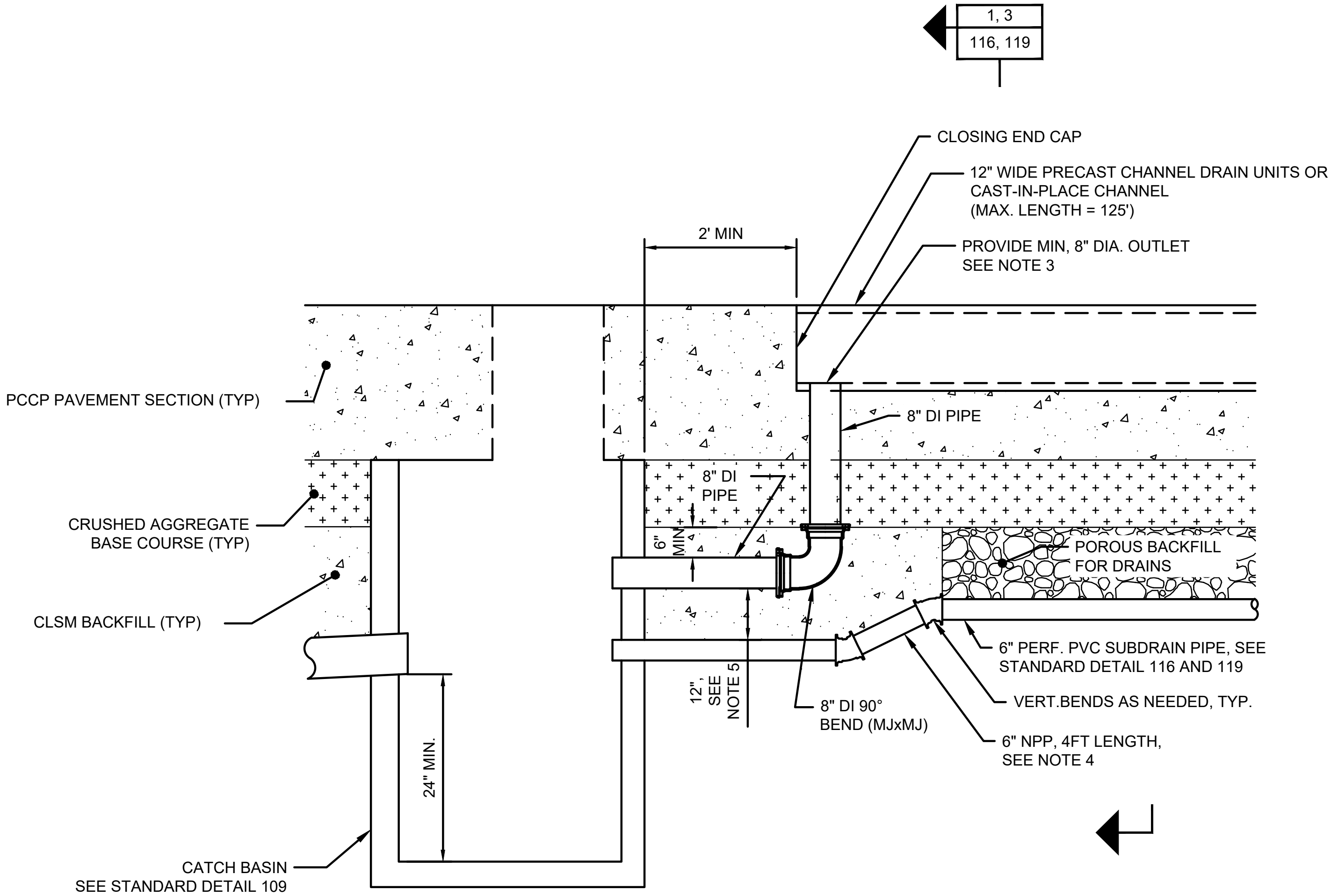
AIRCRAFT RATED CHANNEL DRAIN PLAN IN PCCP
SCALE: NTS

1
114

NOTE:

1. PRECAST CHANNEL DRAINS MAY BE USED WITH A REVERSE SLOPE RELEVANT TO THE PROPOSED SURFACE AS APPROVED BY F&I.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	AIRCRAFT RATED CHANNEL DRAIN PLAN IN PCCP
F&I CIVIL STANDARDS	REVISION DATE: MAY 2023	STANDARD DETAIL NO. 114



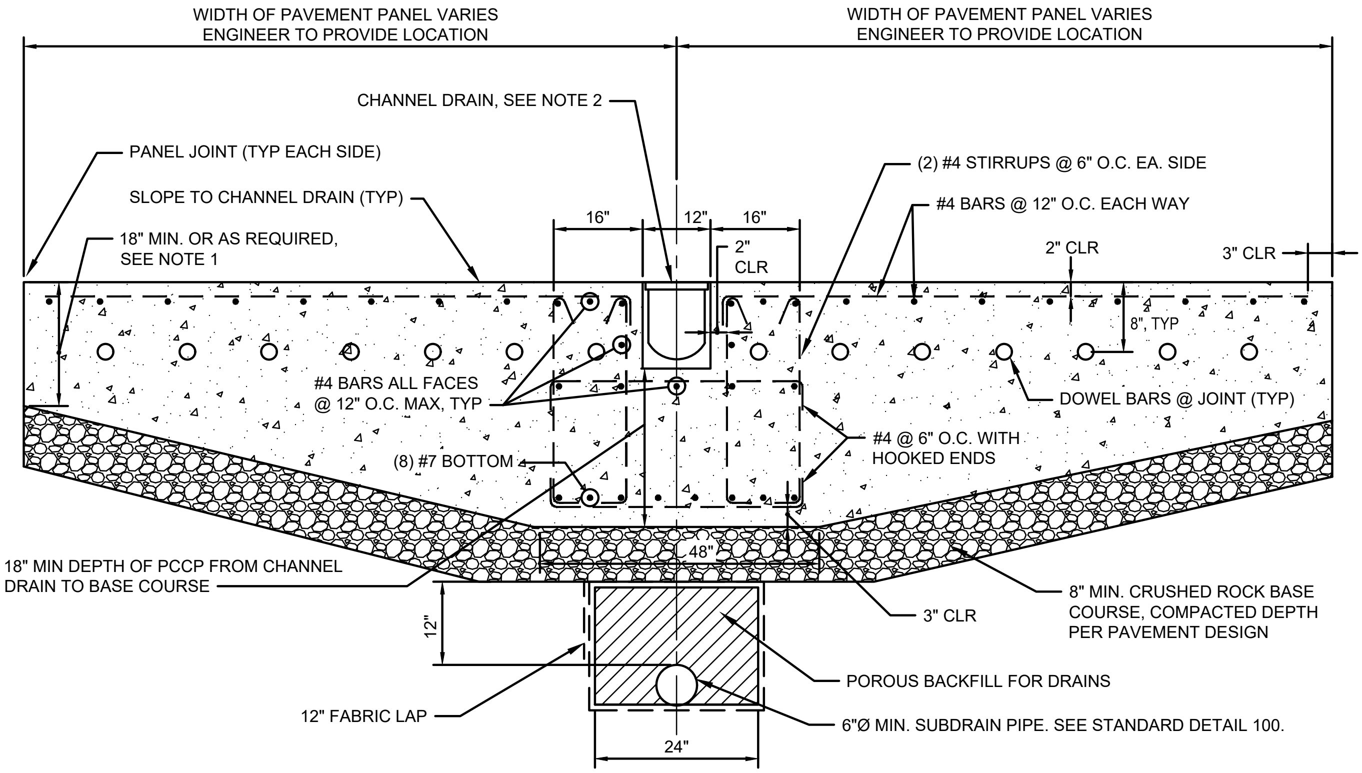
SECTION

CHANNEL DRAIN CONNECTION PROFILE
SCALE: NTS

1
115

NOTES:

1. CATCH BASIN SHALL COLLECT FLOW FROM ONE CHANNEL DRAIN ONLY. ADDITIONAL UPSTREAM DRAINAGE COLLECTION STRUCTURES ARE NOT PERMITTED AT IWS CHANNEL DRAIN CATCH BASIN.
2. SEE STANDARD DETAIL 105 FOR ADDITIONAL IWS LAYOUT REQUIREMENTS.
3. CHANNEL DRAIN, OUTLET PIPE AND FITTINGS SHALL BE SIZED TO CONVEY THE DESIGN FLOW.
4. NON-PERFORATED PIPE (NPP) SHALL BE DUCTILE IRON OR PVC FOR 4FT CONNECTION FROM SUBDRAIN TO CATCH BASIN.
5. CLEARANCE SHALL BE 12" EXCEPT WHERE OTHERWISE NOTED. 6" MINIMUM, UNLESS OTHERWISE SHOWN ON DRAWINGS WITH ETHAFOAM PAD BETWEEN PIPES.



SECTION

AIRCRAFT RATED CHANNEL DRAIN SECTION IN PCCP
SCALE: NTS

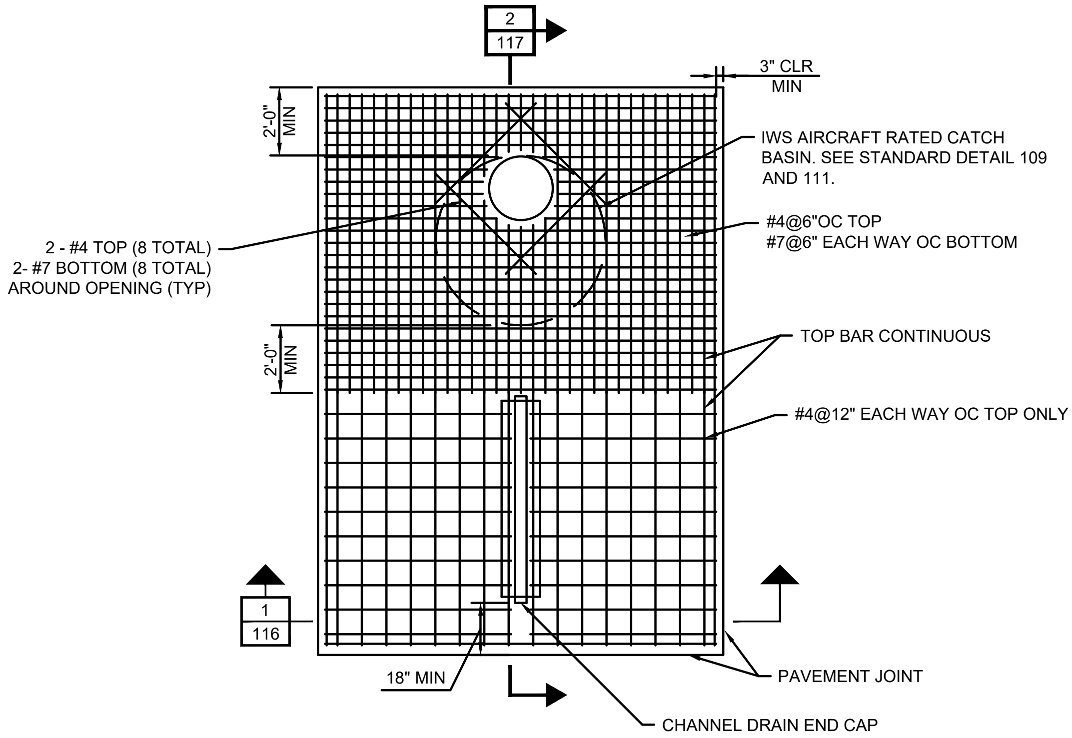
1
116

NOTES:

1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MIN. PCC THICKNESS AT PANEL EDGE AND 18" MIN. PCC THICKNESS BELOW CHANNEL DRAIN. PCC THICKNESS AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

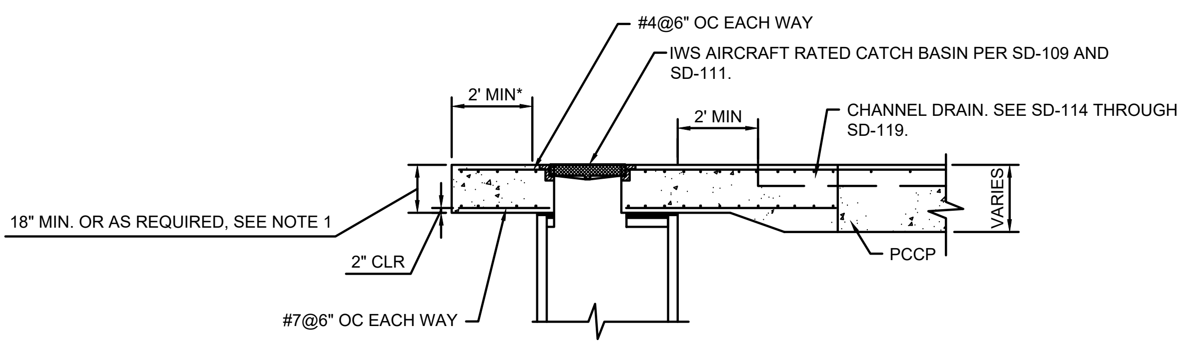
2. PRE-CAST CHANNEL DRAIN UNIT OR CAST-IN-PLACE CHANNEL WITH FRAME AND GRATE (10" MIN INTERIOR DEPTH). WIDTH SHALL BE SIZED TO CONVEY DESIGN FLOW, MIN 12" WIDE. ELEVATION AND INVERT INDICATED ON PROFILE. PRE-CAST CHANNEL DRAIN UNITS (IF USED), FRAMES AND GRATES WITHIN AOA SHALL BE EN1433 LOAD CLASS F RATED FOR 200 KIPS.

3. REBAR SHOWN IS MINIMUM SIZE AND QUANTITY REQUIRED. DESIGN ENGINEER TO REVIEW AND CONFIRM REBAR SIZES AND SPACING ARE ADEQUATE TO SUPPORT SITE CONDITIONS.



DETAIL
AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP
SCALE: NTS

1
117

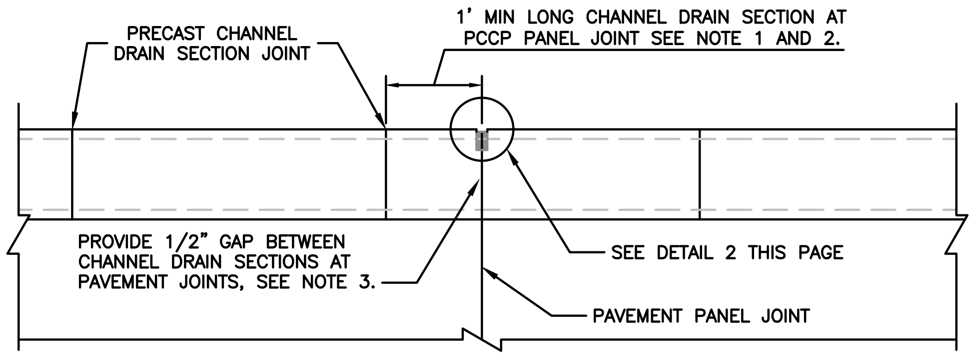


SECTION
AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP
SCALE: NTS

2
117

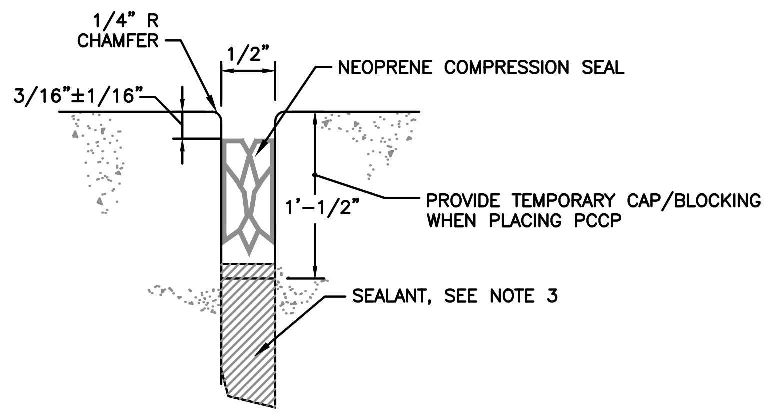
NOTES:
1. REINFORCEMENT SHOWN IS MINIMUM BASED UPON TYPICAL AIR OPERATIONS AREA (AOA) LOADING REQUIREMENTS AND 18" MIN. PCC THICKNESS AT PANEL JOINTS. PCC THICKNESS AND REINFORCEMENT SHALL BE DESIGNED TO MEET MOST DEMANDING LOADING REQUIREMENTS OF AIRCRAFT OR VEHICLES UTILIZING THE AIRPORT.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE REVISION DATE: MAY 2023	AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP STANDARD DETAIL NO. 117



SECTION 1/118

CHANNEL DRAIN SYSTEM IN PCCP – SECTION
SCALE: NTS

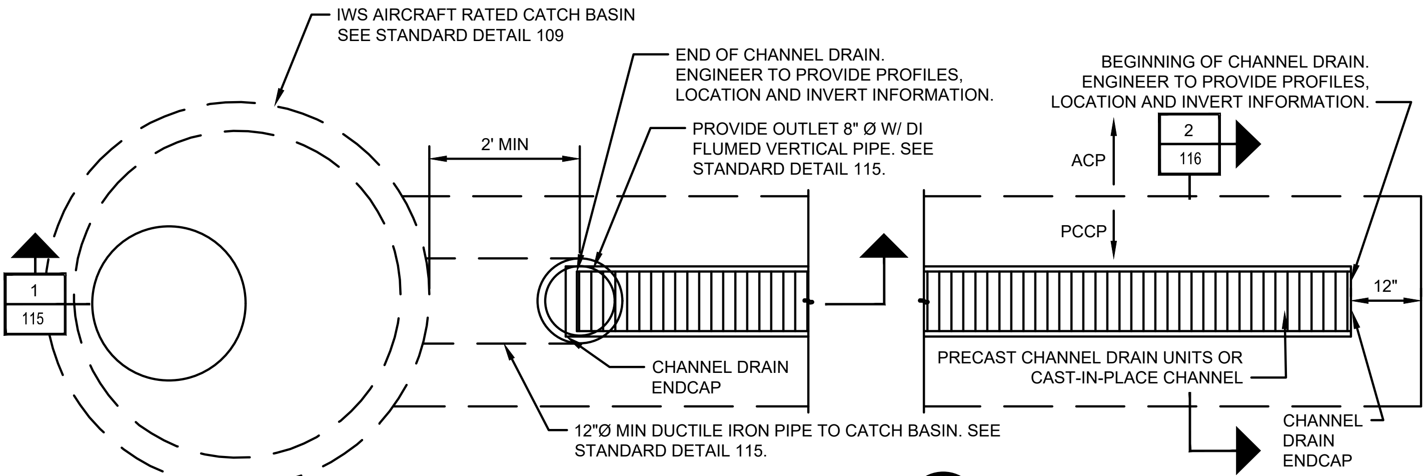


DETAIL 2/118

AIRCRAFT RATED CHANNEL DRAIN JOINT DETAILS
SCALE: NTS

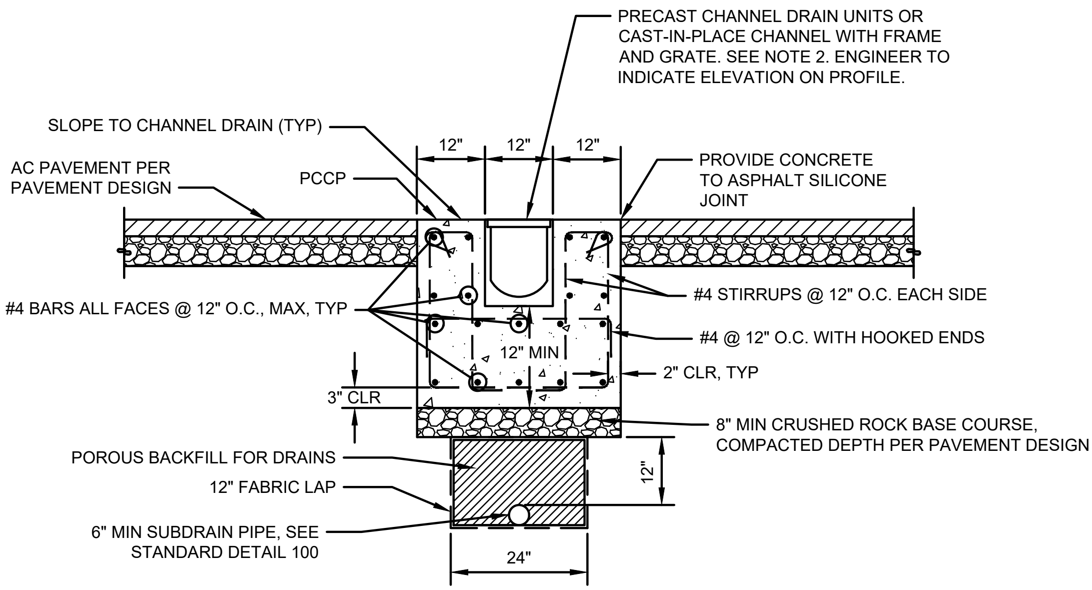
NOTES:

1. IF USING PRECAST CHANNEL DRAIN UNITS, LAYOUT CHANNEL DRAIN SECTION JOINTS SUCH THAT NO CHANNEL DRAIN JOINT IS CLOSER THAN 1' TO THE PAVEMENT JOINT. CUT FRAME AND UNIT AT PANEL JOINT.
2. IF USING CAST–IN–PLACE CHANNEL DRAIN FRAME SYSTEM, FRAME SHALL BE LAID OUT SO THAT WHEN CUT AT PCC PANEL JOINT, A MINIMUM OF 4 CONCRETE FRAME ANCHORS WILL BE INTEGRALLY CAST WITHIN THE SHORTEST LENGTH OF ANY FRAME SECTION. SPACING OF THE FRAME SECTION SHALL ALSO PROVIDE A MINIMUM OF 3" SEPARATION BETWEEN ANCHORS AND NEAREST PCC PANEL JOINT.
3. SEAL GAP WITH LOW MODULUS, 1 COMPONENT, POLYURETHANE BASED, JET FUEL RESISTANT, NON–SAG ELASTOMERIC SEALANT.



DETAIL 1 / 119

TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP - PLAN VIEW
SCALE: NTS



SECTION 2 / 119

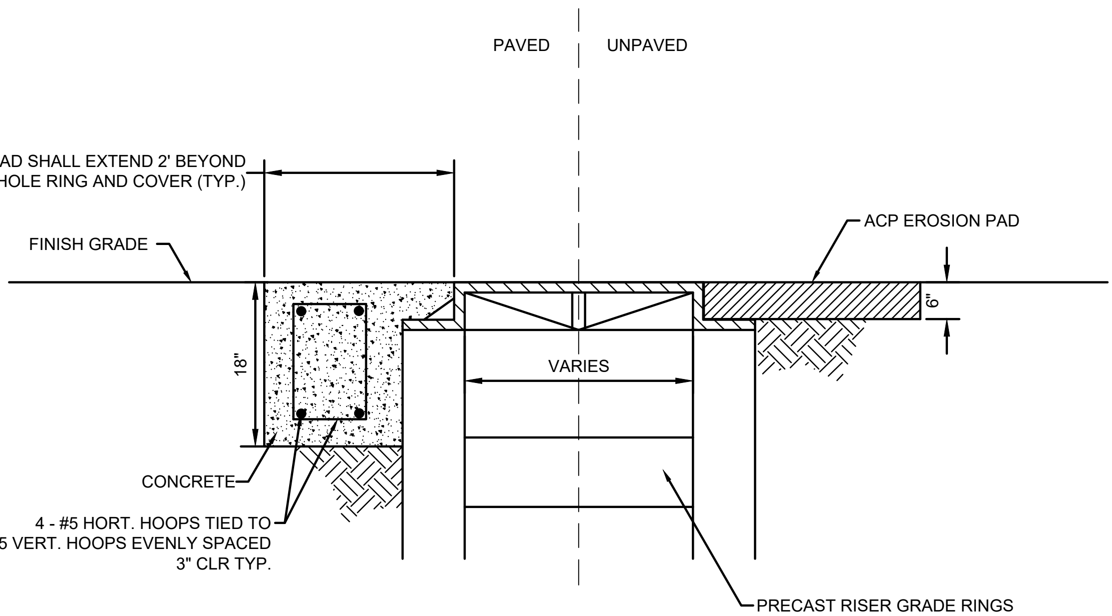
TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP
SCALE: NTS

NOTES:

1. REINFORCEMENT SHOWN IS MINIMUM FOR AREAS WITHIN THE AOA, BUT OUTSIDE OF AIRCRAFT MOVEMENT AREA (AMA). PCC THICKNESS AND REINFORCEMENT SHALL BE DESIGNED TO MEET THE MOST DEMANDING LOADING REQUIREMENTS OF THE VEHICLES UTILIZING THE PAVEMENT. SPECIAL CONSIDERATION SHOULD BE GIVEN TO AREAS INTENDED FOR USE BY CARGO OPERATORS, AIRCRAFT RESCUE FIREFIGHTING EQUIPMENT, AIRLINE GROUND SERVICE EQUIPMENT OR PORT AND AIRCRAFT MAINTENANCE VEHICLES.

2. PRE-CAST CHANNEL DRAIN UNITS (IF USED), FRAMES AND GRATES SHALL BE EN1433 LOAD CLASS E RATED FOR 135 KIPS.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP
F&I CIVIL STANDARDS	REVISION DATE: DATE	STANDARD DETAIL NO. 119



DETAIL

STRUCTURE CONCRETE COLLAR
SCALE: NTS

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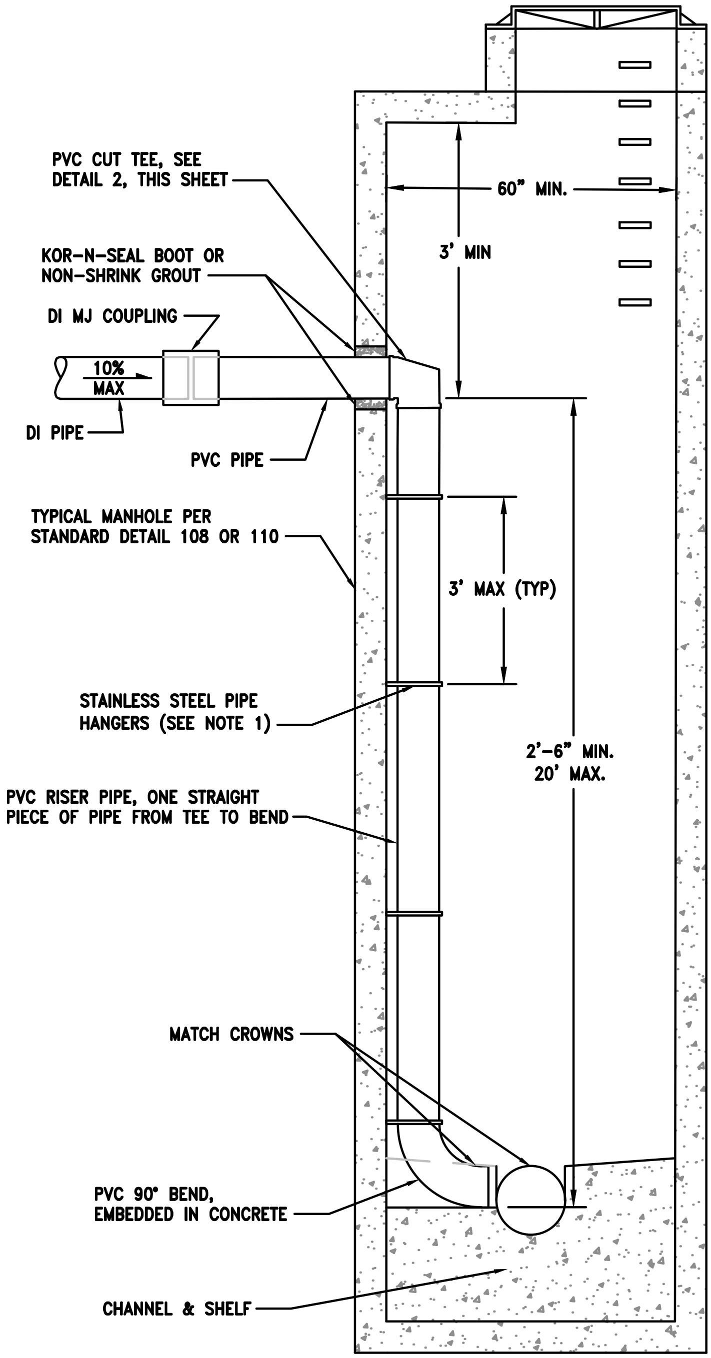
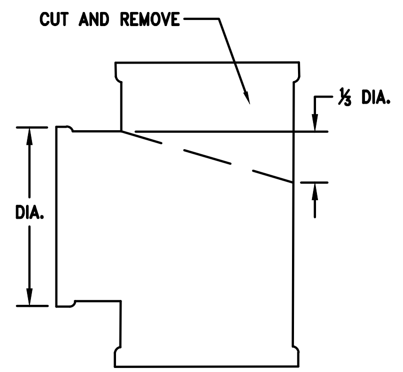
120

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	STRUCTURE CONCRETE COLLAR
F&I CIVIL STANDARDS	REVISION DATE: MAY 2023	STANDARD DETAIL NO. 120



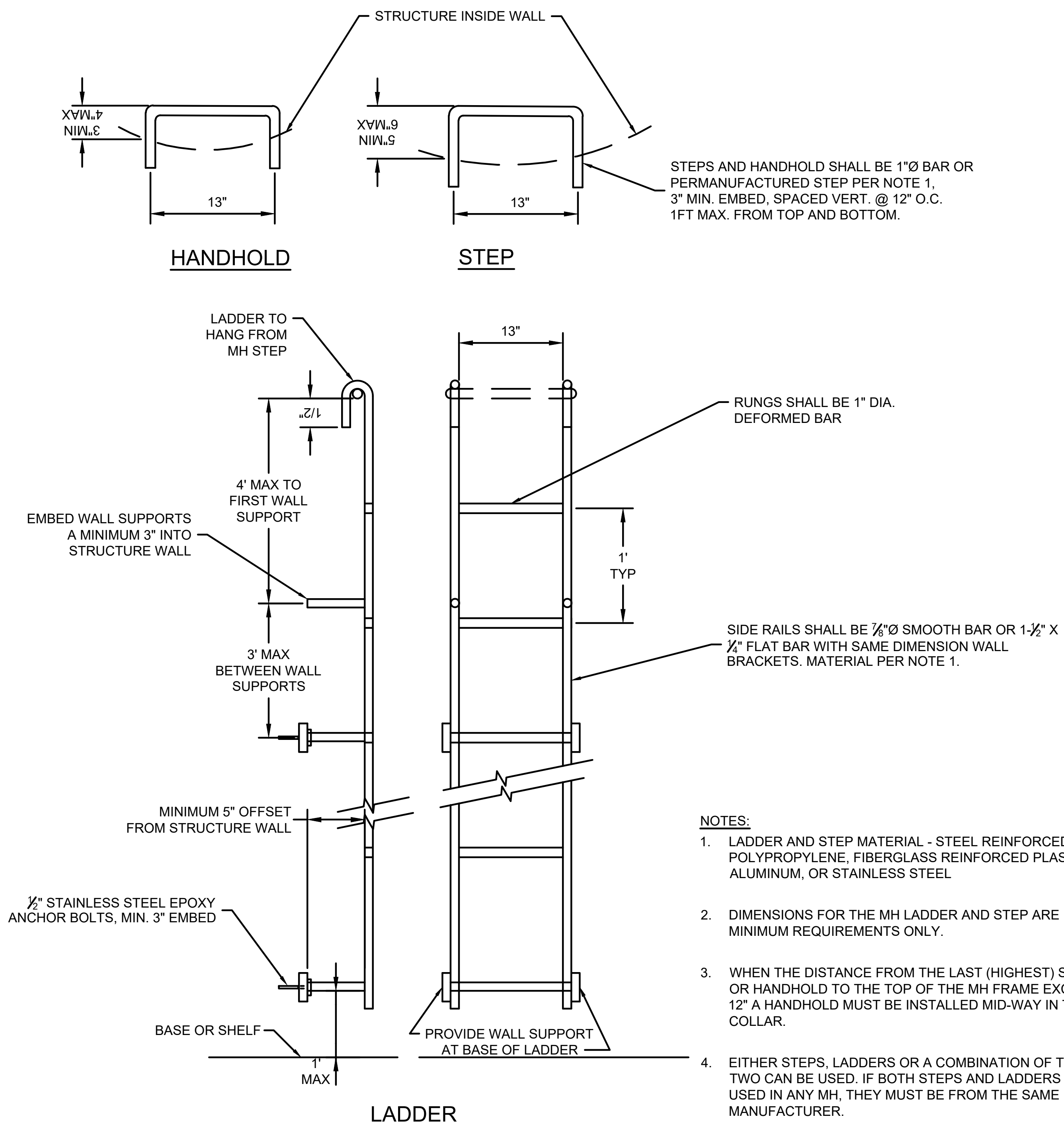
DETAIL 1/121
INSIDE DROP CONNECTION
SCALE: NTS



DETAIL 2/121
TEE MODIFICATION DETAIL
SCALE: NTS

NOTES:
1. PROVIDE PIPE MANUFACTURER RECOMMENDATION FOR PIPE HANGER AND CONCRETE ANCHORAGE TO F&I FOR APPROVAL.
2. MINIMUM MANHOLE SIZE IS 60" INTERNAL DIAMETER.
3. AWWA C900 PVC PIPE AND AWWA C907 PVC FITTINGS, SIZE TO MATCH INLET PIPE, 18" MAXIMUM PIPE DIAMETER.
4. CONSTRUCT CHANNEL WITH CLASS 3000 CONCRETE TO PIPE DIAMETER, AND SHELF TO THE CROWN OF PIPE. PROVIDE SMOOTH FINISH.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	INSIDE DROP CONNECTION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **121**



NOTES:

1. LADDER AND STEP MATERIAL - STEEL REINFORCED POLYPROPYLENE, FIBERGLASS REINFORCED PLASTIC, ALUMINUM, OR STAINLESS STEEL
2. DIMENSIONS FOR THE MH LADDER AND STEP ARE MINIMUM REQUIREMENTS ONLY.
3. WHEN THE DISTANCE FROM THE LAST (HIGHEST) STEP OR HANDHOLD TO THE TOP OF THE MH FRAME EXCEEDS 12" A HANDHOLD MUST BE INSTALLED MID-WAY IN THE COLLAR.
4. EITHER STEPS, LADDERS OR A COMBINATION OF THE TWO CAN BE USED. IF BOTH STEPS AND LADDERS ARE USED IN ANY MH, THEY MUST BE FROM THE SAME MANUFACTURER.
5. A VERTICAL HANDHOLD MUST BE INSTALLED 4'-0" ABOVE THE SHELF WHEN INDICATED IN MH PLAN VIEW.
6. STEPS AND LADDER SUPPORTS SHALL BE CAST IN WALLS WHEN SECTIONS ARE MANUFACTURED, OR INSTALLED WITH DRILLED HOLES AND CEMENTED IN PLACE WITH EPOXY.
7. STEPS OR LADDER SHALL BE VERTICALLY ALIGNED AND LOCATED AWAY FROM PIPE PENETRATIONS.
8. STEPS OR LADDER SHALL BE VERTICALLY ALIGNED AND LOCATED AWAY FROM PIPE PENETRATIONS.

DETAIL

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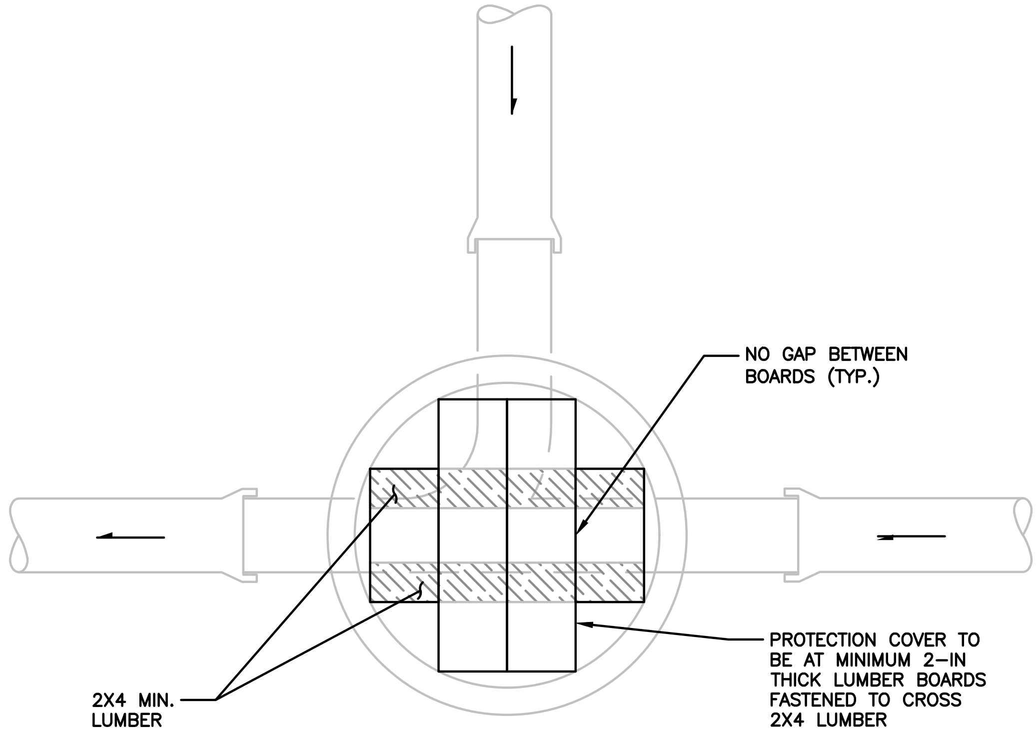
122

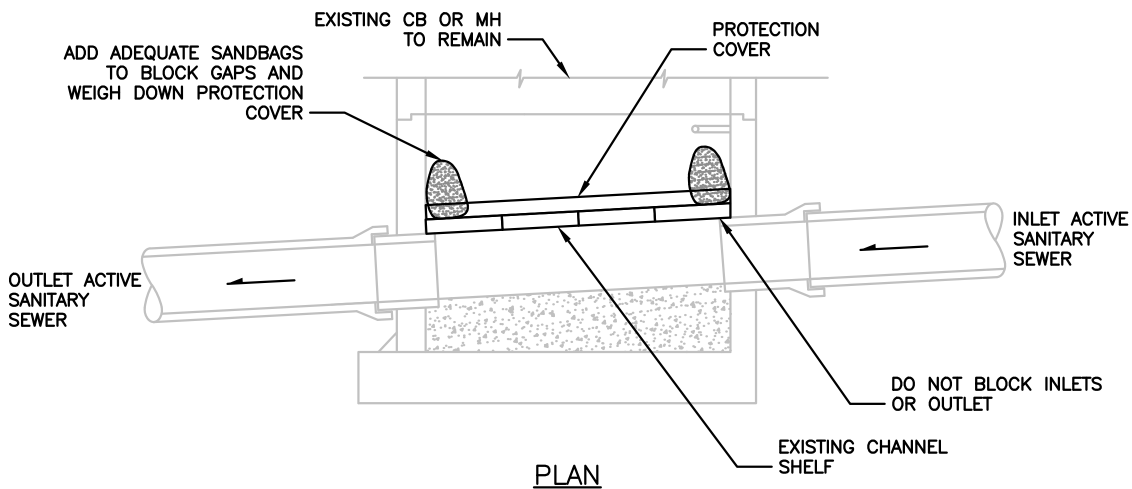
STRUCTURE LADDER, STEP AND HANDHOLD
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	STRUCTURE LADDER AND STEPS
F&I CIVIL STANDARDS	REVISION DATE: MAY 2023	STANDARD DETAIL NO. 122



SECTION 1/123

MINIMAL PROTECTION OF ACTIVE SANITARY SEWER
SCALE: NTS

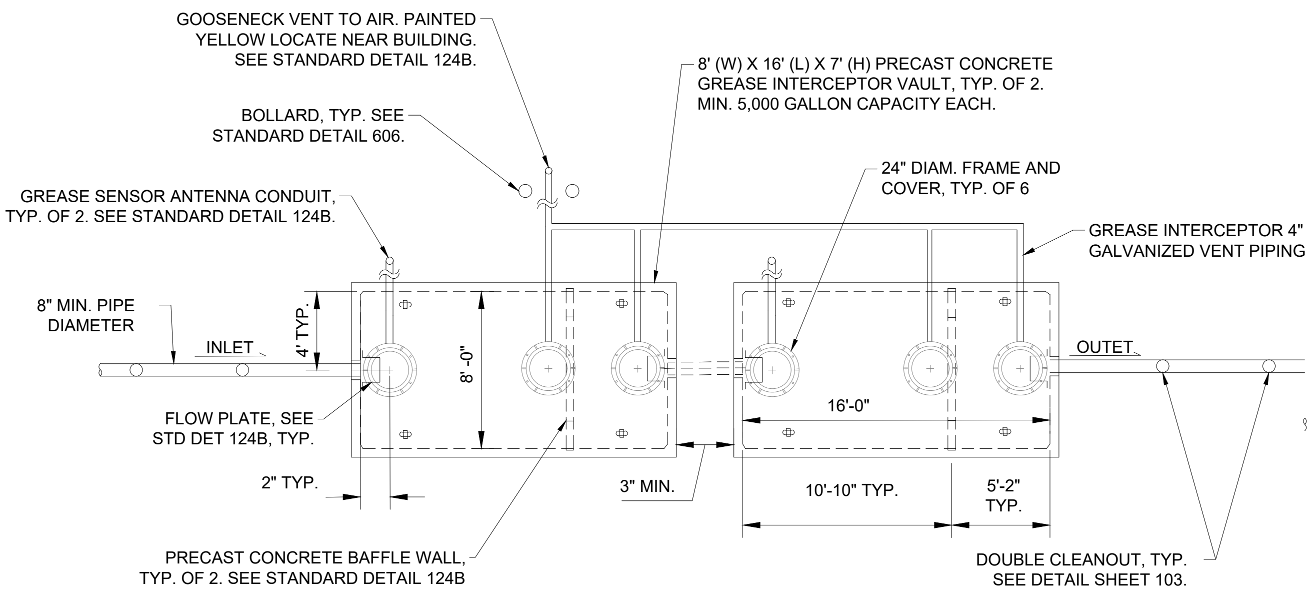


DETAIL 2/123

MINIMAL PROTECTION OF ACTIVE SANITARY SEWER
SCALE: NTS

NOTES:

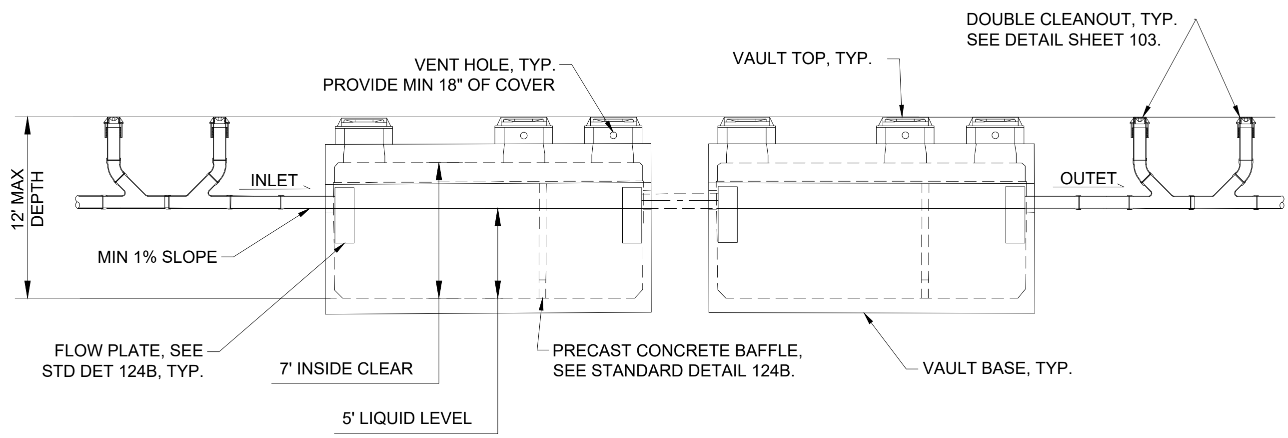
1. CONTRACTOR SHALL PREVENT ALL CONSTRUCTION DEBRIS, ROCKS, CONCRETE, ETC. FROM ENTERING AN ACTIVE SANITARY SEWER.
2. THIS DETAIL SHOWS THE MINIMAL AMOUNT OF PROTECTION. THE CONTRACTOR SHALL MODIFY THE DETAIL AS NEEDED TO PROTECT ACTIVE SEWERS.
3. PRIOR COMPLETION OF THE PROJECT AND WITH THE ENGINEER'S PERMISSION CONTRACTOR SHALL REMOVE THE PROTECTION COVER WITHOUT ANY DEBRIS ENTERING THE ACTIVE SEWER.



DETAIL

GREASE INTERCEPTOR
SCALE: NTS

1 / 124A



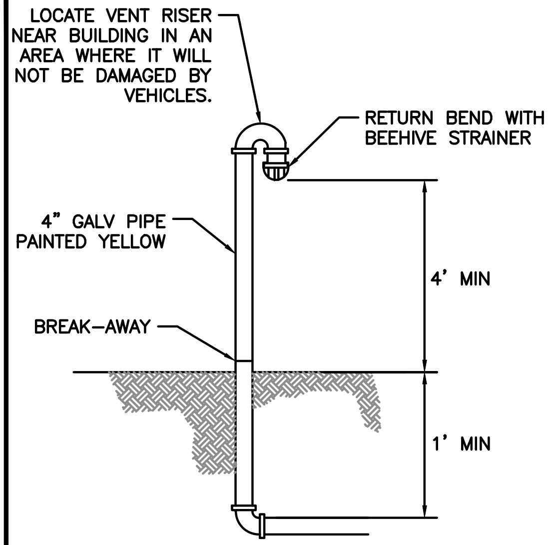
SECTION

GREASE INTERCEPTOR
SCALE: NTS

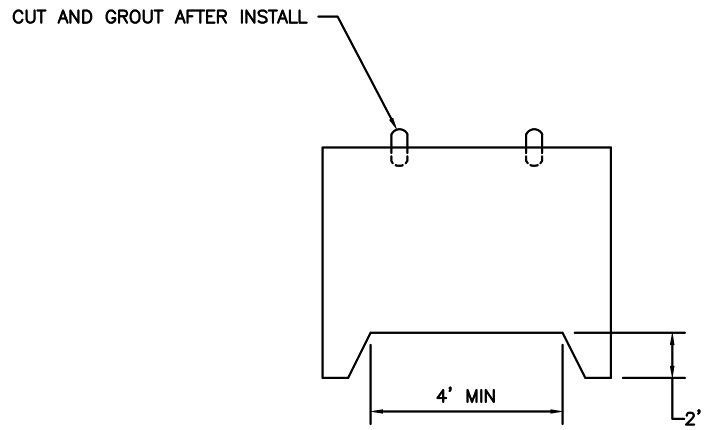
2 / 124A

NOTES:

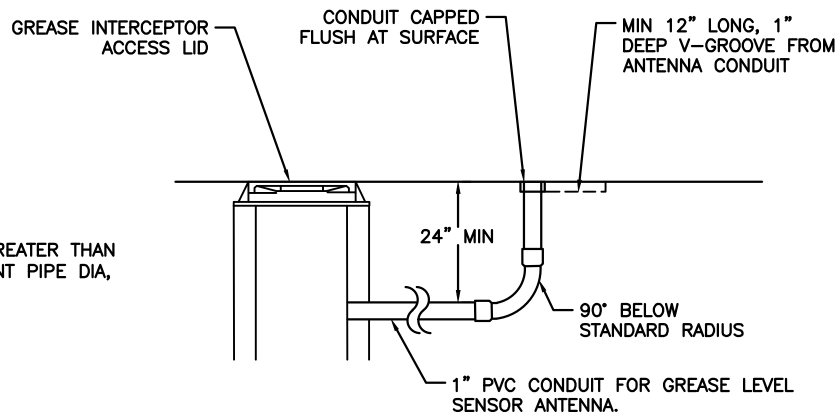
1. GREASE INTERCEPTOR LOCATION SHALL PROVIDE VACTOR TRUCK ACCESS.
2. ONLY GRAY WATER SHALL ENTER THE GREASE INTERCEPTOR. BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.
3. FRAME AND COVER:
   a. PROVIDE CAST PERMANENT "SEWER" LETTERING ON COVER,
   b. WITHIN THE AOA FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   c. OUTSIDE THE AOA, FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF HS-25 LOADING.
   d. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   e. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
4. DETAIL ABOVE IS FOR MINIMUM GREASE INTERCEPTOR SIZING. VAULT SHALL BE UP-SIZED AS NEEDED TO ACCOMMODATE CALCULATED FLOWS.
5. VAULT
   a. WITHIN THE AOA, THE VAULT SHALL BE DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B - DESIGN OF STRUCTURES" (OR LATEST ADDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
   b. OUTSIDE THE AOA, THE VAULT SHALL BE DESIGNED FOR HS-25 LOADING
6. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
7. PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
8. ALL RINGS AND COVERS SHALL BE AIR AND GAS TIGHT BOLT-LOCKING (TYP), RATED PER SECTION 334241.
9. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.



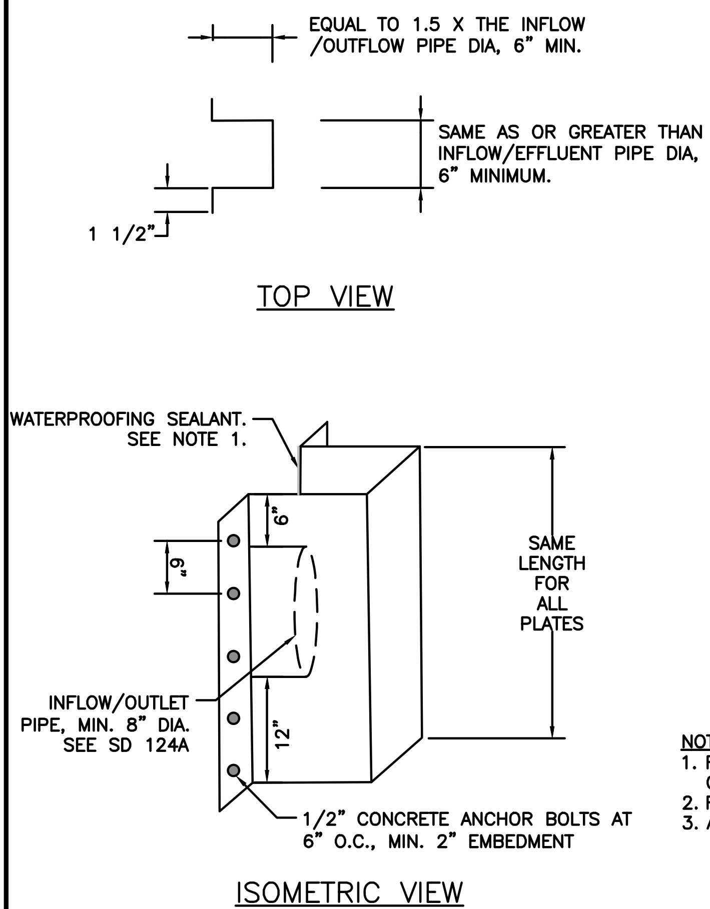
DETAIL 1/124B
GOOSENECK VENT
SCALE: NTS



DETAIL 2/124B
PRECAST CONCRETE BAFFLE
SCALE: NTS



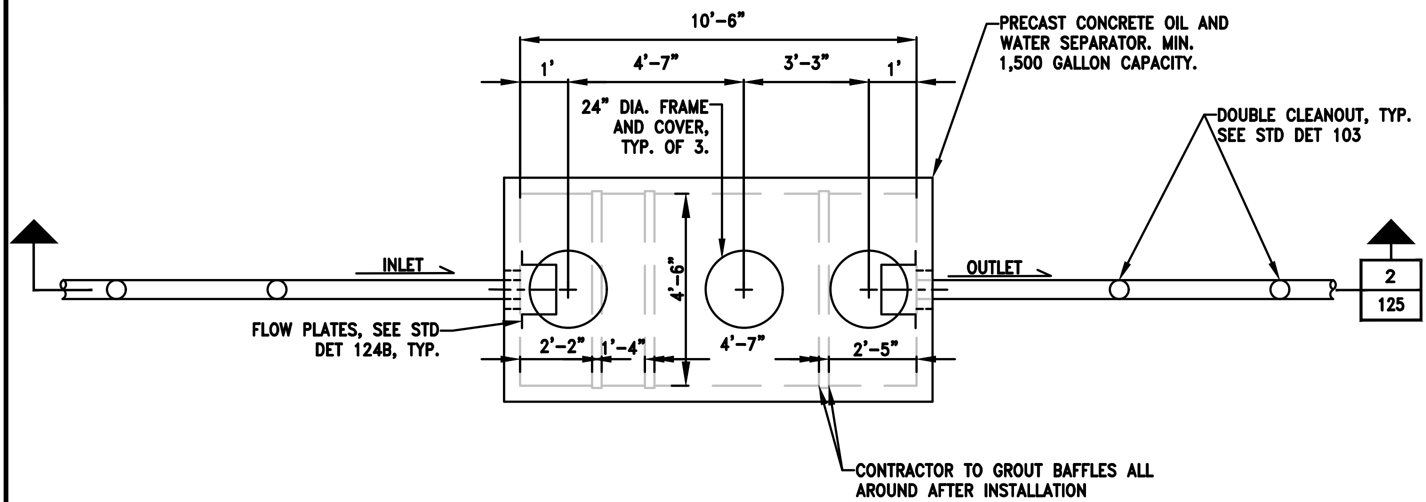
DETAIL 4/124B
GREASE SENSOR ANTENNA CONDUIT
SCALE: NTS



NOTES:
1. FLOW PLATE LINED WITH POLYURETHANE WATERPROOFING SEALANT WHERE CONTACTING GREASE INTERCEPTOR WALL.
2. FLOW PLATE MADE OF 5MM MIN AUSTENITIC STAINLESS STEEL.
3. ANCHOR BOLTS MADE OF AUSTENITIC STAINLESS STEEL.

DETAIL 3/124B
FLOW PLATE
SCALE: NTS

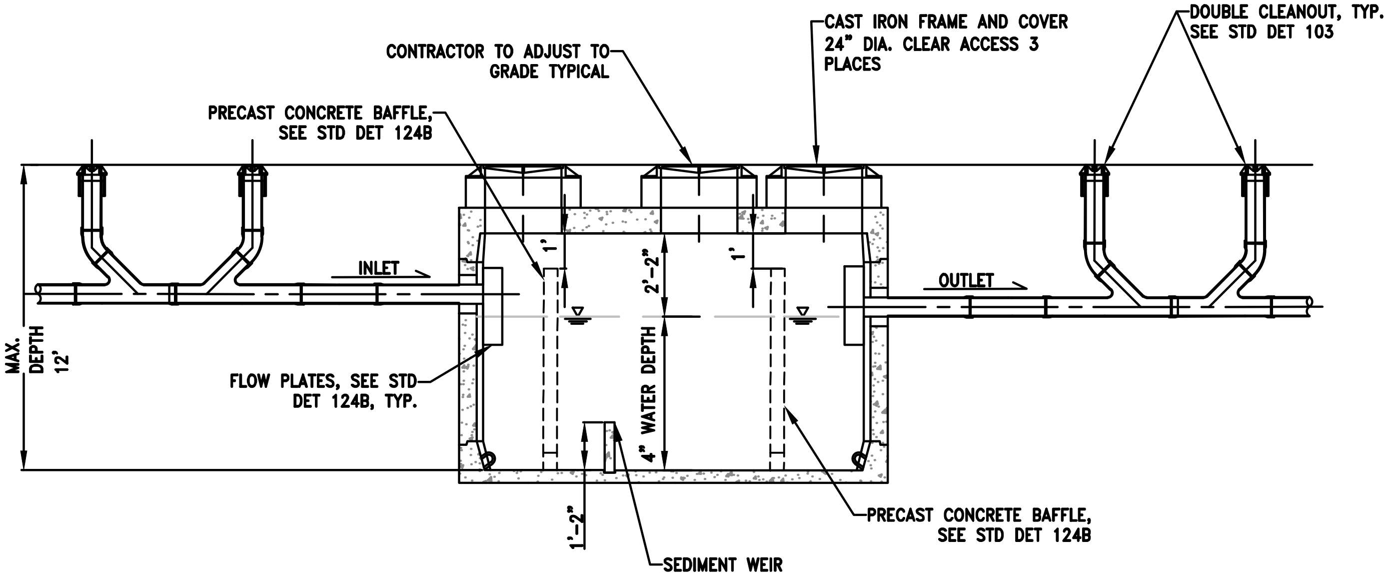
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	GREASE INTERCEPTOR (DETAILS)
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **124B**



PLAN

OIL AND WATER SEPARATOR
SCALE: NTS

1
125



SECTION

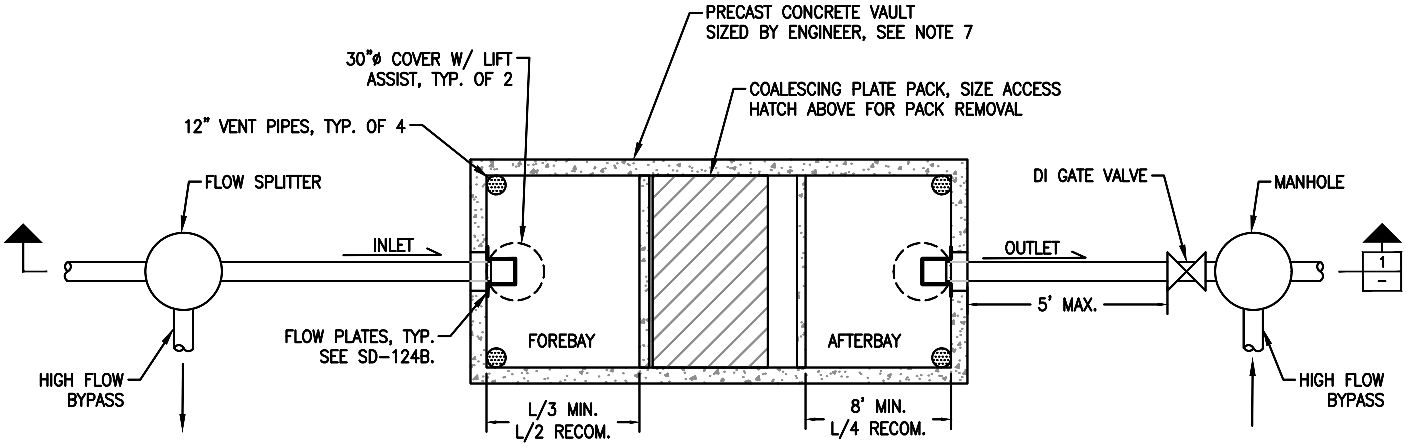
OIL AND WATER SEPARATOR
SCALE: NTS

2
125

NOTES:

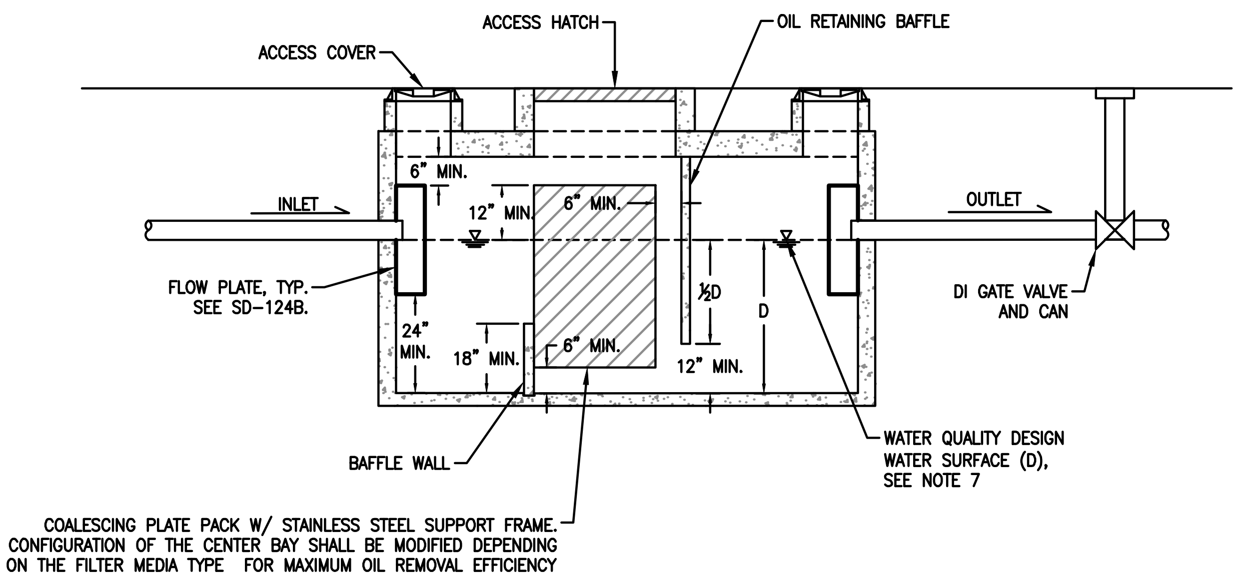
1. VAULT LOCATION SHALL PROVIDE VACTOR TRUCK ACCESS.
2. FRAME AND COVER:
   a. PROVIDE CAST PERMANENT "SEWER" LETTERING ON COVER.
   b. WITHIN THE AOA FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   c. OUTSIDE THE AOA, FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF HS-25 LOADING.
   d. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   e. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
3. VAULT
   a. WITHIN THE AOA, THE VAULT SHALL BE DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6F APPENDIX B - DESIGN OF STRUCTURES" (OR LATEST ADDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
   b. OUTSIDE THE AOA, THE VAULT SHALL BE DESIGNED FOR HS-25 LOADING
4. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
5. PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
6. ALL RINGS AND COVERS SHALL BE AIR AND GAS TIGHT BOLT-LOCKING (TYP), RATED PER SECTION 334241.
7. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.
8. DETAIL ABOVE IS FOR MINIMUM OIL AND WATER SEPARATOR SIZING. VAULT SHALL BE UP-SIZED AS NEEDED TO ACCOMMODATE CALCULATED FLOWS.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	OIL WATER SEPARATOR - API BAFFLE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **125**



DETAIL 1/–

OIL WATER SEPARATOR – COALESCING PLATE
SCALE: NTS



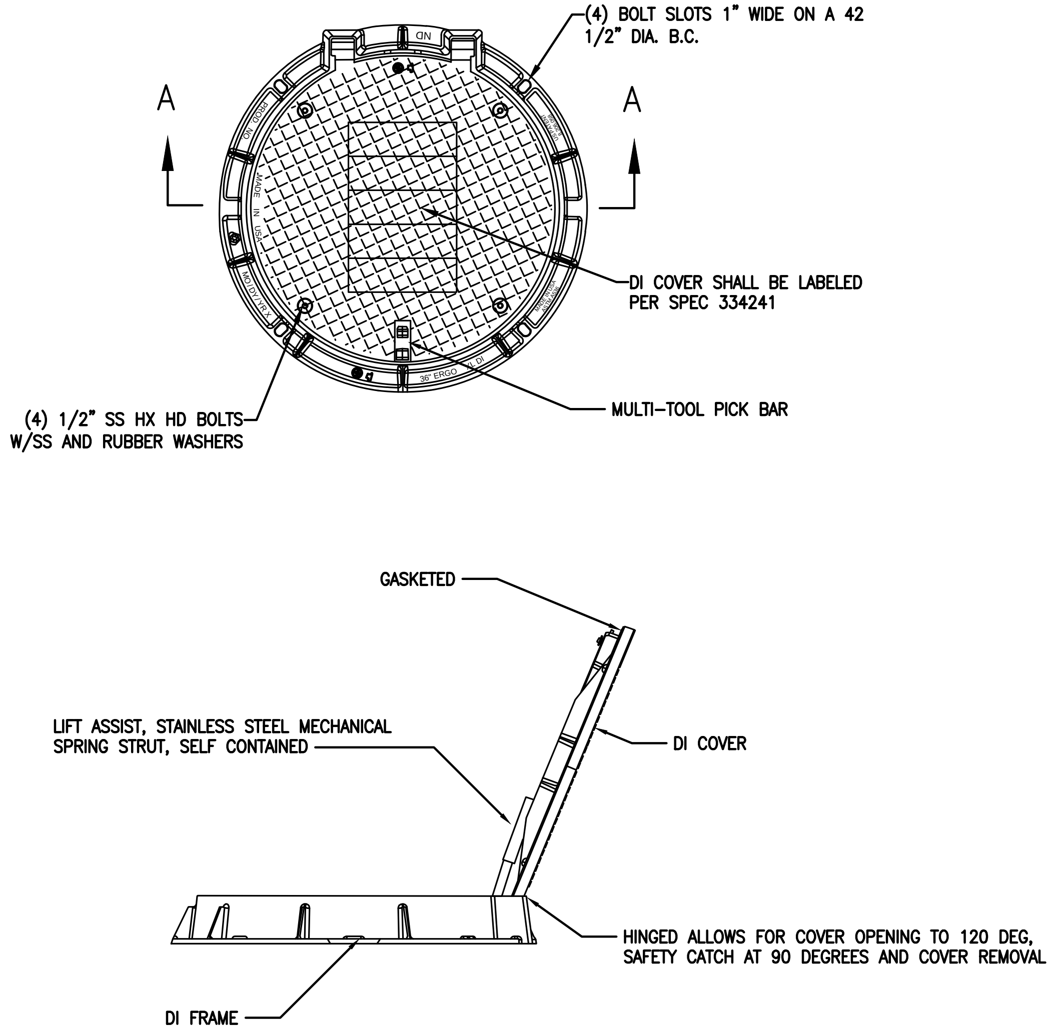
SECTION 1/–

OIL WATER SEPARATOR – COALESCING PLATE
SCALE: NTS

NOTES:

1. VAULT LOCATION SHALL PROVIDE VACTOR TRUCK ACCESS.
2. FRAME AND COVER:
   a. PROVIDE CAST PERMANENT "STORM" OR "IWS" LETTERING ON COVER, DEPENDING ON THE UTILITY SYSTEM.
   b. WITHIN THE AOA FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
   c. OUTSIDE THE AOA, FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF HS-25 LOADING.
   d. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
   e. FRAME AND COVER SHOULD INCLUDE LID ASSIST DEVICE. SEE STANDARD DETAIL NO. 126.
3. VAULT
   a. WITHIN THE AOA, THE VAULT SHALL BE DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150/5320-6G APPENDIX B – DESIGN OF STRUCTURES" (OR LATEST ADDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
   b. OUTSIDE THE AOA, THE VAULT SHALL BE DESIGNED FOR HS-25 LOADING
4. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
5. PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
6. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.
7. VAULT SHALL BE SIZED FOLLOWING DESIGN PROCEDURE AND REQUIREMENTS IN SECTION BMP T11.11 OF THE 2019 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON (SWMMWW).
8. INLET AND OUTLET INVERTS ARE BASED ON THE WATER DESIGN WATER QUALITY SURFACE. BOTH THE INLET AND OUTLET FLOW PLATES SHOULD EXTEND AT LEAST 1' ABOVE AND BELOW THE WATER QUALITY DESIGN WATER SURFACE.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC-2022	OIL WATER SEPARATOR - COALESCING PLATE STANDARD DETAIL NO. **125B**

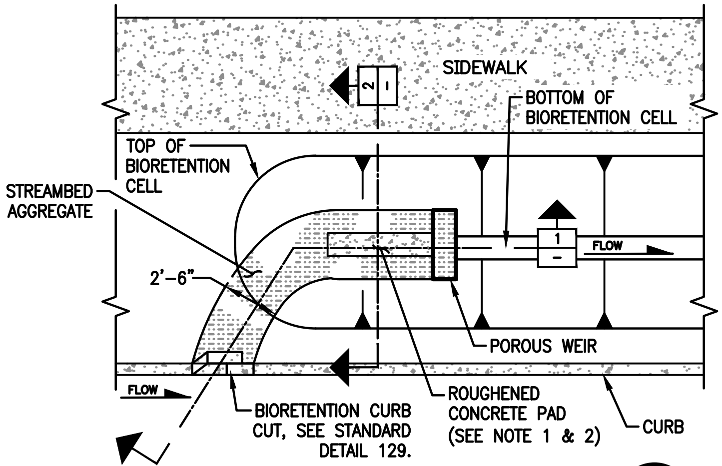


DETAIL 1/126

LID ASSIST DEVICE
SCALE: NTS

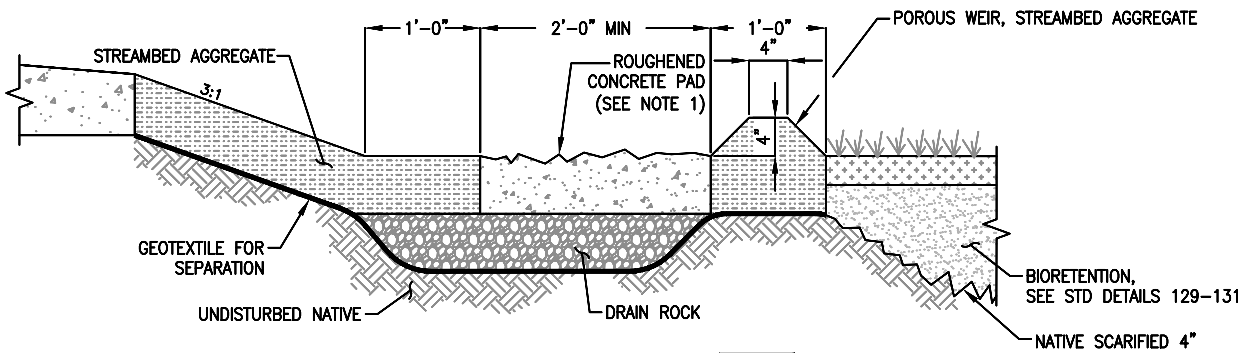
NOTES:
1. METAL CASTINGS SHOULD MEET THE REQUIREMENTS IN SPEC SECTION 334241.
2. STRUCTURES WITH COVERS 30" OR LARGER SHALL USE A LID LIFT-ASSIST DEVICE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	MH COVER LIFT ASSIST DEVICE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **126**



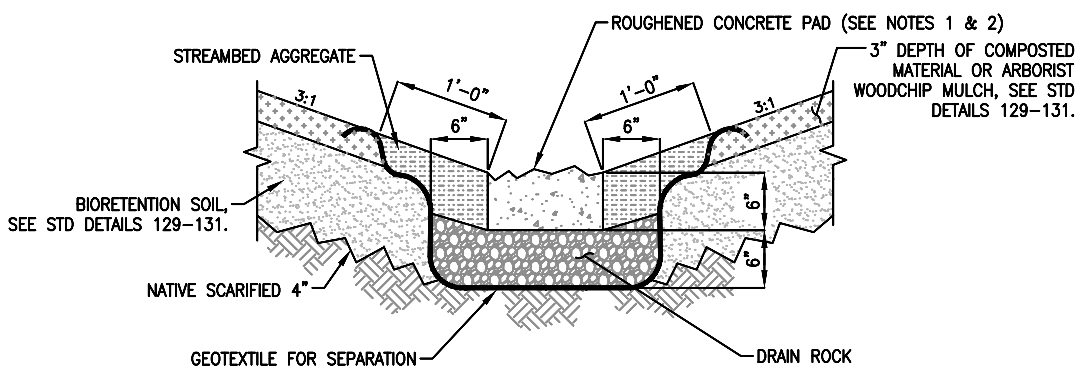
DETAIL 1/–

BIORETENTION PRESETTLING ZONE
SCALE: NTS



SECTION 1/–

BIORETENTION PRESETTLING ZONE
SCALE: NTS



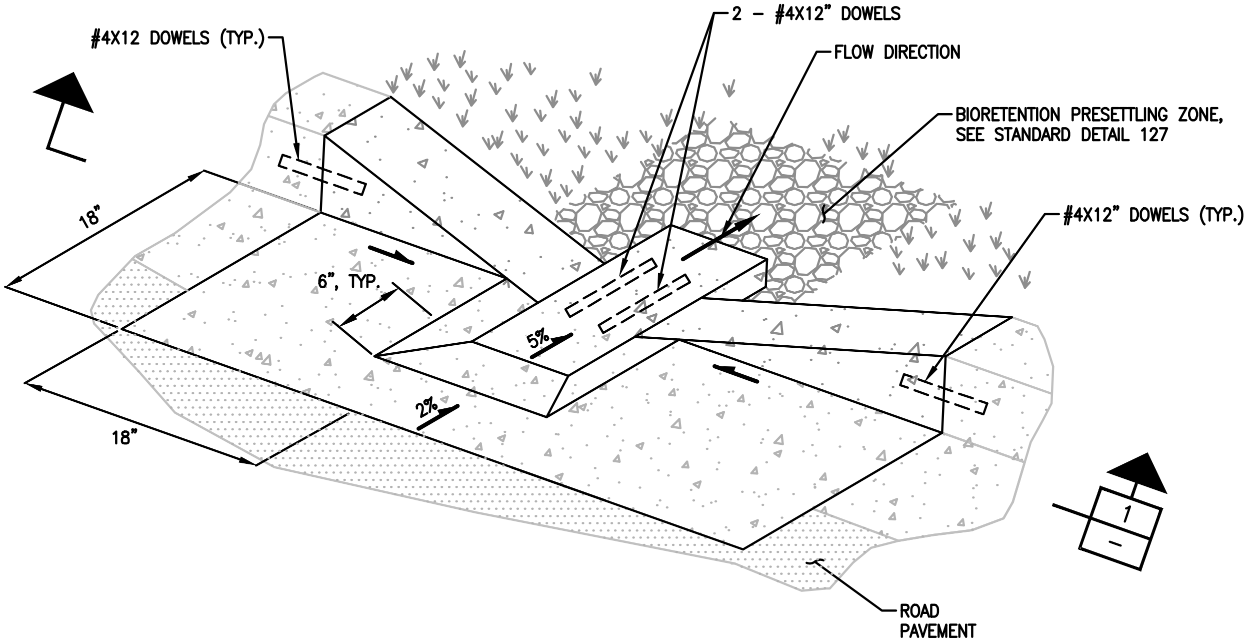
SECTION 2/–

BIORETENTION PRESETTLING ZONE
SCALE: NTS

NOTES:

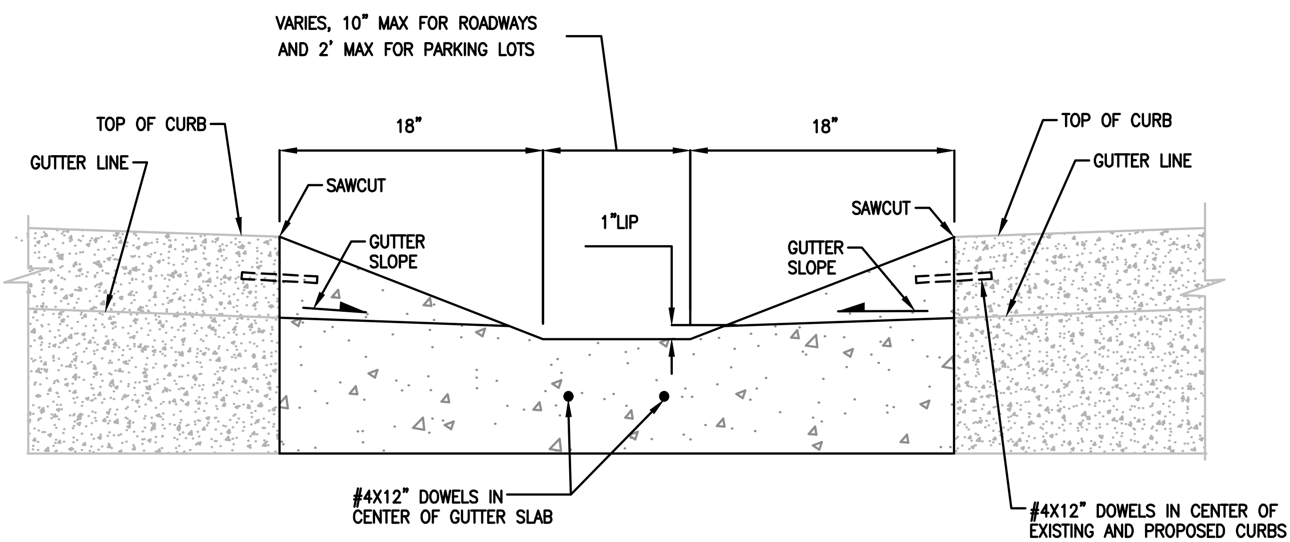
1. ROUGHENED CONCRETE PAD MUST BE MIN 2' LONG & 2.5 SF OR 5.0 SF.
2. ROUGHENED CONCRETE PAD MUST BE CONSTRUCTED WITH CLASS 3000 CEMENT CONCRETE EMBED WELL MIXED 6"–8" STREAMBED AGGREGATE INTO CONCRETE SURFACE TO CREATE ROUGHNESS. 50% MIN OF THE SURFACE MUST HAVE PROTRUDING AGGREGATE.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** OCT-2022	BIORETENTION PRESETTLING ZONE STANDARD DETAIL NO. **127**



DETAIL
BIORETENTION CURB CUT
SCALE: NTS

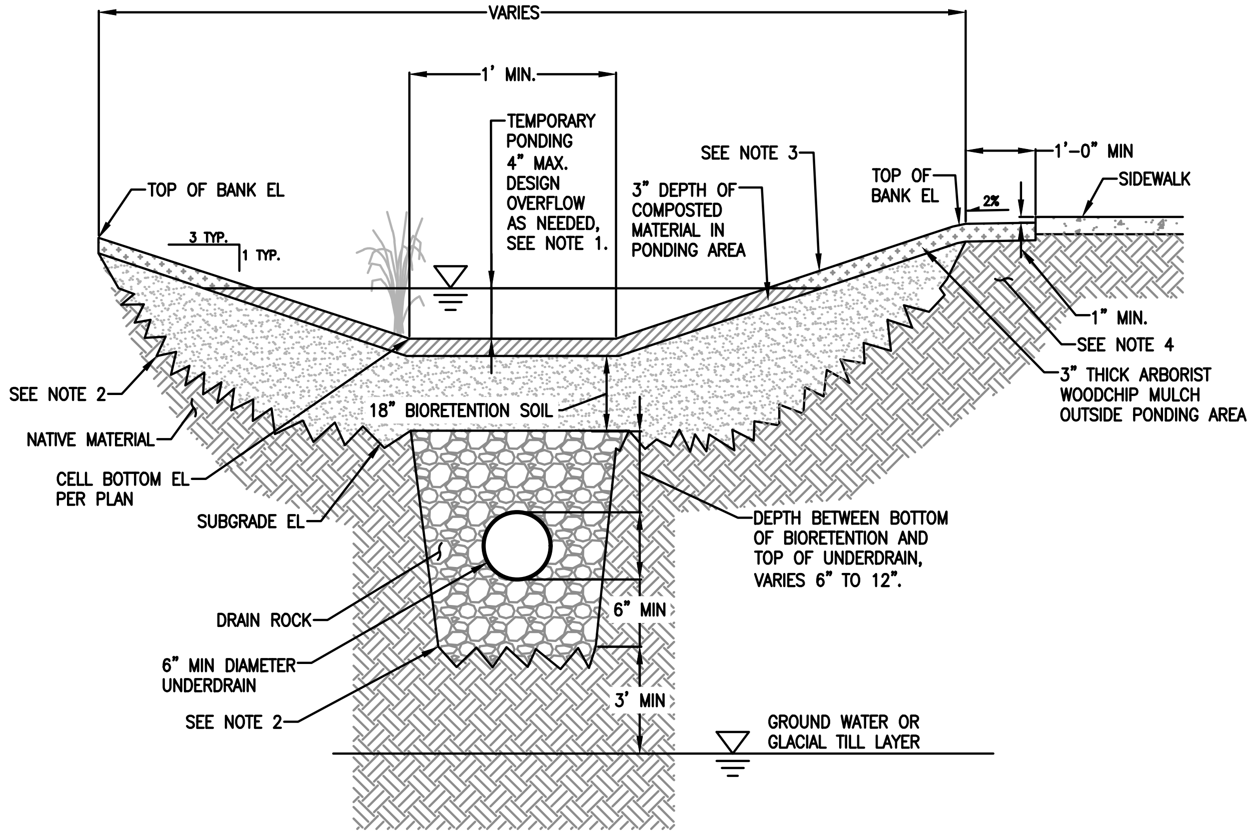
1
–

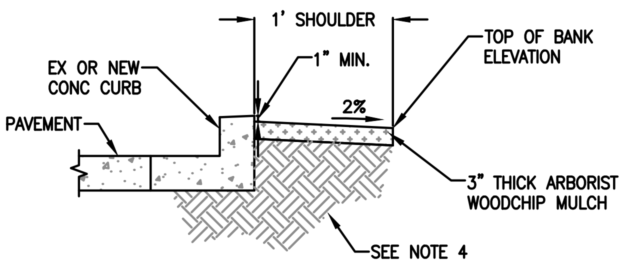


SECTION
BIORETENTION CURB CUT
SCALE: NTS

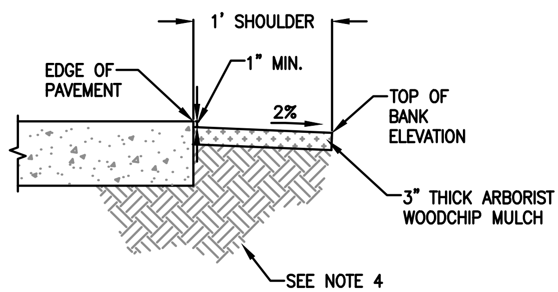
1
–

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC-2022	BIORETENTION CURB CUT STANDARD DETAIL NO. **128**





DETAIL A
CURBED ROADWAY



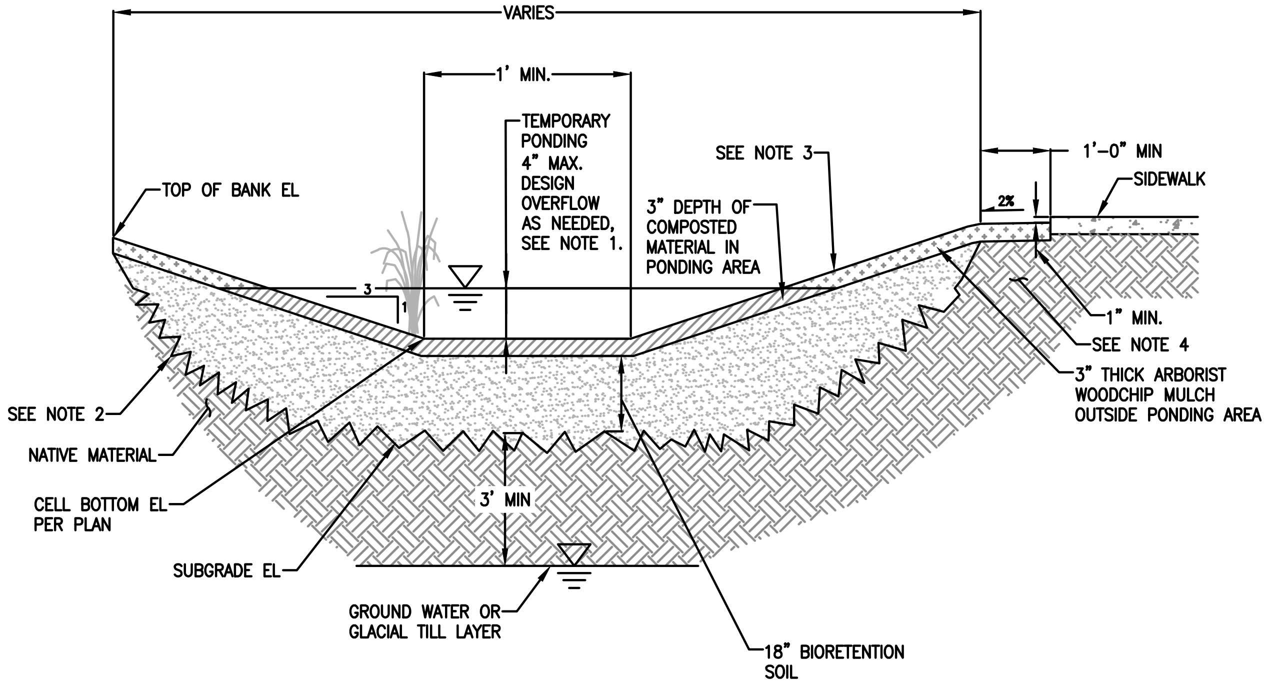
DETAIL B
CURBLESS ROADWAY

DETAIL 1 / –

INFILTRATING BIORETENTION
WITH UNDERDRAIN (LANDSIDE ONLY)
SCALE: NTS

NOTES:

1. BIORETENTION OVERFLOW ELEVATIONS MUST BE SET BELOW SIDEWALK ELEVATION.
2. SCARIFY SUBGRADE TO A MINIMUM DEPTH OF 3 INCHES IN THE AREA SUBJECT TO TEMPORARY PONDING BEFORE BIORETENTION SOIL INSTALLATION.
3. CELL MUST BE PLANTED WITH VEGETATION CONSISTENT WITH STIA WILDLIFE HAZARD MANAGEMENT PLAN (WHMP).
4. SOIL UNDER SHOULDERS OR PAVED AREAS MUST BE UNDISTURBED NATIVE SOIL OR APPROVED FILL COMPACTED TO 95% DENSITY.
5. REFER TO PORT OF SEATTLE STORMWATER MANAGEMENT MANUAL, CHAPTER 4. BMP AND FACILITY SELECTION PROCESS FOR PERMANENT STORMWATER CONTROL PLANS AND THE PORT OF SEATTLE LOW IMPACT DEVELOPMENT GUIDELINE FOR SELECTING TYPE OF BIORETENTION BMP TO USE FOR DESIGN.



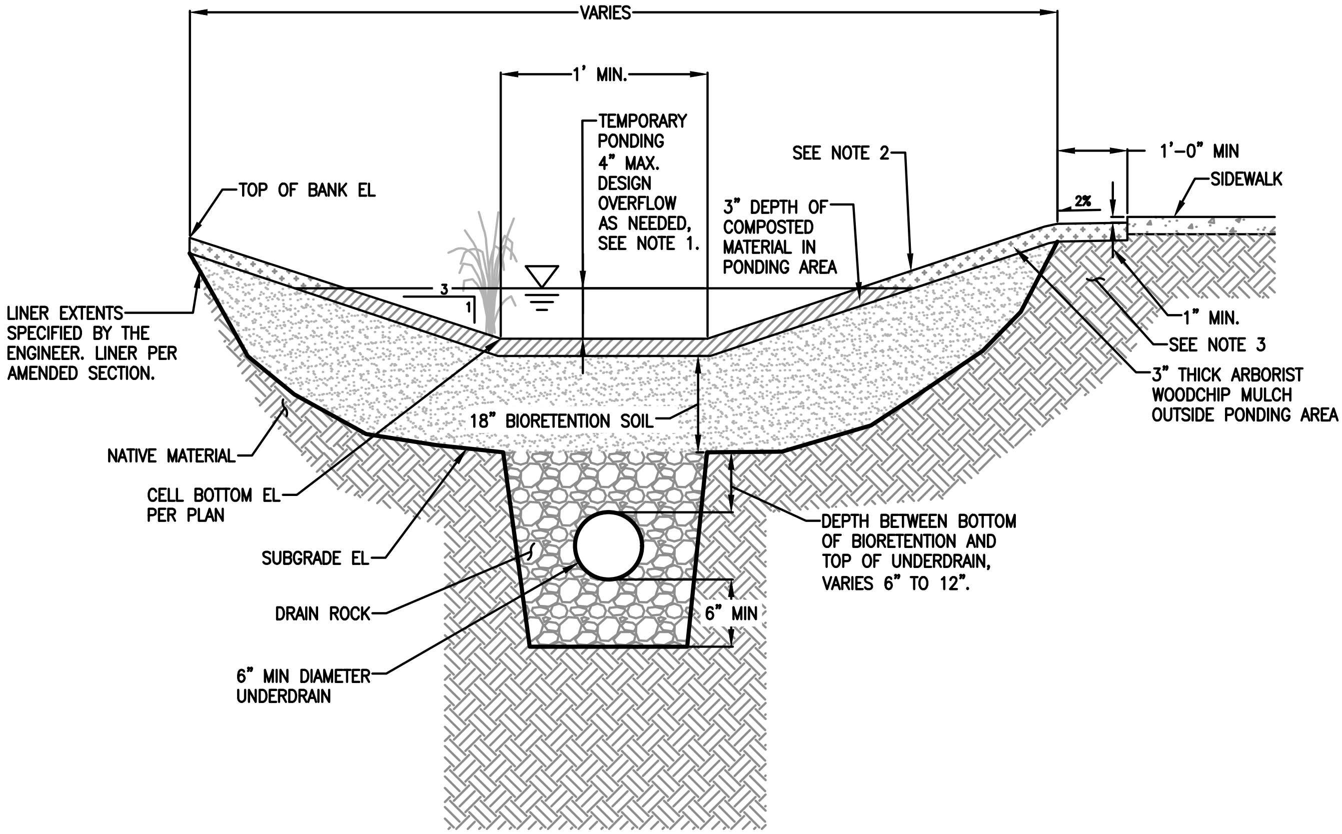
DETAIL 1 / –

INFILTRATING BIORETENTION (LANDSIDE ONLY)
SCALE: NTS

NOTES:

1. BIORETENTION OVERFLOW ELEVATIONS MUST BE SET BELOW SIDEWALK ELEVATION.
2. SCARIFY SUBGRADE TO A MINIMUM DEPTH OF 3 INCHES IN THE AREA SUBJECT TO TEMPORARY PONDING BEFORE BIORETENTION SOIL INSTALLATION.
3. CELL MUST BE PLANTED WITH VEGETATION CONSISTENT WITH STIA WILDLIFE HAZARD MANAGEMENT PLAN (WHMP).
4. SOIL UNDER SHOULDERS OR PAVED AREAS MUST BE UNDISTURBED NATIVE SOIL OR APPROVED FILL COMPACTED TO 95% DENSITY.
5. ALSO SEE STANDARD DETAIL 128 AND 129 (A&B) FOR INTERFERENCE WITH ROADWAY.
6. REFER TO PORT OF SEATTLE STORMWATER MANAGEMENT MANUAL, CHAPTER 4. BMP AND FACILITY SELECTION PROCESS FOR PERMANENT STORMWATER CONTROL PLANS AND THE PORT OF SEATTLE LOW IMPACT DEVELOPMENT GUIDELINE FOR SELECTING TYPE OF BIORETENTION BMP TO USE FOR DESIGN.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** OCT-2022	INFILTRATING BIORETENTION (LANDSIDE ONLY) STANDARD DETAIL NO. **130**



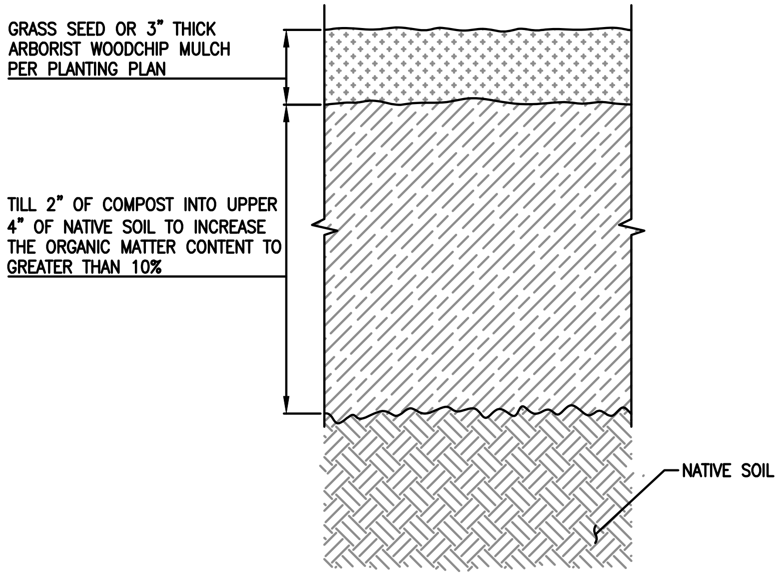
DETAIL 1 / –

NON-INFILTRATING BIORETENTION WITH UNDERDRAIN (LANDSIDE ONLY)
SCALE: NTS

NOTES:

1. BIORETENTION OVERFLOW ELEVATIONS MUST BE SET BELOW SIDEWALK ELEVATION.
2. CELL MUST BE PLANTED WITH VEGETATION CONSISTENT WITH STIA WILDLIFE HAZARD MANAGEMENT PLAN (WHMP).
3. SOIL UNDER SHOULDERS OR PAVED AREAS MUST BE UNDISTURBED NATIVE SOIL OR APPROVED FILL COMPACTED TO 95% DENSITY.
4. ALSO SEE STANDARD DETAIL 128 AND 129 (A&B) FOR INTERFERENCE WITH ROADWAY.
5. REFER TO PORT OF SEATTLE STORMWATER MANAGEMENT MANUAL, CHAPTER 4. BMP AND FACILITY SELECTION PROCESS FOR PERMANENT STORMWATER CONTROL PLANS AND THE PORT OF SEATTLE LOW IMPACT DEVELOPMENT GUIDELINE FOR SELECTING TYPE OF BIORETENTION BMP TO USE FOR DESIGN.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** OCT-2022	NON-INFILTRATING BIORETENTION WITH UNDERDRAIN (LANDSIDE ONLY) STANDARD DETAIL NO. **131**



DETAIL
SOIL AMENDMENT
SCALE: NTS

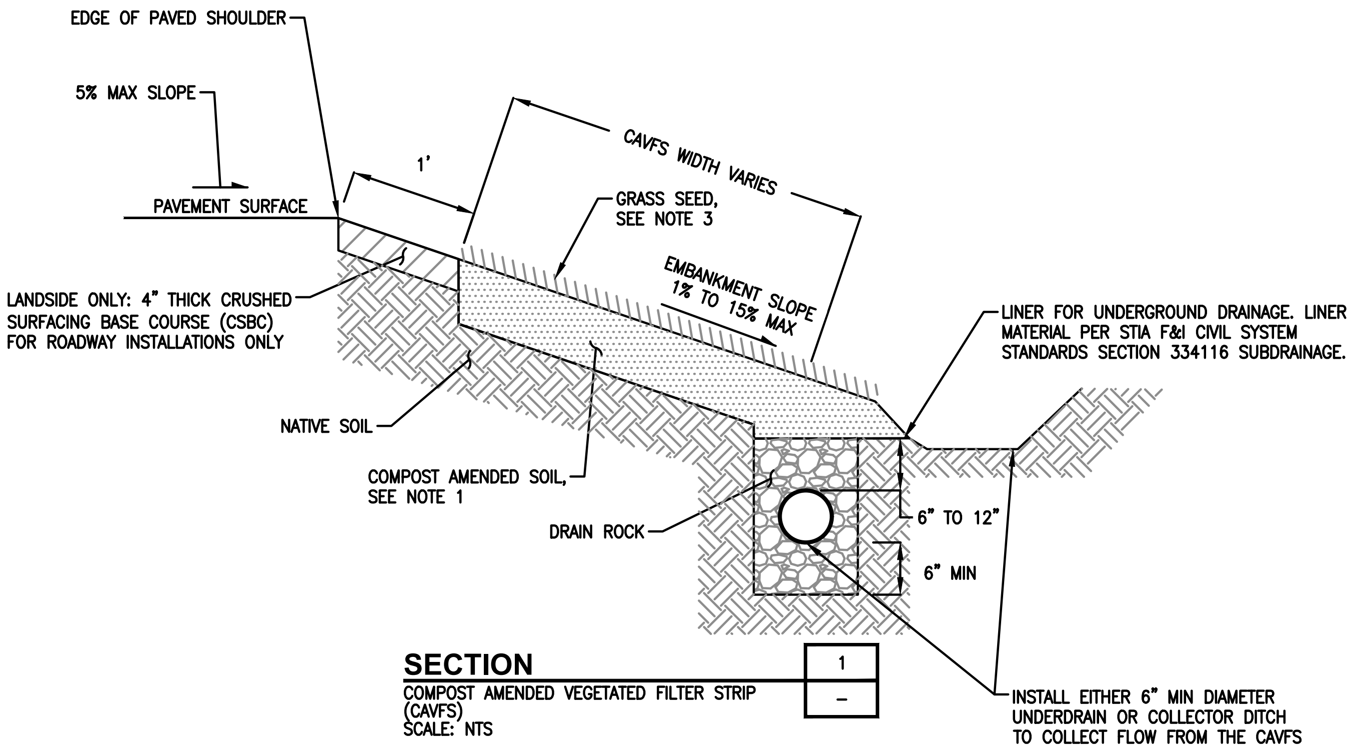
1
–

NOTES:
1. ALL SOIL AREAS DISTURBED OR COMPACTED DURING CONSTRUCTION, AND NOT COVERED BY BUILDINGS OR PAVEMENT, MUST BE AMENDED WITH COMPOST AS DESCRIBED BELOW.

2. PLANT GRASS SEED PER T–901 SEEDING OF FAA AC 150/5370–10H OR ARBORIST WOODCHIP MULCH PER STIA F&I CIVIL SYSTEM STANDARDS SECTION 338000 COMPOST AMENDED BMPS SECTION 2.03.

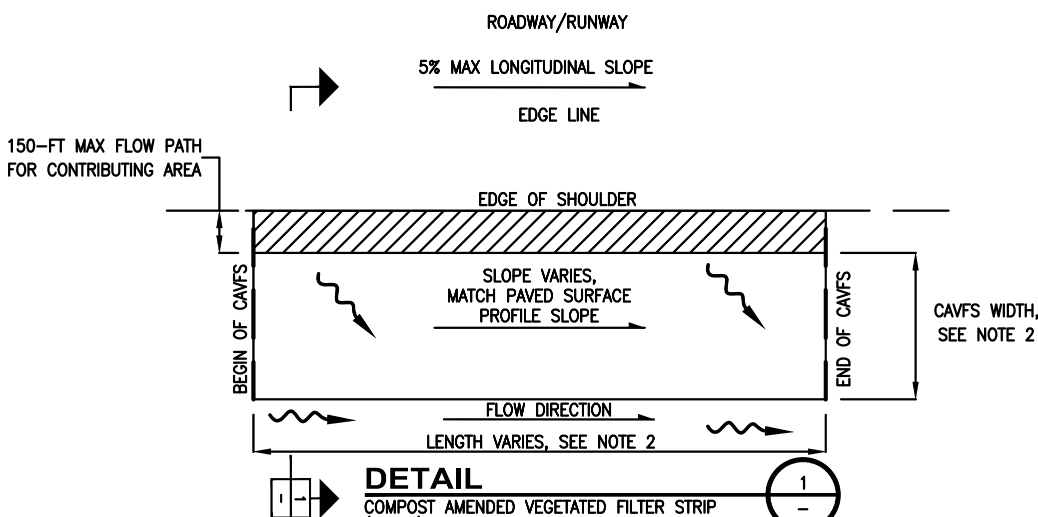
3. SETBACKS:
   a. TO PREVENT UNEVEN SETTLING, NO SOIL AMENDMENT WITHIN 3 FEET OF UTILITY INFRASTRUCTURES (POLES, VAULTS, METERS ETC.)
   b. WITHIN ONE FOOT OF PAVEMENT EDGE, CURBS AND SIDEWALKS SOIL SHOULD BE COMPACTED TO APPROXIMATELY 90% PROCTOR TO ENSURE A FIRM SURFACE.
   c. WITHIN RUNWAY SAFETY AREAS, UNDERLYING SOIL SHOULD BE COMPACTED TO NO LESS THAN 95% TO MEET FAA REQUIREMENTS.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** OCT-2022	SOIL AMENDMENT STANDARD DETAIL NO. **132**



SECTION 1 / –

COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS)
SCALE: NTS



DETAIL 1 / –

COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS)
SCALE: NTS

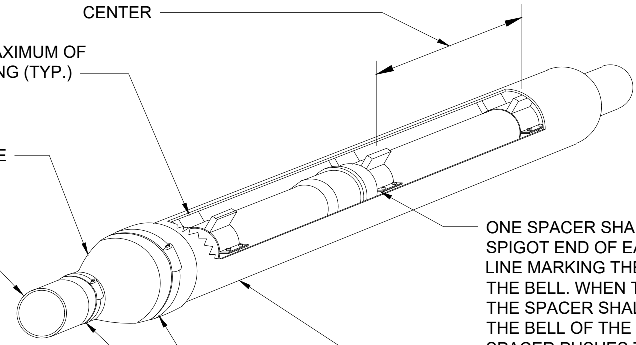
NOTES

1. SOIL AMENDMENT:
   A. FOR AIRSIDE INSTALLATIONS:
   TILL 2" OF COMPOST INTO UPPER 4" OF UNCOMPACTED NATIVE SOIL TO INCREASE ORGANIC MATTER CONTENT TO 10% OR GREATER PER STD DETAIL 132.
   B. FOR LANDSIDE INSTALLATIONS ADJACENT TO A ROAD:
   SHALL BE PER STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON: TILL 1.75 INCHES OF COMPOSTED MATERIAL INTO 6.25 INCHES OF NATIVE SOIL (A TOTAL AMENDED DEPTH OF ABOUT 9.5 INCHES), FOR A SETTLED DEPTH OF 8 INCHES. WATER OR ROLL TO COMPACT SOIL TO 85% MAXIMUM.

2. WIDTHS ARE DESIGNED IN ACCORDANCE WITH SECTION BMP T7.40 T9.40 EXCEPT FOR EXTENDED CAVFS ALONG RUNWAYS. FOR EXTENDED CAVFS, WIDTHS ARE TYPICALLY 100 FEET OR GREATER (3 TO 4 TIMES GREATER THAN WIDTHS REQUIREMENTS IN THE SWMMWW).

3. PLANT GRASS SEED PER T-901 SEEDING OF FAA AC 150/5370-10H.

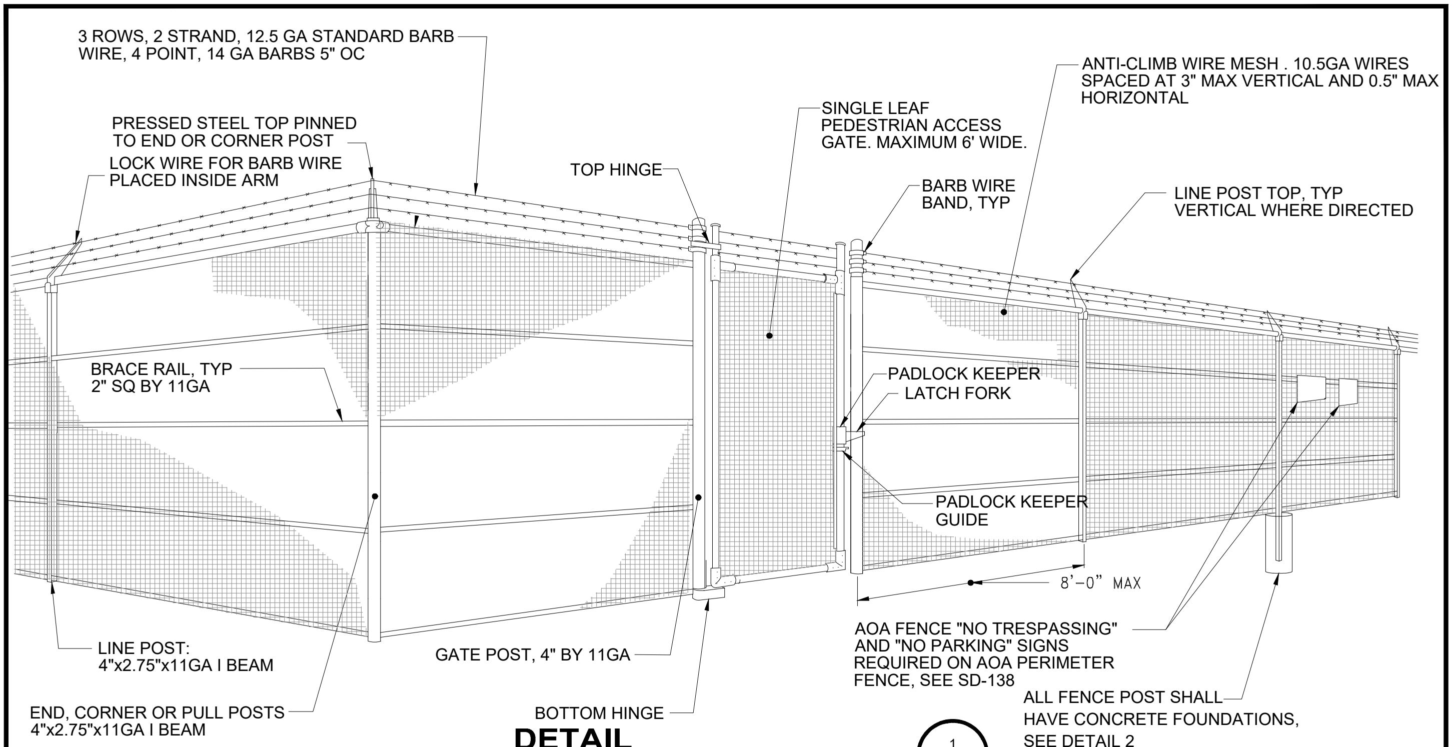
SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** OCT-2022	COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS) STANDARD DETAIL NO. **133**



NOTES:

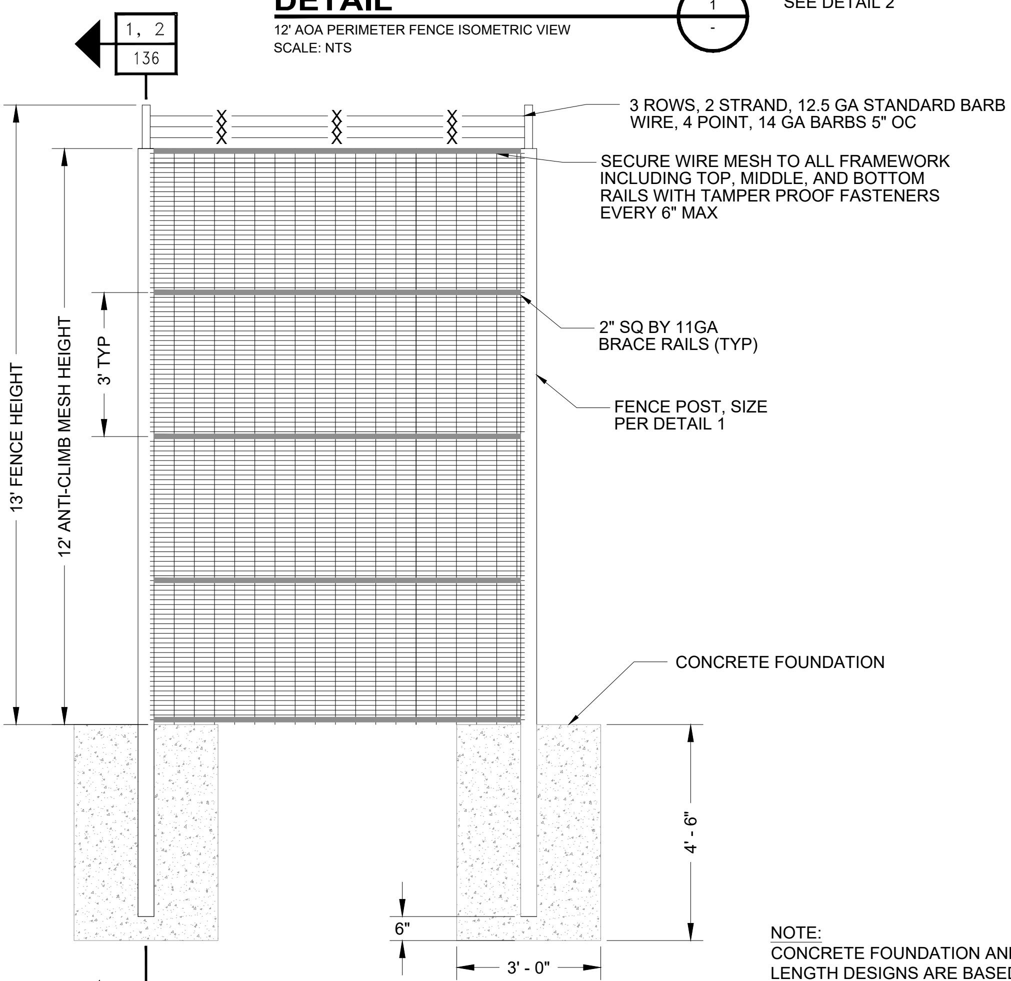
1. CASING SPACERS SHALL POSITION THE CARRIER PIPE AS LOW IN THE CASING PIPE AS POSSIBLE.
2. MINIMUM RUNNER WIDTH SHALL BE 2 INCHES.
3. RUNNER HEIGHT SHALL BE SIZED TO PROVIDE MINIMUM 1" CLEARANCE BETWEEN RUNNERS AND TOP OF CASING WALL TO PREVENT JAMMING DURING INSTALLATION.
4. CASING SPACER SYSTEM SHALL BE DESIGNED TO SUPPORT THE WEIGHT OF THE CARRIER PIPE WHEN FILLED.
5. STEEL CASING DIAMETERS ARE "OUTSIDE DIAMETER" FOR 16" AND LARGER.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	UTILITY CASING INSTALLATION
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **134**



DETAIL 1 / -

12' AOA PERIMETER FENCE ISOMETRIC VIEW
SCALE: NTS



DETAIL 2 / -

12' AOA PERIMETER FENCE ELEVATION VIEW
SCALE: NTS

NOTE:
CONCRETE FOUNDATION AND EMBEDMENT LENGTH DESIGNS ARE BASED ON A TYPICAL LATERAL SOIL-BEARING PRESSURE OF 150 PSF. ENGINEER TO RECALCULATE FOOTING SIZE AND POST EMBEDMENT LENGTH IF PROJECT SPECIFIC SOIL PROPERTIES DIFFER.

SEA Seattle-Tacoma International Airport

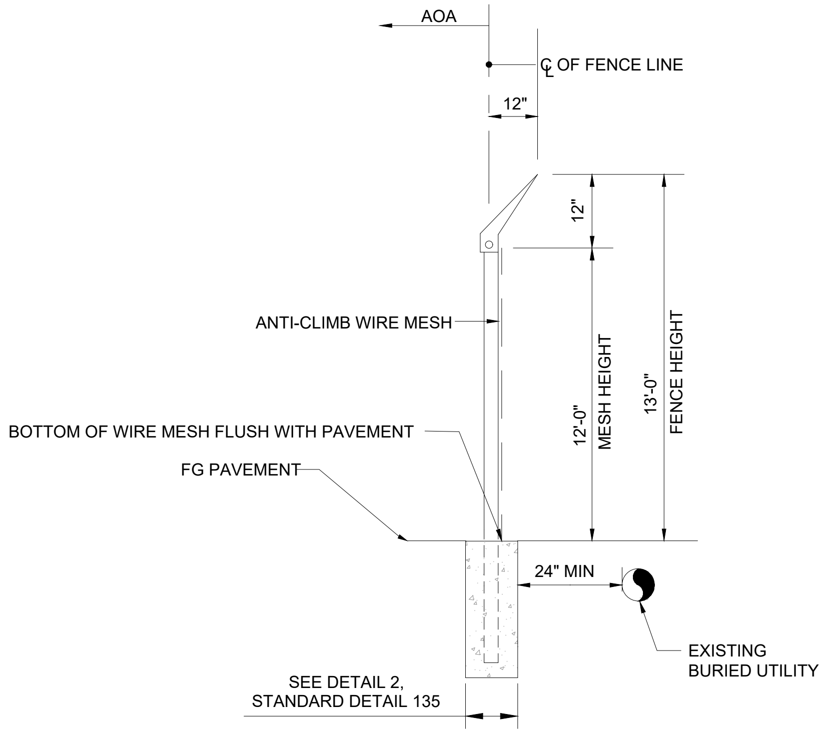
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: 2023

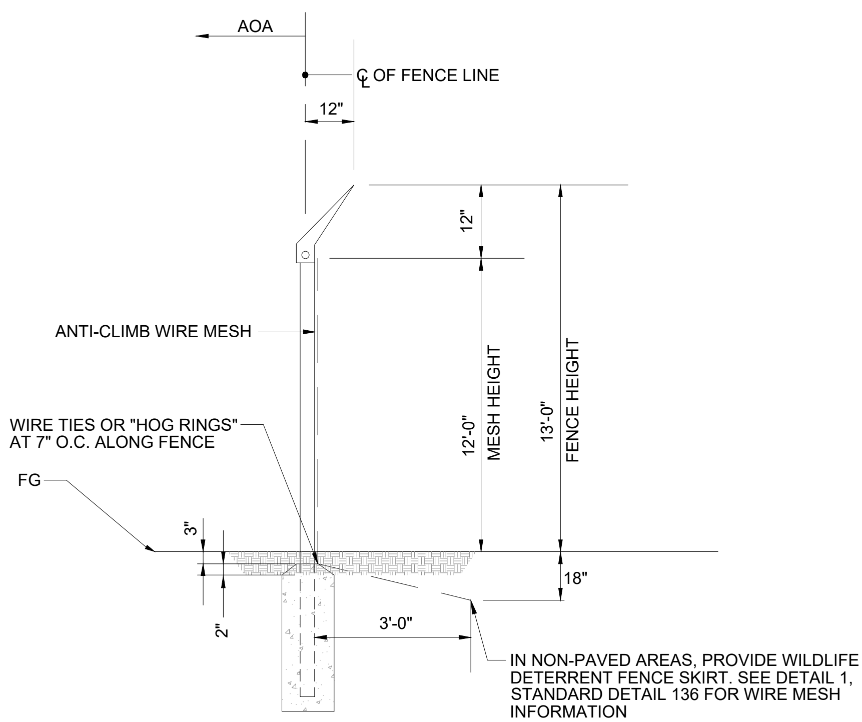
AOA FENCE

STANDARD DETAIL NO. **135**



SECTION | 2 / 135

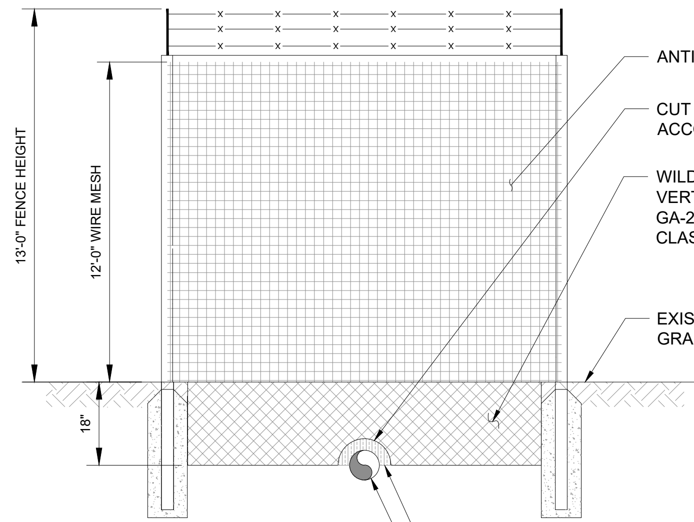
AOA PERIMTER FENCE - IN PAVED AREAS
SCALE: NTS



SECTION | 2 / 135

AOA PERIMTER FENCE - IN NON-PAVED AREAS
SCALE: NTS

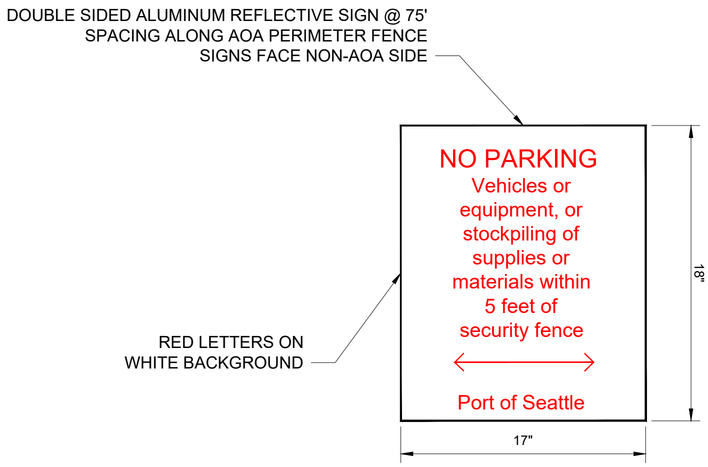
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	AOA FENCE SECTIONS
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **136**



DETAIL 1 / -

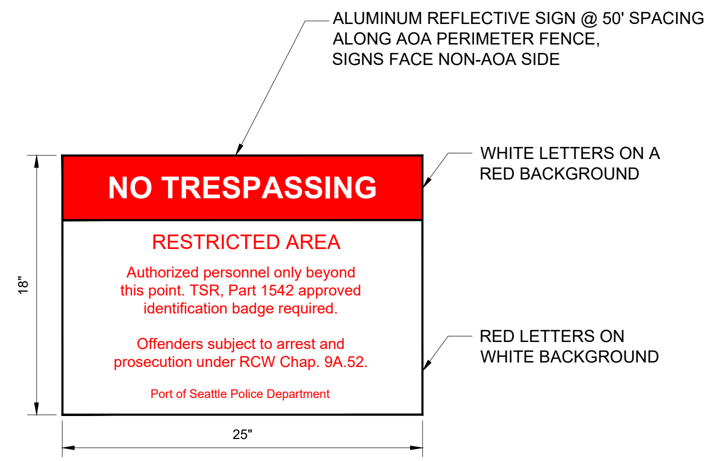
WILDLIFE DETERRENT FENCE SKIRT ELEVATION
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	WILDLIFE DETERRENT FENCE SKIRT
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **137**



DETAIL 1 -

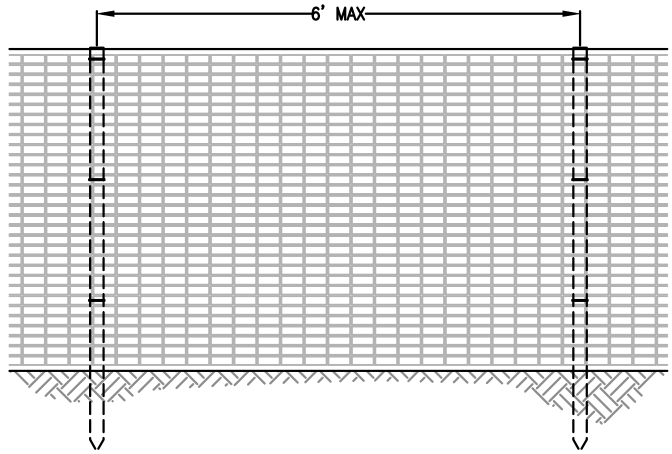
AOA PERIMETER FENCE NO PARKING SIGN
SCALE: NTS



DETAIL 2 -

AOA PERIMETER FENCE NO TRESSPASSING SIGN
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	AOA FENCE SIGNS
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **138**



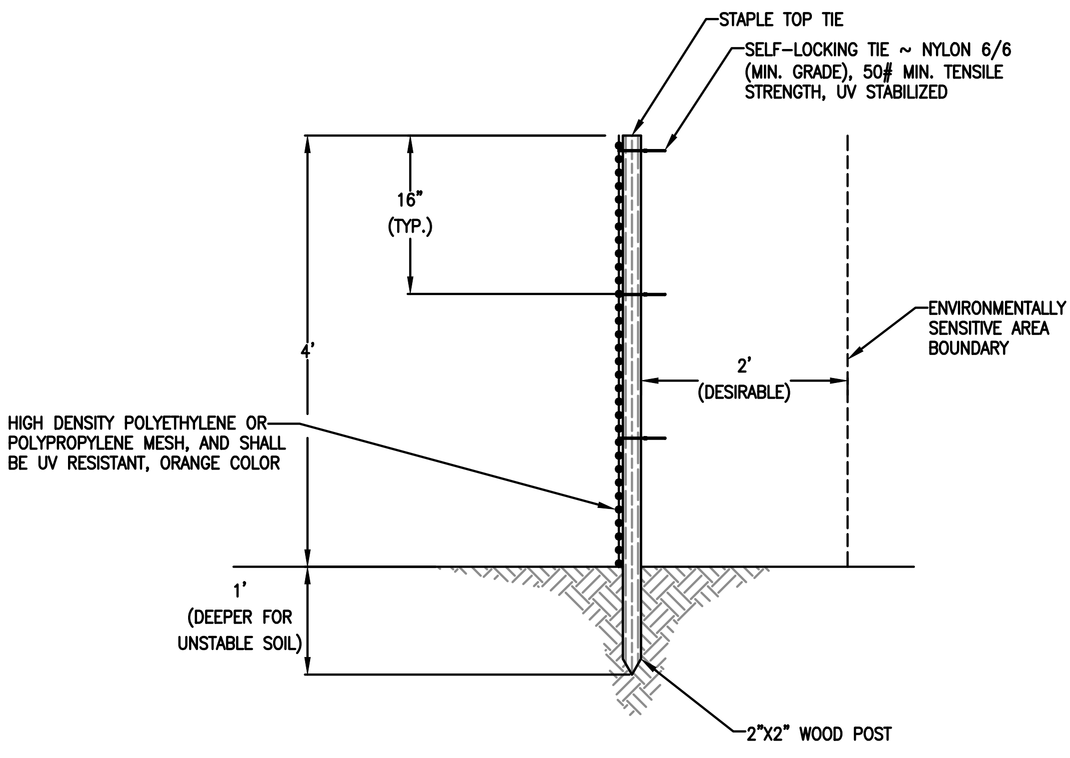
NOTES

1. POST SHALL HAVE SUFFICIENT STRENGTH AND DURABILITY TO SUPPORT THE FENCE THROUGH THE LIFE OF THE PROJECT.

SECTION

HIGH VISIBILITY FENCE (LANDSIDE ONLY)
SCALE: NTS

1
–



DETAIL

HIGH VISIBILITY FENCE (LANDSIDE ONLY)
SCALE: NTS

1
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SEA Seattle-Tacoma International Airport

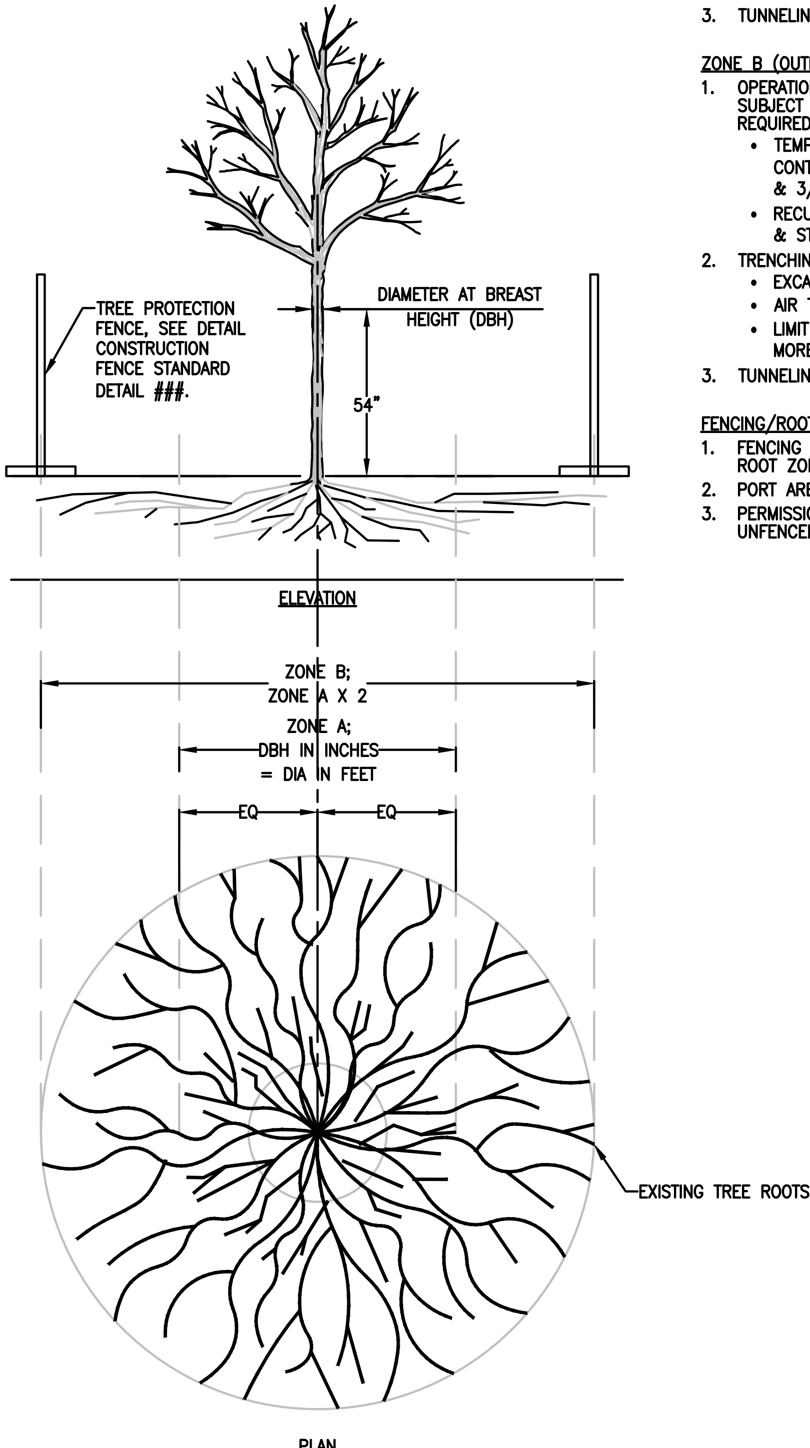
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC-2022

HIGH VISIBILITY FENCE (LANDSIDE ONLY)

STANDARD DETAIL NO. **200**



SPECIAL CONSTRUCTION REQUIREMENTS (TRENCHING/ EXCAVATION)

ZONE A (INTERIOR CRITICAL ROOT ZONE)

1. NO DISTURBANCE ALLOWED WITHOUT SITE-SPECIFIC INSPECTION AND APPROVAL OF METHODS TO MINIMIZE ROOT DAMAGE
2. SEVERANCE OF ROOTS LARGER THAN 2" DIA REQUIRES ENGINEER'S AND A PORT ARBORIST'S APPROVAL.
3. TUNNELING REQUIRED TO INSTALL LINES 3'-0" BELOW GRADE OR DEEPER

ZONE B (OUTER CRITICAL ROOT ZONE)

1. OPERATION OF HEAVY EQUIPMENT AND/OR STOCKPILING OF MATERIALS SUBJECT TO PORT ARBORIST'S APPROVAL. SURFACE PROTECTION MEASURES REQUIRED:
   - TEMPORARY ACCESS FOR ONLY EQUIPMENT WITH < 10 PSI GROUND CONTACT PRESSURE: ARBORIST WOODCHIP MULCH LAYER, 6"-8" DEPTH, & 3/4" PLYWOOD SHEETS
   - RECURRING ACCESS: ARBORIST WOODCHIP MULCH LAYER, 6"-8" DEPTH, & STEEL PLATES
2. TRENCHING ALLOWED WITH PRIOR PORT ARBORIST'S APPROVAL AS FOLLOWS:
   - EXCAVATION BY HAND;
   - AIR TRENCHING OR VACUUM EXCAVATION;
   - LIMIT TRENCHING WIDTH. DO NOT DISTURB ZONE A; MAINTAIN 2/3 OR MORE OF ZONE B IN UNDISTURBED CONDITION;
3. TUNNELING MAY BE REQUIRED FOR TRENCHES DEEPER THAN 3'-0"

FENCING/ROOT PROTECTION

1. FENCING TO BE PROVIDED AND MAINTAINED AT LIMITS OF OUTER CRITICAL ROOT ZONE.
2. PORT ARBORIST'S APPROVAL REQUIRED FOR USE/ ACCESS WITHIN ZONE B.
3. PERMISSION FOR USE/ ACCESS REQUIRES SURFACE PROTECTION FOR ALL UNFENCED, UNPAVED SURFACES WITHIN CRITICAL ROOT ZONE.

DETAIL 1 / –

TREE PROTECTION
SCALE: NTS

SEA Seattle-Tacoma International Airport

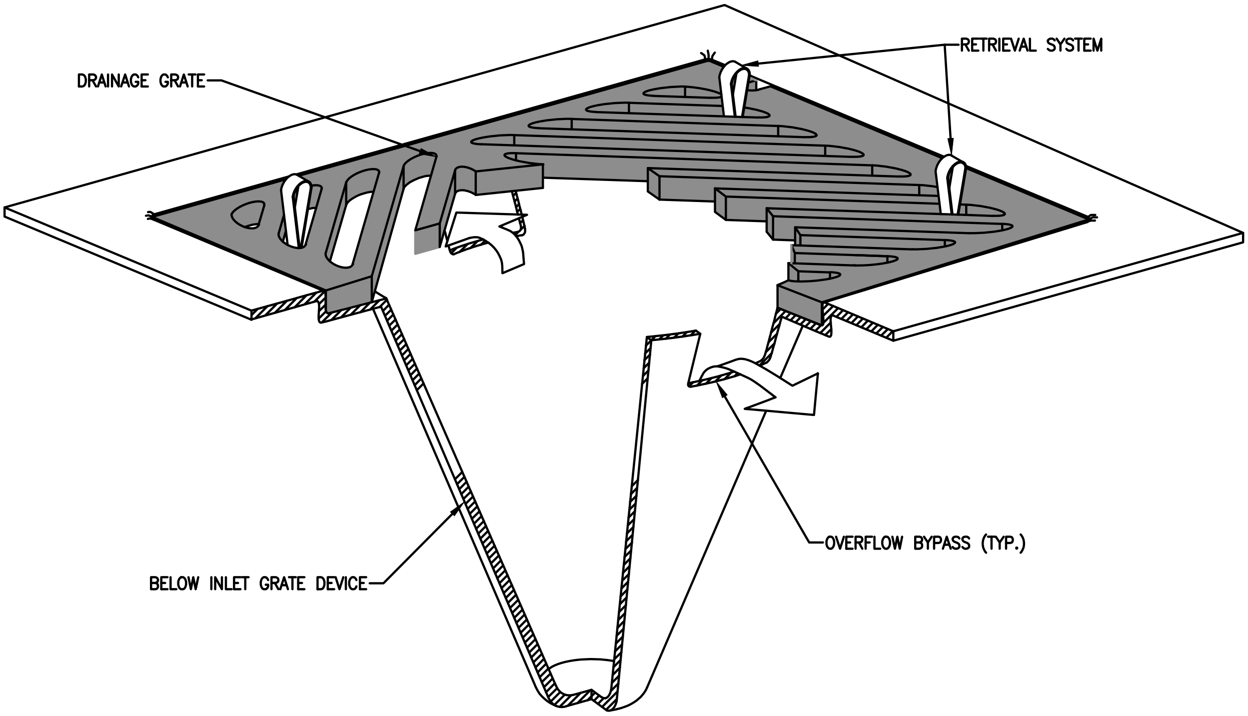
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC-2022

TREE PROTECTION (LANDSIDE ONLY)

STANDARD DETAIL NO. **202**



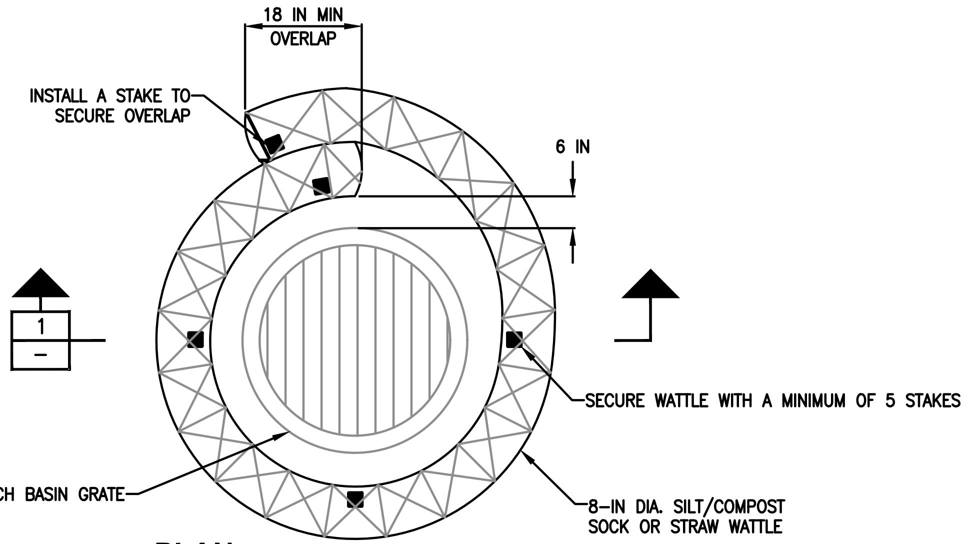
DETAIL 1 / –

STRUCTURE INLET PROTECTION
SCALE: NTS

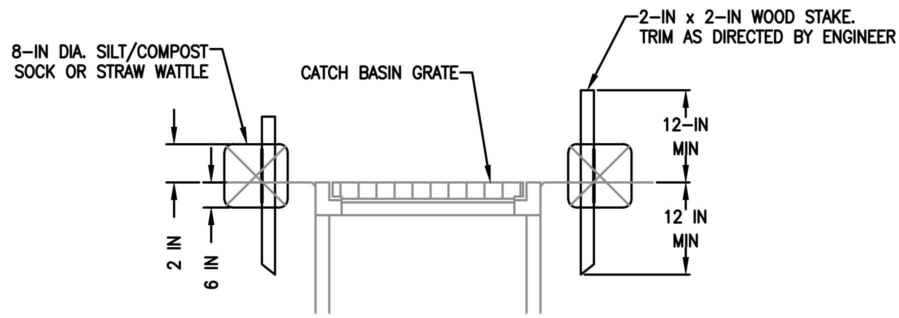
NOTES

1. SIZE THE BELOW INLET GRATE DEVICE (BIGD) FOR THE STORM WATER STRUCTURE IT WILL SERVICE.
2. THE BIGD SHALL HAVE A BUILT-IN HIGH-FLOW RELIEF SYSTEM (OVERFLOW BYPASS).
3. THE RETRIEVAL SYSTEM MUST ALLOW REMOVAL OF THE BIGD WITHOUT SPILLING THE COLLECTED MATERIAL.
4. PERFORM MAINTENANCE IN ACCORDANCE WITH TESC SPECIFICATION 3.03 A.5.

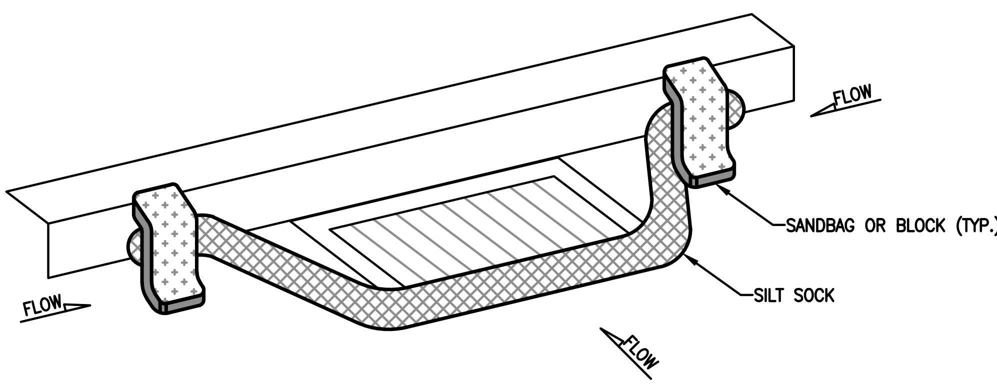
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	STRUCTURE INLET PROTECTION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC-2022	STANDARD DETAIL NO. **203**



PLAN
SCALE: NTS



SECTION 1/–
SCALE: NTS



PLAN
SCALE: NTS

DETAIL 1/–
STRAW WATTLE/
COMPOST/SILT SOCK INLET PROTECTION
SCALE: NTS

SEA Seattle-Tacoma International Airport

F&I CIVIL STANDARDS

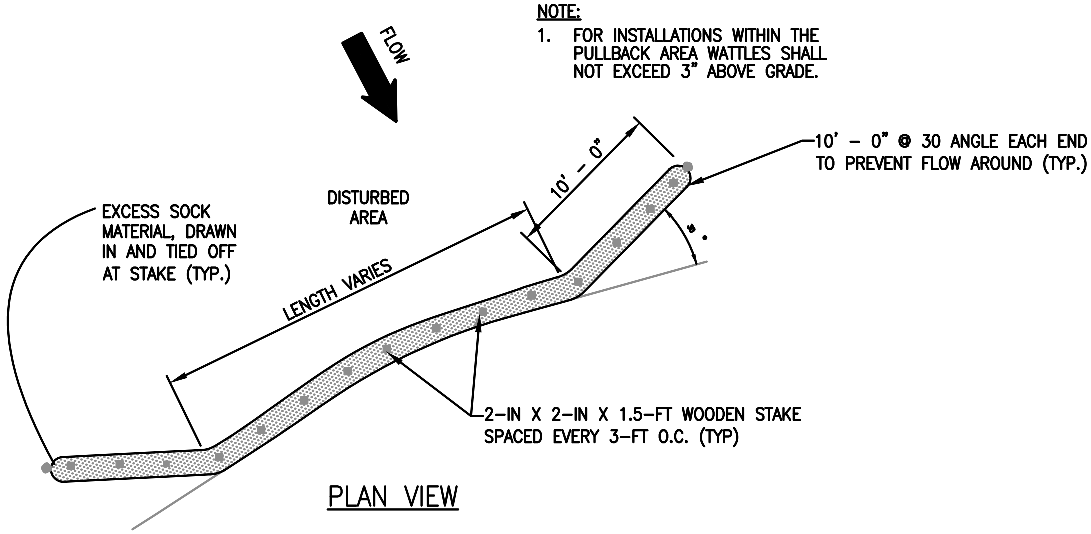
SCALE: NOT TO SCALE

REVISION DATE: DEC-2022

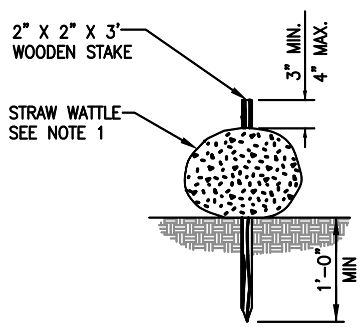
STRAW WATTLE/ COMPOST/SILT SOCK INLET PROTECTION

STANDARD DETAIL NO. **204**

NOTE:
1. FOR INSTALLATIONS WITHIN THE PULLBACK AREA WATTLES SHALL NOT EXCEED 3" ABOVE GRADE.



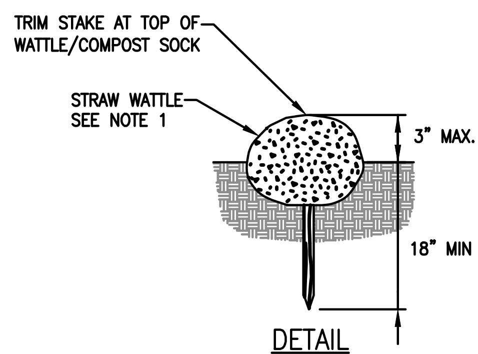
PLAN VIEW



DETAIL

DETAIL 1 / –

STRAW WATTLE/COMPOST SOCK (LANDSIDE ONLY)
SCALE: NTS



DETAIL

DETAIL 2 / –

STRAW WATTLE/COMPOST SOCK (AIRSIDE ONLY)
SCALE: NTS

NOTES:

1. COMPOST SOCK SHALL BE IN ACCORDANCE WITH TESC SPECIFICATION 2.04.F. COMPOST SOCK SHALL BE A MINIMUM OF 10" IN DIAMETER OR SIZED TO SUIT CONDITIONS AS SPECIFIED BY THE ENGINEER.
2. ALWAYS INSTALL COMPOST SOCK PERPENDICULAR TO SLOPE AND ALONG CONTOUR LINES.
3. REMOVE SEDIMENT FROM THE UP SLOPE SIDE OF THE COMPOST SOCK WHEN ACCUMULATION HAS REACHED 1/2 OF THE EFFECTIVE HEIGHT OF THE STRAW WATTLE.
4. WEIGH DOWN COMPOST SOCK ON PAVED AREAS USING SAND BAGS PLACED PERPENDICULAR ACROSS THE COMPOST SOCK. SAND BAGS SHALL BE USED WHERE COMPOST SOCK ARE ADJACENT TO ONE ANOTHER AND ON 5–FT INTERVALS.

SEA Seattle-Tacoma International Airport

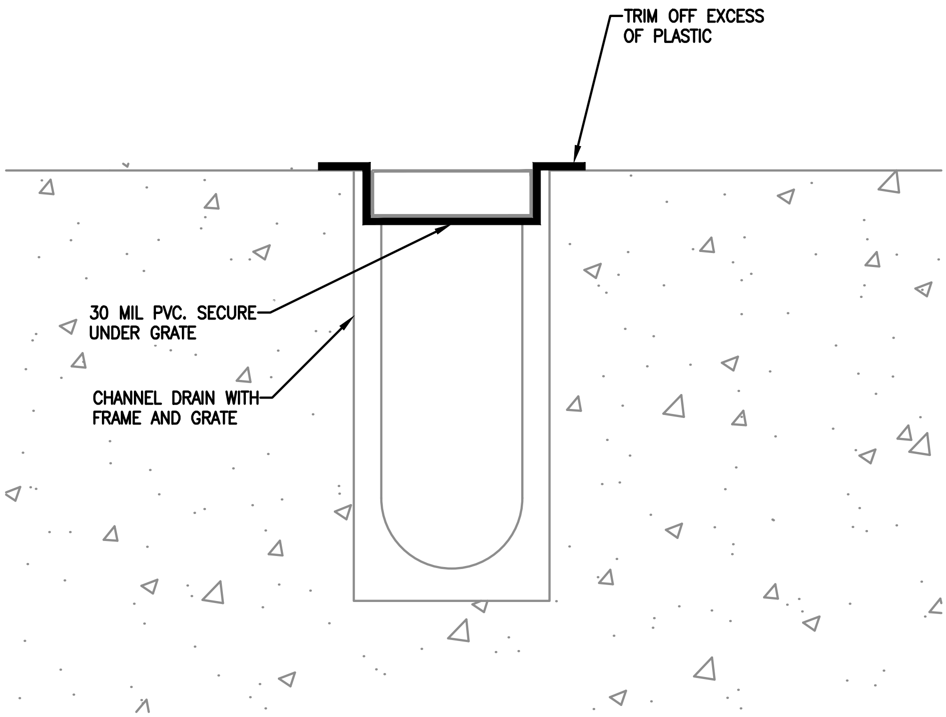
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC-2022

STRAW WATTLE/COMPOST SOCK

STANDARD DETAIL NO. **205**



DETAIL

CHANNEL DRAIN PROTECTION
SCALE: NTS

1
–

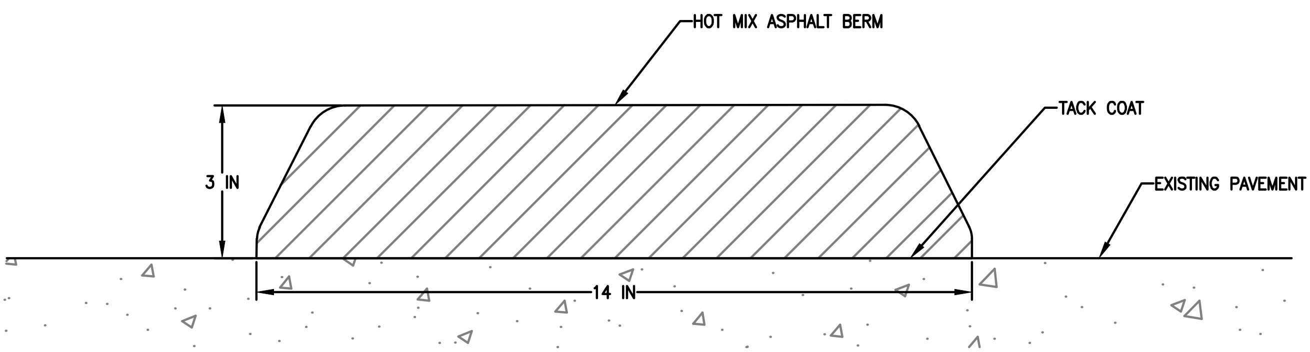
SEA Seattle-Tacoma International Airport

F&I CIVIL STANDARDS

SCALE:	NOT TO SCALE
REVISION DATE:	DEC-2022

CHANNEL DRAIN PROTECTION

STANDARD DETAIL NO. **206**



DETAIL
HMA BERM
SCALE: NTS

1
–

Seattle-Tacoma International Airport

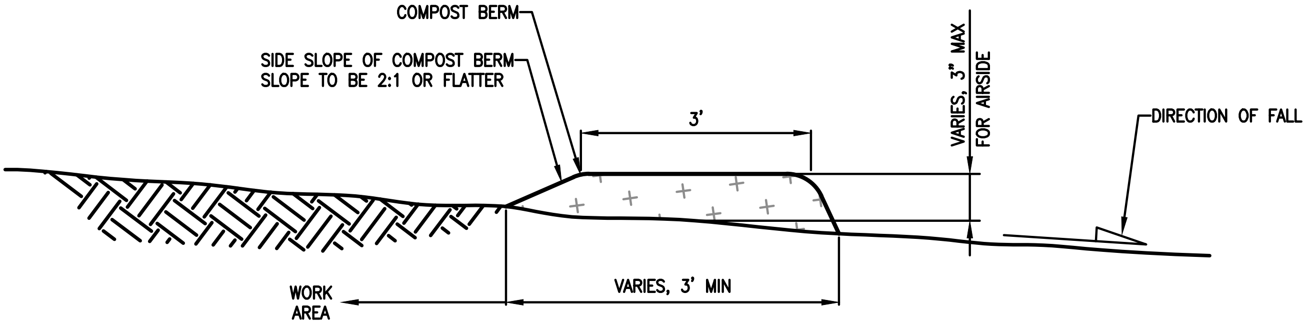
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC-2022

HMA BERM

STANDARD DETAIL NO. **207**



DETAIL
COMPOST BERM
SCALE: NTS

1
–

SEA Seattle-Tacoma International Airport

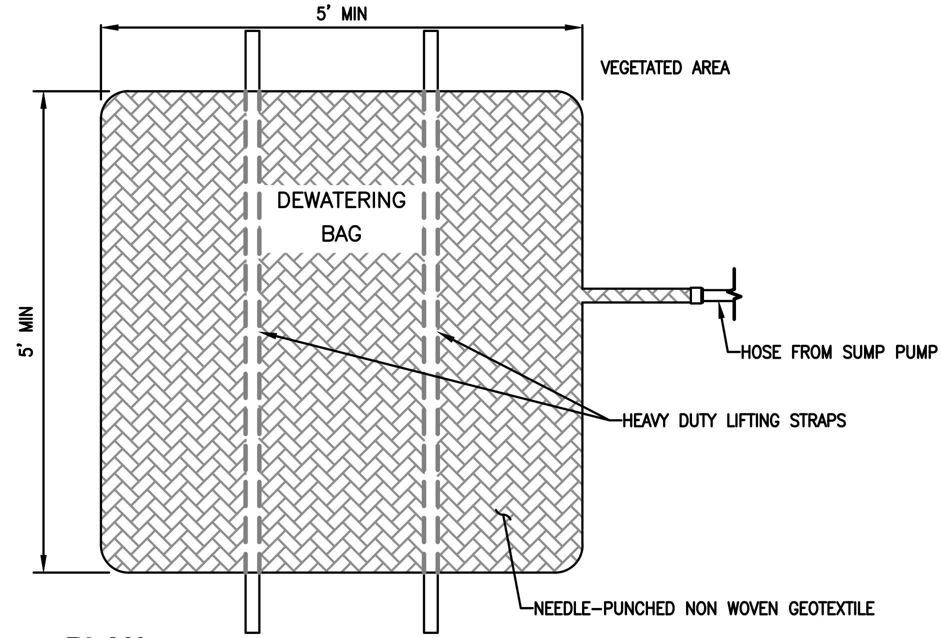
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

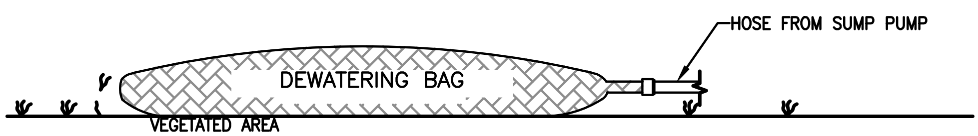
REVISION DATE: DEC-2022

COMPOST BERM

STANDARD DETAIL NO. **208**



PLAN
SCALE: NTS



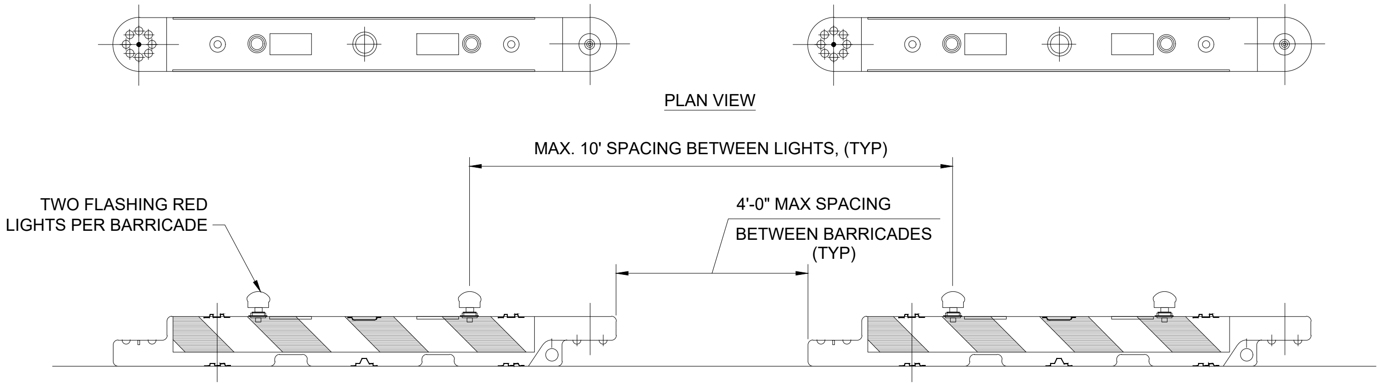
ELEVATION
SCALE: NTS

NOTE:

REFER TO SPECIFICATION SECTION 01 57 13 FOR DEWATERING BAG SPECIFICATIONS

DETAIL 1 / –
DEWATERING BAG
SCALE: NTS

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE REVISION DATE: DEC-2022	DEWATERING BAG STANDARD DETAIL NO. 209

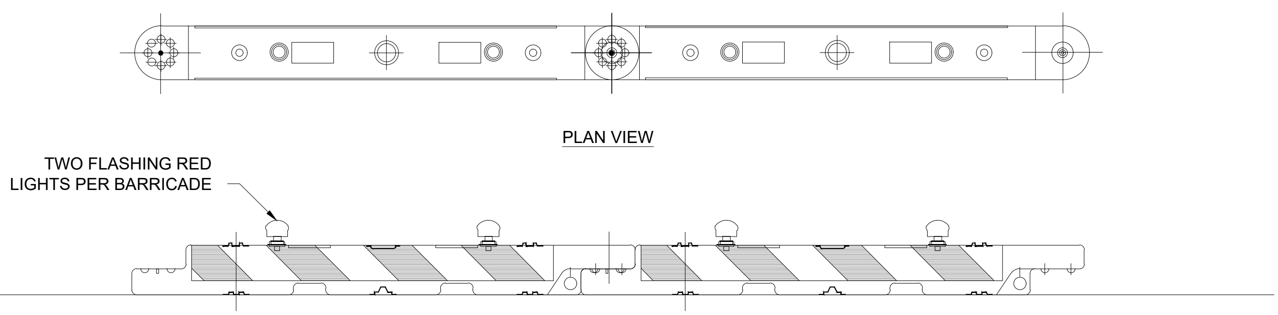


NOTES:

1. BARRICADES SHALL BE FILLED TO CAPACITY WITH WATER AND TWO SAND BAGS (35 POUNDS EACH, MINIMUM) ON EACH BARRICADE.

DETAIL 1 / –

AIRPORT BARRICADE - TYPE 1
SCALE: N.T.S.



DETAIL 2 / –

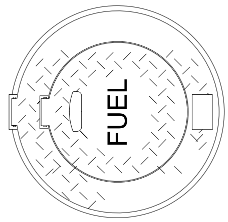
AIRCRAFT BARRICADE - TYPE 2
SCALE: N.T.S.

NOTES:

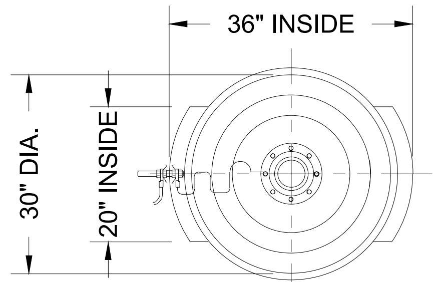
1. PLACE AND INTERLOCK LOW-PROFILE BARRICADES TO COMPLETELY SURROUND OR BLOCK ACCESS TO WORK AREA FROM EDGE OF PAVEMENT TO EDGE OF PAVEMENT.

2. BARRIER SYSTEM CAN BE PLACED IN CURVES OR ANGLES SO LONG AS THEY ARE PLACED IN A NEAT AND ORDERLY PATTERN AND THE BARRICADES REMAIN INTERLOCKED.

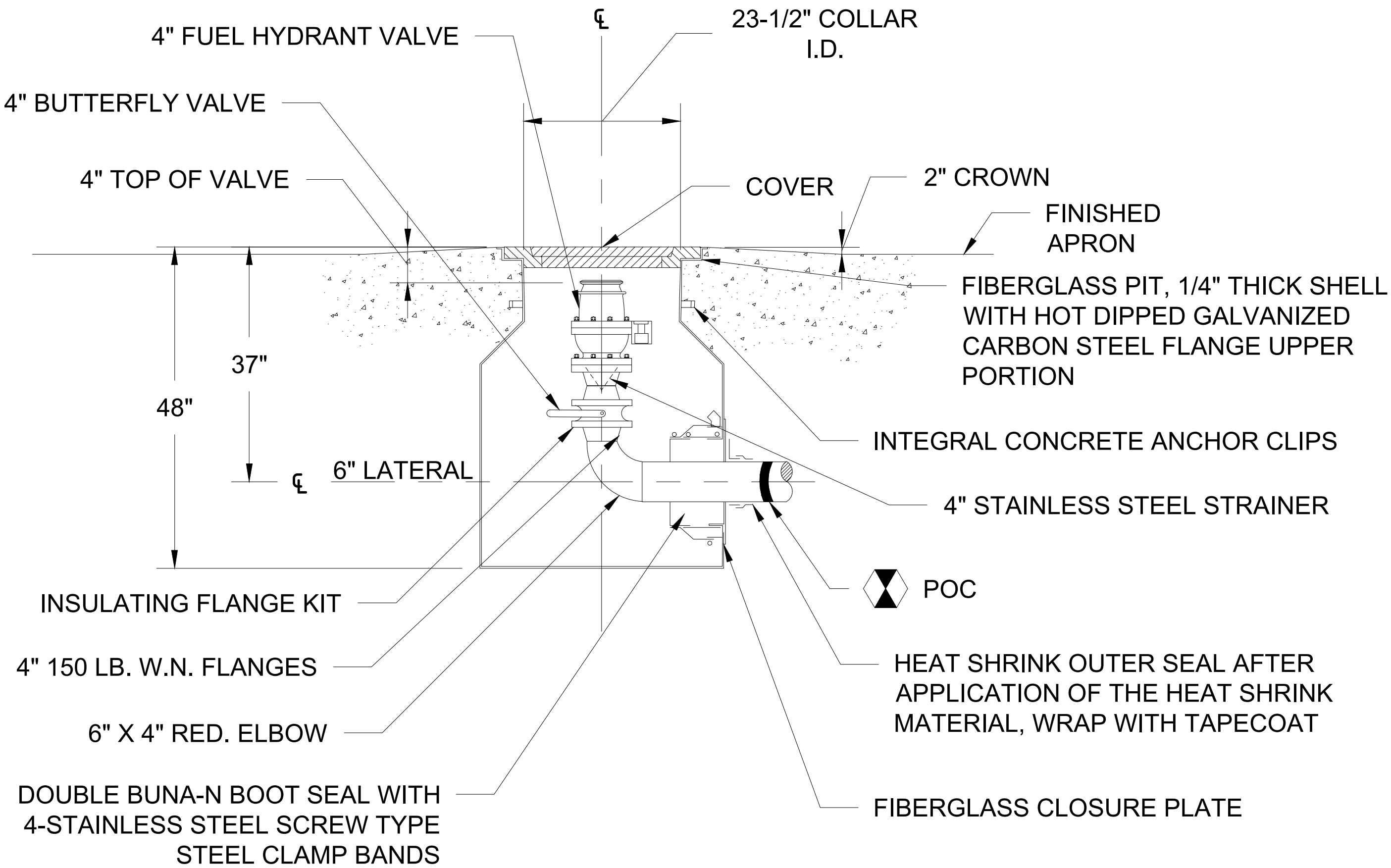
3. AT NIGHT, LIGHT TOWERS SHALL BE PLACED AT CLOSURE POINTS AT THE ENGINEER'S DISCRETION AND SHALL ILLUMINATE THE CLOSED PAVEMENT BARRIER SYSTEM. ALL CONTRACTOR LIGHT TOWERS SHALL HAVE HOODED LUMINAIRES AND BE AIMED INWARD AND DOWNWARD TO THE CONSTRUCTION AREA IN SUCH A WAY AS TO MINIMIZE GLARE FOR AIR TRAFFIC CONTROLLERS, AIRCRAFT, AND VEHICLES OPERATING ON THE ACTIVE AIRFIELD, TO THE SATISFACTION OF THE ENGINEER AND AIRPORT.



COVER DETAIL



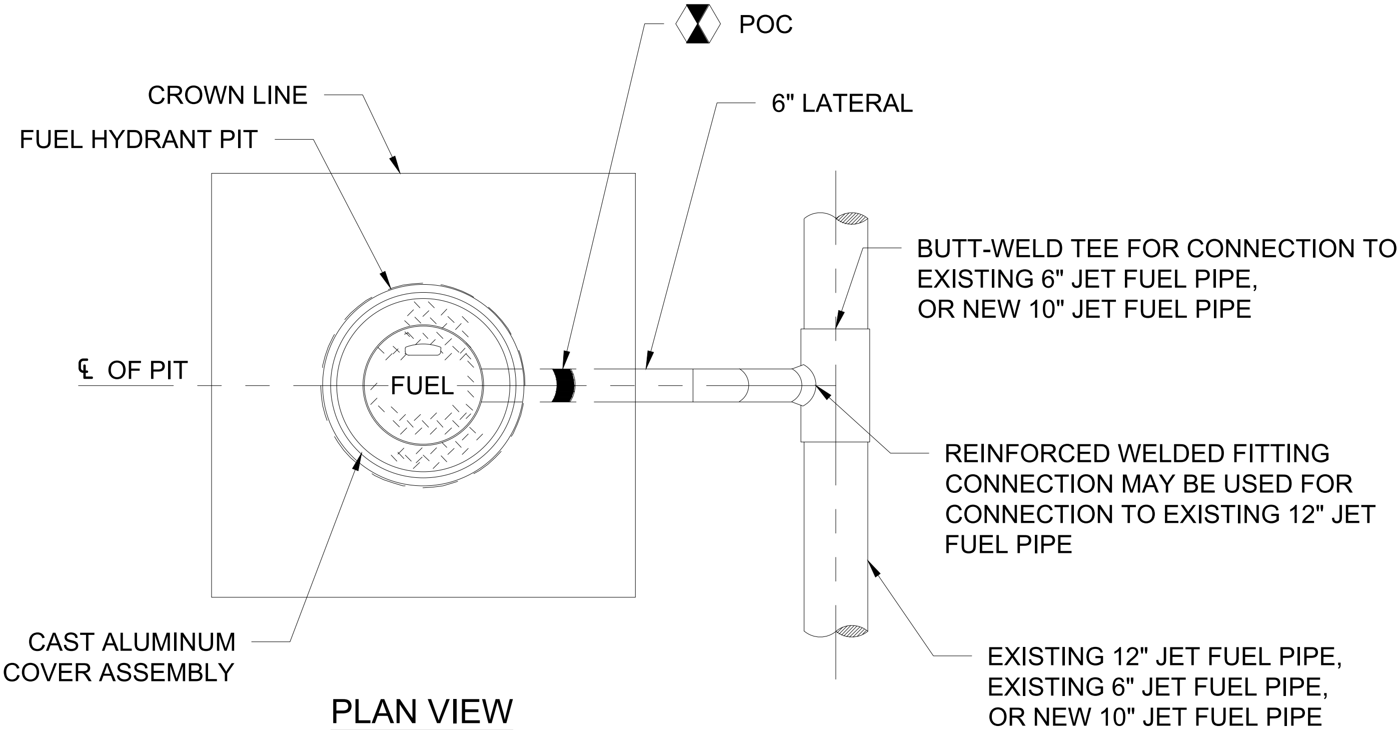
PLAN VIEW



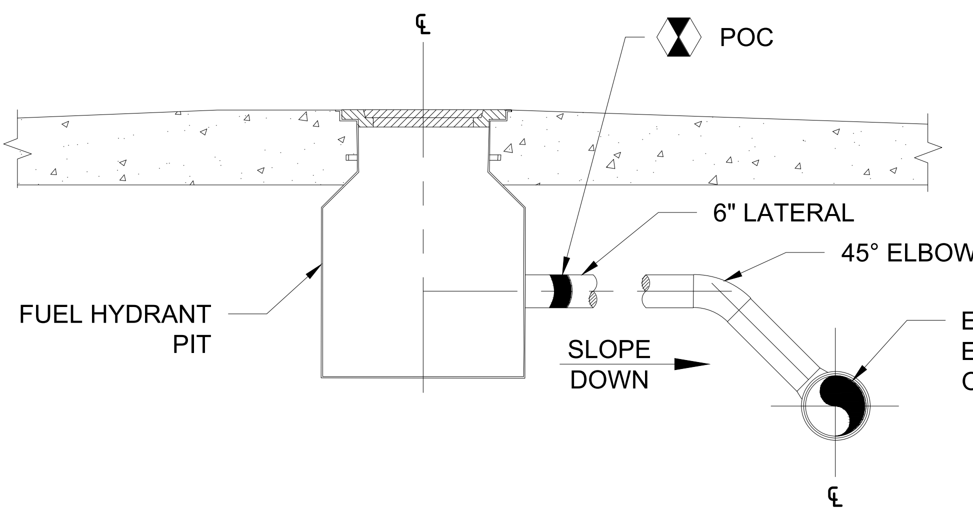
NOTE:
FUEL HYDRANT PIT ASSEMBLY INCLUDING COVER, VALVES, AND PIPING INSIDE PIT SHALL BE OWNER FURNISHED AS AN ASSEMBLED UNIT. CONTRACTOR SHALL INSTALL PIT ASSEMBLY AND CONNECT 6" FUEL BRANCH LINE AT POC LOCATED OUTSIDE THE PIT.

DETAIL 1/300
FUEL HYDRANT VALVE PIT ASSEMBLY
NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	FUEL HYDRANT VALVE PIT ASSEMBLY
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **300**



PLAN VIEW



DETAIL

HYDRANT BRANCH CONNECTION
NTS

1
301

SEA Seattle-Tacoma International Airport

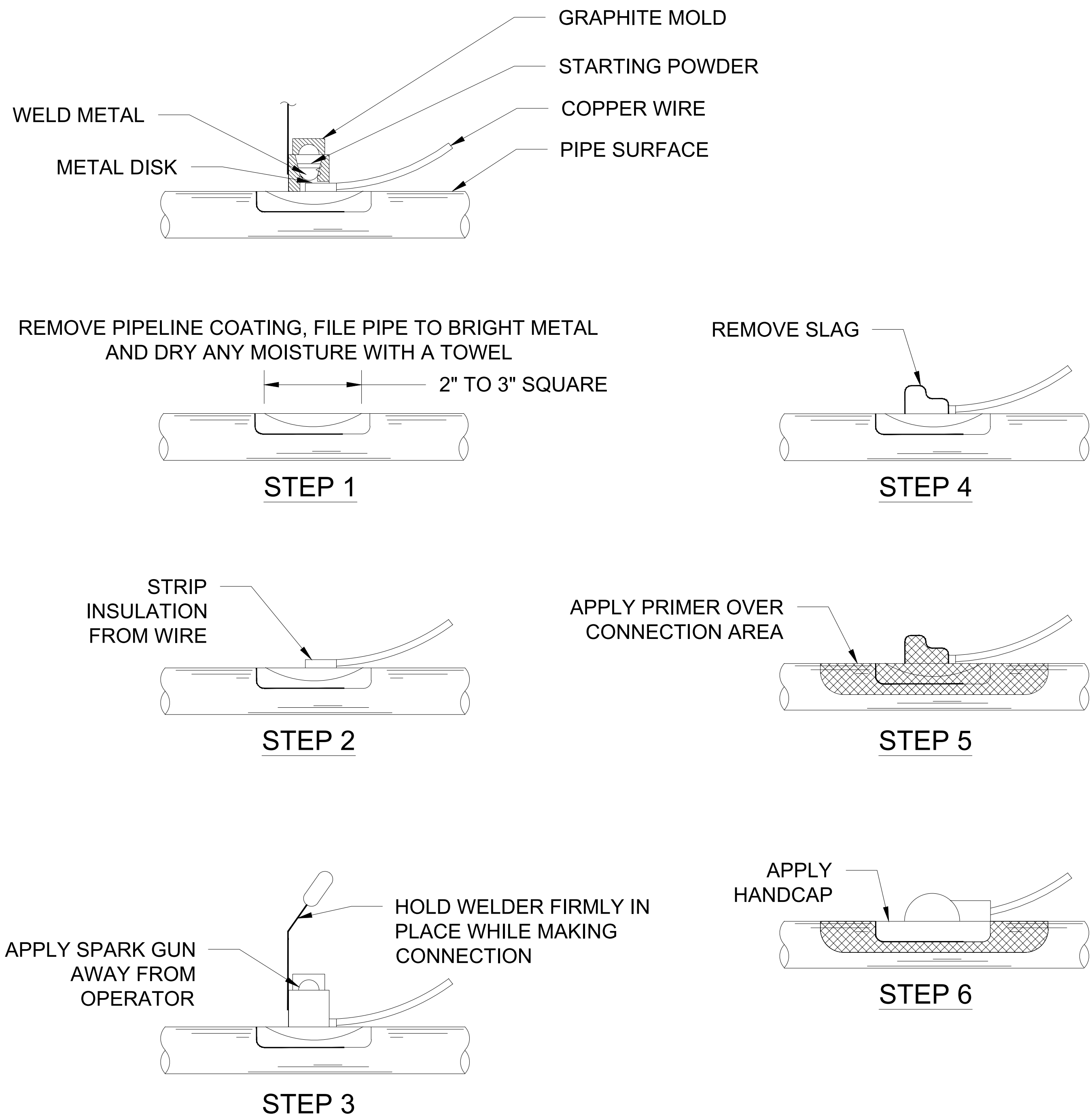
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: 2023

HYDRANT BRANCH CONNECTION

STANDARD DETAIL NO. **301**

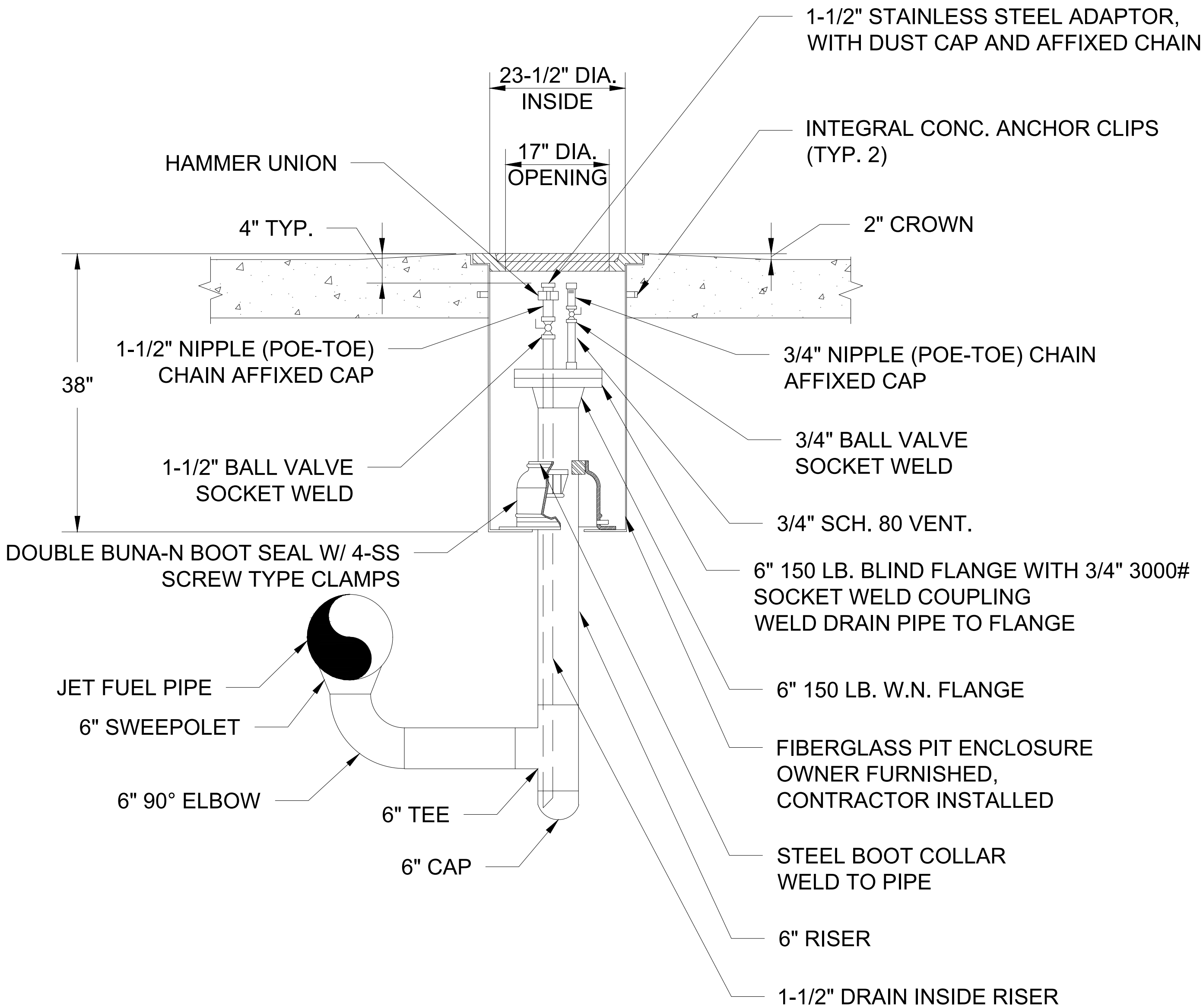


DETAIL

EXOTHERMIC WELDING DETAIL
NTS

1
302

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	EXOTHERMIC WELDING DETAIL
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **302**



DETAIL

LOW POINT DRAIN
NTS

1
303

SEA Seattle-Tacoma International Airport

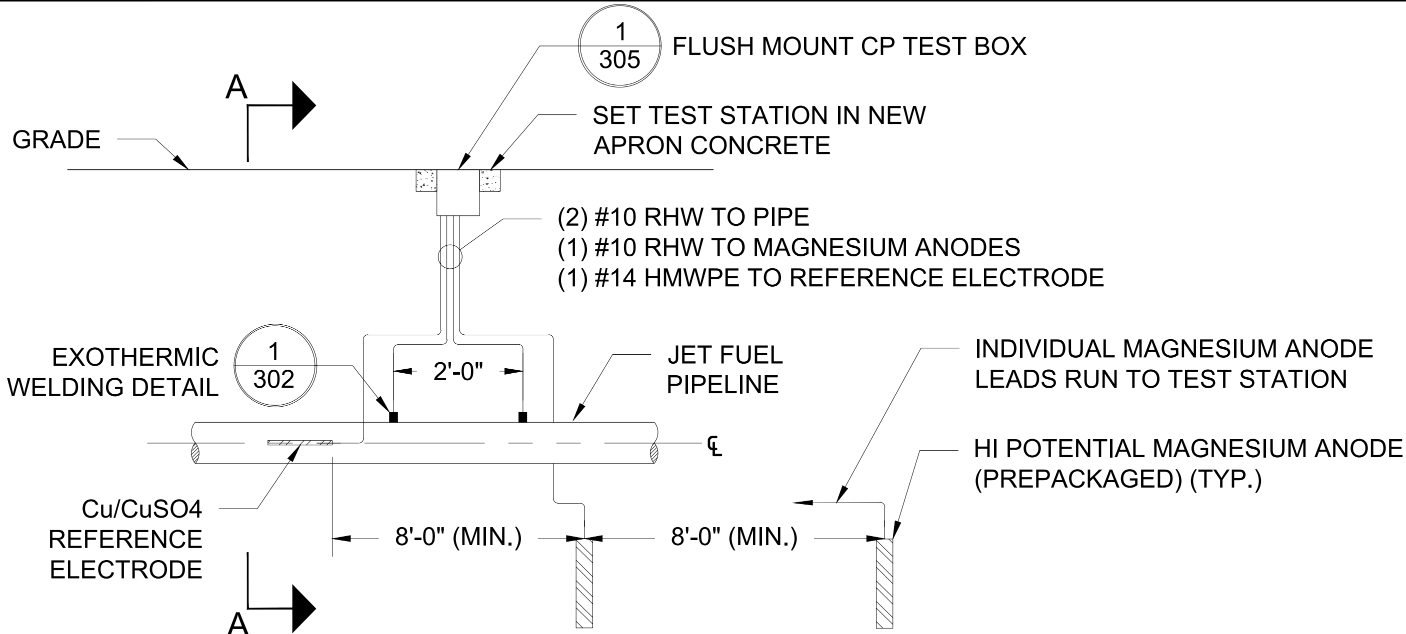
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

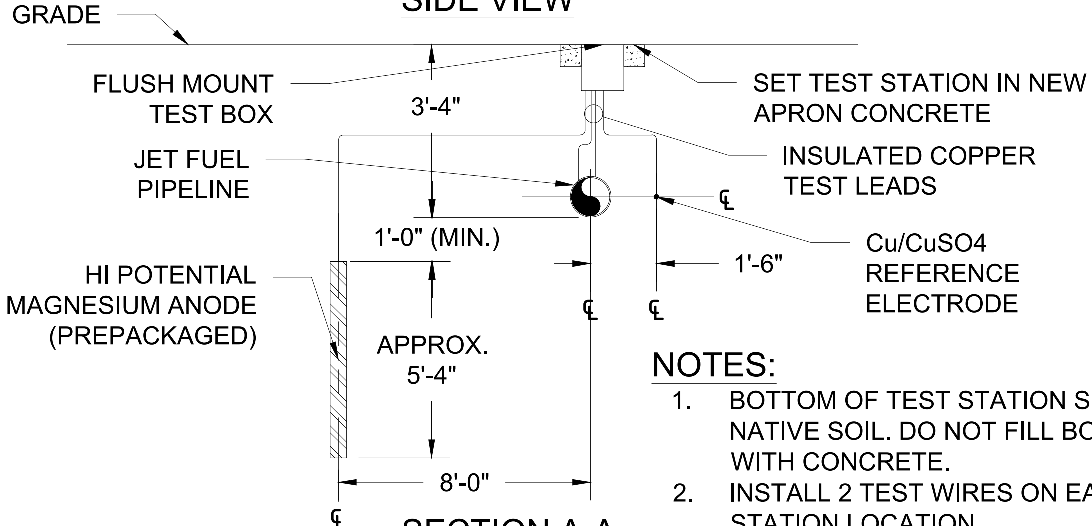
REVISION DATE: 2023

LOW POINT DRAIN

STANDARD DETAIL NO. **303**



SIDE VIEW

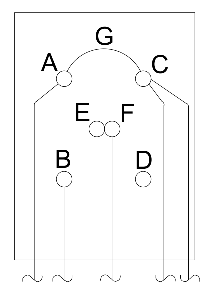


SECTION A-A

NOTES:

1. BOTTOM OF TEST STATION SHALL EXTEND INTO NATIVE SOIL. DO NOT FILL BOTTOM OF TEST STATION WITH CONCRETE.
2. INSTALL 2 TEST WIRES ON EACH PIPE AT EACH TEST STATION LOCATION.

WIRE	GAUGE (AWG)	INSULATION	COLOR	CONNECTION
A	NO. 10	RHW	WHITE	PIPELINE
B	NO. 10	RHW	WHITE	PIPELINE
C	NO. 10	RHW	BLACK	ANODE
D	N/A	N/A	N/A	SPARE
E	N/A	N/A	N/A	SPARE
F	NO. 14	HMWPE/RWH	YELLOW	REF.ELECT.
G	NO. 10	RHW	WHITE	JUMPER WIRE



MAG ANODE TEST STATION WIRING SCHEMATIC

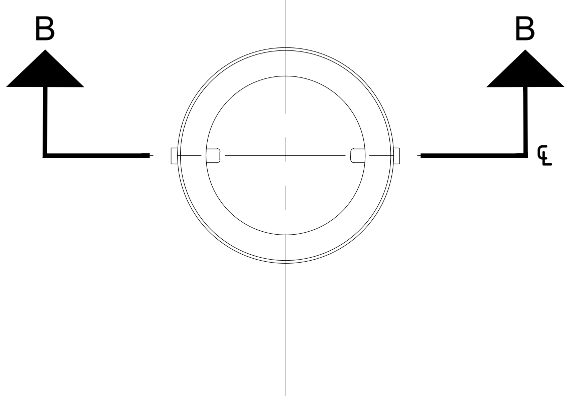
NOTE:

LABEL ALL WIRES/CABLES WITH PERMANENT METALLIC TAGS. LABEL AS SHOWN IN "CONNECTION" COLUMN OF THE TABLE.

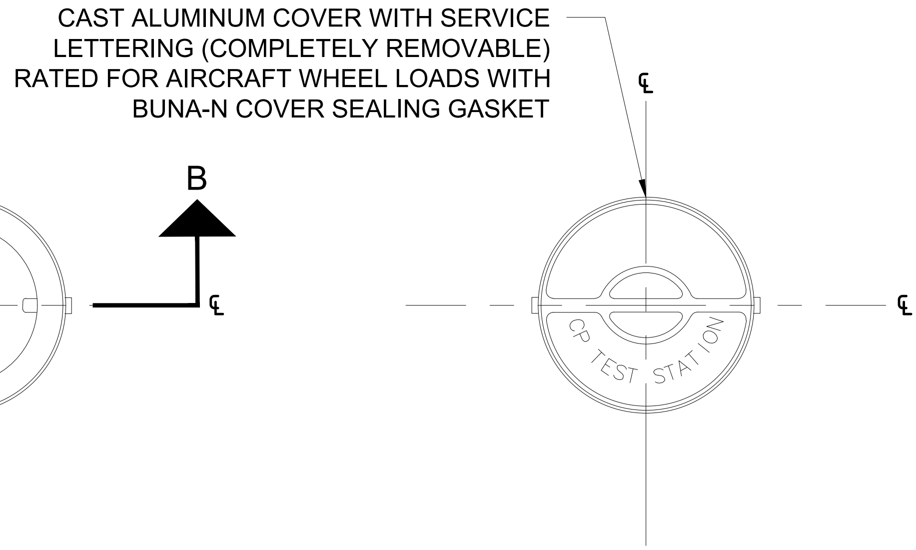
DETAIL 1/304

CATHODIC PROTECTION TEST STATION
NTS

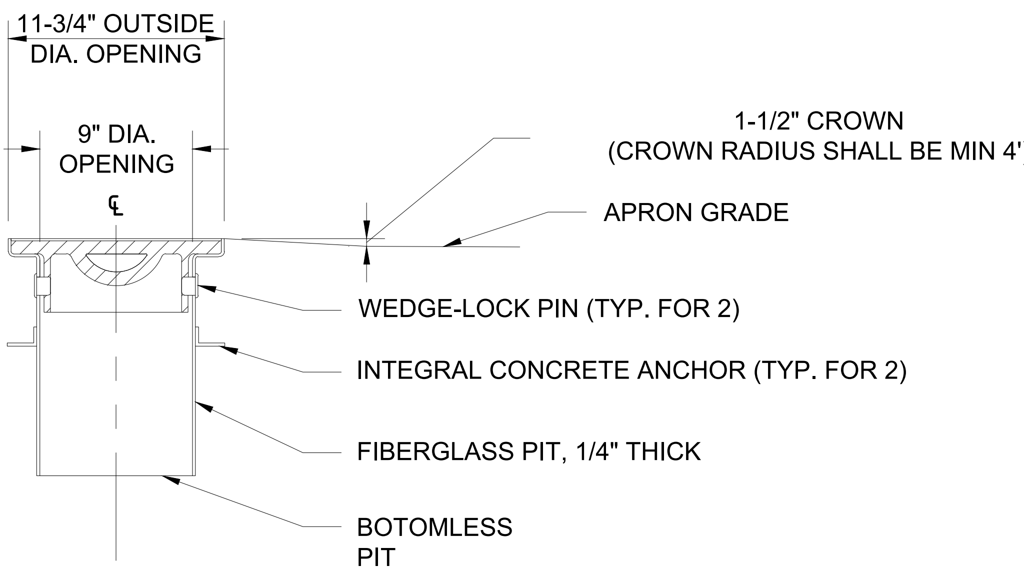
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CATHODIC PROTECTION TEST STATION
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **304**



PLAN VIEW (COVER REMOVED)



COVER DETAIL



SECTION B-B

NOTES:

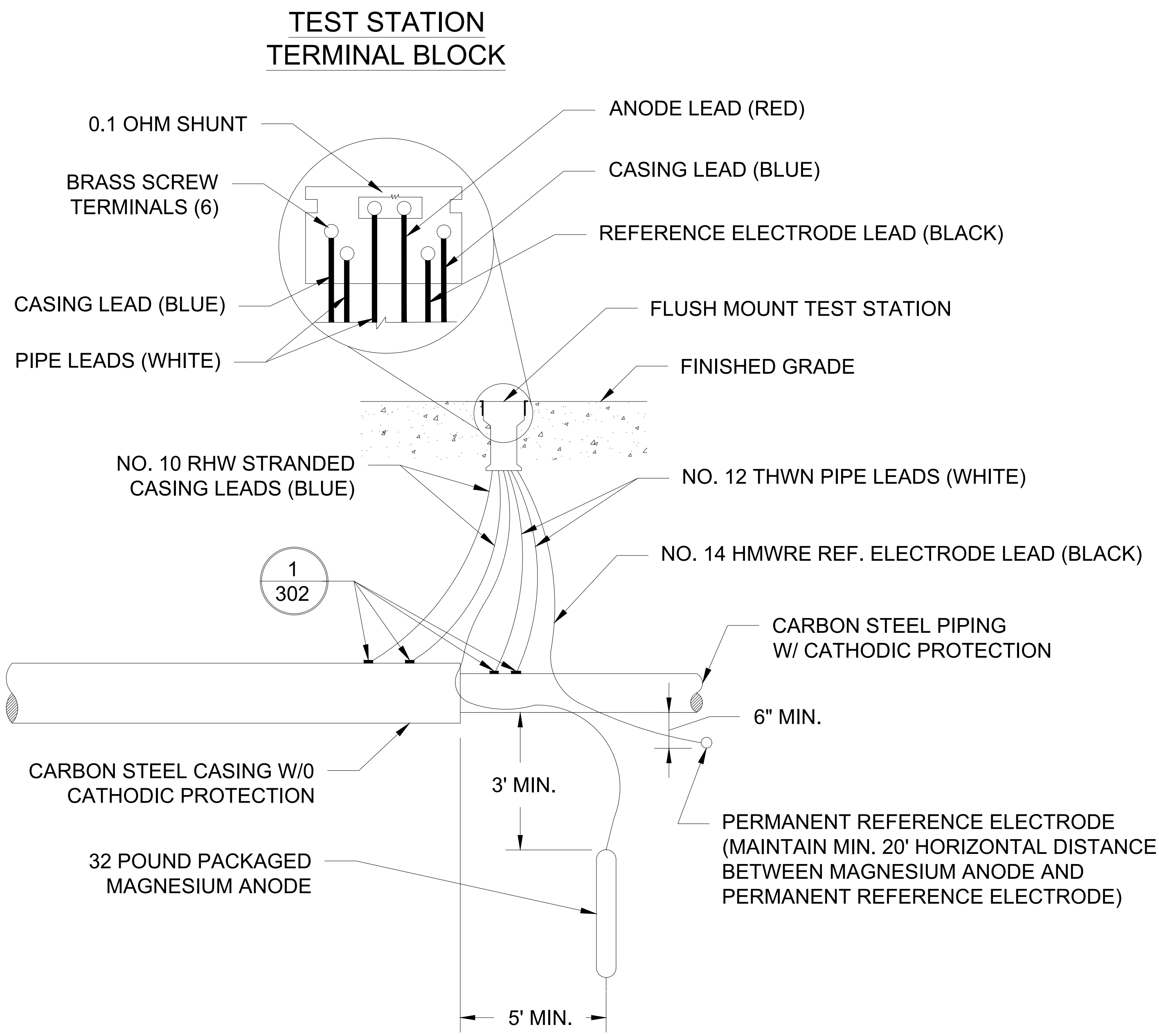
1. TOTAL STATION DEPTH SHALL BE GREATER THAN CONCRETE APRON DEPTH.
2. BOTTOM OF TEST STATION SHALL EXTEND INTO NATIVE SOIL. DO NOT FILL BOTTOM OF TEST STATION WITH CONCRETE/OTHER DEBRIS.

DETAIL

FLUSH MOUNT CP TEST BOX
NTS

1
305

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	FLUSH MOUNT CP TEST BOX
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **305**

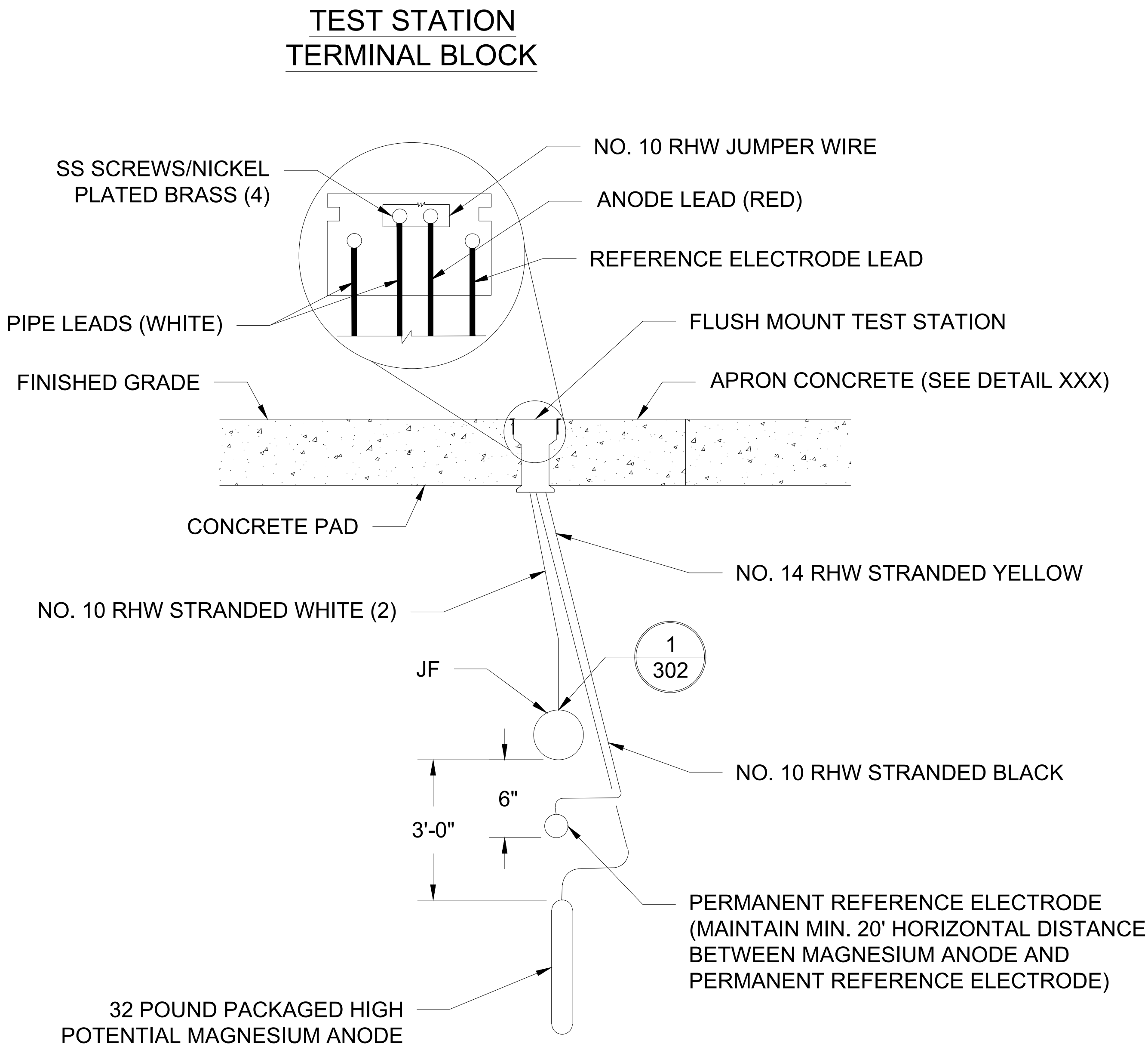


DETAIL

CASING TEST STATION W/ REFERENCE ELECTRODE
SEE INSTALLATION NOTES SHEET XXX
NTS

1
306

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CASING TEST STATION W/REFERENCE ELECTRODE
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **306**



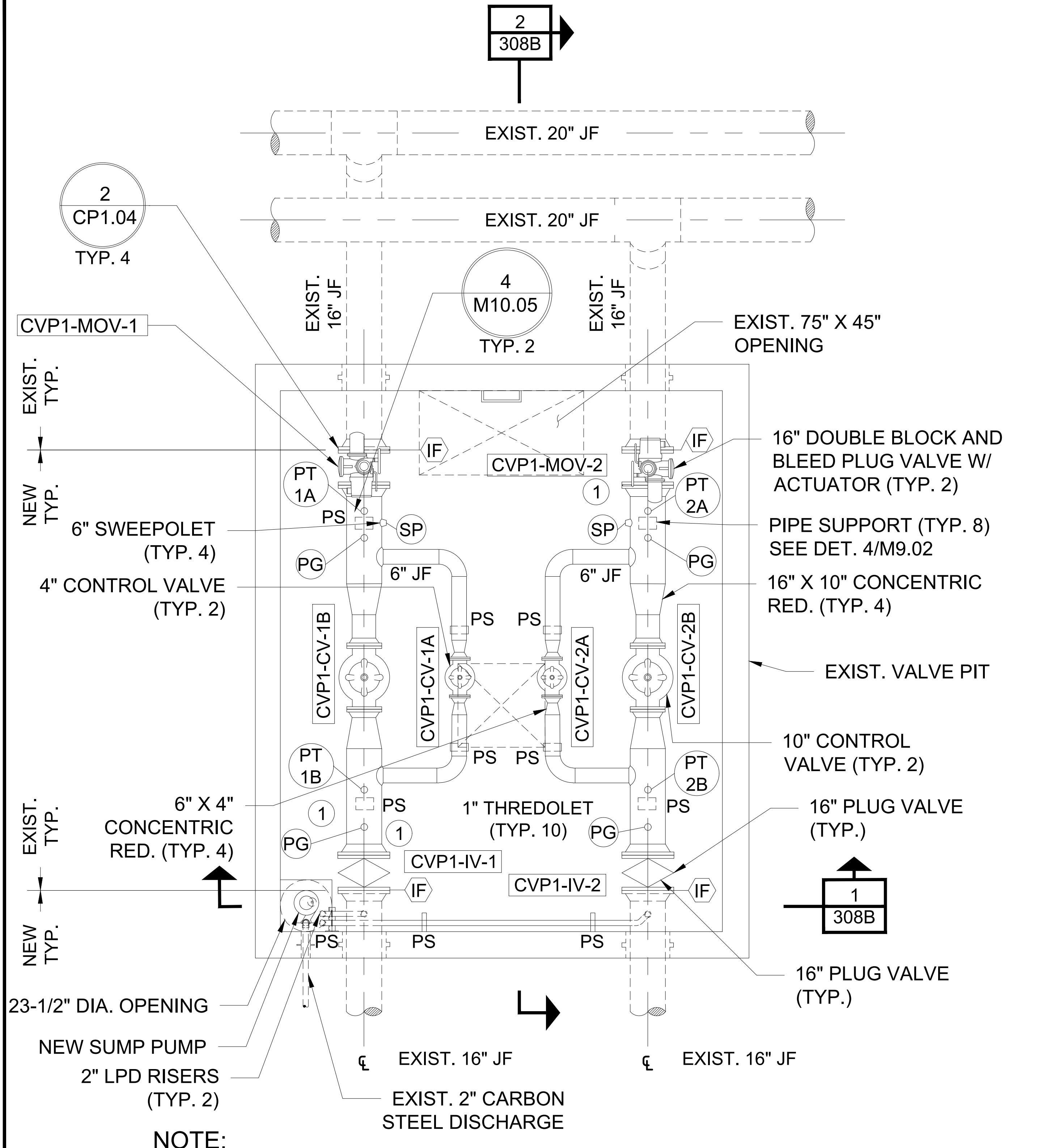
NOTE:

FOR CONCRETE PAD IN GRASS OR ASPHALT ROAD [36"X36"X6"] (SEE DETAIL XXX).

DETAIL 1 / 307

TEST STATION W/ ANODE AND REFERENCE ELECTRODE
SEE INSTALLATION NOTES ON THIS SHEET
NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	TEST STATION W/ ANODE AND REFERENCE ELECTRODE
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **307**

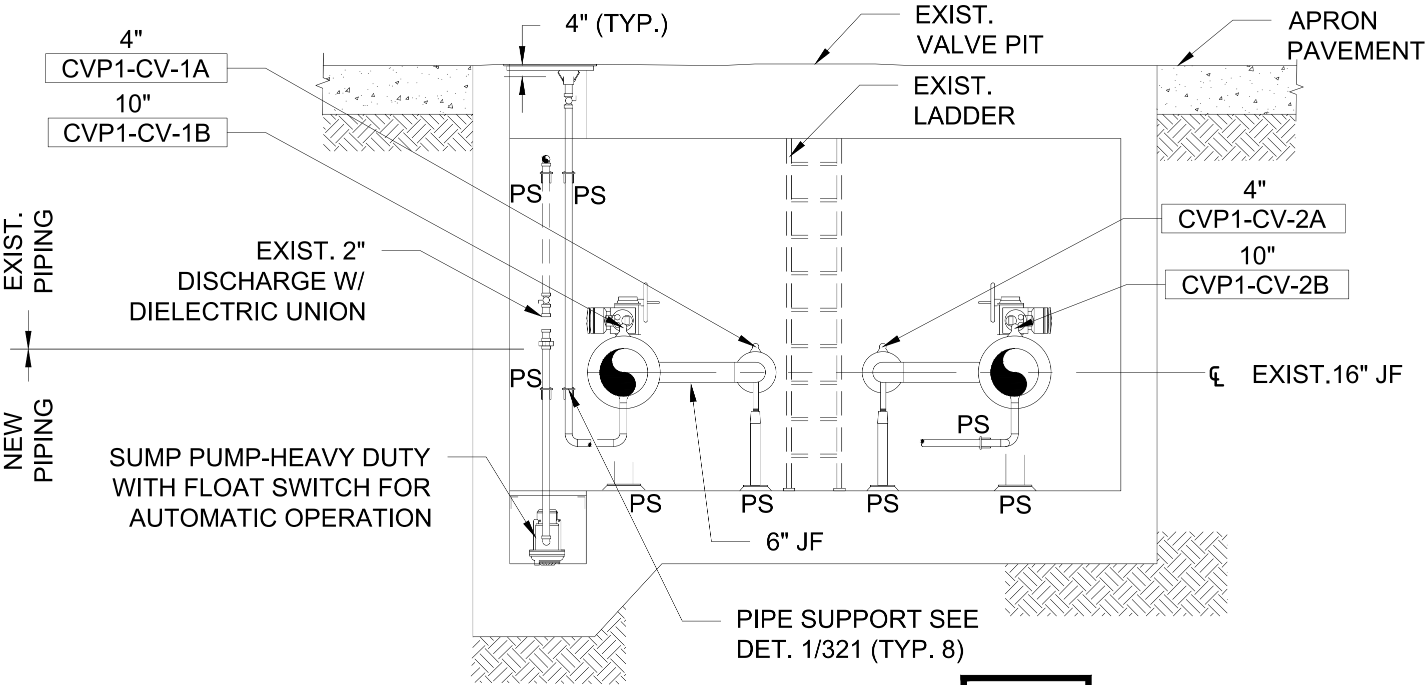


NOTE:
SEE PORT EXTERIOR UTILITY BASE MAPS FOR ACTUAL UNDERGROUND PIPE LOCATION AND ROUTING.

CONTROL VALVE PIT PLAN

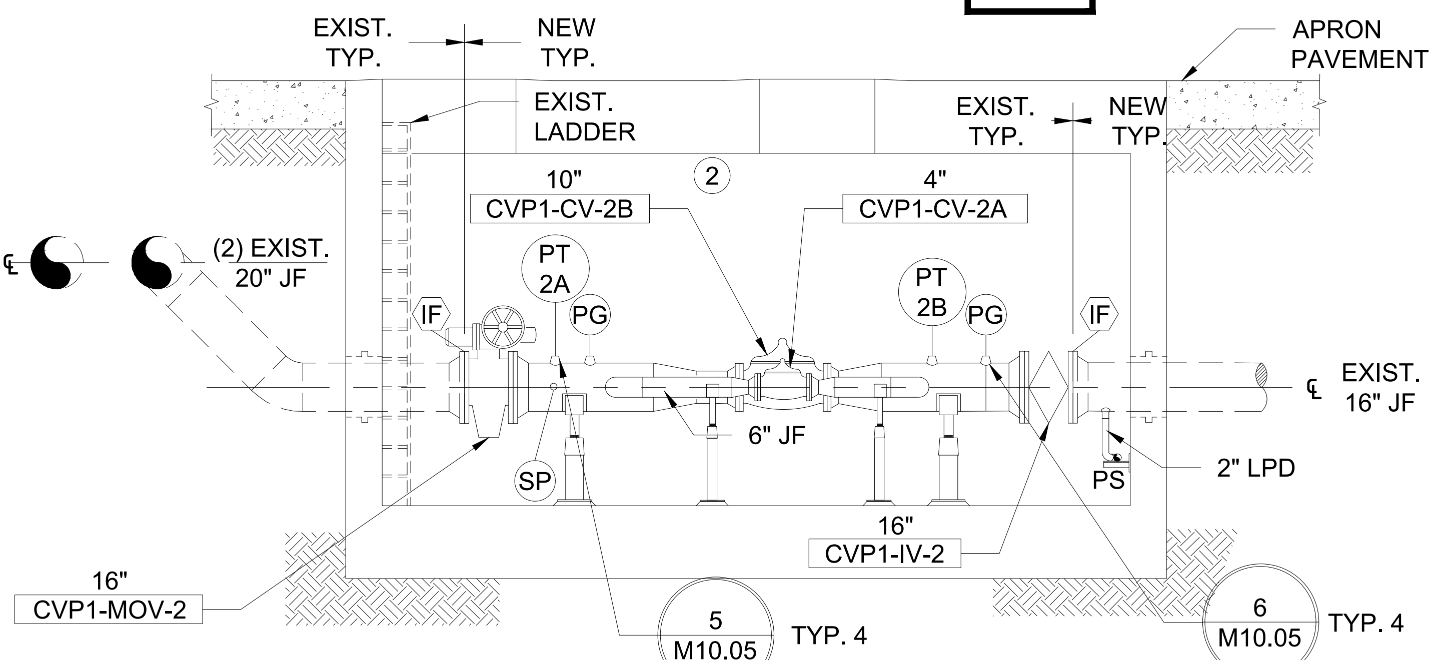
NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CONTROL VALVE PIT PLAN VIEW
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **308**



SECTION 1

NTS 308B



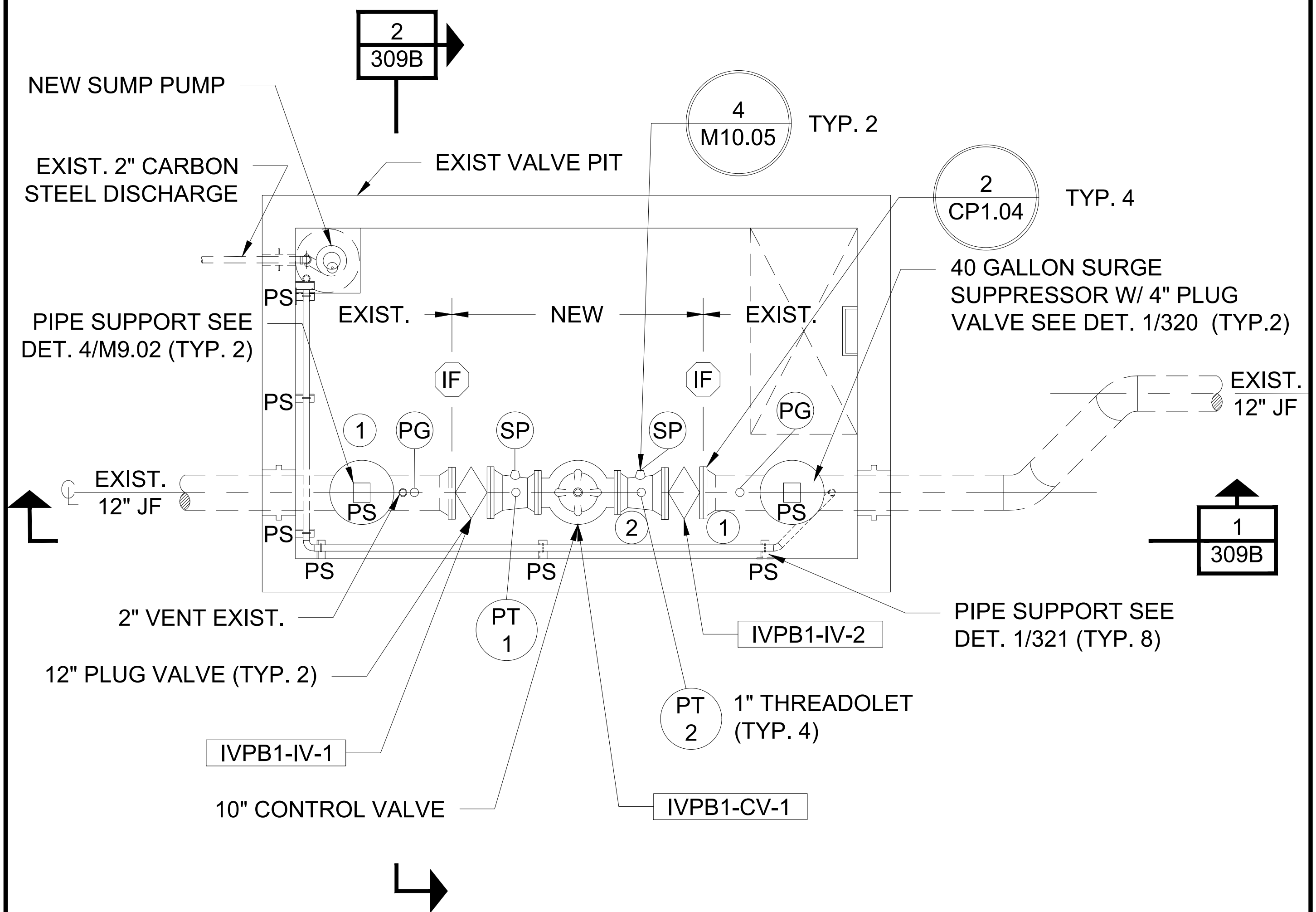
NOTES:

1. REMOVE 16" SPOOL AND INSTALL NEW PIPING/EQUIPMENT, REFER TO EXISTING CONDITIONS DWG. C3.31
2. FOR COMPLETE DESIGNATION OF PRESSURE SENSOR AND VALVE TAGS, SEE FLOW MECHANICAL DIAGRAM DWG. M1.03.

SECTION 2

NTS 308B

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CONTROL VALVE PIT PLAN SECTION VIEW
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **308B**



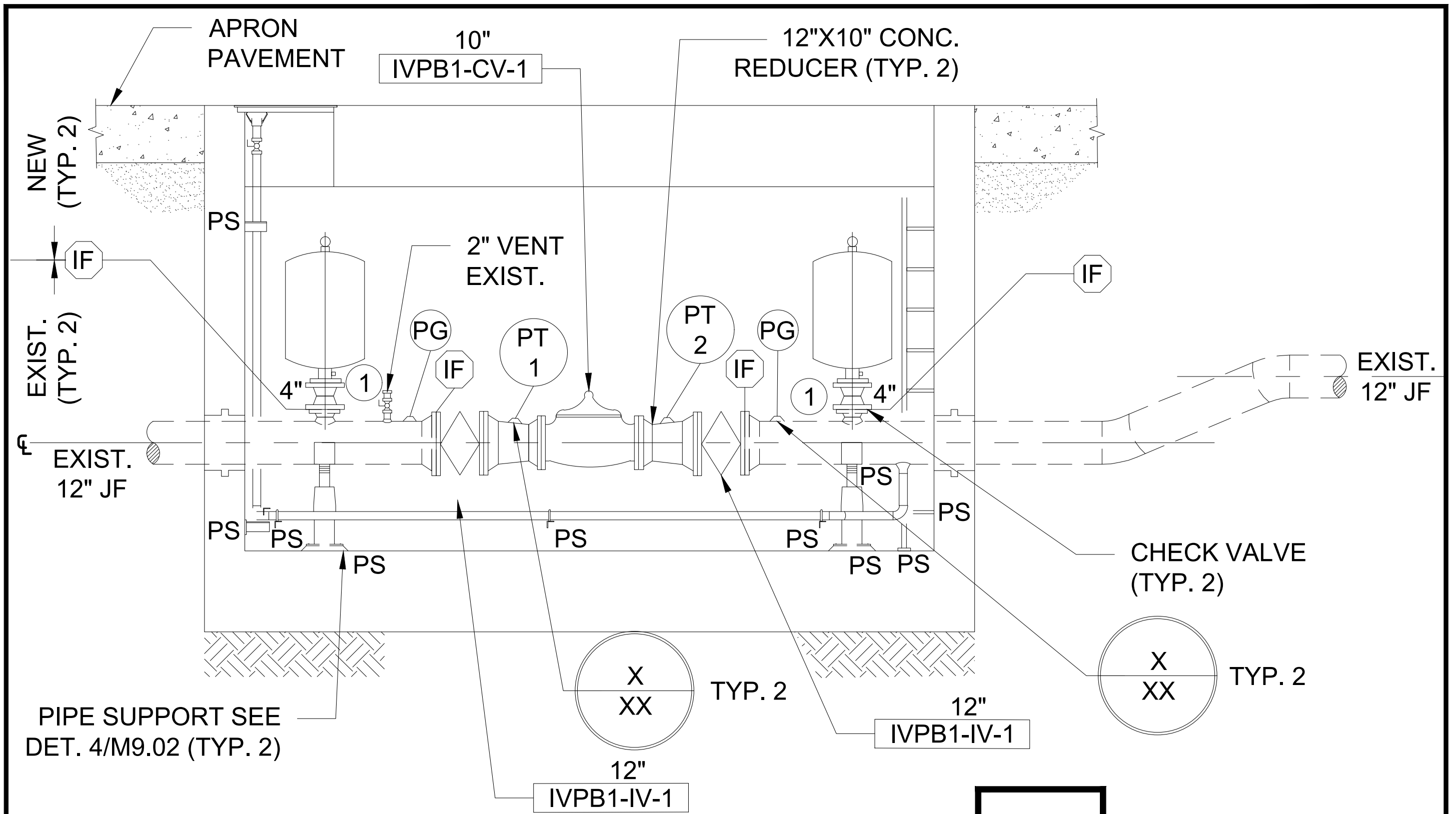
NOTES:

1. REMOVE BLIND FLANGE AND INSTALL 40 GALLON SURGE SUPPRESSOR WITH PLUG VALVE.
2. REMOVE SPOOL AND INSTALL PIPING/EQUIPMENT. REFER TO EXISTING CONDITIONS DRAWING C3.33.
3. FOR COMPLETE DESIGNATION OF PRESSURE SENSOR AND VALVE TAGS, SEE FLOW MECHANICAL DIAGRAM DWG. M1.03.

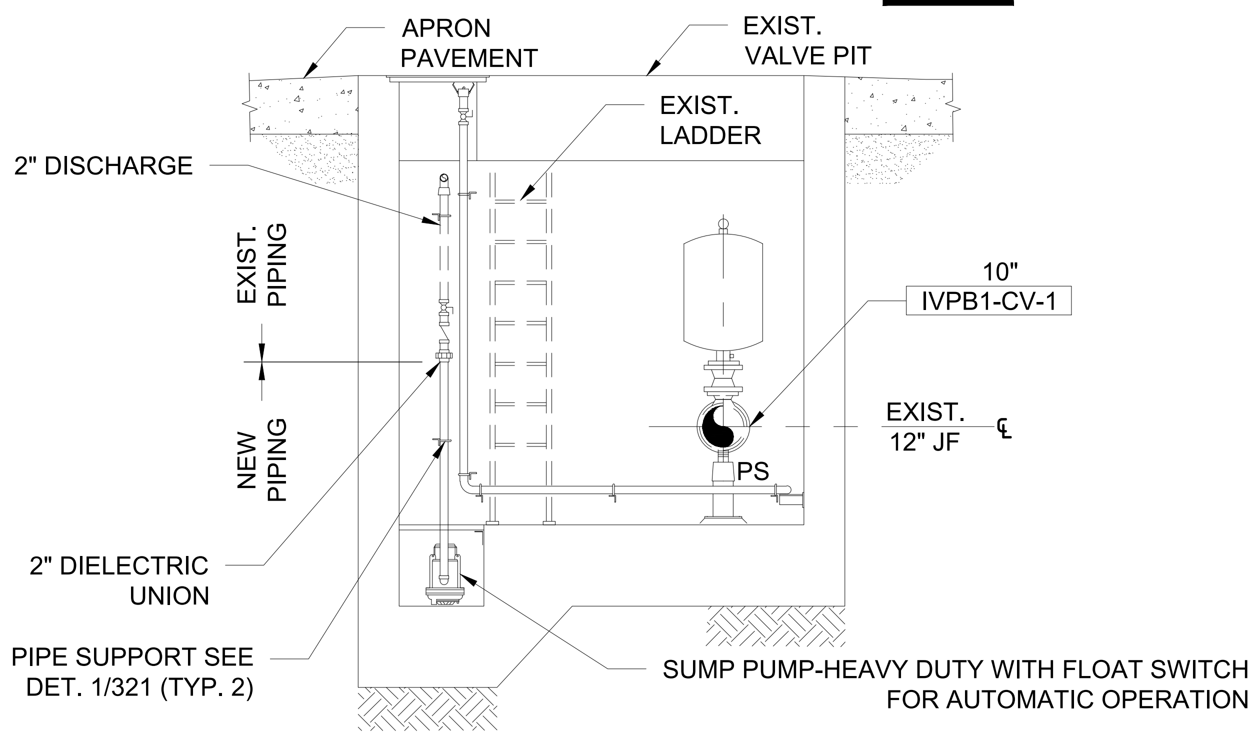
ISOLATION VALVE PIT PLAN

NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	ISOLATION VALVE PIT PLAN VIEW
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **309**



SECTION | 1
NTS | 309B



SECTION | 2
NTS | 309B

SEA Seattle-Tacoma International Airport

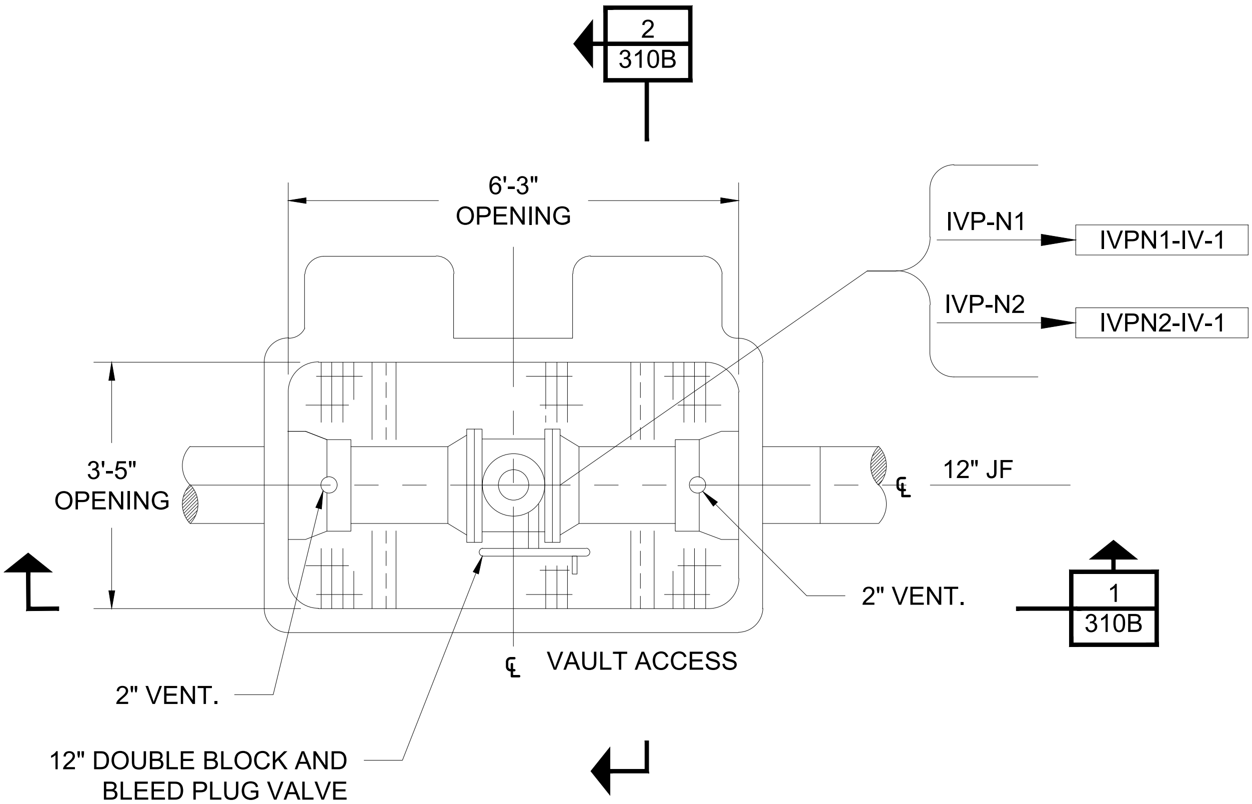
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: 2023

ISOLATION VALVE PIT PLAN SECTION VIEW

STANDARD DETAIL NO. **309B**



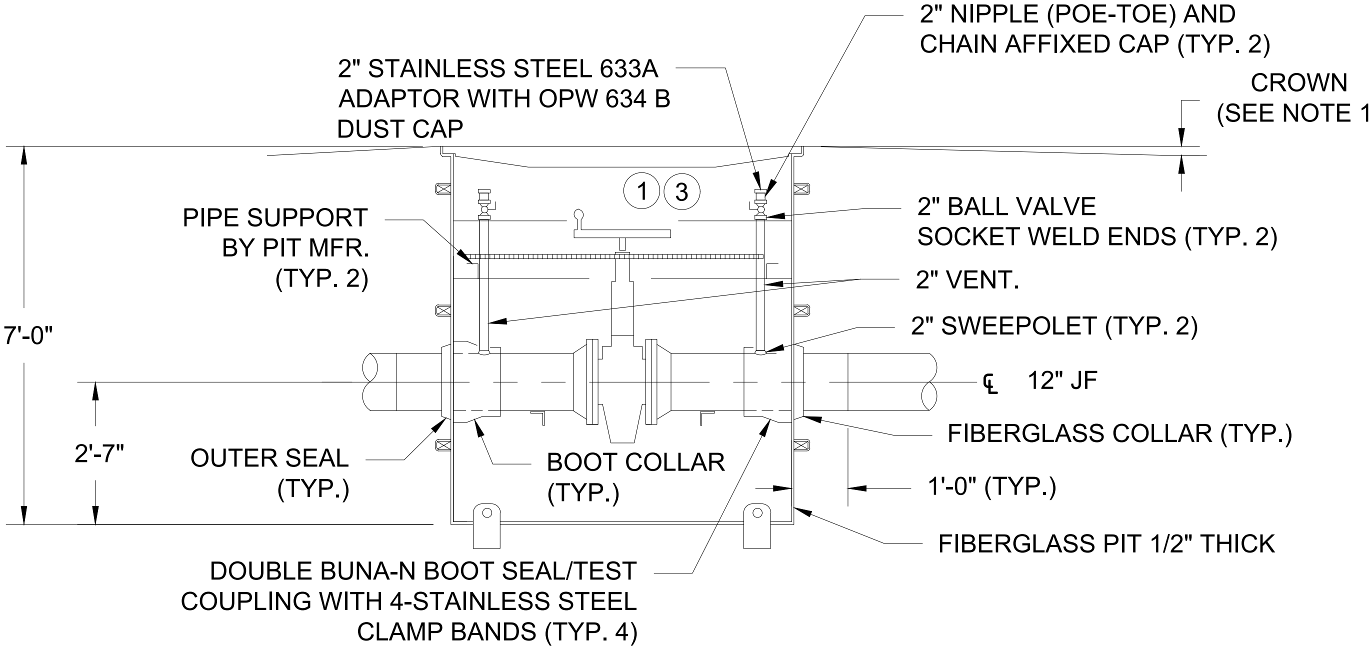
NOTE:

1. FOR FIBERGLASS VAULT PIT INSTALLATION SEE UTILITY SLAB PAVEMENT DETAILS DWG. C7.23.
2. FOR COMPLETE DESIGNATION OF PRESSURE SENSOR AND VALVE TAGS, SEE MECHANICAL FLOW DIAGRAM DWG. M1.03.
3. FIELD COORDINATE FINAL ARRANGEMENT OF VALVES AND PIPING TO PROVIDE ADEQUATE CLEARANCE FOR VALVE OPERATIONS AND HOSE CONNECTION.

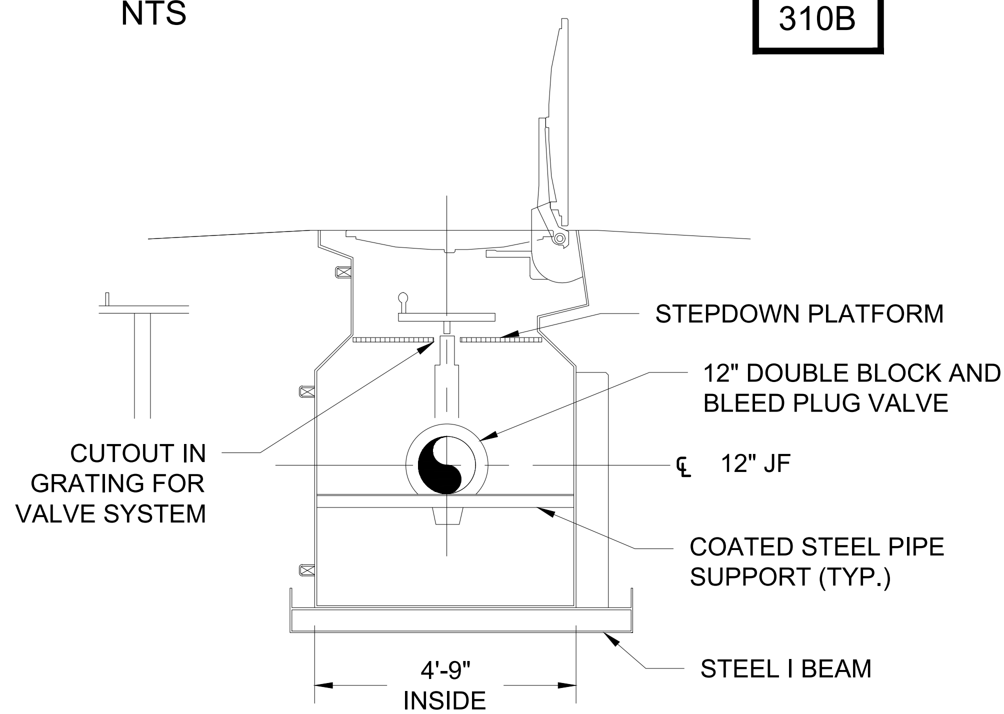
TYPICAL ISOLATION VALVE PIT (IVP) PLAN

NTS

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE REVISION DATE: 2023	TYPICAL ISOLATION VALVE PIT (IVP) PLAN VIEW STANDARD DETAIL NO. **310**



SECTION | 1
NTS | 310B



SECTION | 2
NTS | 310B

SEA Seattle-Tacoma International Airport

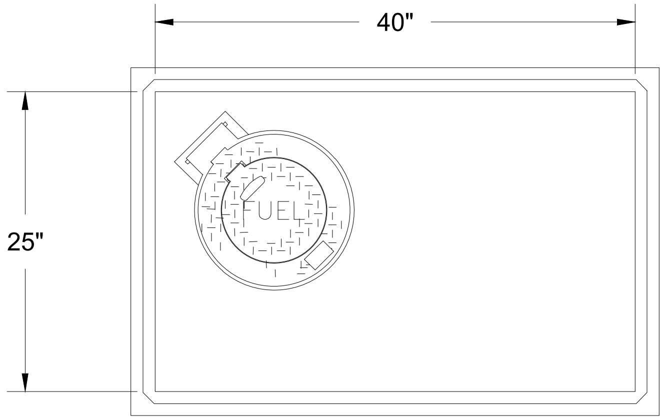
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

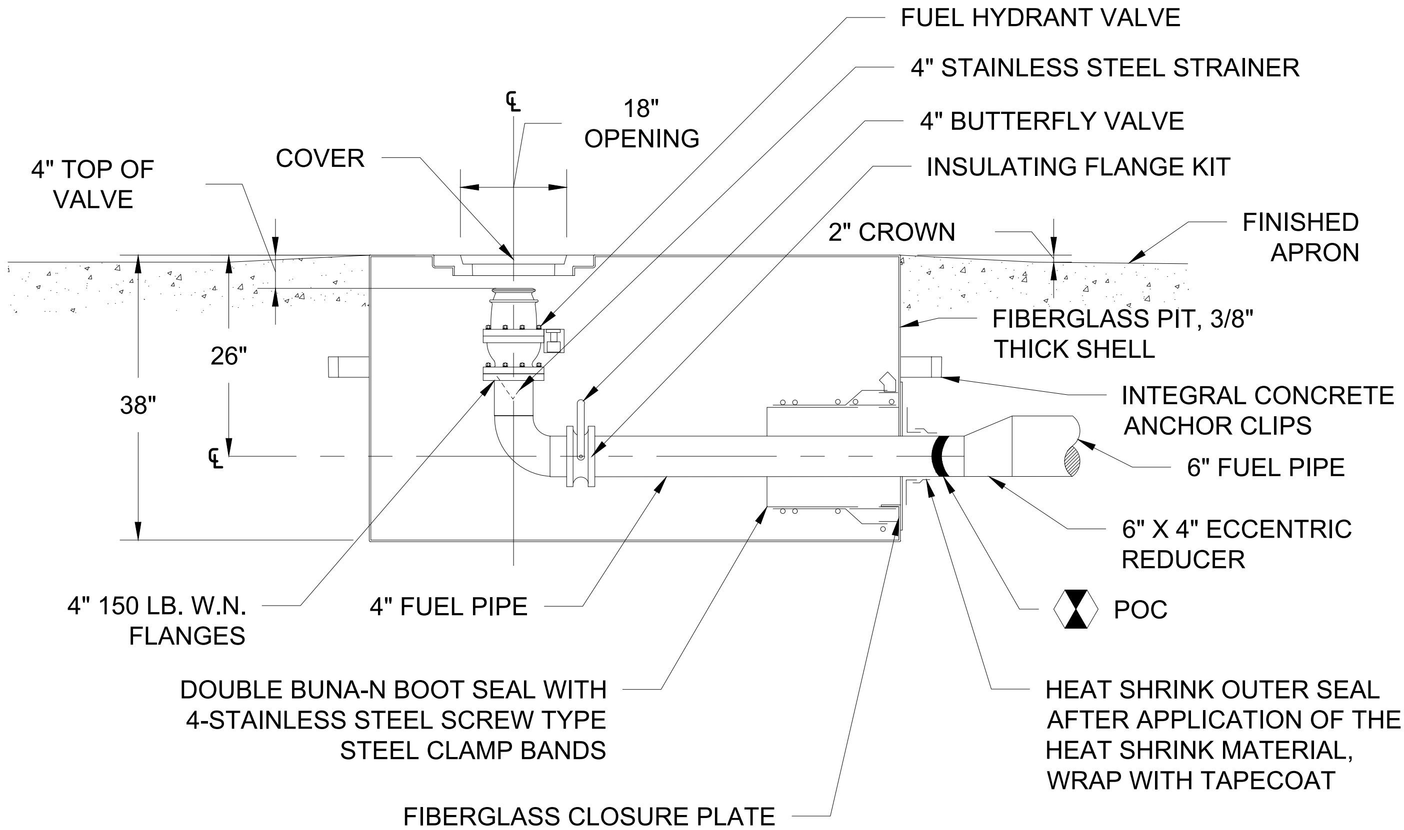
REVISION DATE: 2023

TYPICAL ISOLATION VALVE PIT (IVP) PLAN SECTION VIEW

STANDARD DETAIL NO. **310B**



SIDE VIEW



NOTE:
FUEL HYDRANT PIT ASSEMBLY INCLUDING COVER, VALVES, AND PIPING INSIDE PIT SHALL BE OWNER FURNISHED AS AN ASSEMBLED UNIT. CONTRACTOR SHALL INSTALL PIT ASSEMBLY AND CONNECT 4" FUEL BRANCH LINE AT POC LOCATED OUTSIDE THE PIT. REFER TO DETAIL.

DETAIL 1/311

LOW PROFILE HYDRANT PIT ASSEMBLY
NTS

SEA Seattle-Tacoma International Airport

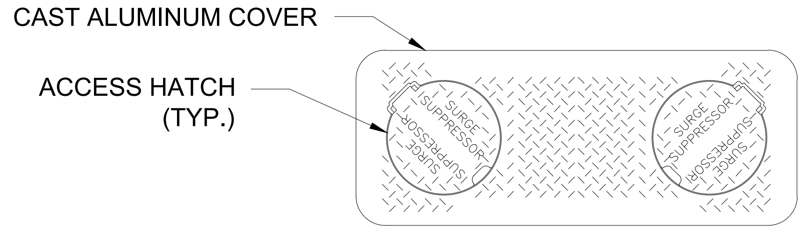
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

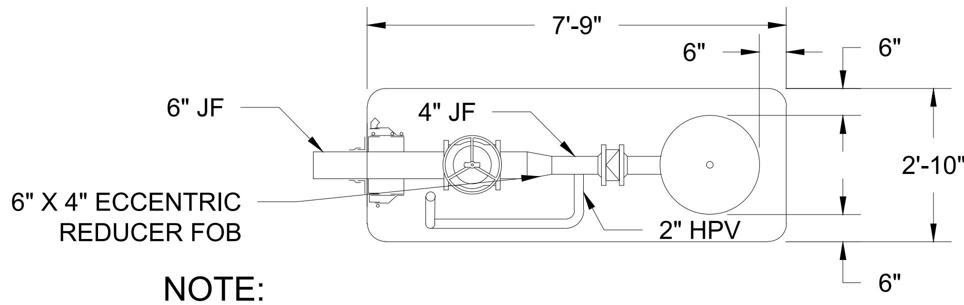
REVISION DATE: 2023

LOW PROFILE HYDRANT PIT ASSEMBLY

STANDARD DETAIL NO. **311**

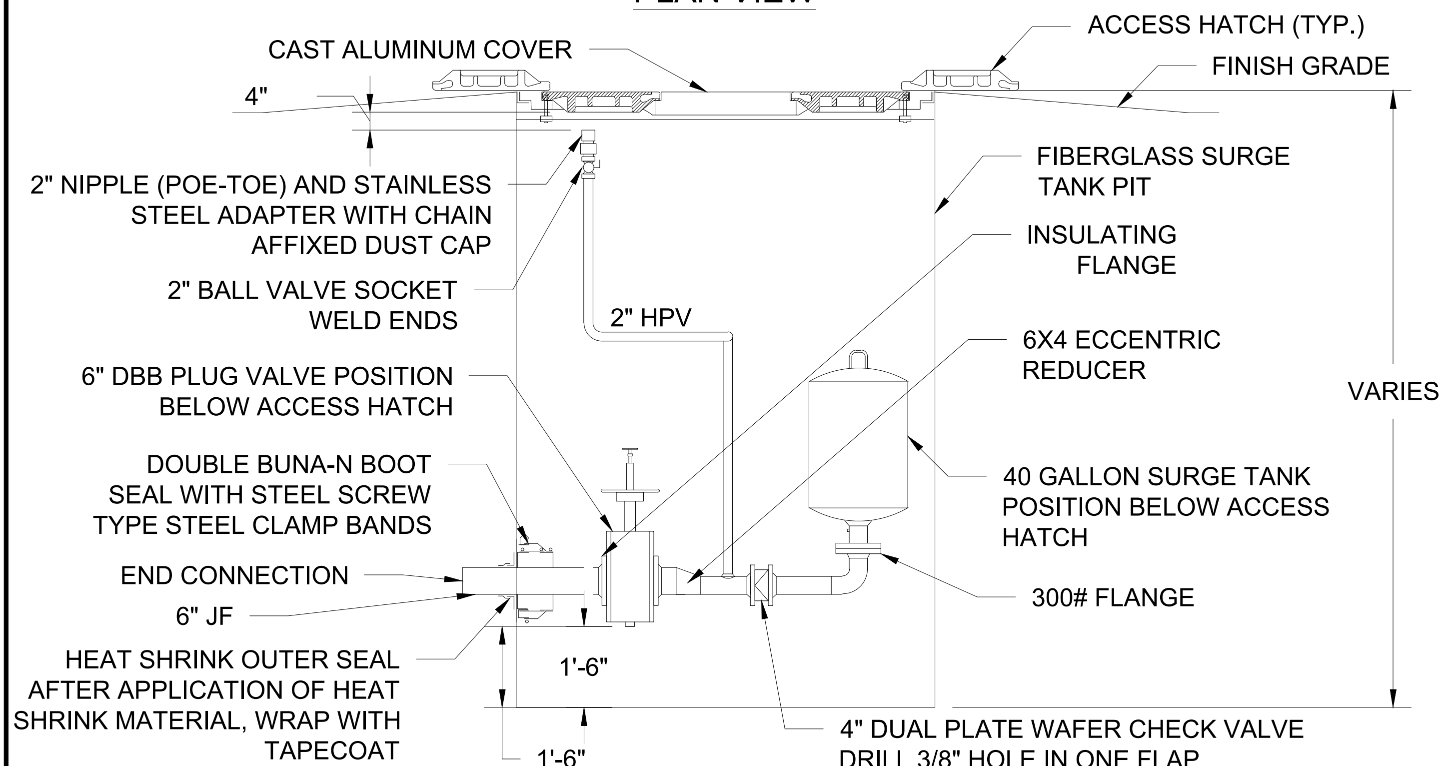


COVER DETAIL



NOTE:
DIMENSIONS SHOWN ARE MINIMUM INTERIOR CLEARANCE.

PLAN VIEW

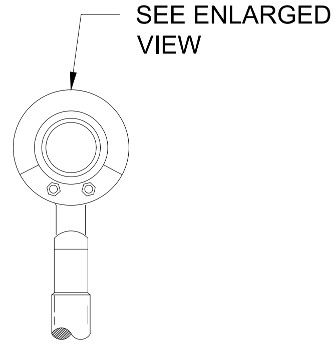


NOTE:
SURGE SUPPRESSOR PIT ASSEMBLY INCLUDING COVER, VALVES, AND PIPING INSIDE PIT SHALL BE OWNER FURNISHED AS AN ASSEMBLED UNIT. CONTRACTOR SHALL INSTALL PIT ASSEMBLY AND CONNECT 6" FUEL BRANCH LINE AT POC LOCATED OUTSIDE THE PIT.

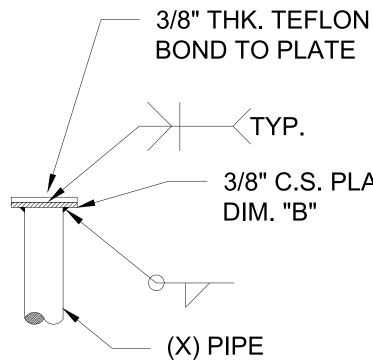
SECTION VIEW

DETAIL 1/312
SURGE TANK PIT
NTS

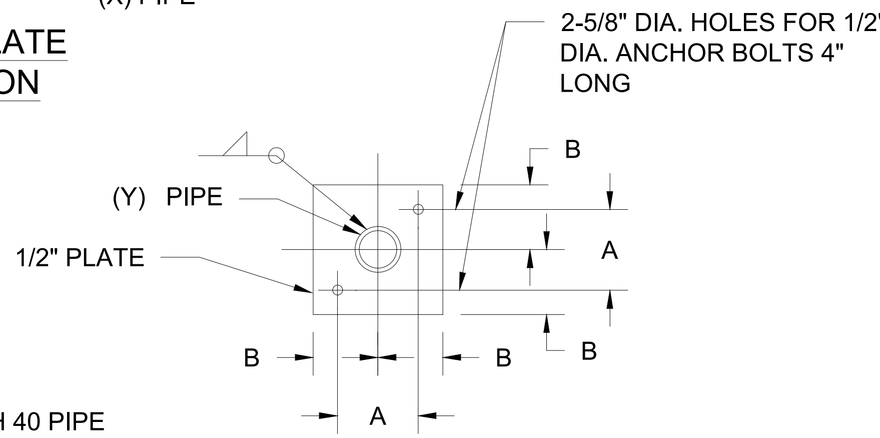
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	SURGE TANK PIT
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **312**



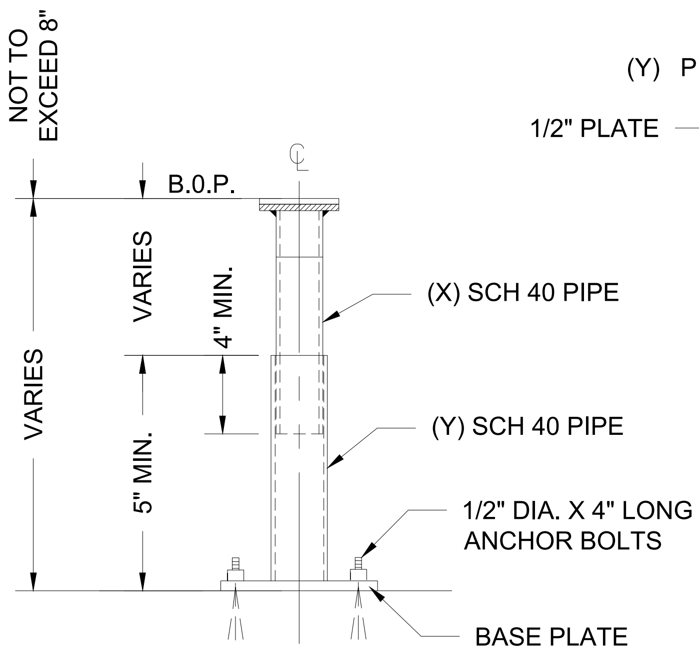
FLANGE MOUNT OPTION



BAR PLATE OPTION



BASE PLATE



NOTES:

1. ALL MATERIAL TO BE HOT DIPPED GALVANIZED.
2. CONTINUOUS WELD AFTER PIPE IS POSITIONED.

PIPE DIA.	A DIM.	B DIM.	X PIPE DIA.	Y PIPE DIA.
3"	2-1/2"	4"	1-1/2"	2-1/2"
4"	2-1/2"	4"	2-1/2"	3"
6"	2-1/2"	4"	2-1/2"	3"
8"	2-1/2"	4"	2-1/2"	3"
10"	4-1/2"	6"	4"	6"

PIPE DIA.	A DIM.	B DIM.	X PIPE DIA.	Y PIPE DIA.
12"	4-1/2"	6"	4"	6"
14"	4-1/2"	6"	4"	6"
16"	4-1/2"	6"	4"	6"
20"	4-1/2"	6"	4"	6"
24"	4-1/2"	6"	4"	6"

DETAIL 1

PEDESTAL PIPE SUPPORT 313
NTS

SEA Seattle-Tacoma International Airport

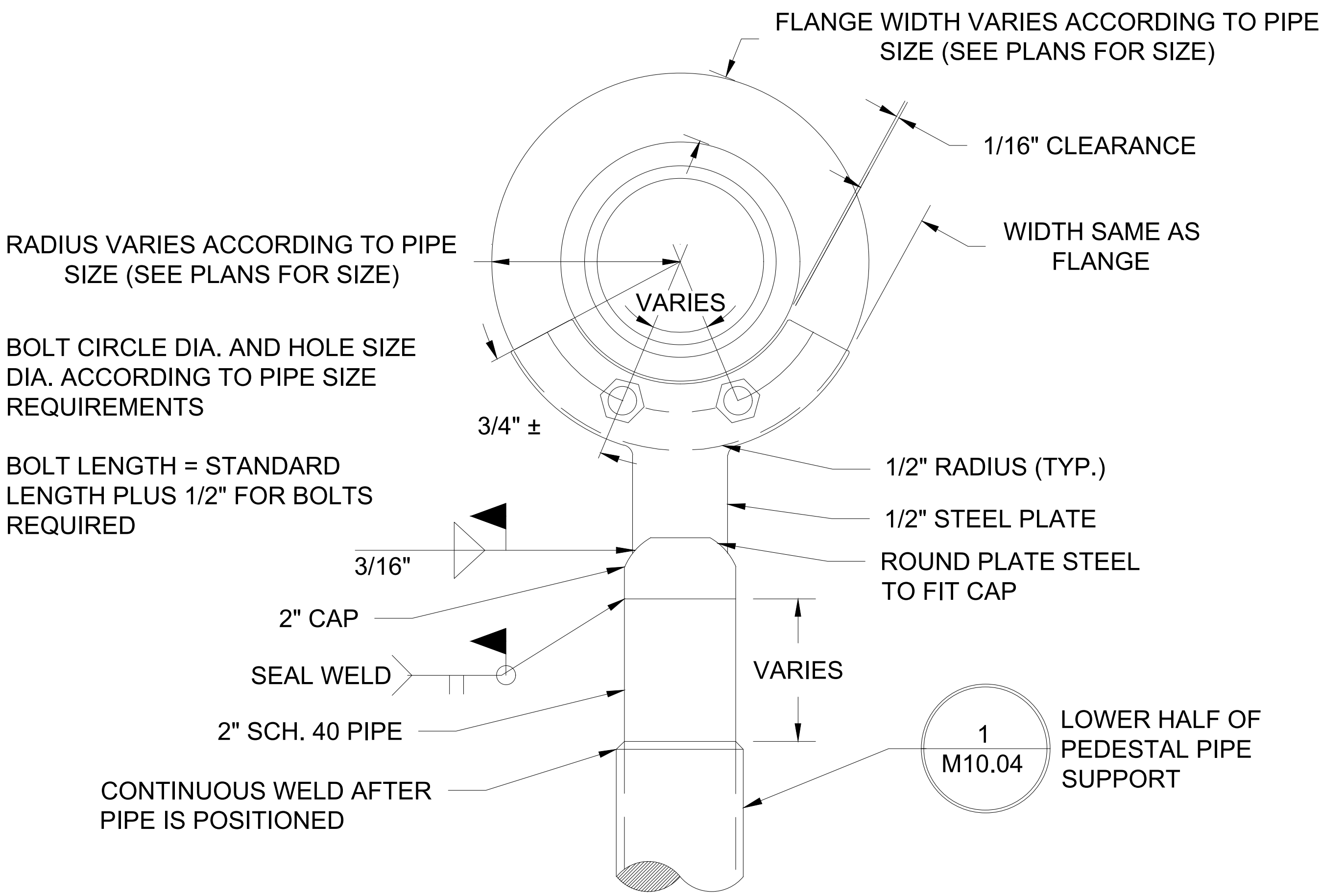
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: 2023

PEDESTAL PIPE SUPPORT

STANDARD DETAIL NO. **313**

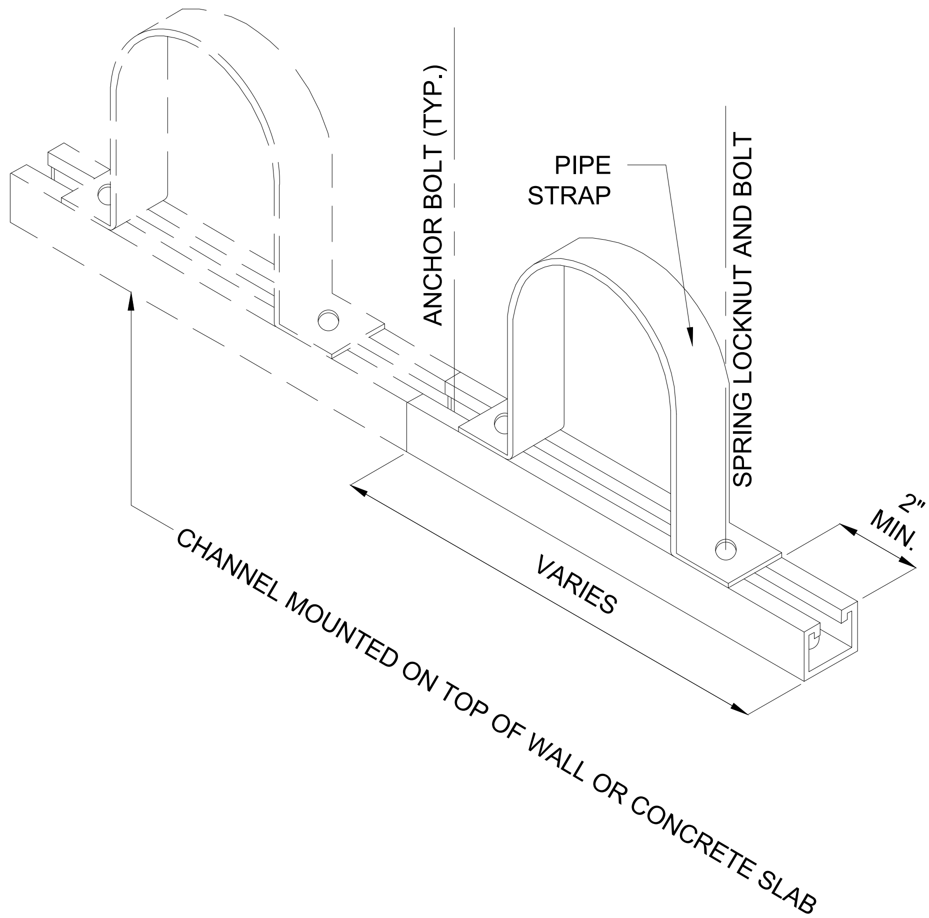


NOTE:
ALL MATERIAL TO BE HOT DIPPED GALVANIZED.

DETAIL
FLANGE PIPE TOP SUPPORT
NTS

1
314

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	FLANGE PIPE TOP SUPPORT
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **314**



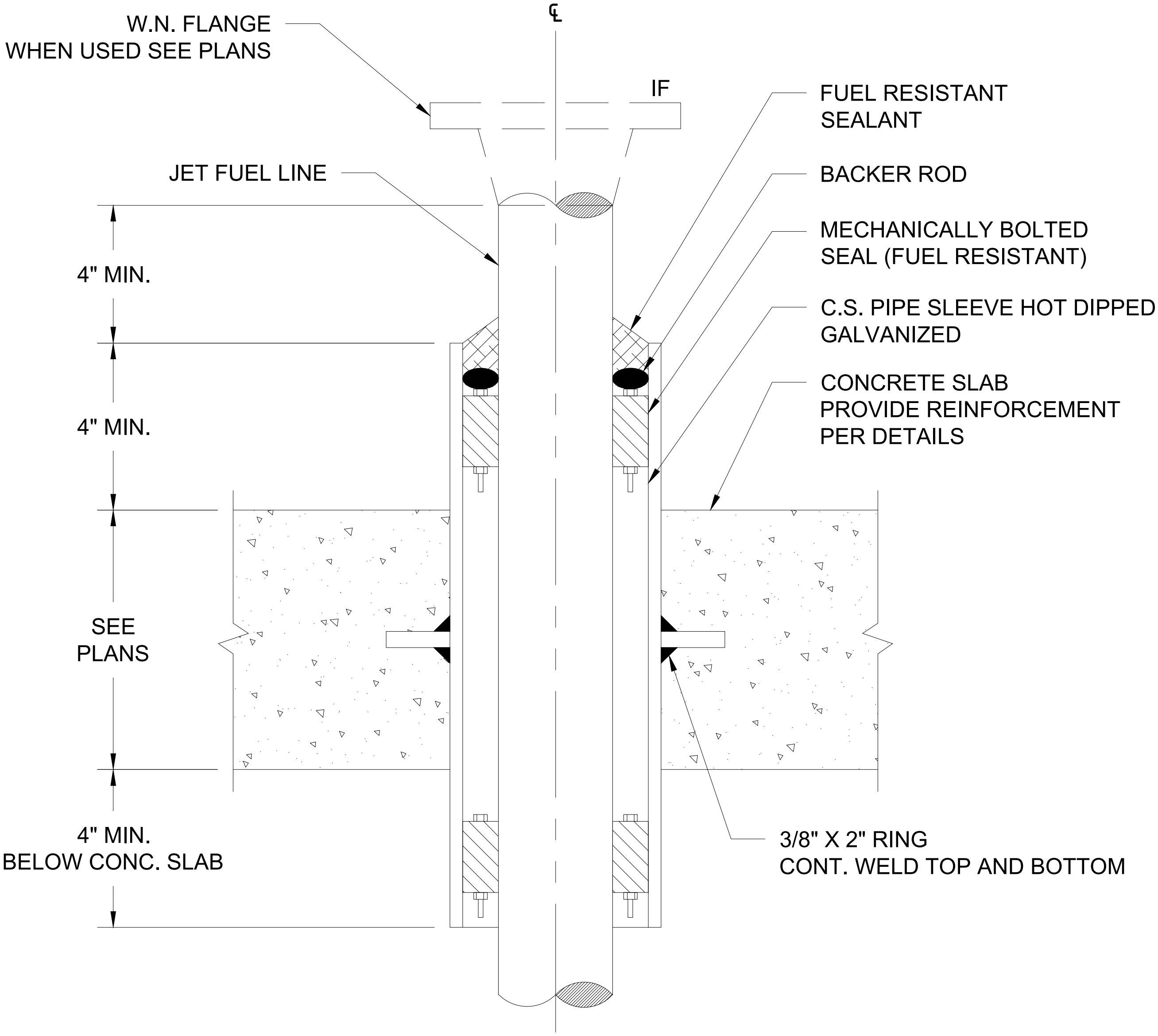
NOTES:

1. ALL MATERIAL TO BE HOT DIPPED GALVANIZED.
2. ALL ANCHOR BOLTS AND CONNECTING HARDWARE TO BE STAINLESS STEEL.

DETAIL 1/315

PIPE CLAMP SUPPORT
NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	PIPE CLAMP SUPPORT
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **315**



NOTES:

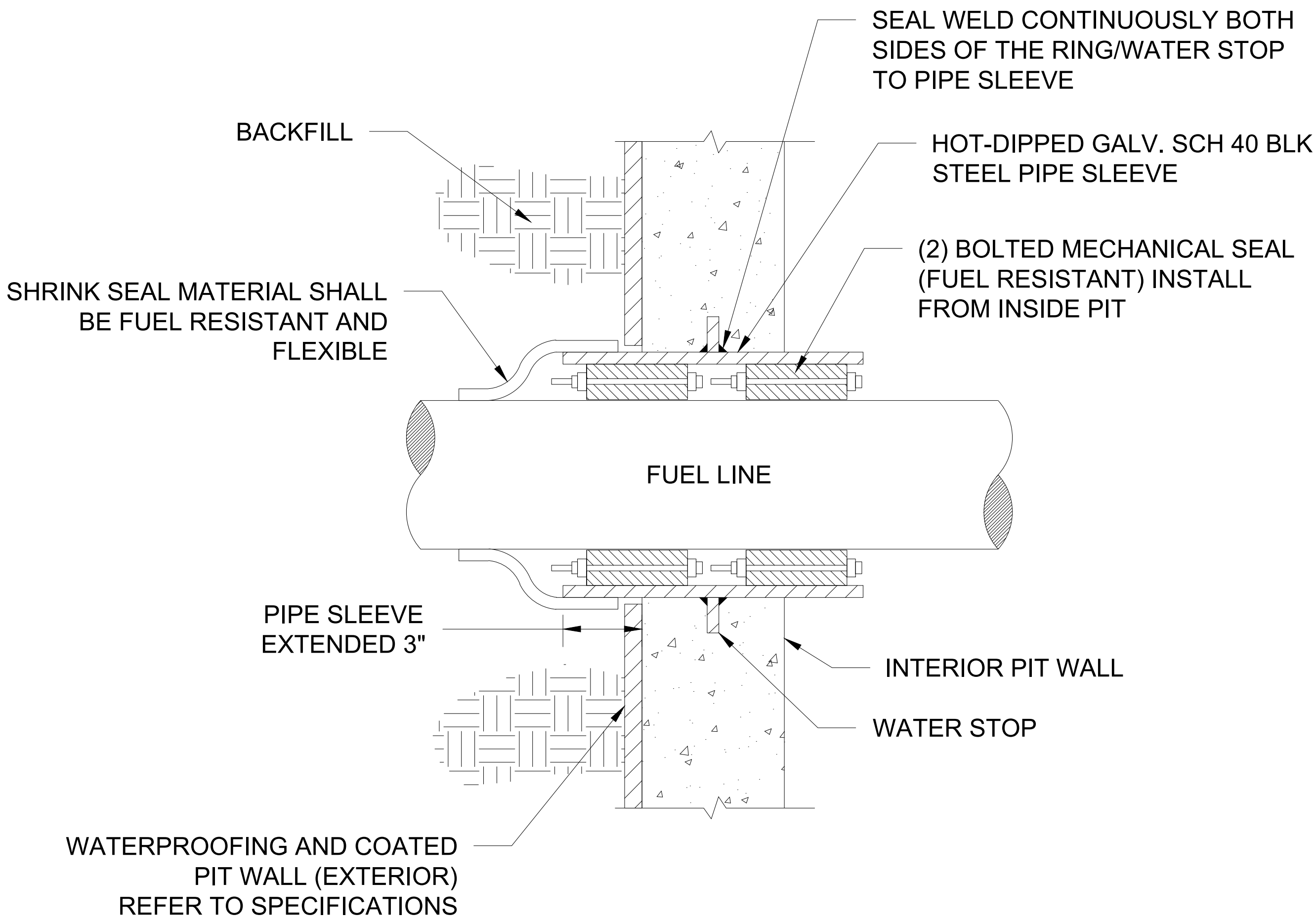
1. PAINT PER SPECIFICATIONS.
2. SIZE ACCORDING TO PIPE.

DETAIL

FLOOR SLEEVE
NTS

1
316

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	FLOOR SLEEVE
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **316**



COMMON WALL PENETRATION NOTES:

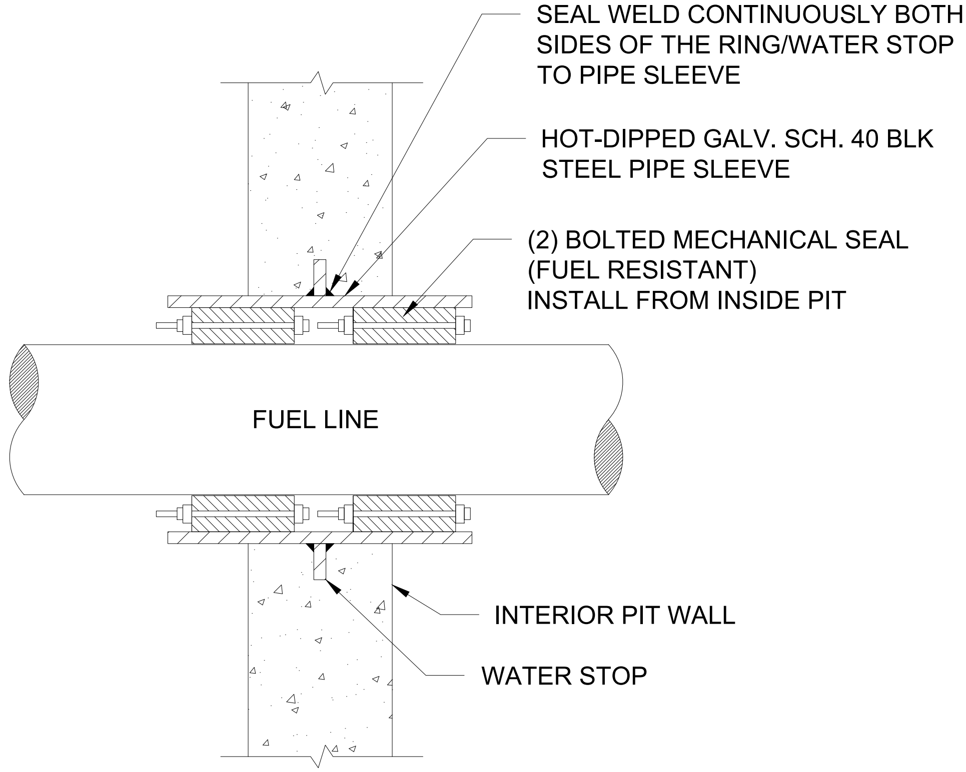
1. PIPE SHALL BE EPOXY COATED INSIDE AND OUT TO MATCH FUEL LINE SPECIFICATIONS.
2. PIPE SHALL BE PROTECTED FROM CONTACT WITH ANY REBAR.
3. ALL EXPOSED PIPING SHALL BE HOLIDAY TESTED IN ACCORDANCE WITH SPECIFICATIONS.
4. WELD ALL PIPE PRIOR TO INSTALLING JET FUEL SEALANT.

DETAIL

WALL SLEEVE
NTS

1
317

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	WALL SLEEVE
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **317**



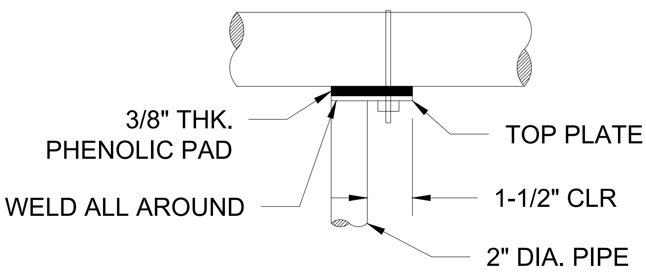
COMMON WALL PENETRATION NOTES:

1. PIPE SHALL BE EPOXY COATED INSIDE AND OUT TO MATCH FUEL LINE SPECIFICATIONS.
2. PIPE SHALL BE PROTECTED FROM CONTACT WITH ANY REBAR.
3. ALL EXPOSED PIPING SHALL BE HOLIDAY TESTED IN ACCORDANCE WITH SPECIFICATIONS.
4. WELD ALL PIPE PRIOR TO INSTALLING JET FUEL SEALANT.

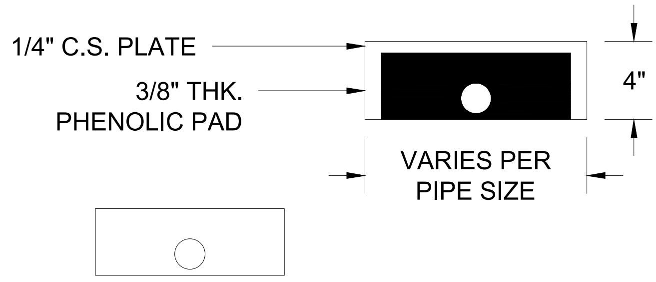
DETAIL 1/318

WALL SLEEVE
NTS

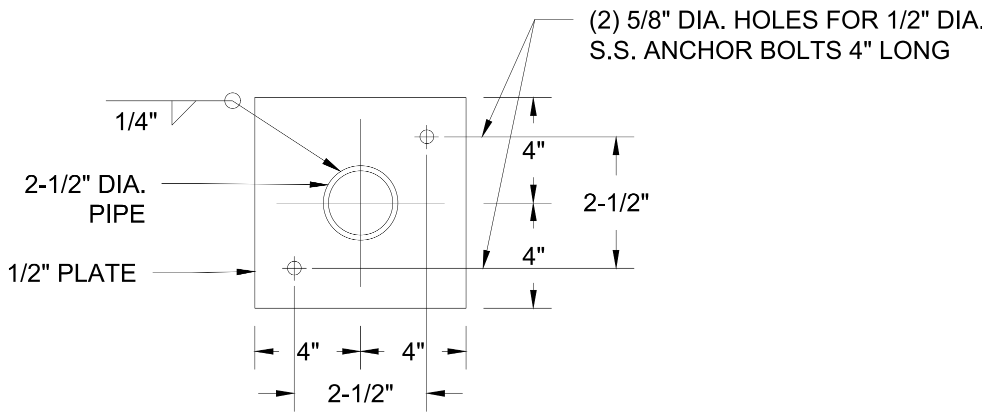
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	WALL SLEEVE
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **318**



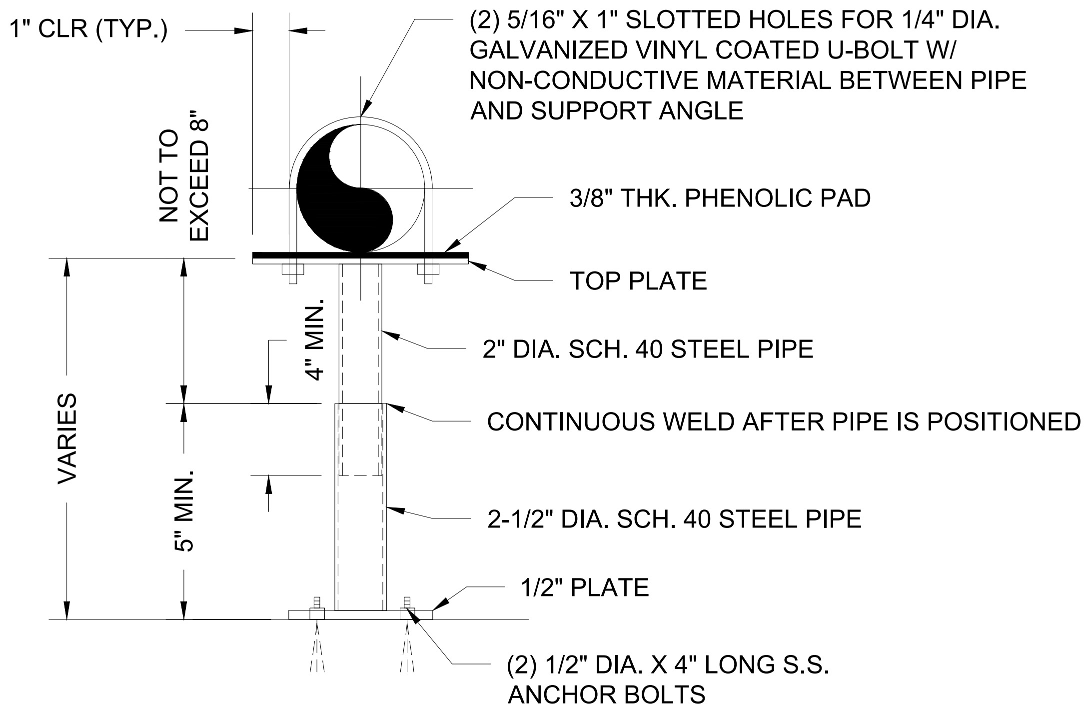
BAR PLATE



TOP PLATE



BASE PLATE

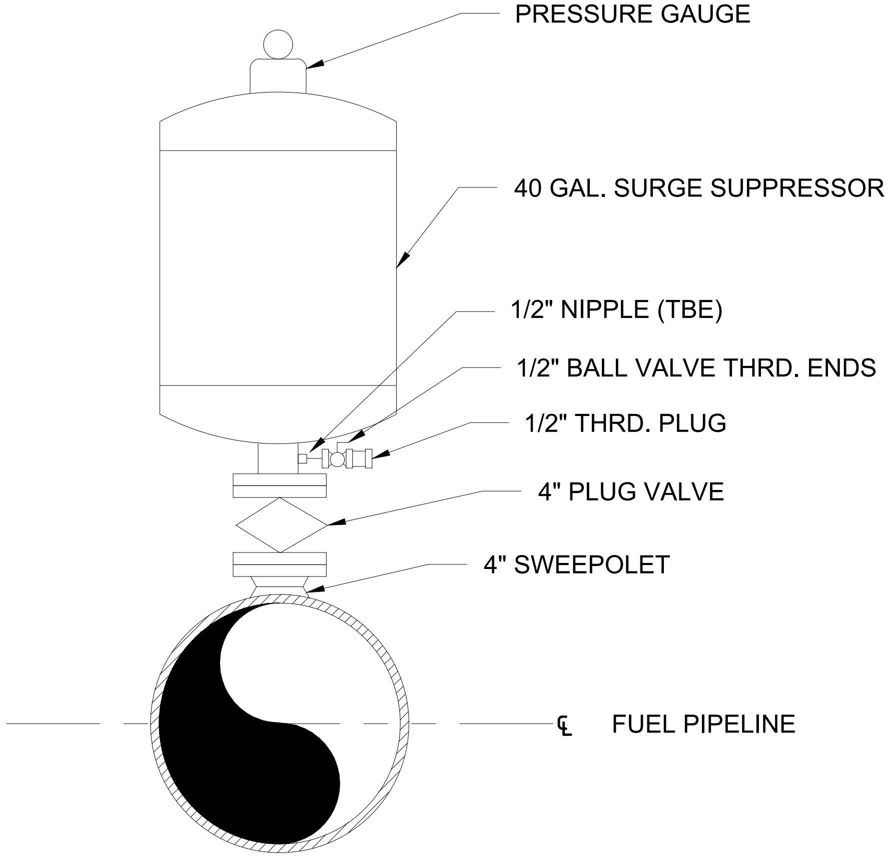


DETAIL

"U" BOLT PIPE SUPPORT
NTS

1
319

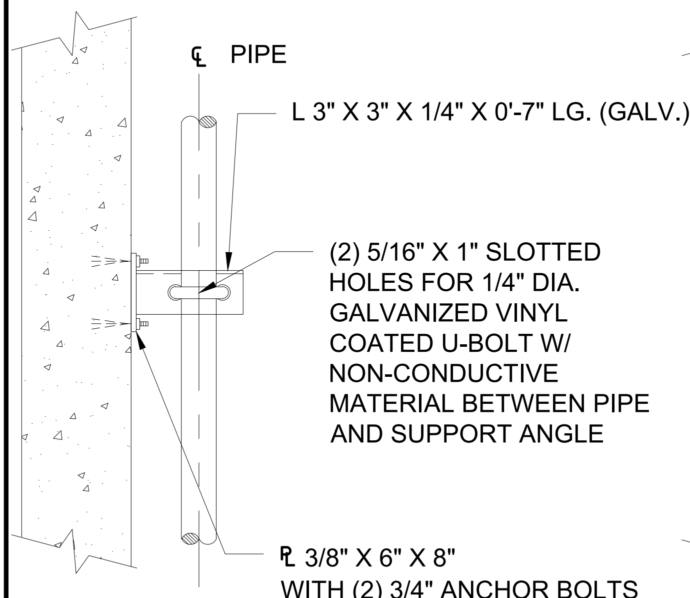
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	"U" BOLT PIPE SUPPORT
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **319**



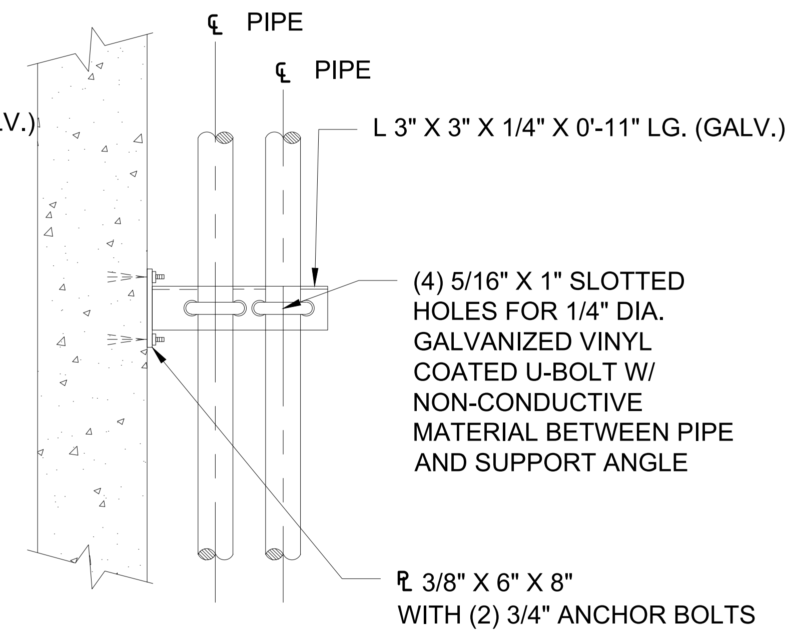
DETAIL 1/320

SURGE SUPPRESSOR
NTS

Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	SURGE SUPPRESSOR
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **320**



1-PIPE WALL BRACKET



2-PIPE WALL BRACKET

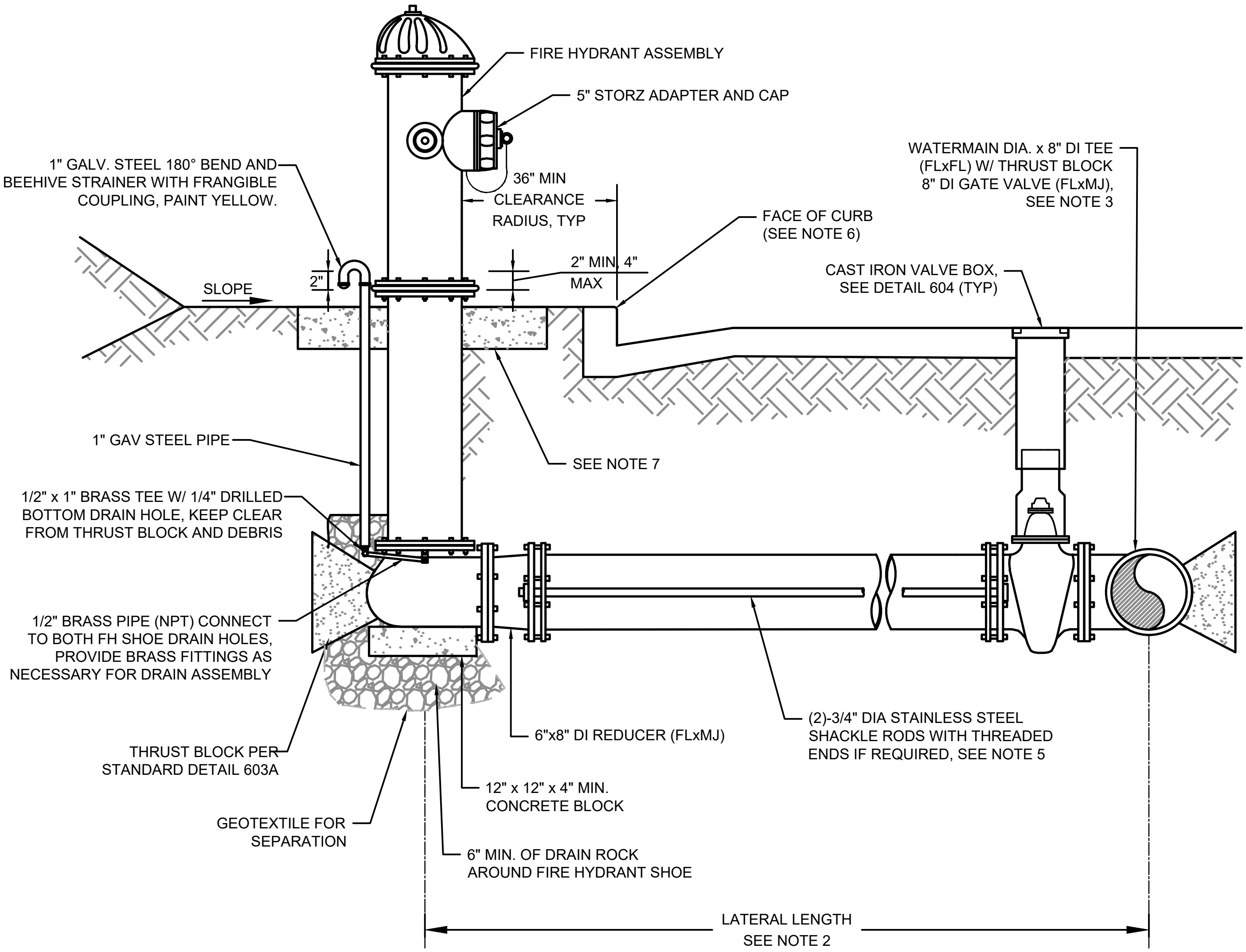
NOTE:

ALL WELDED PIPE SUPPORT ASSEMBLIES TO BE HOT-DIPPED GALVANIZED VINYL COATED PRIOR TO INSTALLATION.

DETAIL 1/321

PIPE BRACKET SUPPORTS
NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	PIPE BRACKET SUPPORTS
F&I CIVIL STANDARDS	REVISION DATE: 2023	STANDARD DETAIL NO. **321**



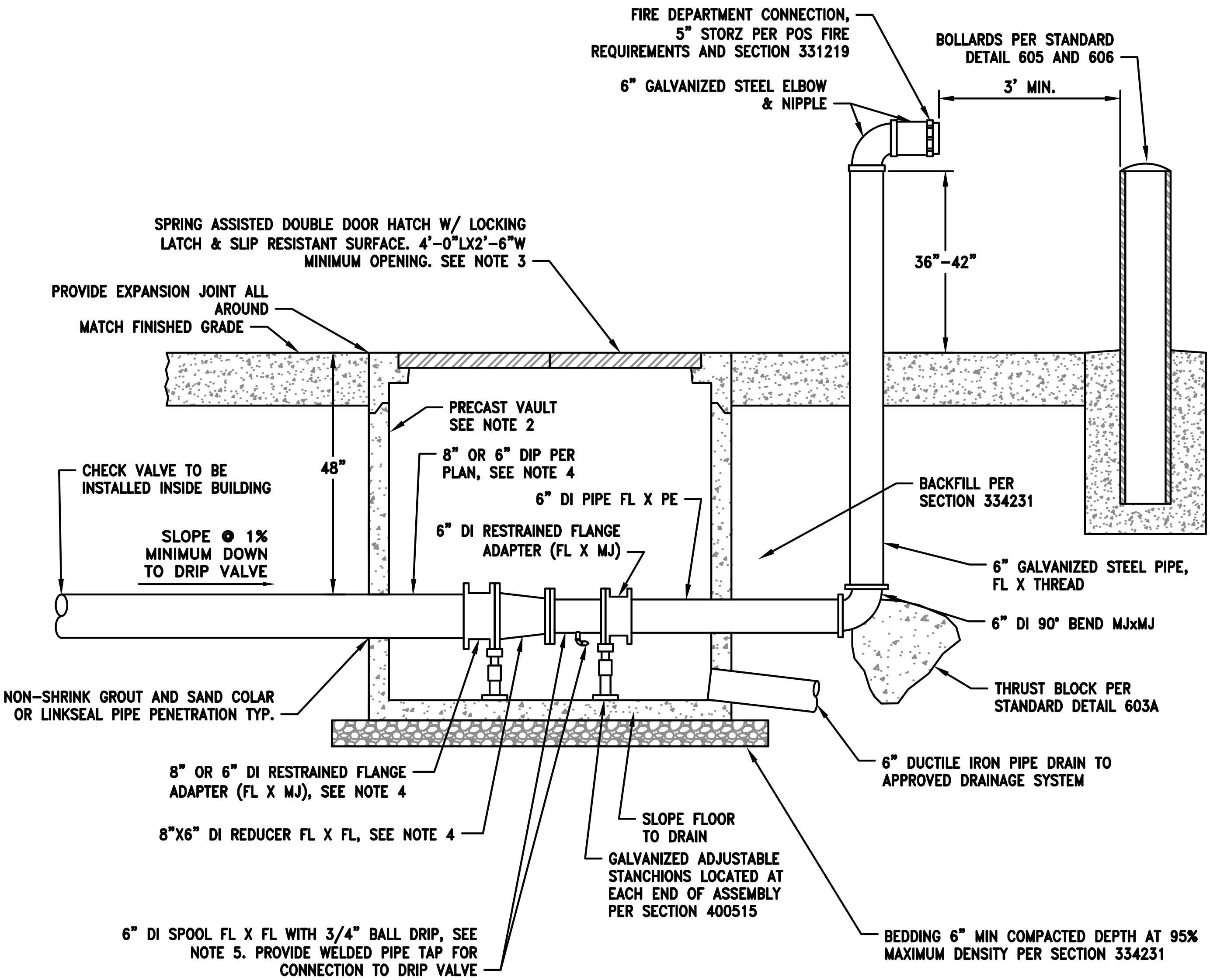
DETAIL

FIRE HYDRANT
SCALE: NTS

1
600

NOTES:

1. SEE SECTION 33 12 19 FOR FIRE HYDRANT ASSEMBLY PRODUCTS
2. IF LATERAL LENGTH IS < 50', THEN PIPE SIZE SHALL BE 6" MIN. WITH A 8" GATE VALVE (FL X FL) AND 8"X6" REDUCER (FL X MJ). IF LATERAL IS > 50', THEN PIPE SIZE SHALL BE 8" MIN.
3. FIRE HYDRANT VALVE SHALL BE NO MORE THAN 10 FT AND NO LESS THAN 4 FT FROM THE FIRE HYDRANT. A SECOND LINE-SIZED VALVE SHALL BE REQUIRED WHEN THE MAIN-HYDRANT TEE VALVE DOES NOT MEET THIS REQUIREMENT.
4. ALL JOINTS SHALL BE RESTRAINED JOINTS. MECHANICAL JOINTS SHALL BE RESTRAINED BY MEGALUG RESTRAINT OR APPROVED EQUAL.
5. SHACKLE RODS CAN BE UTILIZED IN LIEU OF THRUST BLOCK AT HYDRANT.
6. HYDRANTS NOT LOCATED ALONG ROAD WITH CURB LINE SHALL BE PROVIDED WITH BOLLARDS PER STD DETAIL 605 AND 606 AND AS APPROVED BY F&I.
7. IN UNPAVED AREAS INSTALL A 3' X 3' X 4" THICK CONCRETE PAD. PAD NOT DRAWN TO SCALE.
8. FIRE HYDRANT SHALL BE PAINTED RED WITH REFLECTORIZED SILVER TOP, SEE SECTION 33 12 19.



DETAIL 1/601
REMOTE FDC & VAULT ASSEMBLY
SCALE: NTS

NOTES:

1. ALL PIPE OPENINGS IN VAULT WALLS SHALL BE FILLED WITH NON-SHRINK GROUT.

2. PRECAST UTILITY VAULT AND LID:
   A. VAULTS LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE PRECAST AND DESIGNED FOR FAA LOADS AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION).
   B. VAULTS NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. SHOP DRAWINGS AND STRUCTURAL CALCULATIONS FOR THE VAULT SHALL BE STAMPED BY A LICENSED PROFESSIONAL STRUCTURAL ENGINEER AND SUBMITTED TO F&I FOR APPROVAL PRIOR TO FABRICATION.

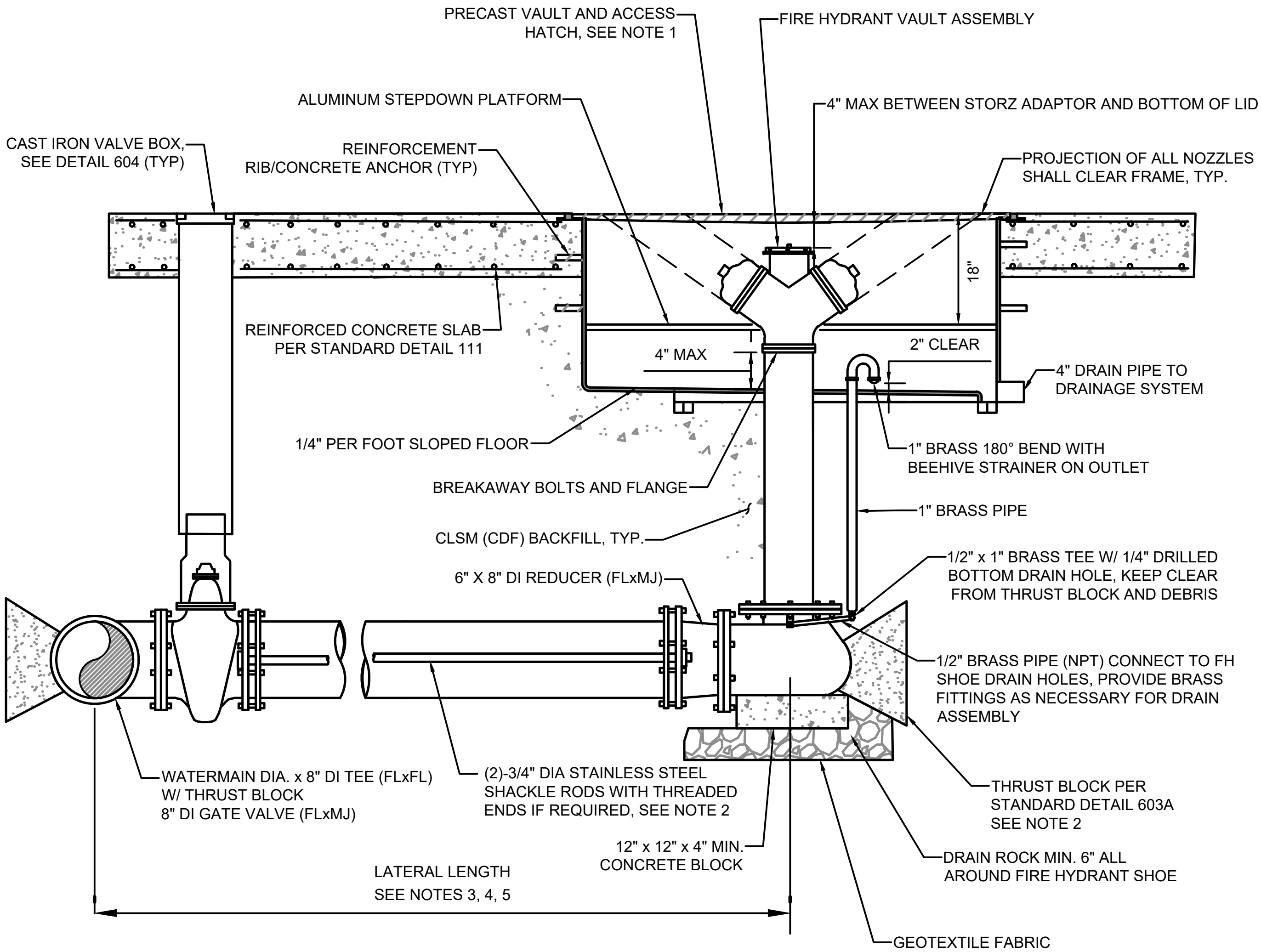
3. HATCHES FOR VAULTS:
   A. HATCHES LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE LOCKING, AIRCRAFT RATED AND DESIGNED TO SUPPORT A MINIMUM 100,000 LB WHEEL LOAD WITH 250 PSI TIRE PRESSURE.
   B. HATCHES NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. HATCH SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED TO POS F&I FOR APPROVAL PRIOR TO FABRICATION.

4. PROVIDE GALVANIZED PIPE AND FITTINGS AS INDICATED IN DETAIL. ABOVE GROUND PIPING/FITTINGS AND PIPING/FITTINGS EXPOSED IN VAULT THAT IS GALVANIZED SHALL BE PAINTED RED.

5. REMOTE FDC PIPE RUN SHALL BE SIZED AS SHOWN ON PLANS. FOR 6" FDC PIPE RUN, REDUCER IS NOT REQUIRED AND MJ X FL ADAPTER SHALL BE INSTALLED ADJACENT TO GALVANIZED COUPLING.

6. 3/4" AUTOMATIC BALL DRIP SHALL HAVE A MIMINUM WORKING PRESSURE OF 250 PSI. VALVE SHALL OPEN UNDER A MINIMUM PRESSURE OF 10 PSI. ELEVATION DIFFERENCE BETWEEN BALL DRIP AND TOP OF FDC OR SPRINKLER ROOM CHECK VALVE (WHICHEVER IS HIGHER) SHALL NOT EXCEED 10'.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	REMOTE FDC & VAULT ASSEMBLY
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **601**



DETAIL

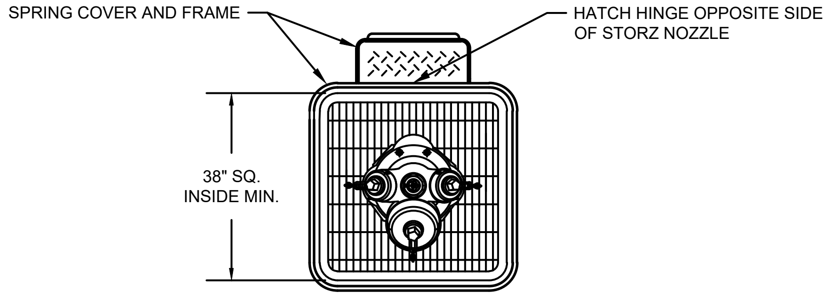
FIRE HYDRANT VAULT ASSEMBLY
SCALE: NTS

1 / 602A

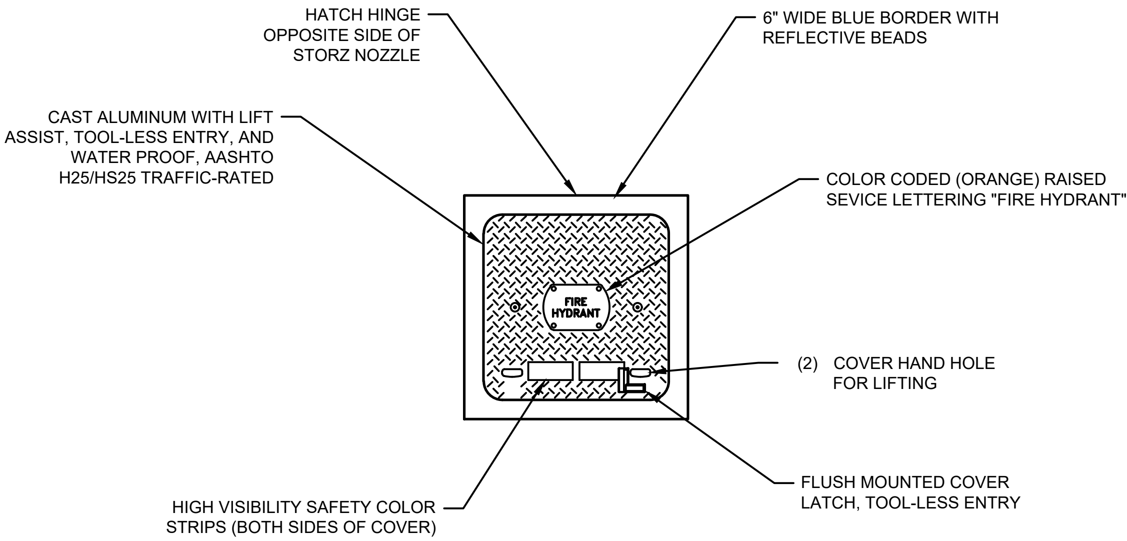
NOTES:

1. VAULT AND HATCH LOCATED IN AOA OR LANDSIDE ROADWAYS SHALL BE CAVOTEC D38WP-VA-24D OR SIMILAR BY CAVOTEC DABICO AND DESIGNED TO SUPPORT 200,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE. HATCH SHALL BE WATERPROOF, LIFT ASSISTED, AND TOOL LESS ENTRY. HATCH AND VAULT SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.
2. SHACKLE RODS CAN BE UTILIZED IN LIEU OF THRUST BLOCKS.
3. IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. WITH A 8" GATE VALVE (FL X FL) AND 8" X 6" REDUCER (FL X MJ). IF LATERAL IS >50', THEN PIPE SIZE SHALL BE 8" MIN.
4. FIRE HYDRANT VALVE SHALL BE NO MORE THAN 10 FT AND NO LESS THAN 4 FT FROM THE FIRE HYDRANT. A SECOND LINE-SIZED VALVE SHALL BE REQUIRED WHEN THE MAIN-HYDRANT TEE VALVE DOES NOT MEET THIS REQUIREMENT.
5. ALL JOINTS SHALL BE RESTRAINED JOINTS. MECHANICAL JOINTS SHALL BE RESTRAINED BY MEGALUG RESTRAINT, EBAA IRON MEGALUG, ROMAC ROMAGRIP, STAR PIPE PRODUCTS STARGRIP, OR APPROVED EQUAL.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	FIRE HYDRANT VAULT ASSEMBLY
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 602A



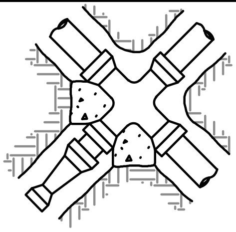
DETAIL
FIRE HYDRANT VAULT ASSEMBLY
SCALE: NTS
1
602B



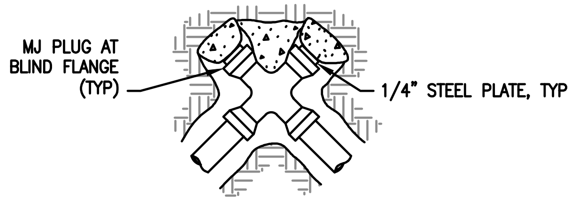
DETAIL
FIRE HYDRANT VAULT ASSEMBLY
SCALE: NTS
2
602B

SEE NOTES ON STANDARD DETAIL 602A.

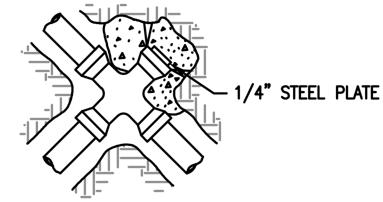
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	FIRE HYDRANT VAULT AND HATCH DETAIL
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 602B



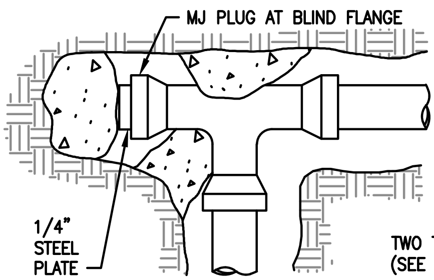
UNBALANCED CROSS
(USE COLUMN A)



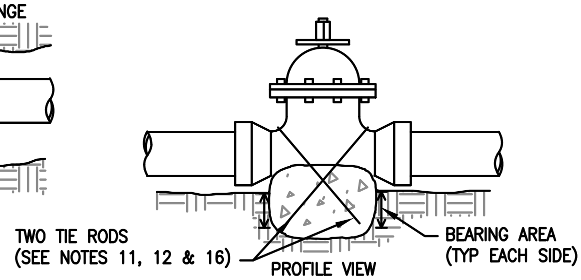
PLUGGED CROSS
(USE COLUMN B)



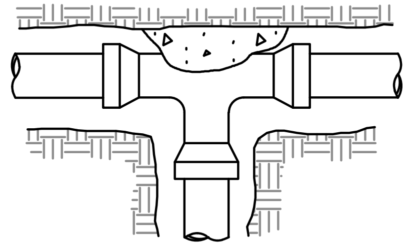
PLUGGED CROSS
(USE COLUMN A)



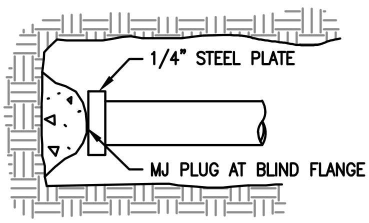
PLUGGED TEE
(USE COLUMN B)



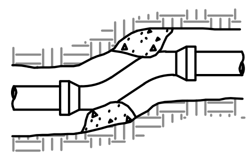
CUT-IN VALVE 16" TO 24" DIAMETER ONLY
(USE COLUMN A)



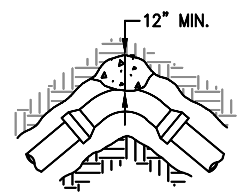
TEE
(SEE NOTE 15)



DEAD END



OFFSET
(USE COLUMNS B~E)



BEND

SOIL TYPE	SAFE BEARING LOAD (PSF)
MUCK, PEAT, ETC.	0
SOFT CLAY	1000
SAND	2000
SAND AND GRAVEL	3000
SAND AND GRAVEL CEMENTED W/CLAY	4000
HARD SHALE	10000

TABLE 1 THRUST BLOCK REQUIREMENTS-HORIZONTAL BEARING

	A		B		C		D		E	
PIPE SIZE (INCHES)	CUT-IN VALVE, TEES AND DEAD ENDS THRUST (IN LBS)	SF*	90 DEGREE BEND THRUST (IN LBS)	SF*	45 DEGREE BEND THRUST (IN LBS)	SF*	22-1/2 DEGREE BEND THRUST (IN LBS)	SF*	11-1/4 DEGREE BEND THRUST (IN LBS)	SF*
4	4,525	3.4	6,398	4.8	3,463	2.6	1,765	1.3	888	0.7
6	9,348	7.0	13,220	9.9	7,155	5.4	3,648	2.7	1,833	1.4
8	16,083	12.1	22,743	17.1	12,308	9.2	6,275	4.7	3,153	2.4
10	24,193	18.1	34,213	25.7	18,515	13.9	9,440	7.1	4,743	3.6
12	34,213	25.7	48,383	36.3	26,185	19.6	13,350	10.0	6,708	5.0
16	59,448	44.6	84,070	63.1	45,498	34.1	23,195	17.4	11,653	8.7
18	74,663	56.0	105,588	79.2	57,145	42.9	29,133	21.8	14,638	11.0
24	130,698	98.0	184,835	138.6	100,033	75.0	50,995	38.2	25,623	19.2

*MINIMUM BEARING AREA AGAINST UNDISTURBED SOIL (BASED ON SAFE SOIL BEARING OF 2000 PSF)

1. BEARING AREA OF CONCRETE THRUST BLOCKS SHOWN IN TABLE 1 BASED ON 250 PSI PRESSURE AND SAFE SOIL BEARING LOAD OF 2,000 POUNDS PER SQUARE FOOT.
2. BEARING AREAS SHALL BE ADJUSTED FOR OTHER PIPE SIZES, SOIL CONDITIONS AND PRESSURES, WITH SOIL BEARING PRESSURE DETERMINED BY A LICENSED GEOTECHNICAL ENGINEER. DIVIDE THRUST BY SAFE BEARING LOAD TO DETERMINE REQUIRED AREA (IN SQUARE FEET) OF CONCRETE TO DISTRIBUTE LOAD. LOCATION AND SIZE OF BLOCKING FOR PIPE LARGER THAN 24" DIAMETER AND FOR PRESSURE AND SOIL TYPES DIFFERENT THAN SHOWN SHALL BE DETERMINED BY THE ENGINEER.
3. SIZE OF THRUST BLOCKS TO BE PER NFPA 24 AND USE A SAFETY FACTOR OF 1.5.
4. CONCRETE BLOCKING (CLASS 3000) SHALL BE CAST IN PLACE AGAINST UNDISTURBED NATIVE EARTH.
5. CONCRETE THRUST BLOCK AREAS SHALL BE CENTERED ON PIPE.
6. CONCRETE BLOCKING SHALL BEAR AGAINST FITTINGS ONLY AND SHALL BEAR AGAINST THE GREATEST FITTING SURFACE AREA POSSIBLE, BUT SHALL BE CLEAR OF JOINTS TO PERMIT TAKING UP OR DISMANTLING OF JOINT.
7. CONTRACTOR SHALL INSTALL BLOCKING ADEQUATE TO WITHSTAND FULL TEST PRESSURE UNDER ALL CONDITIONS OF SERVICE.
8. PLACE SHEET PLASTIC OVER NUTS AND BOLTS PRIOR TO CONCRETE POUR USING
9. ALL POURED THRUST BLOCKS SHALL BE BACKFILLED AFTER MIN. 1 DAY. PRESSURE TESTING SHALL OCCUR AFTER CONCRETE HAS REACHED NOMINAL COMPRESSIVE STRENGTH.
10. WHERE POURED-IN-PLACE BLOCKING IS REQUIRED AT A POINT OF CONNECTION TO AN EXISTING WATERMAIN, THE BLOCKING SHALL BE INSTALLED PRIOR TO CONNECTION.
11. TIE RODS TO BE DESIGNED BY STRUCTURAL ENGINEER.
12. TEMPORARY BLOCKING, IF USED, SHALL BE APPROVED BY THE ENGINEER.
13. THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS.
14. UNBALANCED TEES WITH DIFFERENT PIPE SIZES ON RUN REQUIRE ADDITIONAL THRUST BLOCKING. THRUST CALCULATIONS BY A LICENSED ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO INSTALLATION.
15. THRUST BLOCKS ARE REQUIRED FOR CUT-IN VALVES 16" TO 24" IN DIAMETER CONNECTING TO EXISTING UNRESTRAINED WATERMAIN PIPING. THRUST BLOCK CALCULATIONS FOR CONDITIONS NOT COVERED IN TABLE TO BE PERFORMED BY A LICENSED ENGINEER AND SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO INSTALLATION.
16. THRUST CALCULATED USING THE OUTSIDE DIAMETER OF DUCTILE IRON PIPE PER NFPA 24.

SEA Seattle-Tacoma International Airport

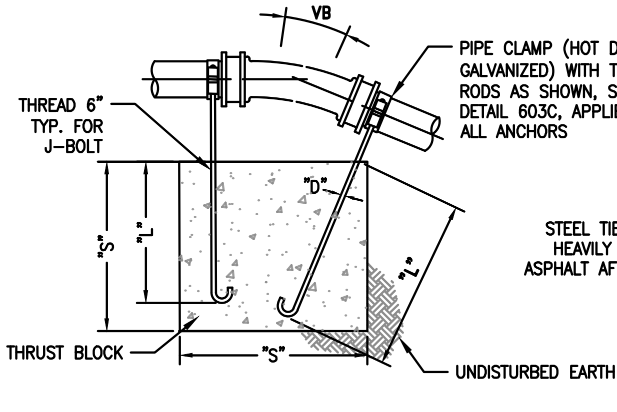
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

REVISION DATE: DEC. 2022

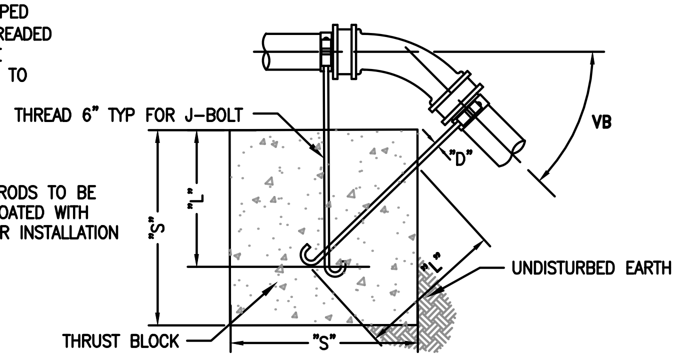
CONCRETE THRUST BLOCKING HORIZONTAL FITTINGS

STANDARD DETAIL NO. **603A**



11 1/4° THRU 22 1/2° VERTICAL BENDS

STEEL TIE RODS TO BE HEAVILY COATED WITH ASPHALT AFTER INSTALLATION



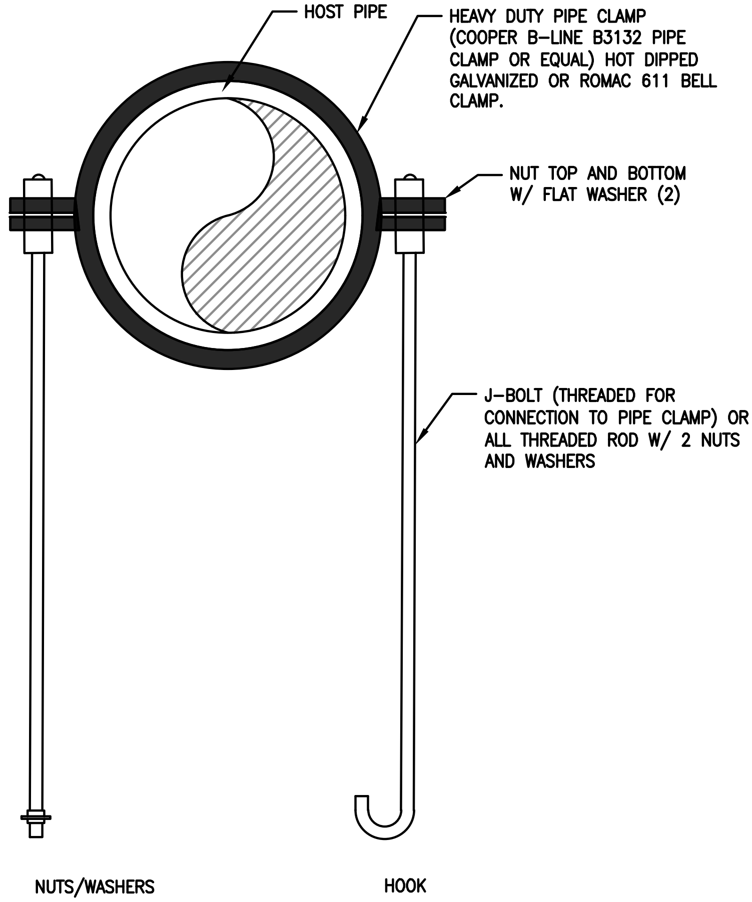
45° VERTICAL BEND

PIPE SIZE DIA (INCHES)	TEST PRESSURE (PSI)	VERTICAL BEND, VB (DEGREES)	NO OF CU FT OF CONCRETE BLOCKING	SIDE OF CUBE, "S" (FEET)	DIAMETER OF TIE RODS, "D"(INCHES)	DEPTH OF RODS IN CONCRETE, "L" (INCHES)
4	250	11 1/4	6	1.8	5/8	17
		22 1/2	12	2.3		
6		11 1/4	14	2.4		
		22 1/2	27	3.0		
8		11 1/4	25	2.9		
		22 1/2	48	3.6		
10		11 1/4	38	3.4		
		22 1/2	75	4.2		
12		11 1/4	55	3.8		
		22 1/2	108	4.8		
14		11 1/4	75	4.2		
		22 1/2	147	5.3	3/4	20
16		11 1/4	98	4.6	5/8	17
		22 1/2	192	5.8	7/8	24
18		11 1/4	124	5.0	3/4	23
		22 1/2	243	6.2	1	30
24		11 1/4	221	6.0	1 1/8	42
		22 1/2	433	7.6	1 3/8	48

PIPE SIZE DIA (INCHES)	TEST PRESSURE (PSI)	VERTICAL BEND, VB (DEGREES)	NO OF CU FT OF CONCRETE BLOCKING	SIDE OF CUBE, "S" (FEET)	DIAMETER OF TIE RODS, "D"(INCHES)	DEPTH OF RODS IN CONCRETE, "L" (INCHES)
4	250	45	22	2.8	5/8	17
6			50	3.7		
8			89	4.5		
10			139	5.2	3/4	20
12			200	5.8	7/8	24
14			272	6.5	1	27
16			355	7.1	1-1/8	30
18			450	7.7	1-1/4	33
24			800	9.3	1-5/8	42

NOTES

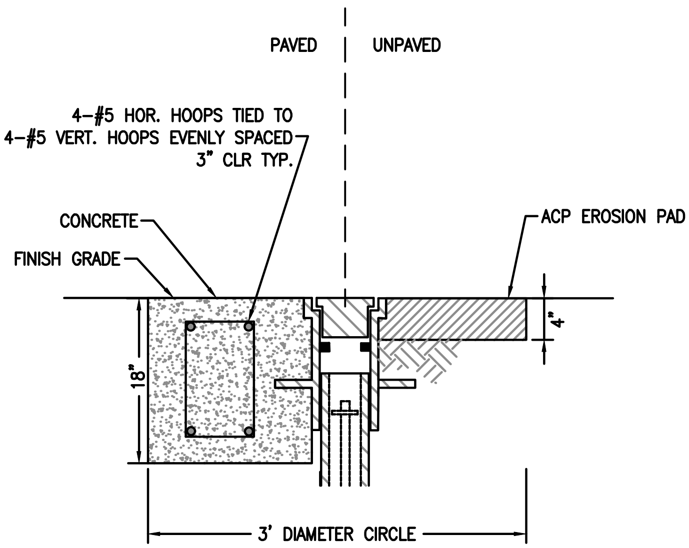
1. LOCATION AND SIZE OF BLOCKING FOR PIPE LARGER THAN 24" DIAMETER AND FOR PRESSURE DIFFERENT THAN SHOWN SHALL BE DETERMINED BY THE ENGINEER.
2. VERTICAL BENDS THAT REQUIRE A THRUST BLOCK VOLUME EXCEEDING 135 CUBIC FEET (5 CUBIC YARDS) REQUIRE SPECIAL BLOCKING DETAILS.
3. CONCRETE BLOCKING (CLASS 3000) SHALL BE CAST IN PLACE AGAINST UNDISTURBED NATIVE EARTH.
4. CONTRACTOR SHALL INSTALL BLOCKING ADEQUATE TO WITHSTAND FULL TEST PRESSURE UNDER ALL CONDITIONS OF SERVICE.
5. PLACE SHEET PLASTIC OVER NUTS AND BOLTS PRIOR TO CONCRETE POUR.
6. ALL POURED THRUST BLOCKS SHALL BE BACKFILLED AFTER MIN. 1 DAY. PRESSURE TESTING SHALL OCCUR AFTER CONCRETE HAS REACHED NOMINAL COMPRESSIVE STRENGTH.
7. WHERE POURED-IN-PLACE BLOCKING IS REQUIRED AT A POINT OF CONNECTION TO AN EXISTING WATERMAIN, THE BLOCKING SHALL BE INSTALLED PRIOR TO CONNECTION.
8. MINIMUM ROD DIAMETER SHALL BE 5/8" ASTM A-307 WITH 36KSI YIELD STRENGTH.
9. THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS, PER STANDARD DETAIL 603A.



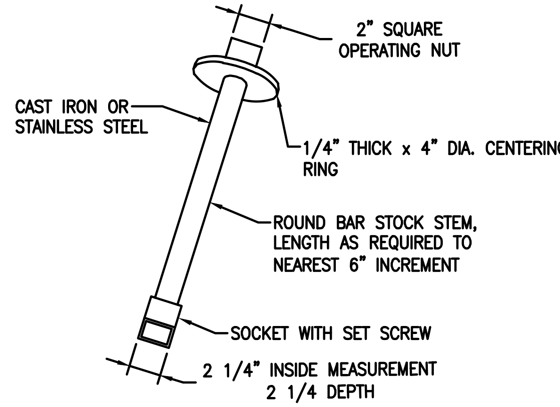
NOTES

1. J-BOLT OR ALL THREADED ROD. DIAMETER PER BEND AND PIPE DIAMETER IN DIMENSION TABLE IN DETAIL 603B.
2. TIGHTEN TOP NUTS TO TENSION BOLTS.
3. TIGHTEN LOWER NUTS TO COMPRESS CLAMP SNUG.
4. TIE RODS SHALL BE STEEL, ASTM A-307 WITH 36 KSI YIELD STRENGTH.

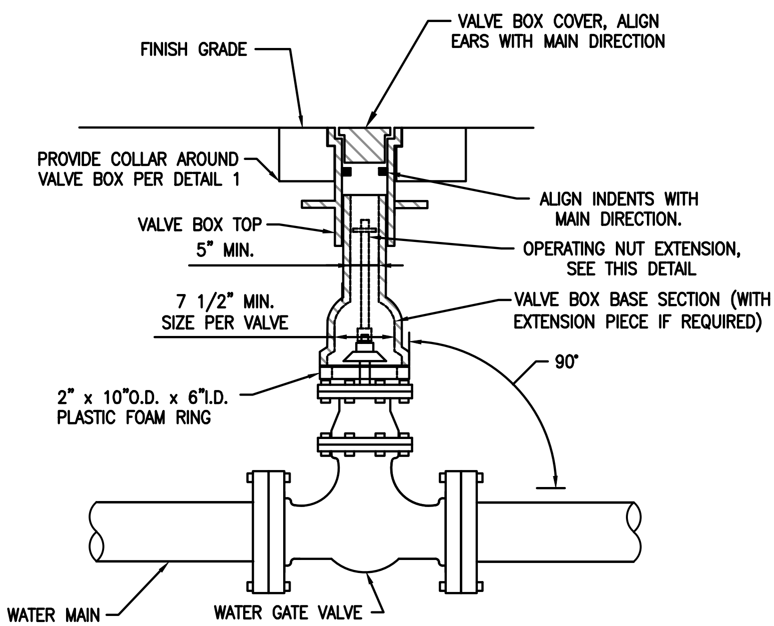
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	PIPE CLAMP AND ANCHOR RODS FOR CONCRETE BLOCKING
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **603C**



DETAIL 1/604
CAST-IN-PLACE CONCRETE COLLAR
SCALE: NTS



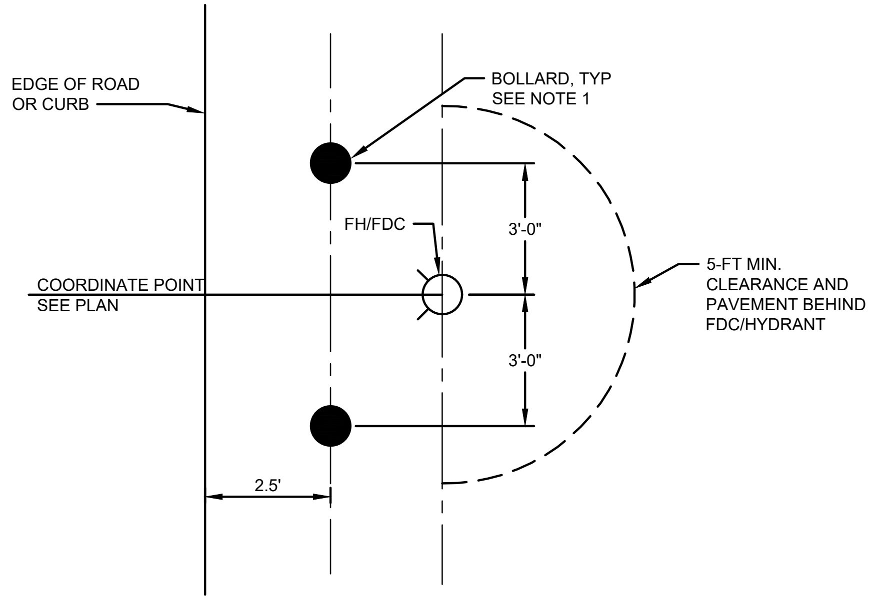
DETAIL 2/604
OPERATING NUT EXTENSION
SCALE: NTS



SECTION 3/604
VALVE BOX
SCALE: NTS

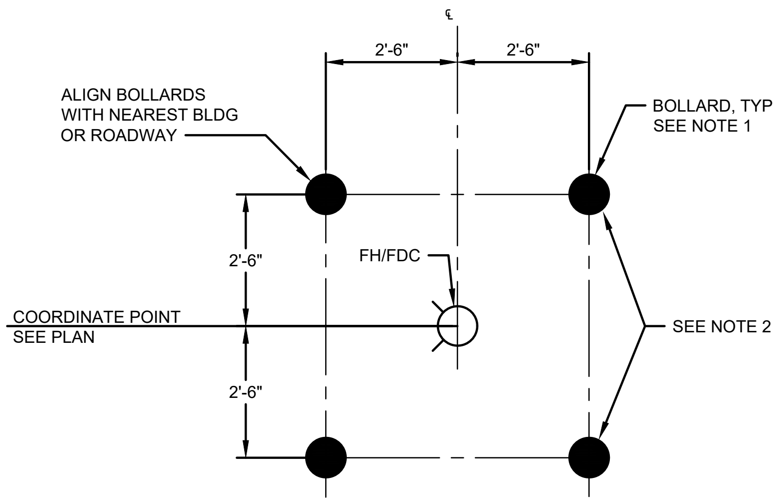
NOTES:
1. BOX SHALL BE PERPENDICULAR TO THE VALVE AND MAIN.
2. BOX SHALL BE CENTERED OVER VALVE NUT.
3. NO DEBRIS WILL BE ALLOWED AROUND THE VALVE NUT.
4. ALL VALVE BOX PARTS AND EXTENSIONS SHALL BE GRAY CAST IRON OR DUCTILE IRON, ASPHALTIC COATED.
5. VALVE BOX AND LID SHALL BE EAST JORDAN 68/8555 (SEE APPROVED MATERIAL LIST).
6. EXTENSIONS FOR DEEP VALVES MAY BE ACCOMPLISHED WITH CAST IRON DRAIN PIPE. BELL END OVER LOWER SECTION.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	VALVE BOX & OPERATING NUT EXTENSION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **604**



DETAIL 1/605

BOLLARD LOCATIONS ADJACENT TO ROADWAY
SCALE: NTS



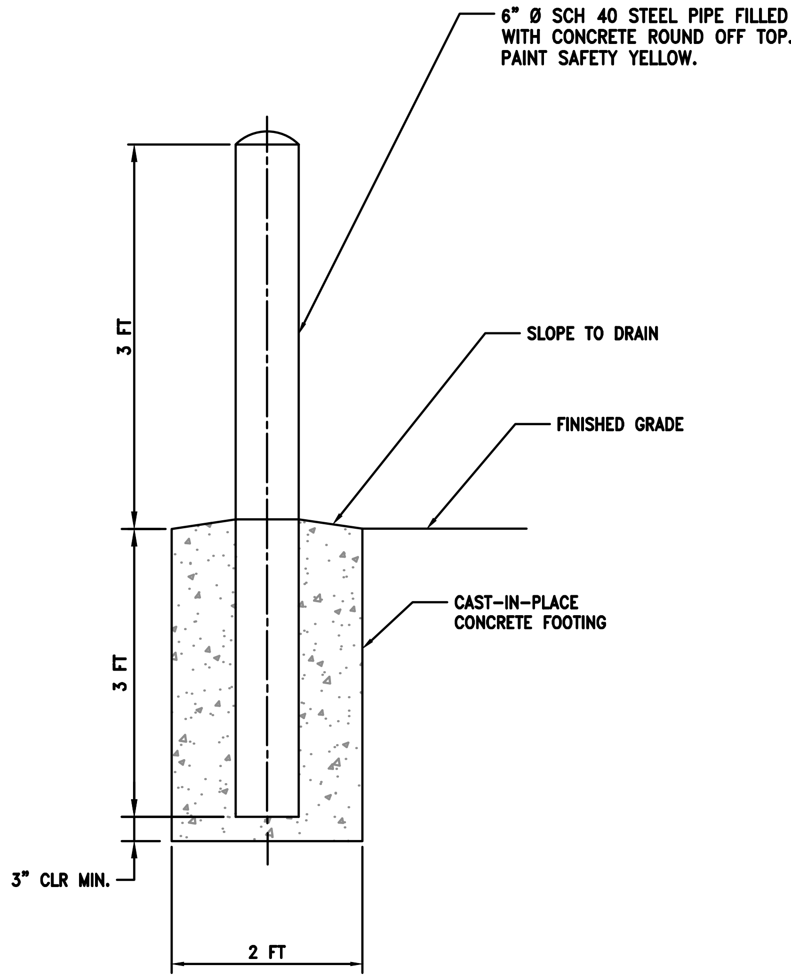
DETAIL 2/605

HYDRANT AND FDC BOLLARD LOCATION PLAN
SCALE: NTS

NOTES:

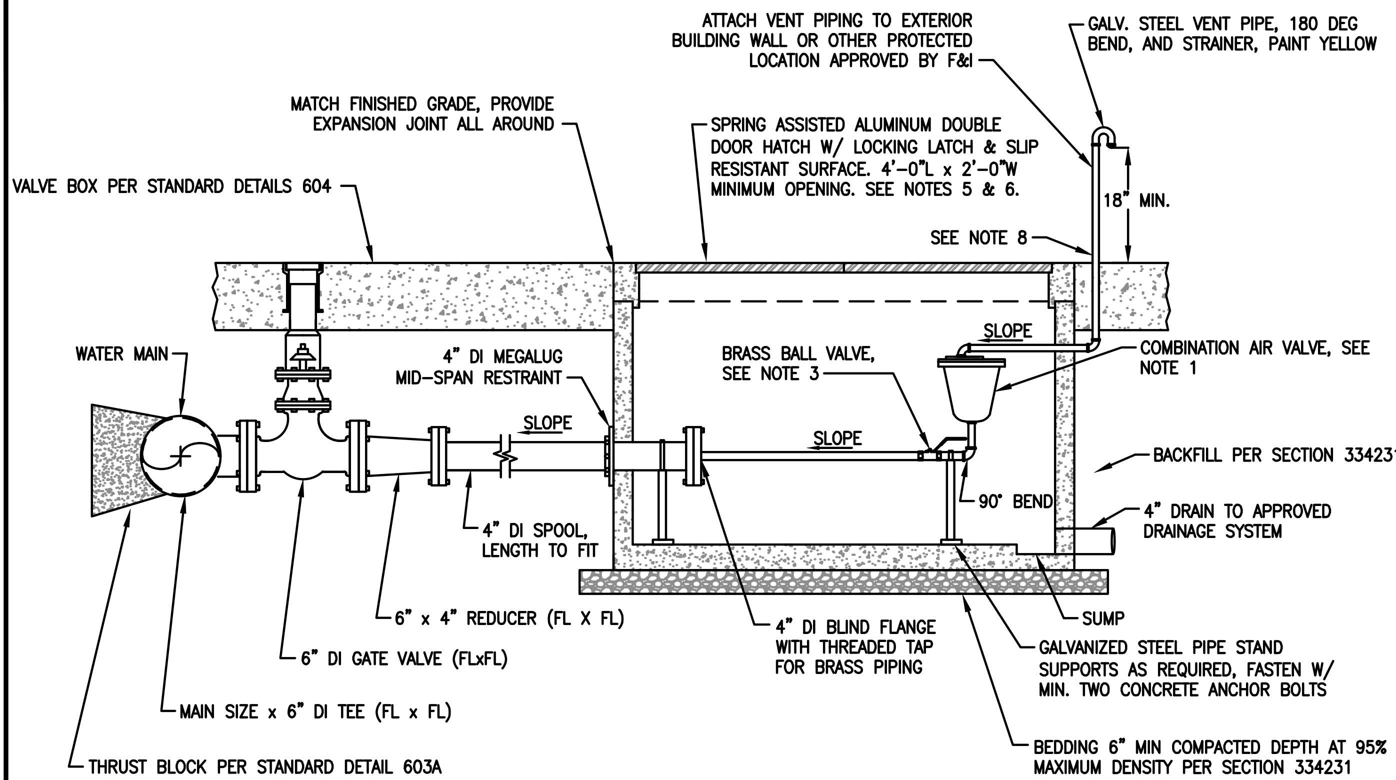
1. BOLLARD LOCATIONS SHALL BE APPROVED BY POS F&I PRIOR TO INSTALLATION.
2. BOLLARDS SHALL BE IN ACCORDANCE WITH STANDARD DETAIL 606.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	HYDRANT AND FDC BOLLARD LOCATION PLAN
F&I CIVIL STANDARDS	REVISION DATE: MAY 2023	STANDARD DETAIL NO. 605



DETAIL 1/606
BOLLARD
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	BOLLARD
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **606**

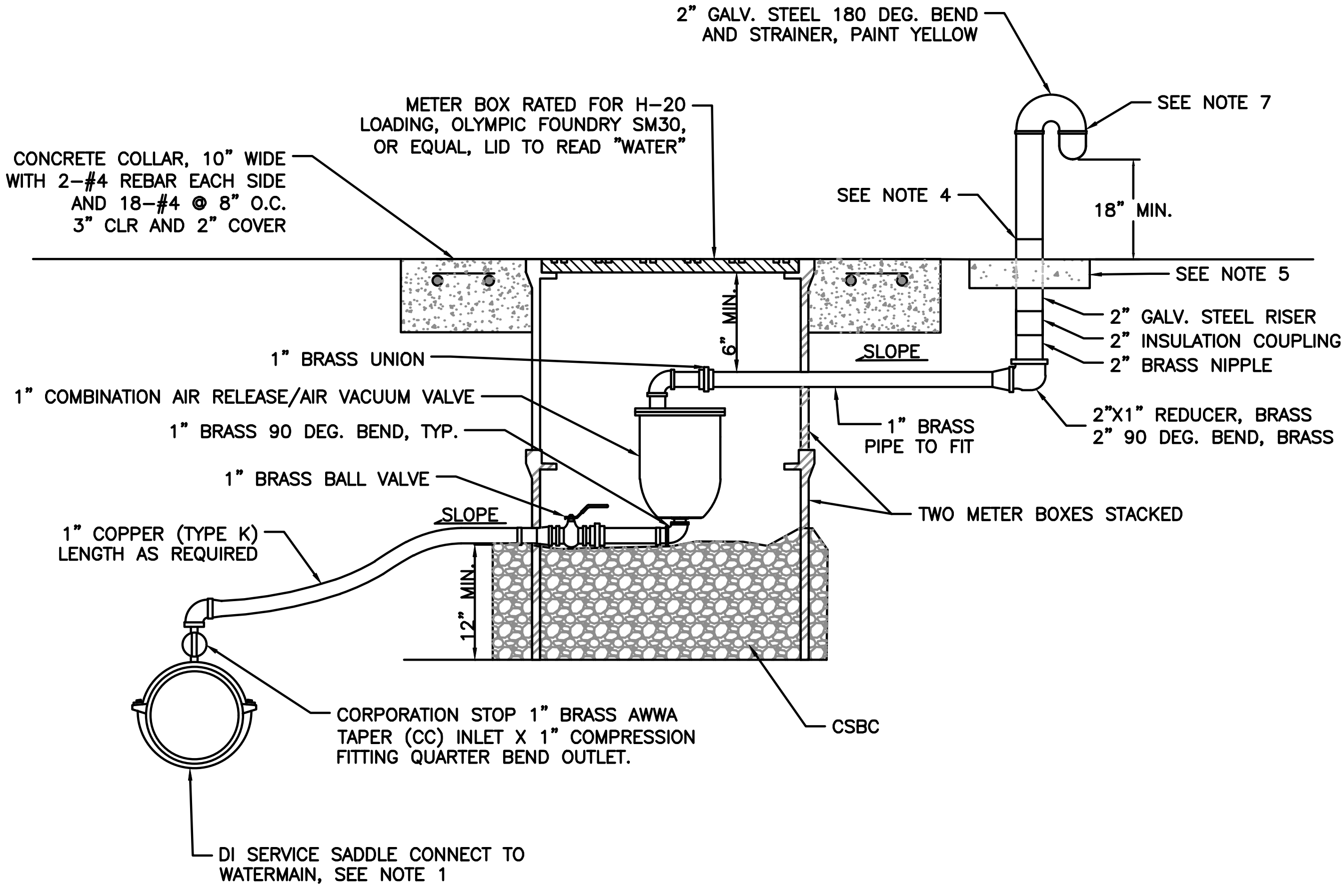


DETAIL 1 / 607A

COMBINATION AIR RELEASE AND AIR VACUUM VALVE
SCALE: NTS

NOTES:

1. THE SIZE OF THE COMBINATION AIR RELEASE / AIR VACUUM VALVE SHALL BE DETERMINED BY THE ENGINEER. COMBINATION AIR RELEASE / AIR VACUUM VALVES LARGER THAN 2" SHALL BE DESIGNED BY THE ENGINEER.
2. LOCATE THE COMBINATION AIR RELEASE / AIR VACUUM VALVE ASSEMBLY AT THE HIGH POINTS OF THE MAIN.
3. BRASS PIPE, FITTINGS AND BALL VALVE TO AIR VALVE AND GALV. STEEL VENT PIPING FROM AIR VALVE SHALL BE THE SAME SIZE AS THE COMBINATION AIR RELEASE / AIR VACUUM VALVE.
4. ALL VAULT PIPE PENETRATIONS SHALL BE SEALED WITH NON-SHRINK GROUT OR LINK-SEAL MECHANICAL SEALS.
5. PRECAST UTILITY VAULT AND LID:
   A. VAULTS LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE PRECAST AND DESIGNED FOR FAA LOADS AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION).
   B. VAULTS NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. SHOP DRAWINGS AND STRUCTURAL CALCULATIONS FOR THE VAULT SHALL BE STAMPED BY A LICENSED PROFESSIONAL STRUCTURAL ENGINEER AND SUBMITTED TO F&I FOR APPROVAL PRIOR TO FABRICATION.
6. HATCHES FOR VAULTS:
   A. HATCHES LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE LOCKING, AIRCRAFT RATED AND DESIGNED TO SUPPORT A MINIMUM 100,000 LB WHEEL LOAD WITH 250 PSI TIRE PRESSURE.
   B. HATCHES NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. HATCH SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED TO POS F&I FOR APPROVAL PRIOR TO FABRICATION.
7. ALL PIPING ABOVE GROUND TO BE PAINTED WITH TWO COATS OF YELLOW PAINT.
8. THREADED FRANGIBLE COUPLE REQUIRED NO MORE THAN 4" ABOVE GROUND SURFACE. PROVIDE 90-DEGREE BEND OR ROLL TEE HORIZONTALLY WITH VALVE ON TEE.



DETAIL

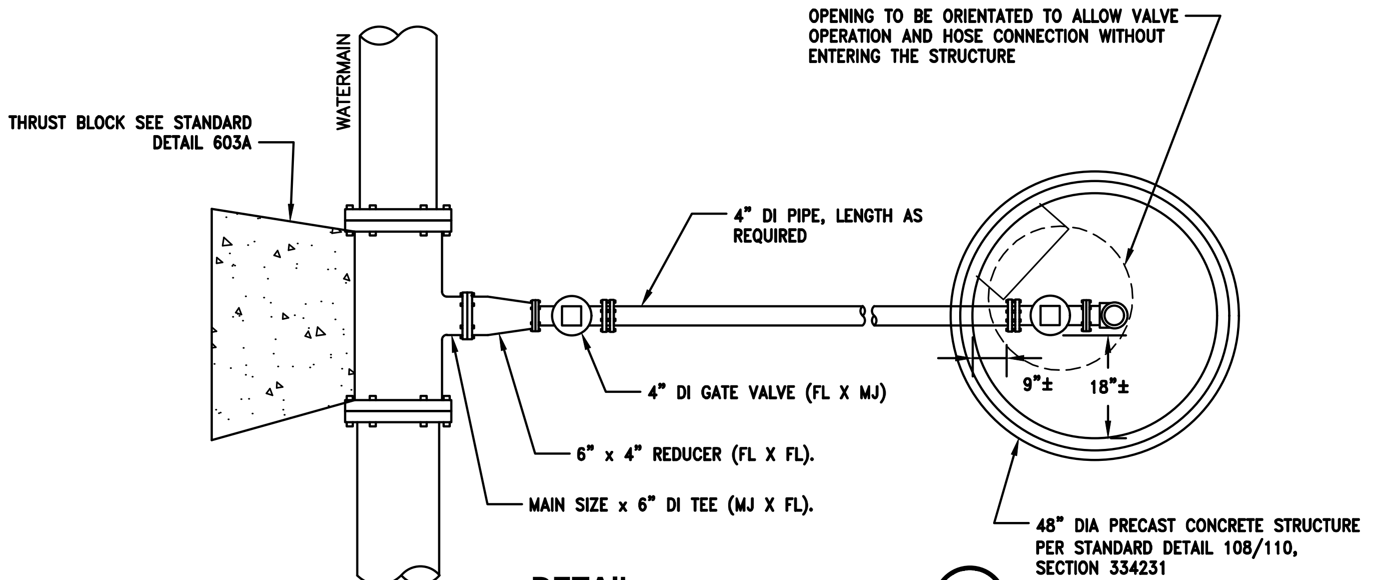
1" TRAFFIC RATED COMBINATION AIR RELEASE AND AIR VACCUM VALVE
SCALE: NTS

1
607B

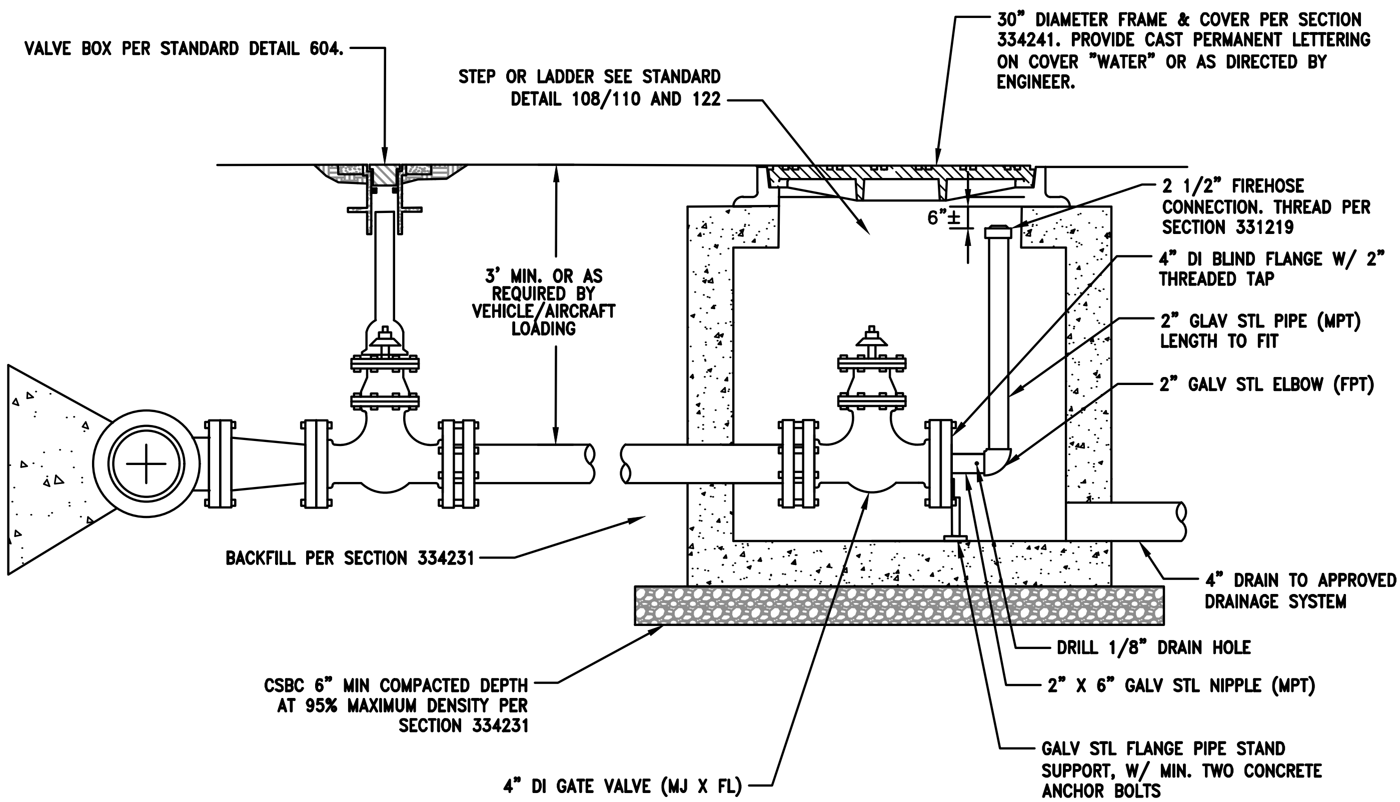
NOTES:

1. SERVICE SADDLE SHALL BE EPOXY OR NYLON COATED HIGH TENSILE DI WITH DOUBLE STAINLESS STEEL STRAP, RATED TO 250 PSI WORKING PRESSURE, 1" AWWA TAPER (CC) TAP.
2. LOCATE THE COMBINATION AIR RELEASE / AIR VACUUM ASSEMBLY AT THE HIGH POINTS OF THE MAIN.
3. ALL PIPING ABOVE GROUND TO BE PAINTED WITH TWO COATS OF YELLOW PAINT.
4. THREADED FRANGIBLE COUPLE REQUIRED NO MORE THAN 4" ABOVE GROUND SURFACE. PROVIDE 90-DEGREE BEND OR ROLL TEE HORIZONTALLY WITH VALVE ON TEE.
5. INSTALL 2' RADIUS BY 4" THICK CONCRETE PAD.
6. INSTALLATION FOR LANDSLIDE USE AND IN UNPAVED AREAS ONLY.
7. LOCATE AIR VENT AT A LOCATION PROTECTED FROM DAMAGE FROM VEHICLES OR WORK ACTIVITY.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	1" COMBINATION AIR VALVE - LANDSLIDE AND UNPAVED
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **607B**

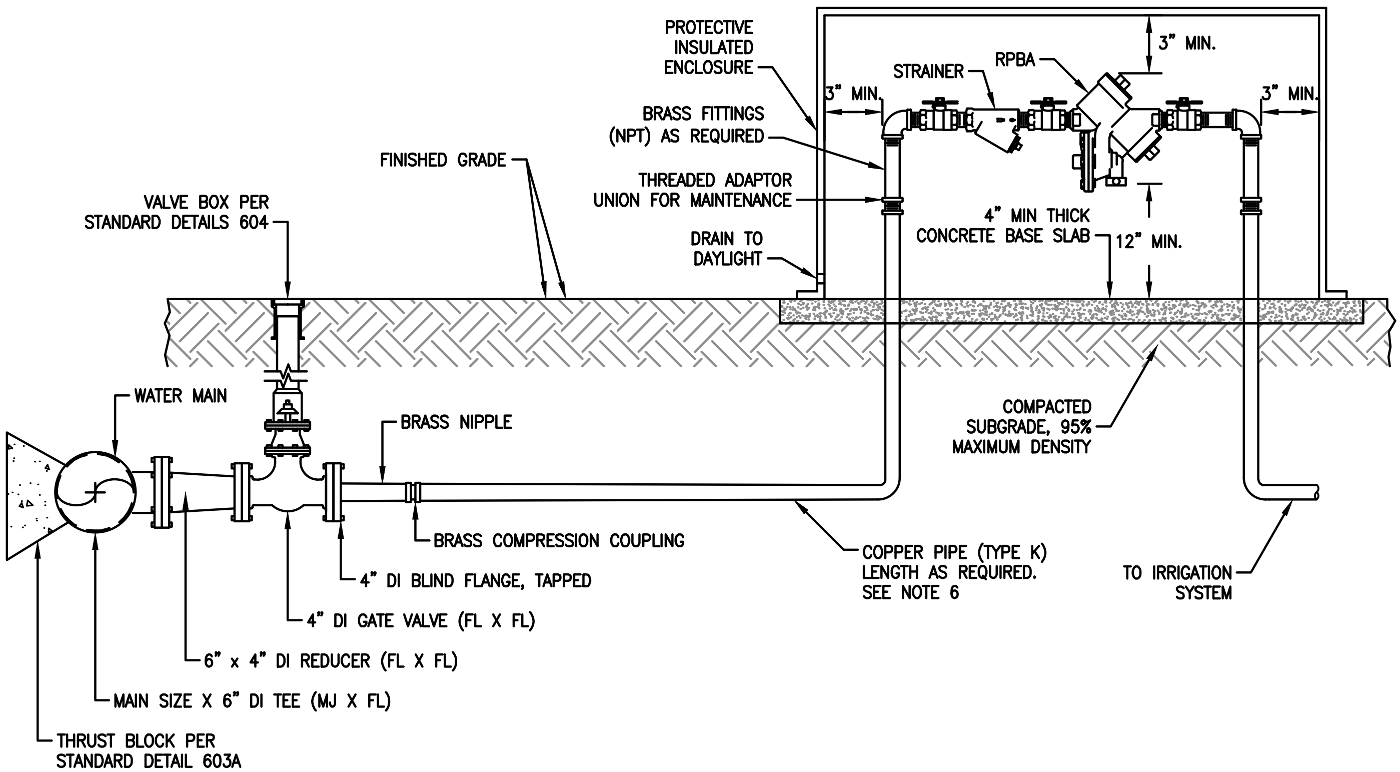


DETAIL 1/608
WATER BLOW OFF VALVE
SCALE: NTS



SECTION 2/608
WATER BLOW OFF VALVE
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	WATER BLOW OFF VALVE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **608**



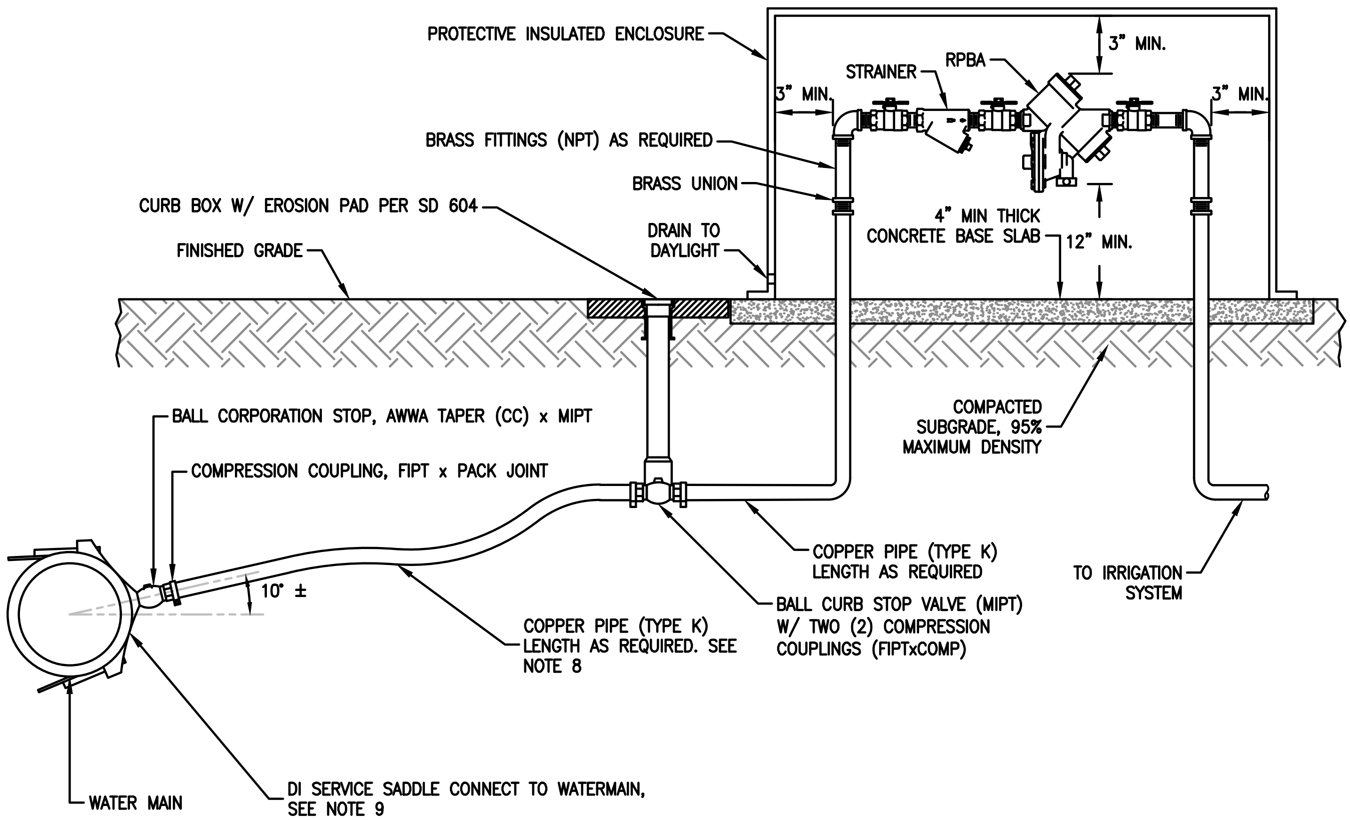
DETAIL (1 / 609A)

IRRIGATION CONNECTION
SCALE: NTS

NOTES:

1. THE SIZE OF THE IRRIGATION SERVICE AND REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) SHALL BE DETERMINED BY THE ENGINEER.
2. LOCATE THE RPBA AND PROTECTIVE ENCLOSURE IN LANDSCAPED AREAS AS CLOSE AS FEASIBLE TO THE IRRIGATION SYSTEM.
3. RPBA AND PROTECTIVE ENCLOSURE SHALL BE INSTALLED ABOVE GRADE. INSTALLATION OF RBPA IN A BELOW GRADE VAULT IS NOT PERMITTED.
4. THE INSULATED PROTECTIVE ENCLOSURE SHALL BE REMOVABLE TO ALLOW FULL ACCESS TO THE RPBA. INSULATION R-VALUE TO THE ENCLOSURE SHALL BE R13.
5. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.
6. IF LENGH OF PIPE RUN IS OVER 50 FEET, PIPE MATERIAL SHALL BE HDPE RATED TO 250 PSI WITH NO JOINTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	IRRIGATION CONNECTION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **609A**



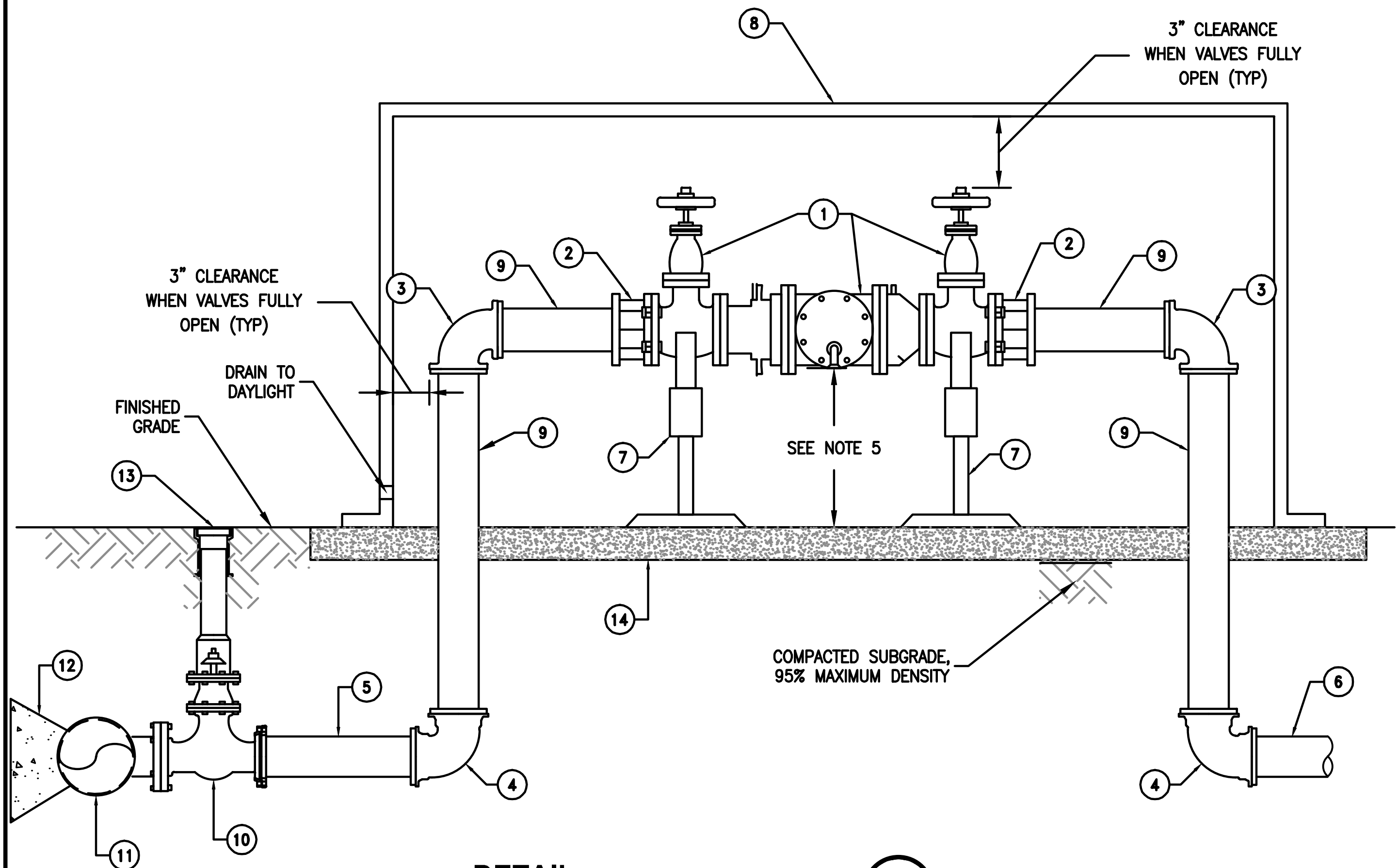
DETAIL
IRRIGATION CONNECTION
SCALE: NTS

1
609B

NOTES:

1. THE SIZE OF THE IRRIGATION SERVICE AND REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) SHALL BE DETERMINED BY THE ENGINEER.
2. LOCATE THE RPBA AND PROTECTIVE ENCLOSURE IN LANDSCAPED AREAS AS CLOSE AS FEASIBLE TO THE IRRIGATION SYSTEM.
3. RPBA AND PROTECTIVE ENCLOSURE SHALL BE INSTALLED ABOVE GRADE. INSTALLATION OF RBPA IN A BELOW GRADE VAULT IS NOT PERMITTED.
4. THE INSULATED PROTECTIVE ENCLOSURE SHALL BE REMOVABLE TO ALLOW FULL ACCESS TO THE RPBA. INSULATION R-VALUE OF THE ENCLOSURE SHALL BE R13
5. CORPORATION STOP AND COUPLING SHALL BE BRASS, SIZE TO MATCH IRRIGATION SERVICE.
6. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.
7. ALL FITTINGS SHALL BE BRASS, UNLESS OTHERWISE SHOWN.
8. IF LENGTH OF PIPE RUN IS OVER 50 FT, PIPE MATERIAL SHALL BE HDPE RATED TO 250 PSI WITH NO JOINTS
9. SERVICE SADDLE SHALL BE EPOXY OR NYLON COATED HIGH TENSILE D.I. WITH DOUBLE STAINLESS STEEL STRAP AND AWWA TAPER (CC) TAP, RATED TO 250 PSI.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	IRRIGATION CONNECTION - LANDSIDE AND UNPAVED AREAS ONLY
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **609B**



DETAIL
IRRIGATION CONNECTION
SCALE: NTS

1
609C

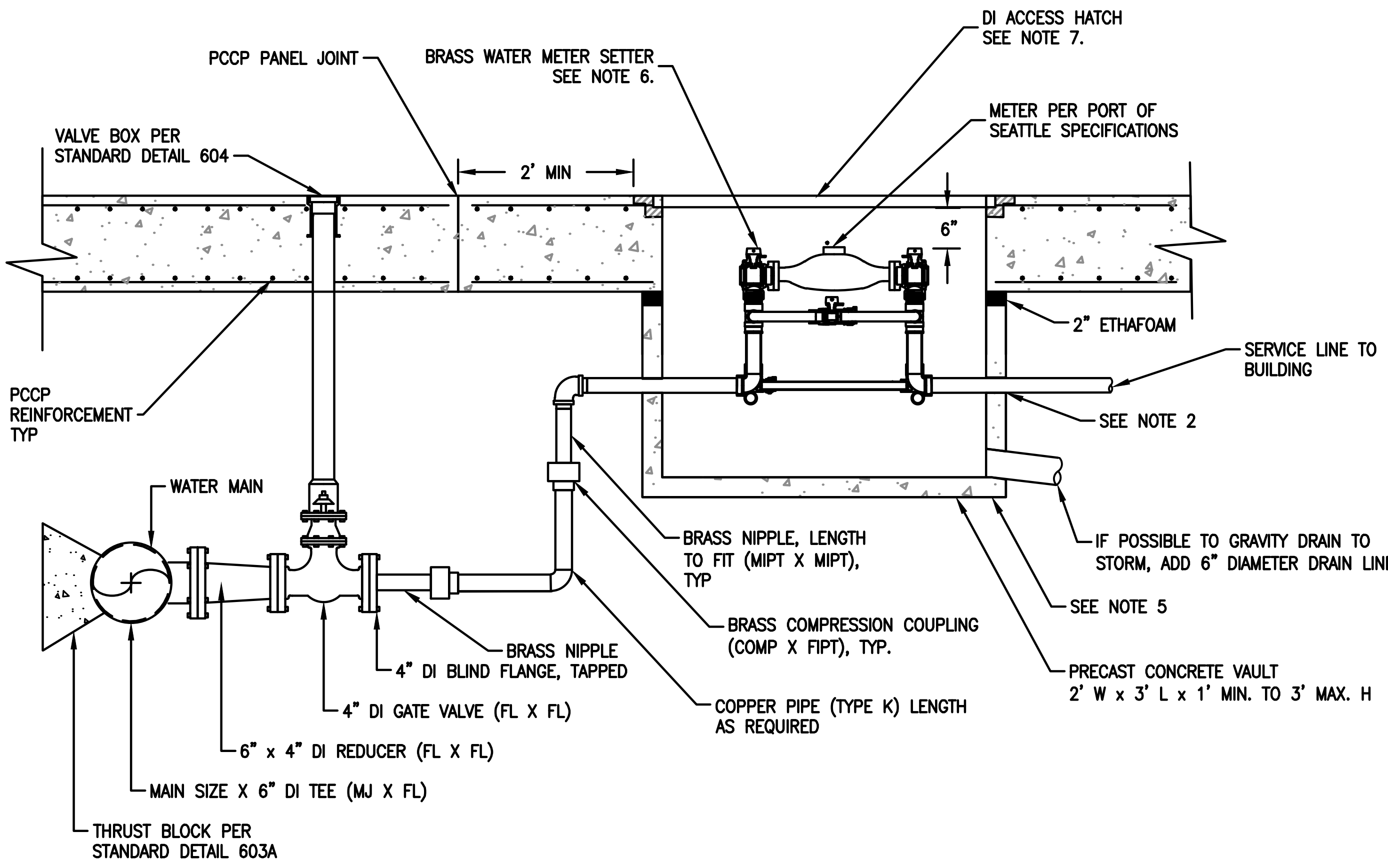
KEYED NOTES (ALL SIZES SHALL EQUAL IRRIGATION SERVICE SIZE, EXCEPT WHERE OTHERWISE NOTED):

1. STATE APPROVED REDUCED PRESSURE BACKFLOW ASSEMBLY, COMPLETE WITH (2) RESILIENT SEATED GATE VALVES AND (4) RESILIENT SEATED TEST COCKS. FACE TEST COCKS IN AN ACCESSIBLE POSITION..
2. DI FLANGE COUPLING ADAPTER, RESTRAINED.
3. DI 90 DEGREE BEND (FL X FL).
4. DI 90 DEGREE BEND (MJ X MJ) WITH RESTRAINED JOINT ON EACH SIDE.
5. DI PIPE, RESTRAINED JOINTS FROM GATE VALVE AT MAIN TO VERTICAL BEND BELOW ASSEMBLY.
6. DI PIPE, RESTRAINED JOINTS FROM VERTICAL BEND BELOW ASSEMBLY. PROVIDE ADEQUATE DISTANCE OF RESTRAINED JOINTS TO PROVIDE RESTRAINT AGAINST HORIZONTAL THRUST AT VERTICAL BEND. IF CANNOT PROVIDE ADEQUATE LENGTH OF RESTRAINED JOINT PIPE, PROVIDE A CONCRETE THRUST BLOCK AT BEND FOR HORIZONTAL THRUST PER STANDARD DETAIL 603A.
7. ADJUSTABLE PIPE STANCHION BOLTED TO CONRETE SLAB.
8. PROTECTIVE INSULATED ENCLOSURE.
9. DI SPOOL (PE X FL), PLAIN END TO BE RESTRAINED AT THE FITTING (LENGTH TO FIT).
10. DI GATE VALVE (FL X MJ), WITH RESTRAINED JOINT ON MJ END.
11. DI TEE (MJ X FL), MAIN LINE SIZE BY IRRIGATION SIZE ON FLANGED OUTLET END. MINIMUM 6" OUTLET SIDE ON TEE. FOR 4" IRRIGATION SERVICE FOLLOW TEE WITH A 6" X 4" DUCTILE IRON REDUCER (FL X FL).
12. CONCRETE THRUST BLOCK PER STANDARD DETAIL 603A.
13. VALVE BOX PER STANDARD DETAIL 604.
14. CONCRETE BASE SLAB, MINIMUM 4" THICK.

NOTES:

1. THE SIZE OF THE IRRIGATION SERVICE AND REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) SHALL BE DETERMINED BY THE ENGINEER.
2. LOCATE THE RPBA AND PROTECTIVE ENCLOSURE IN LANDSCAPED AREAS AS CLOSE AS FEASIBLE TO THE IRRIGATION SYSTEM.
3. RPBA AND PROTECTIVE ENCLOSURE SHALL BE INSTALLED ABOVE GRADE. INSTALLATION OF RBPA IN A BELOW GRADE VAULT IS NOT PERMITTED.
4. THE INSULATED PROTECTIVE ENCLOSURE SHALL BE REMOVABLE TO ALLOW FULL ACCESS TO THE RPBA. INSULATION R-VALUE OF THE ENCLOSURE SHALL BE R13.
5. ALLOW 12" PLUS NOMINAL DIAMETER OF ASSEMBLY CLEARANCE BELOW RELIEF PORT FOR REPAIR. ALSO PROVIDE 12" MINIMUM AIR GAP CLEARANCE FROM TOP OF THE ENCLOSURE DRAIN TO DAYLIGHT.
6. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE	IRRIGATION CONNECTION - 4" AND LARGER
	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **609C**



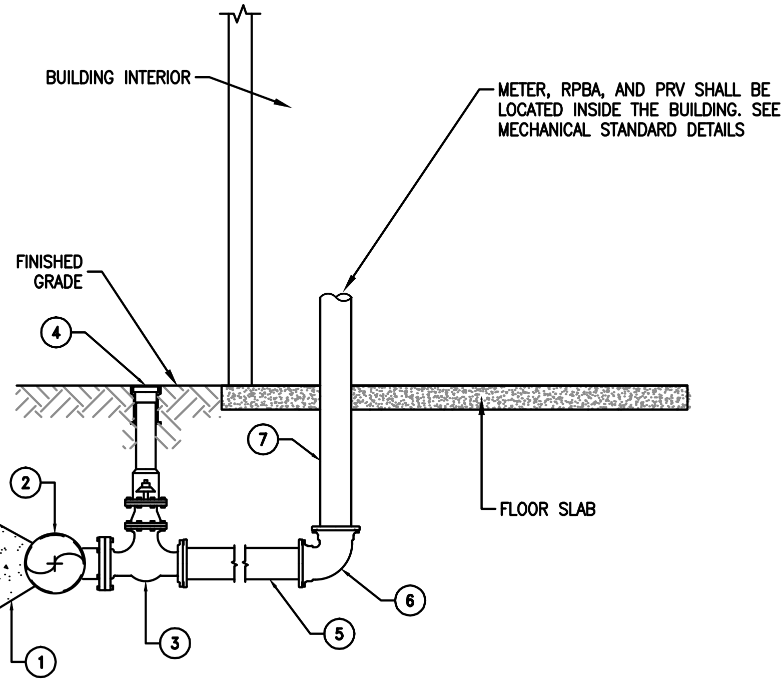
DETAIL 1/609D

WATER SERVICE CONNECTION
SCALE: NTS

NOTES:

1. THE SIZE OF THE WATER SERVICE SHALL BE DETERMINED BY THE ENGINEER.
2. ALL PIPE PENETRATIONS TO VAULT SHALL BE SEALED WITH NON-SHRINK GROUT OR LINK-SEAL MECHANICAL SEALS.
3. MINIMUM CLEARANCE BETWEEN METER/METER SETTER AND VAULT WALL SHALL BE 4"
4. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN
5. WHEREVER POSSIBLE WATER METER SHALL BE LOCATED OUTSIDE OF AIRCRAFT AND TRAFFIC LOADED AREAS. LOCATION SHALL BE COORDINATED WITH THE PORT.
6. METER SETTER SHALL BE BRASS AND COPPER, WITH ANGLE BALL VALVE ON EACH SIDE OF METER CONNECTION, INTEGRAL FULL FLOW BYPASS, AND FEMALE IRON PIPE THREAD AT SETTER INLET AND OUTLET. 1-1/2" AND 2" STYLE SHOWN.
7. ACCESS HATCH SHALL BE D.I. AIRCRAFT RATED FRAME AND COVER WITH 24" X 36" CLEAR OPENING AND HINGED WITH MECHANICAL LIFT ASSIST AND GASKET. EQUAL TO EAST JORDAN (EJ) MODEL 8192. COVER SHALL READ "WATER".

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	WATER SERVICE CONNECTION (2" AND SMALLER IN PCCP AREAS)
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **609D**



DETAIL
IRRIGATION CONNECTION
SCALE: NTS

1
609E

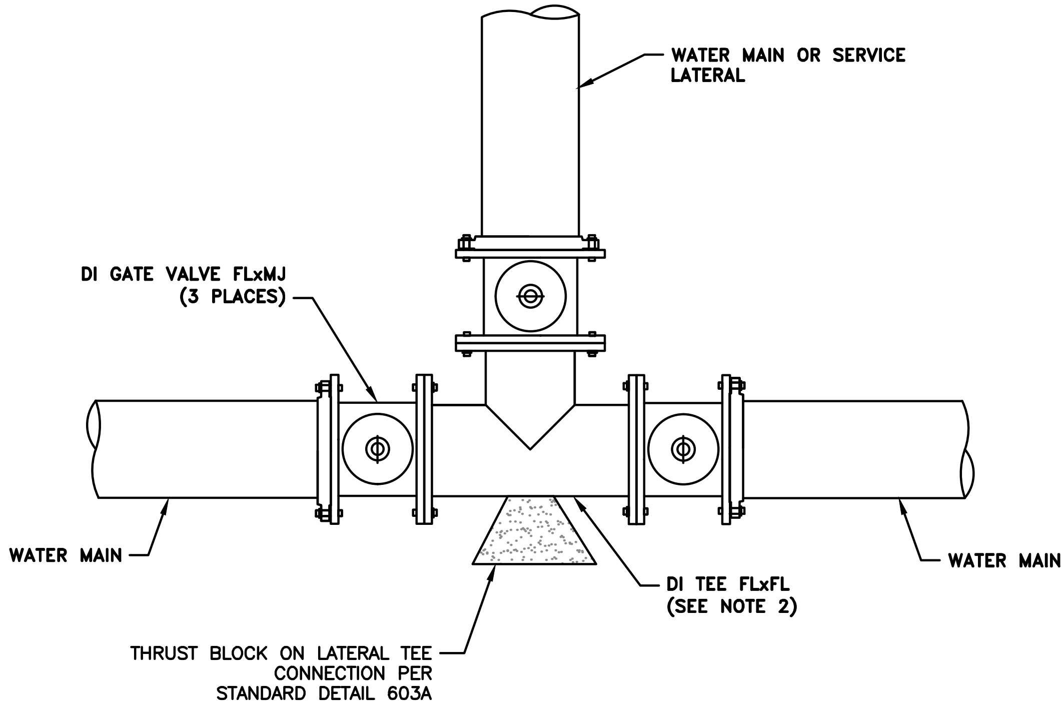
KEYED NOTES (ALL SIZES SHALL EQUAL WATER SERVICE SIZE, EXCEPT WHERE OTHERWISE NOTED):

1. CONCRETE THRUST BLOCK PER STANDARD DETAIL 603A.
2. DI TEE (MJ X FL), MAIN LINE SIZE BY WATER SERVICE SIZE. MINIMUM 6" DIA BRANCH ON TEE. FOR 4" OR 3" SERVICE FOLLOW TEE WITH A 6" X 4", OR 6" X 3" DI REDUCER (FL X FL).
3. DI GATE VALVE (FL X MJ), WITH RESTRAINED JOINT ON MJ END.
4. VALVE BOX PER STANDARD DETAIL 604.
5. DI PIPE, RESTRAINED JOINTS FROM GATE VALVE AT MAIN TO VERTICAL BEND BELOW FLOOR SLAB.
6. DI 90 DEGREE BEND (MJ X MJ) WITH RESTRAINED JOINT ON EACH SIDE.
7. DI PIPE (PE X PE), PLAIN ENDS TO BE RESTRAINED AT EACH FITTING (LENGTH TO FIT).

NOTES:

1. THE SIZE OF THE WATER SERVICE SHALL BE DETERMINED BY THE ENGINEER.
2. SHOW POINT OF CONNECTION TO WATER MAIN ON UTILITY PLAN.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	WATER SERVICE CONNECTION - 3" AND LARGER
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2022	STANDARD DETAIL NO. **609E**

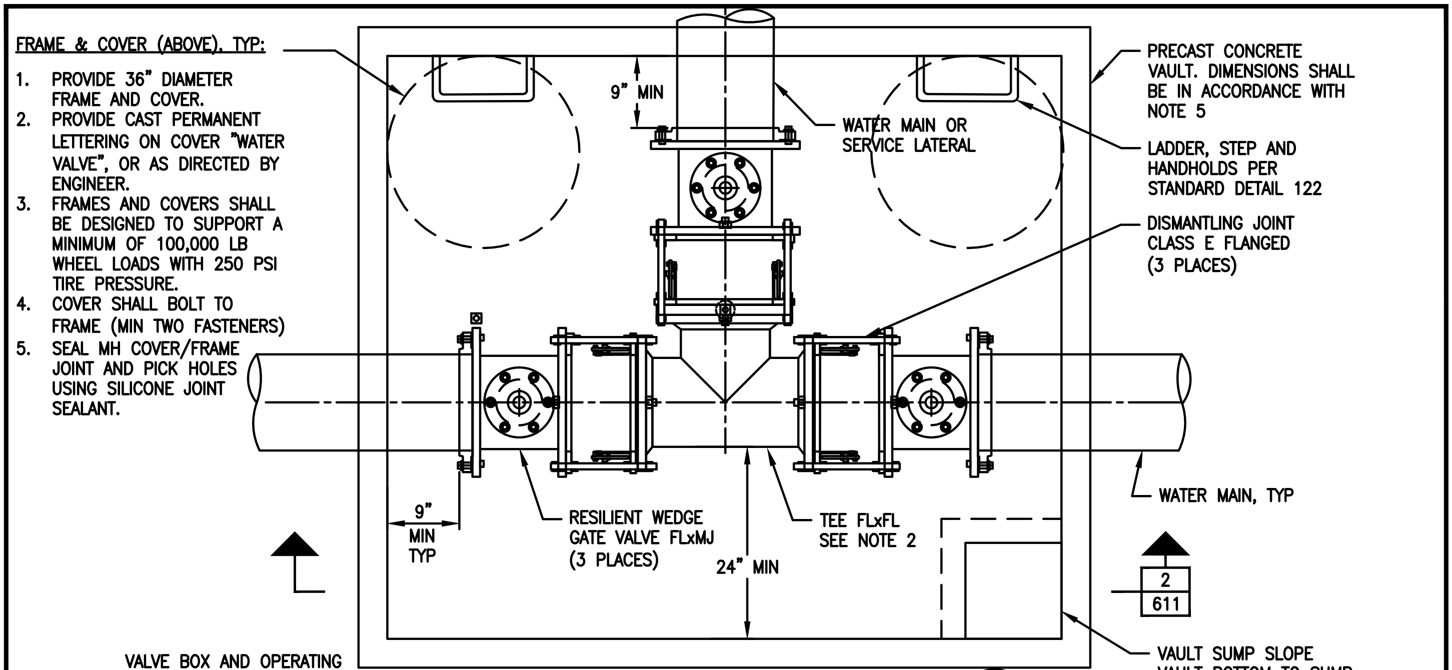


DETAIL 1/610
WATER VALVE CLUSTER WITH TEE
SCALE: NTS

NOTES:

1. ALL FITTINGS SHALL BE DUCTILE IRON, ALL MECHANICAL JOINT FITTINGS SHALL BE RESTRAINED WITH APPROVED MECHANICAL JOINT RESTRAINT.
2. UNBALANCED TEES WITH DIFFERENT PIPE SIZES ON RUN REQUIRE ADDITIONAL THRUST BLOCKING. SEE THRUST BLOCK STANDARD DETAIL 603A FOR ADDITIONAL REQUIREMENTS.
3. ALL FASTENING MATERIAL (BOLTS, NUTS, WASHERS, TIE RODS) SHALL BE EITHER TYPE 304 OR TYPE 316 STAINLESS STEEL.

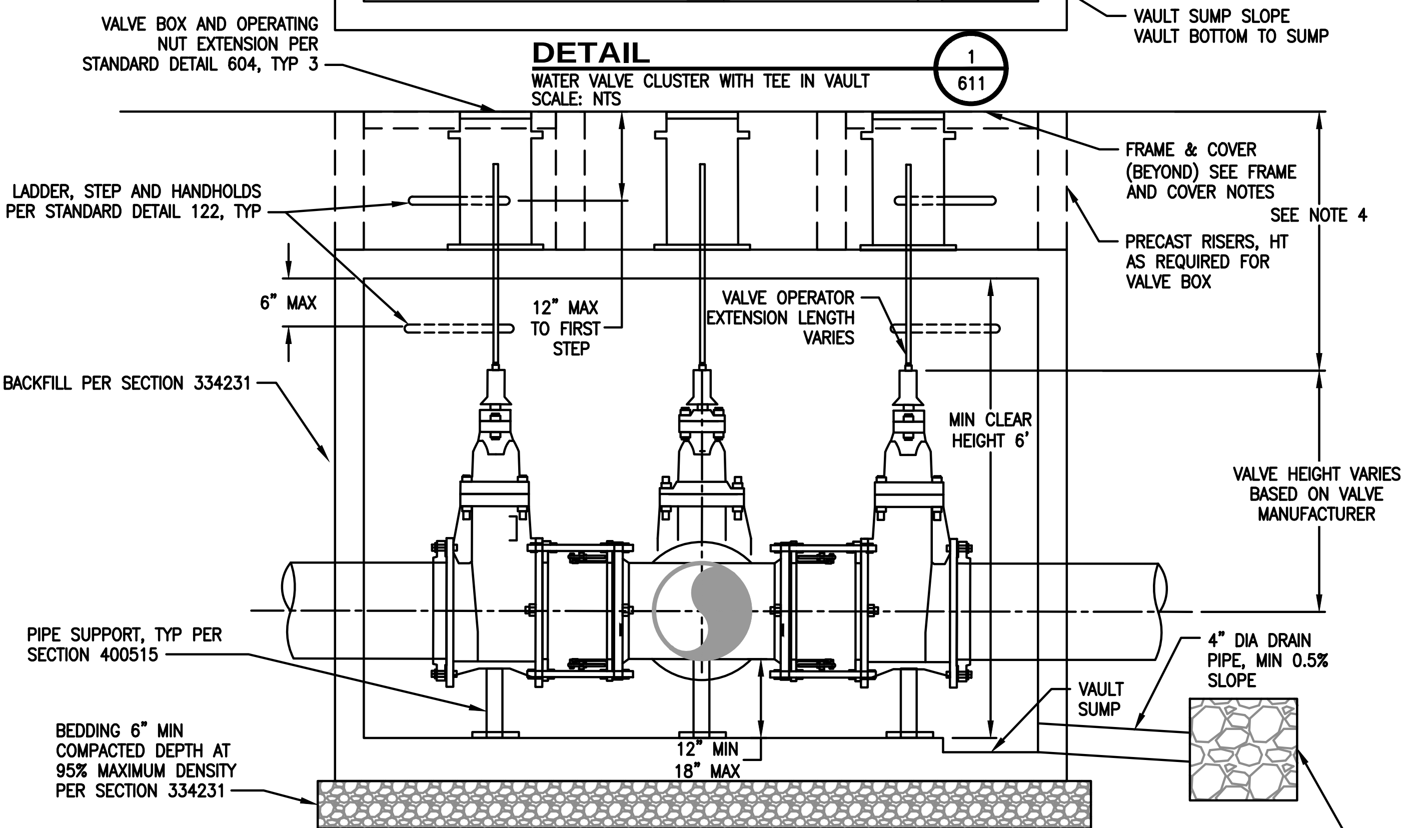
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	WATER VALVE CLUSTER WITH TEE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **610**



DETAIL

1/611

WATER VALVE CLUSTER WITH TEE IN VAULT
SCALE: NTS



SECTION

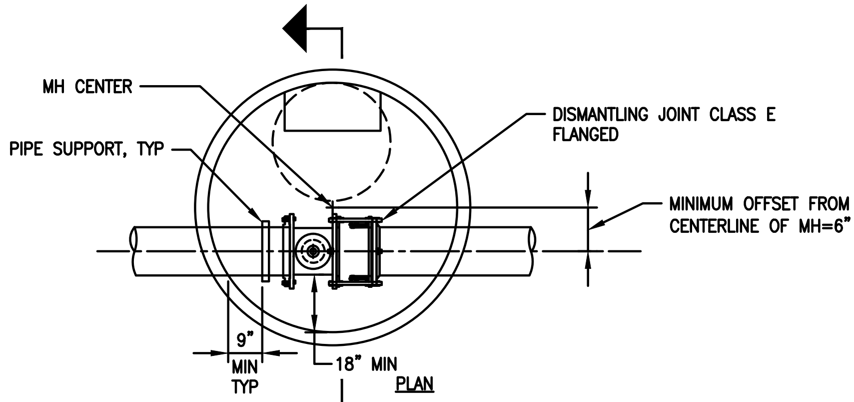
2/611

WATER VALVE CLUSTER WITH TEE IN VAULT
SCALE: NTS

NOTES:

1. ALL FITTINGS SHALL BE RESTRAINED DUCTILE IRON.
2. UNBALANCED TEES WITH DIFFERENT PIPE SIZES MAY REQUIRE ADDITIONAL THRUST RESTRAINT. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
3. ALL FASTENING MATERIAL (BOLTS, NUTS, WASHERS, TIE RODS) SHALL BE EITHER TYPE 304 OR TYPE 316 SS.
4. VALVE VAULT REQUIRED ANY TIME THE LENGTH FROM THE VALVE OPERATING NUT TO GROUND SURFACE EQUALS OR EXCEEDS 6 FEET.
5. VALVE BOX DIMENSIONS SHALL BE IN ACCORDANCE WITH VALVE AND APPURTENANCE LAYOUT PLUS SETBACKS SHOWN ABOVE.
6. PRECAST UTILITY VAULT AND LID:
   A. VAULTS LOCATED IN THE RAMP AIR OPERATIONS AREA (AOA) SHALL BE PRECAST AND DESIGNED FOR FAA LOADS AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION).
   B. VAULTS NOT LOCATED IN THE AOA SHALL BE DESIGNED FOR THE GREATER OF AASHTO HS-25 OR THE VEHICLES IMPARTING THE HIGHEST LOAD FACTORS AT THE SITE, SEE SECTION 334231.
   C. SHOP DRAWINGS AND STRUCTURAL CALCULATIONS FOR THE VAULT SHALL BE STAMPED BY A LICENSED PROFESSIONAL STRUCTURAL ENGINEER AND SUBMITTED TO F&I FOR APPROVAL PRIOR TO FABRICATION.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	WATER VALVE CLUSTER WITH TEE IN VAULT
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2020	STANDARD DETAIL NO. **611**

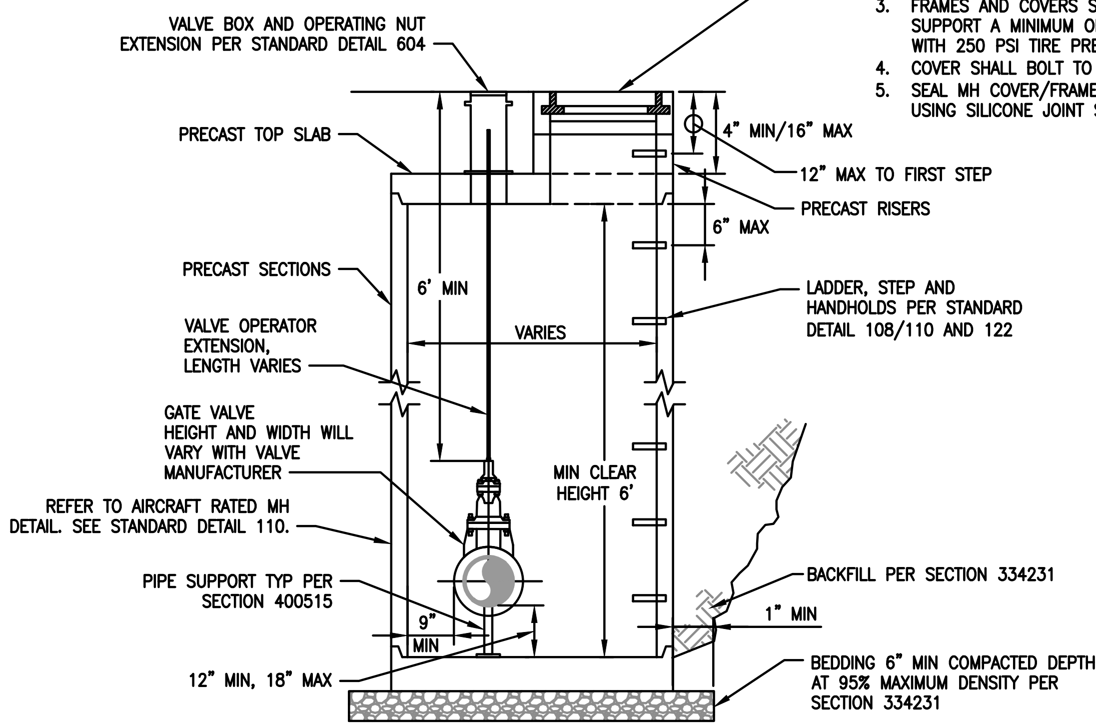


DETAIL

AIRCRAFT RATED WATER VALVE MANHOLE
SCALE: NTS

1
612

FRAME & COVER:
1. PROVIDE 36" DIAMETER FRAME AND COVER.
2. PROVIDE CAST PERMANENT LETTERING ON COVER, "WATER VALVE" AS DIRECTED BY THE ENGINEER.
3. FRAMES AND COVERS SHALL BE DESIGNED TO SUPPORT A MINIMUM OF 100,000 LB WHEEL LOADS WITH 250 PSI TIRE PRESSURE.
4. COVER SHALL BOLT TO FRAME (MIN. TWO FASTENERS)
5. SEAL MH COVER/FRAME JOINT AND PICK HOLES USING SILICONE JOINT SEALANT.



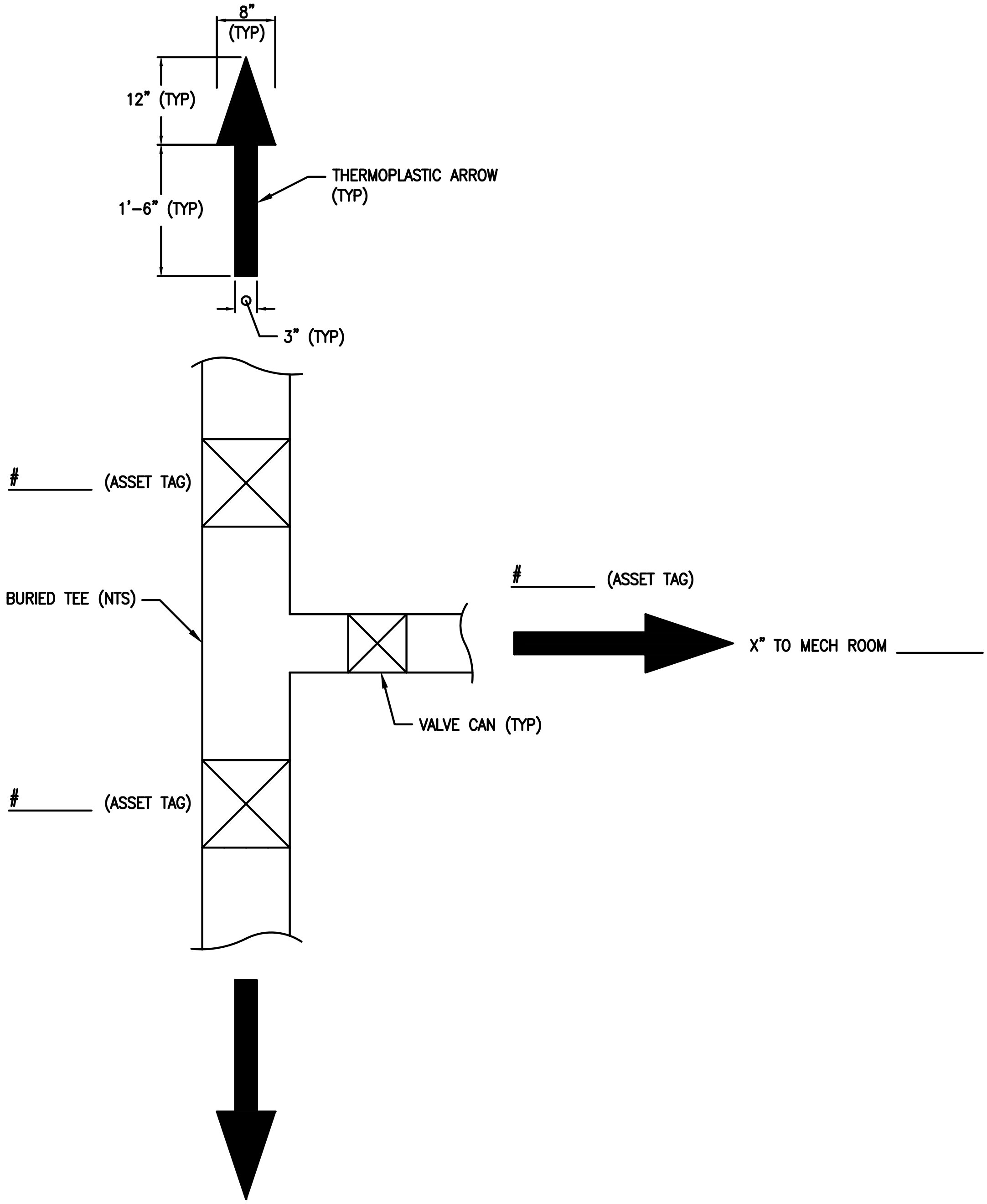
SECTION

AIRCRAFT RATED WATER VALVE MANHOLE
SCALE: NTS

2
612

NOTES:
1. MH DIA WILL VARY BASED ON PIPE AND VALVE DIA.
2. STEPS IN ADJUSTMENT SECTION SHALL HAVE 3" MINIMUM CLEARANCE FROM STRUCTURE WALL. STEPS IN MH'S SHALL HAVE 6" MINIMUM CLEARANCE FROM STRUCTURE WALL.
3. VALVE MH REQUIRED ANY TIME THE LENGTH FROM THE VALVE OPERATING NUT TO GROUND SURFACE EQUALS OR EXCEEDS 6 FEET.
4. PIPE, VALVE AND DISMANTLING JOINT MUST BE CLEAR OF MH FRAME & COVER OPENING. MH OFFSET FROM PIPE CENTERLINE WILL VARY BASED ON NOMINAL PIPE SIZE AND VALVE AND DISMANTLING JOINT MANUFACTURER.
5. MANHOLES LOCATED IN RAMP AIR OPERATIONS AREA (AOA) SHALL BE DESIGNED AS PRESCRIBED IN "FAA ADVISORY CIRCULAR 150-5320-6F APPENDIX B, DESIGN OF STRUCTURES FOR HEAVY AIRPLANES" (OR LATEST EDITION). SHOP DRAWINGS AND STRUCTURAL CALCULATIONS STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION.

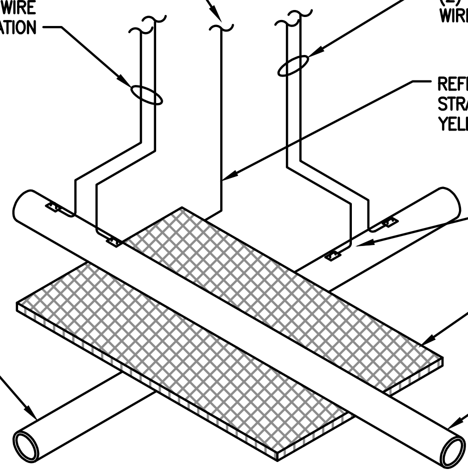
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	AIRCRAFT RATED WATER VALVE MANHOLE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **612**



DETAIL 1/613
THERMOPLASTIC LETTERING FOR VALVES
SCALE: NTS

NOTES:
1. LABEL SIZE AND ASSET TAG NUMBER FOR EACH VALVE WITH 4" TALL WHITE THERMOPLASTIC LETTERING.
2. INDICATE EACH PIPE DIRECTION WITH A THERMOPLASTIC ARROW.
3. INDICATE VALVE SIZE, ASSET TAG #, AND MECHANICAL ROOM NUMBER (WHERE APPLICABLE).
4. CONFIRM LABELS AND TEXT IN WRITING WITH F&I PRIOR TO INSTALLATION.
5. THERMOPLASTIC SHALL FOLLOW FAA ITEM P-620.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	THERMOPLASTIC LETTERING FOR VALVES
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **613**

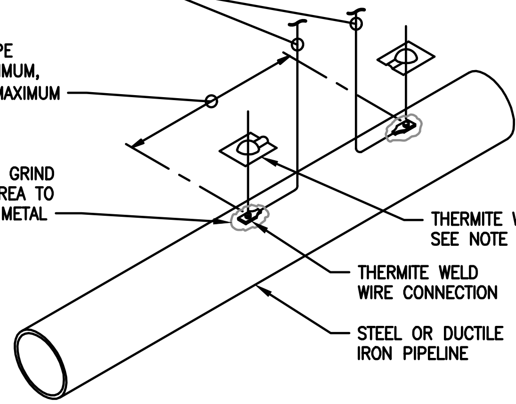


DETAIL 1/700
IINSULATED BLANKET INSTALLATION
SCALE: NTS

NOTES:

1. INSTALL INSULATING BLANKET BETWEEN METALLIC PIPELINES WHEN ONE OR BOTH PIPES HAVE CATHODIC PROTECTION AND THE SEPARATION DISTANCE IS 24" OR LESS.
2. BLANKET SHALL BE 3 TIMES THE PIPE DIAMETER IN THE LARGEST DIMENSION AND EXTEND 2 FEET LARGER THAN THE LARGEST PIPELINE DIAMETER (E.G. 24" PIPE CROSSING AN 18" PIPE WOULD HAVE A 72"L X 48"W BLANKET).
3. ENSURE THE BLANKET IS PLACED ON FLAT BACKFILL FREE OF ROCKS AND DEBRIS TO AVOID PUNCTURE, AND SPATIALLY CENTERED BETWEEN PIPES.
4. PERMANENT REFERENCE ELECTRODES SHALL BE PLACED ON PROJECT PIPELINE SIDE OF BLANKET, 6" TO 12" FROM SPRINGLINE.
5. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'-6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.
6. OBTAIN APPROVAL OF NON-POS PIPELINE OWNER PRIOR TO EXCAVATION.
7. WIRE CONNECTIONS TO NON-POS PIPELINE SHALL BE MADE BY NON-POS PIPELINE REPRESENTATIVE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	INSULATED BLANKET INSTALLATION
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **700**

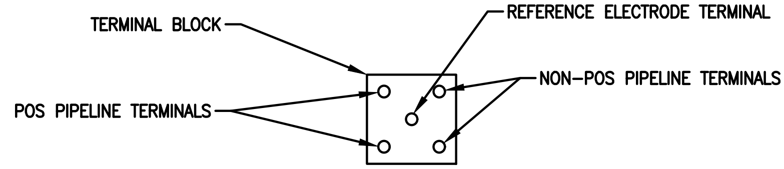


DETAIL 1/701
WIRE CONNECTION FOR STEEL AND DUCTILE IRON PIPE
SCALE: NTS

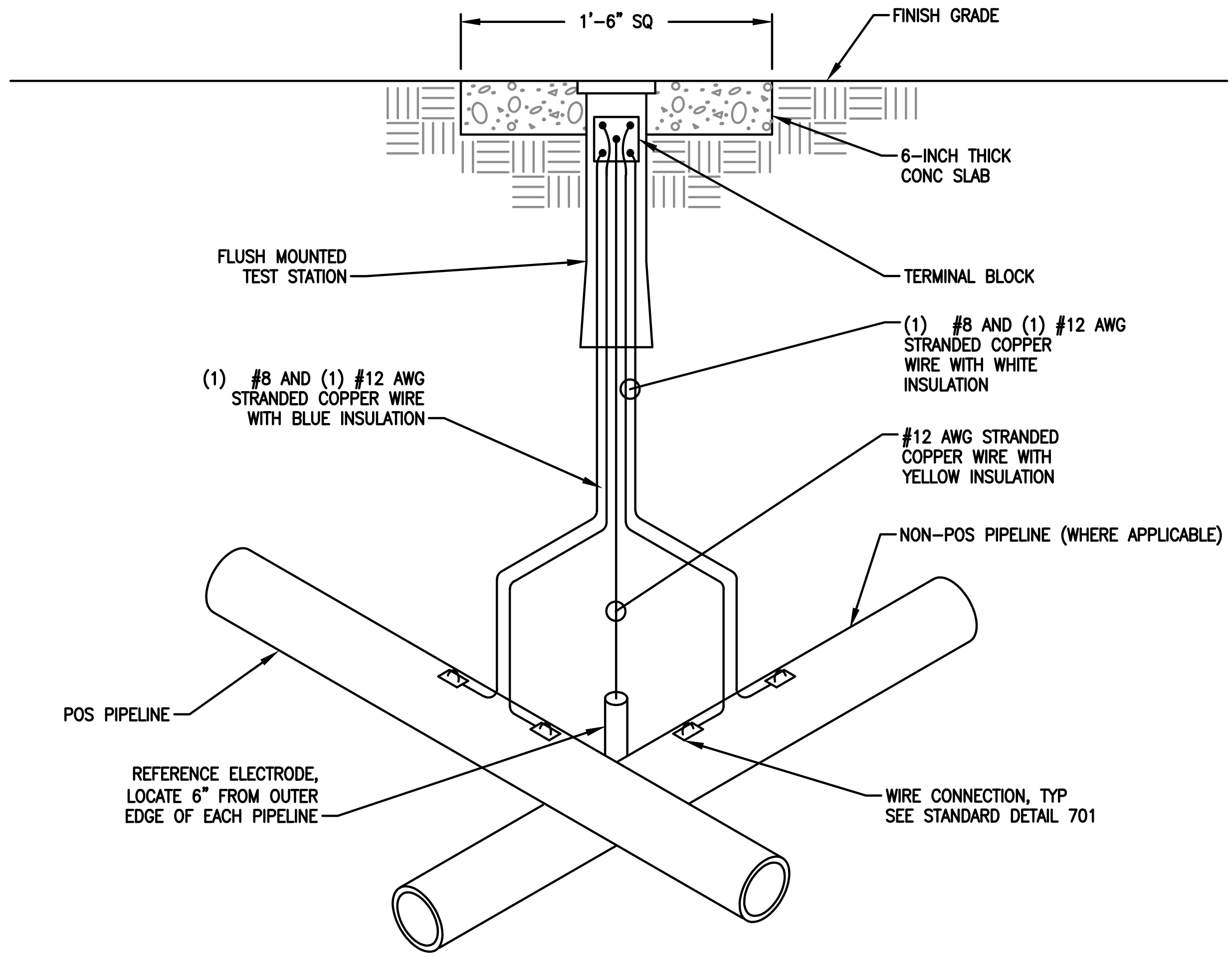
NOTES:

1. COPPER SLEEVE REQUIRED FOR THERMITE WELDING OF #10 AWG AND SMALLER WIRE.
2. USE COPPER SLEEVE ON #2 AWG JOINT BONDING WIRES.
3. WELDER AND CARTRIDGE SIZE VARIES ACCORDING TO WIRE SIZE AND PIPE MATERIAL, CONSULT WELDER MANUFACTURER FOR RECOMMENDED WELDER AND CARTRIDGE.
4. COAT WELD AREA AND FILL RECESS ON THERMITE WELD CAP WITH COLD APPLIED COAL TAR MASTIC AND APPLY CAP TO WELD.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION WIRE CONNECTION FOR STEEL AND DI PIPE
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **701**



WIRE DIAGRAM



TYPE FF-R

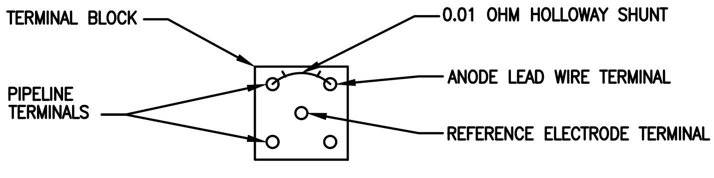
DETAIL 1 / 702

FLUSH MOUNTED TEST STATION TYPE FF-R
SCALE: NTS

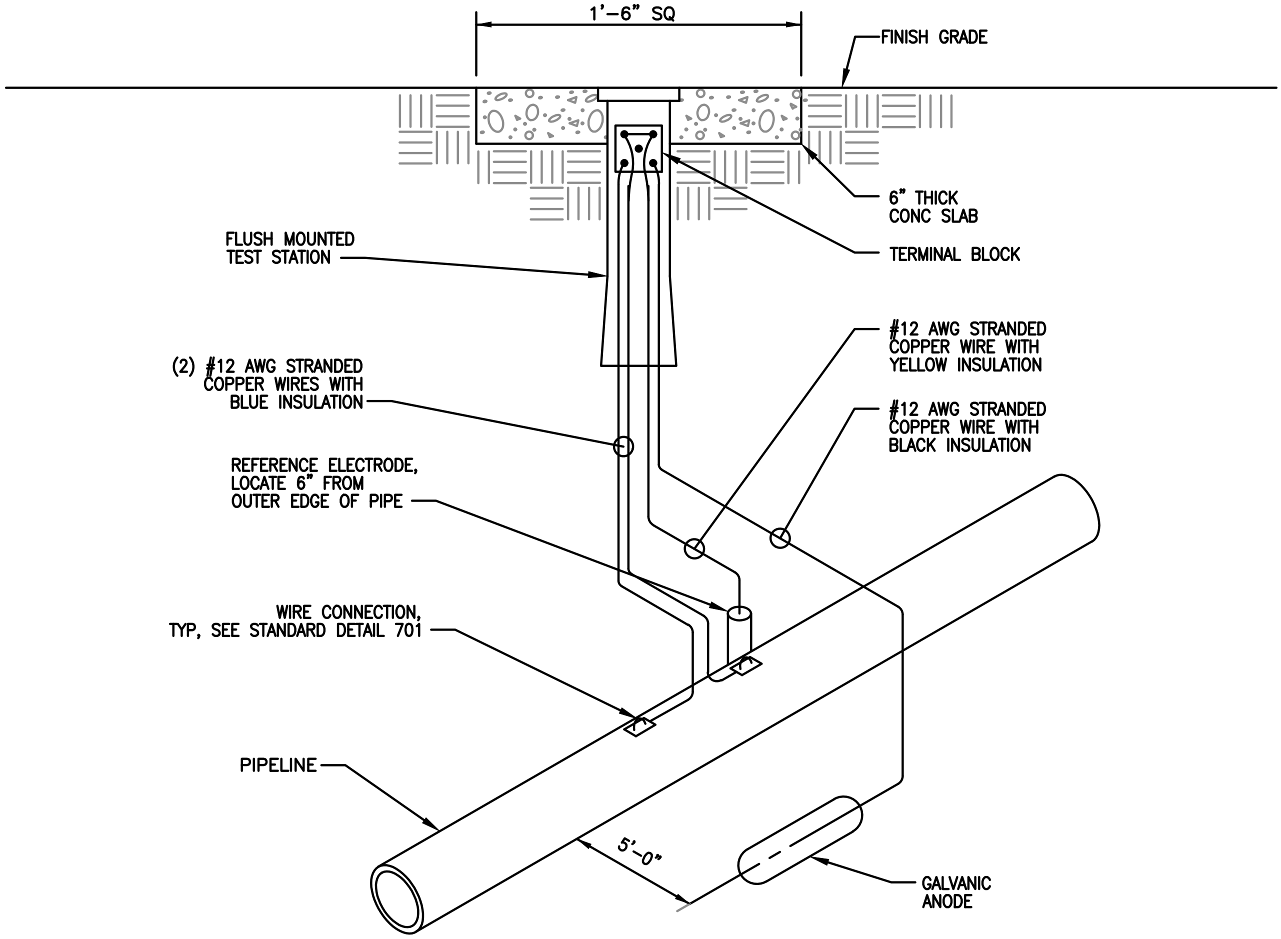
NOTES:

1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'-6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.
2. OBTAIN APPROVAL OF NON-POS PIPELINE OWNER PRIOR TO EXCAVATION.
3. WIRE CONNECTIONS TO NON-POS PIPELINE SHALL BE MADE BY NON-POS PIPELINE REPRESENTATIVE.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FF-R
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **702**



WIRE DIAGRAM



TYPE FT–RA

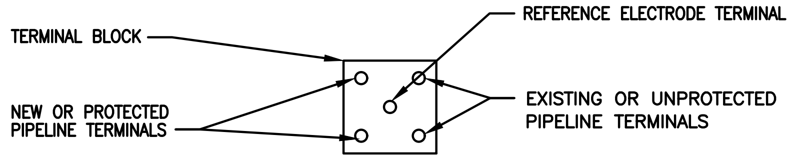
DETAIL 1/703

FLUSH MOUNTED TEST STATION TYPE FT–RA
SCALE: NTS

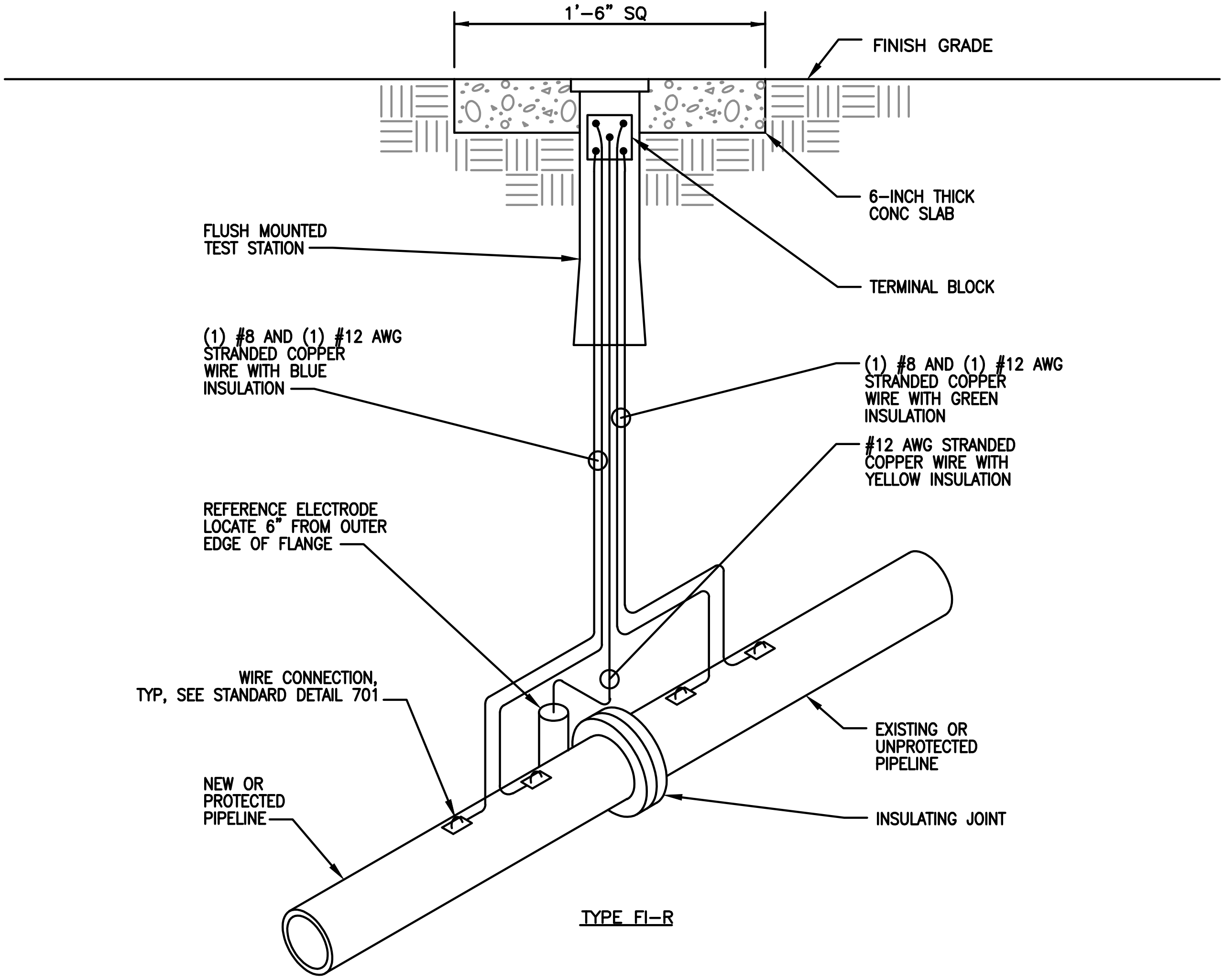
NOTES:

1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'–6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.
2. INSTALL GALVANIC ANODE 1'–0" BELOW PIPE INVERT ELEVATION.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	**SCALE:** NOT TO SCALE **REVISION DATE:** DEC. 2020	CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FT-RA STANDARD DETAIL NO. **703**



WIRE DIAGRAM



TYPE FI–R

DETAIL 1/704

FLUSH MOUNTED TEST STATION TYPE FI–R
SCALE: NTS

NOTES:

1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'–6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.

SEA Seattle-Tacoma International Airport

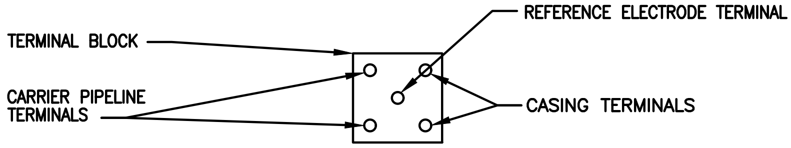
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

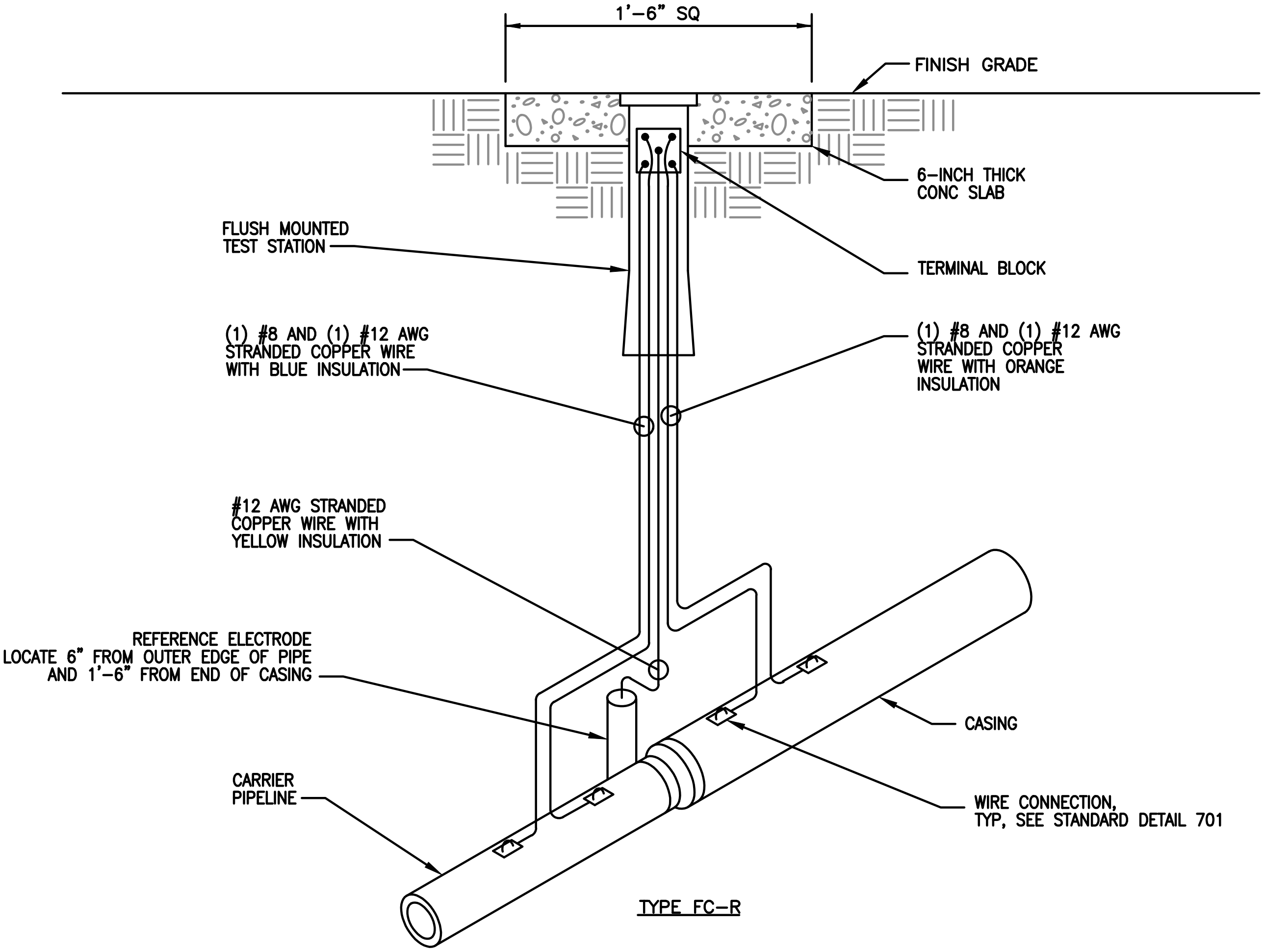
REVISION DATE: DEC. 2020

CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FI-R

STANDARD DETAIL NO. **704**



WIRE DIAGRAM



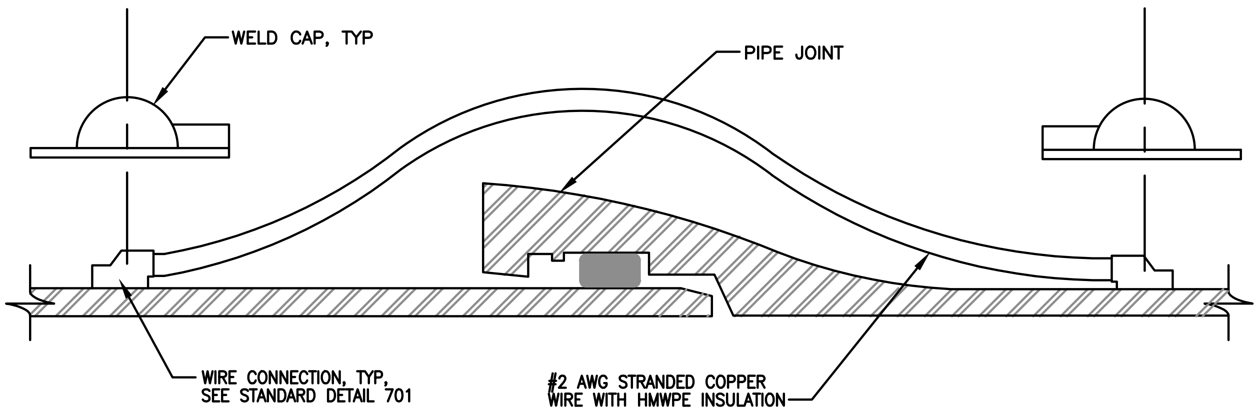
TYPE FC-R

DETAIL 1/705

FLUSH MOUNTED TEST STATION TYPE FC-R
SCALE: NTS

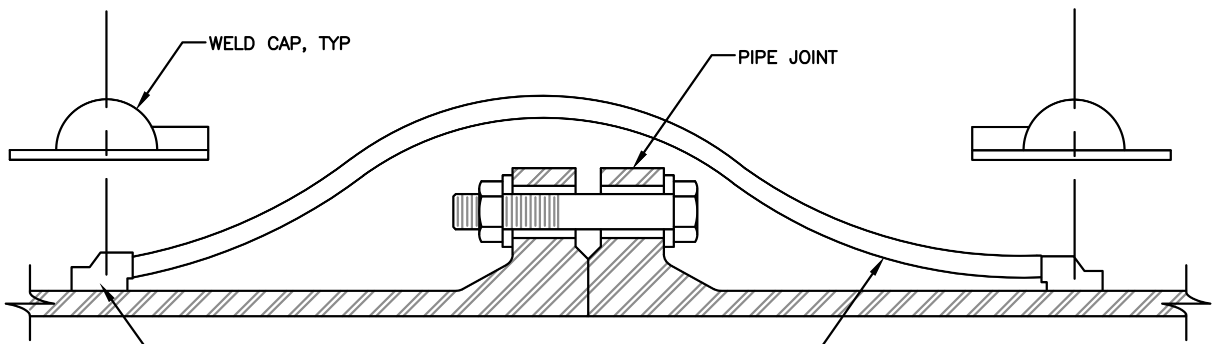
NOTES:
1. PROVIDE SUFFICIENT SLACK IN TEST WIRES TO ALLOW TERMINAL BLOCK TO EXTEND 1'-6" OUT OF TEST STATION. COIL WIRES IN TEST STATION.

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLUSH MOUNTED TEST STA TYPE FC-R
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **705**



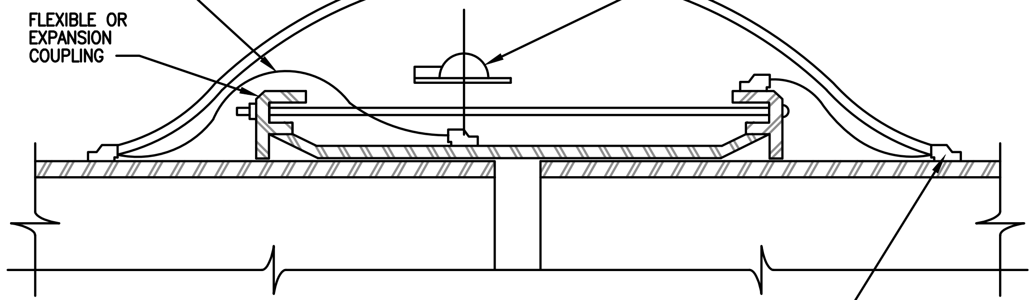
DETAIL 1/706
PUSH-ON JOINT BOND
SCALE: NTS

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PRTECTION PUSH-ON JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **706**



DETAIL 1/707
FLANGED JOINT BOND
SCALE: NTS

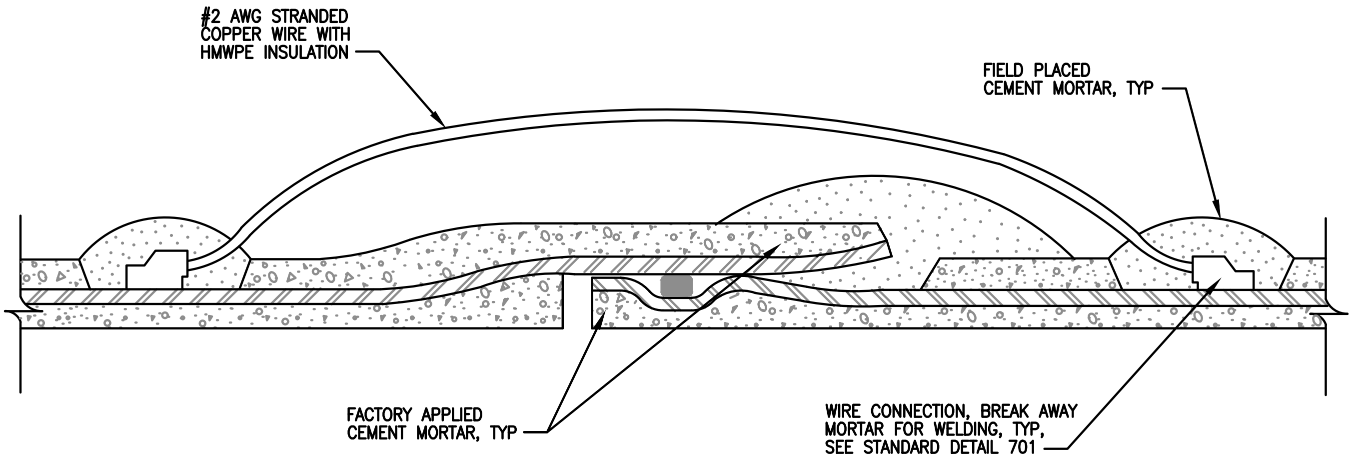
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLANGED JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **707**



DETAIL
FLEXIBLE JOINT BOND
SCALE: NTS

1 / 708

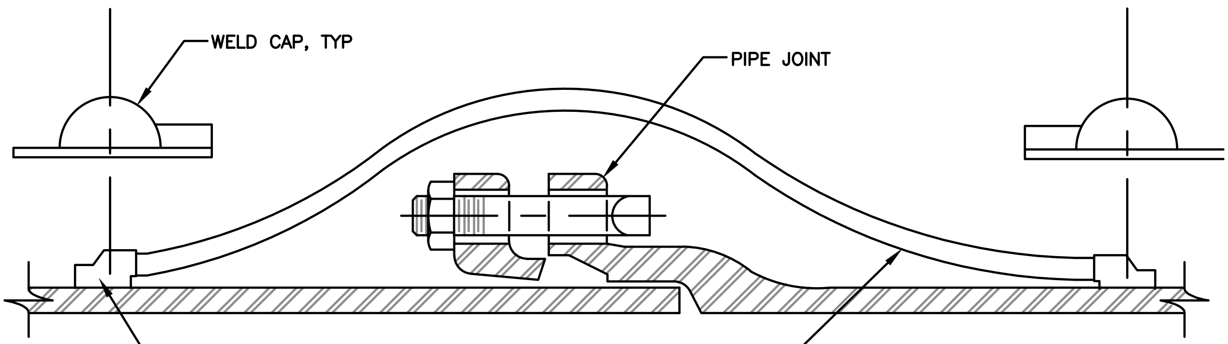
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION FLEXIBLE JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **708**



DETAIL 1/709

CEMENT COATED STEEL PIPE JOINT BOND
SCALE: NTS

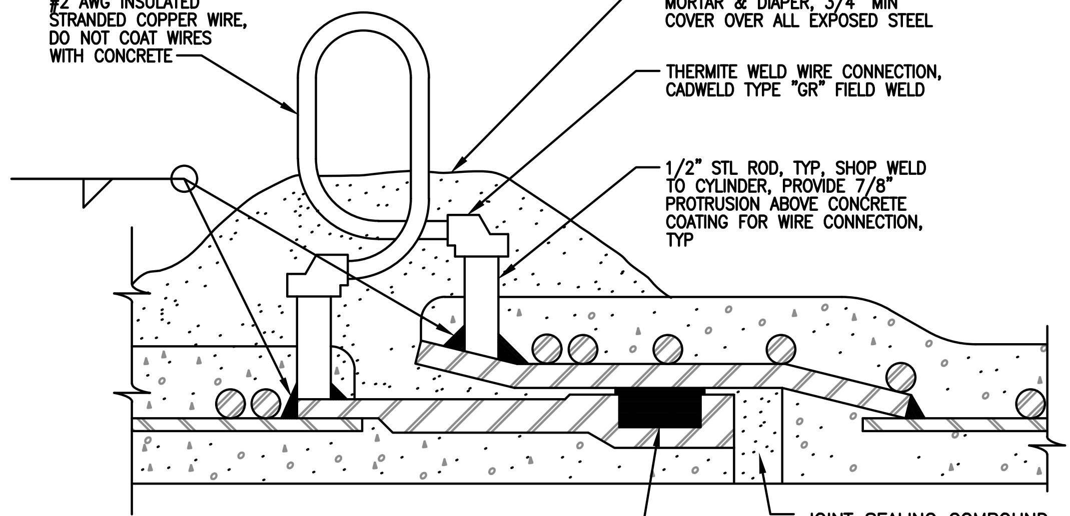
SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION CEMENT COATED STEEL JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **709**



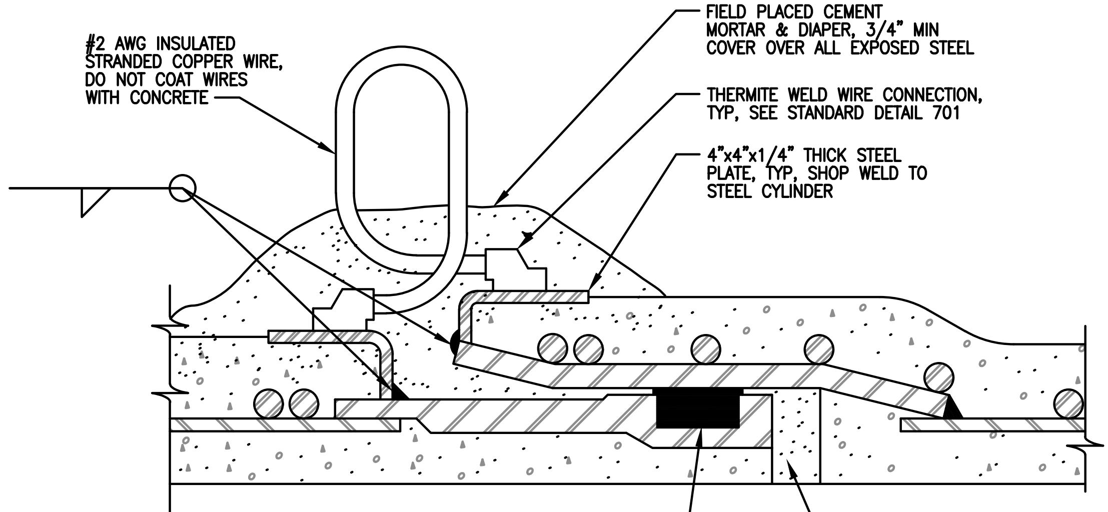
DETAIL
MECHANICAL JOINT BOND
SCALE: NTS

1
710

SEA Seattle-Tacoma International Airport	**SCALE:** NOT TO SCALE	CATHODIC PROTECTION MECHANICAL JOINT BOND
F&I CIVIL STANDARDS	**REVISION DATE:** DEC. 2020	STANDARD DETAIL NO. **710**



METHOD 1



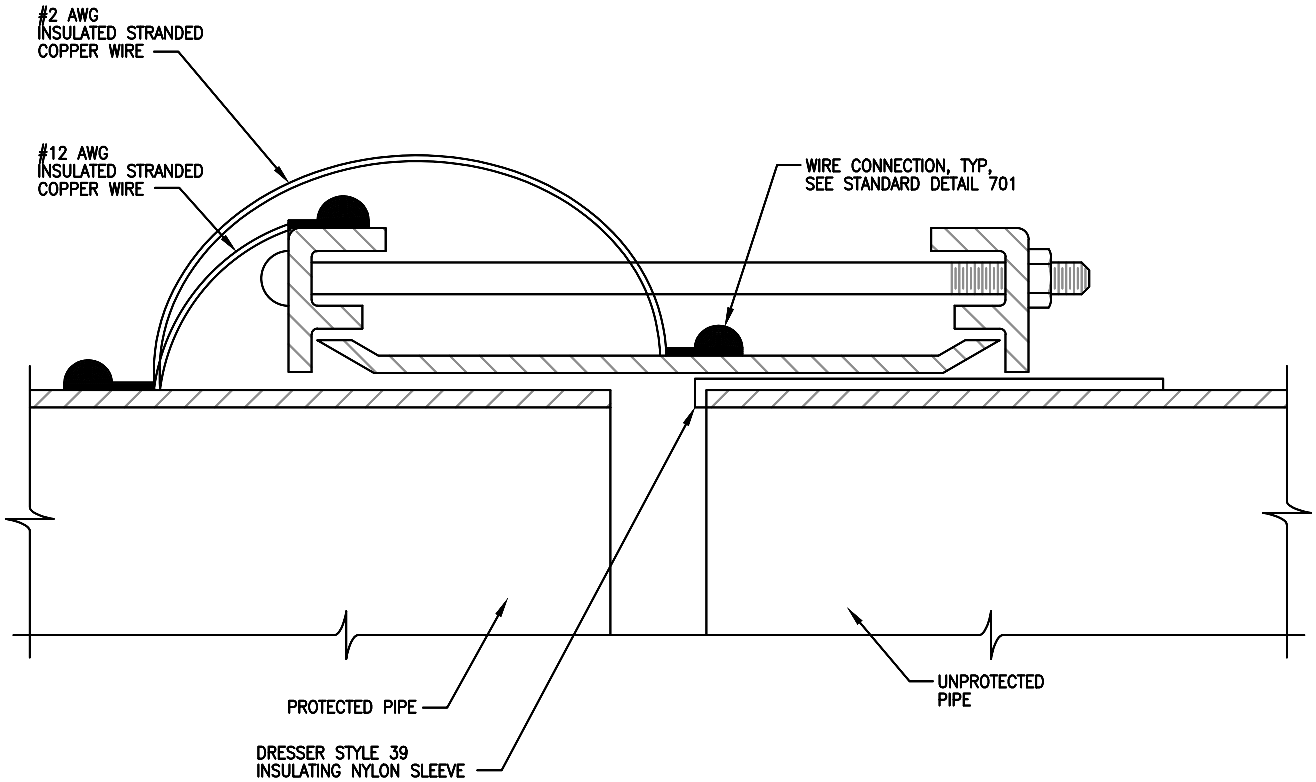
METHOD 2

DETAIL 1/711

CONCRETE CYLINDER PIPE JOINT BOND
SCALE: NTS

NOTES:
1. SEE SPECIFICATIONS FOR NUMBER OF BOND WIRES REQUIRED AT EACH PIPE JOINT.

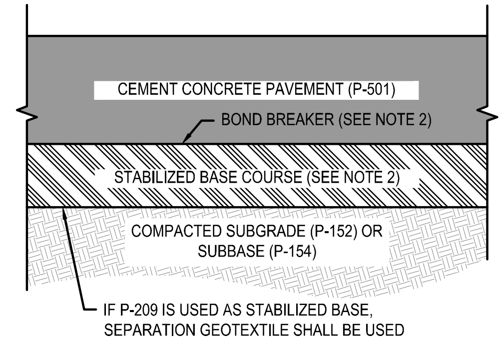
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CATHODIC PROTECTION CONCRETE CYLINDER PIPE JOINT BOND
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2020	STANDARD DETAIL NO. 711



DETAIL 1/712

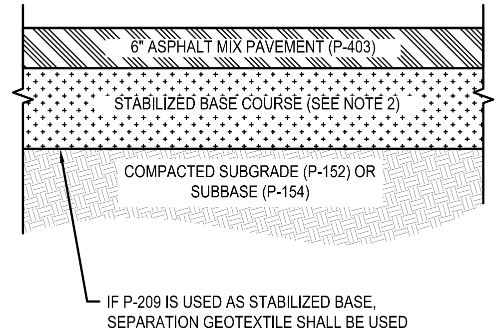
INSULATED FLEXIBLE COUPLING
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CATHODIC PROTECTION INSULATED FLEX COUP
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2020	STANDARD DETAIL NO. **712**



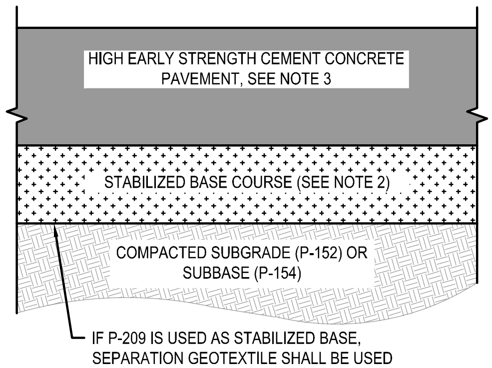
SECTION 1 / -

NEW CONCRETE RUNWAY, TAXIWAY, OR APRON PAVEMENT SECTION
SCALE: NTS



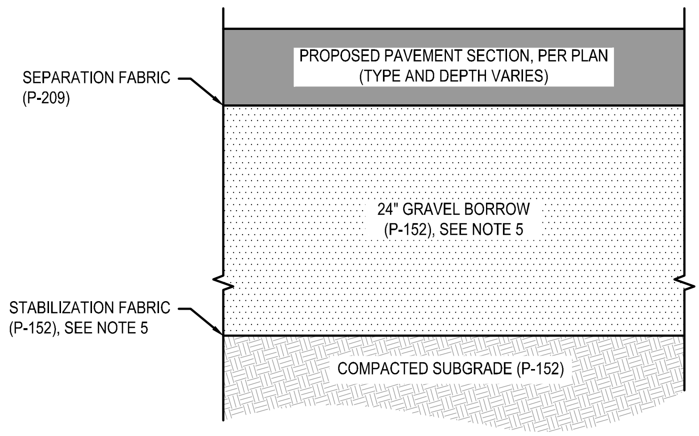
SECTION 2 / -

ASPHALT AIRFIELD SHOULDER PAVEMENT SECTION
SCALE: NTS



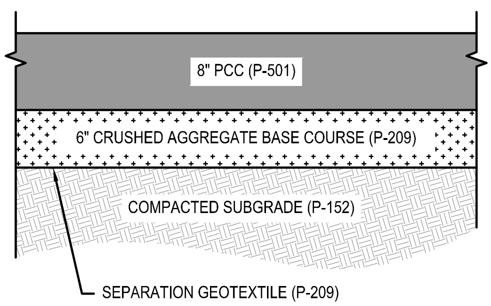
SECTION 3 / -

CONCRETE INDIVIDUAL PANEL REPLACEMENT PAVEMENT SECTION - ACCELERATED CONSTRUCTION
SCALE: NTS



SECTION 4 / -

SUB-EXCAVATE UNSUITABLE SUBGRADE
SCALE: NTS



SECTION 5 / -

NEW HEAD OF STAND (GSE-RATED) PCCP PAVEMENT SECTION
SCALE: NTS

NOTES:

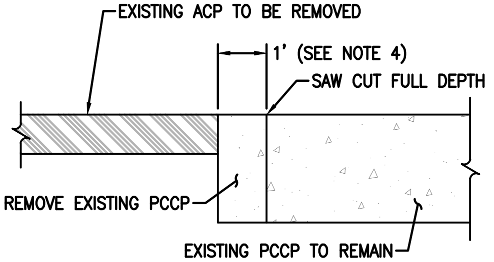
1. THICKNESS FOR PAVEMENT SECTION LAYERS, WHERE SHOWN, ARE MINIMUMS AND SHALL BE DETERMINED BY EACH PROJECT'S PAVEMENT DESIGN. PAVEMENT THICKNESS FOR FAA AIRPORT IMPROVEMENT PROGRAM (AIP)-ELIGIBLE PROJECTS, AND ANY PAVEMENTS THAT WILL SUPPORT AIRCRAFT TRAFFIC, SHALL BE DESIGNED PER FAA AC 150/5320-6 (CURRENT VERSION). FOR NON-AIP, NON-AIRCRAFT PAVEMENTS, DESIGN PAVEMENT THICKNESSES TO MEET WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT) "PAVEMENT POLICY" (CURRENT VERSION), OR OTHER STANDARD METHODOLOGY WHEN APPROVED BY THE PORT OF SEATTLE PROJECT MANAGER.
2. TYPE OF STABILIZED BASE COURSE MATERIAL AND NEED FOR BOND BREAKER TO BE DETERMINED BY PROJECT PAVEMENT DESIGN. STABILIZED BASE MAY INCLUDE CRUSHED AGGREGATE BASE COURSE (P-209), ASPHALT MIX PAVEMENT BASE COURSE (P-403 OR P-401), CEMENT TREATED BASE COURSE (P-304), LEAN CONCRETE BASE COURSE (P-306), CEMENT TREATED PERMEABLE BASE COURSE (P-307), OR ASPHALT TREATED PERMEABLE BASE COURSE (P-407).
3. USE OF HIGH EARLY STRENGTH CEMENT CONCRETE IS GENERALLY DISCOURAGED, AND SHALL ONLY BE USED WITH APPROVAL IN CASES WHERE THERE IS A SIGNIFICANT NEED FOR REDUCED CURE TIME. REFER TO FAA AC 150/5370-16 FOR ADDITIONAL INFORMATION.
4. CONCRETE PAVEMENTS FOR RUNWAY, TAXIWAY, AND APRON PAVEMENT SHALL BE DESIGNED FOR A 40-YEAR SERVICE LIFE.
5. OVER-EXCAVATE 24" OF UNSUITABLE SUBGRADE AND PLACE 24" GRAVEL BORROW OVER STABILIZATION FABRIC AT LOCATIONS DIRECTED BY THE RESIDENT ENGINEER IN WRITING.
6. STAMP THE INITIAL SLAB, THE SECOND SLAB, EVERY FIFTH SLAB, THE NEXT TO THE FINAL SLAB, AND THE FINAL SLAB IN EACH PAVING LANE WITH THE DATE AND STIA NUMBER. THE DATE STAMP WILL INDICATE THE MONTH, DAY, AND THE FOUR-DIGIT YEAR OF THE SLAB PLACEMENT WITH 3" NUMBERS AS WELL AS AN ARROW INDICATING THE PAVING DIRECTION. PLACE THE DATE AND STIA NUMBER STAMP IN THE SOUTHEASTERN CORNER OF THE SLAB, THREE FEET FROM EACH JOINT IN CONJUSTION WITH THE SURFACE TEXTURING OF THE PAVEMENT.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	AIRFIELD PAVEMENT TYPICAL SECTIONS
F&I CIVIL STANDARDS	REVISION DATE: MAY 2023	STANDARD DETAIL NO. 801

FAA TECHNICAL SPECIFICATIONS REFERENCED FOR AIRFIELD PAVING PROJECTS

FAA TECHNICAL SPECIFICATION NUMBER*	DESCRIPTION
P–152	EXCAVATION, SUBGRADE, AND EMBANKMENT
P–153	CONTROLLED LOW–STRENGTH MATERIAL (CLSM)
P–154	SUBBASE COURSE
P–155	LIME–TREATED SUBGRADE
P–209	CRUSHED AGGREGATE BASE COURSE
P–304	CEMENT TREATED AGGREGATE BASE COURSE
P–306	LEAN CONCRETE BASE COURSE
P–307	CEMENT TREATED PERMEABLE BASE COURSE
P–401	ASPHALT MIX PAVEMENT
P–403	ASPHALT MIX PAVEMENT SURFACE COURSE
P–407	ASPHALT TREATED PERMEABLE BASE COURSE
P–501	CEMENT CONCRETE PAVEMENT
P–603	EMULSIFIED ASPHALT TACK COAT
P–604	COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS
P–605	JOINT SEALANTS FOR PAVEMENTS
P–608R	RAPID CURE SEAL COAT
P–609	SEAL COATS AND BITUMINOUS SURFACE TREATMENTS
P–610	CONCRETE FOR MISCELLANEOUS STRUCTURES

*REFER TO LATEST EDITION OF FAA ADVISORY CIRCULAR 150/5370–10, "STANDARD SPECIFICATIONS FOR CONSTRUCTION OF AIRPORTS" AVAILABLE VIA FAA WEBSITE AT:
https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.current/documentnumber/150_5370–10

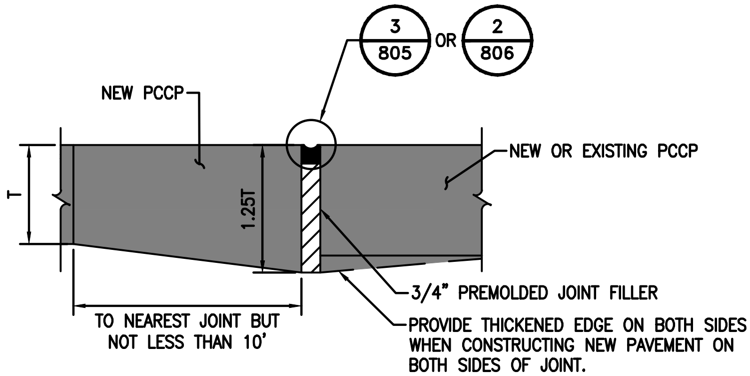


NOTE: THIS DETAIL TO BE USED ONLY WHERE REQUIRED DUE TO DAMAGED EDGE OF EXISTING CONCRETE PAVEMENT.

SECTION 1 / –
PCCP DEMOLITION DETAIL
SCALE: NTS

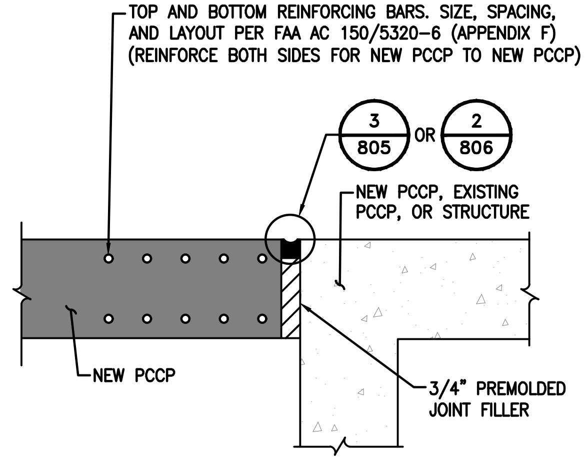
PAVEMENT DEMOLITION NOTES:

1. FOR SLAB REPLACEMENT, ALL REMOVALS SHALL BE ALONG EXISTING JOINTS, AND PARTIAL PANEL REPLACEMENTS ARE NOT ALLOWED. IF EXISTING JOINTS ARE NOT STRAIGHT OR ARE DAMAGED, SAW CUT FULL DEPTH INTO CLEAN, STRAIGHT LINES AS DIRECTED BY THE ENGINEER. KERF CUTS FOR WIRE OR PIPE INSTALLATION ARE NOT ALLOWED.
2. DEMOLITION OF EXISTING CONCRETE PAVEMENTS LOCATED WITHIN 25' OF EXISTING FUEL LINES OR TUNNEL STRUCTURES SHALL BE BY SAW CUT AND LIFT–OUT ONLY. BREAKING IN PLACE WILL NOT BE ALLOWED.
3. DEMOLITION OF EXISTING CONCRETE PAVEMENT ADJACENT TO PAVEMENT TO REMAIN SHALL BE BY SAW CUT AND LIFT–OUT ONLY. A RELIEF SAW CUT 2' FROM EDGE OF PAVEMENT TO REMAIN IS STRONGLY RECOMMENDED. REMOVE INTERIOR PIECES BEFORE REMOVING PIECES IMMEDIATELY ADJACENT TO PAVEMENT TO REMAIN.
4. AS DIRECTED BY THE ENGINEER, REMOVE PCCP TO OBTAIN A STRAIGHT HORIZONTAL AND VERTICAL EDGE.



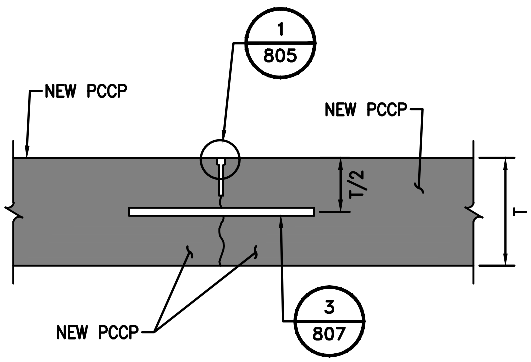
SECTION 1 / –

JOINT TYPE A
NEW PCCP TO NEW/EXISTING PCCP
THICKENED EDGE ISOLATION JOINT
SCALE: NTS



SECTION 2 / –

JOINT TYPE A-1
NEW PCCP TO NEW/EXISTING PCCP OR STRUCTURE
REINFORCED ISOLATION JOINT
SCALE: NTS



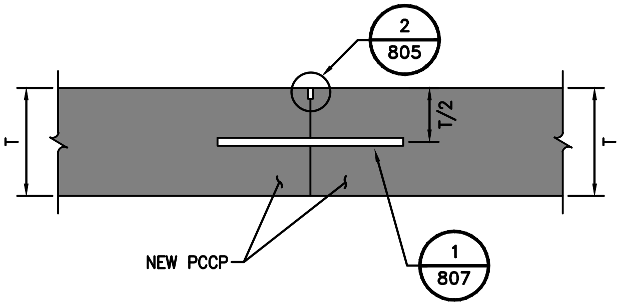
SECTION 3 / –

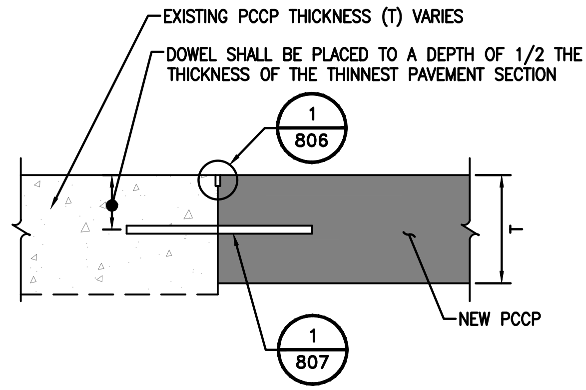
JOINT TYPE C
NEW PCCP
DOWELED CONTRACTION JOINT
SCALE: NTS

GENERAL NOTES:

1. PCCP = PORTLAND CEMENT CONCRETE PAVEMENT (P-501).
2. T = THICKNESS OF PCCP.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	AIRFIELD PAVEMENT TYPICAL SECTIONS
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **803**



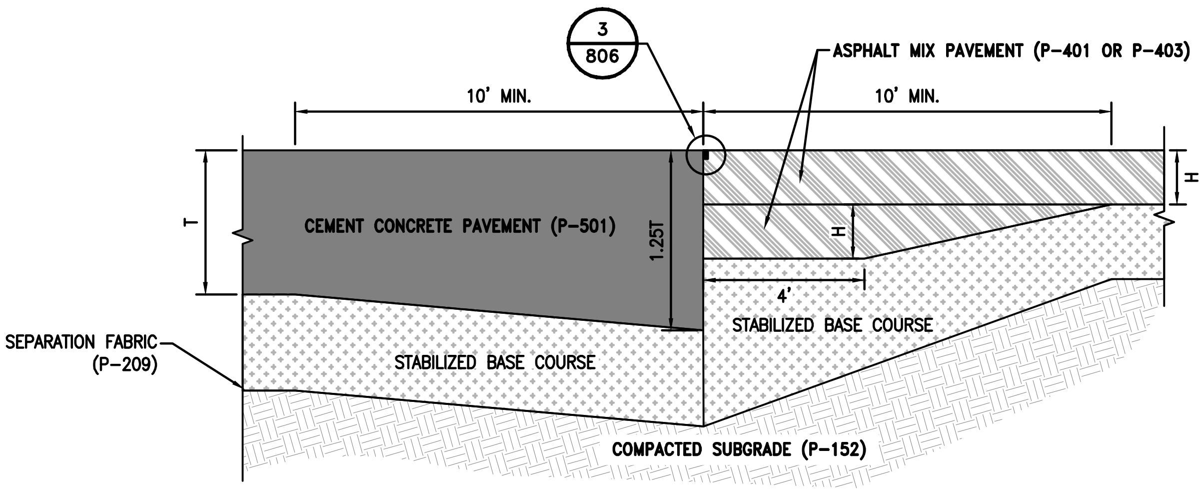


SECTION | 1 / –

JOINT TYPE E
NEW PCCP TO NEW PCCP
DOWELED CONSTRUCTION JOINT
SCALE: NTS

SECTION | 2 / –

JOINT TYPE E-1
NEW PCCP TO EXISTING PCCP
DOWELED CONSTRUCTION JOINT
SCALE: NTS

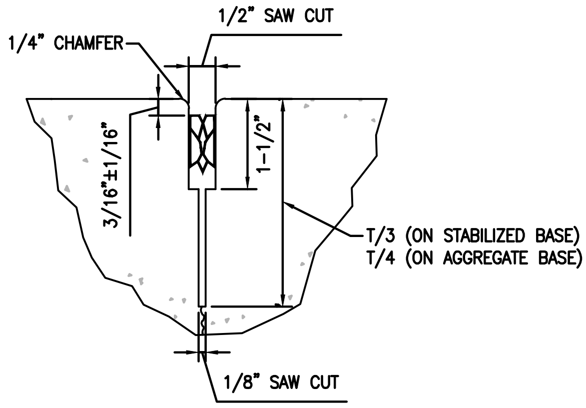


NOTE: THIS DETAIL IS INTENDED FOR TRANSITIONS BETWEEN RIGID AND FLEXIBLE PAVEMENTS SUBJECTED TO REGULAR AIRCRAFT OR VEHICLE TRAFFIC. THIS DETAIL DOES NOT TYPICALLY APPLY TO RUNWAY OR TAXIWAY SHOULDERS, EXCEPT IN SPECIFIC AREAS WHERE THERE IS FREQUENT OR REGULAR TRAFFIC ANTICIPATED.

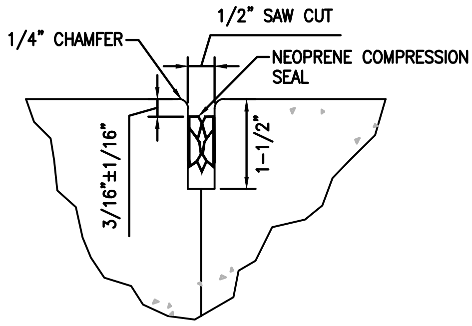
SECTION | 3 / –

JOINT TYPE G
NEW PCCP TO NEW ASPHALT PAVEMENT
SCALE: NTS

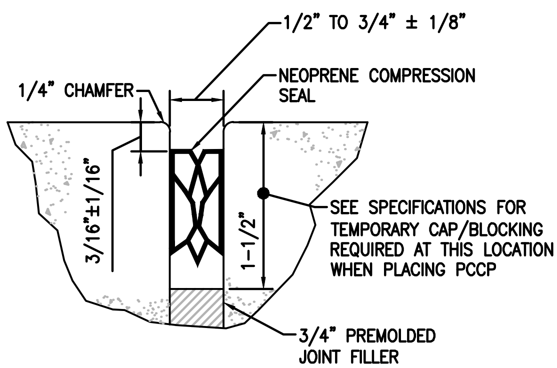
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	AIRFIELD PAVEMENT TYPICAL SECTIONS
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **804**



DETAIL 1 –
CONTRACTION JOINT
NEW PCC TO NEW PCC
SCALE: NTS

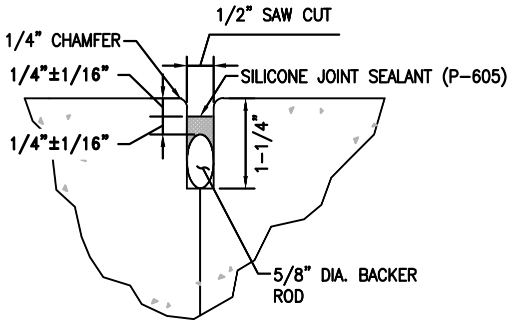


DETAIL 2 –
CONSTRUCTION JOINT DETAIL
NEW PCC TO NEW PCC
SCALE: NTS



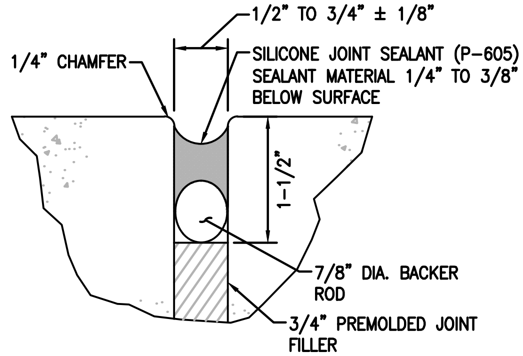
DETAIL 3 –
ISOLATION JOINT DETAIL
NEW PCC TO NEW PCC
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	PCCP JOINT DETAILS
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **805**



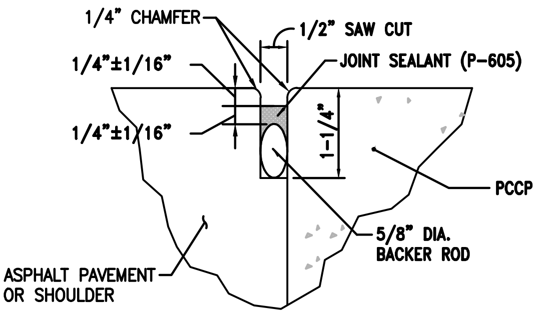
DETAIL 1 –

CONSTRUCTION JOINT DETAIL
NEW PCC TO EXISTING PCC
SCALE: NTS



DETAIL 2 –

ISOLATION JOINT DETAIL
NEW PCC TO EXISTING PCC
SCALE: NTS



DETAIL 3 –

CONSTRUCTION JOINT DETAIL
ASPHALT TO PCC
SCALE: NTS

SEA Seattle-Tacoma International Airport

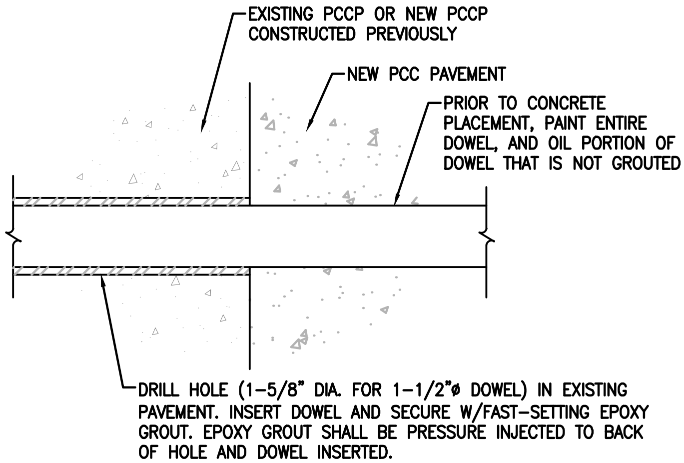
F&I CIVIL STANDARDS

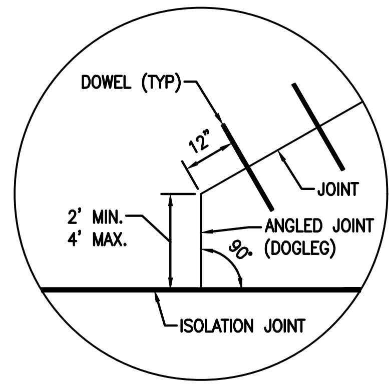
SCALE: NOT TO SCALE

REVISION DATE: DEC. 2022

PCCP JOINT DETAILS

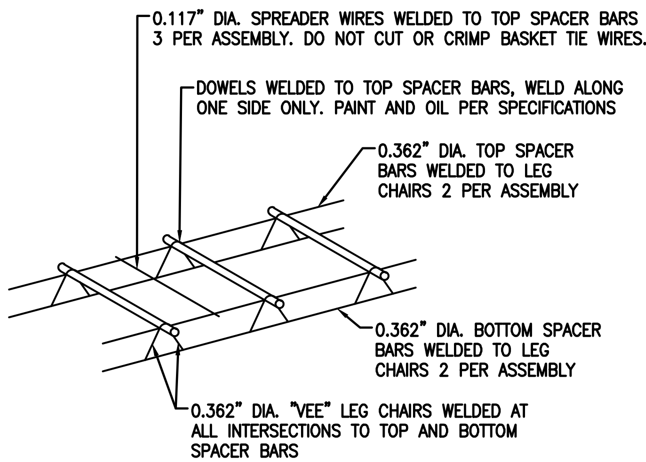
STANDARD DETAIL NO. **806**





DETAIL 1 –
DRILLED DOWELS
SCALE: NTS

DETAIL 2 –
DOGLEG JOINTS
SCALE: NTS

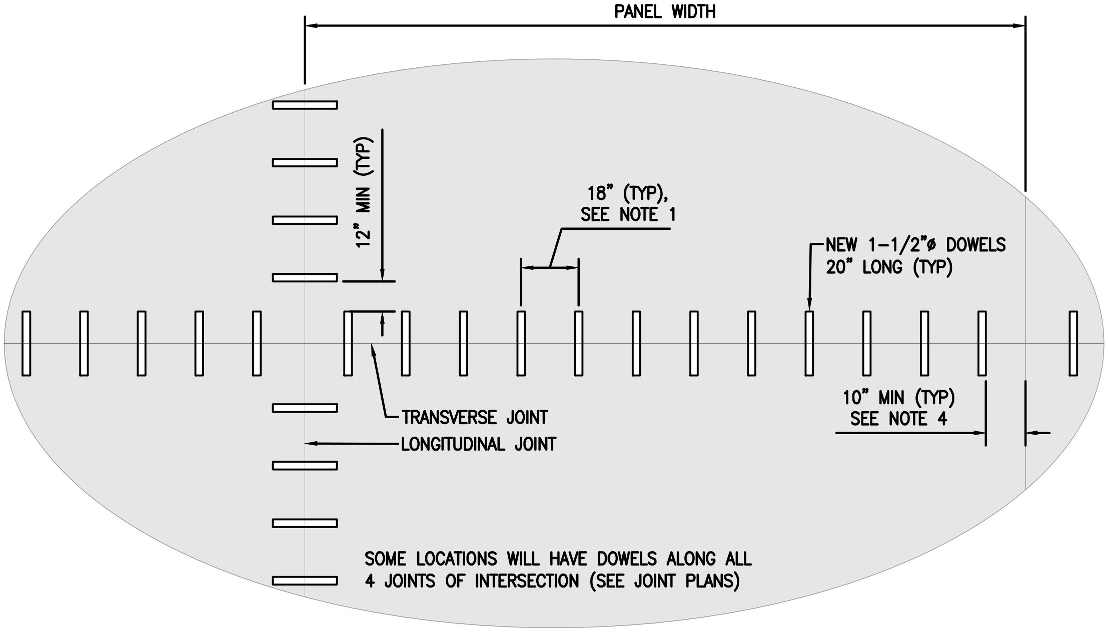


DETAIL 3 –
DOWEL BASKET ASSEMBLY
SCALE: NTS

DOWEL BAR NOTES:

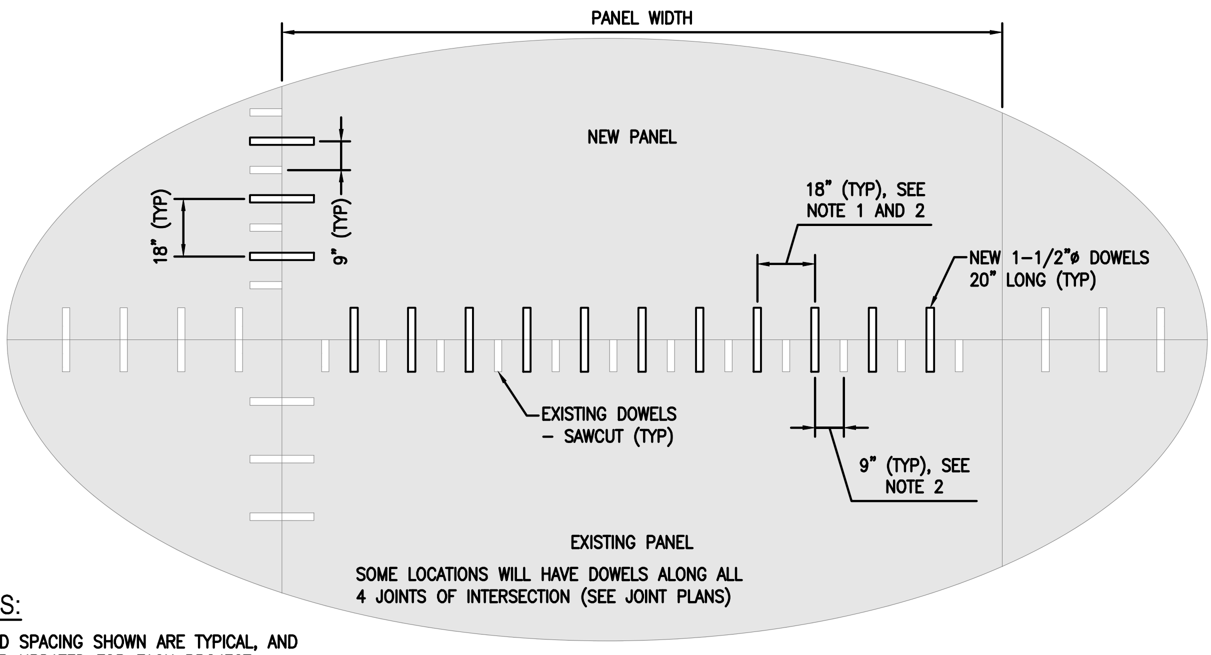
1. DOWEL BAR SIZES AND SPACING SHOWN ARE TYPICAL, AND SHALL BE VERIFIED OR UPDATED FOR EACH PROJECT ACCORDING TO THE REQUIREMENTS GIVEN IN FAA AC 150/5320-6.
2. BASKET MUST BE FIRMLY ATTACHED TO EXISTING OR NEW BASE.
3. ALL WIRE SIZES SHOWN ARE MIN.
4. DOWELS & TIE BARS SHALL BE HELD FIRMLY IN THE WELDED BASKET ASSEMBLY.
5. OIL FULL LENGTH OF DOWEL BARS AND ENTIRE BASKET AT ALL CONTRACTION JOINTS PER SPECIFICATIONS.

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	DOWEL BAR DETAILS
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **807**



DETAIL 1 –

TYPICAL DOWEL BAR LAYOUT
NEW PCCP
SCALE: NTS



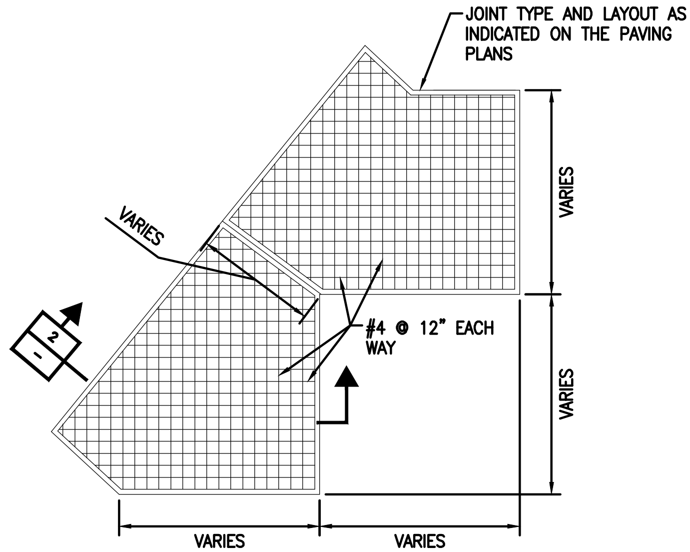
DETAIL 2 –

TYPICAL DOWEL BAR LAYOUT
NEW PCCP TO EXISTING PCCP
SCALE: NTS

DOWEL BAR NOTES:

1. DOWEL BAR SIZES AND SPACING SHOWN ARE TYPICAL, AND SHALL BE VERIFIED OR UPDATED FOR EACH PROJECT ACCORDING TO THE REQUIREMENTS GIVEN IN FAA AC 150/5320-6.
2. ACTUAL LOCATION OF EXISTING DOWELS IN THE FIELD MAY VARY. WHEN LAYOUT DIFFERS FROM EXISTING LAYOUT SHOWN IN DETAIL 2, INSTALL NEW DOWELS HALF WAY BETWEEN EXISTING DOWELS AND AT A MINIMUM DISTANCE FROM NEAREST JOINT AS SPECIFIED IN SPECIFICATION P-501.
3. DOWELS SHALL BE NO CLOSER THAN 10" TO THE JOINT.
4. DOWEL LAYOUT SHALL INCLUDE THE MAXIMUM NUMBER OF DOWELS THAT CAN FIT WHILE MAINTAINING THE SPECIFIED CENTER-TO-CENTER AND EDGE CLEARANCES.

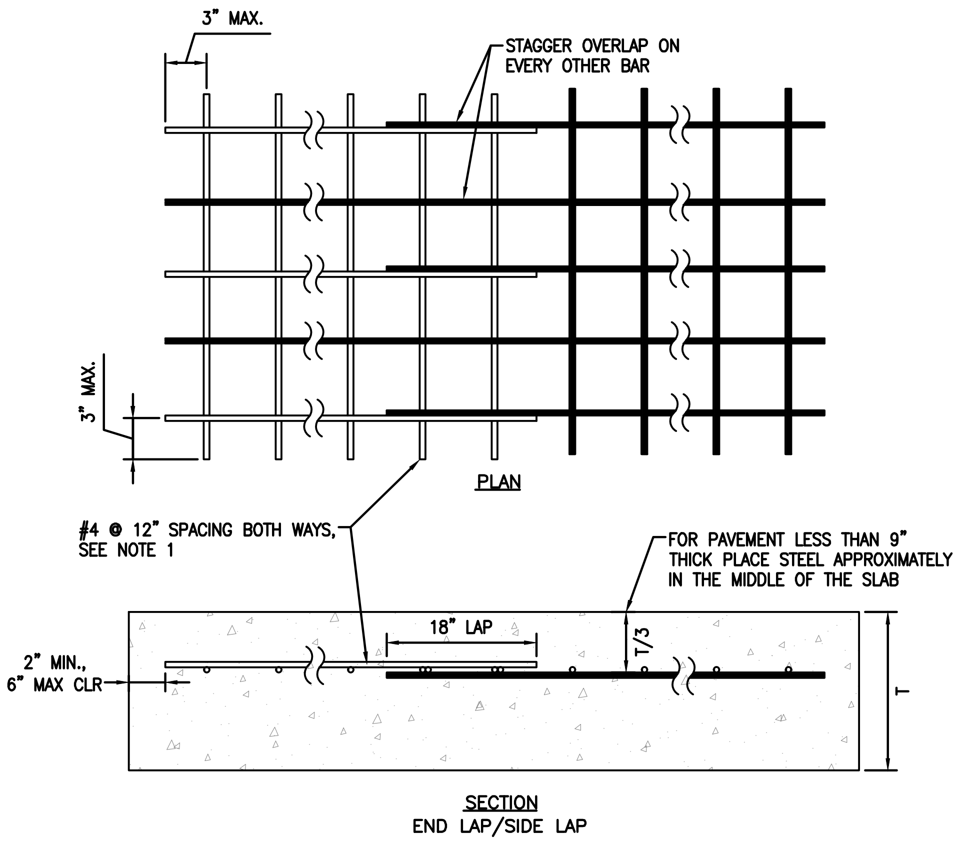
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	TYPICAL DOWEL BAR LAYOUTS
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **808**



DETAIL 1 –
STEEL REINFORCEMENT MAT
TYPICAL LAYOUT
SCALE: NTS

REINFORCING STEEL NOTES:

1. BAR SIZES, SPACING, AND OVERLAP SHOWN ARE TYPICAL, AND SHALL BE VERIFIED OR UPDATED FOR EACH PROJECT ACCORDING TO THE REQUIREMENTS GIVEN IN FAA AC 150/5320–6.
2. PLACE ALL STEEL REINFORCEMENT ACCURATELY AND HOLD FIRMLY IN THE POSITION INDICATED ON THE DRAWING PRIOR TO AND DURING CONCRETE PLACEMENT.
3. TIE BARS AT ALL INTERSECTIONS, EXCEPT WHERE SPACING IS LESS THAN 1 FOOT IN EACH DIRECTION IN WHICH CASE TIE EVERY OTHER INTERSECTION.
4. AT PERIMETER, TIE BARS AT ALL INTERSECTIONS.

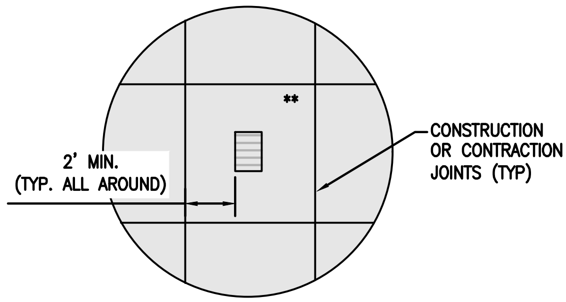


DETAIL 2 –
STEEL REINFORCEMENT MAT – TYPE I
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CONCRETE PAVEMENT REINFORCING
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **809**

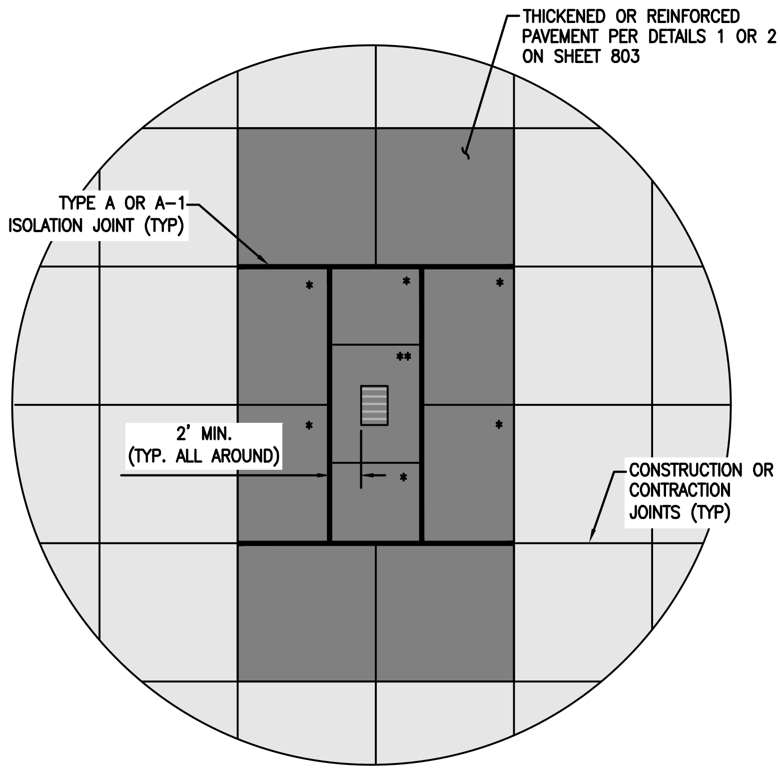
JOINT LAYOUT NOTES:

1. JOINT LAYOUT FOR CONCRETE PAVEMENTS SHALL BE IN ACCORDANCE WITH FAA GUIDANCE AND REQUIREMENTS IN AC 150/5320-6 (CURRENT VERSION).
2. TYPICAL JOINT LAYOUT GUIDANCE FROM THE FAA IS ALSO AVAILABLE ONLINE – REFER TO SAMPLE PCC JOINT PLANS AT https://cms.faa.gov/airports/engineering/pavement_design



** TYPE II PAVEMENT REINFORCING PER STANDARD DETAIL NO. 111

DETAIL 1 / –
IDEAL STRUCTURE PLACEMENT
IN CONCRETE PAVEMENT
SCALE: NTS

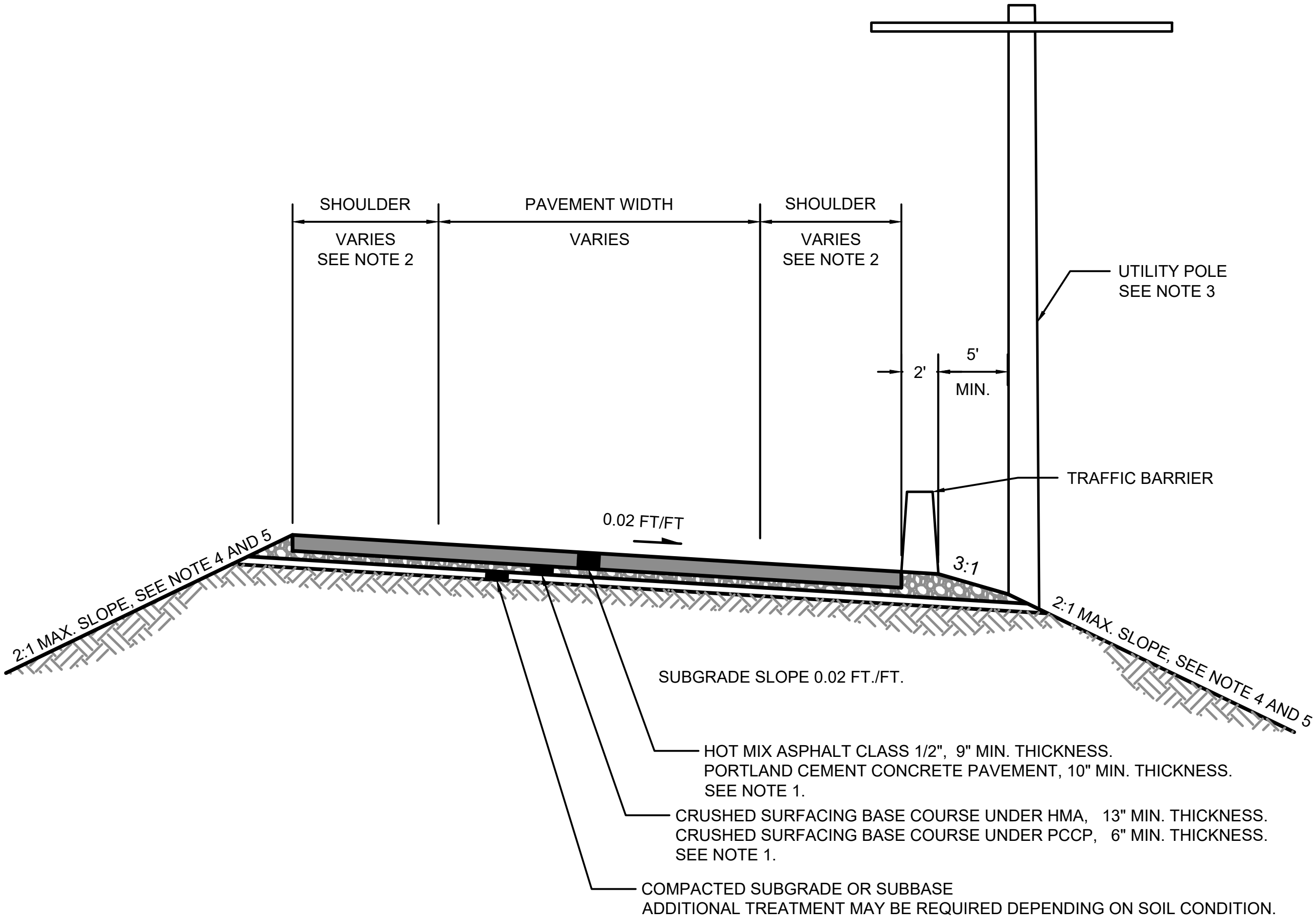


** TYPE I PAVEMENT REINFORCING PER STANDARD DETAIL NO. 809
** TYPE II PAVEMENT REINFORCING PER STANDARD DETAIL NO. 111

NOTE: USE OF THIS DETAIL IS ONLY ALLOWED WHEN IDEAL PLACEMENT OF STRUCTURE SHOWN IN DETAIL 1 IS NOT POSSIBLE.

DETAIL 2 / –
ALTERNATE JOINT LAYOUT AROUND STRUCTURE
IN CONCRETE PAVEMENT
SCALE: NTS

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	TYPICAL CONCRETE JOINT LAYOUTS
F&I CIVIL STANDARDS	REVISION DATE: DEC. 2022	STANDARD DETAIL NO. **810**



DETAIL 1/900

TYPICAL LIMITED-ACCESS PRINCIPAL ARTERIAL SECTION
SCALE: NTS

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL HOT MIX ASPHALT OR PORTLAND CEMENT CONCRETE PAVEMENT FOR LIMITED - ACCESS PRINCIPAL ARTERIAL SECTION. SEE SECTION 321000 1.01A FOR ADDITIONAL REQUIREMENTS.
2. SHOULDER SLOPE SHALL MATCH CROWN SLOPE OR 0.02 FT./FT. IF PAVED.
3. SEE SECTION 321000 1.01C FOR CLEARANCE REQUIREMENT OF UTILITY POLES.
4. DITCH SECTIONS AND/OR LOCATIONS MAY VARY TO MEET REQUIREMENTS OF THE SURFACE WATER DESIGN MANUAL IF NEEDED.
5. SEE SECTION 321000 1.01B FOR SIDE SLOPE REQUIREMENTS.
6. MINIMUM PAVEMENT SECTION THICKNESS SHOWN IN THIS STANDARD DETAIL ARE THE MINIMUM ACCEPTABLE PAVEMENT SECTION THICKNESS FOR THE CUSTOM DESIGN.

STANDARD DESIGN PARAMETER FOR HMA

DESIGN ESAL:	14,400,000
RELIABILITY, R%:	95%
DEVIATION, So:	0.45
INITIAL SERVICEABILITY, Po:	4.2
TERMINAL SERVICEABILITY, Pt:	3
SERVICEABILITY INDEX, PSI:	1.2
ASSUMED SUBGRADE MODULUS, Mr:	10,000
ASSUMED CSBC MODULUS, Mr:	25,000
DESIGN SN:	5.6

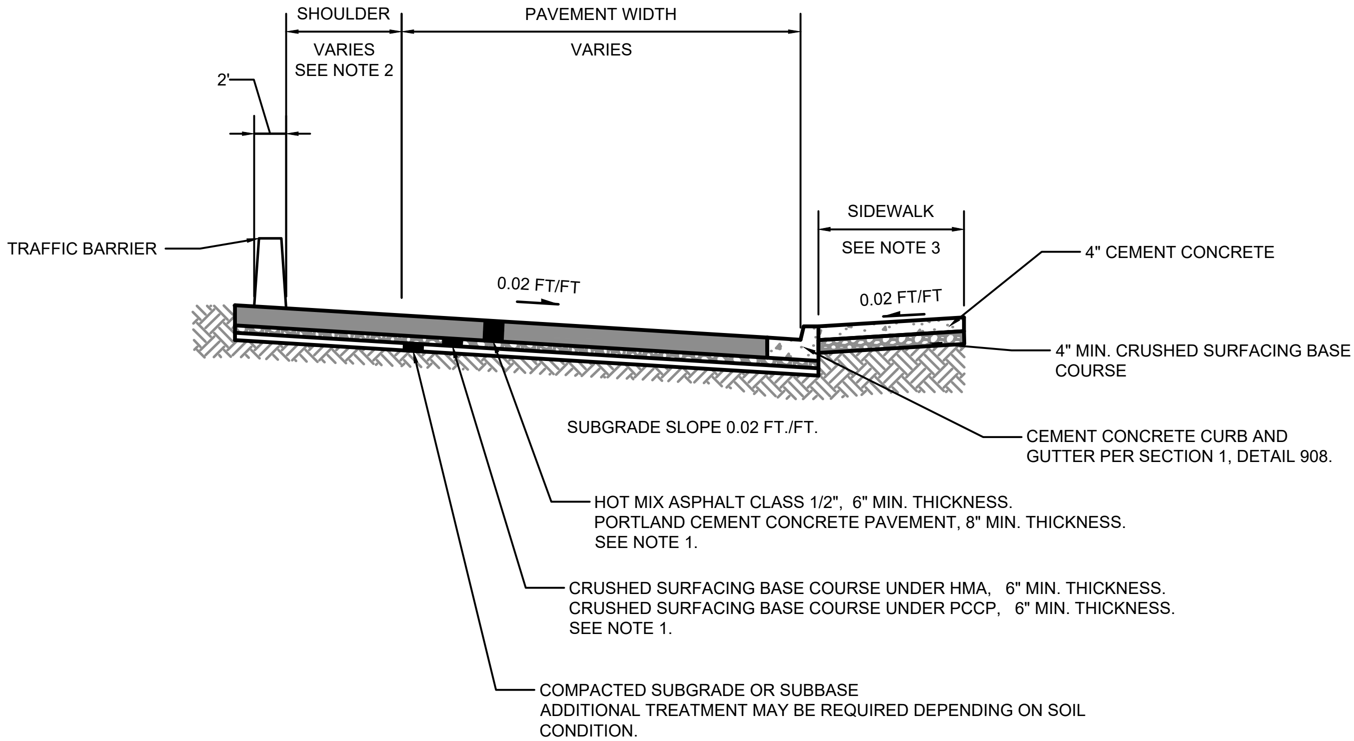
STANDARD DESIGN PARAMETER FOR PCCP

DESIGN ESAL:	14,400,000
RELIABILITY, R%:	95%
DEVIATION, So:	0.35
INITIAL SERVICEABILITY, Po:	4.5
TERMINAL SERVICEABILITY, Pt:	3
SERVICEABILITY INDEX, PSI:	1.5
ASSUMED ELASTIC MODULUS, Ec (psi):	4,000,000
MODULUS OF RUPTURE, Sc (psi):	700
LOAD TRANSFER COEFFICIENT, J:	3.2
MODULUS OF SUBGRADE REACTION , K (pci):	300

STANDARD DESIGN PARAMETER NOTE

1. RELIABILITY PER URBAN FUNCTIONAL CLASSIFICATION FROM AASHTO, 1993 TABLE 2.2
2. DEVIATION IS PER MIDDLE RANGE OF SUGGESTED FLEXIBLE AND RIGID PAVEMENT VALUES PROVIDED BY AASHTO, 1993
3. TERMINAL SERVICEABILITY PER FUNCTIONAL CLASSIFICATION AND AASHTO, 1993 GUIDELINES
4. ASSUMED SUBGRADE MODULUS PER WSDOT GUIDANCE IN ESTABLISHING A UNIFORM POLICY FOR SELECTING PAVEMENT TYPE, 2021
5. CSBC PER TEST DATA FROM KENTUCKY TRANSPORTATION CENTER, RESILIENT MODULUS OF COMPACTED CRUSHED STONE AGGREATE BASES, 2007
6. MODULUS OF SUBGRADE REACTION PER ASSUMING SILTY SAND SUBGRADE AND FOLLOWING RECOMMENDATIONS FROM SUPPLEMENTAL VERSION OF AASHTO GUIDE, PART II, TABLE 11
7. GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE ACTUAL SOIL CONDITIONS ARE EQUAL TO OR BETTER THAN MR = 10,000 TO USE STANDARD SECTIONS.
8. CUSTOM PAVEMENT SECTION DESIGN SHALL BE PREPARED BY A LICENSED PROFESSIONAL CIVIL OR GEOTECHNICAL ENGINEER REGISTERED IN STATE OF WASHINGTON FOR POOR SUBGRADE OR THE AREA WITH DESIGN ESALS VALUE THAT IS DIFFERENT FROM EXPECTED VALUE.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE DATE: JAN. 2024	TYPICAL LIMITED ACCESS PRINCIPAL ARTERIAL SECTION STANDARD DETAIL NO. 900



DETAIL 1/901

TYPICAL TERMINAL FRONTAGE SECTION
SCALE: NTS

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL HOT MIX ASPHALT OR PORTLAND CEMENT CONCRETE PAVEMENT FOR TERMINAL FRONTAGE ROAD SECTION. SEE SECTION 321000 1.01A FOR ADDITIONAL REQUIREMENTS.
2. SHOULDER SLOPE SHALL MATCH CROWN SLOPE OR 0.02 FT./FT. IF PAVED.
3. SIDEWALKS SHALL BE 8' MIN. WIDE AND SHALL BE WIDE ENOUGH TO ACCOMMODATE TWO-WAY PEDESTRIAN FLOW WITH ROLLER BAG . SEE SECTION 321623 AND STANDARD DETAIL 907A AND 907B FOR ADDITIONAL SIDEWALK REQUIREMENTS.
4. MINIMUM PAVEMENT SECTION THICKNESS SHOWN IN THIS STANDARD DETAIL ARE THE MINIMUM ACCEPTABLE PAVEMENT SECTION THICKNESS FOR THE CUSTOM DESIGN.

STANDARD DESIGN PARAMETER FOR HMA

DESIGN ESAL:	1,000,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.45
INITIAL SERVICEABILITY, Po:	4.2
TERMINAL SERVICEABILITY, Pt:	2.5
SERVICEABILITY INDEX, PSI:	1.7
ASSUMED SUBGRADE MODULUS, Mr:	10,000
ASSUMED CSBC MODULUS, Mr:	25,000
DESIGN SN:	3.2

STANDARD DESIGN PARAMETER FOR PCCP

DESIGN ESAL:	1,000,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.35
INITIAL SERVICEABILITY, Po:	4.5
TERMINAL SERVICEABILITY, Pt:	2.5
SERVICEABILITY INDEX, PSI:	2.0
ASSUMED ELASTIC MODULUS, Ec (psi):	4,000,000
MODULUS OF RUPTURE, Sc (psi):	700
LOAD TRANSFER COEFFICIENT, J:	3.2
MODULUS OF SUBGRADE REACTION , K (pci):	300

STANDARD DESIGN PARAMETER NOTE

1. RELIABILITY PER URBAN FUNCTIONAL CLASSIFICATION FROM AASHTO, 1993 TABLE 2.2
2. DEVIATION IS PER MIDDLE RANGE OF SUGGESTED FLEXIBLE AND RIGID PAVEMENT VALUES PROVIDED BY AASHTO, 1993
3. TERMINAL SERVICEABILITY PER FUNCTIONAL CLASSIFICATION AND AASHTO, 1993 GUIDELINES
4. ASSUMED SUBGRADE MODULUS PER WSDOT GUIDANCE IN ESTABLISHING A UNIFORM POLICY FOR SELECTING PAVEMENT TYPE, 2021
5. CSBC PER TEST DATA FROM KENTUCKY TRANSPORTATION CENTER, RESILIENT MODULUS OF COMPACTED CRUSHED STONE AGGREATE BASES, 2007
6. MODULUS OF SUBGRADE REACTION PER ASSUMING SILTY SAND SUBGRADE AND FOLLOWING RECOMMENDATIONS FROM SUPPLEMENTAL VERSION OF AASHTO GUIDE, PART II, TABLE 11
7. GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE ACTUAL SOIL CONDITIONS ARE EQUAL TO OR BETTER THAN MR = 10,000 TO USE STANDARD SECTIONS.
8. CUSTOM PAVEMENT SECTION DESIGN SHALL BE PREPARED BY A LICENSED PROFESSIONAL CIVIL OR GEOTECHNICAL ENGINEER REGISTERED IN STATE OF WASHINGTON FOR POOR SUBGRADE OR HIGHER THAN EXPECTED ESALS.

SEA Seattle-Tacoma International Airport

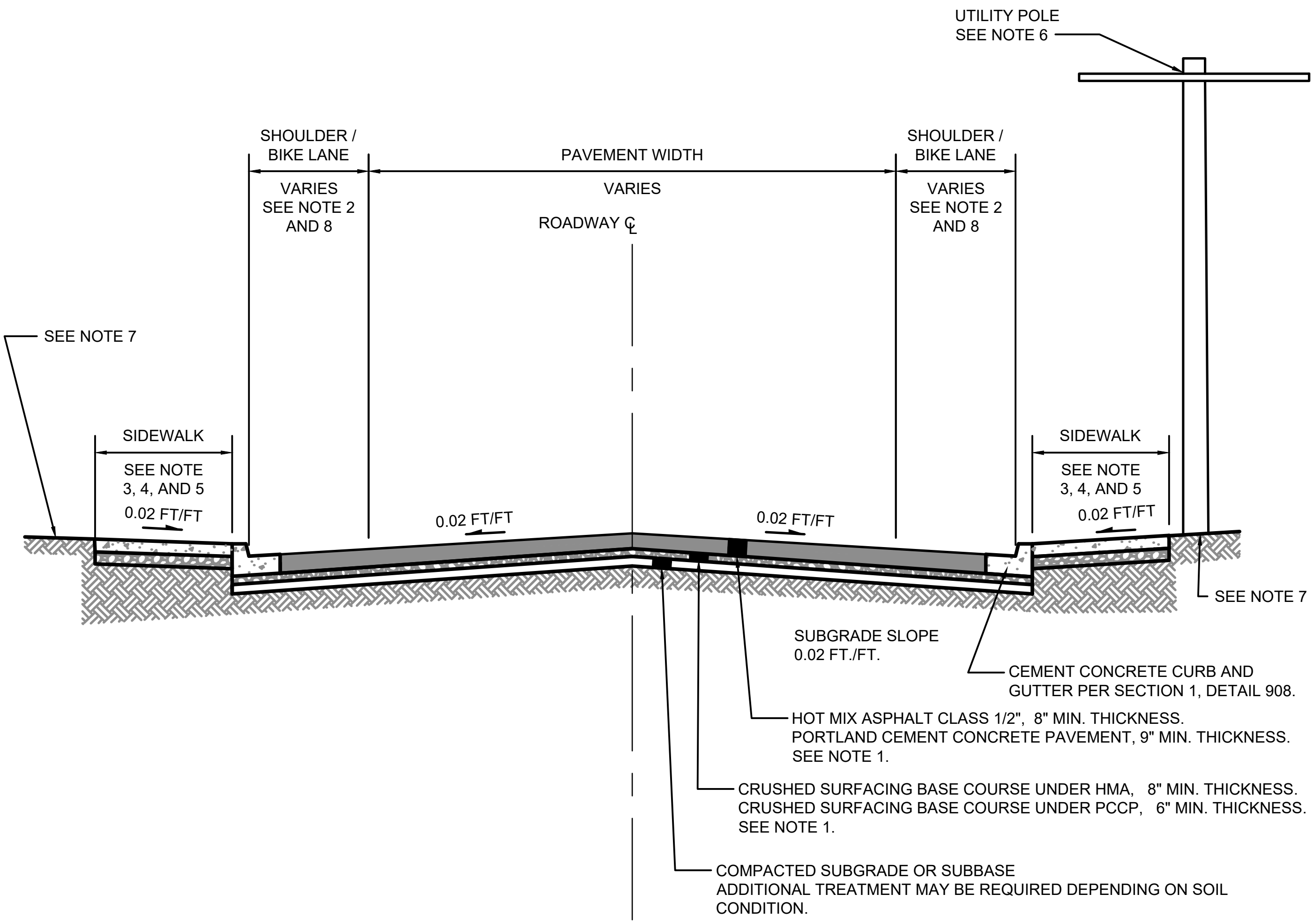
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

DATE: JAN. 2024

TYPICAL TERMINAL FRONTAGE SECTION

STANDARD DETAIL NO. 901



DETAIL 1/902

TYPICAL MINOR ARTERIAL SECTION
SCALE: NTS

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL HOT MIX ASPHALT OR PORTLAND CEMENT CONCRETE PAVEMENT FOR MINOR ARTERIAL SECTION. SEE SECTION 321000 1.01A FOR ADDITIONAL REQUIREMENTS.
2. SHOULDER SLOPE SHALL MATCH CROWN SLOPE OR 0.02 FT./FT. IF PAVED.
3. SIDEWALK OR SHARED USE PATH MAY BE REQUIRE WITH OR WITHOUT LANDSCAPE BUFFER FROM BACK OF CURB.
4. SIDEWALKS SHALL BE 6' MIN. SEE SECTION 321623 AND STANDARD DETAIL 907A AND 907B FOR ADDITIONAL SIDEWALK AND SIDEWALK BUFFER REQUIREMENTS.
5. SHARED USE PATH SHALL BE 10' MIN. SEE SECTION 321000 1.01 E FOR ADDITIONAL SHARE USE PATH REQUIREMENTS.
6. SEE SECTION 321000 1.01C FOR CLEARANCE REQUIREMENT OF UTILITY POLES.
7. SEE SECTION 321000 1.01B FOR SIDE SLOPE REQUIREMENTS.
8. SEE SECTION 321000 1.01E FOR BIKE LANE REQUIREMENTS.
9. MINIMUM PAVEMENT SECTION THICKNESS SHOWN IN THIS STANDARD DETAIL ARE THE MINIMUM ACCEPTABLE PAVEMENT SECTION THICKNESS FOR THE CUSTOM DESIGN.

STANDARD DESIGN PARAMETER FOR HMA

DESIGN ESAL:	6,000,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.45
INITIAL SERVICEABILITY, Po:	4.2
TERMINAL SERVICEABILITY, Pt:	2.7
SERVICEABILITY INDEX, PSI:	1.5
ASSUMED SUBGRADE MODULUS, Mr:	10,000
ASSUMED CSBC MODULUS, Mr:	25,000
DESIGN SN:	4.3

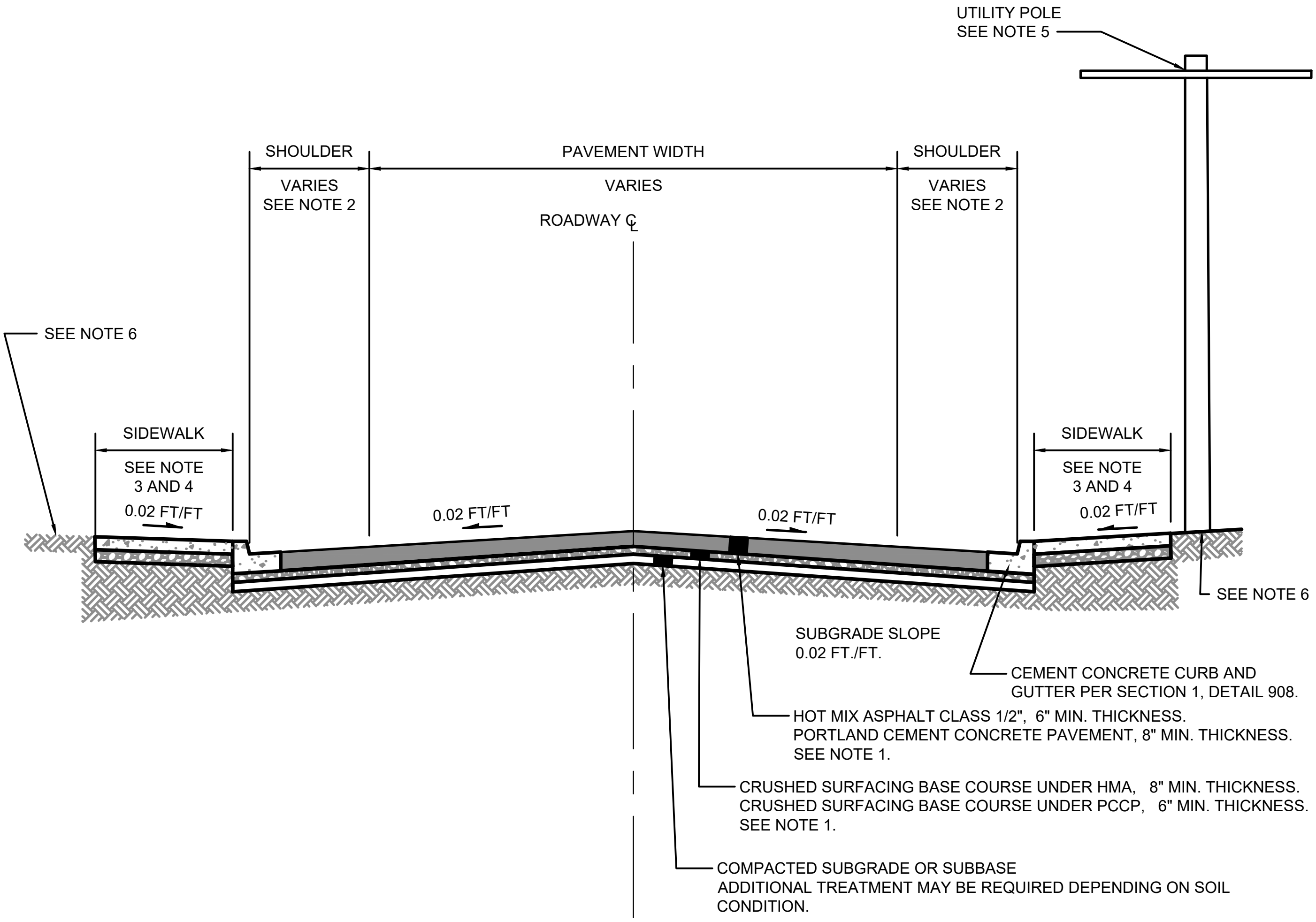
STANDARD DESIGN PARAMETER FOR PCCP

DESIGN ESAL:	6,000,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.35
INITIAL SERVICEABILITY, Po:	4.5
TERMINAL SERVICEABILITY, Pt:	2.7
SERVICEABILITY INDEX, PSI:	1.8
ASSUMED ELASTIC MODULUS, Ec (psi):	4,000,000
MODULUS OF RUPTURE, Sc (psi):	700
LOAD TRANSFER COEFFICIENT, J:	3.2
MODULUS OF SUBGRADE REACTION , K (pci):	300

STANDARD DESIGN PARAMETER NOTE

1. RELIABILITY PER URBAN FUNCTIONAL CLASSIFICATION FROM AASHTO, 1993 TABLE 2.2
2. DEVIATION IS PER MIDDLE RANGE OF SUGGESTED FLEXIBLE AND RIGID PAVEMENT VALUES PROVIDED BY AASHTO, 1993
3. TERMINAL SERVICEABILITY PER FUNCTIONAL CLASSIFICATION AND AASHTO, 1993 GUIDELINES
4. ASSUMED SUBGRADE MODULUS PER WSDOT GUIDANCE IN ESTABLISHING A UNIFORM POLICY FOR SELECTING PAVEMENT TYPE, 2021
5. CSBC PER TEST DATA FROM KENTUCKY TRANSPORTATION CENTER, RESILIENT MODULUS OF COMPACTED CRUSHED STONE AGGREATE BASES, 2007
6. MODULUS OF SUBGRADE REACTION PER ASSUMING SILTY SAND SUBGRADE AND FOLLOWING RECOMMENDATIONS FROM SUPPLEMENTAL VERSION OF AASHTO GUIDE, PART II, TABLE 11
7. GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE ACTUAL SOIL CONDITIONS ARE EQUAL TO OR BETTER THAN MR = 10,000 TO USE STANDARD SECTIONS.
8. CUSTOM PAVEMENT SECTION DESIGN SHALL BE PREPARED BY A LICENSED PROFESSIONAL CIVIL OR GEOTECHNICAL ENGINEER REGISTERED IN STATE OF WASHINGTON FOR POOR SUBGRADE OR HIGHER THAN EXPECTED ESALS.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE	TYPICAL MINOR ARTERIAL SECTION
	DATE: JAN. 2024	STANDARD DETAIL NO. 902



DETAIL

TYPICAL COLLECTOR ARTERIAL SECTION
ARTERIAL SECTION

1
903

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL HOT MIX ASPHALT OR PORTLAND CEMENT CONCRETE PAVEMENT FOR COLLECTOR ARTERIAL SECTION. SEE SECTION 321000 1.01A FOR ADDITIONAL REQUIREMENTS.
2. SHOULDER SLOPE SHALL MATCH CROWN SLOPE OR 0.02 FT./FT. IF PAVED.
3. SIDEWALK MAY BE REQUIRE WITH OR WITHOUT LANDSCAPE BUFFER FROM BACK OF CURB.
4. SIDEWALKS SHALL BE 6' MIN. SEE SECTION 321623 AND STANDARD DETAIL 907A AND 907B FOR ADDITIONAL SIDEWALK AND SIDEWALK BUFFER REQUIREMENTS.
5. SEE SECTION 321000 1.01C FOR CLEARANCE REQUIREMENT OF UTILITY POLES.
6. SEE SECTION 321000 1.01B FOR SIDE SLOPE REQUIREMENTS.
7. MINIMUM PAVEMENT SECTION THICKNESS SHOWN IN THIS STANDARD DETAIL ARE THE MINIMUM ACCEPTABLE PAVEMENT SECTION THICKNESS FOR THE CUSTOM DESIGN.

STANDARD DESIGN PARAMETER FOR HMA

DESIGN ESAL:	1,500,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.45
INITIAL SERVICEABILITY, Po:	4.2
TERMINAL SERVICEABILITY, Pt:	2.5
SERVICEABILITY INDEX, PSI:	1.7
ASSUMED SUBGRADE MODULUS, Mr:	10,000
ASSUMED CSBC MODULUS, Mr:	25,000
DESIGN SN:	3.4

STANDARD DESIGN PARAMETER FOR PCCP

DESIGN ESAL:	1,500,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.35
INITIAL SERVICEABILITY, Po:	4.5
TERMINAL SERVICEABILITY, Pt:	2.5
SERVICEABILITY INDEX, PSI:	2.0
ASSUMED ELASTIC MODULUS, Ec (psi):	4,000,000
MODULUS OF RUPTURE, Sc (psi):	700
LOAD TRANSFER COEFFICIENT, J:	3.2
MODULUS OF SUBGRADE REACTION , K (pci):	300

STANDARD DESIGN PARAMETER NOTE

1. RELIABILITY PER URBAN FUNCTIONAL CLASSIFICATION FROM AASHTO, 1993 TABLE 2.2
2. DEVIATION IS PER MIDDLE RANGE OF SUGGESTED FLEXIBLE AND RIGID PAVEMENT VALUES PROVIDED BY AASHTO, 1993
3. TERMINAL SERVICEABILITY PER FUNCTIONAL CLASSIFICATION AND AASHTO, 1993 GUIDELINES
4. ASSUMED SUBGRADE MODULUS PER WSDOT GUIDANCE IN ESTABLISHING A UNIFORM POLICY FOR SELECTING PAVEMENT TYPE, 2021
5. CSBC PER TEST DATA FROM KENTUCKY TRANSPORTATION CENTER, RESILIENT MODULUS OF COMPACTED CRUSHED STONE AGGREATE BASES, 2007
6. MODULUS OF SUBGRADE REACTION PER ASSUMING SILTY SAND SUBGRADE AND FOLLOWING RECOMMENDATIONS FROM SUPPLEMENTAL VERSION OF AASHTO GUIDE, PART II, TABLE 11
7. GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE ACTUAL SOIL CONDITIONS ARE EQUAL TO OR BETTER THAN MR = 10,000 TO USE STANDARD SECTIONS.
8. CUSTOM PAVEMENT SECTION DESIGN SHALL BE PREPARED BY A LICENSED PROFESSIONAL CIVIL OR GEOTECHNICAL ENGINEER REGISTERED IN STATE OF WASHINGTON FOR POOR SUBGRADE OR HIGHER THAN EXPECTED ESALS.

SEA Seattle-Tacoma International Airport

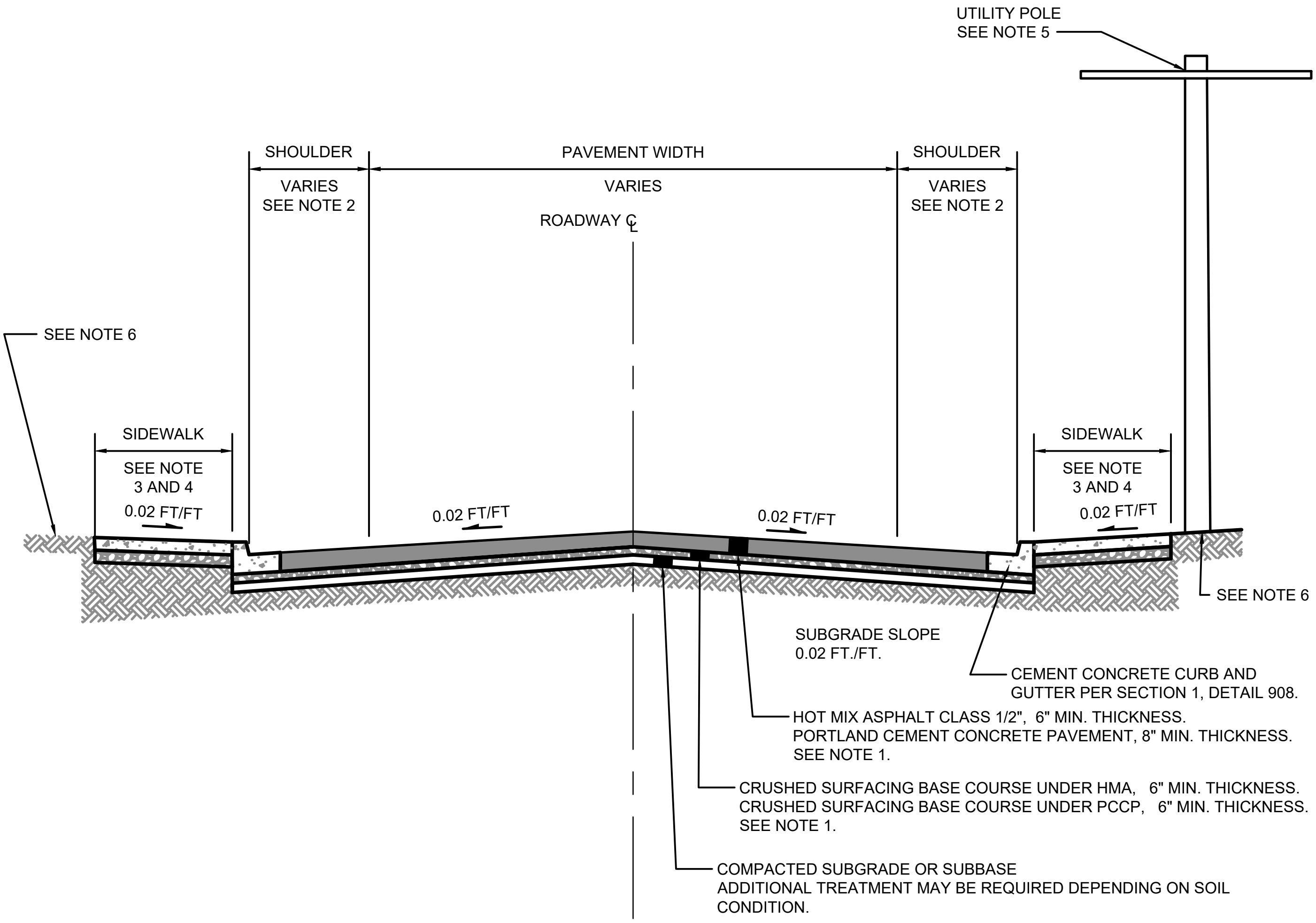
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

DATE: JAN. 2024

TYPICAL COLLECTOR ARTERIAL SECTION

STANDARD DETAIL NO. 903



DETAIL 1/904

TYPICAL INDUSTRIAL ACCESS SECTION
SCALE: NTS

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL HOT MIX ASPHALT OR PORTLAND CEMENT CONCRETE PAVEMENT FOR INDUSTRIAL ACCESS SECTION. SEE SECTION 321000 1.01A FOR ADDITIONAL REQUIREMENTS.
2. SHOULDER SLOPE SHALL MATCH CROWN SLOPE OR 0.02 FT./FT. IF PAVED.
3. SIDEWALK MAY BE REQUIRE WITH OR WITHOUT LANDSCAPE BUFFER FROM BACK OF CURB.
4. SIDEWALKS SHALL BE 6' MIN. SEE SECTION 321623 AND STANDARD DETAIL 907A AND 907B FOR ADDITIONAL SIDEWALK AND SIDEWALK BUFFER REQUIREMENTS.
5. SEE SECTION 321000 1.01C FOR CLEARANCE REQUIREMENT OF UTILITY POLES.
6. SEE SECTION 321000 1.01B FOR SIDE SLOPE REQUIREMENTS.
7. MINIMUM PAVEMENT SECTION THICKNESS SHOWN IN THIS STANDARD DETAIL ARE THE MINIMUM ACCEPTABLE PAVEMENT SECTION THICKNESS FOR THE CUSTOM DESIGN.

STANDARD DESIGN PARAMETER FOR HMA

DESIGN ESAL:	1,000,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.45
INITIAL SERVICEABILITY, Po:	4.2
TERMINAL SERVICEABILITY, Pt:	2.5
SERVICEABILITY INDEX, PSI:	1.7
ASSUMED SUBGRADE MODULUS, Mr:	10,000
ASSUMED CSBC MODULUS, Mr:	25,000
DESIGN SN:	3.2

STANDARD DESIGN PARAMETER FOR PCCP

DESIGN ESAL:	1,000,000
RELIABILITY, R%:	90%
DEVIATION, So:	0.35
INITIAL SERVICEABILITY, Po:	4.5
TERMINAL SERVICEABILITY, Pt:	2.5
SERVICEABILITY INDEX, PSI:	2.0
ASSUMED ELASTIC MODULUS, Ec (psi):	4,000,000
MODULUS OF RUPTURE, Sc (psi):	700
LOAD TRANSFER COEFFICIENT, J:	3.2
MODULUS OF SUBGRADE REACTION , K (pci):	300

STANDARD DESIGN PARAMETER NOTE

1. RELIABILITY PER URBAN FUNCTIONAL CLASSIFICATION FROM AASHTO, 1993 TABLE 2.2
2. DEVIATION IS PER MIDDLE RANGE OF SUGGESTED FLEXIBLE AND RIGID PAVEMENT VALUES PROVIDED BY AASHTO, 1993
3. TERMINAL SERVICEABILITY PER FUNCTIONAL CLASSIFICATION AND AASHTO, 1993 GUIDELINES
4. ASSUMED SUBGRADE MODULUS PER WSDOT GUIDANCE IN ESTABLISHING A UNIFORM POLICY FOR SELECTING PAVEMENT TYPE, 2021
5. CSBC PER TEST DATA FROM KENTUCKY TRANSPORTATION CENTER, RESILIENT MODULUS OF COMPACTED CRUSHED STONE AGGREATE BASES, 2007
6. MODULUS OF SUBGRADE REACTION PER ASSUMING SILTY SAND SUBGRADE AND FOLLOWING RECOMMENDATIONS FROM SUPPLEMENTAL VERSION OF AASHTO GUIDE, PART II, TABLE 11
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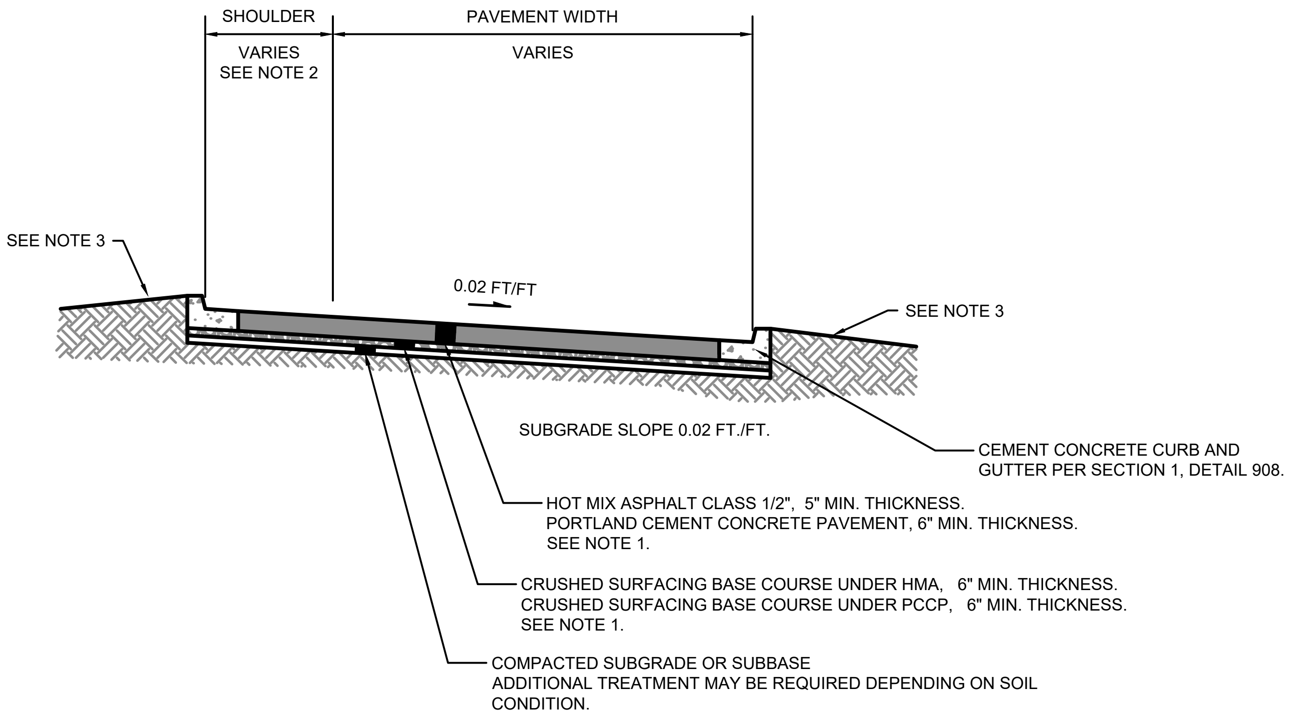
8. CUSTOM PAVEMENT SECTION DESIGN SHALL BE PREPARED BY A LICENSED PROFESSIONAL CIVIL OR GEOTECHNICAL ENGINEER REGISTERED IN STATE OF WASHINGTON FOR POOR SUBGRADE OR HIGHER THAN EXPECTED ESALS.



DETAIL 1/905

TYPICAL PARKING ACCESS SECTION
SCALE: NTS

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL HOT MIX ASPHALT OR PORTLAND CEMENT CONCRETE PAVEMENT FOR PARKING ACCESS SECTION. SEE SECTION 321000 1.01A FOR ADDITIONAL REQUIREMENTS.
2. SHOULDER SLOPE SHALL MATCH CROWN SLOPE OR 0.02 FT./FT. IF PAVED.
3. SEE SECTION 321000 1.01B FOR SIDE SLOPE REQUIREMENTS.
4. MINIMUM PAVEMENT SECTION THICKNESS SHOWN IN THIS STANDARD DETAIL ARE THE MINIMUM ACCEPTABLE PAVEMENT SECTION THICKNESS FOR THE CUSTOM DESIGN.

STANDARD DESIGN PARAMETER FOR HMA

DESIGN ESAL:	<1,000,000
RELIABILITY, R%:	80%
DEVIATION, So:	0.45
INITIAL SERVICEABILITY, Po:	4.2
TERMINAL SERVICEABILITY, Pt:	2.0
SERVICEABILITY INDEX, PSI:	2.2
ASSUMED SUBGRADE MODULUS, Mr:	10,000
ASSUMED CSBC MODULUS, Mr:	25,000
DESIGN SN:	2.9

STANDARD DESIGN PARAMETER FOR PCCP

DESIGN ESAL:	<1,000,000
RELIABILITY, R%:	80%
DEVIATION, So:	0.35
INITIAL SERVICEABILITY, Po:	4.5
TERMINAL SERVICEABILITY, Pt:	2.0
SERVICEABILITY INDEX, PSI:	2.5
ASSUMED ELASTIC MODULUS, Ec (psi):	4,000,000
MODULUS OF RUPTURE, Sc (psi):	700
LOAD TRANSFER COEFFICIENT, J:	3.2
MODULUS OF SUBGRADE REACTION , K (pci):	300

STANDARD DESIGN PARAMETER NOTE

1. RELIABILITY PER URBAN FUNCTIONAL CLASSIFICATION FROM AASHTO, 1993 TABLE 2.2
2. DEVIATION IS PER MIDDLE RANGE OF SUGGESTED FLEXIBLE AND RIGID PAVEMENT VALUES PROVIDED BY AASHTO, 1993
3. TERMINAL SERVICEABILITY PER FUNCTIONAL CLASSIFICATION AND AASHTO, 1993 GUIDELINES
4. ASSUMED SUBGRADE MODULUS PER WSDOT GUIDANCE IN ESTABLISHING A UNIFORM POLICY FOR SELECTING PAVEMENT TYPE, 2021
5. CSBC PER TEST DATA FROM KENTUCKY TRANSPORTATION CENTER, RESILIENT MODULUS OF COMPACTED CRUSHED STONE AGGREATE BASES, 2007
6. MODULUS OF SUBGRADE REACTION PER ASSUMING SILTY SAND SUBGRADE AND FOLLOWING RECOMMENDATIONS FROM SUPPLEMENTAL VERSION OF AASHTO GUIDE, PART II, TABLE 11
7. GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE ACTUAL SOIL CONDITIONS ARE EQUAL TO OR BETTER THAN MR = 10,000 TO USE STANDARD SECTIONS.
8. CUSTOM PAVEMENT SECTION DESIGN SHALL BE PREPARED BY A LICENSED PROFESSIONAL CIVIL OR GEOTECHNICAL ENGINEER REGISTERED IN STATE OF WASHINGTON FOR POOR SUBGRADE OR HIGHER THAN EXPECTED ESALS.

SEA Seattle-Tacoma International Airport

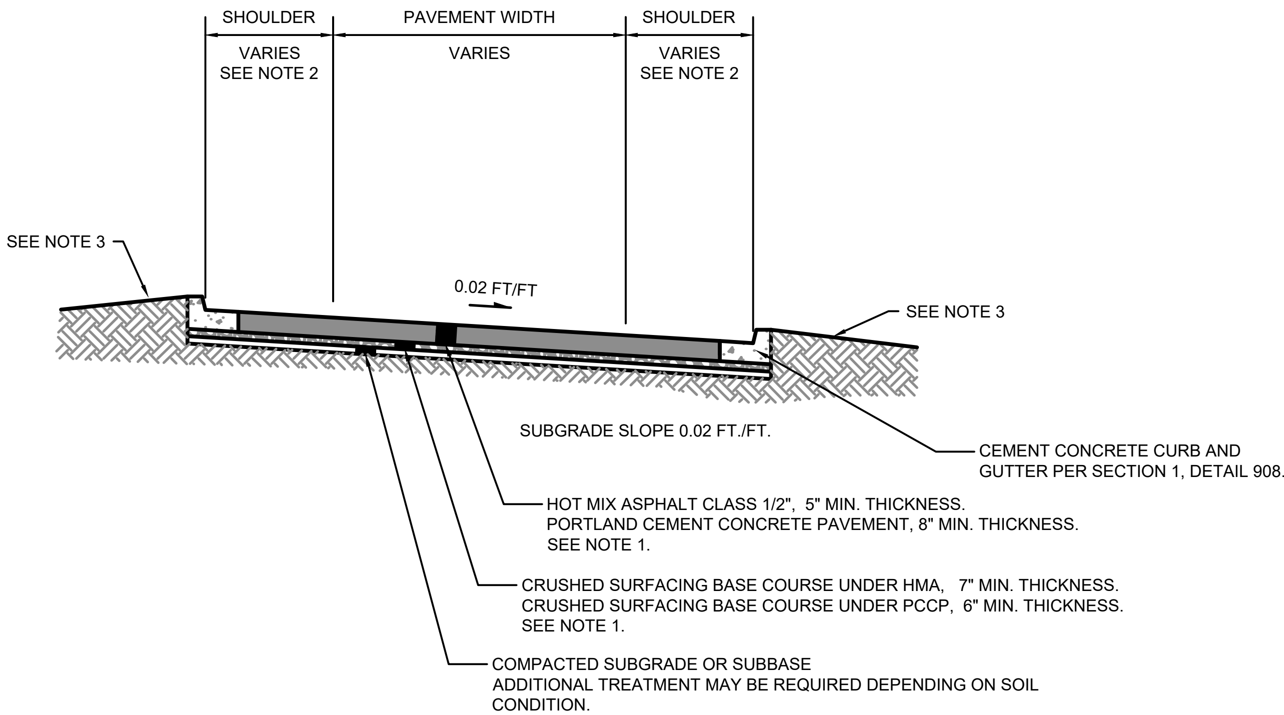
F&I CIVIL STANDARDS

SCALE: NOT TO SCALE

DATE: JAN. 2024

TYPICAL PARKING ACCESS SECTION

STANDARD DETAIL NO. 905



DETAIL

1
906

TYPICAL RESTRICTED VEHICLE SERVICE ROAD SECTION
SCALE: NTS

NOTES:

1. THIS DRAWING ILLUSTRATES A TYPICAL HOT MIX ASPHALT OR PORTLAND CEMENT CONCRETE PAVEMENT FOR RESTRICTED VEHICLE SERVICE ROAD SECTION. SEE SECTION 321000 1.01A FOR ADDITIONAL REQUIREMENTS.

2. SHOULDER SLOPE SHALL MATCH CROWN SLOPE OR 0.02 FT./FT. IF PAVED.

3. SEE SECTION 321000 1.01B FOR SIDE SLOPE REQUIREMENTS.

4. MINIMUM PAVEMENT SECTION THICKNESS SHOWN IN THIS STANDARD DETAIL ARE THE MINIMUM ACCEPTABLE PAVEMENT SECTION THICKNESS FOR THE CUSTOM DESIGN.

STANDARD DESIGN PARAMETER FOR HMA

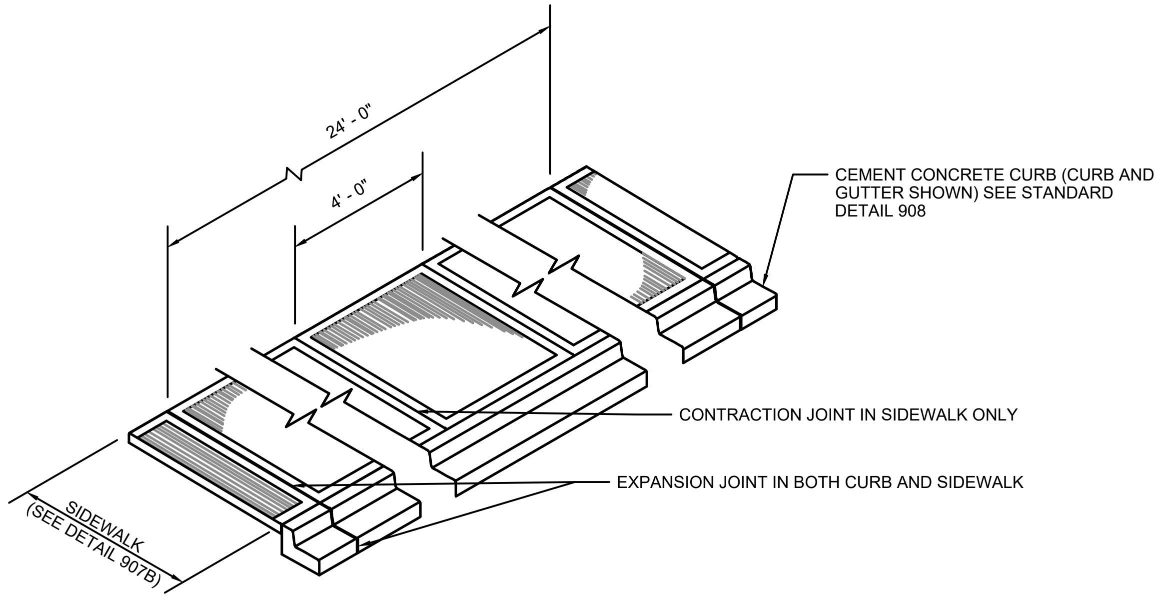
DESIGN ESAL:	1,000,000
RELIABILITY, R%:	85%
DEVIATION, So:	0.45
INITIAL SERVICEABILITY, Po:	4.2
TERMINAL SERVICEABILITY, Pt:	2.3
SERVICEABILITY INDEX, PSI:	1.9
ASSUMED SUBGRADE MODULUS, Mr:	10,000
ASSUMED CSBC MODULUS, Mr:	25,000
DESIGN SN:	3.0

STANDARD DESIGN PARAMETER FOR PCCP

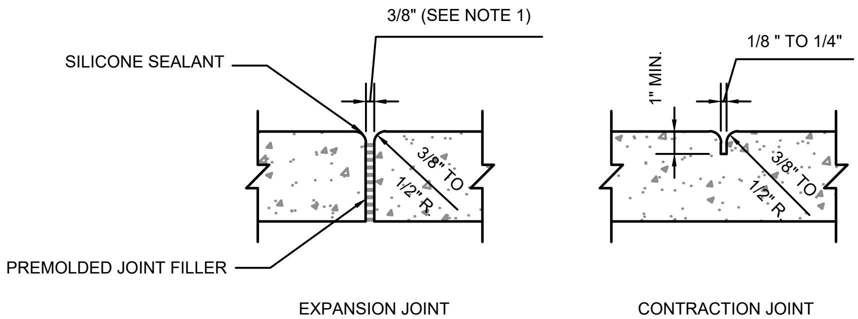
DESIGN ESAL:	1,000,000
RELIABILITY, R%:	85%
DEVIATION, So:	0.35
INITIAL SERVICEABILITY, Po:	4.5
TERMINAL SERVICEABILITY, Pt:	2.3
SERVICEABILITY INDEX, PSI:	2.2
ASSUMED ELASTIC MODULUS, Ec (psi):	4,000,000
MODULUS OF RUPTURE, Sc (psi):	700
LOAD TRANSFER COEFFICIENT, J:	3.2
MODULUS OF SUBGRADE REACTION , K (pci):	300

STANDARD DESIGN PARAMETER NOTE

1. RELIABILITY CHOSEN PER URBAN FUNCTIONAL CLASSIFICATION FROM AASHTO, 1993 TABLE 2.2
2. DEVIATION IS PER MIDDLE RANGE OF SUGGESTED FLEXIBLE AND RIGID PAVEMENT VALUES PROVIDED BY AASHTO, 1993
3. TERMINAL SERVICEABILITY PER FUNCTIONAL CLASSIFICATION AND AASHTO, 1993 GUIDELINES
4. ASSUMED SUBGRADE MODULUS PER WSDOT GUIDANCE IN ESTABLISHING A UNIFORM POLICY FOR SELECTING PAVEMENT TYPE, 2021
5. CSBC PER TEST DATA FROM KENTUCKY TRANSPORTATION CENTER, RESILIENT MODULUS OF COMPACTED CRUSHED STONE AGGREATE BASES, 2007
6. MODULUS OF SUBGRADE REACTION PER ASSUMING SILTY SAND SUBGRADE AND FOLLOWING RECOMMENDATIONS FROM SUPPLEMENTAL VERSION OF AASHTO GUIDE, PART II, TABLE 11
7. GEOTECHNICAL ENGINEER SHALL CONFIRM THAT THE ACTUAL SOIL CONDITIONS ARE EQUAL TO OR BETTER THAN MR = 10,000 TO USE STANDARD SECTIONS.
8. CUSTOM PAVEMENT SECTION DESIGN SHALL BE PREPARED BY A LICENSED PROFESSIONAL CIVIL OR GEOTECHNICAL ENGINEER REGISTERED IN STATE OF WASHINGTON FOR POOR SUBGRADE OR HIGHER THAN EXPECTED ESALS.



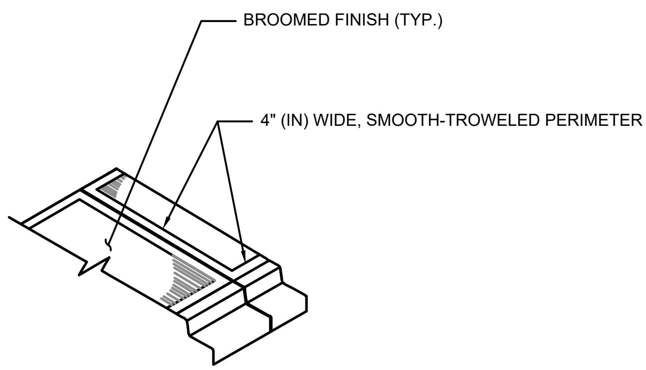
DETAIL
CEMENT CONCRETE SIDEWALK
SCALE: NTS
1
907A



DETAIL
CONCRETE JOINTS
SCALE: NTS
2
907A

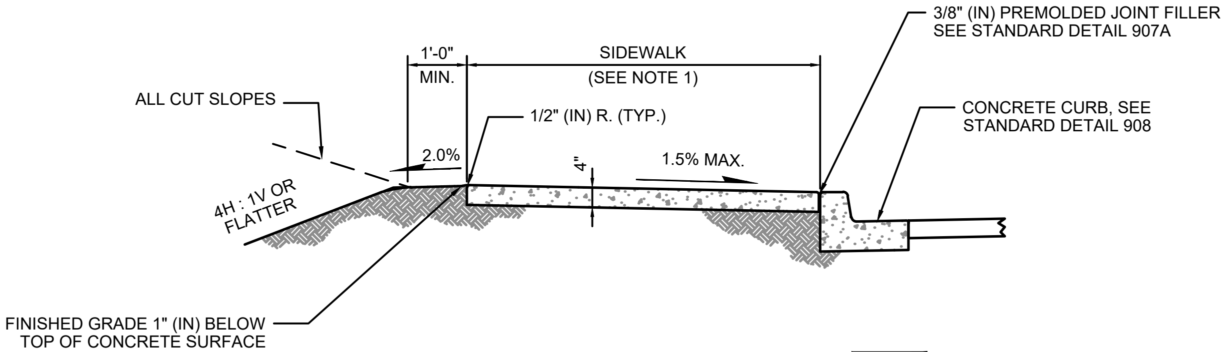
NOTES:

1. 1" EDGED GROOVE MAY REPLACE 3/8" EXPANSION JOINT AT INTERFACE BETWEEN CURB AND ADJACENT SIDEWALK FOR SEPARATE POUR CONSTRUCTION. SEE PROJECT SPECIFICATIONS FOR JOINT REQUIREMENTS.
2. GRATING, ACCESS COVERS, JUNCTION BOXES, CABLE VAULTS, PULL BOXES AND OTHER APPURTENANCES WITHIN THE SIDEWALK MUST HAVE SLIP RESISTANT SURFACES, BE FLUSH WITH SURFACE, AND MATCH GRADE OF THE SIDEWALK.
3. ALL CONCRETE SHALL BE "CLASS 4000".
4. USE OF POROUS CONCRETE SHALL REQUIRE COORDINATION AND APPROVAL FROM POS.



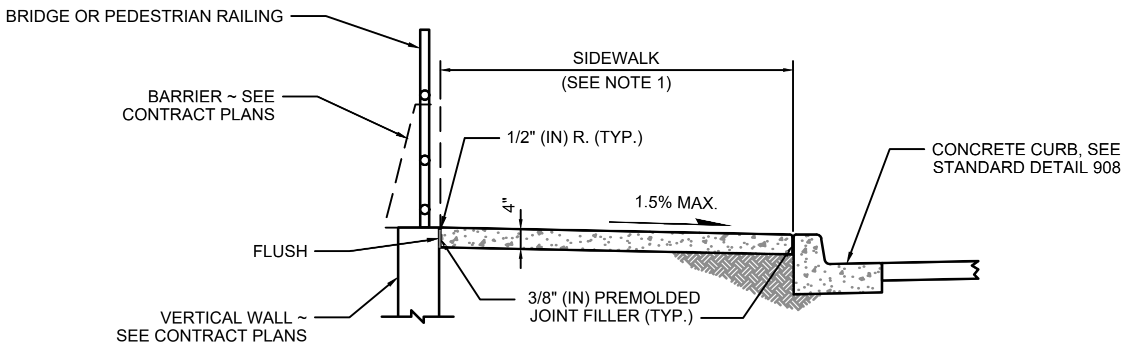
DETAIL
CONCRETE FINISH
SCALE: NTS
3
907A

SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CEMENT CONCRETE SIDEWALK
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 907A



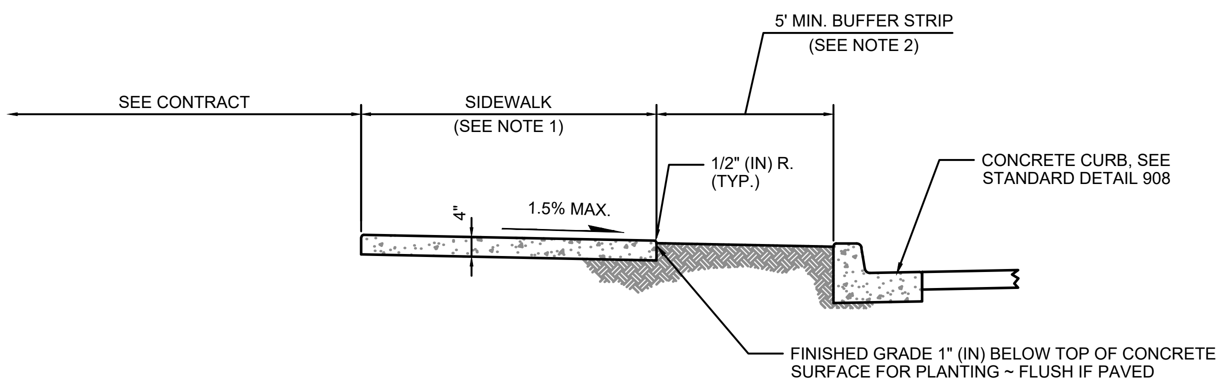
SECTION 1 / 907B

ADJACENT TO CURB
SCALE: NTS



SECTION 2 / 907B

ADJACENT TO WALL OR BARRIER
SCALE: NTS



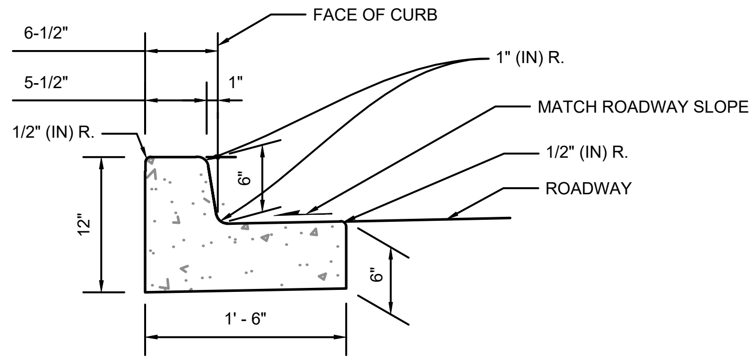
SECTION 3 / 907B

ADJACENT TO BUFFER STRIP
SCALE: NTS

NOTES:

1. STANDARD SIDEWALK MIN. WIDTH SHALL BE 6 FEET. TERMINAL FRONTAGE ROADWAY SIDEWALK (CURBSIDE) WIDTH PER F&I DIRECTIONS.
2. LANDSCAPE BUFFER WIDTH SHALL BE IN ACCORDANCE WITH POS LANDSCAPE DESIGN STANDARDS, SECTION III.

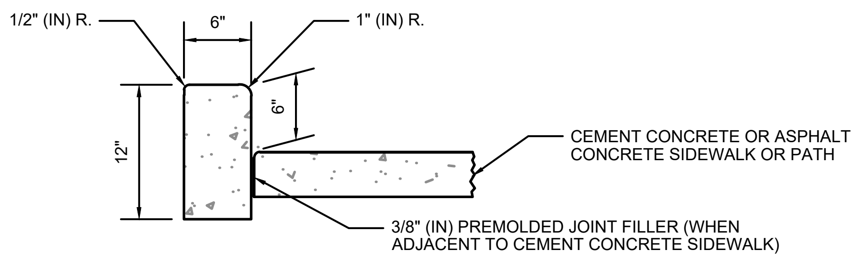
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CEMENT CONCRETE SIDEWALK
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 907B



SECTION

1	908

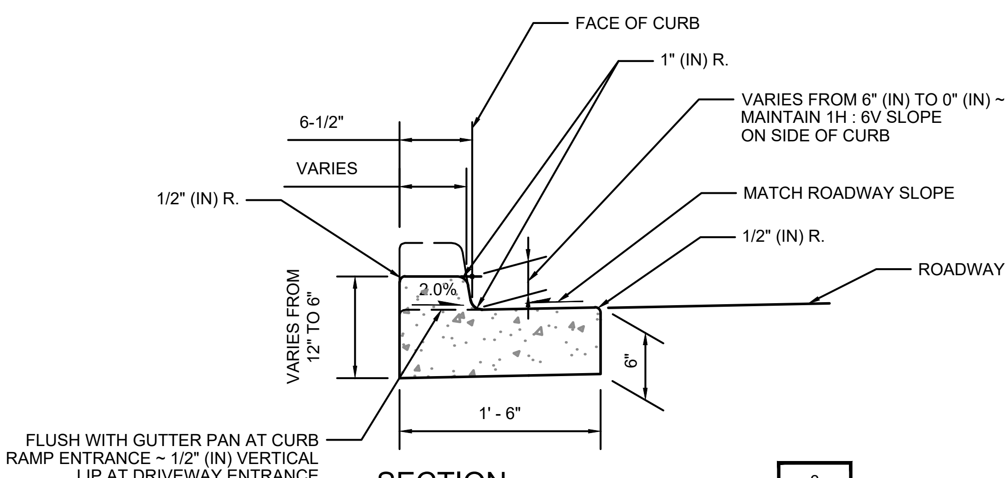
CEMENT CONCRETE TRAFFIC CURB & GUTTER
SCALE: NTS



SECTION

2	908

CEMENT CONCRETE PEDESTRIAN CURB
SCALE: NTS



SECTION

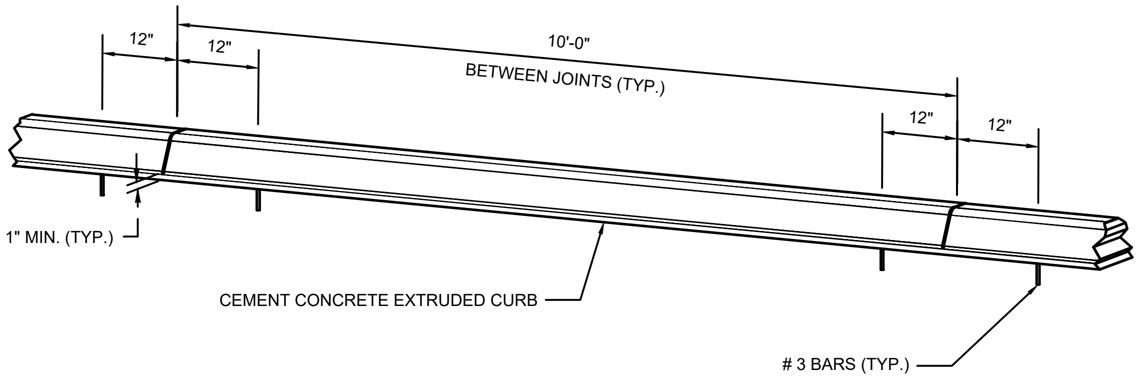
3	908

DEPRESSED CURB AND GUTTER
AT CURB RAMPS AND DRIVEWAY ENTRANCE
SCALE: NTS

NOTES:

1. SEE STANDARD SIDEWALK DETAIL 907A FOR CURB EXPANSION AND CONTRACTION JOINT SPACING. SEE SECTION 321613 FOR ADDITIONAL REQUIREMENTS.
2. CEMENT CONCRETE FOR CURB SHALL BE CLASS 4000.
3. CURB HEIGHTS SHALL BE 6" UNLESS IT IS DEPRESSED CURB AND GUTTER OR TRANSITIONING. CURB HEIGHT MAY VARY PER CONTRACT PLANS IN LIMITED CIRCUMSTANCES WITH THE APPROVAL AND ACCEPTANCE BY F&I REPRESENTATIVE, BUT SHALL NOT EXCEED 8 INCHES.

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE DATE: JAN. 2024	CONCRETE CURB STANDARD DETAIL NO. 908



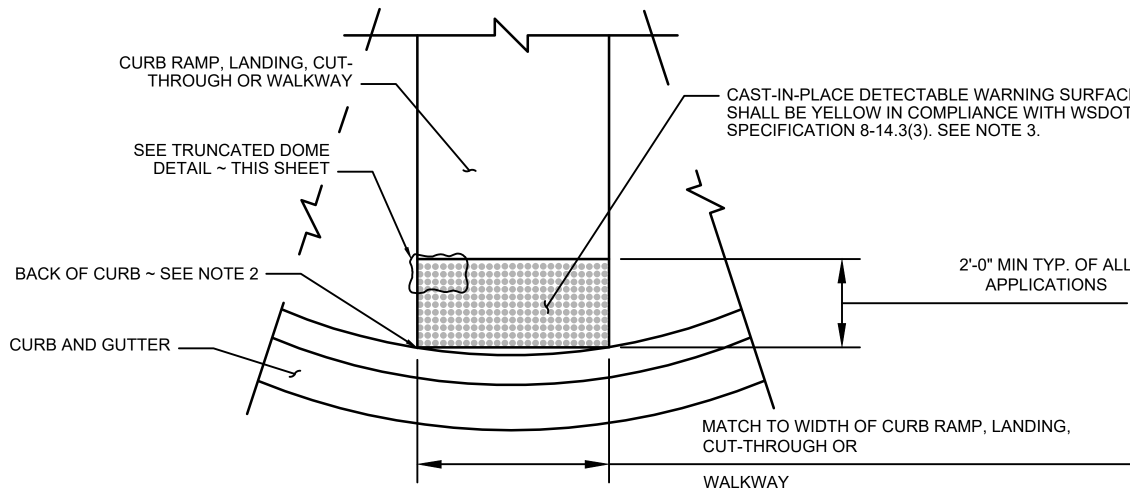
DETAIL
CONCRETE EXTRUDED CURB
SCALE: NTS

1
909

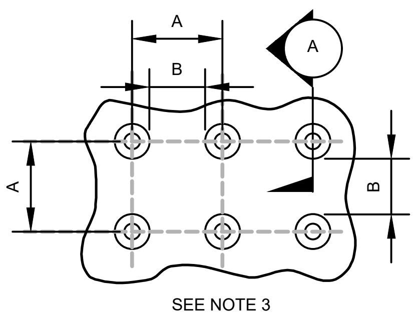
NOTES:

1. CONCRETE EXTRUDED CURBS ARE RESTRICTED TO PARKING AREAS UNLESS APPROVED OTHERWISE BY POS.
2. JOINTS MAY BE FORMED DURING INSTALLATION USING A RIGID DIBVIDER OR SWACUT AFTER CONCRETE CURES TO MINIMUM STRENGTH.
3. CEMENT CONCRETE FOR CURB SHALL BE CLASS 4000.
3. EXTRUDED CURB HEIGHTS SHALL BE 6". EXTRUDED CURB HEIGHT MAY VARY PER CONTRACT PLANS IN LIMITED CIRCUMSTANCES WITH THE APPROVAL AND ACCEPTANCE BY F&I REPRESENTATIVE, BUT SHALL NOT EXCEED 8 INCHES.

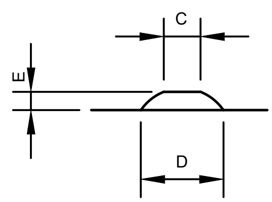
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	CONCRETE EXTRUDED CURB
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 909



DETAIL (1 / 910)
ADA RAMP DETECTABLE WARNING SURFACE
SCALE: NTS



DETAIL (2 / 910)
TRUNCATED DOME SPACING
SCALE: NTS



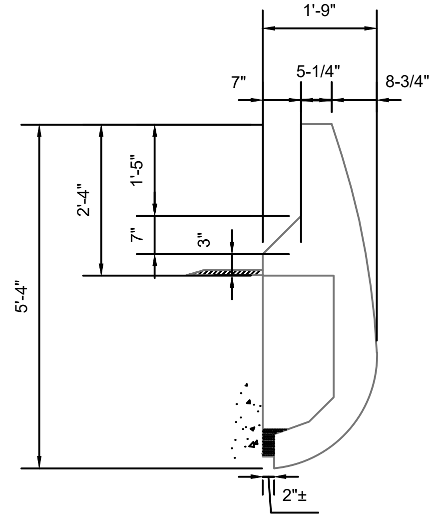
SECTION (A / 910)
TRUNCATED DOME
SCALE: NTS

	MIN.	MAX.
A	1.60"	2.40"
B	0.65"	-
C	0.45"	0.90"
D	0.9"	1.40"
E	0.2"	0.2"

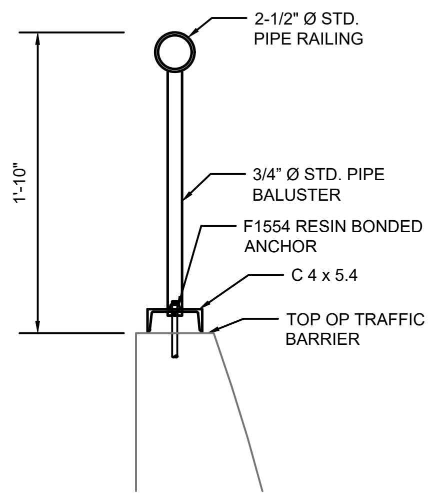
NOTE:

1. PERMANENT DETECTABLE WARNING SURFACES (DWS) SHALL EXTEND THE FULL WIDTH OF THE CURB RAMP, LANDING, OR OTHER ROADWAY ENTRANCE AS APPLICABLE. EXCEPTION: IF THE MANUFACTURER OF THE DWS REQUIRES A CONCRETE BORDER AROUND THE DWS, A VARIANCE OF UP TO 2" (IN) ON EACH SIDE OF THE DWS IS PERMITTED.
2. PERMANENT DETECTABLE WARNING SURFACES (DWS) SHALL BE PLACED ON A MINIMUM 4" (IN)THICK CONCRETE PAD. THE DWS PANEL SHALL BE PLACED ADJACENT TO THE BACK OF THE CURB AND WITH NO MORE THAN A 2" (IN) GAP BETWEEN THE DWS AND THE BACK OF THE CURB MEASURED AT THE CENTER OF THE DWS PANEL. EXCEPTION: IF THE MANUFACTURER OF THE SELECTED DWS REQUIRES A CONCRETE BORDER AROUND THE DWS, A VARIANCE OF UP TO 2" (IN) FROM THE BACK OF THE CURB IS PERMITTED (MEASURED AT THE LEADING CORNERS OF THE DWS PANEL).
3. THE ROWS OF TRUNCATED DOMES SHALL BE ALIGNED TO BE PARALLEL TO THE DIRECTION OF TRAVEL, AND PERPENDICULAR TO THE GRADE BREAK AT THE BACK OF CURB.
4. IF CURB AND GUTTER ARE NOT PRESENT, SUCH AS A SHARED-USE PATH CONNECTION, THE DETECTABLE WARNING SURFACE SHALL BE PLACED AT THE PAVEMENT EDGE.
5. SEE STANDARD DETAIL 907A AND 907B FOR SIDEWALK DETAILS.
6. IF A CURB RAMP IS REQUIRED, THE LOCATION OF THE DETECTABLE WARNING SURFACE MUST BE AT THE BOTTOM OF THE RAMP AND WITHIN THE REQUIRED DISTANCE FROM THE RAIL CROSSING.
7. WHEN THE GRADE BREAK BETWEEN THE CURB RAMP AND THE LANDING IS LESS THAN OR EQUAL TO 5 FT. FROM THE BACK OF CURB AT ALL POINTS, PLACE THE DETECTABLE WARNING SURFACE ON THE BOTTOM OF THE CURB RAMP DIRECTLY ABOVE THE GRADE BREAK.
8. GLUED OR STICK DOWN DETECTABLE WARNING SURFACES ARE ALLOWED ONLY FOR TEMPORARY WORK ZONE APPLICATIONS.

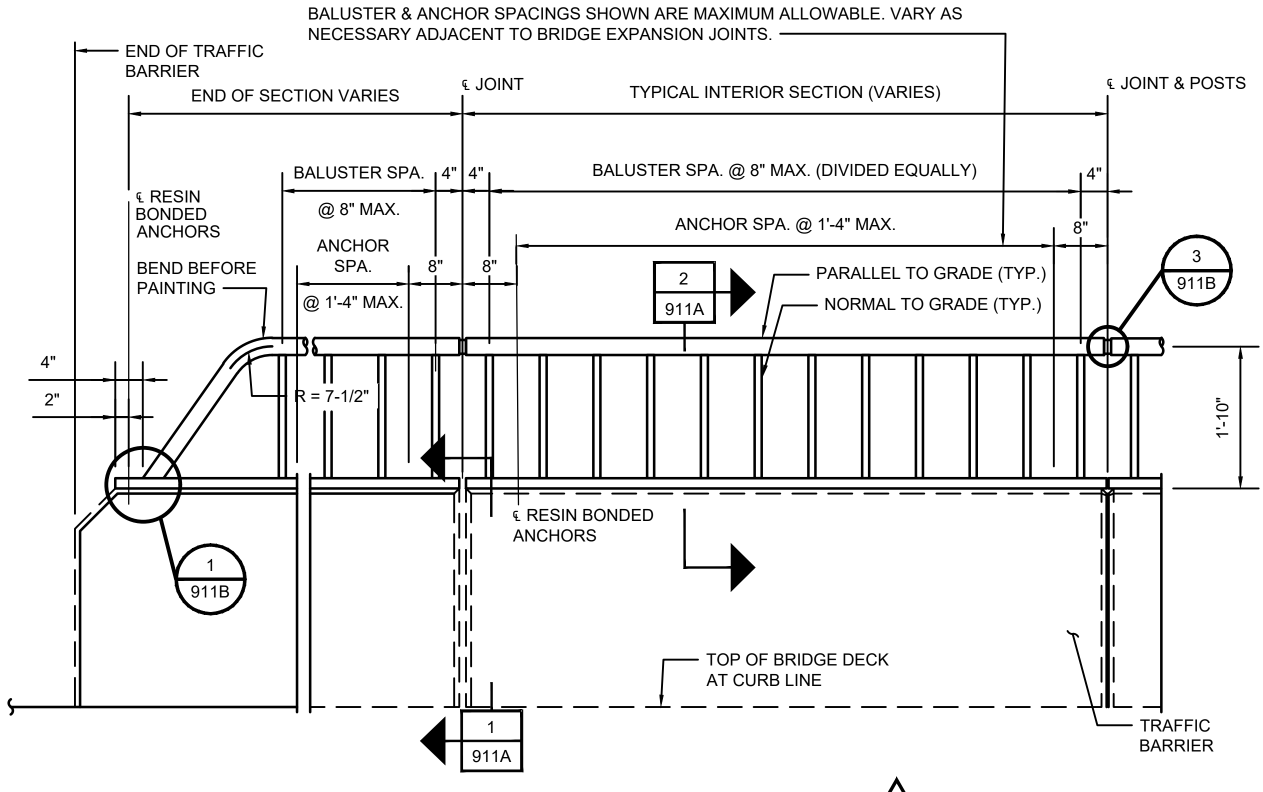
MAT'L	PART	MATERIAL SPECIFICATION
STEEL	RAILS & BALUSTER	ASTM A53 GRADE B OR ASTM A500 GRADE C SCHEDULE 40 (STD. PIPE).
	WASHERS	ASTM 193 GRADE B7
	PLATES/BAR CHANNELS	ASTM A36
	DRIVE PINS	ASTM A276 OR A240 TYPE 302 STAINLESS STEEL
	RESIN BONDED ANCHORS & WASHERS	ASTM F1554, GR. 55
	NUTS	TAMPER-PROOF TYPE ZINC ALLOY SEE WSDPT SPECIAL PROVISIONS SECTION 6-06.2



SECTION
EXISTING CONCRETE BARRIER
SCALE: NTS
1
911A



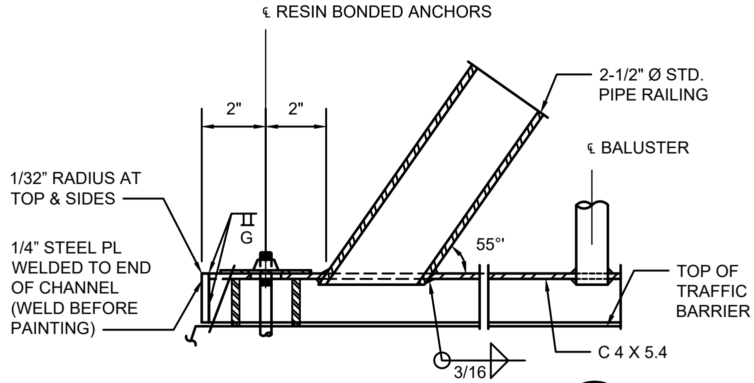
SECTION
EXISTING CONCRETE BARRIER RAILING
SCALE: NTS
2
911A



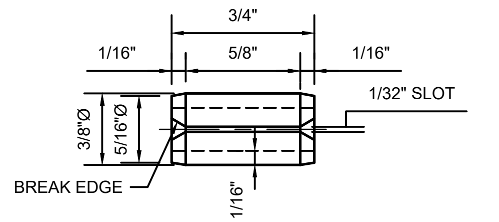
ELEVATION
BALUSTER ATTACHMENT NOT SHOWN
SCALE: NTS
1
911A

NOTES:
1. EXISTING BARRIER DIMENSIONS SHALL BE VERIFIED BY CONTRACTOR PRIOR TO RETROFITTING WITH RAILING. VARIANCE OF MORE THAN 1/4" FOR BARRIER WIDTHS OR 2" FOR BARRIER HEIGHTS SHALL BE REPORTED TO THE ENGINEER OF RECORD.
2. PIPE RAILING, PIPE RAILING SPLICES AND BOTTOM CHANNELS SHALL BE BENT TO THE HORIZONTAL CURVE WHERE THE RADIUS OF CURVATURE IS LESS THAN 200'.
3. SHOP DRAWINGS OF RAILING SHALL BE SUBMITTED AS A TYPE 2 WORKING DRAWING SHOWING COMPLETE DIMENSIONS AND DETAILS OF FABRICATION AND INCLUDING AN ERECTION DIAGRAM. MATERIAL SPECIFICATIONS SHALL BE PROVIDED IN THE SHOP DRAWINGS FOR ALL COMPONENTS.
4. CUTTING SHALL BE DONE BY SAWING OR MILLING AND ALL CUTS SHALL BE TRUE AND SMOOTH. FLAME CUTTING WILL NOT BE PERMITTED.
5. WELDING OF STEEL SHALL CONFORM TO THE LATEST EDITION OF AWS D1.1.
6. RAILINGS SHALL BE PAINTED IN ACCORDANCE WITH WSDOT STANDARD SPECIFICATIONS SECTION 6-07.3(9).
7. PIPE RAILING, PIPE BALUSTERS AND PIPE RAILING SPLICES SHALL BE ADEQUATELY WRAPPED TO INSURE SURFACE PROTECTION DURING HANDLING AND TRANSPORTATION TO THE JOB SITE.

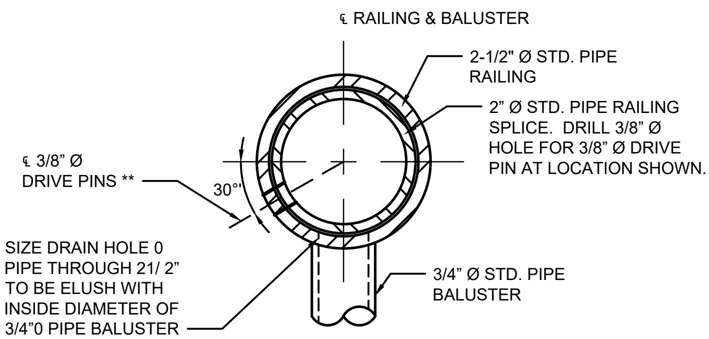
SEA Seattle-Tacoma International Airport	SCALE: NOT TO SCALE	RAIL RETROFIT (1 OF 2)
F&I CIVIL STANDARDS	DATE: JAN. 2024	STANDARD DETAIL NO. 911A



DETAIL
CONCRETE EXTRUDED CURB
SCALE: NTS
1
911A

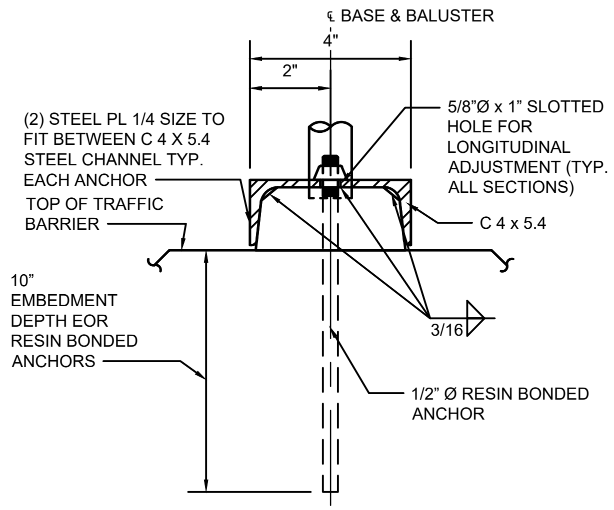


DETAIL
DRIVE PIN
SLOTTED TYPE SPRING PIN (ANSI B18.8.2)
SCALE: NTS
2
911B

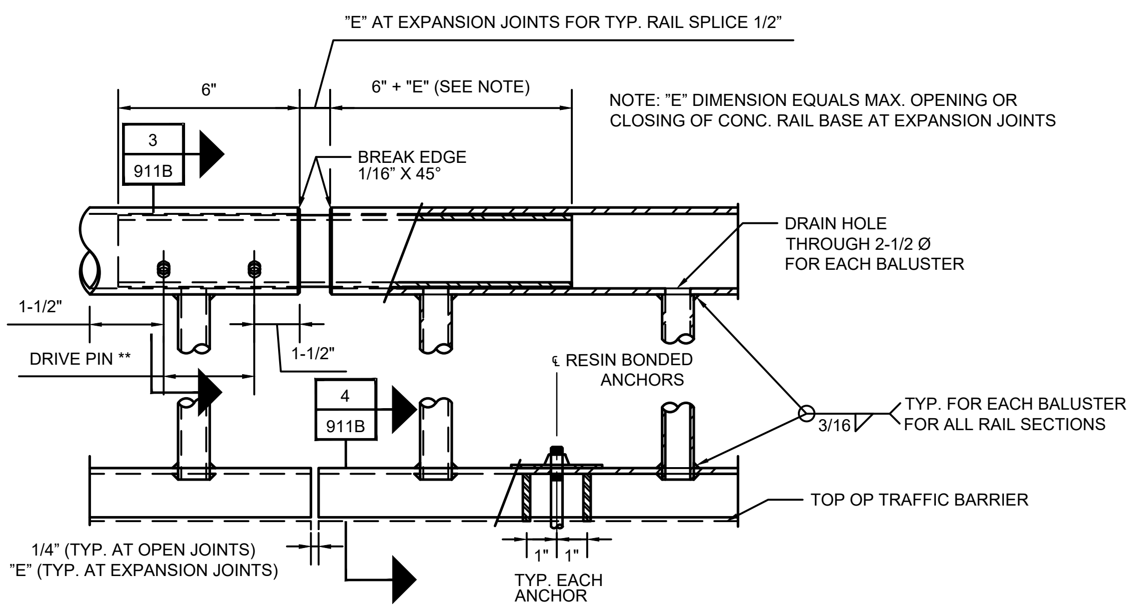


SECTION
RAILING & BALUSTER
SCALE: NTS
3
911B

** LOCATE ON OPPOSITE SIDE OF TRAFFIC. DRIVE PINS SHALL BE DRIVEN FLUSH WITH THE OUTSIDE FACE OF THE RAILING



SECTION
ANCHOR BOLTS SHALL BE POSITIONED IN A JIG DURING WELDING
SCALE: NTS
4
911B



DETAIL
PART ELEVATION
SCALE: NTS
3
911A

SEA Seattle-Tacoma International Airport F&I CIVIL STANDARDS	SCALE: NOT TO SCALE	RAIL RETROFIT (2 OF 2)
	DATE: JAN. 2024	STANDARD DETAIL NO. 911B

AVIATION FACILITIES AND INFRASTRUCTURE

SEATTLE-TACOMA INTERNATIONAL AIRPORT

FACILITIES AND INFRASTRUCTURE

CIVIL SYSTEMS STANDARDS

APPENDIX B

CIVIL SYSTEM STANDARD VARIANCE REQUEST FORM

SEA Seattle-Tacoma International Airport

Seattle Tacoma International Airport F&I Civil System Standard Variance Request Form

Date:

Request Point of Contact:

Project Name:

Project Number:

Project Address:

Project Manager:

Project Status (e.g. 30% design):

Variance #:

Describe the variance(s) requested. Include existing standard or design criteria to be deviated from and documentation outlining the infeasibility, safety hazard, or security concern that prevents the standard from being achieved:

Describe the proposed alternative:

Justification for Variance:

The requestor is responsible for ensuring that any and all proposed alternatives will conform to the locations, dimensions, security, and all other requirements to allow for safe and reasonably accessible.

Email this request form and all attachments to Baisch.D@portseattle.org or Shen.P@portseattle.org to begin the variance request process.

Port of Seattle F&I Approval:

☐ **Approved** ☐ **Denied** ☐ **Provide Additional Data:** ________________________

AV F&I Civil Standards Revision Record
Revision Date: December 2023

Standard Specifications:

Section	Title	Previous	Current
	Table of Contents	N/A	New Details and Specifications added
I	GENERAL PROVISIONS	N/A	Added Design Variance Procedure, Fuel System Design Approach Requirements and Roadway Functional Classifications section
I	GENERAL PROVISIONS	N/A	Minor updates to various requirement languages and reference to other standards requirements.
02 22 22	Aviation Fuel Line Removal	N/A	New specification section added
02 41 13.23	Utility Demolition and Abandonment	N/A	Added standard requirement language on utility demolition and abandonment for utility not owned and operated go Port of Seattle.
26 42 00.13	Cathodic Protection For Aviation Fuel System	N/A	New specification section added
31 23 33	UTILITY TRENCHING AND BACKFILL	Section 32 23 33	Changed section title to 31 23 33 to align with the current CSI section
31 23 33	UTILITY TRENCHING AND BACKFILL	1.01.D: references standard detail SD-007**.**	1.01.D: updated detail reference to "standard detail SD-006**".**
31 23 33	UTILITY TRENCHING AND BACKFILL	2.04.A: Polyethylene plastic foam (Ethafoam) used in underground utility separation must comply with the Federal Specification Cid A-A 59136 Type 1, Class 1, Grade A.	2.04.A:Polyethylene plastic foam (Ethafoam) used in underground utility separation must be Dow Ethafoam 220, min 2.5 inch thicknes
312333	Utility Trenching and Backfill	Refer to Section 31 40 00 for Trench Safety Systems	Updated to refer to Specification Section 31 50 00 for Trench Safety Systems
312333	Utility Trenching and Backfill	N/A	Added requirements for installing steel plates in accordance with WSDOT Standard Specification or directed by F&I Design Engineer when utility crossings required to be open to traffic.
312333	Utility Trenching and Backfill	N/A	Added Utility Trench Restoration requirement language.
312333	Utility Trenching and Backfill	N/A	Updated bedding material to be crushed surfacing top course per WSDOT Standard Specification
312333	Utility Trenching and Backfill	Allowed use of recycled concrete aggregate for crushed surfacing top course.	Updated to prohibit use of recycled concrete aggregate for crushed surfacing top course.
312333	Utility Trenching and Backfill	N/A	Added exception to backfill requirements for landside utilities not located directly underneath pavement.
312333	Utility Trenching and Backfill	Refer to Section 310000	Updated to refer Specification Section 310000
312333	Utility Trenching and Backfill	N/A	Added 28-day compressive strength requirement fro CLSM for landside to between 50 psi to 300 psi
321000	Pavement Section Design	N/A	New Section
321100	Base Course	N/A	New Section
321613	Curb and Gutters	N/A	New Section
321623	Sidewalk	N/A	New Section
321633	Driveway	N/A	New Section
321726	Tactile Warning Surfacing	N/A	New Section
323200	Retaining Wall	N/A	New Section
33 10 00	WATER DISTRIBUTION SYSTEM REQUIREMENTS	1.05.C.1.a: PVC per AWWA C900	1.05.C.1.a: deleted PVC requirement
33 10 00	WATER DISTRIBUTION SYSTEM REQUIREMENTS	1.05.C.1.b: The crossing utility shall be encased in concrete, or in one quarter-inch...	1.05.C.1.b: The crossing utility shall be encased in CDF, or installed with a casing of one quarter-inch...
33 10 00	WATER DISTRIBUTION SYSTEM REQUIREMENTS	N/A	New Section: 1.05.D.5: Backfill the space between the two casings with CDF

331219	Fire Hydrants	Hydrants shall be designed to provide a minimum 5 feet clear access directly behind the hydrant	Added a additional clearance requirement of requiring 3-foot minimum clearance around outside of hydrant for operation and providing 5 feet clear horizontal clearance from the outside of the hydrant to concrete walls, structures, utility poles and above grade electrical enclosures. Added a requirement that clearances shall be level
331219	Fire Hydrants	Reference to STIA Civil System Standard 331110 Water Distribution System	Update the reference to be STIA Civil Systems Standards Section 331110 Water Distribution System Piping and Fittings
33 31 20	GREASE INTERCEPTOR VAULTS	2.02.B: 1. Pipe between the building and the first grease interceptor vault shall be Epoxy Coated and Lined Cast Iron Soil Pipe and Fittings in conformance with ASTM A74 and EN 877. 2. Pipe and fittings between the grease interceptor vaults and downstream of the second vault shall be C900 PVC per STIA F&I Civil Systems Standards Section 333111, Sanitary Sewer Piping.	2.02.B: 1. SDR35 PVC Gravity sewer pipe 2.Schedule 40 PVC pipe
33 31 20	GREASE INTERCEPTOR VAULTS	2.03.A: A.Ductile-Iron Sewer Pipe: ASTM A746, Class 52, for push-on joints. 1.Lining: AWWA C104, asphaltic material seal coat, minimum 1 mil thick. 2. Gaskets: AWWA C111, rubber.	2.03.A: Minimum 3 inch galvanized steel pipe.
33 42 11	STORM AND IWS PIPEING AND VALVES	N/A	1.03: Added the following refernececs: "LL.American Society for Testing and Materials (ASTM) F2562 “Standard Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage” MM.American Society for Testing and Materials (ASTM) D3350 “Standard Specification for Polyethylene Plastic Pipe and Fitting Materials. "
33 42 11	STORM AND IWS PIPEING AND VALVES	2.03: Gravity storm drainage pipe 60-inches in diameter or larger, regardless of location, shall be reinforced concrete pipe meeting the following material requirements: A.Reinforced concrete pipe, meeting ASTM C76 and AASHTO M170, Class V, or as designed using D-Load strength requirements per ASTM C655 B. Joint Performance: Bell and spigot single offset joint, sealed with elastomeric rubber gasket, watertight, ASTM C443. C. Material Properties: Min. compressive strength and mix design requirements per ASTM C76, pipe class designation per ASTM C655 and ASTM C1417. Reinforcing steel per ASTM A82, A185, A496 or A497 and bars in ASTM A615.	2.03: Gravity storm drainage pipe 60-inches in diameter or larger, regardless of location, Steel Reinforced Polyethylene Pipe (SRPE), meeting the following material requirements A.Reinforced polyethylene pie with a smooth interior wall and an exterior that is reinforced with high strength galvanized steel ribs. The pipe shall be manufactured using high-quality stress-rated thermoplastic meeting the requirements of ASTM F2562. B. Joint Performance: Pipe lengths shall be joined on site using manufacturer’s welded coupler joints. Pipe plane ends shall be welded together utilizing exclusive pressure testable extrusion welded couplers. Field welding to be performed by certified HDPE welding technician with a minimum of two years HDPE welding experience. C.Material Properties: Resins shall conform to the minimum requirements of cell classification 345464C as defined and described in the latest version of ASTM D3350.
334211	Storm and IWS Piping and Valves	N/A	Added following language: Catch basins shall be spaced no greater than 150 feet for grades less than one percent, 200 feet for grades between 1 percent and 3 percent and 300 feet for grades 3 percent and greater
334211	Storm and IWS Piping and Valves	N/A	Added additional reference to 1.03
334211	Storm and IWS Piping and Valves	N/A	Added following language: Double walled plastic pipe meeting the requirements of section 2.01 above may be used in lieu of ductile iron pipe under paved surfaces for landside (outside of the AOA) in instances where the pipe does not have less than 24” of cover to top of subgrade.
334211	Storm and IWS Piping and Valves	Gravity storm drainage pipe 60-inches in diameter or larger shall be reinforced concrete pipe.	Gravity storm drainage pipe 60-inches in diameter or larger shall be reinforced concrete pipe or steel-reinforce polyethylene pipe (SRPE)

334231	Sewer, Storm and IWS Structures	N/A	Added a requirement to prohibit concentric or eccentric cone section for storm drainage.
334231	Sewer, Storm and IWS Structures	N/A	Added and structure access size requirements
334231	Sewer, Storm and IWS Structures	N/A	Added following language: Backfilling is not allowed until concrete or mortar has thoroughly set and until concrete has attained 90 percent of its specified compressive strength
347113	Vehicle Barriers	N/A	New Section
33 52 29	Liquid Fuels Piping System Supports & Anchors	N/A	New specification section added
33 52 43	Aviation Fueling System - General Requirements	N/A	New specification section added
33 52 43.11	Aviation Fueling System Equipment	N/A	New specification section added
33 52 43.13	Aviation Fueling Pipe, Manual Valves, And Fittings	N/A	New specification section added
33 52 43.14	Aviation Fueling System Control Valves	N/A	New specification section added
33 52 53	Aviation Fueling System Cleaning, Testing And Flushing	N/A	New specification section added
33 52 80	Liquid Fuels Pipe Coating Systems	N/A	New specification section added
33 52 90	Welding For Fuel Service Piping	N/A	New specification section added
33 52 92	Aviation Fuel System - Mechanical Identification	N/A	New specification section added

Standard Details:

SD No.	Title	Previous	Current
001	TYPICAL UTILITY DEMOLITION	N/A	Reformat to comply with POS CAD Standard.
002	PIPE ABANDONMENT	N/A	Reformat to comply with POS CAD Standard and added restrictive note for option 2.
003	MANHOLE ABANDONMENT	N/A	Reformat to comply with POS CAD Standard and added pavement restoration detail. Added a note "ABANDON-IN-PLACE OF EXISTING STRUCTURE SHALL BE ALLOWED WITH POS VARIANCE APPROVAL."
004	PIPE BEDDING AND TRENCH BACKFILL	N/A	Reformat to comply with POS CAD Standard.
005	ACP TRENCH PATCH	Shoaed locate wire above pipe	Removed locate wire from detail. Reformat to comply with POS CAD Standard and added additional notes for ACP overlay requirements and temporary trench backfill requirement for open trench.
102	TYPICAL CLEANOUT	Concrete collar on the unpaved side	Removed concrete collar and changed to an asphalt erosion pad
107	TRAFFIC RATED CATCH BASIN	Note 3 contained structure steps or ladder information. Section view contained a specific boot connector product "Kor-N-Seal"	Deleted Note 3 and renumbered notes. Updated callouts in section view. Removed "Kor-N-Seal" product from callout and replaced with "ASTM C923 BOOT CONNECTOR"

108	TRAFFIC RATED MANHOLE	Note 3 contained structure steps or ladder information. Section view contained a specific boot connector product "Kor-N-Seal"	Deleted Note 3 and renumbered notes. Updated callouts in section view. Removed "Kor-N-Seal" product from callout and replaced with "ASTM C923 BOOT CONNECTOR" Reformat to comply with POS CAD Standard and added manhole channel.
109	AIRCRAFT RATED CATCH BASIN	Note 3 contained structure steps or ladder information. Recent construction used flat top manhole to separate structure from PCCP panel but this option was not shown in the detail. Section view contained a specific boot connector product "Kor-N-Seal" All catch basins were designed per FAA AC 150-5320-6F.	Deleted Note 3 and renumbered notes. Updated callouts in section view. Updated detail to show flat top manhole and added callout to use flat top manhole between structure and PCCP panel or concrete form the bottom of the PCCP panel. Removed "Kor-N-Seal" product from callout and replaced with "ASTM C923 BOOT CONNECTOR" added option for structures below PCCP panel to be designed to HS-20 loading.
110	AIRCRAFT RATED MANHOLE	Note 4 contained structure steps or ladder information. Recent construction used flat top manhole to separate structure from PCCP panel but this option was not shown in the detail. Section view contained a specific boot connector product "Kor-N-Seal" All manholes basins were designed per FAA AC 150-5320-6F.	Deleted Note 4 and renumbered notes. Updated callouts in section view. Updated detail to add callout to use flat top manhole between structure and PCCP panel or concrete form the bottom of the PCCP panel. Removed "Kor-N-Seal" product from callout and replaced with "ASTM C923 BOOT CONNECTOR" added option for structures below PCCP panel to be designed to HS-20 loading.
111	UTILITY STRUCTURE IN PCCP	Recent construction used flat top manhole to separate structure from PCCP panel but this option was not shown in the detail. Section had a range of rebar in the section.	Updated detail to show flat top manhole and added callout to use flat top manhole between structure and PCCP panel or concrete form the bottom of the PCCP panel. Updated and simplified rebar design
114	AIRCRAFT RATED CHANNEL DRAIN PLAN IN PCCP	Min outlet was 8"	Updated Min outlet to 8", updated channel drain size to 12"
115	CHANNEL DRAIN CONNECTION PROFILE	Min outlet was 6", upsized to 8" for connection to CB	Updated min outlet to 8", and removed reducers and adaptor fittings. Updated min channel drain width to 12"
116	AIRCRAFT RATED CHANNEL DRAIN SECTION IN PCCP	previous detail had 6" MIN CHANNEL DRAIN	Updated and simplified rebar design Updated min channel drain to 12"
117	AIRCRAFT RATED CHANNEL DRAIN CATCH BASIN TOP	Did not show flat top option in section	Updated section view to show a flat top manhole under the PCCP panel and Ethafoam
119	TRAFFIC RATED CHANNEL DRAIN SECTION IN ACP	previous detail had min outlet of 6", and 6"-12" channel drain size	Updated Min outlet to 8", updated channel drain size to 12" Updated and simplified rebar design
120	STRUCTURE CONCRETE COLLAR	Paved or within 10ft of acp pavemement	removed "Or Within 10-Feet of ACP Pavement"
122	STRUCTURE LADDER AND STEPS		added note 8 "STEPS OR LADDER SHALL BE VERTICALLY ALIGNED AND LOCATED AWAY FROM PIPE PENETRAITONS"
124a	GREASE INTERCEPTOR	vent holes are shown in the body of the grease interceptor	moved vent holes to the vault risers. Added "1% min slope" to inlet pipe
134	UTILITY CASING INSTALLATION	N/A	new detail
135	AOA PERIMTER FENCE	N/A	new detail
136	AOA PERIMTER FENCE SECTIONS	N/A	new detail

137	WILDLIFE DETERRENT FENCE SKIRT	N/A	new detail
138	AOA PERIMETER FENCE SIGNS	N/A	new detail
210	AIRCRAFT BARRICADES	N/A	new detail
300	FUEL HYDRANT VALVE PIT ASSEMBLY-DETAIL	N/A	New detail
301	HYDRANT BRANCH CONNECTION-DETAIL	N/A	New detail
302	EXOTHERMIC WELDING DETAIL-DETAIL	N/A	New detail
303	LOW POINT DRAIN-DETAIL	N/A	New detail
304	CATHODIC PROTECTION TEST STATION-DETAIL	N/A	New detail
305	FLUSH MOUNT CP TEST BOX-DETAIL	N/A	New detail
306	CASING TEST STATION W REFERENCE ELECTRODE-DETAIL	N/A	New detail
307	TEST STATION W ANODE AND REFERENCE ELECTRODE-DETAIL	N/A	New detail
308	CONTROL VALVE PIT PLAN - PLAN VIEW-PLAN	N/A	New detail
308B	CONTROL VALVE PIT PLAN - SECTION VIEW-SECTION	N/A	New detail
309	ISOLATION VALVE PIT PLAN - PLAN VIEW-PLAN	N/A	New detail
309B	ISOLATION VALVE PIT PLAN - SECTION VIEW-SECTION	N/A	New detail
310	TYPICAL ISOLATION VALVE PIT (IVP) PLAN-PLAN VIEW	N/A	New detail
310B	TYPICAL ISOLATION VALVE PIT (IVP) PLAN-SECTION VIEW	N/A	New detail
311	LOW PROFILE HYDRANT PIT ASSEMBLY-DETAIL	N/A	New detail
312	SURGE TANK PIT-DETAIL	N/A	New detail
313	PEDESTAL PIPE SUPPORT-DETAIL	N/A	New detail
314	FLANGE TOP SUPPORT-DETAIL	N/A	New detail
315	PIPE CLAMP SUPPORT-DETAIL	N/A	New detail
316	FLOOR SLEEVE-DETAIL	N/A	New detail
317	WALL SLEEVE-DETAIL	N/A	New detail
318	WALL SLEEVE-DETAIL	N/A	New detail
319	U BOLT PIPE SUPPORT-DETAIL	N/A	New detail
320	SURGE SUPPRESSOR-DETAIL	N/A	New detail
321	PIPE BRACKET SUPPORTS-DETAIL	N/A	New detail
600	FIRE HYDRANT	Note 2: IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. WITH 6" GATE VALVE (FL X FL) AND 8" X 6" REDUCER (FL X MJ). IF LATERAL IS >50', THEN PIPE SIZE SHALL BE 8" MIN. IF LATERAL LENGTH IS >10', INSTALL A SECOND LINE-SIZED GATE (MJ X MJ) 4' MIN. TO 10' MAX. FROM FIRE HYDRANT. Note 3: ALL JOINTS SHALL BE RETRAINED JOINTS. MECHANICAL JOINTS SHALL BE RESTRAINED BY MEGALUG RESTRAINT, EBAA IRON MEGALUG, ROMAC ROMAGRIP, STAR PIPE PRODUCTS STARGRIP, AND APPROVED EQUAL.	Reformat to comply with POS CAD Standard. Revised Note 2 to: 2. IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. WITH 8" GATE VALVE (FL X FL) AND 8" X 6" REDUCER (FL X MJ). IF LATERAL IS >50', THEN PIPE SIZE SHALL BE 8" MIN. 3. FIRE HYDRANT VALVE SHALL BE NO MORE THAN 10 FT AND NO LESS THAN 4 FT FROM THE FIRE HYDRANT. A SECOND LINE-SIZED VALVE SHALL BE REQUIRED WHEN THE MAIN-HYDRANT TEE VLAVE DOES NOT MEET THIS REQUIREMENT. Revised Note 3 to: 4. ALL JOINTS SHALL BE RETRAINED JOINTS. MECHANICAL JOINTS SHALL BE RESTRAINED BY MEGALUG RESTRAINT OR APPROVED EQUAL.

602A	FIRE HYDRANT VAULT ASSEMBLY	Note 1: VAULT AND HATCH LOCATED IN RAMP AIR OPREATION AREA (AOA) SHALL BE AIRCRAFT RATED AND DESIGNED TO SUPPORT A MINIMUM OF 200,000 LB WHEEL LOADS WITH 250 PSI TIE PRESSURE. HATCH SHALL BE WATERPROOF, LIFT ASSISTED, AND TOLL LESS ENTRY. HATCH AND VAULT SHOP DRAWING AND STRUCTURL CALCULATION STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION. Note 2: IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. WITH 6" GATE VALVE (FL X FL) AND 8" X 6" REDUCER (FL X MJ). IF LATERAL IS >50', THEN PIPE SIZE SHALL BE 8" MIN. IF LATERAL LENGTH IS >10', INSTALL A SECOND LINE-SIZED GATE (MJ X MJ) 4' MIN. TO 10' MAX. FROM FIRE HYDRANT.	Reformat to comply with POS CAD Standard. Revised Note 1 to: 1. VAULT AND HATCH LOCATED IN AOA OR LANDSIDE ROADWAYS SHALL BE CAVOTEC D38WP-VA-24D OR SIMILAR BY CAVOTEC DABICO AND DESIGNED TO SUPPORT 200,000 LB WHEEL LOADS WITH 250 PSI TIE PRESSURE. HATCH SHALL BE WATERPROOF, LIFT ASSISTED, AND TOLL LESS ENTRY. HATCH AND VAULT SHOP DRAWING AND STRUCTURL CALCULATION STAMPED BY A LICENSED STRUCTURAL ENGINEER SHALL BE SUBMITTED FOR PORT APPROVAL PRIOR TO FABRICATION. Revised Note 2 to: 3. IF LATERAL LENGTH IS <50', THEN PIPE SIZE SHALL BE 6" MIN. WITH 8" GATE VALVE (FL X FL) AND 8" X 6" REDUCER (FL X MJ). IF LATERAL IS >50', THEN PIPE SIZE SHALL BE 8" MIN. 4. FIRE HYDRANT VALVE SHALL BE NO MORE THAN 10 FT AND NO LESS THAN 4 FT FROM THE FIRE HYDRANT. A SECOND LINE-SIZED VALVE SHALL BE REQUIRED WHEN THE MAIN-HYDRANT TEE VLAVE DOES NOT MEET THIS REQUIREMENT.
602B	FLUSH FIRE HYDRANT VAULT AND HATCH DETAIL	N/A	Reformat to comply with POS CAD Standard.
605	HYDRANT AND FDC BOLLARD LOCATION PLAN		added "and pavement" to 5-ft min cleanrance note.
801	AIRFIELD PAVEMENT TYPICAL SECTIONS		Added unsuitable material removal and head of stand pavement sections. Added note 5 for date and STIA stamping directions
900	TYPICAL LIMITED-ACCESS PRINCIPAL ARTERIAL SECTION	N/A	New Standard Detail
901	TYPICAL TERMINAL FRONTAGE SECTION	N/A	New Standard Detail
902	TYPICAL MINOR ARTERIAL SECTION	N/A	New Standard Detail
903	TYPICAL COLLECTOR ARTERIAL SECTION	N/A	New Standard Detail
904	TYPICAL INDUSTRIAL ACCESS SECTION	N/A	New Standard Detail
905	TYPICAL PARKING ACCESS SECTION	N/A	New Standard Detail
906	TYPICAL RESTRICTED VEHICLE SERVICE ROAD SECTION	N/A	New Standard Detail
907A	CEMENT CONCRETE SIDEWALK	N/A	New Standard Detail
907B	CEMENT CONCRETE SIDEWALK	N/A	New Standard Detail
908	CONCRETE CURB	N/A	New Standard Detail
909	CONCRETE EXTRUDED CURB	N/A	New Standard Detail
910	ADA RAMP DETECTABLE WARNING SURFACE	N/A	New Standard Detail
911A	RAIL RETROFIT (1 OF 2)	N/A	New Standard Detail
911B	RAIL RETROFIT (2 OF 2)	N/A	New Standard Detail