UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
****

SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 52 43.14

AVIATION FUEL CONTROL VALVES

08/18, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES
1.2 ADMINISTRATIVE REQUIREMENTS
1.3 SUBMITTALS
1.4 QUALITY ASSURANCE
1.4.1 Field Assistance
1.4.2 Training
1.5 WARRANTY

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT
2.2 CONTROL VALVES
2.2.1 General
2.2.1.1 Bodies, Bonnets, and Covers
2.2.1.2 Valve Seats
2.2.1.3 Valve Discs
2.2.1.4 Diaphragm Assembly
2.2.1.5 Bolts, Screws and Nuts
2.2.1.6 Pilot Control System and Auxiliary Piping
2.2.1.7 Pilot Valves
2.2.1.8 Solenoids
2.2.2 Serviceability of Main Valve Internal Parts
2.2.3 Total Lengths
2.2.4 Flanges
2.2.5 Identification
2.2.5.1 Main Valve Body
2.2.5.2 Main Valve Cover
2.2.5.3 Brass Name Plates
2.2.5.4 Inlet Name Plate
2.2.5.5 Outlet Name Plate
2.2.5.6 Pilot Valves
2.3 INDIVIDUAL CONTROL VALVE OPERATIONAL REQUIREMENTS
2.3.1 High Liquid Level Shut-Off Valve (HLV-1 AND HLV-2)

2.3.1.1 Size
2.3.1.2 Flow
2.3.1.3 Operation
2.3.1.4 Check Valve Feature
2.3.1.5 Manual Test Feature
2.3.1.6 Strainer
2.3.1.7 Pressure Sensitive Close Feature
2.3.1.8 Minimum Differential Pressure Feature
2.3.1.9 Opening and Closing Feature
2.3.1.10 Solenoid Control
2.3.2 Non-Surge Check Valve (CV-1 THRU CV-7)
2.3.2.1 Size
2.3.2.2 Flow
2.3.2.3 Operation
2.3.2.4 Quick closure
2.3.2.5 Flow Control
2.3.2.6 Strainer
2.3.2.7 Emergency Shut-off Operation
2.3.3 Non-Surge Check/Air Block Valve (AB/CV-1 THRU AB/CV-[ ])
2.3.3.1 Size
2.3.3.2 Flow
2.3.3.3 Operation
2.3.3.4 Speed Control
2.3.3.5 Check Feature
2.3.3.6 Solenoid Control
2.3.3.7 Strainer
2.3.4 Filter Separator Control Valve (FSCV-1 Thru FSCV-7)
2.3.4.1 Size
2.3.4.2 Flow
2.3.4.3 Operation
2.3.4.4 Check Valve Feature
2.3.4.5 Water Slug Shut-Off
2.3.4.6 Shut-Off Feature at Maximum Differential Pressure
2.3.4.7 Emergency Shut-off Operation
2.3.4.8 Solenoid Control
2.3.4.9 Minimum Differential Pressure Feature
2.3.5 Filter Separator Float Control Valve and Tester (FC-1 THRU FC-7)
2.3.5.1 Operation
2.3.5.2 Float Control Pilot and Tester
2.3.6 Back Pressure Control Valve (BPCV-1)
2.3.6.1 Size
2.3.6.2 Flow
2.3.6.3 Operation
2.3.6.4 Check Valve Feature
2.3.6.5 Solenoid Control
2.3.6.6 Speed Control
2.3.6.7 Opening Feature
2.3.7 Pressure Control Valve (PCV-1)
2.3.7.1 Size
2.3.7.2 Flow
2.3.7.3 Operation
2.3.7.4 Check Valve Feature
2.3.7.5 Solenoid Control
2.3.7.6 Speed Control
2.3.8 Defuel/Flush Valve (D/FV-1)
2.3.8.1 Size
2.3.8.2 Flow
2.3.8.3 Operation

2.3.8.4 Check Valve Feature
2.3.8.5 Solenoid Control
2.3.8.6 Speed Control
2.3.9 Hydrant Control Valve (HCV)
2.3.9.1 Size
2.3.9.2 Flow
2.3.9.3 Operation
2.3.9.4 Quick Closure
2.3.9.5 Deadman Control
2.3.9.6 Defuel
2.3.9.7 Speed Control
2.3.9.8 Thermal Relief
2.3.9.9 Adapter
2.3.9.10 Strainer
2.3.9.11 Minimum Differential Pressure Feature
2.3.9.12 Contaminant Analyzer
2.3.10 Overfill Valve for Product Recovery Tank (OV-1)
2.3.10.1 Size
2.3.10.2 Capacity
2.3.10.3 Operation
2.3.10.4 Control Float
2.3.10.5 Pressure Reservoir
2.3.10.6 Thermal Relief
2.3.10.7 Limit Switch
2.3.10.8 Strainer
2.3.11 Truck Fill Stand Control Valve (TFV)
2.3.11.1 Size
2.3.11.2 Flow
2.3.11.3 Operation
2.3.11.4 Quick Closure
2.3.11.5 Opening Speed Control
2.3.11.6 Deadman Control
2.3.11.7 Thermal Relief
2.3.11.8 Strainer
2.3.11.9 Solenoid Control
2.3.12 Pantograph Control Valve (PTCV)
2.3.12.1 Size
2.3.12.2 Flow
2.3.12.3 Operation
2.3.12.4 Opening Speed Control
2.3.12.5 Thermal Relief
2.3.12.6 Strainer
2.3.12.7 Minimum Differential Pressure Feature
2.3.13 Flushing Valve (FV-1)
2.3.13.1 Size
2.3.13.2 Flow
2.3.13.3 Operation
2.3.13.4 Solenoid Control
2.3.14 Pantograph Pressure Control Valve (PPCV-1 thru PPCV-[ ])
2.3.14.1 Size
2.3.14.2 Operation
2.3.14.3 Check Valve Feature

PART 3 EXECUTION

3.1 VALVE TESTING AND START-UP SUPPORT

-- End of Section Table of Contents --

****

USACE / NAVFAC / AFCEC / NASA	**UFGS-33 52 43.14 (August 2018)** **Change 1 - 02/21**
Preparing Activity: USACE	**Superseding** **UFGS-33 52 43.14 (February 2010)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

****

SECTION 33 52 43.14

AVIATION FUEL CONTROL VALVES
08/18, CHG 1: 02/21

****

NOTE: This guide specification covers the requirements for diaphragm type automatic control valves used in aircraft refueling systems constructed to the requirements of the DoD Type III/IV/V, and Cut and Cover Hydrant Refueling System Standards.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

PART 1 GENERAL

****

NOTE: NOTE: DoD Type III systems must conform to Standard Design AW 078-24-28 PRESSURIZED HYDRANT FUELING SYSTEM TYPE III. DoD Type IV/V systems must conform to Standard Design AW 078-24-29 PRESSURIZED HYDRANT DIRECT FUELING SYSTEM TYPE IV/V. Cut and Cover systems must conform to Standard Design AW 078-24-33 UNDERGROUND VERTICAL STORAGE TANKS CUT AND COVER. Field fabricated ASTs must conform to AW 078-24-27 ABOVEGROUND VERTICAL STEEL TANKS WITH FIXED ROOFS.Standards can be found on the Whole Building Design Guide at the following location

https://www.wbdg.org/ffc/dod/non-cos-standards.

Subject Matter Expert (SME) is defined as Service Headquarters Subject Matter Experts: Air Force - The Air Force Fuels Facilities Subject Matter Expert (HQ AFCEC/COS), Army - Headquarters, U.S. Army Corps of Engineers, POL-MCX Facilities Proponent (CECW-EC) through the Army Petroleum Center (APC), Navy/Marine Corps - NAVFAC POL Facility Subject Matter Expert (NAVFAC EXWC, CI11).

****

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	(2017) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.24	(2016) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A194/A194M	(2020a) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A216/A216M	(2016) Standard Specification for Steel

	Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A269/A269M	(2015; R 2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A320/A320M	(2017b) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A352/A352M	(2018a) Standard Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service
ASTM A743/A743M	(2019) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM B26/B26M	(2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings
ASTM D751	(2006; R 2011) Coated Fabrics
ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications

ENERGY INSTITUTE (EI)

EI 1570	(2012) Handbook on Electronic Sensors for the Detection of Particulate Matter and/or Free Water During Aircraft Refueling
EI 1598	(2012) Design Functional Requirements and Laboratory Testing Protocols for Electronic Sensors to Monitor Free Water And/or Particulate Matter in Aviation Fuel

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3216	(2005; Rev G) Fluorocarbon (FKM) Rubber High-Temperature - Fluid Resistant Low Compression Set 70 To 80
SAE J200	(2015) Classification System for Rubber Materials
SAE J429	(2014) Mechanical and Material Requirements for Externally Threaded Fasteners

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-8625 (1993; Rev F; Am 1 2003) Anodic Coatings, for Aluminum and Aluminum Alloys

1.2 ADMINISTRATIVE REQUIREMENTS

Design conditions must be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT. Components must be suitable for ANSI Class 150 (2 MPa 275 psig at 38 degrees C 100 degrees F).

a. Control valves specified herein must be of one manufacturer. The valve manufacturer must also produce the hydraulically-operated pilots. For each type control valve required and specified, submit the following:

(1). Flow diagrams.
(2). Operational description of the control valve and pilot control system.
(3). Complete valve assembly list of materials, along with material Certificates of Conformance, used in the manufacture of the control valves and pilot systems.
(4). sectional drawings of main valve and control pilot systems.

b. Before shipment, each individual control valve must be operationally tested and adjusted by manufacturer under actual flow conditions utilizing a hydrocarbon test fluid with a specific gravity comparable to [Jet A (F-24)][Jet A-1 (F-35)][JP-4 (F-40)][JP-5 (F-44)][JP-8 (F-34)]fuel. Manufacturer must submit certified records of test data.

c. Operation and maintenance information must be submitted for each individual type control valve specified herein. Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted.

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for

Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control Valves; G[, [_____]].

SD-03 Product Data

Control Valves; G[, [_____]].

SD-06 Test Reports

Control Valves; .

SD-07 Certificates

Previous Air Force/Military Projects; G[, [_____]].

Qualified Engineers; G[, [_____]].

Field Assistance; G[, [_____]].

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]].

1.4 QUALITY ASSURANCE

1.4.1 Field Assistance

Provide the following:

a. Proof of experience on previous Air Force/Military projects.

b. Number of qualified engineers (factory trained)available to provide startup support.

c. Written assurance as to ability to respond to specified time for field assistance.

1.4.2 Training

The manufacturer must conduct two eight hour training classes for Liquid Fuels Maintenance Technicians which include valve overhaul procedures, pilot overhaul procedures, valve adjustments, and valve diagnostics. The manufacturer must provide a 100 mm 4-inch valve mock-up with various trim components (i.e., rate of flow, solenoid control, and speed control features) to be used during training. Video recording of training must be allowed or provided at the time of the class, and an attendance roster maintained by the Contractor. The 100 mm 4-inch valve mock-up must become the property of the Government and must be turned over to the Contracting Officer. Submit copies of the Operation and Maintenance Manuals for approval.

1.5 WARRANTY

****
NOTE: Modify hours for projects outside the UNITED STATES.
****

[For this section, Subject Matter Expert (SME) is defined as Service Headquarters Subject Matter Experts. SME for this project is [Air Force - The Air Force Fuels Facilities Subject Matter Expert (HQ AFCEC/COS)[[Army - Headquarters, U.S. Army Corps of Engineers, POL-MCX Facilities Proponent (CECW-EC) through the Army Petroleum Center (APC)] [Navy/Marine Corps - NAVFAC POL Facility Subject Matter Expert (NAVFAC EXWC, CI11)]]].]

If a problem attributable to the valve's manufacturer or installation arises after the initial system start-up has been accomplished, and after system final acceptance date, [48] [_____] hours from the time of notification that a problem exists is allowed to solve the problem. The problem must be solved to the satisfaction of the [Contracting Officer, the Base Civil Engineer and/or the SME] [Contracting Officer]. If the Contractor cannot effectuate a proper resolution to the problem as outlined above in the [48] [_____] hour period, provide a factory trained engineer from the manufacturer of the valve within [48] [_____] hours after the expiration of the Contractor's initial [48] [_____] hour period to effectuate a resolution of the problem above. All services provided by the valve manufacturer must be at no cost to the Government. When it has been determined by the Contractor, Contracting Officer, and the valve manufacturer's representative that the valve(s) cannot be repaired in its installed position in the fuel system, it must be replaced with a new valve and pilot assembly within [48][_____] hours after the initial 96-hour period listed above expires and at no cost to the Government.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

The type of materials which come in contact with the fuel, if not specified herein before, must be noncorrosive.

2.2 CONTROL VALVES

2.2.1 General

Control valves must be single-seated globe type, diaphragm actuated,

hydraulically operated valves. Valves must consist of 3 major components: the valve body, valve cover, and diaphragm assembly. The diaphragm assembly must be the only moving part. In the event of diaphragm failure, valve must fail closed against flow, unless otherwise indicated. The main valve must be drip-tight when closed. Each valve must have an external indicator to show the position of the valve disc at all times. Control valves must be shipped from the factory as a complete assembly with all pilot controls and pilot auxiliary piping properly installed on the main valve. Materials which come in contact with the fuel must be resistant to the effects of and not harmful to aircraft engine fuel and must be stainless steel, or electroless nickel plated cast steel unless noted otherwise. [High level shut-off valve bodies must be electroless nickel plated.] [Valves at exterior locations must be stainless steel. Open canopies are considered an exterior location.] Materials for control valves, and items to be mounted on the valves must be as follows:

****
NOTE: Provide per SME direction.
****

2.2.1.1 Bodies, Bonnets, and Covers

Bodies, bonnets, and covers must 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. Cast steel conforming to ASTM A352/A352M Grade LCB internally plated with chromium, nickel, or internally electroless nickel plated.

d. Bodies must have flanged inlet and outlet connections. Valve must have a screwed bottom drain plug.

2.2.1.2 Valve Seats

****
NOTE: Provide per SME direction.
****

Valve seats must be stainless steel in accordance with ASTM A743/A743M. It must be possible to remove the valve seat while the valve is connected in the line. Valve seat and upper stem bearing must be removable and screwed in the body and/or cover. The lower stem bearing must be concentrically contained in the valve seat and must be exposed to flow on all sides. The diameter of the valve seat must be the same size as the inlet and/or outlet flanges of the main valve.

2.2.1.3 Valve Discs

Valve discs must 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 must be usable on either side. The disc guide must 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 must be capable of withstanding rapid closing shocks.

2.2.1.4 Diaphragm Assembly

Diaphragm Assembly must form a sealed chamber in the upper portion of the valve, separating the operating fluid from the line pressure. The diaphragm assembly must 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 must be sealed by the diaphragm. Valve stem must be stainless steel. The bearing material must be compatible with the fuel specified and must not contain zinc coated metals, brass, bronze, or other copper bearing alloys. The diaphragm must be of a nonwicking material or design, with a minimum of 2 layers of nylon fabric bonded with a minimum of 3 layers of synthetic rubber (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 must 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 must be certified by the manufacturer. The diaphragm must 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.

2.2.1.5 Bolts, Screws and Nuts

a. For Ductile Iron, and Cast Steel Body Valves.

(1) Bolts and Screws, cadmium plated steel in accordance with SAE J429, Grade 5.

(2) Nuts, cadmium plated steel in accordance with ASTM A194/A194M, Grade 2 H.

b. For Stainless Steel Body Valves. Bolts, Screws and Nuts, ASTM A320/A320M, Grade B8M C.1.1.

2.2.1.6 Pilot Control System and Auxiliary Piping

Pilot Control System and auxiliary piping must 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 0.9 mm 0.035-inch. Threaded connections must be used in pilot system piping and unions must be o-ring type with FKM o-rings. Tubing connections must not be welded.

2.2.1.7 Pilot Valves

Pilot valves must 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 must be as specified herein before. The setting of adjustable type pressure operated pilot valves must be easily adjusted by means of a single adjusting screw. The adjusting screw must be protected by a threaded cap drilled to accommodate a lead-seal wire and a lock nut must be provided on the adjusting screw to

lock it in position at the desired setting. The lead seal wire must be installed after final acceptance of the system. Spare wire seals and the "embossing" tool will be turned over to the Contracting Officer for the installation.

****
NOTE: Per SME direction.
****

2.2.1.8 Solenoids

Solenoids for operation of pilot valves must be housed in an explosion-proof case suitable for Class I, Division 1, Group D with maximum temperature rating of T3 (200 degrees C 392 degrees F), hazardous locations as defined in NFPA 70. Solenoids must be provided at voltage and frequency as shown on plans. A manual type operator or needle valve to bypass the solenoid valve must be provided for emergency manual operation.

2.2.2 Serviceability of Main Valve Internal Parts

Main valve movable parts including strainers, valve seat, stem bearings, and control system must be replaceable without removing the main valve from the line. All nonmetallic parts must be replaceable.

2.2.3 Total Lengths

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 must bring the valve face-to-face dimension equal to those listed below plus 2.2 mm 0.0875 inch. The lengths of the valves must be equal for the following materials: cast stainless steel, and cast steel.

SIZE mminches	VALVE LENGTH mminches
381-1/2	2168.5
502	2349.375
753	30512
1004	38115
1506	50020
2008	63525.4
25010	74529.8
30512	85034
35014	97539
40016	103441.375

SIZE mminches	VALVE LENGTH mminches
Note: Tolerance must be ±0.75 mm0.03 inch for size 38 mm 1-1/2 inches through 200 mm 8 inches and ±1.5 mm0.06 inch for size 250 thru 400 mm 10 thru 16 inches.	

Control valves not meeting these face to face dimensions must be supplied with spacers suitable for the proper installation of the valve.

2.2.4 Flanges

****
NOTE: Per SME direction.
****

MATERIAL	SEALING SURFACE
Cast Steel, ASME B16.5 Class 150	Raised Face
Cast Stainless Steel, ASME B16.5	Raised Face Class 150
Ductile Iron, ASME B16.24 Class 150	Flat Face
Note: The mating flange must be made the same as above.	

2.2.5 Identification

2.2.5.1 Main Valve Body

The following must 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

2.2.5.2 Main Valve Cover

The following must be cast into the main valve cover:

a. Size
b. Material
c. Foundry Heat Number and Identification

2.2.5.3 Brass Name Plates

Brass name plates must be fastened to the valve. Body name plates must list the following:

a. Size
b. Model Number
c. Stock Number

d. Manufacturer/Supplier
e. Manufacturer's Inspection Stamp

2.2.5.4 Inlet Name Plate

Inlet name plate must list the following:

a. Size
b. "Inlet" Marking
c. Assembly Model Number
d. Part Number

2.2.5.5 Outlet Name Plate

Outlet name plate must list the "Outlet" Marking.

2.2.5.6 Pilot Valves

Pilot valves must be tag identified. The valve must have the field adjusted start up setting engraved on a plastic tag, white with black lettering.

2.3 INDIVIDUAL CONTROL VALVE OPERATIONAL REQUIREMENTS

Operation, performance, and special features of the individual control valves must be as specified herein.

2.3.1 High Liquid Level Shut-Off Valve (HLV-1 AND HLV-2)

2.3.1.1 Size

200 mm 8-inch

2.3.1.2 Flow

75 L/s 1200 GPM

2.3.1.3 Operation

High liquid level shut-off valve must be hydraulically operated and must be provided with a tank exterior mounted float. Activation point of the float for opening and closing the high liquid level shut-off valve must be as shown on the drawings. Upon a rise in fluid level to the float activation point, the float control system must cause the main valve to close tightly. The main valve must remain closed until a drop in tank fluid level occurs. Upon a drop in fluid level beneath the float activation point, the float control must cause the main valve to open completely.

2.3.1.4 Check Valve Feature

****
NOTE: Delete for Cut and Cover Tanks.
****

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.1.5 Manual Test Feature

Manual testing of high level shut-off valve and exterior mounted float's automatic opening and closing feature must be possible.

2.3.1.6 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.1.7 Pressure Sensitive Close Feature

****
NOTE: Set the pressure to 10% over pump dead head pressure.
****

If the upstream pressure rises to 1 MPa 150 psi [____] or above while closing, the valve will stop closing or open slightly until the pressure is less than 1 MPa 150 psi [____].

[2.3.1.8 Minimum Differential Pressure Feature

The valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 34 to 170 kPa 5 to 25 psi.

][2.3.1.9 Opening and Closing Feature

The valve must be equipped with an adjustable differential pressure pilot and a quick cover exhaust system to allow the valve to open in 3-4 seconds when pressure is greater than [____][207] kPa [____][30] psig.

][2.3.1.10 Solenoid Control

The valve must be provided with solenoid control. The solenoid must close the HLV upon high-high level alarm activation. The solenoid must be energized to close. .

]2.3.2 Non-Surge Check Valve (CV-1 THRU CV-7)

2.3.2.1 Size

150 mm 6-inch; 50 mm 2-inch for FTP-1 and Jockey Pump

2.3.2.2 Flow

[60][40]L/s [950][650]GPM; 13 L/s 50 GPM for FTP-1; 1.3 L/s 5 GPM for Jockey Pump.

2.3.2.3 Operation

Non-surge check valve must open slowly. Opening speed must be adjustable from two (2) to 30 seconds without affecting closing of valve. Factory set for 15 seconds. The nonsurge check valves must fail closed against reverse flow in check condition.

2.3.2.4 Quick closure

Valve closure to be rapid, closing quickly when outlet pressure exceeds inlet pressure.

2.3.2.5 Flow Control

Valve to limit flow to [60] [40] L/s [950] [650] GPM (CV-1 thru CV-5), 13 L/s 50 GPM (CV-6 and CV-7). Sensing must be by orifice. Valve to modulate to limit flow without hunting. Rate of flow to be manually adjustable and utilize a downstream orifice plate holder.

2.3.2.6 Strainer

A 40-mesh, stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.2.7 Emergency Shut-off Operation

****
NOTE: To be added only to the pumps on Cut and Cover Tanks.
****

Open/closed valve, solenoid operated (CV-1 thru CV-5). Closure must be accomplished within 10 seconds upon power failure or activation of an emergency-stop pushbutton.

2.3.3 Non-Surge Check/Air Block Valve (AB/CV-1 THRU AB/CV-[ ])

2.3.3.1 Size

100 mm 4 inch and 50 mm 2 inch

2.3.3.2 Flow

0-[21.4][38.5]L/s 0-[310][610]GPM and 9.5 L/s for 50 mm 150 gpm for 2 inch.

2.3.3.3 Operation

Backpressure control pilots will cause main valve to modulate to maintain constant inlet pressure. There must be 3 backpressure control pilots, A, B, and C. Pilot A must be solenoid enabled and set at pressure which corresponds with unloading pump flow rate of 38 L/s 600 GPM. Pilot B must be solenoid enabled and set at pressure which corresponds with unloading pump flow rate of 19 L/s 300 GPM. Pilot C must be set at pressure corresponding with unloading pump flow rate of 10 L/sec 150 GPM through the secondary control valve. All pilots are to have 125-1250 kPa 20-200 PSIG range.

2.3.3.4 Speed Control

Valve must open slowly. Opening speed must be adjustable from two (2) to 30 seconds without affecting closing of valve. Factory set for 15 seconds. The valves must fail closed against reverse flow in check condition.

2.3.3.5 Check Feature

Valve closure to be rapid, closing quickly when outlet pressure exceeds inlet pressure.

2.3.3.6 Solenoid Control

Solenoid control of valve must be as indicated on the drawings.

2.3.3.7 Strainer

A 40-mesh, stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.4 Filter Separator Control Valve (FSCV-1 Thru FSCV-7)

2.3.4.1 Size

150 mm 6-inch

2.3.4.2 Flow

[56] [36] L/s [900] [600] GPM

2.3.4.3 Operation

Filter Separator Control Valve must limit flow to [56] [36] L/s [900] [600] GPM. Controlling to be by orifice. Rate of flow to be manually adjustable and utilize a downstream orifice plate holder.

2.3.4.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.4.5 Water Slug Shut-Off

****

NOTE: Do a hydraulic analysis on the transfer line to see if the water slug shut-off should be deleted from the receipt filter separators.

****

Valve must close rapidly when water is sensed at filter separator sump high level as indicated by Float Control Valve float position. Manual testing of operation must be possible.

[2.3.4.6 Shut-Off Feature at Maximum Differential Pressure

****

NOTE: Coordinate selection of this feature with the SME. For use on long transfer lines.

****

Valve must close rapidly when differential control pilot increases to preset point. Resetting of the differential control pilot must be manually reset after each shutoff.

]2.3.4.7 Emergency Shut-off Operation

****
NOTE: Delete from this location for Cut and Cover Tanks.
****

Open/closed valve, solenoid operated. Closure must be accomplished within 10 seconds upon power failure or activation of an emergency-stop pushbutton.

2.3.4.8 Solenoid Control

****
NOTE: Per SME direction. Function can also be done via a manual valve.
****

Solenoid control must be as indicated on the drawings.

2.3.4.9 Minimum Differential Pressure Feature

Valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 34 to 170 kPa 5 to 25 psi.

2.3.5 Filter Separator Float Control Valve and Tester (FC-1 THRU FC-7)

2.3.5.1 Operation

Float must ride on the fuel-water interface inside filter separator sump. Activation must initiate water slug shutoff of filter separator valve.

2.3.5.2 Float Control Pilot and Tester

The filter separator housing sump must be fitted with a float control pilot valve assembly made of stainless steel. The pilot valve is connected to the filter separator control valve. An integral float control tester must provide a means to remove a portion of the float ball ballast allowing the float to rise, verifying operation of the water slug and flow control valve, and the integrity of the float ball.

2.3.6 Back Pressure Control Valve (BPCV-1)

2.3.6.1 Size

150 mm 6-inch

2.3.6.2 Flow

0-[151] [170] L/s0-[2400][2700] GPM

2.3.6.3 Operation

****
NOTE: To be determined by system hydraulics. For the Type IV System, pantograph is required, inlet pressure will vary based on manufacturer, size, and number of legs.

****

Back pressure control valve must modulate to maintain constant inlet pressure. Set-point must be adjustable with a range of 1.3 to 13 MPa 20 to 200 psig. Factory set at [860] [550] [_____] kPa [130] [80] [_____] psig, and 1.1 MPa 160 psig. Valve must fail in the open position.

2.3.6.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.6.5 Solenoid Control

The valve must be provided with 2 solenoid controls and must operate as indicated on the drawings.

2.3.6.6 Speed Control

Valve must close slowly without affecting the opening speed and must be factory set for 8 seconds. Closing time must be adjustable with a range of 2 to 30 seconds. Valve opening time must be 1.0 second maximum.

[2.3.6.7 Opening Feature

The valve must be equipped with cover quick exhaust system to allow the valve to open in 3-4 seconds when pressure is greater than [_____] [1.1] MPa [_____] [170] psig.

]2.3.7 Pressure Control Valve (PCV-1)

2.3.7.1 Size

50 mm 2-inch.

2.3.7.2 Flow

3 L/s 50 GPM under normal operating conditions.

2.3.7.3 Operation

Pressure control valve must modulate to control inlet pressure and must have adjustable set-point with a range[s] of 0.13 to 1.3 MPa 20 to 200 psig. Factory set at 500 kPa 75 psig[, and 667 kPa 50 psig].

2.3.7.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.7.5 Solenoid Control

The valve must be provided with 2 solenoid controls and must operate as indicated on drawings.

2.3.7.6 Speed Control

Provide separate opening and closing speed controls each adjustable between 1 and 30 seconds. Factory set at 3 seconds for opening speed and 1 second for closing speed.

2.3.8 Defuel/Flush Valve (D/FV-1)

2.3.8.1 Size

203 mm 8-inch.

2.3.8.2 Flow

19 to [151] [170] L/s 300 to [2400] [2700] GPM.

2.3.8.3 Operation

Valve must modulate to control inlet pressure and must have adjustable set-point with a range of 0.125 to 1.25 MPa 20 to 200 psig. Factory set at 550 kPa 80 psig.

2.3.8.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.8.5 Solenoid Control

The valve must be provided with 2 solenoid controls and must operate as indicated on drawings.

2.3.8.6 Speed Control

Valve must open slowly without affecting the closing speed and must be factory set for 3 seconds. Opening time to be adjustable with a range of 2 to 30 seconds.

2.3.9 Hydrant Control Valve (HCV)

2.3.9.1 Size

100 mm 4 inch

2.3.9.2 Flow

38 L/s 600 GPM.

2.3.9.3 Operation

Hydrant control valve must modulate, by use of a liquid sensing line from [pantograph] [refueler] venturi, and regulate at a maximum pressure at the skin of the aircraft of 330 kPa 45 psig at any flow rate from 3 to 38 L/s 50 to 600 GPM. Pressure to be adjustable with a range of 103 to 515 kPa 15 to 75 psi. Valve, adapter and 90-degree hydrant coupler pressure drop must not exceed 7 MPa at 38 L/s 9 psi at 600 GPM with the valve fully open.

2.3.9.4 Quick Closure

Valve must close rapidly when outlet pressure exceeds control set-point. Valve must limit the surge pressure on the aircraft to a maximum of 800 kPa 120 psig when fueling at 38 L/s 600 GPM with an aircraft tank valve closure of 0.5 second. The valve must reopen when the outlet pressure drops below the set-point of the pilot if the deadman control lever is still depressed.

2.3.9.5 Deadman Control

****

NOTE: Select deadman control option, hydraulic for pantograph, pneumatic for refueler trucks. Verify type of deadman control to select with the SME.

****

Deadman must be [hydraulically] [pneumatically] connected to the pilot system of main valve. Valve must open when deadman control lever is pressed and must close valve when the lever is released to bleed air from the hydrant hose truck. On rupture of the deadman hose between outlet of deadman control and main valve pilot system, there must be no fuel leakage. Main valve must close in 5 seconds maximum when deadman is released or when one of the deadman hose couplers is disconnected.

2.3.9.6 Defuel

Valve must be capable of reverse flow at the rate of 19 L/s 300 GPM at 1.1 MPa 165 psig. Valve must be capable of defueling regardless of nozzle pressure created by the R-12.

'

2.3.9.7 Speed Control

Valve must open slowly without affecting the closure rate. Provide adjustable speed control with a range of 2 to 30 seconds.

2.3.9.8 Thermal Relief

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

2.3.9.9 Adapter

Valves must be provided with type adapter as indicated on drawings. Adapter must have pressure equalizing feature and have a vacuum tight dust cap.

2.3.9.10 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

[2.3.9.11 Minimum Differential Pressure Feature

The valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 34 to 170 kPa 5 psi to 25 psi.

][2.3.9.12 Contaminant Analyzer

****

NOTE: The use of contaminant analyzers must be only when approved by Service Headquarter.

****

The contaminant analyzer must use laser sensing technology to detect contaminants in the fuel. The complete contaminant analyzer component (including valve) must be in compliance with EI 1570 and EI 1598.

A. Sensor

1. Sensor must sense the presence of free water and solid particles entrained in fuel by sensing a change in electrical properties or light scatter patterns. No chemical means must be allowed. No use of consumables must be allowed.

2. Sensor must be capable of quantifying the concentration of contamination with the fuel. Contamination is defined as solid particles and undissolved or free water.

3. Sensor must differentiate between free water and solids. Sensor must quantify amount of each type of contamination within the fuel supply.

a. Sensor must be able to detect a high water "slug" defined as a free water measurement between 0 and 20 parts per million (ppm) (volume/volume) and have an accuracy of +/- 2 ppm or less; +/- 10% error or less. Factory set at 10 ppm.

b. Sensor must be able to provide solids measurement between 0.0 and 2.0 milligrams per liter, mg/L (ppm weight/volume is also acceptable), and have an accuracy of +/- 10% error or less. Factory setting based on end customer established issue requirements. Unless otherwise specified by customer, for US Army, 1.0 mg/L, for US Navy, 2.0 mg/L, and for US Air Force, 0.5 mg/L.

c. Sensor must be able to sense free water and solids independently and simultaneously to the accuracy stated in a and b.

4. Sensor must be able to start automatically on the initiation of fueling and once the fueling is over sensor must automatically shut off.

5. Sensor must sense high water "slug" and give an alarm output within 3 seconds of the event.

6. Sensor must recover from 50% water slug event within 30 minutes of clean fuel flow and 5 minutes for a high water "slug". Sensor must be able to recover automatically. Removal from piping must not be allowed. Fuel is defined as clean fuel when the water and solid measurements are below the thresholds listed in A.3.a an A.3.b

7. Calibration report must be included with sensor and must include detailed calibration method description.

B. Mechanical/Design

1. Sensor must use the full flow of product; i.e. sensor must be full flow, no sample lines must be allowed.

2. Sensor must be able to operate on rated flow of the system, and provide less than 5 psi loss of pressure at rated flow.

3. Valve and sensor must have a design pressure of 275 psi (gauge) or higher, an operation pressure of -1.5 psi to 200 psi pressure and a proof (test) pressure in excess of 415 psi.

4. Power to the system must be in the form of Alternating Current (AC). AC voltage requirements: 110-240 VAC, 50/60Hz; 40 Watt maximum power draw.

a. Sensor must be designed for and constructed to standards for operation in hazardous locations, minimum of Class 1, Division 2, per NFPA 497.

C. Output

1. Sensor must output a digital data stream that can be imported to a data acquisition system. Analog signals must not be allowed.

2. Sensor must be able to send data signals over long distances (greater than 50 feet,) which may be accomplished by data signal conversion.

D. Controls

1. A three position switch with the following functions must be provided: Bypass, Alarm, Alarm and Closure.

2. Bypass position must allow the alarm and closure to be deactivated and continue with fueling, completely disregarding the quality alerts being given.

a. In the event that the alarm system is bypassed, fuel quality information must continue to be collected. The bypass of the sensor may not be by powering down, or turning off the sensor.

3. Alarm position must sound an alarm and illuminate a red light upon detection of contamination.

4. Alarm and Closure position must perform the alarm functions and close the valve upon detection of contamination.

5. Alarm thresholds must be field adjustable.

6. Alarm system must be set up in a ‘Fail Safe’ manner so that in the event of

a. Incorrect or impaired functioning of the equipment, caused by reduction in supply voltage, or by any other means, the equipment must go into alarm and provide an alert to its condition

b. Loss of power, the equipment must go into closure position and when the power is restored, the equipment must go into the alarm condition.

7. A green light must be illuminated when the system is on and operational.

E. Valve Configuration

1. Sensors meeting the above requirements must be configured as a part of the control valve.

2. Sensing must be initiated by the opening of the control valve.

3. Sensor power down sequence must be initiated by closure of control valve.

4. Sensor must be capable of affecting the alarm shutdown condition directly on the control valve, stopping flow of fuel at the sensing location.

a. Sensor must retain ability to have an alarm override, and allow normal function of the control valve in event the sensor is impaired.

F. Modular User Readout - Sensor must interface to a modular user readout with the following features:

1. User readout consisting of a backlit LCD display indicating free water content in PPM and particulate solids in mg/L.

2. A visual alarm indicator lamp viewable from 50 feet.

3. A key operated by-pass switch.

4. Data logging feature to capture historical data on a flash memory card.

5. A real-time RS-232 data port for connection to a laptop computer equipped with compatible software.

6. A real time PC-based graphical user interface for data capture and viewing.

]2.3.10 Overfill Valve for Product Recovery Tank (OV-1)

2.3.10.1 Size

50 mm 2-inch.

2.3.10.2 Capacity

3 L/s50 GPM.

2.3.10.3 Operation

Hydraulically operated overfill valve must close automatically upon rising to Product Recovery Tank 95 percent fill level. Valve must open automatically upon falling below level as indicated on the drawings.

2.3.10.4 Control Float

Automatic opening and closing of the valve must be initiated by a control float located within the Product Recovery Tank. Control float must be provided with a manual tester, mounted external to the tank, for testing of overfill valve operation.

2.3.10.5 Pressure Reservoir

Valve must be provided with a pressure reservoir to supply required hydraulic pressure for operation. Reservoir pressure to be supplied by

Fuel Transfer Pump (FTP-1)using 13 mm 0.5-inch tubing connected upstream of the pump non-surge check valve. Valve must close upon loss of reservoir pressure. Reservoir must be a 4 L 1 gal capacity bladder-type tank, carbon steel constructed, tested and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 800 kPa 125 psi and precharged with air of 80-100 kPa 13-15 psig. The tank will be epoxy lined. The tank will be fitted with an air charging valve and pressure gauge.

2.3.10.6 Thermal Relief

Overfill valve must be provided with a pressure sustaining control valve that must automatically, upon inlet pressure rising to 1.3 MPa 200 psig, open allowing thermal relief around overfill valve. Pressure sustaining valve must automatically close upon inlet pressure dropping below 1.3 MPa 200 psig.

2.3.10.7 Limit Switch

Limit switch must be single pole, single throw contract (SPST) and provided with valve for remote indication of valve open or closed position. Valve closed position will become an alarm condition at the pump control panel (PCP).

2.3.10.8 Strainer

Pressure reservoir inlet line must be provided with a shut-off valve, strainer and check valve.

2.3.11 Truck Fill Stand Control Valve (TFV)

2.3.11.1 Size

100 mm 4-inch.

2.3.11.2 Flow

33 L/s525 GPM.

2.3.11.3 Operation

Valve must modulate to regulate downstream pressure to 200 kPa 35 psig at a flow rate of 3 to 33 L/s 50 to 525 GPM. Pressure must be adjustable with a range of 100 to 518 kPa 15 TO 75 psi. Valve solenoid must be connected to the overfill protection system.

2.3.11.4 Quick Closure

Valve must close rapidly when outlet pressure exceeds control set-point. Valve must limit the surge pressure on the bottom loader of a tank truck to a maximum of 585 kPa 85 psig when filling at 38 L/s 600 GPM with a tank truck valve closure of 0.5 second. The valve must reopen when the outlet pressure drops below the set-point of the pilot if the deadman control lever is still depressed.

2.3.11.5 Opening Speed Control

Valve must control the opening speed of the main valve. The control must be adjustable with a range of 2 to 30 seconds. Factory set at 10 seconds.

2.3.11.6 Deadman Control

Deadman must be hydraulically [electronically (Navy Ships)] connected to the pilot system of the main valve. Valve must open when deadman control lever is pressed and must close the valve when the lever is released. On rupture of the deadman hose between outlet of deadman control and main valve pilot system, there must be no fuel leakage. Main valve must close in 2 seconds maximum when one of the deadman hose couplers is disconnected. Length of hose must be 4.6 m 15 feet.

2.3.11.7 Thermal Relief

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

2.3.11.8 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.11.9 Solenoid Control

****
NOTE: For use with ground proving system.
****

Solenoid control of valve must operate as indicated on drawings.

2.3.12 Pantograph Control Valve (PTCV)

****
NOTE: Select use of pantograph control valve per SMEdirection.
****

2.3.12.1 Size

100 mm4-inch.

2.3.12.2 Flow

38 L/s 600 GPM.

2.3.12.3 Operation

Valve must modulate, by use of a liquid sensing line from the pantograph venturi, and regulate downstream to 379 kPa 55 psig at a flow rate of 3.8 to 38 L/s 50 to 600 GPM. Pressure must be adjustable with a range of 103 to 517 kPa 15 to 75 psi.

2.3.12.4 Opening Speed Control

Valve must control the opening speed of the main valve. The control must be adjustable with a range of 2 to 30 seconds. Factory set at 10 seconds.

[2.3.12.5 Thermal Relief

****

NOTE: For use Type IV Aircraft direct Fueling stations.
****

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

][2.3.12.6 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

]2.3.12.7 Minimum Differential Pressure Feature

The valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 34 to 170 kPa 5 to 25 psi.

2.3.13 Flushing Valve (FV-1)

2.3.13.1 Size

150 mm6-inch.

2.3.13.2 Flow

0-91 L/s0-1200 GPM.

2.3.13.3 Operation

Valve must open and close by means of hydraulic line pressure.

2.3.13.4 Solenoid Control

Solenoid control of valve must operate as indicated on drawings.

2.3.14 Pantograph Pressure Control Valve (PPCV-1 thru PPCV-[ ])

****
NOTE: Quantity based on number of Aircraft direct Fueling stations. One per station.
****

2.3.14.1 Size

38 mm1-1/2-inch.

2.3.14.2 Operation

Valve must open and close by means of hydraulic line pressure. Initial setting must be 517 kPa 75 PSIG and must be field adjustable between 345-690 kPa 50-100 PSIG. Final field pressure setting of valve must be equal to 10 percent above recorded line pressure at 45 L/s 600 GPM flow rate.

2.3.14.3 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

PART 3 EXECUTION

3.1 VALVE TESTING AND START-UP SUPPORT

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 must 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.

-- End of Section --