
USACE / NAVFAC / AFCEC / NASA

UFGS-33 08 55 (July 2007)

Preparing Activity: AFCEC

Superseding

UFGS-23 14 00 (April 2007)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2016

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SECTION 33 08 55

COMMISSIONING OF FUEL FACILITY SYSTEMS

07/07

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SECTION 33 08 55

COMMISSIONING OF FUEL FACILITY SYSTEMS 07/07

NOTE: This guide specification covers the requirements for commissioning of petroleum fuel systems. A "Fuel System" includes all equipment, components, control systems, devices, and associated appurtenances which are used for the receipt, storage, transfer and issue of petroleum fuel products. The following types of systems are covered: receipt systems, storage tank systems, transfer systems, hydrant systems, marine fueling systems, truck fillstands.

For "Type III" Hydrant System commissioning, use Specification Section 15899 of DoD Standard Design Number AW-078-24-28.

The designer should include the Contractor's / subcontractor's efforts associated with system startup and commissioning in any required Construction Cost Estimates.

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 items(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

1.1 SUMMARY/APPLICABILITY

This specification defines the requirements and procedures for startup and commissioning of fuel facility systems. It covers requirements for safety, Government scheduling and coordination, device testing, system flushing and cleaning, demonstration of indicated and specified system performance and final acceptance and reporting.

1.2 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 within the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-3004

((2014; Rev D; Chg 2015) Quality Assurance/Surveillance for Fuels, Lubricants and Related Products

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated 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 submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation 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.

Use the "S" classification only in SD-11 Closeout Submittals. The "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Commissioning Plan; G[, [_____]]

SD-06 Test Reports

Piping Flushing Checklist; G[, [_____]]

Piping Cleaning Checklist; G[, [_____]]

Control Valve Checklist; G[, [_____]]

Commissioning Report; G[, [_____]]

SD-07 Certificates

Certification of Completion

Disposal of Waste Materials

1.4 SAFETY

Prior to any on-site commissioning activities, the following safety procedures shall be accomplished in all fueling areas to be commissioned

under this specification section: testing/operation of emergency eyewash facilities, placement of Contractor-provided portable eyewash units within <31 meters><100 feet> or 10 seconds from the fueling point, verification of proper grounding throughout system, coordination with Government Fire and Safety Office and Fuels personnel, placement of [Contractor-][Government-]provided spill pads[and containment booms], placement of [Contractor-][Government-]provided fire extinguishers capable of extinguishing a fuel fire. Ensure that all radios/devices at all Class I, Division 1 areas are intrinsically safe.

1.5 [SYSTEM SUPPLIER INVOLVEMENT

NOTE: Include bracketed text if previous specifications require the use of a system supplier for equipment/controls supply, coordination and installation verification.

The System Supplier is defined in Specification [____]. The Contractor and the System Supplier shall work together to prepare the work plan, commissioning plan, test reports and final reports. They shall both be present during all commissioning activities and shall coordinate and schedule the work during construction, testing, calibration and acceptance of the system, and operator training. The System Supplier shall be responsible to the Contractor for scheduling all Contractor, sub-Contractor, and manufacturer's service personnel during system startup and final commissioning.

]1.6 COMMISSIONING PLAN

The Contractor shall submit a detailed written plan[prepared by the system supplier] for implementation of system commissioning. The commissioning plan shall specify a detailed plan incorporating in an sequenced manner all work specified in PART 3 EXECUTION of this specification section. The plan shall be submitted for Government approval [90][____] calendar days prior to commencement of fuel system commissioning. The plan shall include:

- a. Personnel. List of Contractor's personnel by trade, list of key personnel, list of safety equipment, list of miscellaneous equipment such as two-way radios, and personnel transportation vehicles.
- b. Performance Testing. Detailed equipment startup procedures and schedules to perform all system tests under each operating scenario in accordance with paragraph entitled "Performance Tests".
- [c. Pigging Plans. The Contractor shall submit a detailed written plan covering all aspects of the pipeline pigging operation, including anticipated pig runs, types of pigs, sequence of work, and retrieval/repair procedures. For gas-propelled pig runs, propellant shall only be used behind pigs and shall be isolated from the remaining system.]
- d. Test forms. Develop all test forms required for documenting the fuel system commissioning work. The format of the test forms shall follow the sequencing and terminology of the commissioning plan and shall furnish data grids and ample areas for test data recording.
- e. Schedule. Schedules shall generated listing dates and durations of all

commissioning activities as well as regular coordination and safety meetings and dates of key events for Government [and AFPET] participation.

- f. Fuel. Quantities of fuel needed for all commissioning activities and fuel delivery schedules. Plan shall include requirements and schedules for Government-provided materials and equipment.
- g. Contingency plans. Information on spill and fire contingencies, along with the required Government Fire and Safety Office involvement and approvals.

NOTE: Designer should identify all base-specific phasing and operational issues for incorporation in the contract documents.

- h. Coordination with Base. Description of how Contractor [and system supplier]shall implement system start-up in coordination with ongoing base operations. Plan shall incorporate all phasing and work restriction requirements of the Contract Documents.

1.7 CERTIFICATION OF COMPLETION

As a prerequisite to fuel system commissioning, the Contractor shall submit a Certificate of Completion that certifies all work provided on the fuel system, except for field painting, has been inspected and approved by the specified approving authorities. Further, the Contractor shall certify on this certificate that all specified checks and inspections have been successfully completed prior to commissioning. The Contractor shall give the Contracting Officer at least [45][30][_____] calendar days notice prior to commencement of fuel system commissioning. The Contractor shall submit the Certificate of Completion to the Contracting Officer at least [7][_____] calendar days prior to commencement of system commissioning. The Contracting Officer shall then be responsible for scheduling the Government representatives [and appropriate military command authority] [and designers]for participation in the inspection, performance testing, and final approval activities. Any contractual deficiencies observed shall be corrected by the Contractor without cost to the Government.

1.8 COMMISSIONING REPORT

Contractor shall prepare a commissioning report that documents the execution of the approved commissioning plan. All items of work specified in the commissioning plan shall be carried out and reported in this report unless otherwise approved by the Contracting Officer. Include as a part of this report verification letters of approved fuel storage tank hydrostatic tests and the piping hydrostatic tests, as generated under other specification sections. The commissioning report shall include the final settings of the control valves and pressure and flow switches [and a copy of the PLC-generated data spreadsheets and trend analysis graphs/charts] [and a copy of the strip chart graphs]with an explanation of what each graph indicates and what the system is doing.

1.9 DISPOSAL OF WASTE MATERIALS

The Contractor shall be responsible for properly disposing of any sludge, debris, filtration elements, and waste fuel resulting from piping and tank

cleaning and flushing activities as specified in Section [____]. [Comply with all applicable local, State, and Federal Regulations for hazardous waste disposal.]

PART 2 PRODUCTS

2.1 DESIGN CONDITIONS

Temporary flushing lines and equipment shall be equal in strength, stability, and materials to the associated permanent components; however, temporary spools may be carbon steel.

2.2 CONTRACTOR PROVIDED MATERIALS AND EQUIPMENT

NOTE: Delete all bracketed materials and equipment which do not apply to this project.

The Contractor shall provide all material, equipment and labor required for proper start-up of the system(s), except for that specified to be Government furnished. Equipment shall include but not be limited to the following:

- a. Temporary strainers.
- b. Pipe spools[to include spool pieces with a Single Point Receptacle on each end to allow defueling of the refueler tank trucks through the hydrant hose truck].
- c. Flow meters.
- d. Pressure Gages[to include bayonet type gage to be used on the SPR on the Government truck. Gage shall be turned over to the Government after startup is complete].
- [e. Electronic sensors and [PLC data logging feature][strip recorders] for pressure and flow recording are included in the PCP[, except for a sensor and cable for the data from the Hydrant Control Valve, to be plugged into the PCP]. This equipment shall be used to monitor and record the system during the "Equipment Test" and "Performance Testing" portions of this Specification Section. Recorded data shall be used by the Contractor and equipment factory representatives to achieve final control valve and equipment adjustments. Recorded data shall include:
 - (1) Fueling pumps discharge pressures.
 - (2) Supply Venturi flow rates.
 - (3) Hydrant Control Valve pressures.
 - (4) Back Pressure Control Valve upstream pressures.
 - (5) Back Pressure Control Valve downstream pressures.
 - (6) Return Venturi flow rates.]
- f. The Contractor must have on hand sufficient filter/separator elements and cartridges to adequately clean the system to aircraft quality use

limits. During cleaning operation specified in paragraph below, "Cleaning, Testing and Sampling", Contractor shall provide a flow versus pressure drop graph for each filter/separator[, including pantograph-mounted units]. Contractor shall change elements and cartridges upon reaching a differential pressure (DP) of <103 kPa at [38][19] lps> <15 psi at [600][300] gpm> or per manufacturer's recommended maximum DP at the actual flow rate, or when pressure drop is less than previously graphed or fails to increase properly. A minimum of one complete set of coalescer cartridges and separator elements for each filter/separator shall be turned over to the Government after new coalescer cartridges and separator elements are installed in each vessel and after completion of acceptance testing.

- [g. The Contractor must have on hand sufficient fuel quality monitor elements to adequately clean the system to aircraft quality use limits. During cleaning operation as described in the paragraph below, "Cleaning, Testing and Sampling", Contractor shall provide a flow versus pressure drop graph for each vessel[, including pantograph-mounted units]. Contractor shall change elements upon reaching a differential pressure (DP) of <103 kPa at [38][19] lps> <15 psi at [600][300] gpm> or per manufacturer's recommended maximum DP at the actual flow rate, or when pressure drop is less than previous graph or fails to increase properly. A minimum of one complete set of elements for each vessel shall be turned over to the Government after new elements are installed in each vessel and after completion of acceptance testing.]
- [h. Refueled tanker trucks for flushing and draining of the system.]
- [i. Hydrant hose trucks for fueling and defueling of aircraft.]
- [j. Defuel carts for defueling operation.]
- [k. The Contractor shall be responsible for providing the electrical power from a a source identified by the Government to the testing locations.]
- [l. Pig launching and receiving barrels.]
- [m. Temporary filtration/strainers.]

2.3 GOVERNMENT FURNISHED MATERIALS AND EQUIPMENT

**NOTE: Delete all bracketed materials and equipment
which do not apply to this project.**

The Government will furnish the following materials, equipment and services used during the execution of the commissioning plan. Any damage caused by the Contractor's operations shall be repaired at no additional cost to the Government.

2.3.1 Fuel

The Government will provide the fuel necessary for system testing. The Contractor shall notify the Contracting Officer a minimum of 60 days in advance of the requirements. Additional fuel will be provided by the Government as required for satisfactory flushing of the system. Upon satisfactory completion of the flushing and cleaning operations, the

Government will supply the additional quantities of fuel required to complete the other work under this specification section.

Fuel will not be delivered to the system until the Contractor has satisfactorily completed all work and, in particular, the cleaning and coating of the interior surfaces of the storage tanks and the removal of preservatives and foreign matter from those portions coming in contact with the fuel valves, pumps, filter/separators and other such equipment. Fuel delivered to the system shall remain the property of the Government and the Contractor shall reimburse the Government for shortages not attributable to normal handling losses.[The Contractor shall be responsible for the disposal of any contaminated fuel.] The Government shall be reimbursed for fuel lost as a result of defective materials or workmanship.

[2.3.2 Utilities

Electric power required for the performance of the work under this specification section will be furnished at no charge to the Contractor.

][2.3.3 Tank Trucks

Refueler tank trucks[and defueler tank trucks] will be furnished and operated by Government personnel.

][2.3.4 Hydrant Hose Trucks

The Government will furnish and operate the hydrant hose trucks required for ground refueling and defueling of aircraft at hydrant pits.

][2.3.5 Defuel Cart

**NOTE: Select defuel cart for systems using
hydraulic pantographs.**

The Government will furnish a defuel cart for the defueling operation on systems using pantographs.

][2.3.6 Pantographs

The Government will furnish and operate additional mobile pantographs for systems which do not provide enough pantographs to accomplish the full flow testing.

]PART 3 EXECUTION

3.1 PRELIMINARY REQUIREMENTS

**NOTE: Delete bracketed text if system does not
include an Oil/Water Separator.**

All activities listed in paragraph "PART 3 EXECUTION" shall be performed sequentially in the order they are presented. Prior to any on-site commissioning activities, the Contractor shall ensure that all requirements of the paragraph entitled "Safety" are satisfied. Project shall be substantially complete and Contractor's work area shall be free of debris,

trash and obstacles. [Correct functioning of oil/water separator(s) shall be verified prior to receipt of fuel.] Perform the following activities prior to receipt of fuel:

3.1.1 Electrical Preparations

Prior to energizing the electrical equipment, verify that short-circuit links have been removed from current transformer and that secondary circuits have been connected. Confirm that all tests required for fire detection and suppression systems have been performed and accepted. Verify all electrical transmitter connections and ensure proper calibration. Verify all electrical equipment meets Class I Division 1 requirements. Verify correct rotation of all motors prior to testing. Verify paddle type flow switches by physically actuating vanes and checking outputs. Conduit explosion-proof sealoffs shall be poured after initial electrical checks but before fuel receipt.

3.1.2 Emergency Fuel Shutoff (EFSO) System Testing

NOTE: Select appropriate functions/valve(s) of EFSO system.

Prior to initial fuel receipt, verify that each switch will trip the circuit breaker of the fuel pump[s] and de-energize the EFSO relay and close the [main emergency fuel shut-off valve] [flow control valve of each filter/separator].]

3.1.3 Storage Tanks

NOTE: Select appropriate tank features.

Ensure approved performance of storage tank integrity testing, hydrostatic tests and coating application/inspection per the applicable specifications. Include verification letter of approved test results for information in commissioning report. Ensure that tank interior is clean and free of any fuel-contaminating debris. Verify operation of tank level alarms[by closing tank connection valves and filling housings with fuel to confirm action]. Ensure that certified strapping charts for all tanks are available for start-up personnel.[Verify correct orientation of internal tank inlet diffuser.]

3.1.4 Piping System

Ensure that all piping weld integrity and coating inspections have been performed per the applicable specifications. Include verification of approved test results for information in the commissioning report. Evacuate all accumulated water from piping low point drains, valve cavities, and equipment drains. Verify all bolted connections are tightness tested to required torque using a calibrated torque wrench. Verify that all pressure gauges are properly located and installed. Ensure that piping's cathodic protection system is tested and operational. Ensure that pipe marking and identification is provided as specified. Ensure that piping system thermal relief provisions are installed and operating as designed. Verify the correct installation of piping expansion loops[, joints,] and supports.

[3.1.4.1 Pier Piping Systems

For pier delivery/receipt systems or other over-water piping installations, ensure compliance with the Contractor's previously approved spill control plans.

]3.2 PREPARATIONS FOR FLUSHING

Upon completion of the construction to the satisfaction of the Contracting Officer, the Contractor shall make the following preparations for system flushing.

3.2.1 Protection Of Equipment

The following components shall be removed from the system prior to start of flushing operations and, where applicable, replaced with pipe spools of internal diameter equal to the item removed.

- a. Control valves[, including hydrant pit control valves if flushing outlets into tank trucks. The Contractor shall be responsible for any damage to valves left in place].
- b. Flow and pressure sensors which are exposed to the system flush.
- c. Coalescer and separator elements in filter/separators.
- [d. Elements in fuel quality monitors.]
- [e. Venturi tubes and flow and pressure transmitters.]
- f. Fuel meters.

After flushing[and pigging], the above items shall be reinstalled in the system and the spool sections turned over to the Contracting Officer.

3.2.2 Strainers

**NOTE: Require permanent strainers as directed by
Service Headquarters Fuels Group.**

Temporary 40 mesh cone type strainers shall be installed in the suction line ahead of each fueling pump [for the entire flushing operation][to remain permanently in the system]. [A temporary strainer should be installed immediately upstream of the product recovery tank overfill valve.]Any damaged strainers shall be replaced by the Contractor at no additional cost to the Government.

3.2.3 Water Draw-Off

Remove any accumulated water from storage tanks' sumps and bottoms. Drain water and return fuel via filtration to storage tank. Repeat process until all water is removed.

[3.3 SWAB PIG RUN - PNEUMATIC

NOTE: Select bracketed paragraph if system is designed to be piggable and an initial cleaning/verification pig run is desired.

Upon completion of the piping system and all associated integrity and coating tests, an initial foam swab pig cleaning run should be performed. This will provide line proving and bulk cleaning of the interior of the piping system. [Contractor-provided pig launching and receiving barrels should be installed.]The pig should be constructed of light (2-5 lbs/cu. ft. density) open cell polyurethane foam, with polyurethane back and transmitter cavity. Propellant shall be pressurized dry air. [If piping system has previously been filled with fuel, propellant shall be pressurized nitrogen.]The swab pig shall be examined after the initial run for signs of possible pipe blockage or damage which may prevent future pig runs. The Contractor shall prepare a contingency plan for retrieving a stuck pig and repairing any piping deformations per the applicable specifications. Additional runs shall be performed until the amount of collected debris is minimized, as determined by the [Contracting Officer][System Supplier].

]3.4 INITIAL FUEL RECEIPT

3.4.1 General

Utilize one storage tank for initial fuel receipt to isolate contaminated fuel. Initial receipt of fuel shall be done by gravity if possible. The Contractor shall station personnel throughout piping system at high point vents to bleed air. All flanges and equipment will be periodically inspected for leaks during filling procedures.

3.4.2 Storage Tanks

Receipt flow rate into an empty storage tank shall not exceed 1 m per second 3 feet per second (FPS), as measured in the main receipt piping, until outlet of tank fill tube is submerged and pan/roof legs are lifted.

3.4.3 Components

Ensure that filter/separators and other vessels are filled slowly by closing outlet valves and venting through air eliminators. Downstream valves shall be throttled to maintain a packed condition in vessels throughout initial fill of piping system. Differential pressure across strainers shall be continuously monitored. Any time a strainer DP reaches 138 kPa 20 psig, it shall be cleaned.

3.4.4 Fuel Quality

Fuel used during initial receipt shall be considered contaminated and shall be positively isolated, with blind flanges or closed, padlocked manual valves, from any active aircraft or truck fueling operations. Fuel isolation shall continue until all flushing and cleaning is completed.

3.4.5 Fuel Receipt

[3.4.5.1 Fuel Receipt by Pipeline

Start-up personnel shall meet with Government personnel in charge of existing fuel storage to discuss fuel transfer procedures. Topics shall

include: methods of communication to start/stop remote transfer pumps; flow rate and head characteristics of transfer pumps; methods of restricting initial receipt flow rate; methods of straining and filtering initial receipt fuel; accommodating multiple pump starts resulting from required strainer and filter cleaning operations; required quantity of fuel to be transferred. Contractor shall provide a written summary of pipeline receipt procedures to the Contracting Officer.

][3.4.5.2 Receipt by Commercial Truck

Coordinate with Government personnel to schedule quantity of trucks required. Contractor's personnel shall be positioned at each unloading island, at the pumphouse and at the receipt tank, all in radio contact. Contractor shall provide a written summary of truck receipt procedures to the Contracting Officer.[If truck unloading system is newly constructed, perform initial receipt, flushing, and testing prior to performance testing.]

][3.4.6 Initial Low Point Flush

NOTE: Select "Initial Low Point Flush" paragraph for long piping systems, if a pneumatic swab pig run is not performed, or if piping system may be subject to collecting debris during installation.

Perform an initial low point flush operation by flushing each low point drain through a portable basket strainer for 10 seconds at a system pressure of 30 psig. Repeat flush until basket strainer collects no additional debris.

][3.4.7 Storage Tank and Piping Hydrostatic Tests with Fuel

After initial receipt of fuel into storage tanks, perform tank hydrostatic tests with fuel per Specification Section [_____]. Remaining system piping shall be packed with fuel, following procedures outlined in paragraph "General" above. Perform piping hydrostatic tests with fuel per the applicable specifications, ensuring the piping system is completely vented of air through the piping high point vent system. Contractor shall submit a tank and piping testing checklist to ensure the requirements of this and other applicable specifications are met.

3.5 FLUSHING

NOTE: Select type of piping system being flushed.
Select pantographs or hydrant hose truck.

The intent of the flushing operation is to remove bulk solids and water from the system. Flushing procedures shall precede cleaning procedures. All new [and modified]fuel piping, including the transfer line, receipt system piping, pier piping, pump house piping, apron loop, supply and return lines to the storage tanks, hydrant and fillstand piping, product recovery lines and [pantograph] [hydrant hose truck] lines shall be flushed with fuel.

3.5.1 Flushing Requirements

NOTE: Select bracketed text based on available pumping capacity. Require temporary pumps only after A/E feasibility review; if used, provide detailed work sequence/limitations on contract documents.

Begin flushing of fuel system pipelines at low flow rates using one delivery pump. Slowly increase flushing flow rate with additional pumps [until a +/-3.5 m/s 12 FPS fuel velocity is achieved][to full flow capacity] for a minimum of 30 minutes.[If 3.5 m/s 12 FPS cannot be achieved using system pumps, the Contractor shall provide additional temporary pumping capacity.] [For gravity, suction, or other non-pumped piping segments, minimum flushing volume shall be four times the pipe volume.]Flushing shall continue until the fuel being delivered is free of construction debris to the satisfaction of the Contracting Officer. Samples of fuel shall be taken and tested by the designated Government agency and shall be free of gross contamination and visible free water[, maximum of 8.0 mg/gallon solids and free water not to exceed 2 ml per quart for aviation fuel systems].

3.5.2 Fueling System Piping

The flushing of system pipelines shall be accomplished by pumping fuel from one storage tank through the fueling system piping[and back to another tank]. After high-speed flush of main system piping, all piping laterals shall be flushed with at least one refueling truck (18,930 L5000 gallons) of fuel. Air shall be bled from system high points. The procedure shall be continued until the fuel being delivered into the tanks is acceptable to the Contracting Officer. After the main piping system has been flushed to the satisfaction of the Contracting Officer, and periodically during the flushing operation, the Contractor shall flush all high point vents and low point drains for a minimum of 10 seconds at a pressure of 207 kPa 30 psig. Remove any accumulated water from storage tank sumps and bottoms. [In piggable systems, all plug valves shall be flushed of all debris using the drain port at the bottom of the valve.]Strainers shall be kept clean in order to insure maximum flow rate. All accumulated material from the strainers shall be reviewed and identified, including source if possible. Upon completion of the first flushing operations, the cone strainers shall be [removed from the system.][cleaned, reinstalled, and remain in the system.] In addition, baskets from all strainers shall be removed and cleaned.

[3.5.3 Pier Piping

NOTE: Modify to suit project-specific facilities/water availability at pier.

Pier piping and loading arms should be hydrostatically tested with fresh water per the applicable specification. After testing, flush piping with fresh water at 3.5 m/s 12 FPS for 30 minutes. [The Contractor will be allowed to use Government-furnished hoses.]Drain all water from piping system and refill with product. Perform flushing with product at 3.5 m/s 12 FPS for 30 minutes. [Government barges/equipment may be used to

facilitate system flushing.]

13.5.4 Piping Flushing Checklist

The Contractor shall generate a comprehensive matrix of all new[and existing] piping sections in the system. Matrix shall serve as an Owner's piping inventory and a checklist for all Contractor-provided flushing operations. Column entries shall include pipe section name, location, diameter, approximate length, flushing fuel velocity and volume achieved and acceptable results of sampling.

[3.6 PIPE PIGGING RUNS

**NOTE: Select bracketed paragraph if system is
designed to be piggable. Standard cleaning pig runs
are recommended on all systems.**

3.6.1 General

**NOTE: Include bracketed text for non-stainless
piping systems, or if excessive contamination is
anticipated.**

Track all pigs, using transmitter and receivers, at no less than 805 m 1/2 mile increments, but no less than at four locations. The Contractor shall prepare a contingency plan for retrieving a stuck pig and repairing any piping deformations. After pigging, plug valves shall be flushed of all debris using the drain port at the bottom of the valve. [Ensure that the fuel that is returned to the storage tanks during the pig runs is free of gross contamination and passes the color assessment method, and meets the requirements of MIL-STD-3004. Provide temporary storage tanks for the high particulate and dark color fuel that accumulates in front of and behind each pig. The contractor is responsible for [cleaning the off-spec fuel in order to meet the requirements of MIL-STD-3004] [dispose of the off-spec fuel off-base][obtain permission from the Contracting officer to downgrade the fuel and dispose of it in the appropriate tank.]]

3.6.2 Cleaning Pig Run

[Contractor-provided pig launching and receiving barrels shall be installed.]Initially, a proving pig run (foam density $<32 \text{ kg/m}^3$ $<2 \text{ lb/ft}^3$) should be performed to ensure the system is fully piggable. Upon completion of the successful proving pig run, the piping system shall be cleaned with a standard cleaning pig. This will provide thorough cleaning of the interior of the piping system. Cleaning pig shall be the bi-directional disk scraper style with steel body and replaceable polyurethane guiding and sealing disks, as well as gauge plates of 80 percent pipe diameter with 3 mm 1/8-inch segmented aluminum fins. The pig body should include bypass nozzles and transmitter cavity. Propellant shall be pressurized fuel using the main system delivery pumps. The pig shall be examined after the initial run for signs of possible pipe damage, interior slag or other adhered particles. Additional runs shall be performed until the amount of collected sludge or debris is minimized, as determined by the [Contracting Officer][System Supplier].

[3.6.3 Wire Brush Pig Run

NOTE: Select wire brush cleaning pig option if excessive slag or other adhered particles are suspected on the pipe interior. Require stainless steel brushes on stainless steel piping systems.

Note: Never perform wire brush cleaning pig on interior epoxy coated piping systems.

After the cleaning pig runs, the piping system shall be cleaned with a wire brush style pig. This will remove weld slag and adhered particles from the system. Wire brush pig shall be the bi-directional disk style or directional cup style with two circular [stainless] steel wire brushes. The pig body should include bypass nozzles and transmitter cavity. Perform wire brush pig runs until the amount of collected weld slag or debris is minimized, as determined by the [Contracting Officer][System Supplier].

]][3.7 CLEANING, TESTING, AND SAMPLING

NOTE: Include this paragraph and subparagraphs only when this paragraph is covering the commissioning of aviation fuel systems.

After the completion of the initial flushing[and cleaning pig runs], all new[and modified] piping shall be cleaned in accordance with the procedure specified hereafter. The intent of this cleaning operation is to remove trace solids and water from the system.

3.7.1 Preparation for Cleaning

Filter elements shall be installed in the filter/separators.[Elements shall be installed in the fuel quality monitors.] Adjust filter/separator flow control valve. Valves and equipment removed for flushing shall be reinstalled.[Cone strainers shall be removed.][Cone strainers shall be cleaned, reinstalled, and remain in the system.]Tanks[, including the product recovery tank] shall be drained, vapor freed and cleaned per the tank cleaning specification. Transfer the contents from one storage tank to the other through the filter/separators for the purposes of cleaning. [Provide temporary filtration as required to prevent cross-contamination of fuel.]

3.7.2 Cleaning Requirements

Pump fuel through all new[and existing] piping sections[including pantographs] in the system. Fuel velocity during all cleaning operations shall be full pumping capacity.[Minimum cleaning volume through non-pumped piping segments shall be four times the pipe volume.] Cleaning shall continue until Contracting Officer certifies that the fuel contains 2 milligrams per gallon or less of particulate and 10 parts per million or less of free water. Perform sampling at all system discharge points, at tanks, and throughout pumphouse and piping system. Sampling and testing shall be done by [the appropriate military service][an independent testing laboratory].

3.7.3 Cleaning Procedure

During cleaning procedure periodically bleed air through high point vents and flush low point drains for a minimum of 10 seconds at a system pressure of 207 kPa 30 psig. Monitor pressure drop through the filter/separators[and fuel quality monitor][including pantograph-mounted units] during each cleaning operation and provide flow vs. pressure drop graphs. Any time filter/separator[or fuel quality monitor] DP reaches its maximum allowable value, vessel elements should be replaced. [In piggable systems, all plug valves shall be flushed of all debris using the drain port at the bottom of the valve.]

3.7.4 Piping Cleaning Checklist

The Contractor shall generate a comprehensive matrix of all new[and existing] piping sections in the system. Matrix shall serve as a checklist for all Contractor-provided cleaning operations. Column entries shall include pipe section name, location, diameter, approximate length, fuel velocity and volume achieved, and acceptable results of sampling.

]3.8 CONTROL VALVE [AND VENTURI]ADJUSTMENT

All control valve settings shall be checked and field adjusted from the factory settings at start-up as necessary to provide a smooth operation. Adjustments to valves shall be made only by the Valve Manufacturer's authorized Field Test Engineer.

3.8.1 Control Valve Checklist

The Contractor shall generate a comprehensive matrix of all control valves in the system. Matrix shall serve as a checklist of all required control valve features, settings, and functions as specified. Column entries shall include control valve name, valve tag, pilot features, solenoid control features (if applicable), factory settings, and field adjusted settings. Submit matrix with commissioning "Final Reports".

[3.8.2 Venturi Adjustment

Calibrate and adjust each venturi and its associated transmitter readout to demonstrate accurate flow measurement.

]3.8.3 Pantograph Venturi Needle Valve

NOTE: Delete if pantographs are not used.

Venturi needle valve shall be adjusted to ensure a pressure equal to nozzle pressure at maximum flow possible. After initial setting, valve shall be locked in adjusted position.

]3.9 EQUIPMENT TESTS

After completion of flushing[, cleaning], and control valve and electrical component adjustments, the equipment tests and performance tests specified hereinafter shall be performed. [After cleaning is complete and]prior to performance testing, field adjustment of automatic control valves and automatic pump controls while in operation shall be made only by the valve manufacturer's authorized field test engineer. For final adjustment of

installed electrical control equipment the Contractor shall provide an experienced electrical engineer, factory representative of control panel manufacturer[and factory representative of pressure and flow device manufacturers]. Both the mechanical and electrical components shall be adjusted concurrently. Tests will be witnessed by the Contracting Officer and other Government representatives.

3.9.1 Emergency Fuel Shutoff System

With one fueling pump operating, test each "Emergency Stop" pushbutton station to verify that the pump stops and the[main emergency shutoff valve][fuel control valve of each filter/separator] closes.[Demonstrate operation of the EFSO station at the control center.] Repeat this procedure for each fueling pump and "Emergency Stop" pushbutton station. Conduct tests for both the automatic and manual modes. With all the fueling pumps circulating fuel through the system, push an "Emergency Stop" pushbutton station, ensure all pumps stop, and emergency fuel shutoff valve[s] close[s].

3.9.2 Filter/Separator Control Valve

Using the manual float control test lever on each filter/separator, slowly lift the weight from the float ball and verify the operation and closure of the water slug shut-off feature on the Filter/Separator Control Valve.

3.10 PERFORMANCE TESTS

During performance testing, the Contractor shall demonstrate that all portions of the fuel system are operating as designed and specified. Tests shall be performed under all operating scenarios. Additional tests may be required by the Contracting Officer [and Command Fuels Engineer]to fully demonstrate system performance. These tests shall be accomplished by the Contractor at no additional cost to the Government. The Contractor shall notify the Contracting Officer [15][____] calendar days in advance of the test to permit arrangement for the use of Government furnished items. Record required data necessary to prepare reports specified in paragraph entitled "Commissioning Report".

3.10.1

NOTE: Select all applicable systems, features, and functions of the project for which tests should be performed.

Fuel Receipt Systems

3.10.1.1 Aboveground systems

Demonstrate the following features:

- a. Static and continuity ground verification system.
- b. Manual start/stop pushbutton control.
- c. Level probe interconnection with flow control valve solenoids.
- d. Pump shutdown upon no-flow/empty off-loading tanker condition signal from flow switch.

- e. Receipt meter performance[and verification of proper calibration].
- f. [_____].

3.10.1.2 Drop tank systems

Demonstrate the following features:

- a. Tank overfill valve closure upon tank high level condition.
- b. Level alarm actuation.
- c. On/off staging of pump[s] by tank level alarms/probes.
- d. Pump shutdown on tank low level condition.
- e. Tank leak detection system performance (remove probe[s] and actuate by dipping into water/fuel test buckets).
- f. Manual start/stop pushbutton control.
- g. Tank gauging system.
- h. Pump shutdown upon no-flow condition signal from flow switch.
- i. Receipt meter performance[and verification of proper calibration].
- j. [_____].

Demonstrate all other tank features and functions per the applicable specifications.

3.10.2 Storage Tank Systems

Demonstrate the following features:

- a. Tank overfill valve closure upon tank high level condition.
- b. Level alarm actuation.
- c. Pump shutdown on tank low level condition.
- d. Tank leak detection system performance (remove probe[s] and actuate by dipping into water/fuel test buckets).
- f. Tank gauging system.
- g. Fire detection/suppression system performance (if AFFF system is used, do not test into tanks).
- h. [_____].

Ensure certified strapping charts are provided to the Contracting Officer. Demonstrate all other tank features and functions per the applicable specifications.

3.10.3 Transfer/Delivery Systems

Demonstrate the following features:

- a. Manual start/stop pushbutton control.
- b. Pump shutdown upon no-flow condition signal from flow switch,
- c. Pump shutdown upon signal from remote EFSO switch.
- d. [_____].

3.10.4 Hydrant Systems

Demonstrate the following features:

- a. Operation of all pressure and flow devices to automatically start and stop the fueling pumps at the indicated pressures and flow rates. The operating sequence shall be repeated with each of the pumps being selected as lead pump.
- b. Completely redundant, independent programmable logic controller capability.
- c. System's ability to deliver fuel to multiple fueling points at specified flow rates.
- d. Hydrant control valve surge shutdown and pressure control features.
- [e. Defueling performance of system under static conditions, with one fueling pump operating, and in the "Flush" mode.]
- [f. Operation of HSV/Pantograph checkout and flushing station.]
- [g. System performance in all operating[and pressure test/leak detection] modes.]
- [h. Operation of emergency generators during a simulated power outage.]
- i. [_____]

3.10.5 Marine Fueling Systems

Demonstrate the following features:

- a. Performance of loading meters[and verification of proper calibration].
- b. Performance of filter/separators.
- c. Loading/unloading arm function and operating range.
- d. Stripping pump operation.
- e. Operation of vents, drains, air eliminators, and hose connections.
- f. [_____].

Verify correct installation of piping expansion loops and supports. Verify electrical isolation between pier piping and ship. Verify that pier piping

thermal relief system is properly installed.

3.10.6 Truck Fillstands

Demonstrate the following features:

- a. Manual start/stop pushbutton control.
- b. Static and continuity ground verification (with actual ground/continuity readings) and overfill prevention system.
- c. Control valve deadman control, surge shutdown, and pressure control features.
- d. Issue meter performance[and preset controls][and verification of proper calibration].
- [e. Control valve and meter preset interconnections for flow control and automatic shutdown.]
- [f. Additive injector system.]
- [g. Bypass mode.]
- h. [_____]

3.10.7 Satisfactory Performance

In the event a portion of the system or any piece of equipment fails to meet the test, the Contractor shall make the necessary repairs or adjustments and repeat the Performance Test until satisfactory performance is obtained. Measured flow rates should be within [] percent of design. Tank level gauging and alarm measurements should be within [] of design. Any component found not to be working as specified shall be repaired/replaced by the Contractor at no additional cost to the Government. The determination of satisfactory performance shall be made by the Contracting Officer[and the Military Command Authority[and Government representatives]]. The system shall be filled with fuel and shall be operable and leak-free prior to acceptance. The Contractor shall be responsible for any leaks in the new or modified portions of the system. Anything wet with fuel is considered to be leaking.

3.11 TRAINING / INSTRUCTION FOR GOVERNMENT PERSONNEL

The contracting authority should provide one or two key personnel from their "operations" and "maintenance" departments to participate in all phases of system commissioning. The Contractor and System Supplier will be responsible for coordinating the involvement and training of these individuals during the startup process, including hands-on familiarization and adjustment of devices, valves, and components.

In addition, the Contractor and System Supplier shall conduct two 8-hour formal training sessions at the conclusion of system performance testing. These sessions shall include initial classroom system presentations as well as a complete system walk-through. The function, operation and maintenance procedures for all system devices and components will be explained. Training shall be videotaped and submitted in CD ROM or DVD format.

3.12 PROJECT CLOSEOUT

Ensure that As-Built drawings, equipment warranty documentation, and other project closeout activities are completed per the requirements of the applicable specifications.

-- End of Section --