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MILITARY SPECIFICATION

NOZZLE, PRESSURE FUEL SERVICING, LOCKING, TYPE D-1, D-1R, D-2 AND D-2R, NOMINAL 2½ INCH DIAMETER

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This document specifies the requirements for four types of locking pressure fuel servicing nozzles, designated Types D-1, D-1R, D-2 and D-2R, which have a nominal inlet diameter of 2½ inches.

1.2 Classification. Nozzles shall be of the following types, as specified (see 6.2):

Type Designation	Military Standard Number	Inlet Configuration	Pressure Regulation
D-1	MS29520	45° Elbow	None
D-1R	MS29520	45° Elbow	55 psi
D-2	MS29520	Straight	None
D-2R	MS29520	Straight	55 psi

All types employ a swivel fitting to facilitate hose handling during refueling.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Air Systems Command, AIR-5363, Washington, DC 20361-5360, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4930

SPECIFICATIONS

FEDERAL

P-D-680	Dry Cleaning Solvent
TT-S-735	Standard Test Fluids; Hydrocarbon
PPP-B-601	Boxes, Hood, Cleated-Plywood
PPP-B-621	Boxes, Hood, Nailed and Lock-Corner
PPP-B-636	Box, Shipping, Fiberboard
PPP-B-640	Boxes, Fiberboard, Corrugated, Triple-Hall
PPP-C-1752	Cushioning Material, Packaging, Unicellular Polyethylene Foam, Flexible
PPP-C-1842	Cushioning Material, Plastic, Open Cell (for Packaging Applications)
PPP-E-540	Envelopes: Water-Resistant for Packing List and Shipping Documents

MILITARY

MIL-P-116	Preservation-Packaging, Methods of
MIL-P-5315	Packing, Preformed, Hydrocarbon Fuel Resistant
MIL-C-5541	Chemical Conversion Coatings on Aluminum Alloys
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General specification for
MIL-I-8500	Interchangeability and Replaceability of Component Parts for Aerospace Vehicles
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for
MIL-R-25988	Rubber, Fluorosilicone Elastomer, Oil and Fuel Resistant, Sheets, Strips, Molded Parts, and Extruded Shapes
MIL-T-38219	Turbine Fuel, Low Volatility, JP-7
MIL-T-83133	Turbine Fuel, Aviation, Kerosene Type, Grade JP-8
MIL-R-83248	Rubber, Fluorocarbon Elastomer, High Temperature Fluid and Compression Set Resistant
MIL-C-83488	Coating, Aluminum Vapor Deposited

STANDARDS

MILITARY

DOD-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking for U.S. Military Property
MIL-STD-810	Environmental Test Methods and Engineering Guidelines

MIL-STD-831	Test Reports, Preparation of
MIL-STD-889	Dissimilar Metals
MIL-STD-970	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-1523	Age Control of Age Sensitive Elastomeric Material
MIL-STD-1629	Procedures for Performing a Failure Mode, Effects and Criticality Analysis
MIL-STD-2175	Casting, Classification and Inspection of
AN763	Gasket - Swivel, Fitting Flanged
MS24484	Adapter, Pressure Fuel Servicing, Aircraft Nominal 2½ Inch Diameter
MS26551	Strainer, 2½ Inch Pressure Fuel Servicing
MS29513	Packing, Preformed, Hydrocarbon Fuel Resistant, "O" Ring
MS29520	Envelope Dimensions, Nozzle, Pressure Fuel Servicing Locking Aircraft, Type D-1 and D-2
MS33786	Fitting Installation, Flared Tube and Hose, Swivel

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issue of the nongovernment documents cited in on the date of the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 910	Standard Specification for Aviation Gasolines
ASTM D 3951	Commercial Packaging, Practice for (DoD ADOPTED)

(Application for copies of ASTM publications should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

2.3 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein (except for MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The D-1, D-1R, D-2 and D-2R nozzles furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.3).

3.2 Materials. Materials and processes used in the manufacture of nozzles shall be resistant to all fluids as specified in TT-S-735, MIL-T-5624, MIL-T-38219, MIL-T-83133, and ASTM D 910. When used in alloys, copper and magnesium shall be limited to 5% of the total metal, unless authorized by the qualifying activity. The use of cadmium is prohibited.

3.2.1 Metals. Corrosion resistant metals shall be used. Exterior surfaces susceptible to contact with ferrous surfaces during use shall use nonsparking materials.

3.2.1.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals as defined by MIL-STD-889 shall not be used in contact with each other.

3.2.1.2 Protective coatings. All aluminum alloy parts shall be protected by coatings in accordance with MIL-A-8625, MIL-C-5541, MIL-C-83488, or other protective coatings which will withstand the effects of this specification.

3.2.1.3 Color Identification. The nozzle shall employ a red bumper or red embossed nameplate to identify use with fuel.

3.2.2 Castings. Castings shall be classified and inspected as specified in MIL-STD-2175.

3.3 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-970.

3.4 Design. The nozzle shall be designed to operate within the clearance envelope of MS29520 and shall mate with the MS24484 adapter within a misalignment angle up to 4 degrees. The nozzle shall transfer fuel at flows up to 600 gallons per minute (gpm) with operating pressures of up to 55 psi. The fuel flow shall be controlled by an ON/OFF fuel flow actuation lever separate from the handles used to hold or attach the nozzle to the adapter. Actuation of the lever shall simultaneously open or close the adapter sealing unit and permit flow to or from the aircraft. Operation of the lever from the non-flow to flow position shall be impossible unless the nozzle is secured onto the adapter. Removal of the nozzle from the adapter shall be impossible unless the lever is in the non-flow position. The lever shall remain in either the full flow or non-flow position under the full range of flows and pressures, during fueling or defueling, without the need of maintaining continuous manual holding force. To prevent leakage, the nozzle-to-adapter main seal shall automatically conform to the adapter when the nozzle is attached and opened. The seal must compensate for 0.020 inch wear on the adapter lugs, dimensional tolerances, side loading, and temperature changes. Provision should be made for the clearance of a screen conforming to MS26551, as detailed in MS29520. The inlet flange shall be designed to accommodate an AN763-40 gasket. In addition to these design requirements, D-1R and D-2R nozzles shall regulate the downstream pressure to within the pressure regulation envelope (Figure 6) when subjected to inlet pressures ranging from 60 to 120 psi and shall incorporate a pressure relief valve which will relieve any trapped downstream pressure within 10 seconds.

3.4.1 Swivel inlet. The nozzle shall employ a swivel inlet fitting capable of 360° rotation to allow the hose connection to turn without hindrance.

3.4.2 Dust cap. A nonmetallic cap shall be provided to prevent dust from entering that portion of the nozzle which engages the adapter and protect the seal face of the nozzle during handling when tested to the requirements of MIL-STD-810, (see 4.6.4). When not in use, the cap shall hang free outside the refueling envelope so that it will not interfere with the refueling. Retention springs are not permitted.

3.4.3 Lubricants. The nozzle shall operate satisfactorily without the use of lubricants.

3.4.4 "O" ring packing and seals. "O" ring packing and associated seals shall conform to MIL-P-5315, MIL-R-25988, MIL-R-83248, MS29513, or MS33666 as applicable, or other materials approved by qualification testing (see 4.3.1).

3.4.4.1 Age controls for synthetic rubber parts. Age sensitive synthetic components shall be marked in accordance with MIL-STD-1523.

3.4.5 Maintenance. The overhaul of the nozzle or any subcomponents shall be possible by maintenance personnel with tools and equipment normally available commercially.

3.4.6 Pressure drop. Sufficient line pressure shall be maintained to sustain stabilized flow in the fueling and defueling modes when tested with the fuel flowing through the nozzle and MS24484 adapter, with the MS26551 strainer removed for both modes.

3.4.6.1 Fueling mode. The pressure drop across unregulated nozzles, D-1 and D-2, shall be not greater than 15 pounds per square inch (psi) corrected, when subjected to a 600 gpm flow of fuel and when tested in accordance with 4.6.2.2.1. The pressure drop across the regulator only, shall be less than 5.0 psig at 300 gpm.

3.4.6.2 Defueling mode. With reversed fuel flow through the nozzle, the pressure drop shall be not greater than 3 psi corrected, when subjected to a 200 gpm flow of fuel and when tested in accordance with 4.6.2.2.2. The pressure drop across regulated nozzles, D-1R and D-2R, shall not be greater than 7.0 psig at 200 gpm.

3.4.7 Flow-actuation lever. The flow-actuation lever shall be capable of operating from full closed to full open with a maximum torque of 40 pounds force inch (lbf•in) when a force of 50 pounds is applied against the nozzle poppet in the direction to close the nozzle.

3.4.8 Strength. The nozzle shall be able to withstand the loads shown on Figures 1 and 2 without leakage, distortion, or failure when tested in accordance with 4.6.6.

3.4.9 Accessory ports. The nozzle shall be provided with two sampling port bosses having a 0.375 inch National Pipe Thread (NPT). Location and design shall allow insertion of a sampling probe which protrudes 1.0625 inches beyond the probe thread. Insertion of the probe shall not interfere with the operation of the nozzle or the MS26551 screen.

3.4.10 Electrical continuity. Electrical continuity between the nozzle and adapter shall be established through the attaching lugs when the units are connected. The resistance from the nozzle inlet flange to the adapter locking flange shall be not greater than 10 ohms.

3.5 Construction. The nozzle shall be so constructed that it will pass the tests defined in Section 4.

3.6 Performance. The nozzle shall satisfy all performance requirements when subjected to any tests of 4.2 in the order listed. In addition, D-1R and D-2R nozzles shall regulate the downstream fuel pressure such that it never exceeds 60 psi under steady state flow and 120 psi under surge conditions.

3.7 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable in accordance with MIL-I-8500. The item identification and part number requirements of DOD-STD-100 shall govern the manufacturer's part numbers and changes thereto.

3.8 Weight. The weight of a D-1 or D-2 nozzle shall be not greater than 11.5 pounds. A D-1R or D-2R nozzle shall not exceed 14 pounds in weight.

3.9 Threads. All machine screw threads shall be in accordance with MIL-S-7742 or MIL-S-8879.

3.9.1 Locking of threaded parts. All threaded parts shall be locked to prevent loosening or detachment which would result in the part entering the system being refueled or cause foreign object damage to the aircraft.

3.10 Operational/Maintenance Manual. A manual which provides specific instructions for the operation, maintenance, and repair of the nozzle by refueling personnel shall be provided and approved in accordance with 4.3.4 and 5.1.1.2.

3.11 Identification of product. The nozzle shall be marked for identification in accordance with MIL-STD-130. The identification shall be permanent and its location shall not affect nozzle performance. The minimum information is as follows:

Nozzle, Pressure Fuel Servicing
Contract No.
Type D- (insert applicable dash number)
Manufacturer's identification, part number, serial number
Cure date per MIL-STD-1523 *(if applicable)*

3.12 Safety. The nozzle shall be designed to minimize fuel sprays and/or spills resulting from failure of any nozzle component. The manufacturer shall prepare a detailed nozzle Failure Modes and Effects Analysis (FMEA) in accordance with MIL-STD-1629, which will at a minimum, list each individual component or piece part, its purpose, each possible component failure; i.e., loose, broken, missing, etc., and the effect of each failure under

operating conditions. The government will determine any corrective actions deemed necessary by the FMEA.

3.13 Workmanship. The nozzle shall be uniform in quality, clean and free from faults and burrs.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classifications of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.3).

b. Quality conformance inspection (see 4.4).

4.3 Qualification inspection. Qualification inspection shall consist of the tests specified in paragraph 4.3.1. At the discretion of the qualifying activity, individual qualification tests may be waived or modified. The Government reserves the right to conduct verification tests and field evaluation on four additional untested nozzles. The verification tests shall consist of any tests contained in paragraph 4.6 which the Government desires to perform. Successful completion of this inspection is required for qualification. Samples submitted shall be accompanied by two complete sets of detail and assembly drawings. Detail and assembly drawings are supplied for qualification and conformance only, and for no other purpose. Samples shall be submitted to the Naval Air Warfare Center - Aircraft Division - Trenton, P.O. Box 7176, Trenton, NJ 08628-0176.

4.3.1 Qualification tests. The qualification tests, which are listed in Table I, shall be conducted on two sample nozzles which represent production units. The tests shall be conducted in the order specified by the "Test Number" in TABLE I. D-1R/D-2R tests

encompass D-1/D-2 however, D-1/D-2 testing does not encompass D-1R/D-2R.

4.3.1.1 Rejection and retest. When a nozzle fails to meet any of the requirements of the qualification tests, the program will be halted until the extent and cause of failure are determined. Prior to reinitiation of the test program, full particulars of the failure and the action required to correct the fault will be reported to the qualifying activity. All qualification tests which are affected by the corrections shall be repeated.

4.3.2 Manufacturer's drawings. Included with the manufacturer's drawings submitted with the qualification test specimens shall be a cutaway section showing all parts in their normal assembled positions and shall specify part numbers of all parts and subassemblies. The drawings shall be considered proprietary to the vendor. In additional the following information shall be furnished on or together with the assembly drawings.

a. Envelope dimensions and mounting provisions.
b. Materials, construction, treatment, and finish.
c. Pressure and flow rate ratings.

4.3.3 Test report. The test report submitted with the untested qualification test specimens shall conform to MIL-STD-831 and shall include the following:

a. Report of all tests, together with a detailed statement indicating conformance or extent of conformance with all requirements of this specification, referring specifically to paragraph numbers. Wherever a requirement is considered to be not applicable, the report shall so state.

b. Summary of endurance test.

c. Diagrams of all test setups.

d. Outline and description of tests and test conditions.

e. Copies of test log sheets.

f. Photographs.

g. List and descriptions of testing equipment.

h. List of where specific tests were conducted.

i. The Failure Modes & Effects Analysis (FMEA) for the nozzle.

4.3.4 Operational/Maintenance Manual. The manual shall be provided with the test samples detailing the recommended operation, maintenance, and repair of the nozzle. Format for the manual shall be in accordance with normal commercial practice. Review and approval of the manual by the qualifying activity is necessary prior to release for procurement purposes (see 3.10 and 5.1.1.2).

4.3.5 Retention of qualification. To retain qualified status, each manufacturer is required, at intervals not exceeding two years, to forward to the qualifying activity, a certificate signed by a responsible official of management. The certification shall state that all conditions are the same that existed at the time of qualification and that the requirements of the current specification can be met.

TABLE I.
Qualification Tests

Test	Test Number		Test Paragraph
	Sample 1	Sample 2	
Examination of product	1	1	4.6.1
Proof pressure	2		4.6.9
Calibration	3	2	4.6.2
Dust test	4		4.6.4
Swivel endurance	5		4.6.5
Endurance	6		4.6.7
Electrical conductivity	7		4.6.12
Fuel resistance and low temperature		3	4.6.3
Salt water immersion		4	4.6.8
Strength		5	4.6.6
Leakage		6	4.6.2.3
Regulator Endurance	8*		4.6.14.1
Contaminated fuel		7*	4.6.14.2
Pressure regulation	9*	8*	4.6.14.3
Pressure relief		9*	4.6.14.4
Piston strength	10*		4.6.14.5
Downstream lockout	11*	10*	4.6.14.6
Surge Control	12*	11*	4.6.14.7
Burst Pressure	13		4.6.10
Drop test		12	4.6.11
Disassembly and inspection	14	13	4.6.13

* Additional tests for regulated nozzles.

4.4 Quality conformance inspection. Quality conformance inspection shall be performed under the surveillance of the Government Inspector on lots submitted for acceptance under contract. The quality conformance test shall consist of individual tests (See 4.4.1) and sampling tests (See 4.4.2).

4.4.1 Individual tests. Each nozzle shall be subjected to the following tests, as described under 4.6.

a. Examination of product (see 4.6.1).

b. Functional, no flow required (see 4.6.2.1).

c. Leakage, +10 and 60 psig only (see 4.6.2.3).

d. Downstream lockout D-1R/D-2R only (see 4.6.14.4)

4.4.2 Sampling plan and tests.

4.4.2.1 Sampling plan. One nozzle shall be selected at random from each production lot up to 200 units, and one out of every 500 units thereafter.

4.4.2.2 Sampling tests. The nozzles, selected in accordance with 4.4.2.1 shall be subjected to the following tests, which shall be in addition to the individual tests specified in 4.4.1.

a. Calibration (see 4.6.2).

b. Strength (see 4.6.6)

c. Proof pressure (see 4.6.9)

d. Disassembly and inspection (see 4.6.13).

4.4.2.3 Failures. When a nozzle selected from a production run fails to conform to the specification, no items still on hand or produced later shall be accepted until the extent and cause of failure have been determined, reported on, and appropriately corrected. Reports shall be forwarded in accordance with 4.3.3.

4.5 Test conditions. Unless otherwise specified, the following test conditions shall apply.

4.5.1 Test fluid. Fluid in accordance with ASTM D 910 grades 100/130 or 100LL; MIL-T-5624, grades JP-4 or JP-5, MIL-T-83133, grade JP-8, or TT-S-735, type I and type III, MIL-T-38219 shall be used for testing. Fluid conforming to P-D-680, type II, or any fluid acceptable to the contracting activity, may be used when a specific fluid is not specified.

4.5.2 Ambient temperature and pressure. All tests shall be performed with the ambient and test fluid at temperatures of 60°F to 90°F and at local barometric pressure.

4.5.3 Test adapter. The test adapter used shall be an MS24484 installed in a test housing (see Figure 3).

4.6 Test methods.

4.6.1 Examination of product. Each nozzle shall be subjected to inspection for adherence to the envelope requirements of MS29520 and applicable design drawings. The nozzle shall be examined to determine conformance to the requirements of this specification with respect to materials, interchangeability, construction, finish, identification, workmanship, weight, location of accessory ports, and protective coatings. The foregoing shall be noted and recorded.

4.6.2 Calibration.

4.6.2.1 Functional. The nozzle shall be attached onto the test adapter (see Figure 3) and the adapter sealing valve actuated a minimum of five times. Test fluid shall be passed through the nozzle and adapter with flows from 100 to 600 gpm in 100 gpm increments with a minimum inlet static pressure of 40 psig under flow conditions and 55 psig in the non-flow position. The adapter sealing valve shall be actuated to open and shut a minimum of three times at each flow condition, and there shall be no evidence of binding or chattering of the lever. The torque required to actuate the lever shall be less than 40 lbf•in. under no-flow conditions.

4.6.2.2 Pressure drop tests. With a test setup similar to Figure 4, and the MS24484 adapter and test housing in accordance with Figure 3, pressure drop data shall be obtained. When testing a regulated nozzle, D-1R or D-2R, it will be necessary to block the regulator open to prevent regulator operation due to downstream pressure losses while conducting pressure drop tests. Test results shall reflect both actual and corrected pressure drops and compliance with the fueling and defueling pressure drop. The formula for correction is as follows:

$$\Delta P_{corrected} = \Delta P \times \left[\frac{1.34}{\nu}\right]^{0.25}_{cs} \times \left[\frac{0.769}{\rho}\right]$$

where: ν = kinematic viscosity of test fluid (cs)
ρ = specific gravity of test fluid
ΔP = pressure drop through nozzle and test adapter determined as shown in figure 4.

4.6.2.2.1 Fueling mode. With an inlet pressure of 40 psi, a pressure drop test shall be performed with fuel flows from 0 to 600 gpm, in 100 gpm increments.

4.6.2.2.2 Defueling mode. A pressure drop test shall be performed with fuel flows from 0 to 200 gpm, in 50 gpm increments.

4.6.2.3 Leakage.

4.6.2.3.1 Connected. With the nozzle connected to the adapter (see Figure 3) and the nozzle flow-actuation lever in the full open position, the leakage test shall be conducted over a range of -12 to 4 psig in 2 psi increments and from 10 to 60 psig in 10 psi increments. Air at pressures from -12 to 0 psig shall be applied to the nozzle inlet. The pressure shall be maintained at each increment for at least one minute. There shall be no evidence of external fuel leakage from the nozzle, and air leakage inward into the nozzle shall not exceed 50 cc per minute during any part of the leakage tests.

4.6.2.3.2 Disconnected. With the nozzle disconnected from the adapter, fuel pressures of 0 to 60 psig in 10 psi increments, air at pressures from -12 to 0 psig in 2 psi increments, shall be applied to the nozzle inlet. Pressure shall be maintained for at least one minute at each increment. There shall be no external fuel leakage nor air leakage into the nozzle.

4.6.2.4 High flow shutoff. With the nozzle connected to the adapter (Figure 3) and test housing, conduct ten rapid shutoffs with the flow-actuation lever while flowing 400 gpm and 600 gpm at an minimum inlet pressure of 60 psig. There shall be no evidence of deformation, fracture, or malfunction of the nozzle.

4.6.3 Fuel resistance and low temperature. A fuel resistance and low temperature test shall be conducted in accordance with Table II.

4.6.4 Dust. The nozzle, with the dust cover in place and the inlet sealed, shall be subjected to test method 510.2 of MIL-STD-810. The functional test requirement of 4.6.2.1 shall be conducted following completion of the dust test.

4.6.5 Swivel endurance. The nozzle swivel shall be wear-tested by loading the nozzle with a 100 pounds force feet (lbf•ft) bending load (see Figure 1) and turning the swivel 2000 times through at least a 45° arc. During this test, the nozzle will be pressurized with test fluid to 55 psig. Following this loading, the nozzle shall successfully complete the proof pressure test of 4.6.9.

4.6.6 Strength. An MS24484 adapter shall be retained by the mounting flange only, to a fluid container capable of sustaining any pressures applied. The nozzle shall be connected and the adapter valve actuated to the flow position. The nozzle shall be filled with test fluid. There shall be no evidence of leakage, deterioration, deformation, fracture, or malfunction when the following loads are applied to the nozzle (Figures 1 and 2).

a. 25 applications of a 600 pound force foot (lbf•ft) bending load, applied as shown on Figure 1.

Table II Fuel Resistance and Low Temperature Test Schedule

Test Period [1]	Fuel Resistance				Low Temperature
	Phase I, Soak	Phase I, Dry	Phase II, Soak	Phase II, Dry	
Component configuration	Valve closed during first 72 hours and open during last 24 hours [2]	Drained, valve closed, inlet port open	Valve closed during first 12 hours and open during last 6 hours [2]	Drained, valve closed, inlet port open	Valve closed [2]
Test Fluid	TT-S-735, type III	None	TT-S-735, type III	None	TT-S-735, type I
Period duration	96 hours (4 days)	24 hours	18 hours	30 hours	18 hours
Ambient air or test fluid temperature	158 ±2°F	Circulating air at 158 ±2°F	158 ±2°F	Circulating air at 158 ±2°F	Lower the fluid temperature to -35 ±2°F, then maintain the fluid at that temperature for a minimum of 18 hours
Operation or test during period	Connect and disconnect nozzle and actuate valve once every 6 hours	None	Connect and disconnect nozzle and actuate valve one every 6 hours	None	None
Operation or tests immediately after period	Conduct leakage test (4.6.2.3), using TT-S-735 type III fluid at positive pressures only	Connect and disconnect nozzle and actuate valve once in dry condition. Conduct leakage test (4.6.2.3), using TT-S-735 type I fluid at positive pressures only	Same as phase I soak	Same as phase I dry	With ambient temperature and test fluid at -35°F: (a) operate the nozzle through 10 complete cycles. (b) Conduct leakage test, using TT-s-735 type I fluid at positive pressures only. [3]

[1] Each period shall follow immediately after the preceding one in the order noted.

[2] The component shall be maintained in such a manner as to insure complete contact of all non-metallic parts with the fluid as would be expected under normal service conditions. An assembly test housing conforming to Figure 3 shall be used when the valve is open. No connection shall be made during soak period when the nozzle is closed, except for test purposes.

[3] For the low temperature test (4.6.3), the leakage limits are :
Static: 0-4 psig - No leakage
Static: 4-60 psig - 2 ml per minute
During actuation: 0-60 psig - 2 mil per actuation

b. 950 applications of a 350 lbf•ft bending load, applied as shown on Figure 1.

c. 25 applications of a 200 lbf•ft bending load, applied as shown on Figure 1, with a fluid pressure of 240 psig applied to the adapter-nozzle combination.

d. 100 applications of a combined load of a 100 lbf•ft couple applied to the nozzle handles and an axial load of 200 pounds applied to the nozzle inlet flange in accordance with Figure 2, with a fluid pressure of 240 psig applied to the adapter-nozzle combination.

4.6.7 Endurance. There shall be no evidence of binding, chatter, or leakage during the tests of 4.6.7.1 and 4.6.7.2. The force to actuate the lever shall not exceed the requirements of 4.6.2.1.

4.6.7.1 Normal operation. The nozzle shall be operated for 2,000 cycles (6.4.1) with fuel pressure of 55 psig applied to the nozzle in the closed position and with fuel flow through the nozzle in the open position at a minimum rate of 400 gpm.

4.6.7.2 Maximum loading. The nozzle, filled with fuel, shall be connected to the MS24484 adapter in a test setup capable of imposing a 25 $^{+3}_{-0}$ pounds load on the poppet in the closed position in a direction tending to close the valve. After the valve is opened 0.75 inch, the load shall be increased to 50 $^{+5}_{-0}$ pounds. The valve shall be fully opened and closed 2,000 times. Upon completion of this test, the leakage test (4.6.2.3) shall be conducted at positive pressure only.

4.6.8 Salt water immersion. The nozzle shall be immersed in a solution consisting of 5 percent by weight of NaCl in distilled water. After immersion, the solution shall be drained and the nozzle shall be heated in an oven to a temperature of 130 ±5°F for a period of not less than one hour. The immersion and heating cycle shall be repeated 50 times. The nozzle shall not be operated at any time during the immersion cycles. Immediately after completing the immersion cycles, the nozzle shall be washed with warm water to remove all salt accumulations. The nozzle shall be dried, wetted with fuel, and operated for three complete cycles (see 6.4.1). Corrosion of any part of the nozzle to a degree that affects performance shall be cause for rejection.

4.6.9 Proof pressure. Pressurize the D-1/D-2 to 180 psig for at least one minute. There shall be no evidence of leakage, distortion or other damage to any part of the assembly. The D-1R/D-2R, with their axial center lines parallel with the ground and ambient vent port pointing down, shall not allow formation of a free falling drop from the sense port when inlet and outlet are simultaneously pressurized to 180 psig for at least one minute, nor shall there be evidence of leakage, distortion or other damage.

4.6.10 Burst pressure. Pressurize the D-1/D-2 to 240 psig for at least one minute. There shall be no evidence of distortion or other damage to the nozzle, leakage when lowered to 60 psig. Pressurize the inlet and outlet of the D-1R/D-2R, orientated as in (4.6.9) to 240 psig for at least one minute. There shall be no evidence of distortion, damage or formation of a free falling drop from the sense port, nor leakage when lowered to 60

psig.

4.6.11 Drop test. The nozzle, attached to a 2½ inch ground refueling hose, shall be dropped at least ten times from a height of 6 feet onto a steel plate. Drops shall be configured to impact at least once upon the handles, lever, and the nozzle seal face. The remaining impact shall be at random locations as specified by the Naval Air Propulsion Center. The steel plate shall be at least ½ inch thick resting on a concrete floor. The upstream portion of the hose shall lie at floor level during the test. Upon completion of this test, the nozzle shall satisfactorily pass the functional (4.6.2.1) and leakage (4.6.2.3) tests.

4.6.12 Electrical conductivity. With the nozzle attached to the MS24484 adapter, a resistance reading shall be made between the nozzle inlet and the adapter mounting flange. Resistance shall be not greater than 10 ohms.

4.6.13 Disassembly and inspection. The nozzle shall be disassembled in accordance with the operational manual for inspection of all parts. All anomalies shall be photographed and discussed in the test report. There shall be no defects that would cause the nozzles to fail to function within specification limits.

4.6.14 Pressure regulator performance. The tests contained in the following paragraphs are applicable to pressure regulated nozzles only, i.e. D-1R and D-2R. These tests shall be conducted with the nozzle installed in the figure 5 configuration with the nozzle's flow control lever in the fully opened and locked position.

4.6.14.1 Regulator Endurance. While maintaining a flow between 20 and 400 gpm, cycle the inlet pressure from 50 to 100 to 50 psig for a total of 2,000 cycles. The ambient sense port shall point down to allow drainage of any accumulated test fluid. The outlet pressure shall not exceed 60 psig nor shall a free-forming drop accumulate from the sense port.

4.6.14.2 Contaminated Fuel. Test fluid containing the type and concentration of contamination specified in Table III shall be pumped through the regulator between 20 and 400 gpm for a minimum of 250 cycles. A cycle shall consist of varying the inlet pressure from 50 to 100 to 50 psig. A 60 mesh screen may be placed upstream of the regulator. The outlet pressure shall not exceed 60 psig nor shall a free-forming drop accumulate from the sense port when orientated as in 4.6.14.1.

4.6.14.3 Pressure Regulation. Increase then decrease test fluid flow from 30 cc/minute to 600 gpm to obtain sufficient data to plot the regulating characteristics of the regulated nozzle at inlet pressures of 60, 80, 100 and 120 psig. The resultant outlet pressures shall be within the acceptable area on the Figure 6 diagram.

4.6.14.4 Pressure relief. Establish and maintain a pressure of 120 psig down stream of the regulator. Establish a pressure of 20 psig upstream and measure the time and pressure when the pressures stabilize. The stabilization time shall be less than 10 seconds. The downstream pressure shall be within 10% of the upstream pressure.

TABLE III
Test Fuel Contamination Levels

Contaminant	Particle Size	Quantity
Iron Oxide	0-5 microns 5-10 microns	28.5 gm/400 gal 1.5 gm/400 gal
Sharp silica sand	150-300 microns 300-420 microns	1.0 gm/400 gal 1.0 gm/400 gal
Prepared dirt conforming to AC Spark Plug Co. Part No. 1543637 (Coarse Arizona Road dust)	Mixture as follows: 0-5 microns (12%) 5-10 microns (12%) 10-20 microns (14%) 20-40 microns (23%) 40-80 microns (30%) 80-200 microns (9%)	8.0 gm/400 gal
Cotton linters	Grade 6, staple below 7, second cut linters (US Dept of Agriculture Grading Standards)	0.1 gm/400 gal
Crude napthenic acid		0.03% by volume
Salt water solution shall contain 4 parts NaCl to 96 parts H_20 by weight		0.01% entrained

4.6.14.5 Piston Strength. Set the outlet pressure to 120 psig while maintaining the inlet pressure near 0 psig for a minimum of one minute. This may require blocking the pressure relief valve to maintain the differential. There shall be no signs of failure or fatigue.

4.6.14.6 Downstream Lockout. Set the inlet pressure of the regulated nozzle to 120 psig and monitor the outlet pressure under a maximum leakage flow of 30 cc/min. The outlet pressure may not exceed the regulated value by more than 20 psig.

4.6.14.7 Surge Control. Establish a wide open regulator while flowing 300 and 500 gpm, nozzle inlet pressure shall not be less than 35 psig. Close the outlet shutoff valve in 0.5 (± 5%) and then 1.0 (± 5%) seconds at each flow condition; repeat three times. The shutoff valve closure shall have a linear time rate of change of flow area ± 5% from full open to closed. Outlet pressure spikes shall not exceed 120 psig nor shall there be any indication of fatigue or breakage.

5. PACKAGING

5.1 Preservation. Preservation shall be Level A or Commercial as specified (see 6.2).

5.1.1 Level A. Level A preservation shall be Method III in accordance with MIL-P-116.

5.1.1.1 Cleaning and drying. The nozzle shall be cleaned and dried by a process or combination of processes which will accomplish a thorough cleaning and drying without damage to the nozzle in accordance with MIL-P-116.

5.1.1.2 Unit pack. The unit pack shall contain one nozzle, cleaned as in 5.1.1.1, and one manufacturer's maintenance manual. The nozzle shall be placed in a container conforming to type CF class weather resistant of PPP-B-636 and if necessary, cushioned with material conforming to PPP-C-1842 or PPP-C-1752. The manual shall be placed in an envelope conforming to PPP-E-540, class 4.

5.1.2 Commercial. The nozzle shall be preserved in accordance with ASTM D 3951.

5.2 Packing. The shipping containers shall be of minimum cube consistent with the level of protection specified (see 6.2). All shipping containers will contain the same number of unit packs snugly packed. The levels of packing shall be A, B, or Commercial.

5.2.1 Level A. The specified number of unit packs shall be packed in oversized containers conforming to PPP-B-621 or PPP-B-601 (see 6.2). Strapping and closure shall be in accordance with the appendix of the applicable shipping container.

5.2.2 Level B. The specified number of unit packs shall be packed in weather resistant containers conforming to PPP-B-636 or PPP-B-640 (see 6.2). Closures shall be in accordance with the appendix of the applicable container specification.

5.2.3 Commercial. Commercial packing shall be in accordance with ASTM D 3951.

5.3 Marking.

5.3.1 Military. Each unit pack and shipping container shall be marked in accordance with MIL-STD-129.

5.3.2 Commercial. Commercial marking shall be in accordance with ASTM D 3951.

6. NOTES

(This section contains information of a general or explanary nature that may be helpful, but is not mandatory.)

6.1 Intended use. The nozzles covered by this specification are intended for use in refueling or defueling an aircraft by means of a pressure fuel servicing system. The nozzle types D-1 and D-1R incorporate a 45° inlet configuration which is preferred for horizontal

refueling. The nozzle types D-2 and D-2R incorporate a straight inlet configuration which is preferred for vertical refueling. The nozzle types D-1R and D-2R incorporate a 55 psig pressure regulator.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Type (D-l, D-1R, D-2, or D-2R) nozzle (see 1.2 and 6.1).

c. Levels of preservation, packaging, and packing (see Section 5).

6.3. Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-5877 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, AIR-5363, Washington, DC 20361-5360; however, information pertaining to qualification of products may be obtained from the Naval Air Propulsion Center, P.O. Box 7176, Trenton, NJ 08628-0176.

6.4 Definitions.

6.4.1 Cycle. Unless otherwise specified, a cycle is defined as connecting the nozzle to the test adapter, fully opening and closing the flow-actuation lever four times, and removing the nozzle from the test adapter.

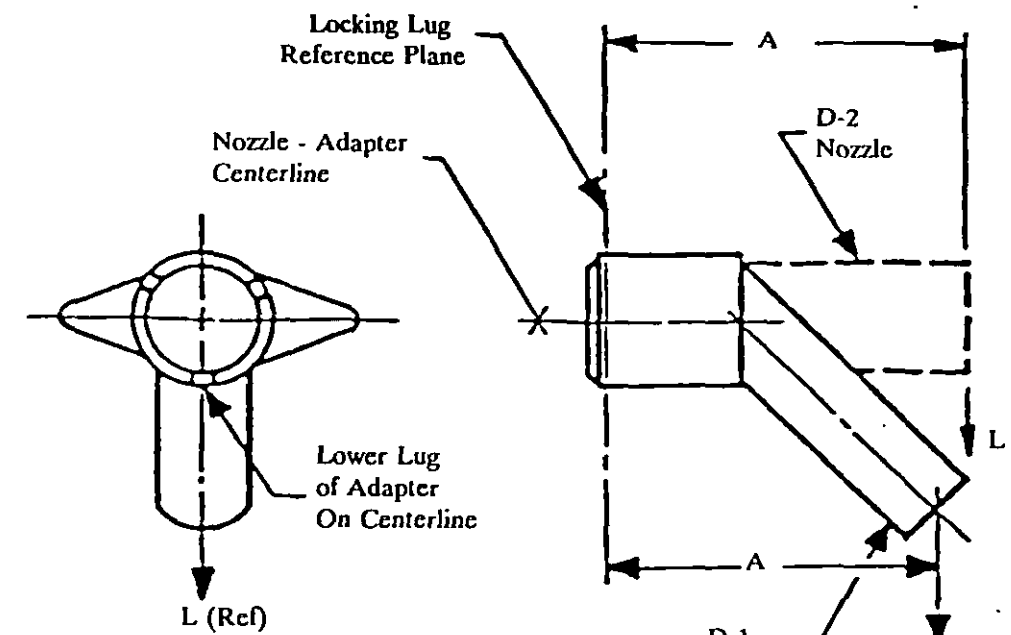
6.5 Subject term (key word) listing.

Aircraft pressure defueling
Aircraft pressure refueling
Fueling
Nozzle
Hose end pressure regulator
Pressure regulator
Regulated nozzle
Unregulated nozzle

6.6 International standardization agreements. Certain provisions of this specification (3.4) are the subject of international standardization agreement ASCC AIR STD 25/4 and STANAG 3105. The amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take

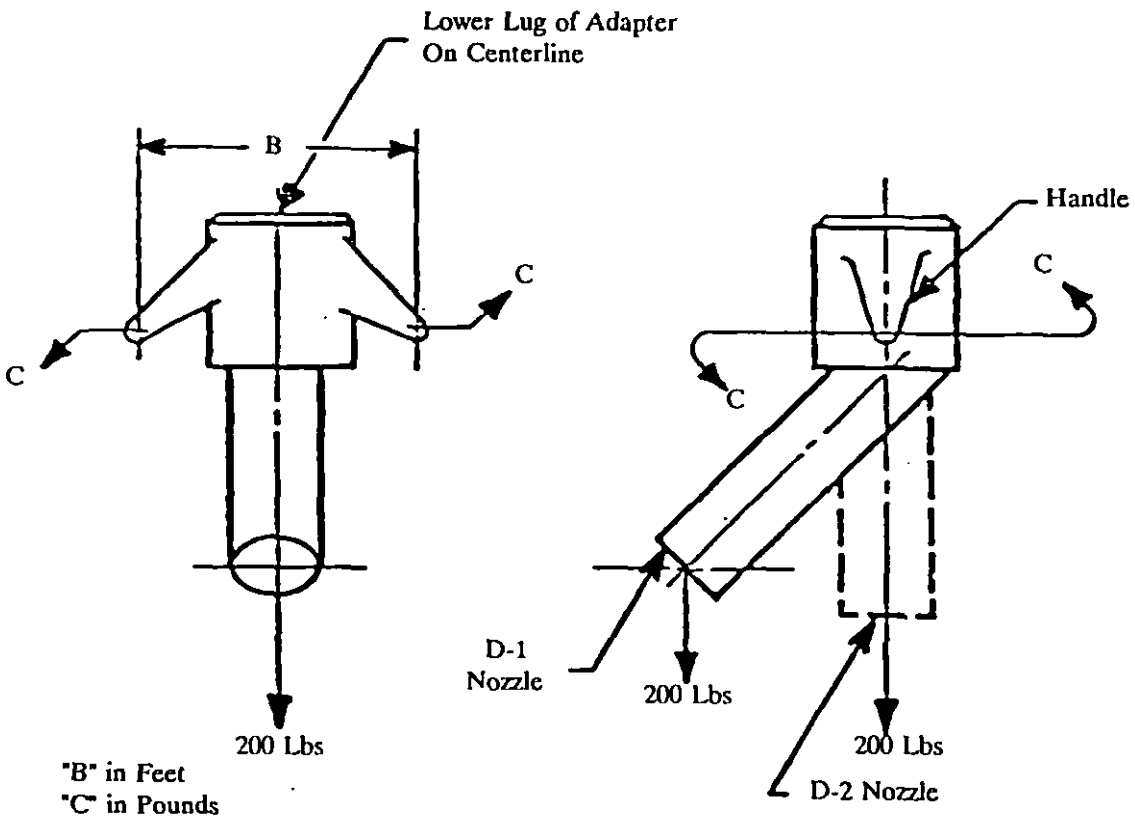
appropriate action through international standardization channels including departmental standardization offices to change the agreement or make other appropriate accommodations.

6.7 Changes from the previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.



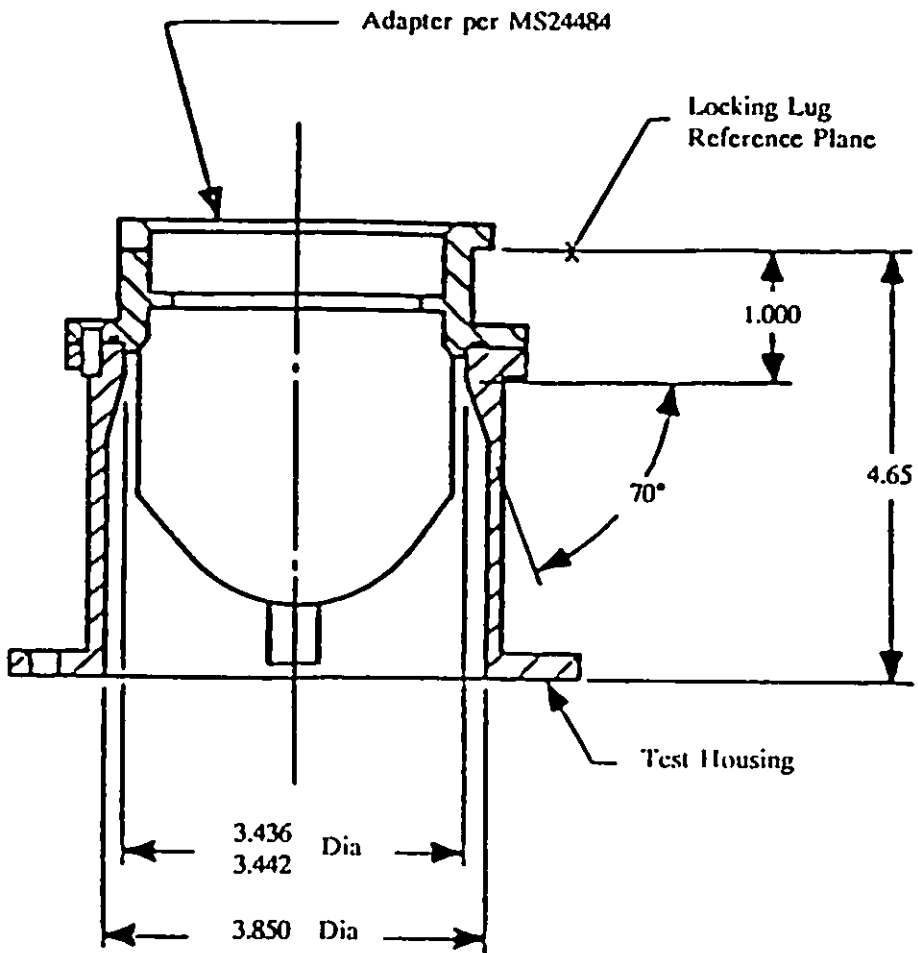
"A" in Feet
"L" in Pounds
Bending Load = L x A

FIGURE 1. Strength Test (Bending)



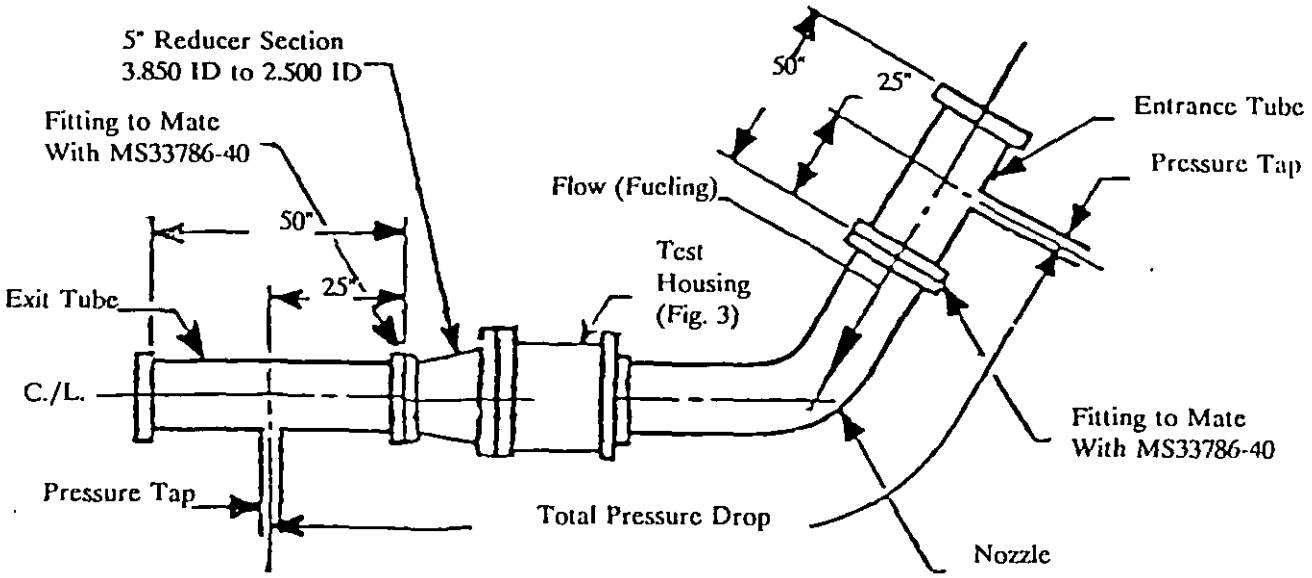
"B" in Feet
"C" in Pounds
Couple = C x B = 100 lbf•ft

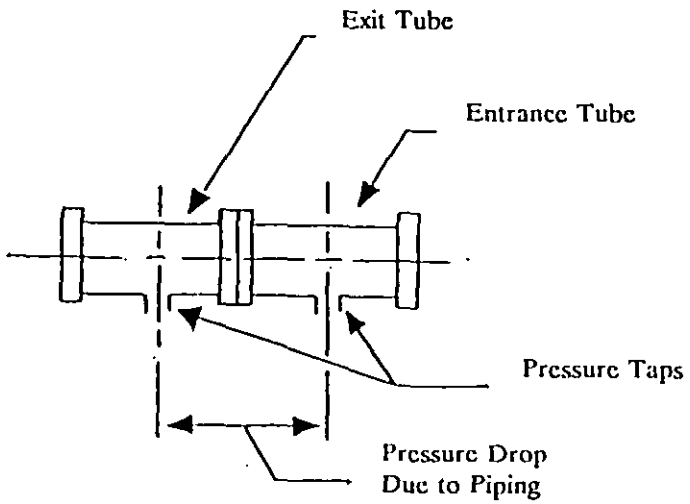
FIGURE 2. Strength Test (Combined Loading)



UNLESS OTHERWISE SPECIFIED
Dimensions are in inches.
Tolerances: 0.XX = ±0.03
0.XXX = ±0.010
Angles = ±1.0°

FIGURE 3. Test Housing





ΔP = Total Pressure Drop - Pressure Drop Due to Piping

Nominal Tube Size, Entrance and Exit Tubes = 2½" Schedule 40

FIGURE 4. Pressure Drop Test

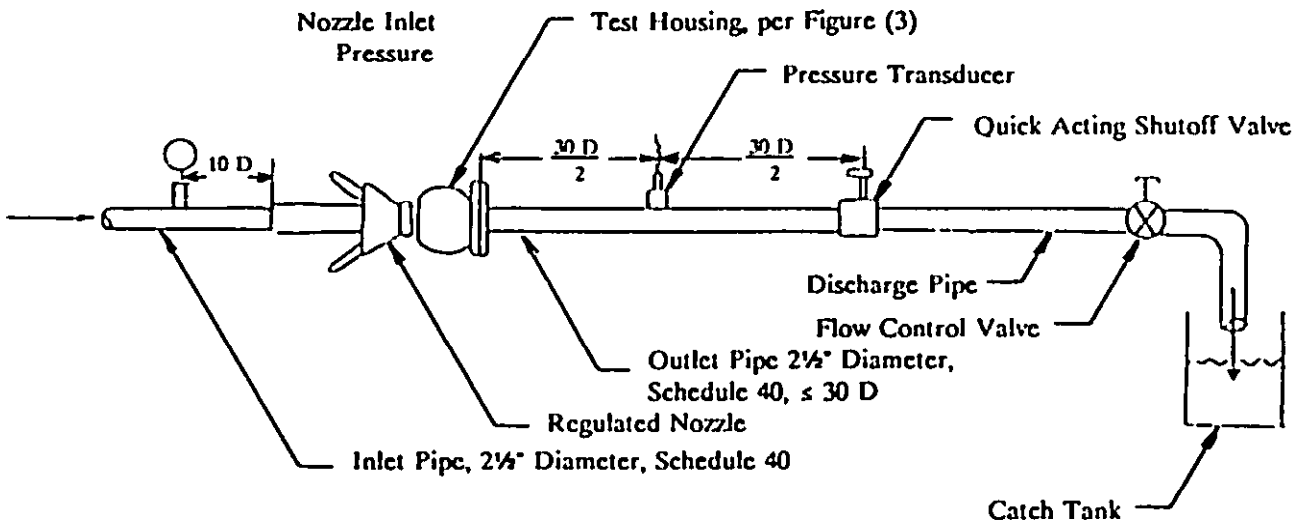


FIGURE 5. Regulation Pressure Test Setup

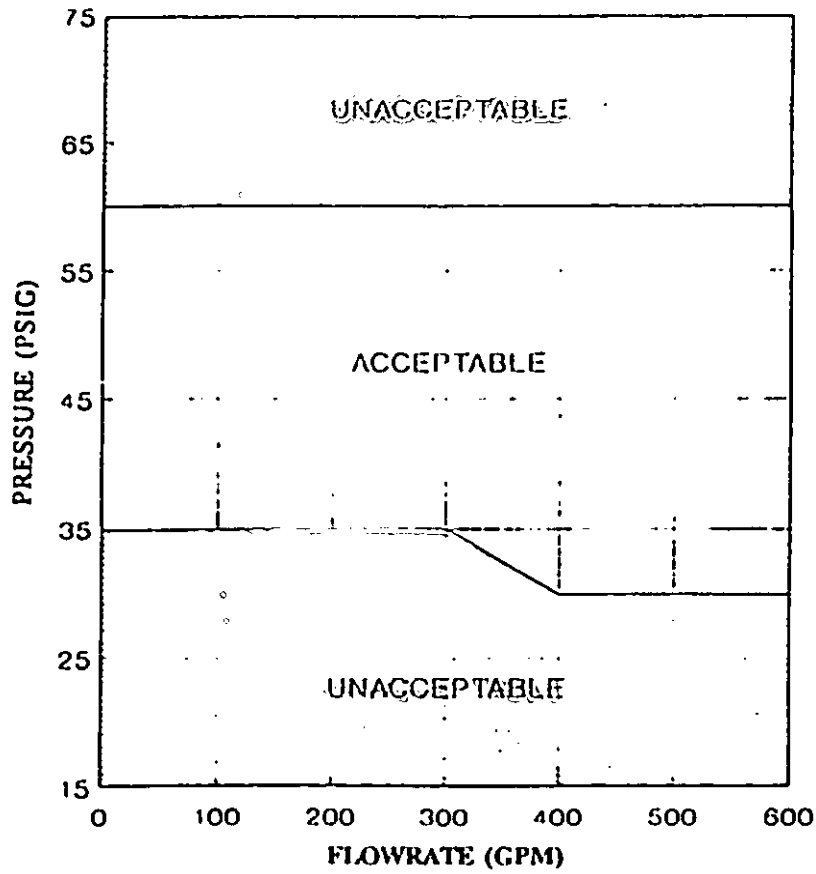


FIGURE 6. Pressure Regulation Envelope

CONCLUDING MATERIAL

Custodians:
Air Force - 11

Preparing activity:
Navy - AS
Project 4930-0362

Review activities:
Air Force -82
DCSC-SS

User activities:
Army -AV, ME

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER	2. DOCUMENT DATE (YYMMDD)
	MIL-N-5877	920701

3. DOCUMENT TITLE
NOZZLE, PRESSURE FUEL SERVICING, LOCKING

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

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a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE (Include Area Code) (1) Commercial	(2) AUTOVON
Naval Air Systems Command AIR-53632	202-692-2653.	222-2653
c. ADDRESS (Include Zip Code) Naval Air Systems Command AIR-53632 Washington, DC 20361-5360	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

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