

MILITARY SPECIFICATION

FITTINGS, TETRAFLUOROETHYLENE HOSE, HIGH TEMPERATURE,  
HIGH PRESSURE (3000 PSI), HYDRAULIC AND PNEUMATIC

1. SCOPE

1.1 This specification covers the general requirements for hose fittings used with high-pressure, high-temperature, tetrafluoroethylene (TFE) hose.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Military

MIL-H-775	Hose, Rubber or Fabric (Including Tubing) and Fittings, Nozzles and Strainers, Packaging of
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series; General Requirements for
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base Hydraulic Fluid, Non-Petroleum Base, Aircraft
MIL-B-7883	Brazing of Steels, Copper, Copper Alloys, and Nickel Alloys
MIL-H-8446	Hydraulic Fluid, Non-Petroleum Base, Aircraft
MIL-W-8611	Welding, Metal Arc and Gas, Steels, and Corrosion and Heat Resistant Alloys; Process for
MIL-F-8815	Filter and Filter Elements, Fluid Pressure, Hydraulic, Line, 15 Micron Absolute, Type II Systems
MIL-S-8879	Screw Threads, Radius Root, for Increased Fatigue Life and Stress Levels
MIL-T-27602	Trichloroethylene, Oxygen Propellant Compatible
MIL-H-83298	Hose, Tetrafluoroethylene, High Temperature, High Pressure

FSC 4730

## STANDARDS

Military

MIL-STD-100	Engineering Drawing Practices
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-453	Inspection, Radiographic
MIL-STD-831	Test Reports, Preparation of
MIL-STD-1514	Fittings, Hose, Tetrafluoroethylene, High Temperature, High Pressure, Classification of Defects
MS27616	Adapter Assembly, Flared, Straight, Tube to Hose - with Swivel Nut
MS27617	Adapter Assembly, Flared, 45° Elbow, Tube to Hose - with Swivel Nut
MS27618	Adapter, Assembly, Flared, 90° Elbow, Tube to Hose - with Swivel Nut
MS27619	Nipple, Sub Assembly, Flared, Straight - with Swivel Nut
MS27620	Elbow Sub Assembly, Flared, 45° , Swivel Nut
MS27621	Elbow Sub Assembly, Flared , 90° , Swivel Nut
MS27622	Socket, Hose Coupling
MS27623	Sleeve, Hose Coupling
MS27624	Union, Nipple
MS27625	Wire, Retainer
MS27626	Nipple, Flared, Tube to Hose - Swivel Nut
MS27627	Elbow, Flared, Tube to Hose - 90° , with Swivel Nut
MS27628	Elbow, Flared, Tube to Hose - 45° , with Swivel Nut
MS27629	Adapter Assembly, Flareless, Straight, Tube to Hose - with Swivel Nut
MS27630	Adapter Assembly, Flareless, 45° Elbow, Tube to Hose - with Swivel Nut
MS27631	Adapter Assembly, Flareless, 90° Elbow, Tube to Hose - with Swivel Nut
MS27632	Nipple Sub Assembly, Flareless, Straight - with Swivel Nut
MS27633	Elbow Sub Assembly, Flareless, 45° , Swivel Nut
MS27634	Elbow Sub Assembly, Flareless, 90° , Swivel Nut
MS27635	Nipple, Flareless, Tube to Hose - Swivel Nut
MS27636	Elbow, Flareless, Tube to Hose - 90° , with Swivel Nut
MS27637	Elbow, Flareless, Tube to Hose - 45° , with Swivel Nut
MS27638	Mandrel Sleeve Setting
MS27639	Disassembly Tool
MS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
MS33656	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

**2.2 Other Publications.** The Following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

### AMERICAN STANDARDS ASSOCIATION

ANSI B46.1-1962 Surface Texture (Surface Roughness, Waviness and Lay)

(Copies of the above publication may be obtained from the American Standards Association, 1430 Broadway, New York, New York 10018.)

## 3. REQUIREMENTS

**3.1 Qualification.** The fittings furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids.

**3.2 Materials.** Materials shall be limited to those specified on the applicable military standards listed in 2.1.

**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-143.

**3.4 Design and Construction.** The design and construction of the fittings shall be in accordance with the applicable detail military standards listed in 2.1. Special features shall not be used on the portion of the fitting that attaches to the hose. The fittings shall be designed for use with hose in accordance with MIL-H-83298.

**3.4.1** The fittings shall mate with fittings ends designed in accordance with MS33514 or MS33656, as applicable.

**3.4.2 Dimensions .** Dimensions of the fittings shall be as specified on the applicable military standards listed in 2.1.

**3.4.3 Surface roughness .** Surface roughness shall be in accordance with ANSI B46.1-1962.

**3.5 Performance.** The fittings shall be capable of meeting the following performance requirements.

3.5.1 Lubricant wear. The fittings shall be assembled four times and disassembled three times, not exceeding the torque listed in table I, when tested in accordance with 4.5.2. The final torque readings shall not exceed the values specified in table I.

Table I. Torque

Size	Socket Torque (pound-foot)
-4	45
-6	65
-8	90
-10	120

3.5.2 Joint integrity proof pressure. Fittings having welded, brazed, or mechanically attached joints shall withstand the proof pressure specified in table II without malfunction or leakage. There shall be no permanent deformation of the fittings when tested in accordance with 4.5.3.

Table II. Physical Requirements of High Pressure, High Temperature Fittings

Size	<sup>1/</sup> Temperature Range	Operating Pressure (Max PSI)	Proof Pressure (Min PSI)	Burst Pressure Room Temp (Min PSI)	Burst Pressure High Temp (Min PSI)	Minimum Bend Radius (Inside of Bend) (Inches)
-4	-65°F to + 400°F	3000	6000	16,000	12,000	3
-6	-65°F to + 400°F	3000	6000	14,000	10,500	5
-8	-65°F to + 400°F	3000	6000	14,000	10,500	5-3/4
-10	-65°F to + 400°F	3000	6000	12,000	9,000	6-1/2

<sup>1/</sup> Pneumatic temperature range shall be -65°F to + 160°F

**3.5.3 Proof pressure.** The fittings shall withstand the proof pressure specified in table II without malfunction or leakage, when tested in accordance with 4.5.4.

**3.5.4 Leakage.** The fittings shall not leak or blow off the hose when subjected to 2 pressure cycles of 70 percent of the minimum room temperature burst pressure specified in table II, when tested in accordance with 4.5.5.

**3.5.5 Room temperature burst pressure.** The fittings shall not leak, rupture, or blow off the hose at any pressure below the minimum room temperature burst pressure specified in table II, when tested in accordance with 4.5.6.

**3.5.6 Stress degradation.** The average air leakage at the fittings shall not exceed 2.0 cc/in<sup>3</sup>/min, when tested in accordance with 4.5.7.

**3.5.7 Pneumatic effusion.** The effusion at the fittings shall not exceed the specified values, when tested in accordance with 4.5.8.

**3.5.8 Pneumatic surge.** The fittings shall not leak, when tested in accordance with 4.5.9.

**3.5.9 Impulse.** The fittings shall not loosen, leak, or blow off the hose when subjected to a minimum of 250,000 impulse cycles, when tested in accordance with 4.5.10

**3.5.10 High pressure burst pressure.** The fittings shall not leak, rupture, or blow off the hose at any pressure below the minimum high temperature burst pressure specified in table II, when tested in accordance with 4.5.11.

**3.5.11 Overtightening torque.** The fittings shall withstand overtightening torque 15 times, when tested in accordance with 4.5.12.

**3.6 Interchangeability.** All parts having the same MS number shall be functionally and dimensionally interchangeable. The item identification and part number requirements of MIL-STD-100 shall govern the manufacturer's part number and changes thereto.

**3.7 Screw threads.** Threads shall be in accordance with MIL-S-7742, except those for the coupling nuts, which shall be in accordance with MIL-S-8879.

3.8 Finish. Corrosion resisting steel parts shall be passivated by immersion in a solution of 2 percent sodium dichromate in nitric acid of a concentration of 15 to 25 percent by volume for 15 to 30 minutes at  $115^{\circ} \pm 5^{\circ}\text{F}$ . Parts shall then be thoroughly rinsed in water and dried.

3.9 Brazing or welding. Fittings requiring welding operations shall be welded in accordance with MIL-W-8611, or brazed in accordance with MIL-B-7883. Welding of socket is not permitted. Inspection shall be in accordance with MIL-STD-453, except that the requirements of paragraphs titled "Detail data" and "Retention of radiographs" shall not apply to the brazed parts.

3.10 Identification of product. Fittings shall be marked for identification in accordance with MIL-STD-130 and the applicable military standards listed in 2.1.

3.11 Workmanship. Fittings shall be free from cracks, laps seams, burrs, longitudinal and spiral tool marks, or any other defects which may detrimentally affect their suitability for the service use intended.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Component and material inspection. The supplier is responsible for insuring that components and materials are manufactured, examined, and tested in accordance with referenced specifications and standards.

4.2 Classification of inspections. The examining and testing of fittings shall be classified as follows:

- a. Qualification inspection (4.3)
- b. Quality conformance inspection (4.4).

#### 4.3 Qualification inspection

4.3.1 Test samples. The samples shall consist of 32 fittings of each size as specified herein and tetrafluoroethylene hose conforming to MIL-H-83298 made up into 16 assemblies of the lengths specified in table III. All assemblies shall be identified with the manufacturer's name and MS part number.

Table III. Lengths of hose Assemblies for Test (In Inches)

Hose Assembly Size	Six Assemblies for Impulse Test	Ten Assemblies for Other Tests
-4	16	18
-6	21	18
-8	24	18
-10	30	18

4.3.1.1 Fitting ends. Qualification inspections shall be performed on straight-type swivel ends (MS27616), except that samples 3, 4, 5, 6, 9, and 10 shall have a 90° elbow-swivel nut (MS27618) on one end. Satisfactory qualification inspections on these fitting ends shall constitute qualification approval on fitting ends (MS27616, MS27617, and MS27618 made up on parts in accordance with MS27619, MS27620, MS27621, MS27622, MS27623, MS27624, MS27625, MS27626, MS27627 and MS27628) in the sizes inspected. Two additional hose assemblies having flareless style fitting ends (MS27629) shall be subjected to the examination of product (4.5.1), overtightening torque (4.5.12), leakage (4.5.5), and room temperature burst pressure (4.5.6) tests. Satisfactory test results on these fitting ends (flareless style) shall constitute qualifications approval on fitting ends (MS27629, MS27630, and MS27631 made up of parts in accordance with MS27632, MS27633, MS27634, MS27635, MS27636, MS27637, and MS27622, MS27623, MS27624, and MS27625) in the sizes inspected. All other fittings that use identical attachment method, as in the standard fittings MS27616, MS27617, MS27618, MS27629, MS27630, and MS27631, but have special end configurations, shall be submitted to the procuring activity for approval.

#### 4.3.2 Assembly procedure

4.3.2.1 Wrap the hose two full turns with a gummed fabric tape where the hose will be cut. Cut the hose squarely through the tape with a power driven, circular "knife-edge" blade. For ease of cutting, the hose may be bent slightly. The knife-edge blade shall be kept sharp to avoid excessive welding of the reinforcement wire ends which may result in poor flaring.

4.3.2.2 Unwrap the gummed fabric tape one full turn and rewrap so the tape can be rolled over the exposed end of the hose. Repeat the above step for each hose cut length.

4.3.2.3 Install sockets on hose. Insert hose into the skirt-end of the socket by applying a twisting, pushing motion. After assembling both sockets, remove tape.

4.3.2.4 There shall be approximately 1/16 inch clearance at the end of the hose between the tube and the reinforcement to permit installation of the sleeve. If it is necessary to flare the reinforcement, the sleeve may be used by placing the edge of the sleeve between the tube and reinforcement and oscillating it around the circumference of the hose. Do not over-flare the reinforcement wires.

4.3.2.5 The sleeve shall be squarely inserted between the reinforcement and tube. If the reinforcement is properly flared as specified in 4.3.2.4, the sleeve shall start easily. The sleeve shall be started by hand and positioned by pushing firmly against a flat surface until the tube bottoms against the shoulder inside the sleeve. Care should be exercised to insure that no reinforcement wires are trapped between the sleeve and the tube. The tube OD shall not be scratched or cut.

4.3.2.6 The tube shall be expanded into the sleeve by inserting the hose on the preassembly tool per MS27638. Use a steady force and a slight rotation of the hose until the sleeve bottoms on the shoulder of the tool. The hose shall be removed from the preassembly tool and a check made to insure that the tube is still bottomed against the shoulder inside the sleeve.

4.3.2.7 The socket shall be held firmly in a vise and the preassembly tool inserted into the end of the hose (pull hose into socket by hand as far as possible). Using a nonferrous hammer, tap the preassembly tool forcing the sleeve into the socket. The threaded end of the socket shall bottom against the shoulder on the pre-assembly tool. Remove the preassembly tool. Reinforcement wires shall not extend into the threaded portion of the socket.

4.3.2.8 The nipple shall be installed onto the hose. Use a steady force and a slight rotation of the nipple until the threads of the nipple and socket engage. Turn the nipple by hand to assure no cross threading.

4.3.2.9 With the proper size wrench, tighten the fitting until a 0.031 + 0.015- to -0.008-inch gap is obtained. (For gap measurement, see figure 1.)

#### 4.3.3 Disassembly procedure

4.3.3.1 With the proper size wrench, the nipple shall be loosened and removed from the socket and hose.

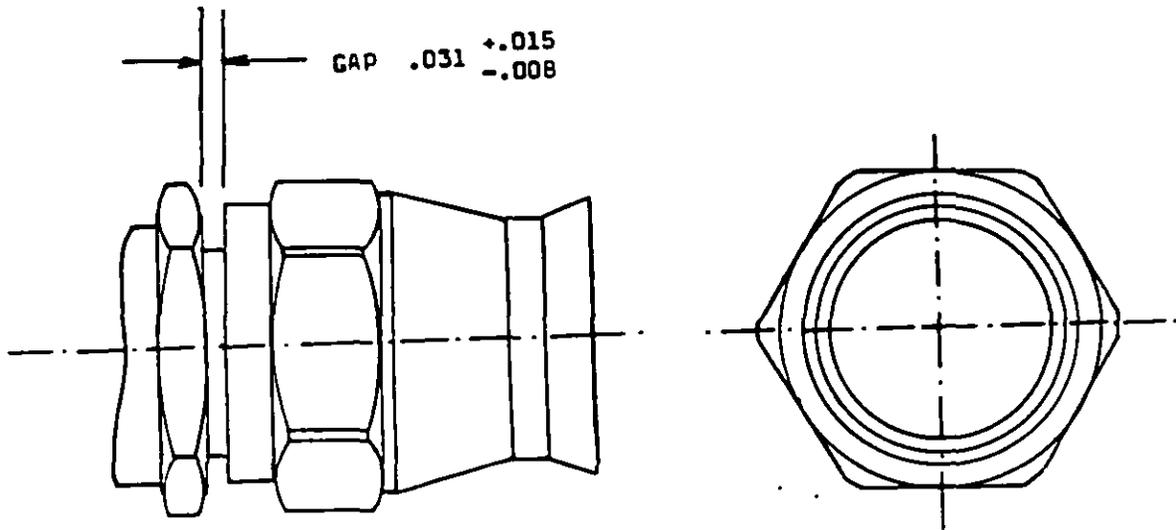


Figure 1. Gap Measurement

4.3.3.2 Cut the hose approximately 1 inch from the socket skirt (if a new hose assembly is to be made from the salvaged length of hose follow the instructions specified in 4.3.2).

4.3.3.3 The socket shall be held firmly in a vise. Using needle nose pliers, remove the tube from the sleeve and hose reinforcement. The tube shall be removed by folding longitudinally and pulling it out of the skirt end of the socket.

4.3.3.4 With the socket still in a vise, the disassembly tool (MS27639) shall be so inserted that the shoulder on the tool engages the shoulder in the sleeve. Using a nonferrous hammer, tap the tool until the sleeve separates from the socket and hose reinforcement. The reinforcement can then be pulled out of the socket.

4.3.3.5 The fitting components shall be cleaned with air pressure to remove dirt and other foreign matter before reuse.

4.3.4 Test conditions. All test conditions shall conform to the tolerances as specified in this section.

4.3.4.1 Atmospheric conditions. Unless otherwise specified herein, all testing shall be performed at the atmospheric pressure within the range of 28 to 31 inches of Mercury, a temperature between + 60° and + 100°F, and a relative humidity of not more than 90 percent.

4.3.4.2 Tolerances. Unless otherwise specified, tolerances of the test conditions shall be as follows:

<u>Test conditions</u>	<u>Tolerances</u>
Temperature	+ 10°F, -5°F
Pressure gage	± 5 percent

4.3.4.3 Accuracy of test apparatus. The accuracy of instruments and test equipment used to control and monitor the test parameters shall be verified as necessary to insure accuracy. All instruments and equipment used in conducting the tests specified herein shall:

- a. Conform to laboratory standards whose calibration is traceable to the prime standards at the U. S. Bureau of Standards
- b. Have an accuracy of a least one third the tolerances for the variable to be measured. In the event of conflict between this accuracy in any one of the test methods of this specification, the latter shall govern
- c. Be appropriate for measuring the test parameters.

**4.3.4.4 Stabilization of test temperatures.** Unless otherwise specified, temperature stabilization will have been attained when the temperature within 6 inches of the assembly does not change more than + 10°F, -5°F per hour.

**4.3.4.5 Test fluids.** Unless otherwise specified, the pressure test fluid shall be hydraulic oil conforming to MIL-H-5606, or water. When a high temperature test fluid is specified, the test fluid shall be MIL-H-8446 hydraulic fluid, MIL-L-7808 lubricating oil, or one of the following:

- a. General Electric F-50, or equal
- b. Dow Chemical F-60, or equal
- c. Oronite Chemical 8200, or equal.

**4.3.4.6 Oil aging.** In all of the tests using oil-aged samples, the hose assemblies shall be filled with a high temperature test fluid and soaked in an air oven at a temperature of 400°F for 7 days. All air shall be excluded from the bore of the assembly during the test.

**4.3.4.7 Air aging.** In all of the tests using air-aged samples, the hose assemblies shall be kept in air at a temperature of 400°F for 7 days.

**4.3.5 Test report, test samples and data for the procuring activity.** When the tests are conducted at a location other than the laboratory of the procuring activity, the following shall be furnished to that activity:

- a. Test report: Three copies of a test report in accordance with MIL-STD-831 which shall include a report of all tests and outline description of tests and conditions
- b. Test samples: The samples which were tested, when requested by the procuring activity
- c. Three sets of engineering data in the form of detail drawings.

**NOTE:** Log sheets, containing required test data, shall remain on file at the source test facility and are not to be sent to the qualifying activity unless specifically requested.

**4.3.6 Qualification test schedule.** Qualification inspections of each size shall consist of all the examinations and tests specified under 4.5. The test schedule shown in table IV shall be followed during qualification testing.

Table IV. Qualification Inspection Schedule

Sample Number	Hose Assemblies (16)					
	1, 2	<sup>1/</sup> 3, 4	<sup>1/</sup> 5, 6	7, 8	<sup>2/</sup> 9 thru 14	<sup>3/</sup> 15, 16
Para	4.5.1	4.5.1	4.5.1	4.5.1	4.5.1	4.5.1
	4.5.12	4.5.2	4.5.2	4.5.2	4.5.2	4.5.2
		4.5.3	4.5.3	4.5.4	4.5.4	4.5.4
		4.5.4	4.5.4	4.5.7	4.5.10	4.5.6
		4.5.8	4.5.5	4.5.9		
		4.5.5	4.5.11			
		4.5.6				

1/ These samples shall have a 90° elbow fitting on one end of the assembly.

2/ Two samples (9 and 10) shall have a 90° elbow fitting on one end of the assembly.

3/ These samples are with flareless fittings.

**4.4 Quality conformance inspection.** Quality conformance inspection shall be sampled in accordance with the procedure in MIL-STD-105 and shall consist of the following tests:

a. Sampling tests (4.4.2)

b. Periodic control tests (4.4.3)

**4.4.1 Brazed, welded, or mechanically attached fittings.** Each fitting having a brazed, welded, or mechanically attached joint shall be subjected to the joint integrity proof pressure test specified in 4.5.3.

**4.4.2 Sampling tests**

**4.4.2.1 Lot.** A sampling lot shall consist of not more than 3,000 fittings, assemblies, or parts thereof, all of one dash size, manufactured under essentially the same conditions, and at essentially the same time.

**4.4.2.2 Visual and dimensional inspection.** Sampling test fittings, or parts thereof, shall be individually selected at random over each entire lot. The fittings or parts thereof, shall be inspected for defective units in accordance with MIL-STD-1514, and MIL-STD-105. The acceptable quality level (AQL) for each class of defects shall be as follows: Major - 1.0, minor - 6.5, at general inspection level II, and spotcheck - 4.0, at special inspection level S-1.

**4.4.2.3 Functional test.** The fittings shall be assembled to hose conforming to MIL-H-83298, and subjected to the test listed below. Any fitting failing to pass this test is counted as a defective unit and is cause for rejection of the lot.

<u>Test</u>	<u>Sample</u>
Lubricant wear (4.5.2)	8 fittings

Fittings, or parts thereof, subjected to the above test shall not be delivered to the Government.

#### 4.4.3 Periodic control tests

**4.4.3.1 Lot.** A periodic control lot shall consist of not more than 9,000 fittings, or parts thereof, all of one dash size, manufactured under essentially the same conditions, and at essentially the same time.

**4.4.3.2 Test.** The following tests, as described under 4.5, shall be performed on random samples:

<u>Test</u>	<u>Sample</u>
a. Proof pressure (4.5.4)	Four 12-inch assemblies consisting of 8 fittings
b. Leakage (4.5.5)	
c. Room temperature burst pressure (4.5.6)	
d. Impulse (unaged samples) (4.5.10) applies only to brazed, welded, or mechanically attached fittings, as applicable	

Fittings, or parts thereof, subjected to the above tests shall not be delivered to the Government. If any sample fails to meet the test requirements, the lot which it represents shall be rejected.

**4.4.4 Rejection and retest.** The provisions of this paragraph apply to both the sampling tests and the periodic control tests. If a sample has defectives equal to or greater than the rejection number, the lot it represents shall be rejected. Once a lot, or part of a lot, has been rejected by any Government or commercial procuring activity, before it can be resubmitted for tests, full particulars concerning the defects in the lot shall be furnished, in writing, by the contractor.

**4.4.5 Switching procedures.** Switching inspection severity levels, for example from normal to tightened inspection, shall be in accordance with MIL-STD-105.

**4.4.6 Destructive test samples.** Prior to testing, a letter "D" shall be impression stamped on each end fitting used for destructive tests (4.4.2 and 4.4.3).

#### **4.5 Inspection methods**

**4.5.1 Examination of product.** The fittings shall be examined to determine compliance with the material, workmanship, and marking requirements specified herein, and to the dimensions specified in MIL-STD-1514.

**4.5.2 Lubricant wear test.** The fittings shall be assembled to the hose as specified in 4.3.2.1 through 4.3.2.9, and disassembled as specified in 4.3.3.1 through 4.3.3.5. New ends of hose shall be used for each assembly during the last assembly, the torque reading shall be recorded.

**4.5.3 Joint integrity proof pressure.** Fittings having brazed, welded or mechanically attached joints shall be subjected to the proof pressure specified in table II. One end of the fitting shall be capped and the proof pressure applied through the other end for a minimum of 30 seconds and a maximum of 5 minutes.

**4.5.4 Proof pressure test.** The assembly shall be subjected to the rated proof pressure specified in table II for 30 seconds minimum.

**4.5.5 Leakage test.** The assembly shall be pressurized to 70 percent of the minimum room temperature burst pressure shown in table II and held for 5 minutes minimum. The pressure shall then be reduced to zero psi after which it shall be raised to 70 percent of the minimum burst pressure for a final 5-minute check.

**4.5.6 Room temperature burst pressure test.** The assembly shall be subjected to a pressure sufficient to burst the assembly with a rate of pressure rise equal to 20,000  $\pm$  5,000 psi per minute. The assembly shall be observed throughout the test and the type of failure and the pressure at which failure occurred shall be recorded.

#### 4.5.7 Stress degradation test

4.5.7.1 The assembly shall be filled with a high temperature test fluid as specified in 4.3.4.5.

4.5.7.2 The assembly shall then be placed in an oven which shall be maintained at the maximum temperature specified in table II. Precautions shall be taken to assure that the assembly does not come in contact with parts of the oven that are a higher temperature. A pressure equal to the rated operating pressure specified in table II shall be applied to the assembly.

4.5.7.3 After a minimum of 20 hours at the maximum temperature specified in table II, the pressure shall be gradually released and the assembly shall be removed from the oven, drained, and cooled to room temperature.

4.5.7.4 The assembly shall be filled with fluid conforming to MIL-H-6506. A pressure equal to the rated operating pressure specified in table II shall be applied and held for a minimum of 2 hours at room temperature.

4.5.7.5 The procedure specified in 4.5.7.1, 4.5.7.2, 4.5.7.3, and 4.5.7.4 shall be repeated for a total of three times.

4.5.7.6 After the final 2-hour pressurization period, the assembly shall be drained and flushed with trichloroethylene conforming to MIL-T-27602, and then placed in an oven for 1 hour. The temperature of the oven shall be maintained at  $160^{\circ} \pm 10^{\circ}\text{F}$ .

4.5.7.7 The assembly shall be removed from the oven, cooled to room temperature, and then subjected to an air-under-water test. To conduct this test, the assembly shall be installed in an apparatus constructed similar to that shown on figure 2.

4.5.7.8 The apparatus with the assembly installed shall be immersed in water containing no wetting agent. A pressure equivalent to the rated operating pressure specified in table II shall be applied for 15 minutes to allow any entrapped air at the fittings to escape.

4.5.7.9 The pressure shall be held an additional 5-minute period during which time the effused gas shall be collected from the fittings, but not including the "B" nut. After the 5-minute period of pressurization, the average rate of leakage through the fittings shall be computed into cc / in / min.

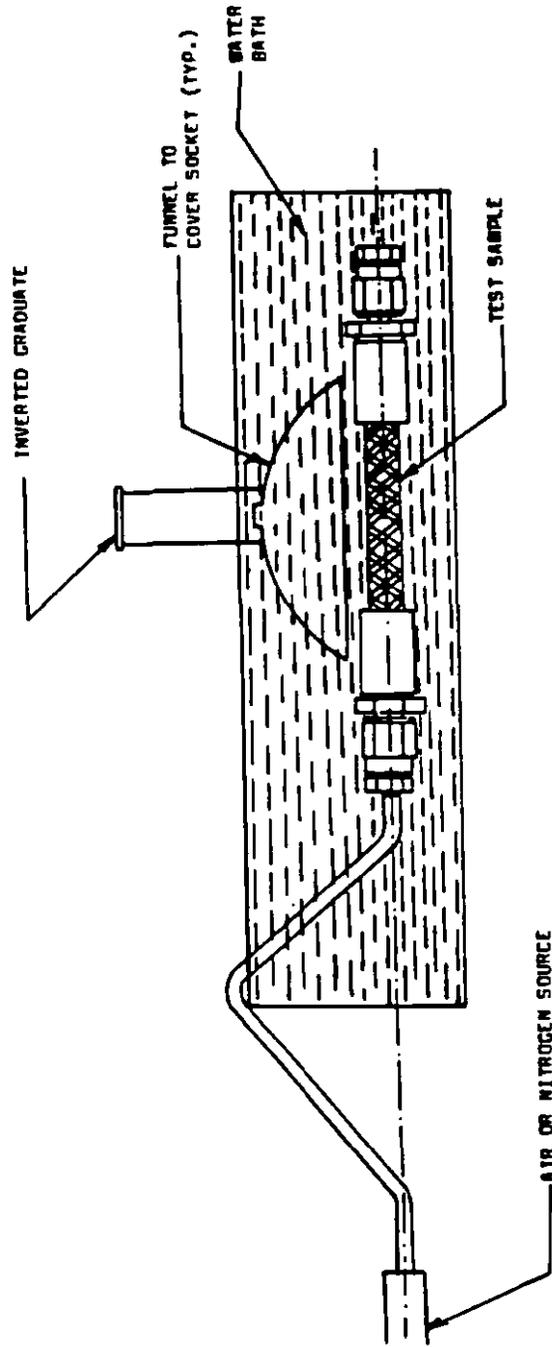


Figure 2. Test Set-up for Pneumatic Effusion Tests and Stress Degradation Tests

**4.5.8 Pneumatic effusion test.** The assembly shall be subjected to the rated operating pressure specified in table II for 1 hour at + 160°F. Air effusion shall be collected using the water displacement method and an air collecting device similar to that shown on figure 2. The total amount of effusion through the hose and two fittings shall be collected over the last 1/2 hour of testing and shall not exceed 8.0 cc /ft / 30 min. for any size.

**4.5.9 Pneumatic surge test.** The assembly shall be installed in the test apparatus shown on figure 3. The assembly shall be subjected to the rated operating pressure specified in table II for 25 minutes at room temperature. After this period of pressurization, the exhaust valve shall be opened within 50 milliseconds to permit rapid discharge of the compressed gas. After 5 minutes the valve shall be closed and the pressure recycled. This sequence of 25 minutes at operating pressure and 5 minutes at zero pressure shall be repeated a total of 16 times. The assembly shall then be subjected to the rated proof pressure specified in table II for a minimum of 2 minutes.

**4.5.10 Impulse test.** The impulse test shall be as follows:

a. Two assemblies shall be oil-aged, two shall be air-aged, and two shall be un-aged. The assemblies shall then be subjected at room temperature to the rated proof pressure specified in table II for a minimum of 5 minutes.

b. The assemblies shall be installed in an impulse tester and bent in a U-shape with a bend radius as specified in table II.

c. Electronic measuring devices shall be used to determine and control the impulse pressures in the inlet manifold to the magnitude shown by the graph on figure 4. The impulse shall occur at  $70 \pm 10$  cpm. The test fluid shall be one of the high temperature test fluids specified in 4.3.4.5. The test shall run in such a manner that the assemblies shall be temperature cycled from room temperature to the maximum ambient temperature specified in table II a minimum of two times with a minimum of 80 percent of the impulses at the maximum temperature.

**4.5.11 High temperature burst pressure test.** The assembly shall be filled with one of the high temperature test fluids specified in 4.3.4.5, and soaked for 1 hour with ambient temperature at the maximum temperature specified in table II. After 1 hour, the pressure shall be raised to the rated operating pressure as specified in table II and held for 5 minutes. The pressure shall then be increased at a rate of pressure rise equal to  $20,000 \pm 5,000$  psi per minute until failure is obtained.

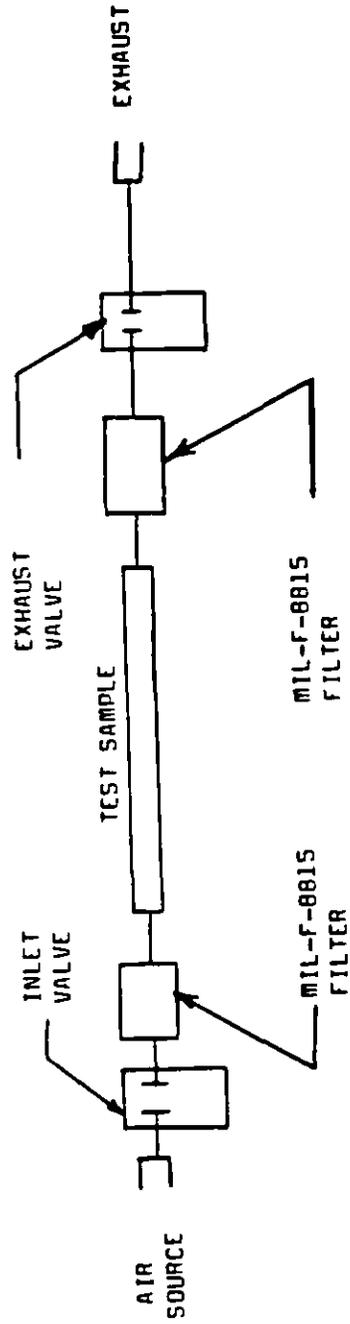
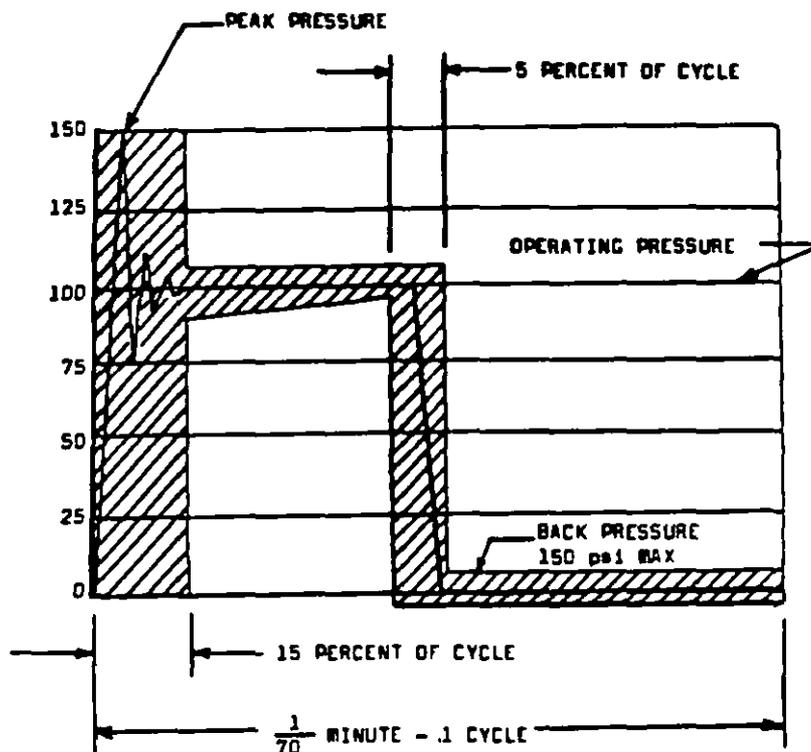


Figure 3. Test Set-Up for Pneumatic Surge Test

THE SLOPE OF THIS CURVE GIVES  
THE RATE OF PRESSURE RISE. RISE TO BE  
175,000 psi PER SECOND MINIMUM



THE CURVE SHOWN ABOVE IS THE APPROXIMATE PRESSURE-TIME CYCLE DETERMINED TO BE OF PROPER SEVERITY FOR IMPULSE TESTING OF HYDRAULIC HOSE. THE PRESSURE-TIME CURVE SHALL BE CONFINED TO THE SHADED AREA INDICATED. RATE OF RISE IS DEFINED AS THE SLOPE OF THE PRESSURE-TIME CURVE. FOR PURPOSES OF DEFINITION, THE SLOPE SHALL BE DETERMINED BY USE OF A STRAIGHT LINE BETWEEN 10 PERCENT AND 90 PERCENT OF PEAK PRESSURE. RATE OF RISE WILL BE CALCULATED AS FOLLOWS:

$$\text{RATE OF RISE (PSI/SEC)} = \frac{.9P - .1P}{T_2 - T_1}$$

WHERE: P = PEAK PRESSURE IN PSI  
T<sub>1</sub> = TIME AT 10% P (SEC)  
T<sub>2</sub> = TIME AT 90% P (SEC)

Figure 4. Dynamic Pressure Impulses

**4.5.12 Overtightening torque test.** Two hose assemblies with flared type end fittings and two hose assemblies with flareless type end fittings of each size shall be subjected to the following test by assembling on a fitting end of steel construction in accordance with MS33656 or MS33514, as applicable. The threads of the MS33656 or MS33514 fittings shall be lubricated with oil conforming to MIL-H-5606 prior to this test. All fittings shall be tightened to the appropriate overtightening torque specified in table V and then loosened. This sequence shall be repeated 15 times. On the 15th overtightening torque application, the hose shall be subjected to the proof pressure test specified in 4.5.4. After this sequence, there shall be no evidence of failure, leakage, or deformation of the fitting assemblies, and the swivel nuts shall be free enough to permit turning on the nipple by hand.

Table V. Overtightening torque Values

Fitting size	Fittings (Pound-Inches)
-4	160
-6	300
-8	560
-10	700

**4.5.13 Examination of preparation for delivery.** The preservation, packaging, and packing for delivery shall be examined for conformance to section 5.

## 5. PREPARATION FOR DELIVERY

**5.1 Preservation and packaging.** Preservation and packaging shall be level A or C, as specified (see 6.2), in accordance with MIL-H-775.

**5.2 Packing.** Packing shall be level A, B or C, as specified (see 6.2), in accordance with MIL-H-775.

## 6. NOTES

**6.1 Intended use.** The fittings covered by this specification are intended for use in aircraft and missile high pressure (3,000 psi) and high temperature (-65° to +400°F) hydraulic systems. The fittings are suitable for use in high pressure (3,000 psi) and high temperature (-65° to 160°F) pneumatic systems. High pressure pneumatic storage system applications are not recommended. Installations in which the limits specified herein are exceeded, or in which the application is not covered specifically by this specification will be subject to the approval of the procuring activity.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification
- b. Type and size of fittings required (see applicable MS's (2.1))
- c. Data requirements (see 4.3.5)
- d. Applicable levels of packaging and packing (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List, whether or not such products have actually been listed by that date. The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Commander, Aeronautical Systems Division, Attn: ENJPF, Wright-Patterson Air Force Base, Ohio 45433, and information pertaining to qualification of product may be obtained from that activity.

Custodian:  
Air Force - 11

Preparing activity:  
Air Force - 11

Review activity:  
Air Force - 82

Project No. 4730-F1222

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
3b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		8. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		9. DATE OF SUBMISSION (YYMMDD)	

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)