

INCH-POUND

MIL-DTL-8790F
w/AMENDMENT 1
16 August 2012
SUPERSEDING
MIL-DTL-8790F
19 April 2007

DETAIL SPECIFICATION

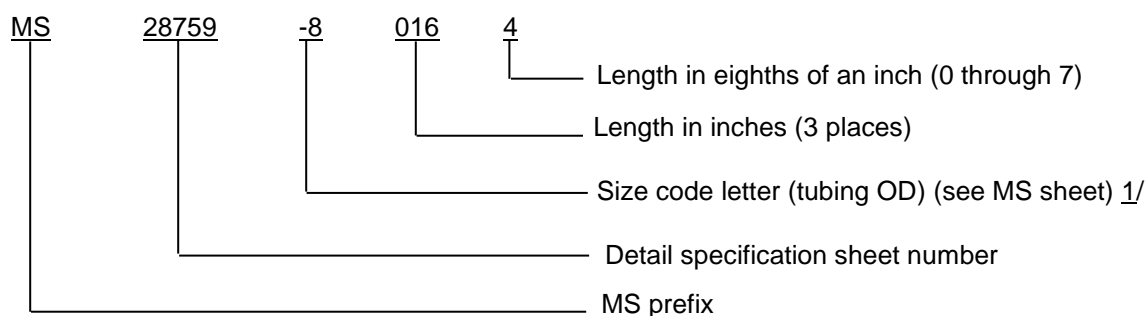
HOSE ASSEMBLIES, RUBBER, HYDRAULIC, HIGH PRESSURE 3,000 PSI,
OPERATING TEMPERATURE RANGE -65°F TO +275°F, FIELD ATTACHABLE

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

1. SCOPE

1.1 Scope. This specification covers the requirements for hose assemblies, rubber hydraulic, high pressure 3000 psi, operating temperature range -65°F to +275°F.

1.2 Part or Identifying Number (PIN). The PIN consists of the letters MS, the detail specification sheet number, a dash number for tube OD, three numbers for length, and a number for 1/8 inch fractional lengths. See the individual MS sheets listed in section 2 for PIN variations.



1/ Letter code sizes have been changed to numeric size codes to be aligned with industry. See individual MS sheets for supersession cross reference data.

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Columbus, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to FluidFlow@dla.mil. Since contact information can change you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, or 5, of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-8788	-	Hose, Rubber, Hydraulic, High Pressure (3,000 psi)
MIL-DTL-8789	-	Fitting End, Attachable, Hydraulic, High Pressure (3,000 psi), General Specification for
MIL-PRF-5606	-	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance Hydrocarbon Base, Aircraft and Missile
MIL-PRF-83282	-	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537
MIL-PRF-87257	-	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft and Missile

DEPARTMENT OF DEFENSE STANDARDS

MS28759	-	Hose Assembly, Rubber, Hydraulic (3,000 psi), Flared Tube
MS28762	-	Hose Assembly, Rubber, Hydraulic (3,000 psi), Flareless Tube
MS28920	-	Hose Assembly, Rubber, Hydraulic (3,000 psi), Fitting End To Elbow 45°, Flared Tube
MS28921	-	Hose Assembly, Rubber, Hydraulic (3,000 psi), Fitting End To Elbow 90°, Flared Tube
MS28924	-	Hose Assembly, Rubber, Hydraulic (3,000 psi), Elbow 90° To Elbow 90°, Flared Tube

(Copies of these documents are available online at <https://assist.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AEROSPACE INDUSTRIES ASSOCIATION (AIA)

NAS847	-	Caps and Plugs, Protective, Dust and Moisture Seal
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(Copies of this document are available online at <http://www.aia-aerospace.com> or from the Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3901).

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ASTM INTERNATIONAL

ASTM D380 - Standard Test Methods for Rubber Hose

(Copies of this document are available online at <http://www.astm.org> or from ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

NCSL INTERNATIONAL

NCSL Z540.3 - Requirements for the Calibration of Measuring and Test Equipment

(Copies of this document are available online at <http://www.ncsli.org> or from NCSL International 2995 Wilderness Place, Suite 107 Boulder, Colorado 80301-5404)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 17025 - General Requirements For The Competence Of Testing and Calibration Laboratories

(Copies of this document are available online at www.ansi.org or from the ANSI Customer Service Department, 25 W. 43rd Street, 4th Floor, New York, NY 10036.)

SAE INTERNATIONAL

SAE-ARP908	-	Torque Requirements Installation and Qualification Test, Hose and Tube Fitting
SAE-AS603	-	Impulse Testing of Hydraulic Hose, Tubing, and Fitting Assemblies
SAE-AS1933	-	Age Controls for Hose Containing Age-Sensitive Elastomeric Material
SAE-AS4395	-	Fitting End - Flared Tube Connection, Design Standard
SAE-AS33514	-	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
SAE-J1966	-	Lubricating Oil, Aircraft Piston Engine (Nondispersant Mineral Oil)

(Copies of these documents are available online at www.sae.org from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, and Tel: 877-606-7323 [inside USA and Canada] or 724-776-4970 [outside USA], email at CustomerService@sae.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), 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 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

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3.2 Qualification. The hose assemblies described in MS28759, MS28762, MS28920, MS28921, and MS28924 consisting of MIL-DTL-8788 hose and MIL-DTL-8789 fittings furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.5 and 6.3).

3.3 Materials. Materials shall be as specified in MIL-DTL-8788 and MIL-DTL-8789.

3.3.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Hazardous substances. The use of hazardous substances, toxic chemicals, or Ozone Depleting Chemicals (ODCs) shall be avoided, whenever feasible.

3.5 Design and construction. The hose assembly shall be constructed with qualified hose (see 3.5.1) and end fittings (see 3.5.2) to meet the requirements specified herein and in the applicable specification sheet.

3.5.1 Hose. The hose shall be as specified in MIL-DTL-8788.

3.5.2 Fittings. The fittings shall be as specified in MIL-DTL-8789.

3.5.3 Loosening or changing end fitting position. After the end fittings have been installed on the hose, there shall be no loosening or changing of an end fitting position on the hose.

3.5.4 Length. Hose assembly tolerances shall be made only with the lengths specified in MS28759, MS28762, MS28920, MS28921, and MS28924.

3.5.5 Orientation angle of bent tube couplings. The displacement angle shall be as specified in the applicable specification sheet.

3.6 Examination of Product. The hose assembly shall conform to the materials (see 3.3), identification markings (see 3.8), age (see 3.9), and workmanship (see 3.10) specified herein, when examined as specified in 4.9.1.

3.7 Performance. Hose assemblies shall satisfy the following performance requirements.

3.7.1 Bulge resistance. The ball gage, used to determine the inner tube diameter at the bulge, shall fall freely through the hose assembly under its own weight through the section of the end-fitting insert in the hose, when tested as specified in 4.9.2.

3.7.2 Proof pressure. The hose assembly shall not leak or fail during or at the completion of the test, when tested as specified in 4.9.3, with the applicable proof pressure specified in table I. There shall be no visual evidence of damage or permanent deformation.

3.7.3 Leakage. The hose assembly shall not show any evidence of leakage during or at the completion of the test, when tested as specified in 4.9.4.

3.7.4 Burst pressure. There shall be no leakage in the hose assembly, when tested as specified in 4.9.5, below and including the minimum burst pressure specified in table I. The hose shall not burst or develop a permanent blister. The fittings shall not loosen or disconnect from the hose.

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3.7.5 Impulse. The hose assembly shall not show any evidence of leakage, burst, or fitting loosening or fitting blow off, when tested as specified in 4.9.6.

3.7.6 Low temperature flexibility. The hose assembly shall not leak and fail at the completion of the test, when tested as specified in 4.9.7. There shall be no visual evidence of damage or permanent deformation.

3.7.7 Over-tightening torque. The fittings shall not show any evidence of material failure, deformation of the assembly or difficulty in turning the swivel nut on the nipple by hand, when tested as specified in 4.9.8.

TABLE I. Performance characteristics. 1/ 2/

Hose size no.	Proof pressure, min psi (MPa)	Burst pressure, min psi (MPa)	Operating pressure psi (MPa)	Bend radius inside, min inch (mm)	Assembly length of test samples inch (cm)
4	8,000 (55.1)	16,000 (110.3)	3,000 (20.7)	3.00 (76.20)	16 (40.64)
5	7,000 (48.3)	14,000 (96.5)	3,000 (20.7)	3.38 (85.85)	18 (45.72)
6	7,000 (48.3)	14,000 (96.5)	3,000 (20.7)	5.00 (127.00)	21 (53.34)
8	7,000 (48.3)	14,000 (96.5)	3,000 (20.7)	5.75 (146.05)	24 (60.96)
10	6,000 (41.4)	12,000 (82.7)	3,000 (20.7)	6.50 (165.10)	30 (76.20)
12	6,000 (41.4)	12,000 (82.7)	3,000 (20.7)	7.75 (196.85)	33 (83.82)
16	5,000 (34.5)	10,000 (69.0)	3,000 (20.7)	9.63 (244.60)	24 (60.96)

1/ Dimensions are in inches.

2/ Metric equivalents are given for information only.

3.8 Identification of product. Each hose assembly shall be identified with a durable permanently attached tag. This tag shall show the PIN, date of assembly, Commercial and Government Entity code (CAGE), and manufacturer's name or trademark.

3.9 Age. Hose assemblies shall meet the age limitation requirements specified in SAE-AS1933.

3.10 Workmanship. The hose assembly shall be uniform in quality and free from defects, irregularities and foreign matter. Assemblies shall be cleaned and dried by any process or combination of processes which will accomplish thorough cleaning and drying without damage to the assemblies.

3.10.1 Cleanliness. The interior surface of the hose assembly shall be free from oil, grease, dirt, moisture, cleaning solvents and foreign materials when examined in accordance with 4.9.1.1.

3.10.2 Hose assembly caps or plugs. Hose assemblies shall be sealed with caps or plugs in accordance with NAS847. The caps or plugs shall be securely attached and shall withstand normal strains, jarring and vibrations encountered during shipping, storage and handling. Hose assemblies without a cap or plug shall be rejected.

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4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.5).
- b. Conformance inspection (see 4.6).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in 4.9.

4.3 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be used. The establishment and the maintenance of a calibration system to control the accuracy of all tests and measuring equipment shall be in accordance with ISO 17025 and NCSL Z540.3 as applicable.

4.4 Responsibility for compliance. All items shall meet all requirements of sections 3, 4, 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.4.1 Assembly distributor. All manufacturing and/or assembling locations must be qualified for listing on, or approved for listing on, the applicable qualified products list by the qualifying activity. This includes manufacturing sites for the bulk hose and sites for assembling hose and fittings, regardless of whether the site is operated by the original manufacturer or an authorized distributor producing hose assemblies.

4.4.2 Manufacturers of hose assemblies. Manufacturers of hose assemblies shall qualify hose assemblies assembled from parts obtained from specific qualified manufactures of fittings and hose. The use of other qualified manufacturers fittings or hose shall require requalification of the hose assembly.

4.5 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the qualifying activity on sample units produced with equipment and procedures used in production.

4.5.1 Samples for qualification. Qualification samples shall be representative of the products proposed to be furnished to this specification. Samples consisting of 10 of each hose assembly size, with lengths as specified in table I, shall be subjected to qualification testing. Each sample shall consist of a hose, in accordance with MIL-DTL-8788, and fittings, in accordance with MIL-DTL-8789.

4.5.2 Qualification inspection routine. All hose assembly samples shall be subjected to qualification testing in accordance with table II and in the sequence specified in table III.

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4.5.3 Alternate qualification inspection criteria. Hose assemblies, consisting of hose and end fittings, shall meet the requirements of 4.5.2. Alternatively, when the identical hose is manufactured and tested in accordance with MIL-DTL-8788, and the identical hose fittings are manufactured and tested in accordance with MIL-DTL-8789, and these items are later assembled into a hose assembly in accordance with MIL-DTL-8790, it is not necessary to test the hose assembly to meet the qualification requirements of this specification. This applies when substantially identical test requirements and test procedures are required for the assembly and the individual components and upon documented approval by the qualifying activity.

TABLE II. Qualification inspection.

Requirement	Requirement paragraph	Test method paragraph
Examination of product	3.6	4.9.1
Bulge resistance	3.7.1	4.9.2
Proof pressure	3.7.2	4.9.3
Leakage	3.7.3	4.9.4
Burst pressure	3.7.4	4.9.5
Impulse	3.7.5	4.9.6
Low temperature flexibility	3.7.6	4.9.7
Over-tightening torque	3.7.7	4.9.8

TABLE III. Qualification inspection sequence.

Required qualification test	Test method paragraph	Sample number									
		1	2	3	4	5	6	7	8	9	10
Examination of product	4.9.1	X	X	X	X	X	X	X	X	X	X
Bulge resistance	4.9.2	X	X	X	X						
Proof pressure	4.9.3	X	X	X	X	X	X	X	X	X	X
Leakage	4.9.4					X	X				
Burst pressure	4.9.5					X	X				
Impulse	4.9.6	X	X	X	X						
Low temperature flexibility	4.9.7							X	X		
Over-tightening torque	4.9.8									X	X
Proof pressure	4.9.3							X	X		

4.5.4 Failures. One or more failures shall be cause for refusal to grant qualification approval.

4.6 Conformance inspection.

4.6.1 Individual tests.

4.6.1.1 Inspection of the product for delivery. Inspection of the product for delivery shall consist of subjecting each hose assembly to the individual tests specified in [table IV](#). Any item failing to meet the requirements of the individual tests shall be immediately removed from the lot.

4.6.2 Sampling tests.

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4.6.2.1 Sampling tests plan. Hose assemblies shall be subjected to the sampling tests specified in [table IV](#).

4.6.2.2 Samples for sampling tests. Samples for sampling tests shall consist of hose assemblies of one size, randomly selected from an inspection lot without regard to quality. Eight samples from a lot size of 3,000 hose assemblies or one sample from each smaller lot size of 375 hose assemblies shall be subjected to the sampling tests. If there has been some production but the number of hose assemblies produced has not reached 375 for a specific size within three years, the manufacturer shall perform sampling tests on one hose assembly of that size unless documented approval to not perform the tests has been obtained from the qualifying activity.

TABLE IV. Individual, sampling, and periodic inspection.

Requirement	Test paragraph	Test method paragraph	Conformance inspection		
			Individual <u>1/</u>	Sampling	Periodic
Examination of product	3.6	4.9.1	X		
Proof pressure	3.7.2	4.9.3	X		
Leakage <u>2/</u>	3.7.3	4.9.4		X	
Burst pressure <u>2/</u>	3.7.4	4.9.5		X	
Impulse <u>2/ 3/</u>	3.7.5	4.9.6			X

1/ 100% inspection required on all hose and hose assemblies supplied to this specification.

2/ These are destructive tests.

3/ Aging not required for periodic inspection.

4.6.2.3 Nonconformance of sampling tests. If one or more defects are found in the inspection sample, both the qualifying and inspection activities shall be immediately notified and the production lot shall be rejected and not be supplied to this specification. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity, has been taken. The corrective measures shall be performed on the materials or processes, or both, as warranted, and on all products considered subjected to the same failure. Once the corrective action has been completed, either the specific sampling test in which the original sample failed or all sampling tests may be required to be repeated on additional samples, at the option of the qualifying activity. However, final acceptance shall be withheld until testing has shown that the corrective action was successful. In the event of a failure after re-inspection, information concerning the failure and the corrective action taken shall be furnished to both the qualifying and inspection activities.

4.6.3 Periodic tests.

4.6.3.1 Periodic test plan. Hose assemblies shall be subjected to periodic testing in accordance with [table IV](#).

4.6.3.2 Periodic test inspection samples. For each size manufactured under essentially the same conditions, periodic control testing shall be performed on either four samples from every 10,000 hose assemblies produced or one sample from every 2,500 hose assemblies. If there has been some production but the number hose assemblies produced has not reached 2,500 for a specific size within three years, the manufacturer shall perform periodic control tests on one hose assembly of that size unless documented approval to not perform the tests has been obtained from the qualifying activity.

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4.6.3.3 Nonconformance of periodic tests. If a sample fails a periodic control test, both the qualifying and inspection activities shall be immediately notified of such failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity, has been taken. The corrective measures shall be performed on the materials or processes, or both as warranted, and on all products considered subjected to the same failure. Once the corrective action has been completed, the periodic control test in which the original sample failed or all individual, sampling or periodic control tests may be required to be repeated on additional samples, at the option of the qualifying activity. However, final acceptance shall be withheld until testing has shown that the corrective action was successful. In the event of a failure after re-inspection, information concerning the failure and the corrective action taken shall be furnished to both the qualifying and inspection activities.

4.6.4 Disposition of test specimens. Samples that have been subjected to any sampling or periodic control tests are considered damaged and shall not be delivered as part of a contract or purchase order.

4.6.5 Discontinuation and resumption of production. If there has been no production of a specific size for a period of three years or more, samples shall be randomly selected from the first lot produced when production of that size has been resumed. Two (2) samples shall be subjected to each of the sampling tests and the remaining four (4) samples shall be subjected to the periodic control tests (see [table IV](#)).

4.6.6 Alternate conformance inspection criteria. Hose assemblies, consisting of hose and end fittings, shall meet the requirements of this specification. Alternatively, when the identical hose is manufactured and tested in accordance with MIL-DTL-8788, and the identical hose fittings are manufactured and tested in accordance with MIL-DTL-8789, and these items are later assembled into a hose assembly in accordance with MIL-DTL-8790, it is not necessary to test the hose assembly to meet the conformance inspection requirements of this specification. This applies when substantially identical test requirements and test procedures are required for the assembly and the individual components and upon documented approval by the qualifying activity. When conformance inspection data is to be accepted for the hose in accordance with MIL-DTL-8788, the hose shall be tested at least once every 36 months, or once every 20,000 feet of hose produced, whichever occurs first. For the purpose of this specification, 10,000 hose assemblies is equivalent to 20,000 feet of bulk hose.

4.7 Additional QPL test and reporting requirements.

4.7.1 Retention of qualification. To retain qualification, the contractor shall submit a test report to the qualifying activity at 12 month intervals. The qualifying activity shall establish the initial reporting date. Each report shall consist of a summary of test and inspection results required by this specification that were performed during the 12 month reporting interval. As a minimum, the report shall include the following:

- a. Number of lots produced and tested, including lot and sample sizes for each lot.
- b. Identify which tests were performed.
- c. Quantities passed.
- d. Quantities failed.
- e. All reworked sampling lots shall be accounted for and identified. A summary of corrective action taken shall be included.

4.7.2 Loss of product qualification.

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4.7.2.1 Failure to meet test requirements. The manufacturer shall immediately notify the qualifying activity at any time during the 12-month reporting period when the qualified product fails to meet the test and inspection requirements of this specification. The manufacturer shall identify and indicate what corrective action will be taken to correct the problem. Failure to take corrective action acceptable to the qualifying activity may result in removal of the product from the QPL.

4.7.2.2 Failure to submit summary test data report. Failure to submit a report within 30 days after the end of the 12 month reporting period may result in loss of qualification for the product.

4.7.2.3 Change to manufacturing process, materials or equipment. The manufacturer shall notify the qualifying activity, in writing, of any changes in the manufacturing process, materials, or equipment used to manufacture a QPL product. Subsequently, the qualifying activity will notify the manufacturer, in writing, if a full re-qualification, partial re-qualification, or no additional testing is required as a result of these changes.

4.7.2.4 No production during reporting period (12 months). When no production occurs during the reporting period, a report shall be submitted to the qualifying activity certifying that the manufacturer still has the capability and facilities necessary to produce the QPL product.

4.8 Preparation of specimens.

4.8.1 Hose assemblies. Test samples shall be assembled with samples of hose and fittings of applicable size in accordance with MIL-DTL-8788 and MIL-DTL-8789, respectively. Assembly lengths shall be as shown in [table I](#).

4.8.2 Test fluid. Unless otherwise specified, the test fluid shall be lubricating oil grade 50 in accordance with SAE-J1966 or hydraulic fluid in accordance with MIL-PRF-5606, MIL-PRF-83282, MIL-PRF-87257 or water.

4.8.3 Aging of samples. When specified, specimens shall be either air aged (see 4.8.3.1) or oil aged (see 4.8.3.2) prior to testing.

4.8.3.1 Air aging. Samples shall be exposed to air at a temperature of 158°F ±2°F (70°C ±1.11°C) for a minimum of 168 continuous hours.

4.8.3.2 Oil aging. Samples shall be completely immersed in fluid in accordance with MIL-PRF-5606, MIL-PRF-83282, or MIL-PRF-87257 at a temperature of 158°F ±2°F (70°C ±1.11°C) for a minimum of 168 continuous hours. Air shall not be trapped in the bore of the tube during this aging period. The volume of fluid used shall be sufficient to completely fill and cover the samples. Both the samples and the fluid shall be placed in a non-pressurized closed type container or in a reflux type condenser to prevent distillation of the volatile matter in the fluid. For qualification tests, a new batch of oil shall be used for each group of test samples. For conformance tests, a new batch of oil shall be used for each 10 or fewer tests.

4.9 Test methods.

4.9.1 Examination of product. Each hose assembly shall be carefully examined visually to determine conformance to this specification with respect to materials (see [3.3](#)), identification marking (see [3.8](#)), age (see [3.9](#)) and workmanship (see [3.10](#)).

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4.9.1.1 Cleanliness inspection. Both ends of the hose assembly shall be visually inspected to determine if caps or plugs are installed at the fittings. The caps or plugs shall then be removed and a light source shall be placed at one end of the hose assembly. The interior of the hose shall be visually examined, without magnification, from the opposite end of the light source. If the length of the hose assembly precludes this, then examination shall be from one end of the hose assembly.

4.9.2 Bulge resistance test. Hose assemblies when subjected to the bulge resistance test shall meet the requirements of 3.7.1. The following details shall apply:

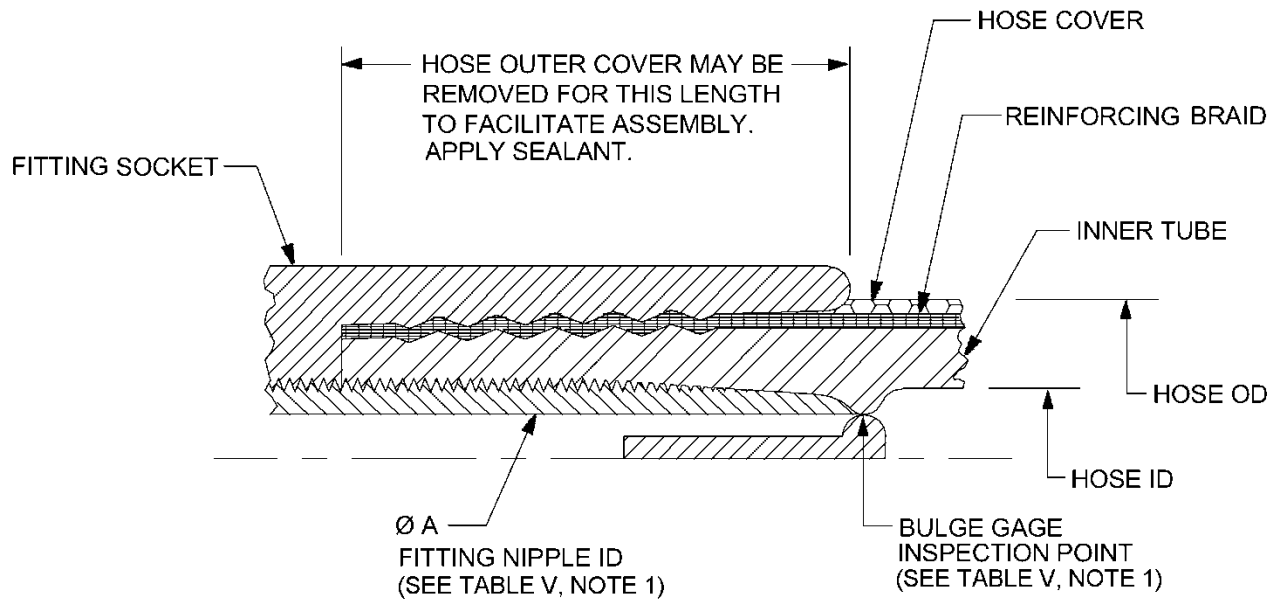
- a. Four hose assembly samples that have been prepared for the impulse test (see 4.9.6) shall be checked for bulging of the inner tube and reduction of fitting nipple inner diameter caused by the attachment of end fittings. Measurements shall be taken on assemblies using a ball-end type gage.
- b. The diameter of the ball shall not be less than .002 inch (0.05 mm) but no greater than .001 inch (0.03 mm) smaller than the bulge diameter "A" specified in table V.
- c. Without using force or lubrication, the ball shall be placed inside the end of the assembly at the bulge gage inspection point shown on figure 1.

TABLE V. Hose inner tube diameter at the bulge.

Fitting size no.	A diameter, min inch (mm) <u>1/</u> <u>2/</u>
4	.146 (3.71)
5	.177 (4.50)
6	.271 (6.88)
8	.365 (9.27)
10	.455 (11.56)
12	.568 (14.43)
16	.778 (19.76)

1/ Diameter A, indicates both the minimum permissible diameter of the inner tube at the bulge, and the minimum nipple ID of the fitting, when the fitting is assembled with the hose.

2/ Dimensions are in inches. Metric equivalents are given for information only.

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4.9.3 Proof pressure test. Each hose assembly shall be tested in accordance with ASTM D380 and subjected to the applicable proof pressure listed in [table I](#). Each hose assembly shall meet the requirements of [3.7.2](#). The test fluid shall be water or fluid in accordance with MIL-PRF-5606, MIL-PRF-83282, or MIL-PRF-87257.

4.9.4 Leakage test. Two unaged hose samples shall be tested as specified in ASTM D380 and meet the requirements of [3.7.3](#). The following details shall apply:

- a. The samples shall be a minimum of 12 inches (30.5 cm) in length.
- b. Test fluid shall be water or hydraulic fluid in accordance with MIL-PRF-5606, MIL-PRF-83282 or MIL-PRF-87257.
- b. Samples shall be subjected to 70% of the minimum burst value specified in [table I](#) and held for 5 minutes.
- c. After 5 minutes, the pressure shall be released and reduced to zero. Then the pressure shall be raised again to 70% of the minimum burst pressure and held for another 5 minutes.
- d. The adjacent outer cover shall be carefully inspected during this period for any wicking or leakage of the test fluid.
- e. After completion of the leakage test on these samples, they shall be subjected to the burst pressure test specified in [4.9.5](#).

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4.9.5 Burst pressure test. Two unaged hose assembly samples shall be subjected to the burst pressure specified in [table I](#) and shall meet the requirements of [3.7.4](#). The following details shall apply:

- a. The assemblies shall be a minimum of 12 inches (30.5 cm) in length.
- b. During this test, the hose assembly shall be fastened at one end to the source of pressure, the hose shall be extended straight, and the free end shall not be restrained or fastened in any way.
- c. Test fluid shall be water or hydraulic fluid in accordance with MIL-PRF 5606, MIL-PRF-83282 or MIL-PRF-87257.
- d. The rate of pressure rise shall be 25,000 +0/-10,000 psi per minute (172.4 MPa +0/-68.9 MPa per minute).
- e. Pressure shall be applied until failure occurs.
- f. The actual pressure at which the samples burst or otherwise fail shall be recorded.

4.9.6 Impulse test. Hose assemblies when subjected to impulse testing in accordance with SAE-AS603 shall meet the requirements of [3.7.5](#). The following details shall apply:

- a. Four samples of the length specified in [table I](#) shall be subjected to the proof pressure test (see [4.9.3](#)), prior to impulsing.
- b. Two of the four samples shall be air aged and the other two shall be oil aged.
- c. Operating pressure for impulse testing shall be specified in [table I](#) and impulse cycles shall be specified [table VI](#).
- d. Only hose size 16 shall be tested without surge peaks and in a straight position with one end free.
- e. Test fluid shall conform to MIL-PRF-5606, MIL-PRF-83282 or MIL-PRF-87257, except that up to 25% of the total volume may be fluid in accordance with SAE-J1966, grade 50.
- f. The fluid temperature, measured in the manifold, shall be held at 120°F ± 20° F(48.9°C ±11.1°C).

TABLE VI. Impulse cycles.

Hose size no.	Minimum impulse cycles per hose	Minimum average impulse cycles <u>1/</u>	Maximum impulse cycles that can be used to compute average <u>2/</u>
4	100,000	---	---
5	100,000	---	---
6	100,000	---	---
8	75,000	100,000	150,000
10	50,000	75,000	100,000
12	35,000	50,000	70,000
16	45,000	55,000	75,000

1/ The average of the test samples shall not be below the values listed in this column.

2/ When test samples impulse cycles are averaged, the maximum cycles that may be used to compute the average shall not exceed the figures given in this column. This column is giving a limit to the number of impulse cycles that are allowed to calculate the average. While testing is in progress the test operator will take a reading of the impulse cycles completed. If it's higher than the value in column 4 the test operator would use the value specified in the table not the higher (true) value from the reading.

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4.9.7 Low temperature flexibility test. Hose when subjected to low temperature flexibility testing shall meet the requirements of 3.7.6. The following details shall apply:

- a. Two samples of the lengths specified in table I.
- b. One sample shall be unaged, while the other shall be oil aged prior to testing.
- c. Samples shall be filled with fluid in accordance with MIL-PRF-5606, MIL-PRF-83282, or MIL-PRF-87257 and then exposed for 24 hours in a chamber at a temperature of $-65^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($-53.9^{\circ}\text{C} \pm 1.11^{\circ}\text{C}$).
- d. After the 24 hour exposure and while still at the specified temperature, the samples shall be flexed through 180° at each extreme travel (see figure 2), considered as one cycle, to the applicable inside bend radius specified in table I.
- e. Each sample shall be subjected to one cycle only, the duration of which shall be no greater than four seconds.
- f. After the flexing cycle (see figure 2), samples shall be removed from the cold chamber and subjected to the proof pressure test (see 4.9.3).

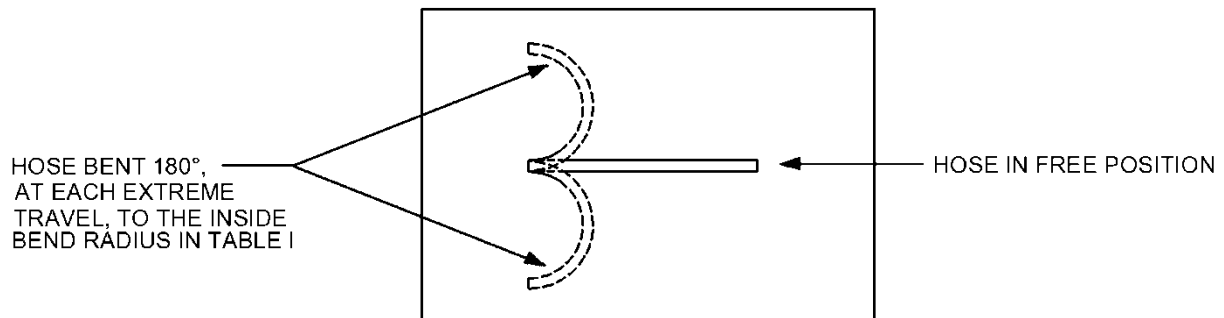


FIGURE 2. Flexibility test set up.

4.9.8 Over-tightening torque test. Hose assemblies when subjected to over-tightening torque in accordance with SAE-ARP908 shall meet the requirements of 3.7.7. The hose assemblies shall be attached to mating adapter ends (SAE-AS4395 or SAE-AS33514).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

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6.1 Intended use. The rubber hose assemblies covered by this specification are intended to be used in aircraft hydraulic systems. The rubber hose assemblies are required to withstand an operating pressure of 3,000 psi and be able to withstand temperatures -65°F to +275°F (-53.9°C to +135°C).

6.1.1 Military unique rational. The rubber hose assemblies described by this specification require qualification (material, part, and process), and on site audits, which include traceability of parts. The rubber hose assemblies must be capable of interoperability and compatibility which can only be assured through strict adherence to the detail specification sheet requirements. Commercial parts are not designed to be interchangeable with military aircraft hydraulic systems.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. PIN of hose assemblies to be furnished in accordance with the applicable hose assembly detail specification sheet (see 1.2).
- c. Bent tube orientation angles (when applicable).
- d. Packaging requirements (see 5.1).
- e. Shelf life requirements (see 6.2.1).

6.2.1 Shelf life. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include, as a minimum, shelf-life code, shelf-life package markings in accordance with MIL-STD-129 or FED-STD-123, preparation of a materiel quality storage standard for type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at time of receipt by the Government. These and other requirements, if necessary, are in DoD 4140.27-M, *Shelf-life Management Manual*. The shelf-life codes are in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4140.27-M, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points that manage the item and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: <http://www.shelflife.hq.dla.mil/>.

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 No. 8790 whether or not such products have actually been so listed by that date. The attention of 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, P.O. Box 3990, ATTN: DSCC-VQ, Columbus, Ohio 43218-3990 or emailed to vqp.chief@dlam.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

6.3.1 Provisions governing qualification (SD-6). Copies of "Provisions Governing Qualification" are available online at <https://assist.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.

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6.4 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

6.5 Subject term (key words) listing.

Aircraft systems
Ball gage
Fitting
Tube

6.6 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodians:

Army - AV
Navy - AS
Air Force - 99
DLA - CC

Preparing activity:
DLA - CC

(Project 4720-2012-011)

Review activities:

Army - MI
Navy - SA
Air Force - 71

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.