

This document and process conversion measures necessary to comply with this revision shall be completed by 1 July 1999.

INCH-POUND

MIL-DTL-13444G
1 June 1999
SUPERSEDING
MIL-DTL.-13444F
4 January 1999

DETAIL SPECIFICATION

HOSE AND HOSE ASSEMBLIES, RUBBER: FUEL AND OIL

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

1. SCOPE

1.1 Scope. This specification covers two types of fuel and oil hose, hose assemblies for military engine installations and other uses (see 6.1).

1.2 Classification. Hose and hose assemblies consist of the following types and nominal inside diameter (I.D.) sizes as specified (see 6.2):

- | | |
|----------|---|
| Type I | - Single fabric braid reinforcement. |
| Type III | - Single fabric and single wire braid reinforcement covered with synthetic-rubber-impregnated fabric braid, medium pressure and high temperature resistant. |

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This 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 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Columbus, ATTN: DSCC-VAI, 3990 East Broad Street, Columbus, Ohio 43216-5000 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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FSC 4720

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 following 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).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

	MIL-PRF-2104	-	Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service.
	MIL-H-5606	-	Hydraulic Fluid, Petroleum Base: Aircraft, Missile, and Ordnance.
Pressure,	MS52103	-	Hose Assembly, Nonmetallic: Fuel and Oil, Medium Flared Tube
	MS52104	-	Hose Assembly, Rubber: Fuel and Oil, Low Pressure, Flared Tube
	MIL-L-21260	-	Lubricating Oil, Internal Combustion Engine, Preservative and Break-in.

STANDARDS

DEPARTMENT OF DEFENSE

	MIL-STD-810	-	Environmental Test Methods.
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(Unless otherwise indicated, copies of the above specifications, standards and handbooks are available from the Defense Printing Service Detachment Office, Bldg. 4D (Customer Service), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

	Handbook H4/H8	-	Commercial and Government Entity (CAGE) Handbook.
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2.3 Non-Government publications. The following documents form a part of this specification 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 issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form).
- ASME B18.2.2 - Square and Hex Nuts (Inch Series).

(Applications for copies of ASME publications should be addressed to the American Society of Mechanical Engineers, 22 Law Drive, P. O. Box 2900, Fairfield, NJ 07007-2900.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B 633 - Standard Specification for Electrodeposited Coating of Zinc on Iron and Steel.
- ASTM B 695 - Coatings of Zinc Mechanically Deposited on Iron and Steel
- ASTM D 380 - Standard Test Methods for Rubber Hose.

(Applications for copies of ASTM publications should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

AMERICAN SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- J516 - Hydraulic Hose Fittings, Standard.
- AS1933 - Age Controls for Hose Containing Age-Sensitive Elastomeric Material.

(Application for copies should be addressed to the American Society Of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI/NCSL Z540-1 - Calibration Laboratories and Measuring and Test Equipment, General Requirements.

(Application for copies should be addressed to the American National Standard Institute, 1430 Broadway New York 10018-3308.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, 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 requirements of this specification and the specification sheets, the latter shall govern.

3.2 Qualification. The hose and hose assemblies furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein and has been listed on or approved for listing on the applicable qualified products list (QPL) (see 4.4 and 6.3).

3.3 Materials. Materials shall be as specified herein and in referenced specifications, standards, and drawings. Materials shall be free from defects which adversely affect performance or serviceability of the finished product (see 6.5).

3.3.1 Hose outer cover.

3.3.1.1 Type I hose. The type I hose outer cover shall be compounded from polychloroprene.

3.3.1.2 Type III hose. The type III hose outer cover shall consist of oil resistant, rubber impregnated fabric.

3.3.2 Hose reinforcement.

3.3.2.1 Type I hose. Reinforcement of type I hose shall consist of a single braid of cotton, polyester, or other nonmetallic reinforcing material or plies of woven fabric of such strength as to meet the requirements of this specification.

3.3.2.2 Type III hose. Reinforcement of type III hose shall consist of an inner ply of fabric braid and an outer ply of single wire braid of such combined strength as to meet the requirements of this specification.

3.3.3 Inner tube. The inner tube shall be fabricated from synthetic, oil resistant rubber polymer (see 4.7.1).

3.4 Construction.

3.4.1 Hose. Hose shall be constructed of a seamless, smooth bore tube of flexible material, a reinforcement, and an outer cover.

3.4.2 Hose assemblies. Hose assemblies shall consist of hose with fittings assembled on each end in accordance with MS52103 or MS52104 (see 4.7.2).

3.4.3 Hose assembly fittings. Unless otherwise specified on the applicable drawing, one fitting in each hose assembly shall be of the male type and one of the female type. The female type shall incorporate a swivel. Dimensions and materials of fittings shall conform to the applicable drawing (see 4.7.1 and 4.7.2).

3.4.3.1 Steel fittings. Steel fittings, except stainless when furnished, shall be zinc plated in accordance with ASTM B 633; type II, Fe/Zn 5, or ASTM B 695, type II, class 5.

3.4.4 Dimensions.

3.4.4.1 Inner tube thickness. The average thickness of a buffed and unbuffed tube shall be not less than 0.040 inch.

3.4.4.2 Length.

3.4.4.2.1 Bulk length. Unless otherwise specified (see 6.2), hose shall be furnished in any length. At least 80 percent of the lengths furnished shall be 40 feet or more in length; minimum length shall be 3 feet.

3.4.4.2.2 Cut length tolerances. When specified in the acquisition document (see 6.2), hose shall be furnished in cut lengths with a tolerance of plus or minus one percent for lengths of 3 feet or greater and plus or minus 0.25 inch for lengths of less than 3 feet.

3.4.4.2.3 Hose assemblies. Lengths of hose assemblies shall be as specified on the applicable drawing, slash sheet, or procurement documents.

3.4.4.3 Diameters. Inside and outside diameters shall conform to tables I and II, as applicable, for the type and size specified.

TABLE I. Inside and outside diameters (type I).

Dash No.	Nominal size, I.D (inches)	Nominal size, I.D (inches) Decimal	Inside diameter (inches)		Outside diameter (inches)	
			Minimum	Maximum	Minimum	Maximum
- 2	1/8	.125	0.109	0.141	0.328	0.375
- 3	3/16	.188	0.172	0.203	0.406	0.468
- 4	1/4	.250	0.234	0.266	0.469	0.531
- 5	5/16	.313	0.296	0.328	0.531	0.593
- 6	3/8	.375	0.359	0.391	0.594	0.656
- 8	1/2	.500	0.469	0.531	0.750	0.812
- 10	5/8	.625	0.593	0.656	0.937	1.000
- 12	3/4	.750	0.718	0.781	1.062	1.125

TABLE II. Inside and outside diameters (type III).

Dash No.	Nominal size, I.D (inches)	Nominal size, I.D (inches) Decimal	Inside diameter (inches)		Outside diameter (inches)	
			Minimum	Maximum	Minimum	Maximum
- 4	3/16	.188	0.188	0.216	0.472	0.510
- 5	1/4	.250	0.250	0.281	0.535	0.573
- 6	5/16	.313	0.313	0.344	0.597	0.635
- 8	13/32	.406	0.406	0.437	0.714	0.760
- 10	1/2	.500	0.500	0.539	0.808	0.854
- 12	5/8	.625	0.625	0.667	0.933	0.979
- 16	7/8	.875	0.875	0.917	1.175	1.237
- 20	1-1/8	1.125	1.125	1.172	1.456	1.518
- 24	1-3/8	1.375	1.375	1.422	1.691	1.753
- 32	1-13/16	1.813	1.812	1.859	2.096	2.190

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3.4.4.4 Concentricity. The inside diameter and the outside diameter shall be concentric within 0.030 inch total indicator reading on 1/8 and 3/16 inch hose and within 0.040 inch total indicator reading on sizes greater than 3/16 inch.

3.4.5 Bend radius. The hose shall be capable of being bent without collapse or damage to an inside bend radius as specified in table III.

TABLE III. Bend radius (hose assembly installation).

Nominal size, I.D. (inches)	Type I	Type III
1/8	1.75	<u>1/</u>
3/16	2.00	0.75
1/4	2.25	1.00
5/16	2.75	1.25
3/8	3.00	<u>1/</u>
13/32	<u>1/</u>	1.75
1/2	3.75	2.25
5/8	4.75	2.75
3/4	5.50	<u>1/</u>
7/8	<u>1/</u>	3.50
1-1/8	<u>1/</u>	4.50
1-3/8	<u>1/</u>	7.50
1-13/16	<u>1/</u>	14.00

1/ Hose type not available in this size.

3.4.6 Fittings.

3.4.6.1 Screw threads. Screw threads of fittings shall be with ASME B1.1 for the size specified. Classes of fits for threads shall be in accordance with best commercial practice.

3.4.6.2 Wrench flats. Nominal distance across wrench flats (hexagon or other) shall be in multiples of 1/16 inch. Tolerance shall not exceed the tolerance across flats for the semifinished hexagon nut nearest the fitting wrench flat size, as specified in ASME B18.2.2.

3.4.6.3 Swivel fittings. Swivel fittings shall swivel freely with hand torque.

3.5 Performance. The following requirements shall be applicable to hose and hose assemblies of type I and type III except as differentiated herein. The term sample shall hereafter refer to either hoses or hose assemblies of both types.

3.5.1 Length change.

3.5.1.1 Type I. When tested in accordance with 4.7.3.1, the test samples shall change no more than plus or minus 5 percent from its original free length. For hose assemblies, the free length shall be the length between the fittings.

3.5.1.2 Type III. After being subjected to the applicable working pressure of table IV, the test sample length increase shall be not greater than 6 percent for all sizes.

TABLE IV. Pressure requirements.

Nominal hose size (I.D.) (inch)	Burst pressure		Proof pressure		Working pressure	
	Type I (psi)	Type III (psi)	Type I (psi)	Type III (psi)	Type I (psi)	Type III (psi)
1/8	2000	1/	1000	1/	500	1/
3/16	1700	6000	850	3000	425	1500
1/4	1250	6000	625	3000	300	1500
5/16	1100	4000	550	2000	275	1000
3/8	1000	1/	500	1/	250	1/
13/32	1/	4000	1/	2000	1/	1000
1/2	750	3500	375	1750	200	875
5/8	700	3000	350	1500	175	750
3/4	500	1/	250	1/	125	1/
7/8	1/	1500	1/	750	1/	375
1-1/8	1/	1250	1/	625	1/	300
1-3/8	1/	1000	1/	500	1/	250
1-13/16	1/	750	1/	375	1/	200

1/ Hose type not available in this size

3.5.2 Proof pressure. When tested in accordance with 4.7.3.2, the test samples shall withstand the proof pressure up to and including that specified in table IV without leakage.

3.5.3 Burst pressure. When tested in accordance with 4.7.3.3, the test samples shall not burst at any pressure up to that specified in table IV. There shall be no leakage around the fittings of test samples below the specified minimum burst pressure.

3.5.4 Low temperature flexibility. The test samples shall show no evidence of breaks when subjected to the low temperature flexibility test specified in 4.7.3.4.

3.5.5 Ozone resistance. The covers of type I hose shall show no evidence of cracks or breaks when subjected to the ozone resistance test specified in 4.7.3.5. The hose outer cover elongated 12.5%, shall exhibit no cracking when examined under a 7 power magnification after having been exposed for a period of 168 hours at a temperature of + 100°F ± 2°F to an ozone concentration maintained at 50 ± 5 parts of ozone per hundred million parts of air.

3.5.6 Vacuum collapse resistance. The decrease in the outside diameter of type I hose shall be not greater than 15 percent when subjected to the vacuum collapse resistance test specified in 4.7.3.6.

3.5.7 Oil resistance. When tested in accordance with 4.7.3.7, the test samples of tube and type I cover shall be within the limits for volume change specified in table V.

TABLE V. Allowable volume change.

Condition	Tube		Cover
	Percent		Percent
	Decrease	Increase	Increase
After oil immersion			
Type I	5	25	100
Type III	0	30	--
After fuel immersion	--	60	110

3.5.8 Fuel resistance. When tested in accordance with 4.7.3.8, the test samples and the type I covers of the samples shall be within the limits of volume change specified in table V.

3.5.9 Vibration resistance. The test samples, when subjected to the vibration resistance test specified in 4.7.3.9, shall not leak nor shall show any evidence of damage.

3.5.10 Fungus resistance. The test samples when subjected to the fungus resistance test specified in 4.7.3.10, shall show no evidence of damage affecting performance.

3.5.11 Hot oil circulation. The samples of type III shall exhibit no leaks, ruptures, or cracks, internally or externally when subjected to the hot oil circulation test specified in 4.7.3.11.

3.6 Marking.

3.6.1 Hose cover material. The outer cover of bulk hose or hose in hose assemblies shall be marked with a water resistant, gasoline resistant, and oil-resistant, continuous yellow stripe. As a minimum, the hose cover material shall be marked with the following information at intervals of not more than 12 inches.

Military designator "MIL-H-13444" ^{1/}
 Type
 Nominal ID size (fraction or dash no. in accordance with table I and II)
 Date of manufacture (quarter of year and year)
 Capital letters "OZ" (type I only)
 Manufacturer's CAGE code

Example: "MIL-H-13444 II 8 3Q98 OZ XXXX" or "MIL-H-13444 II 1/2 3Q98 OZ XXXX"

3.6.2 Hose assemblies. A removable tag shall be attached to each hose assembly and shall contain the military part number, date of assembly and specification number and name or code of assembly manufacturer.

^{1/} The old specification number is used as the military designator to maintain backwards compatibility with existing parts.

3.7 Age. The age of bulk hose and hose assemblies covered by this specification and furnished for use by the Government shall not exceed the limits established in SAE AS1933.

3.8 Workmanship. Workmanship shall be such as to produce hose and hose assemblies free from defects such as cracks, cuts, breaks, blisters, looseness, exposed braid, as well as restricted hole through end fittings or damaged or burred end fitting screw threads. Surface irregularities such as mold marks, laps, or air bubbles, as distinguished from cracks or cuts, shall not be cause for rejection.

4. VERIFICATION

4.1 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 established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment (i.e. Industry Standard, Military Standard, etc...) shall be in accordance with ANSI/NCSL Z540 -1 or equivalent.

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

- a. Qualification inspection (see 4.4).
- b. Screening (see 4.5.1)
- c. Quality conformance inspection (see 4.5.2).
 - 1. Group A lot acceptance inspection (see 4.5.2.1)
 - 2. Group B periodic inspection (see 4.5.2.2)

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in MIL-STD-810 and ASTM D 380 as applicable.

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

4.4.1 Samples for qualification. Samples for qualification shall be representative of the products proposed to be furnished to the Government. Samples shall be of one type and nominal size of hose as specified in table VI and shall be of the quantity and length specified in the applicable test method.

TABLE VI. Qualification inspection samples.

Test samples required		Qualification established for	
Type	ID size ^{1/} (inches)	Type	Nominal ID size (inches) (of same class as tested)
I	1/4	I	1/8, 3/16, 1/4, 5/16, 3/8, 1/2
III	1/4	III	3/16, 1/4, 5/16, 13/32, 1/2
I	3/4	I	5/8, 3/4
III	7/8	III	5/8, 7/8, 1-1/8, 1-3/8, 1-13/16

^{1/} Manufacturers qualifying bulk hose or hose assemblies of a different ID size than listed below shall be independently qualified. See the qualifying activity for guidelines.

4.4.2 Inspection routine. The sample(s) shall be subjected to the inspections specified in table IX.

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

4.4.4 Retention of qualification. To retain qualification, the contractor shall verify in coordination with the qualifying activity the capability of manufacturing products which meet the performance requirements of this specification. Refer to the qualifying activity for the guidelines necessary to retain qualification to this specification. The contractor shall immediately notify the qualifying activity at any time the inspection data indicates failure of the qualified product to meet the performance requirements of this specification.

4.4.4.1 Fittings. Hose assemblies shall be qualified with fittings from a specific manufacturer and bulk hose from a specific manufacturer. Any subsequent changes regarding the sources of a fitting or bulk hose used in a qualified assembly must be approved by the qualifying activity.

4.5 Inspection of product for delivery. Inspection of product for delivery shall consist of screening and group A.

4.5.1 Screening. Each hose and hose assembly shall have been subjected to and passed all the screening tests specified in table VII. Any hose or hose assembly which fail any test criteria in the screening sequence shall be removed from the lot at the time of observation or immediately at the conclusion of the test in which the failure was observed.

4.5.2 Conformance inspection.

4.5.2.1 Group A inspection. Group A inspection shall consist of the inspections specified in table VII in the order shown.

4.5.2.1.1 Group A sampling plan. Group A tests specified in table IX shall be performed on a production lot basis. Random samples shall be selected to form an inspection lot. If one or more defects are found in the inspection lot, then the production lot shall be screened for that particular defect and defects removed. An inspection lot shall be selected from the production lot and all group A tests again performed. If one or more defects are found in the second inspection lot, the production lot shall be rejected and shall not be supplied to this specification.

4.5.2.1.2 Production lot. A production lot shall consist of bulk hose or hose assemblies manufactured on the same production line(s) by means of the same production technique, materials, controls, and design during the same continuous production run.

4.5.2.1.3 Inspection lot. For hose assemblies, the inspection lot shall be product selected at random from the production lot without regard to quality and shall be the size specified in table VII. Each bulk hose manufacturer is responsible for developing a Group A bulk hose sample plan based on production methods, in-line monitors and inspection capabilities which shall be approved by the qualifying activity.

4.5.2.1.4 Visual inspection. Each hose or hose assembly shall be visually examined for configuration and workmanship.

TABLE VII. Group A inspection.

Production lot size	Accept on zero sample size
9 to 90	8
91 to 150	12
151 to 280	19
281 to 500	21
501 to 1,200	27
1,201 to 3,200	35
3,201 to 10,000	38
10,001 to 35,000	46

4.5.2.2 Group B inspection (periodic). Group B inspection shall consist of the inspections specified in table IX and shall be made on test samples of the quantity and length specified in the applicable test which have been subjected to and passed the group A inspection. Group B inspection shall be performed once every 12 calendar weeks. Acceptance may be extended to include an ID range of product in accordance with table VIII but the ID size of product that the extended acceptance applies to shall have been produced during the same production period with the same materials and processes.

TABLE VIII. Group B extended acceptance.

Range	Nominal ID size (inches) (of same type)
$\frac{1}{2}$ inch	1/8, 3/16, 1/4, 5/16, 3/8, 13/32, 1/2
$\frac{5}{8}$ inch	5/8, 3/4, 7/8, 1-1/8, 1-3/8, 1-13/16

4.5.2.2.1 Group B sampling plan. A sample of parts shall be randomly selected in accordance with table IX. Parts shall be as representative as possible of the production lots for the time period that they represent (for example, parts shall be from different lots, different production dates, different ID's etc.). Parts tested must be from actual production lots and are not to be built just for testing. Manufacturers are not required to do Group B testing for a range if there has been no production for that range during the period covered by the testing. If there has been no production for a specific range for a period of two years, the qualifying activity has the option of requiring the manufacturer to build parts to perform Group B tests.

4.5.2.2.2 Nonconformance. If a sample fails to pass any group B inspection, the manufacturer shall immediately notify the qualifying activity and cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group B inspection shall be repeated on additional samples (all inspections, or the inspection which the original sample failed, at the option of the qualifying activity). Group A (and group B if applicable) inspection may be reinstated: however, final acceptance shall be withheld until the group B inspection has shown that the corrective action was successful. In the event of failure after inspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.2.2.3 Disposition of test specimens. Test specimens which have been tested to group B inspection shall not be delivered on the contract or purchase order.

4.5.2.2.4 Group B hose assembly testing. Required individual Group B tests at the hose assembly level that were already performed at the bulk hose level may be eliminated if documented approval has been obtained from the qualifying activity.

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TABLE IX. Inspection table.

Title	Requirement	Inspection	Qualification	Quality conformance		Screening 1/
				Group A (Lot acceptance)	Group B (Periodic)	
Marking	3.6					X
Proof pressure	3.5.2	4.7.3.2	X			X
Workmanship	3.8	4.5.2.1.4	X	X		
Configuration	3.4.4, 3.4.6	4.7.2	X	X		
Length change 2/	3.5.1	4.7.3.1	X		X	
Burst pressure 2/	3.5.3	4.7.3.3	X		X	
Vacuum collapse resistance 2/	3.5.6	4.7.3.6	X		X	
Low temperature flexibility 2/, 3/	3.5.4	4.7.3.4	X			
Ozone resistance 3/	3.5.5	4.7.3.5	X			
Oil resistance 2/, 3/	3.5.7	4.7.3.7	X			
Fuel resistance 2/, 3/	3.5.8	4.7.3.8	X			
Vibration resistance, 3/	3.5.9	4.7.3.9	X			
Hot oil circulation 2/, 3/	3.5.11	4.7.3.11	X			
Fungus resistance 3/, 4/	3.5.10	4.7.3.10	X			

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

2/ These are destructive test.

3/ These tests need only be done during initial qualification as long as materials, material supplier, and designs and manufacturing processes have not changed.

4/ Manufacturers may certify to the qualifying activity that the materials used are fungus resistant in-lieu-of performing this test.

4.7 Methods of inspection.

4.7.1 Test methods. The following identified tests and test methods assure hose and hose assembly integrity within typical operating conditions and applications. Alternate commercial industry standard test methods are allowed; however when an alternate method is used, documented approval must be obtained from the qualifying activity prior to the performance of the test. The test methods described herein are proven methods and shall be the referee method in case of dispute.

4.7.2 Configuration and features. Hose and hose assemblies shall be examined to verify that the design, construction and physical dimensions are in accordance with the applicable requirements.

4.7.3 Performance. Except where otherwise specified herein, tests shall be made in an ambient air temperature of 80 ± 9 degrees Fahrenheit ($^{\circ}\text{F}$) on unaged specimens.

4.7.3.1 Length change. To determine conformance to 3.5.1, the length change test shall be conducted as specified in ASTM D 380, except as modified herein. Test specimens shall consist of three hose assemblies, each not less than 18 inches between fittings. Final pressure shall be the working pressure specified in table IV for the type and size hose tested. Rate of increase from initial (10 psi) pressure to final pressure shall be approximately 1,000 psi per minute. Measurement can be taken 2 minutes after required working pressure has been reached. Average change in length of the three specimens, expressed in percentage of the original length, shall be calculated and used to determine conformance to 3.5.1.

4.7.3.2 Proof pressure. To determine conformance to 3.5.2, the proof pressure test shall be conducted as specified in ASTM D 380, except as specified herein. Each bulk hose length and each hose assembly shall be subjected to this test. Proof pressures shall be as specified in table IV for the type and size tested. . The test fluid may be water, engine oil conforming to MIL-PRF-2104, or hydraulic oil conforming to MIL-H-5606. Proof pressure shall be held for not less than 30 seconds, nor more than 60 seconds, during which time each specimen shall be examined for conformance to 3.5.2

4.7.3.3 Burst pressure. To determine conformance to 3.5.3, the three test specimens used in 4.7.3.1 shall be subjected to the burst pressure test specified in ASTM D 380, except as specified herein. The rate of pressure application shall be from 5,000 to 10,000 psi per minute. Pressure shall be increased until each specimen fails. Failure of the hose specimen shall consist of leakage, rupture, or detachment from a fitting. Failure of a hose assembly specimen shall consist of leakage or rupture of the hose or fitting, leakage between hose and fitting or leakage between fitting and test fixture connector. Average burst pressure for the three specimens shall be calculated and used to determine conformance to 3.5.3.

4.7.3.4 Low temperature flexibility. To determine conformance to 3.5.4, three 18-inch long hose and/or hose assemblies shall be selected from the type(s) of hose being qualified. One of the three specimens shall be air aged for 168 hours at $158^{\circ}\text{F} \pm 2^{\circ}\text{F}$, one shall be aged in accordance with figure 1 using hydraulic oil conforming to MIL-H-5606 at a temperature of $212^{\circ}\text{F} \pm 2^{\circ}\text{F}$, for a period of 70 hours, and the third specimen shall remain untreated. After conditioning, the specimens shall be further conditioned for 70 ± 1 hours at a temperature of $-67^{\circ}\text{F} \pm 6^{\circ}\text{F}$ for type I hose and at a temperature of $-55^{\circ}\text{F} \pm 2^{\circ}\text{F}$ for type III hose. At the end of this period, and while still at the specified temperature, all three specimens shall be bent through 180° from the centerline over a mandrel with a diameter as specified in table X. The specimens shall then be bent through 360° in the opposite direction over the same size mandrel. Bending rate shall be $21 \pm 2^{\circ}$ per second. After bending, the specimens shall be examined to determine conformance. The entire bending operation shall be completed within 45 seconds.

TABLE X. Mandrel diameter.

Hose size (inches)	Paragraph 4.7.3.4 Paragraph 4.7.3.6	Paragraph 4.7.3.11
1/8	3.5	NA
3/16	4.0	2.00
1/4	4.5	2.25
5/16	5.5	2.75
3/8	6.0	NA
13/32	7.0	4.62
1/2	7.5	5.50
5/8	9.5	6.50
3/4	11.0	NA
7/8	12.0	7.38
1-1/8	15.0	9.00
1-3/8	16.0	11.00
1-13/16	20.0	17.00

4.7.3.5 Ozone resistance. To determine conformance to 3.5.5, a specimen of hose shall be subjected to the ozone test specified in ASTM D 380, except as specified herein. Length of time in the ozone chamber, temperature, and the ozone concentration therein shall be as specified in 3.5.5. The specimen shall be examined daily for cracking, with a 7 power magnification and without magnification, except area covered by tape or twine. The first observable cracking shall be recorded. After required exposure to ozone, the specimen shall again be examined with 7 power magnification to determine conformance to 3.5.5.

4.7.3.6 Vacuum collapse resistance. To determine conformance to 3.5.6, a piece of 36 inch long hose shall be wrapped around a mandrel having a diameter as specified in table X. While bent around the mandrel, hose less than 1/2 inch nominal size shall be subjected to an internal vacuum equivalent to 20 inches of mercury; hose 1/2 inch and larger shall be subjected to an internal vacuum equivalent to 10 inches of mercury. While vacuum is being applied, two readings spaced 90° apart shall be taken on the outside diameter of the hose. The readings shall subsequently be averaged and the decrease calculated as a percentage of the original outside diameter.

4.7.3.7 Oil resistance. To determine conformance to 3.5.7, the oil resistance test shall be conducted using the immersion test for change in volume as specified in ASTM D 380, except as specified herein. Three specimens shall be taken from the outer cover of untested hose, and three specimens shall be taken from the inner tube of untested hose. Each specimen shall be approximately 2 square inches in area. Each specimen shall be immersed in petroleum base oil IRM 903 for 70 hours at a temperature of 212°F ± 5°F. The change in volume reported for the outer cover shall be the average of the values obtained from the three outer cover specimens tested. The change in volume of the inner tube shall be the average of the values obtained from the three inner tube specimens tested. The change in volume of the outer cover and inner tube shall each be calculated to determine conformance to 3.5.7.

4.7.3.8 Fuel resistance. To determine conformance to 3.5.8, the fuel resistance test shall be conducted using the immersion test for change in volume as specified in ASTM D 380, except as specified herein. Three specimens shall be taken from the outer cover of untested hose, and three specimens shall be taken from the inner tube of untested hose. Each specimen shall be approximately 2 square inches in area. Each specimen shall be immersed in reference fuel D 48 hours at a temperature of 80°F ± 10°F. The change in volume reported for the outer cover shall be the average of the values obtained from the three outer cover specimens tested. The change in volume of the inner tube shall be the average of the values obtained from the three inner tube specimens tested. The change in volume of the outer cover and inner tube shall each be calculated to determine conformance to 3.5.8.

4.7.3.9 Vibration resistance. To determine conformance to 3.5.9, six hose assemblies with a free hose length of not less than 12 inches shall be selected for testing. Each specimen shall be arranged to provide an initial slack of .375 inch and an offset of 1.500 inches at an angle of 90° to the direction of stroke. The specimens shall then be vibrated through an amplitude of .344 inch (total excursion of .688 inch) at a rate of 1800 ± 10 cycles per minute for 200 hours. During the vibration period, test fluid conforming to grade 10 of MIL-PRF-2104 shall be circulated through each specimen at a pressure of 45 psi and at a temperature of $250^{\circ}\text{F} \pm 5^{\circ}\text{F}$. At the end of the vibration period the specimens shall be examined for evidence of leakage or other failure.

4.7.3.10 Fungus resistance. To determine conformance to 3.5.10, test specimens shall consist of six hose assemblies, each with hose length between fittings of not less than 24 inches. Specimens shall be tested in accordance with MIL-STD-810, method 508, procedure I. Two specimens shall be subjected to the proof pressure test (see 4.7.3.2) after each of the incubation periods (30, 60 and 90 days) to determine conformance to 3.5.10.

4.7.3.11 Hot oil circulation. To determine conformance to 3.5.11, two untested type III hose assemblies shall be selected. Oil conforming to grade 3 of MIL-L-21260 at a temperature of $300^{\circ}\text{F} \pm 5^{\circ}\text{F}$, and at a pressure of 175 ± 25 psi shall be continuously circulated through the hose assemblies for 240 ± 1 hours in an ambient temperature of $75^{\circ}\text{F} \pm 10^{\circ}\text{F}$. After the circulation test, specimens shall be bent around the applicable mandrel specified in table X with hose at a temperature of $75^{\circ}\text{F} \pm 10^{\circ}\text{F}$. While bent around the specified mandrel, the specimens shall be proof-tested in accordance with 4.7.3.2. Specimens shall then be examined for internal or external leaks, ruptures, or cracks.

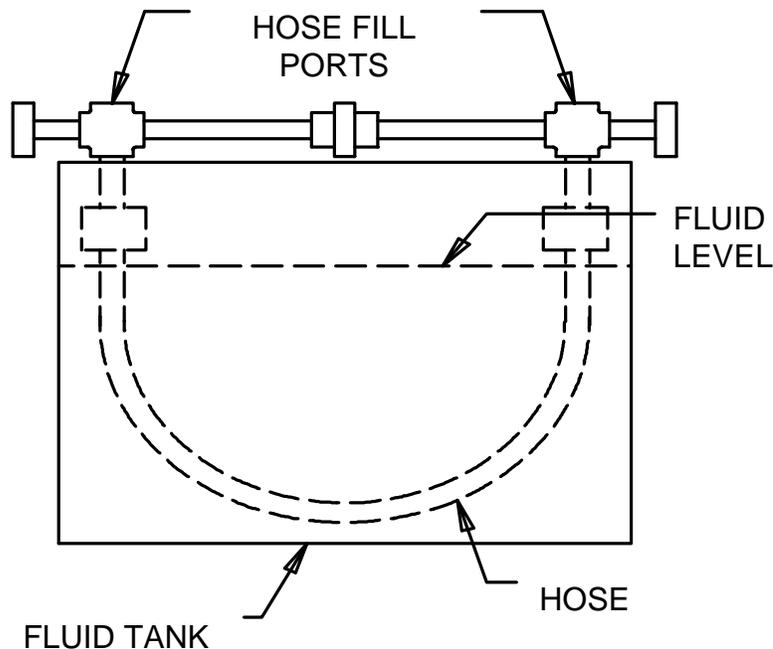


FIGURE 1. Specimen conditioning fluid tank.

NOTE: Type I hose specimen is immersed in test fluid up to but not including hose end couplings. Hose specimen is then filled internally. Type III hose shall receive internal conditioning only.

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 personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department 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

6.1 Intended use. Hose and hose assemblies covered by this specification are intended for use as fuel and oil lines carrying fuel, oil or diesel fuel in military vehicles and for other military applications at temperatures ranging from minus 65°F to plus 250°F for type I and from minus 55°F to plus 300°F for type III. The hose and hose assemblies covered by this specification are military unique because they must be able to operate satisfactorily in temperatures ranging from minus 65°F to plus 250°F and minus 55°F to plus 300°F. Commercial products do not operate at these extremes.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- c. Packaging requirements (see 5.1).
- d. Hose type, class and nominal size (see 1.2.1, 1.2.2 and table I).
- e. Title, number and date of applicable drawings (see 3.3).
- f. Fitting description where applicable (see 3.3).
 1. Male or female
 2. Fixed or swivel
 3. Thread size
 4. Hose to pipe or hose to tube
 5. Flare type (S.A.E. or J.I.C.) or flareless (compression) type where applicable
 6. Fitting material (see 3.4).
 7. Reusable screw-on type or reusable clamp-on type or permanently attached type
- g. Hose or hose assembly length where applicable (see 3.4)

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List (QPL) whether or not such products have actually been so 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 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 Defense Supply Center Columbus (DSCC-VQP), 3990 East Broad Street, Columbus, Ohio 43216-5000.

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6.4 Subject term (key word) listing.

Fittings
Thread size
Tube

6.5 Recycled materials. The use of recycled materials which meet the requirements of the applicable material specifications without jeopardizing the intended use of the item are encouraged (see 3.3).

6.6 References to superseded specifications. All the requirements of MIL-DTL-13444G are interchangeable with those of MIL-H-13444E, therefore, previously existing documents (OEM drawings, etc.) referencing MIL-H-13444 need not be changed.

6.7 Supersession data. Type I hose are used in lieu of the canceled type II hose.

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

Custodians:
Army - AT
Navy - YD2
DLA - CC

Preparing activity:
DLA-CC

(Project No. 4720-0248)

Review activities:
Army - AR, MI
Navy - MC

