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MILITARY SPECIFICATION

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HOSE AND HOSE ASSEMBLIES, RUBBER: FUEL AND OIL

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

1. SCOPE.

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

1.2 Classification. Hose and hose assemblies shall be of the following types, as specified (see 6.2):

- | | |
|----------|---|
| Type I | - Single fabric braid reinforcement. |
| Type II | - Circular woven fabric reinforcement or single 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 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.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-Automotive Materiel Readiness Command by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC-4720

MIL-H-13444D

SPECIFICATIONS

Federal

- FF-B-575 - Bolts, Hexagon and Square.
- QQ-P-416 - Plating, Cadmium (Electrodeposited).
- QQ-Z-325 - Zinc Coating, Electrodeposited, Requirements For.
- TT-S-735 - Standard Test Fluids; Hydrocarbon.

Military

- MIL-P-775 - Hose, Rubber or Fabric (Including Tubing); and Fittings, Nozzles and Strainers, Packaging of.
- MIL-L-2104 - Lubricating Oil, Internal-Combustion Engine, (Heavy-Duty).
- MIL-H-5605 - Hydraulic Fluid, Petroleum Base: Aircraft, Missile, and Ordnance.
- MIL-F-13927 - Fungus Resistance Test; Automotive Components.
- MIL-L-21260 - Lubricating Oil, Internal-Combustion Engine, Preservative.

STANDARDS

Federal

- * FED. STD. NO. 162 - Hose, Rubber, Visual Inspection Guide For
- FED. TEST METHOD STD. NO. 601 - Rubber: Sampling and Testing

Military

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-1523 - Age Controls of Age-Sensitive Elastomeric Materiel.
- * MS52103 - Hose Assembly, Nonmetallic: Fuel and Oil, Medium Pressure, Flared Tube

- (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). Application
- * should be made to the Naval Publications and Forms Center, 5801 Tabor Avenue Philadelphia, Pennsylvania using DD Form 1426, Specifications and Standards Requisition.

2.2 Other publications. The following documents form 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.

NATIONAL BUREAU OF STANDARDS PUBLICATIONS

Handbook H28 - Screw-Thread Standards for Federal Services.

FEDERAL SUPPLY CODE FOR MANUFACTURERS

Cataloging Handbook H4-1

MIL-H-13444D

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C.)

3. REQUIREMENTS

3.1 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 (see 4.2, 6.3, and 6.4).

3.2 Materials. Materials not specified herein or on applicable drawings (see 6.2), shall be of such quality as to be free from defects which might adversely affect performance.

3.3 Design and construction. Hose shall be constructed of a seamless, smooth bore tube of flexible material, a reinforcement, and an outer cover. Hose assemblies shall consist of hose with fittings assembled on each end. Unless otherwise specified, 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 drawings (see 6.2). Steel fittings, except stainless when furnished, shall be zinc plated in accordance with type II, class 2 of QQ-Z-325 or cadmium plated in accordance with type II, class 2 of QQ-P-416.

3.3.1 Outer cover.

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

3.3.1.2 Type II. The outer cover of type II hose shall consist of a material which is resistant to gasoline, oil, and weather.

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

3.3.2 Reinforcement.

3.3.2.1 Type I. Reinforcement of type I hose shall consist of a single braid of cotton 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 II. Reinforcement of type II hose shall consist of a circular woven ply or braided ply of cotton or other reinforcing material of such strength as to meet the requirements of this specification.

3.3.2.3 Type III. 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.

MIL-R-13444D

- * 3.3.3 Inner tube. The inner tube shall be of uniform thickness, seamless construction, and fabricated from synthetic, oil resistant rubber polymer. The average thickness of a buffed and unbuffed tube shall be not less than .025 inch for type II hose and .040 inch for types I and III hose.

3.4 Size.

- * 3.4.1 Diameters. Inside and outside diameters shall conform to tables I and II, as applicable, for the nominal size specified (See 6.2).

Table I. Inside and outside diameters (types I and II)

Nominal size, I.D. (inch)	Inside diameter, inches				Outside diameter, inches			
	Type I		Type II		Type I		Type II	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/8	0.109	0.141	--	--	0.328	0.375	--	--
3/16	.172	.203	.172	.203	.406	.468	.359	.391
1/4	.234	.266	.234	.266	.469	.531	.421	.453
5/16	.296	.328	.296	.328	.531	.593	.515	.547
3/8	.359	.391	.349	.391	.594	.656	.578	.610
1/2	.469	.531	.469	.531	.750	.812	.687	.750
5/8	.593	.656	--	--	.937	1.000	--	--
3/4	.718	.781	--	--	1.062	1.125	--	--

MIL-H-13444D

Table II. Inside and outside diameters (type III)

Nominal size I.D. (inch)	Inside diameter (inches)	Outside diameter (inches)
3/16	0.188 \pm .028 - .000	0.484 \pm .026 - .012
1/4	0.250 \pm .031 - .000	0.547 \pm .026 - .012
5/16	0.313 \pm .031 - .000	0.609 \pm .026 - .012
13/32	0.406 \pm .031 - .000	0.734 \pm .026 - .020
1/2	0.500 \pm .039 - .000	0.828 \pm .026 - .020
5/8	0.625 \pm .042 - .000	0.953 \pm .026 - .020
7/8	0.875 \pm .042 - .000	1.203 \pm .034 - .028
1 1/8	1.125 \pm .047 - .000	1.484 \pm .034 - .028
1 3/8	1.375 \pm .047 - .000	1.722 \pm .031
1 13/16	1.812 \pm .047 - .000	2.143 \pm .047

* 3.4.2 Minimum Bend Radius: The minimum bend radius allowable in the installation of hose assemblies is as specified in Table III.

* Table III. Min. Bend Radius-Hose Assembly Installation

Nominal Size ID (inch)	Type I	Type II	Type III
1/8	1.75	NA	NA
3/16	2.00	2.00	.75
1/4	2.25	2.50	1.00
5/16	2.75	3.00	1.25
3/8	3.00	3.00	NA
13/32	NA	NA	1.75
1/2	3.75	4.00	2.25
5/8	4.75	5.00	2.75
3/4	5.50	6.00	NA
7/8	NA	NA	3.50
1 1/8	NA	NA	4.50
1 3/8	NA	NA	7.50
1 13/16	NA	NA	14.00

NA - Hose Type not available in this size.

NOTE: Bend radius measured to inside of bend.

MIL-H-13444D

3.4.3 Length.

3.4.3.1 Type I. Unless otherwise specified (see 6.2), type I bulk hose shall be furnished in random lengths up to 50 feet. At least 80 percent of the lengths furnished shall be 40 feet or more in length; minimum length shall be 3 feet.

3.4.3.2 Type II. Unless otherwise specified (see 6.2), type II bulk hose shall be furnished in random lengths up to 100 feet. At least 90 percent of the lengths furnished shall be over 10 feet; minimum length shall be 3 feet.

3.4.3.3 Cut length. When specified (see 6.2), hose shall be furnished in cut lengths with a tolerance of ± 1 percent for lengths of 3 feet or greater and $\pm 1/4$ inch for lengths of less than 3 feet.

3.4.3.4 Hose assemblies. Lengths of hose assemblies shall be as specified on the applicable drawings, or in the procurement documents (see 6.2).

3.4.4 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 Fittings.

3.4.5.1 Screw threads. Screw threads of fittings shall be in accordance with Handbook H28 for the size specified. Classes of fits for threads shall be in accordance with best commercial practice.

3.4.5.2 Interchangeability. Fittings shall conform to the performance requirements specified herein when installed on any hose conforming to the requirements specified herein and when attached to any standard mating part for the specified fitting type and size.

3.4.5.3 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 FF-B-575.

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

3.5 Performance requirements.

3.5.1 Conditions. Except when otherwise specified (see 6.2), the requirements of 3.5.2 through 3.5.15 shall be applicable to types I, II and III (see 1.2).

3.5.2 Length change.

3.5.2.1 Types I and II. When tested as specified in 4.5.2, the free length of hose or hose assemblies shall change no more than ± 5 percent from its original length. For hose assemblies, the free length shall be the length between the fittings.

MIL-H-13444D

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

3.5.3 Proof pressure. When tested as specified in 4.5.3, hose or hose assemblies shall withstand the proof pressure up to and including that specified in table IV without leakage.

3.5.4 Burst pressure. When tested as specified in 4.5.4, hose or hose assemblies shall not burst at any pressure up to that specified in table IV. There shall be no leakage around the fittings of hose or hose assemblies below the specified minimum burst pressure.

MIL-H-13444D

Table IV. Pressure requirements

Nominal hose size (I.D.) (inch)	Burst pressure		Proof pressure		Working pressure	
	Types I and II (psi)	Type III (psi)	Types I and II (psi)	Type III (psi)	Types I and II (psi)	Type III (psi)
1/8	2,000	NA	1,000	NA	500	NA
3/16	1,700	6,000	850	3,000	425	1,500
1/4	1,250	6,000	625	3,000	300	1,500
5/16	1,100	4,000	550	2,000	275	1,000
3/8	1,000	NA	500	NA	250	NA
13/32	NA	4,000	NA	2,000	NA	1,000
1/2	750	3,500	375	1,750	200	875
5/8	700	3,000	350	1,500	175	750
3/4	500	NA	250	NA	125	NA
7/8	NA	1,500	NA	750	NA	375
1 1/8	NA	1,250	NA	625	NA	300
1 3/8	NA	1,000	NA	500	NA	250
1 13/16	NA	750	NA	375	NA	200

NA - Hose type not available in this size.

MIL-H-13444D

3.5.5 Low temperature flexibility. When tested as specified in 4.5.5, hose and hose assemblies shall show no evidence of breaks or cracks.

3.5.6 Ozone resistance. When tested as specified in 4.5.6, the covers of types I and II hose shall show no evidence of cracks or breaks.

3.5.7 Vacuum collapse resistance. When tested as specified in 4.5.7, the decrease in the outside diameter of the hose shall be not greater than 15 percent. This requirement applies to types I and II hose only.

* 3.5.8 Oil resistance. When tested as specified in 4.5.8, the test specimens of types I, II, and III tubes and of type I covers shall remain within the limits of volume change specified in table V.

* Table V. Percent of volume change of material.

Condition	Tube (percent)	Cover (max. percent)
After oil immersion	-5 to +25	100
After fuel immersion	60, max.	110

* 3.5.9 Fuel resistance. When tested as specified in 4.5.9, test specimens of types I, II, and III tubes and of type I covers of hose and hose assemblies shall remain within the limits of volume change specified in table V.

3.5.10 Vibration resistance. When tested as specified in 4.5.10, hose assemblies shall not leak. Unless otherwise specified (see 6.2), this test is applicable to all type hose assemblies.

3.5.11 Fungi resistance. When tested as specified in 4.5.11, hose and hose assemblies shall evidence no damage affecting performance.

* 3.5.12 Hot oil circulation. This requirement applies only to type III hose. When tested as specified in 4.5.12, the specimen shall exhibit no leaks, ruptures, or cracks, internally or externally.

* 3.5.13 Marking. 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. The information "MIL-H-13444", type, size, date of manufacture in quarter of year and year, the manufacturer's code as designated in the Federal Supply Code for Manufacturers, Cataloging Handbook H4-1, and (for Types I and II hose only) the capital letters "OZ" shall be legibly marked on, or broken into, the stripe. The marking shall be repeated at intervals of not more than 12 inches along the hose. In addition, hose assemblies shall have an attached tag marked legibly with the following:

NATIONAL STOCK NUMBER
Date of Assembly
MIL-H-13444.

MIL-H-13444D

3.5.14 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 MIL-STD-1523.

- * 3.5.15 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. QUALITY ASSURANCE PROVISIONS

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

4.2 Qualification inspection. Hose and hose assemblies submitted for qualification inspection (see 3.1, 6.3, and 6.4) shall be examined for the defects referenced in 4.3.2.2 and subjected to the tests specified in 4.5.

4.2.1 Samples for qualification. The qualification samples (see 3.1) shall consist of 40 feet of bulk hose when qualifying hose only, or 10 feet of bulk hose with 12 assemblies (free length of 18 inches) and 12 assemblies (free length of 12 inches) when qualifying assemblies only. The samples shall be representative of the units proposed to be furnished to the Government. Qualification testing shall be conducted by the contractor at a place approved by the Government, and shall consist of examination for the defects specified in 4.3.2.2 and testing as specified in table VI.

4.2.2 Failure. Failure of a qualification sample to pass any of the inspection specified herein may be cause for the Government to refuse to conduct additional inspection until the faults revealed by the inspection have been corrected.

MIL-H-13444D

Table VI. Order of qualification testing

Specimen No.	Paragraph No.	Test Name
1, 2, and 3	4.5.2	Length change
	4.5.3	Proof pressure
	4.5.4	Burst pressure
4, 5, and 6	4.5.5	Low temperature flex- ibility
	4.5.3	Proof pressure
7, 8, and 9	4.5.11	Fungi resistance
	4.5.3	Proof pressure
10 through 15	4.5.10	Vibration
16	4.5.8	Oil resistance <u>3/</u>
	4.5.9	Fuel resistance <u>3/</u>
17	4.5.7	Vacuum collapse <u>1/</u>
18 and 19	4.5.6	Ozone resistance <u>1/</u>
20 and 21	4.5.12	Hot oil circulation <u>2/</u>

- * 1/ This test is applicable to types I and II hose only.
 * 2/ Applicable to type III hose only.
 * 3/ Not applicable to types II and III covers.

4.3 Quality conformance inspection.

4.3.1 Sampling.

4.3.1.1 Lot formation. Unless otherwise specified (see 6.2), a lot shall consist of all hose or hose assemblies of one type and part number, from an identifiable production period, produced by one manufacturer, and submitted at one time for quality conformance inspection.

4.3.1.2 Sampling for quality conformance examination. Samples for quality conformance examination shall be selected in accordance with MIL-STD-105, inspection level II. The sample unit shall be one completely fabricated hose or hose assembly.

4.3.1.3 Sampling for quality conformance testing. Samples for quality conformance testing shall be selected in accordance with inspection level S3 of MIL-STD-105. The sample unit shall be one completely fabricated hose or hose assembly.

4.3.2 Quality conformance examination.

MIL-H-13444D

4.3.2.1 Acceptable quality levels. Each sample selected in accordance with 4.3.1.2 shall be examined for conformance to the following acceptable quality levels (AQL) on the basis of percent defective:

<u>Classification</u>	<u>AQL</u>
Major	1.0
Minor	2.5

4.3.2.2 Classification of defects. Using FED. STD. No. 162 as a guide for examination purposes, defects shall be classified as follows:

MIL-H-13444D

Categories	Defects	Hose Only	Hose assembly
Critical	None defined		
Major			
101	Improper construction (see 3.3).	X	X
102	Plating nonconformance (see 3.3).		X
103	Any component damaged, defective, or not as specified	X	X
104	Concentricity nonconformance (see 3.4.3).	X	X
105	Swivel fittings do not swivel freely with hand torque (see 3.4.5.4).		X
106	Age nonconformance (see 3.5.14).	X	X
107	Screw threads of fittings damaged or burred (see 3.5.15).		X
108	Exposed reinforcement (see 3.5.15).	X	X
109	Improperly attached fittings (see 3.5.15).		X
110	Diameter nonconformance (see 3.4.1)	X	X
111	Improper size, length, or form of thread (see 3.4.4.1).		X
Minor			
201	Bulk hose lengths not within percentage specified or less than minimum (see 3.4.3).	X	
202	Nonconformity of length to tolerance (see 3.4.3.3).	X	X
203	Improper angle or depth of seat (see 3.4.5).		X
204	Distance across wrench flats exceeds specified tolerance (see 3.4.5.3).		X
205	Marking of hose or hose assembly missing, illegible, incomplete, or not at specified intervals or color, or hose assembly not tag marked as specified (see 3.5.13).	X	X
206	Poor workmanship (see 3.5.15).	X	X

4.3.3 Quality conformance tests. Samples selected in accordance with 4.3.1.3 shall be subjected to the tests specified in table VII.

4.3.3.1 Failure. Any sample unit found to contain one or more defects during quality conformance examination shall be cause for rejection of the sample unit. If the number of defective sample units exceeds the acceptable quality level for the sam-

MIL-H-13444D

ple, the lot represented by the sample shall be rejected. Failure of any quality conformance tests shall be cause for rejection of the lot represented by the sample. A test may be repeated at the request and expense of the contractor, in which case twice the original number of samples shall be tested. Failure of any retest sample shall be cause for rejection of the lot.

Table VII. Order of quality conformance testing

Specimen No.	Test paragraph	Test name	Assemblies, free length required (inches)	Bulk hose, length required (inches)
★ 1	4.5.2	Length change	18	NA
	4.5.3	Proof pressure	18	NA
	4.5.4	Burst pressure	18	NA
2	4.5.7	Vacuum collapse	NA	36

NA - Test not applicable for quality conformance testing.

4.4 Control tests.

4.4.1 Sampling for bulk hose. Samples shall be selected and tested at time of manufacture at the rate of one sample per approximately 10,000 feet of each nominal size and type produced for the Government, except that not more than two samples shall be selected in any 30-day period. Each sample shall consist of sufficient hose to conduct the specified tests.

4.4.2 Sampling for hose assemblies. Samples shall be selected and tested at the time of assembly of hoses and fittings. One sample shall be selected per approximately 10,000 feet of hose used in fabrication of each type and size (nominal inside diameter) hose assembly produced for the Government, except that not more than two samples shall be selected in any 30-day period. Each sample shall consist of 6 feet of bulk hose and the quantity of hose assemblies (free length of 18 inches) as specified in the applicable tests (see table VI).

4.4.3 Applicable tests. Hose and hose assembly samples selected for control tests shall be subjected to the tests specified in 4.5.2, 4.5.3, 4.5.4, and 4.5.5.

4.5 Test procedures.

4.5.1 Test conditions and equipment. Except where otherwise specified herein, tests shall be made in an ambient air temperature of $80^{\circ} \pm 9^{\circ}\text{F}$. on an unaged specimen. A specimen tested at elevated or reduced temperatures shall have been temperature-stabilized or kept for the specified time in temperature-controlled cabinets at the specified temperatures.

4.5.2 Length change. The free hose length of the test specimen shall be determined while a hydrostatic pressure of 10 psi is applied internally to the hose. Hydrostatic pressure shall then be increased at a uniform rate of approximately

MIL-H-13444D

1000 psi per minute until the internal hose pressure reaches the working pressure specified in table IV. The free hose length shall again be measured. The change in length shall be calculated as percentage of original length to determine conformance to 3.5.2.

4.5.3 Proof pressure. To determine conformance to 3.5.3, hydrostatic pressure shall be applied to hose or hose assemblies in accordance with the proof pressure test specified in method 10211 of Fed. Test Method Std. No. 601, except that the test fluid may be water, engine oil conforming to MIL-L-2104, or hydraulic oil conforming to MIL-H-5606.

4.5.4 Burst pressure. To determine conformance to 3.5.4, hose and hose assemblies shall be subjected to the burst test in conformance with method 10011 of Fed. Test Method Std. No. 601.

4.5.5 Low temperature flexibility.

4.5.5.1 Test specimens. The test specimens of each of the four types shall consist of three 18-inch lengths of hose or hose assemblies, as applicable.

4.5.5.1.1 Specimen conditioning. One of the three specimens being tested shall be air aged for 168 hours at $158^{\circ} \pm 2^{\circ}\text{F}$, one shall be immersed (see figure 1) in hydraulic oil conforming to MIL-H-5606 at a temperature of $212^{\circ} \pm 2^{\circ}\text{F}$. for a period of 70 hours, and the third specimen shall remain untreated.

* 4.5.5.2 Procedure. After conditioning as specified in 4.5.5.1, the specimen shall be further conditioned for 70 ± 1 hours at a temperature of minus 67° plus 0° minus 3.6°F . for types I and II hose specimens and at a temperature of minus $55^{\circ} \pm 2^{\circ}\text{F}$. for type III hose specimens. 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 VIII. The specimens shall then be bent through 360° in the opposite direction over the same size mandrel. Bending rate shall be $21^{\circ} \pm 2^{\circ}$ per second. After bending, the specimens shall be examined to determine conformance to 3.5.5. The entire bending operation shall be completed within 45 seconds.

4.5.6 Ozone resistance.

4.5.6.1 Test specimen. The test specimen shall be a piece of hose 30 inches in length. This shall be wrapped around a mandrel having a diameter as specified in table VIII and secured to the mandrel at both ends.

4.5.6.2 Procedure. The specimen shall be conditioned for 45 minutes in air at room temperature and then, while still on the mandrel, shall be placed in a chamber containing air mixed with ozone in the proportion of 50 ± 5 parts of ozone per 100 million parts of air by volume. The air temperature in the chamber during

MIL-H-13444D

the test shall be $100^{\circ} \pm 5^{\circ}\text{F}$. The specimen shall be exposed to the mixture of air and ozone for 168 hours. To determine conformance to 3.5.6, the cover of the specimen shall subsequently be examined under 7-power magnification.

4.5.7 Vacuum collapse resistance.

4.5.7.1 Test specimen. The test specimen shall be a piece of hose 36 inches in length. This shall be wrapped around a mandrel having a diameter as specified in table VIII.

4.5.7.2 Procedure. 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 to determine conformance to 3.5.7.

MIL-H-13444D

Table VIII. Mandrel diameter

Nominal hose size (inches)	Paragraph 4.5.5.2 Paragraph 4.5.7	Paragraph 4.5.6	Paragraph 4.5.12
1/8	3.5	2.45	NA
3/16	4.0	2.80	2.00
1/4	4.5	3.15	2.25
5/16	5.5	3.85	2.75
3/8	6.0	4.20	NA
13/32	7.0	NA	4.62
1/2	7.5	5.25	5.50
5/8	9.5	6.65	6.50
3/4	11.0	7.70	NA
7/8	12.0	NA	7.38
1 1/8	15.0	NA	9.00
1 3/8	16.0	NA	11.00
1 13/16	20.0	NA	17.00

4.5.8 Oil resistance. A specimen of the tube and a specimen of the cover shall be subjected to the test specified in method 6211 of Fed. Test Method Std. No. 601 to determine conformance to 3.5.8 except that immersion shall be conducted for 70 hours at a temperature of $212^{\circ} \pm 50^{\circ}\text{F}$.

4.5.8.1 Test liquid. The test liquid shall conform to medium No. 3 specified in method 6001 of Fed. Test Method Std. No. 601.

4.5.9 Fuel resistance. To determine conformance to 3.5.9, a specimen of the tube and a specimen of the cover shall be tested as specified in method 6211 of Fed. Test Method Std. No. 601 except that the specimens shall be immersed for 48 hours at a temperature of $80^{\circ} \pm 10^{\circ}\text{F}$. The test liquid shall conform to type II of TT-S-735.

4.5.10 Vibration resistance.

4.5.10.1 Test specimens. Six hose assemblies shall be selected for testing. Each assembly shall have a free hose length of not less than 12 inches.

* 4.5.10.2 Procedure. Each specimen shall be arranged to provide an initial slack of 3/8 inch and an offset of 1 1/2 inches at an angle of 90° to the direction of stroke. The specimens shall then be vibrated through an amplitude of 11/32 inch (total excursion of 11/16 inch) at a rate of 1800 ± 10 cycles per minute (CPM) for 200 hours. During the vibration period, test fluid conforming to grade 10 of MIL-L-2104 shall be circulated through each specimen at a pressure 45 psi and at a temperature of $250^{\circ} \pm 5^{\circ}\text{F}$. At the end of the vibration period the specimens shall be examined for evidence of leakage or other failure to determine conformance to 3.5.10.

MIL-H-13444D

4.5.11 Fungi resistance. To determine conformance to 3.5.11, the specimen shall be subjected to the class 3 fungi resistance test of MIL-F-13927, except that the test shall be continuous for 90 days.

- * 4.5.12 Hot oil circulation. Test specimens shall consist of two untested type III hose assemblies. Oil conforming to grade 3 of MIL-L-21260 and at a temperature of $300^{\circ} \pm 5^{\circ}\text{F}$. and a pressure of 175 ± 25 psi shall be continuously circulated through the hose assemblies for 240 ± 1 hours in an ambient temperature of $75^{\circ} \pm 10^{\circ}\text{F}$. After the circulation test, specimens shall be bent around the applicable mandrel specified in table VIII with hose at a temperature of $75^{\circ} \pm 10^{\circ}\text{F}$. While bent around the specified mandrel, the specimens shall then be proof-tested in accordance with 4.5.3. Specimens shall then be examined to determined conformance to 3.5.12.

4.5.13 Inspection of preparation for delivery. The cleaning, packaging, packing, and marking of the hose shall be inspected to determine compliance with section 5 and specifications referenced therein.

- * 5. Packaging.

- * 5.1 Packaging inspection. Cleaning, packaging, packing, and marking shall be in accordance with applicable packaging data sheet for the desired level of protection, or MIL-P-775.

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° plus 250°F . for types I and II and from minus 55° to plus 300°F . for type III.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type of hose required (see 1.2).
- (c) Materials not specified in specification or on applicable drawings (see 3.2).
- (d) Size and length required (see 3.4.1, 3.4.3, and tables I and II).
- (e) When lengths are to be other than specified in 3.4.3.
- (f) When requirements are to be other than those specified in 3.5.2 through 3.5.12 (see 3.5.1)
- (g) When supplier is not to be responsible for all inspection requirements (see 4.1).
- (h) If lot formation is to be other than specified in 4.3.1.1.
- (i) Selection of applicable level of packaging and packing (see 5.1).
- (j) If vibration test is not to be performed (see 3.5.10).

MIL-H-13444D

6.3 Special provisions for establishing qualification. Qualification by test of types I, II, or III hose of 1/4-inch I.D. nominal size submitted by a manufacturer will establish qualification for the same type of types of hose from 1/8 inch to 1/2 inch I.D. nominal size of hose inclusive, of the same manufacturer; qualification by test of types I and II hose of 3/4-inch I.D. nominal size and of 7/8-inch I.D. nominal size type III hose submitted by a manufacturer, will establish qualification for the same type or types of hose greater than 3/4-inch or 7/8-inch, as applicable, I.D. nominal size, of the same manufacturer.

6.4 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 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. The activity responsible for the Qualified Products List is Commanding General, U.S. Army Tank-Automotive Materiel Readiness Command, Warren, Michigan, 48090 and information pertaining to qualification of products may be obtained from that activity.

6.5 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. 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 and relationship to the last previous issue.

Custodians:

Army - AT
Navy - YD

Preparing activity:

Army - AT

Review activities:

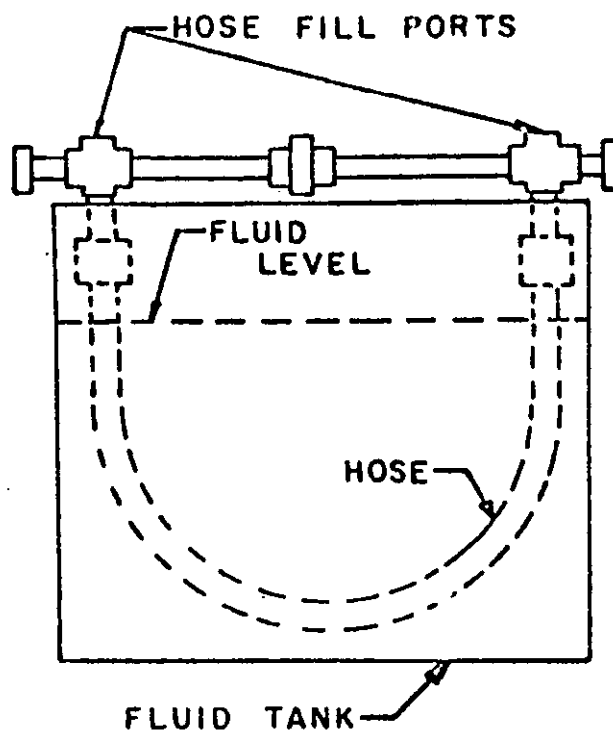
Army - ME, WC, EA
DSA - CS

Project No. 4720-0458

User activities:

Army - AV, MI
Navy - MC

MIL-H-13444D



NOTE: TYPES I AND II HOSE SPECIMENS ARE IMMERSSED IN TEST FLUID UP TO BUT NOT INCLUDING HOSE END COUPLINGS. HOSE SPECIMENS ARE THEN FILLED INTERNALLY. TYPE III HOSE SHALL RECEIVE INTERNAL CONDITIONING ONLY.

FIGURE I. SPECIMEN CONDITIONING FLUID TANK

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