

INCH-POUND

MIL-DTL-13531E
 26 October 1998
 SUPERSEDING
 MIL-DTL-13531D
 22 April 1998

DETAIL SPECIFICATION

HOSE, RUBBER AND HOSE ASSEMBLY, RUBBER (HYDRAULIC, PNEUMATIC, FLEXIBLE)

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 performance requirements and tests for wire-reinforced rubber hydraulic hose and hose assemblies (see 6.1).

1.2 Classification. Hose and hose assemblies are of the following types and classes as specified (see 6.2).

1.2.1 Types. The types of hose and hose assemblies consist of the following:

Type I	Single wire braid reinforced.
Type II	Double wire braid reinforced.
Type III	Double spiral and single wire braid reinforced.

1.2.2 Classes. The classes of hose and hose assemblies consist of the following:

Class A	With heavy cover.
Class B	With thin cover.

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.

AMSC N/A

FSC 4720

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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-6083	-	Hydraulic Fluid, Petroleum Base, For Preservation and Operation.
MIL-DTL-13531/1	-	Hose Assembly, Nonmetallic: Hydraulic and Pneumatic, Medium Pressure, Flared Tube
MIL-DTL-13531/2	-	Hose Assembly, Nonmetallic: Hydraulic and Pneumatic, High Pressure, Flared Tube

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 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.)

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AMERICAN SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

J516	-	Hydraulic Hose Fittings, Standard.
J517	-	Hydraulic Hose, 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/NCSS Z540-1	-	Calibration Laboratories and Measuring and Test Equipment, General Requirements.
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(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 products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.3 Critical interface materials. Materials shall be as specified herein and in reference specifications, standards, drawings, or recognized industry equivalent standards. If materials other than those specified are used, the contractor shall certify to the qualifying activity that the substitute material(s) enables the hose or hose assemblies to meet the performance requirements of this specification. Acceptance of any constituent materials shall not be construed as a guaranty of the acceptance of the product. When a definite material is not specified, a material shall be used which will enable the hose or hose assembly to meet the performance requirements of this specification.

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.

3.3.2 Critical interface fitting materials. Steel fittings, except stainless when furnished, shall be zinc plated type II, Fe/Zn 5, in accordance with ASTM B 633.

3.3.3 Inner tube. The inner tube shall consist of an oil-resistant compound seamless and uniform gauge. The inner tube shall have a smooth bore, shall be free of pitting and other defects, and shall be cleaned free of dirt, foreign material and mandrel lubricants.

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3.3.4 Reinforcement.

3.3.4.1 Type I. Reinforcement of type I hose shall be similar to SAE J517, type 1OORI and consist of one braid of high tensile steel wire.

3.3.4.2 Type II. Reinforcement of type II hose shall be similar to SAE J517, type 1OOR2 and consist of two or more braids of high strength steel wire.

3.3.4.3 Type III. Reinforcement of type III hose shall be similar to SAE J517, type 1OOR2B and consist of one braid of high tensile steel wire covering two spiral plies of high strength steel wire.

3.3.5 Outer cover. The outer cover shall utilize a polymerized chloroprene as the basic material, and shall be capable of meeting the performance requirements of this specification.

3.3.6 Configuration and features. Hose shall be constructed similar to SAE J517. 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 similar to SAE J516. The female type shall incorporate a swivel nut. Dimensions and materials of fittings shall conform to the applicable drawings, see 3.1, 6.2, and 6.6.

3.4 Critical hose interface dimensions.

3.4.1 Hose diameters. Inside diameter and outside diameter of the hose and outside diameter of the wire braid shall be as specified in table I for the specified nominal hose size.

3.4.1.1 Hose lengths. Unless otherwise specified (see 6.2), bulk hose shall be furnished in any length, except that not more than 10 percent may be furnished in random lengths between 10 to 20 feet and not more than an additional 10 percent may be furnished in random lengths between 3 and 10 feet. When hose length is specified, tolerance shall be +.25 inch and -.125 inch for lengths less than 3 feet, and $\pm 1\%$ for lengths of 3 feet or more.

3.4.2 Critical fitting interface dimensions (see 4.7.2).

3.4.2.1 Threaded parts. Screw threads of the form, number per inch and class 2 or as specified on the applicable drawing or military standard shall be in accordance with ASME B1.1.

3.4.2.2 Wrench flats. The nominal distance across wrench flats (hexagon or other) shall be in multiples of .0625 inch. The tolerance shall not exceed the tolerance across flats for the semi-finished hexagon nut, nearest the fitting wrench flat size, as specified in ASME B18.2.2.

3.4.3 Swivel fittings. Swivel fittings shall swivel freely with applied hand torque.

3.5 Performance requirements.

3.5.1 Resistance to impulse pressure (see 4.7.3). Hose and hose assemblies shall withstand specified impulse pressures and cycling (see table II and figure 1) without hose leakage, leakage between the fitting and hose, leakage at the threaded connection, cracking, rupture or detachment of the fitting.

3.5.2 Length change (see 4.7.4). After being subjected to the applicable working pressure of table II, hose length change shall not exceed the limit specified in table III.

3.5.3 Burst pressure (see 4.7.5). Hose or hose assemblies shall withstand, without evidence of leakage, rupture or detachment of any applicable fittings, the applicable burst pressures specified in table II.

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TABLE I. Critical interface hose dimensions.

Dash No.	Nominal hose size (inches)	Nominal hose size (inches, decimal)	Inside diameter Classes A and B	Wire braid outside diameter		Overall outside diameter			
				Type I Classes A and B (inches)	Types II and III Classes A and B (inches)	Type I Class A (inches)	Type I Class B (inches)	Types II and III Class A (inches)	Types II and III Class B (inches)
3	3/16	.188	0.188+.023 -.008	0.375 ± .023	0.438 ± .023	0.500 ± .031	0.465 ± .023	0.625 ± .031	0.535 ± .027
4	1/4	.250	0.250+.023 -.008	0.438 ± .023	0.500 ± .023	0.625 ± .031	0.527 ± .023	0.687 ± .031	0.593 ± .027
5	5/16	.313	0.313+.023 -.008	0.500 ± .023	0.563 ± .023	0.688 ± .031	0.590 ± .023	0.750 ± .031	0.660 ± .027
6	3/8	.375	0.375+.023 -.008	0.594 ± .023	0.656 ± .023	0.781 ± .031	0.684 ± .023	0.843 ± .031	0.754 ± .027
8	1/2	.500	0.500+.031 -.015	0.719 ± .031	0.781 ± .031	0.906 ± .031	0.805 ± .031	0.968 ± .031	0.874 ± .031
10	5/8	.625	0.625+.031 -.015	0.844 ± .031	0.906 ± .031	1.031 ± .031	0.930 ± .031	1.093 ± .031	1.000 ± .031
12	3/4	.750	0.750+.031 -.015	1.000 ± .031	1.063 ± .031	1.187 ± .031	1.086 ± .031	1.250 ± .031	1.156 ± .031
14	7/8	.875	0.875+.031 -.015	1.125 ± .031	1.188 ± .031	1.313 ± .031	1.211 ± .031	1.375 ± .031	1.281 ± .031
16	1	1	1.000+.040 -.015	1.313 ± .031	1.375 ± .047	1.500 ± .046	1.430 ± .031	1.562 ± .046	1.500 ± .031
20	1-1/4	1.250	1.250+.047 -.015	1.594 ± .047	1.750 ± .047	1.812 ± .062	1.741 ± .047	2.000 ± .062	1.867 ± .047
24	1-1/2	1.500	1.500+.047 -.015	1.844 ± .047	2.000 ± .047	2.062 ± .062	1.968 ± .047	2.250 ± .062	2.148 ± .047
32	2	2	2.000+.047 -.015	2.375 ± .047	2.500 ± .047	2.625 ± .062	2.500 ± .047	2.750 ± .062	2.648 ± .047

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TABLE II. Pressure requirements.

Nominal hose size (ID) in inches	Burst pressure (psi)		Proof pressure (psi)		Recommended working pressure (maximum) (psi)	
	Type I	Type II and type III	Type I	Type II and type III	Type I	Type II and type III
3/16	12,000	20,000	6,000	10,000	3,000	5,000
1/4	11,000	20,000	5,500	10,000	2,750	5,000
5/16	10,000	17,000	5,000	8,500	2,500	4,250
3/8	9,000	16,000	4,500	8,000	2,250	4,000
1/2	8,000	14,000	4,000	7,000	2,000	3,500
5/8	6,000	11,000	3,000	5,500	1,500	2,750
3/4	5,000	9,000	2,500	4,500	1,250	2,250
7/8	4,500	8,000	2,250	4,000	1,125	2,000
1	4,000	8,000	2,000	4,000	1,000	2,000
1-1/4	2,500	6,500	1,250	3,250	625	1,625
1-1/2	2,000	5,000	1,000	2,500	500	1,250
2	1,500	4,500	750	2,000	375	1,000

3.5.4 Low temperature flexibility (see 4.7.6). Hose or hose assemblies, the latter with a free length between fittings as specified in ASTM D 380, shall exhibit no cracks in the cover when bent over the applicable mandrel after having been conditioned for not less than 70 hours at $-67^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ambient air temperature. The specimens shall subsequently meet the requirements of 3.5.5.

TABLE III. Physical requirements.

Nominal hose size	Allowable length change (percent)	Minimum bend radius (mandrel radius) Types I, II, and III (inches)	Hose length impulse test (inches)
3/16	+0 -6	4	18
1/4	+0 -6	4	18
5/16	+2 -4	4.5	18
3/8	+2 -4	5	18
1/2	+2 -4	6	23
5/8	+2 -4	8.5	28
3/4	+2 -4	9.5	31
7/8	+2 -4	10.5	18
1	+2 -4	11	18
1-1/4	+2 -4	16	18
1-1/2	+2 -4	20	18
2	+2 -4	22	18

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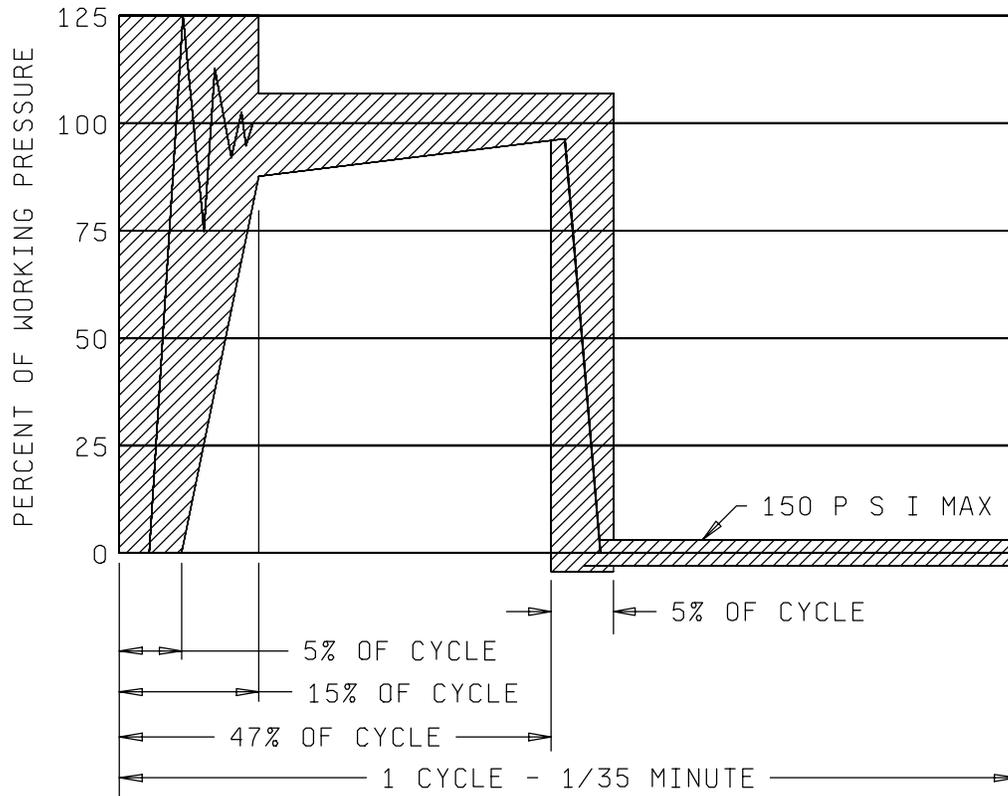


FIGURE 1. Impulse pressure cycle.

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3.5.5 Proof pressure (see 4.7.7). Hose and hose assemblies shall withstand the applicable proof pressure specified in table II without leakage, rupture or detachment from a fitting. Fittings shall withstand the applicable proof pressure specified in table II without rupture, crack, leakage between fittings and hose, or leakage at a threaded junction.

3.5.6 Oil resistance (see 4.7.8). Hose inner tube and outer cover specimens shall withstand immersion in oil conforming to MIL-PRF-6083 at a temperature of $+ 158^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$ for $168 \pm .5$ hours, with their average volume increasing not more than 30% and 100% respectively.

3.5.7 Ozone resistance (see 4.7.9). 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 $+ 100^{\circ}\text{F} \pm 2^{\circ}\text{F}$ to an ozone concentration maintained at 50 ± 5 parts of ozone per hundred million parts of air.

3.5.8 Fungus resistance (see 4.7.10). Hose and hose assemblies shall exhibit no evidence of fungus growth after exposure to fungus.

3.6 Marking.

3.6.1 Hose cover material. 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-13531" ^{1/}
 Type
 Class
 Nominal ID size (fraction or dash no. in accordance with table I)
 Date of manufacture (quarter of year and year)
 Capital letters "OZ"
 Manufacturer's CAGE code

Example: "MIL-H-13531 II A 8 3Q98 OZ XXXX" or "MIL-H-13531 II A 1/2 3Q98 OZ XXXX"

The marking shall either be embossed or marked in white on the lay line of the hose. The marking shall be legible and permanently marked on the hose in such a way as not to deform or otherwise damage the hose covering.

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.

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. All hose and hose assemblies shall be manufactured and processed in such a manner as to be uniform in quality and shall be free from burrs, die marks, chatter marks, foreign material and other defects that will affect life, serviceability, strength, assembly or durability. Workmanship shall be such as to enable the hose and hose assemblies to meet the applicable performance requirements of this specification.

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 or identified 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.

^{1/} The old specification number is used as the military designator to maintain backwards compatibility with existing parts (see 6.6).

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

- a. Qualification inspection (see 4.4).
- b. Screening (see 4.6.1)
- c. Quality conformance inspection (see 4.6.2).
 1. Group A lot acceptance inspection (see 4.6.2.1)
 2. Group B periodic inspection (see 4.6.2.2)

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 qualifying activity 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 IV and shall be of the quantity and length specified in the applicable test method.

TABLE IV. 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	3/16, 1/4, 5/16, 3/8, 1/2
II	1/4	II	3/16, 1/4, 5/16, 3/8, 1/2
III	1/4	III	3/16, 1/4, 5/16, 3/8, 1/2
I	1	I	5/8, 3/4, 7/8, 1, 1-1/4, 1-1/2, 2
II	1	II	5/8, 3/4, 7/8, 1, 1-1/4, 1-1/2, 2
III	1	III	5/8, 3/4, 7/8, 1, 1-1/4, 1-1/2, 2

^{1/} Manufacturers qualifying bulk hose or hose assemblies of a different nominal 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 qualifications inspections specified in table VII.

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 have documented approval by the qualifying activity.

4.5 Test specimen conditioning. Impulse pressure and low temperature flexibility test specimens to be conditioned shall consist of four untested hose assemblies. Each test specimen shall be filled with hydraulic fluid conforming to MIL-PRF-6083 and plugged at one end. The specimens shall be hung in an ambient air temperature of $+250 \pm 5^\circ\text{F}$ for $24 \pm 1/2$ hours. Following this heating, the specimens shall be allowed to cool to room temperature and the oil shall be drained.

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

4.6.1 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.

4.6.2 Conformance inspection.

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

4.6.2.1.1 Group A sampling plan. Group A tests specified in table VII 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. A 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.

4.6.2.1.2 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.

4.6.2.1.3 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 V. 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 that have documented approval by the qualifying activity.

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

TABLE V. 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

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4.6.2.2 Group B inspection (periodic). Group B inspection shall consist of the inspections specified in table VII 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 VI 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 VI. Group B extended acceptance.

Range	Nominal ID size (inches) (of same type and class)
$\leq 1/2$ inch	3/16, 1/4, 5/16, 3/8, 1/2
$\geq 5/8$ inch	5/8, 3/4, 7/8, 1, 1-1/4, 1-1/2, 2

4.6.2.2.1 Group B sampling plan. A sample of parts shall be randomly selected in accordance with table VII. 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.

4.6.2.2.2 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.

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

4.6.2.2.4 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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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 (see 3.4). 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 Resistance to impulse pressure (see 3.5.1). Test specimens shall consist of two hose assemblies, each with a free length between fittings as specified in table III, which have been conditioned in accordance with 4.5.

To determine conformance to 3.5.1, each test specimen of .75 inch inside diameter or less shall be mounted on the impulse test machine in a "U" shape with a bend radius as specified in table III. Each hose assembly of .875 inch inside diameter or larger shall be straight when mounted on the impulse test machine. One end of each test specimen shall be connected to a rigid support and the other end to a non rigid support to allow for specimen contraction in length. Hydraulic fluid conforming to MIL-PRF-6083, maintained at a temperature of $+ 120 \pm 10^{\circ}\text{F}$ shall be used as the impulse medium and shall circulate through the hose during the test. Each impulse cycle shall consist of a pressure rise from 0 pounds per square inch (psi) (tolerance plus 150 psi, minus 0 psi) to $125 \pm 5\%$ of the working pressure specified in table II (except the larger than one inch ID type I hoses shall be 100% of the working pressure specified in table II) followed by a pressure drop to 0 psi (tolerance plus 150 psi, minus 0 psi). The maximum impulse pressure shall not exceed 3,750 psi for type I or 5000 psi for type II or III. The shape of the pressure-time curve shall fall within the shaded area shown on figure 1. Cycles shall occur at the rate of 35 ± 5 cycles per minute. The number of impulse cycles shall be 150,000 for type I hoses and 200,000 for type II and III hoses. Nonconformance to 3.5.1 shall constitute failure of this test.

4.7.4 Length change (see 3.5.2). To determine conformance to 3.5.2, 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 12 inches between fittings. The unpressured assembly shall be marked with a 10 inch benchmark length on the free hose. Final pressure shall be the working pressure specified in table II 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 3.5.2.

4.7.5 Burst pressure (see 3.5.3). To determine conformance to 3.5.3, the three test specimens used in 4.7.4 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.

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TABLE VII. Inspection table.

Inspection or test	Qualification		Screening <u>1/</u>		Group A (Lot acceptance)		Group B (Periodic)	
	Requirement	Test	Requirement	Test	Requirement	Test	Requirement	Test
Marking	3.6.1, 3.6.2		3.6.1, 3.6.2					
Proof pressure	3.5.5	4.7.7	3.5.5	4.7.7				
Workmanship	3.8	4.6.2.1.4			3.8	4.6.2.1.4		
Configuration	3.3.2 - 3.4.3	4.7.2			3.3.2 - 3.4.3	4.7.2		
Length change <u>2/</u>	3.5.2	4.7.4					3.5.2	4.7.4
Burst pressure <u>2/</u>	3.5.3	4.7.5					3.5.3	4.7.5
Impulse pressure <u>2/</u> , <u>3/</u>	3.5.1	4.7.3						
Low temperature flexibility <u>2/</u> , <u>3/</u>	3.5.4	4.7.6						
Oil resistance <u>3/</u>	3.5.6	4.7.8						
Ozone resistance <u>3/</u>	3.5.7	4.7.9						
Fungus resistance <u>3/</u> <u>4/</u>	3.5.8	4.7.10						

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.

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4.7.6 Low temperature flexibility (See 3.5.4). Test specimens shall consist of three hose assemblies. Two specimens shall be selected from those previously conditioned in accordance with 4.5 and one specimen shall be unconditioned. The three specimens shall be subjected to the low temperature test for complete hose specified in ASTM D 380, except as specified herein. To determine conformance to 3.5.4, test specimens and test fixture shall be temperature conditioned as specified in 3.5.4. The test shall then be conducted at the same temperature. Each specimen shall be examined during and after test to determine conformance to 3.5.4.

4.7.7 Proof pressure (see 3.5.5). To determine conformance to 3.5.5, 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 II for the type and size tested. 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 3.5.5.

4.7.8 Oil resistance (see 3.5.6). To determine conformance to 3.5.6, 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 the hydraulic fluid, at the temperature specified in 3.5.6. 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 3.5.6.

4.7.9 Ozone resistance (see 3.5.7). To determine conformance to 3.5.7, 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 3.5.7. 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 3.5.7.

4.7.10 Fungus resistance (see 3.5.8). To determine conformance to 3.5.8, 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 4.7.7) after each of the incubation periods (30, 60 and 90 days) to determine conformance to 3.5.8.

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.

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6. NOTES

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

6.1 Intended use. Hose and hose assemblies covered by this performance specification are intended for use in medium and high pressure hydraulic systems at temperatures between -65° to +200°F. The hose and hose assemblies covered by this specification are military unique because they must be able to operate satisfactorily in temperatures ranging from -65° to +200° 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 3.3).
 7. Reusable screw-on type or reusable clamp-on type or permanently attached type.
- g. Hose (see 3.4.1.1) or hose assembly length where applicable.

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 the applicable Qualified Products List QPL NO.13531 whether or not such products have actually been so listed by that date. The attention of the contractor 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 Defense Supply Center Columbus (DSCC-V), 3990 East Broad Street, Columbus, Ohio 43216-5000.

6.4 Subject term (key word) listing.

Fittings
Thread size
Tube

6.5 Fittings. Fittings for bulk hose should be purchased from the manufacturer of the bulk hose being used.

6.6 References to superseded specifications. All the requirements of MIL-DTL-13531E are interchangeable with those of MIL-H-13531C, therefore, previously existing documents (OEM drawings, etc.) referencing MIL-H-13531 need not be changed.

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

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CONCLUDING MATERIAL

Custodians:

Army - AT
Navy - MC
Air Force - 99

Review activities

Army - AR, AV, CR4, MI
Air Force - 82

Preparing activity:
DLA-CC

(Project 4720-0230)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-DTL-13531E

2. DOCUMENT DATE (YYMMDD)

3. DOCUMENT TITLE

HOSE, RUBBER AND HOSE ASSEMBLY, RUBBER (HYDRAULIC, PNEUMATIC, FLEXIBLE)

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

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED
(YYMMDD)

(1) Commercial

(2) DSN (If applicable)

8. PREPARING ACTIVITY

a. NAME

Defense Supply Center Columbus

b. TELEPHONE (Include Area Code)

(1) Commercial 614-692-7707

(2) DSN 850-7707

(3) Fax 614-692-6939

c. ADDRESS (Include Zip Code)

DSCC-VAI
3990 East Broad Street
Columbus, Ohio 43216-5000

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 DSN 289-2340