

INCH-POUND

MIL-DTL-13531G

17 May 2006

SUPERSEDING

MIL-DTL-13531F

16 August 2002

## DETAIL SPECIFICATION

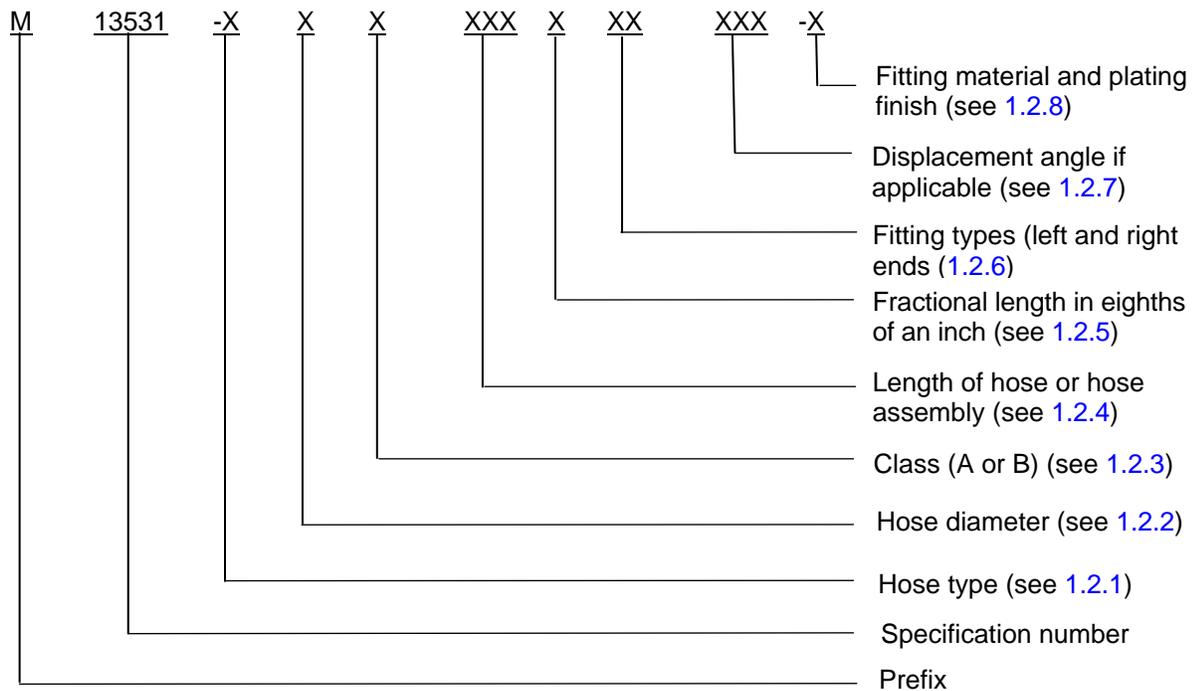
HOSE, RUBBER AND HOSE ASSEMBLY, RUBBER  
(HYDRAULIC, PNEUMATIC, FLEXIBLE)

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

## 1. SCOPE

1.1 Scope. This specification covers hose, rubber and hose assembly, rubber (hydraulic, pneumatic, flexible) (see 6.1). These hoses are not for use as oxygen hoses.

1.2 Part or Identifying Number (PIN). The PIN consists of the letter M (see 3.7), the basic specification number, a dash, type of hose, diameter of hose, class of hose, length of hose or hose assembly, fractional length in 8's of an inch, fitting types, displacement angle, fitting material and finish, as shown in the following example:



PIN example: M13531-A3B0964FD000-A

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center, Columbus, Attn: DSCC-VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to [Construction@dsc.dla.mil](mailto:Construction@dsc.dla.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil>.

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1.2.1 Hose type. The following are the designators for hose types:

- A - Type I - Single wire braid reinforced.
- B - Type II - Double wire braid reinforced.
- C - Type III - Double spiral and single wire braid reinforced.

1.2.2 Hose diameter. Hose diameter number from table I (one or two digits).

1.2.3 Classes. The classes of hose and hose used for assemblies consist of the following:

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

1.2.4 Length of hose. Length of hose and hose assembly in inches. (Always use 3 digits. Use leading zeros as required).

1.2.5 Fractional length. Fractional length in eighths of an inch (0 through 7).

The following designators are for hose assemblies only.

1.2.6 Fitting type. Fitting types are designated as follows - (Reference SAE J516 for fitting configurations):

- A - Male dryseal pipe thread hose fittings.
- B - Male straight thread o-ring hose fittings.
- C - Male 37° flare straight hose fittings.
- D - Female 37° flare swivel straight hose fittings (SWS).
- E - Female 37° flare swivel 45° elbow hose fittings (SWE45).
- F - Female 37° flare swivel 90° elbow hose fittings (SHORT (SWES), medium (SWEM) and long (SWEL)).
- G - Male flareless 24° cone straight hose fittings.
- H - Female flareless 24° cone swivel straight hose fittings.
- J - 4-bolt split flange straight hose fittings.
- K - 4-bolt split flange 22 1/2° elbow hose fittings.
- L - 4-bolt split flange 30° elbow hose fittings.
- M - 4-bolt split flange 45° elbow hose fittings.
- N - 4-bolt split flange 60° elbow hose fittings.
- P - 4-bolt split flange 67 1/2° elbow hose fittings.
- Q - 4-bolt split flange 90° elbow hose fittings.
- R - Female O-ring face seal swivel straight hose fittings (SWSA and SWSB).
- S - Female O-ring face seal swivel 45° elbow hose fittings (SWE45).
- T - Female O-ring face seal swivel 90° elbow hose fittings (SWE).

1.2.7 Displacement angle. Displacement angle: Three digits blank if not required, reference SAE J517 for orientation of fitting.

1.2.8 Fitting material and finish. Fitting and material designators are as follows:

- A - Steel cadmium plated.
- S - Stainless steel use corrosion resistant steel.
- Z - Steel -zinc plated (not for use in aircraft.).

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## 2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

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

## DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-PRF-6083 - Hydraulic Fluid, Petroleum Base, For Preservation and Operation.
- MIL-PRF-5606 - Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
- MIL-PRF-83282 - Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537.

## DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests.
- MIL-STD-889 - Dissimilar Metals

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

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

## ASME INTERNATIONAL

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

(Copies of these documents are available online at <http://www.asme.org> or from ASME International, Three Park Avenue, New York, NY 10016-5990.)

## ASTM INTERNATIONAL

- ASTM B633 - Standard Specification for Electrodeposited Coating of Zinc on Iron and Steel.
- ASTM D380 - Standard Test Methods for Rubber Hose.
- ASTM D413 - Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate
- ASTM D622 - Standard Test Methods for Rubber Hose for Automotive Air and Vacuum Brake System

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

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## NCSL INTERNATIONAL

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

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

## SAE INTERNATIONAL

- SAE AMS 2700 - Passivation of Corrosion Resistant Steels  
 SAE AMS-QQ-P-416 - Plating, Cadmium (Electrodeposited)  
 SAE-ARP603 - Hose, Hydraulic, Tubing and Fitting Assemblies, Impulse Testing of.  
 SAE-AS1933 - Hose Containing Age-Sensitive Elastomeric Material, Age Controls for.  
 SAE-J516 - Hose Fittings, Hydraulic.  
 SAE-J517 - Hose, Hydraulic.

(Copies of these documents are available online at <http://www.sae.org> or from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, 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 (QPL) before contract award (see 4.5 and 6.3).

3.3 Materials. Materials shall be as identified herein or as approved by the qualifying activity. However, when a definite material is not specified, a material shall be used which will enable the hose of hose assembly to meet the requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of acceptance of the finished product.

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 Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. Dissimilar metals such as brass, copper or steel (except corrosion-resisting steel passivated in accordance with SAE-AMS 2700) shall not be used in intimate contact with aluminum or aluminum alloy. Protective measures for dissimilar metals shall be in accordance with MIL-STD-889.

3.4 Hose construction. Hose shall be constructed with an inner tube, wire reinforcement, and an outer cover.

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3.4.1 Reinforcement.

3.4.1.1 Type I. Reinforcement of type I hose shall consist of one braid of high-tensile steel wire.

3.4.1.2 Type II. Reinforcement of type II hose shall consist of two or more braids of high-tensile steel wire.

3.4.1.3 Type III. Reinforcement of type III hose shall consist of one braid of high tensile steel wire covering two spiral plies of high-tensile steel wire.

3.4.2 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.

3.4.3 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.

3.4.4 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.

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TABLE I. Hose dimensions. 1/ 2/

Designator	Nominal hose size inch fraction	Nominal hose size inches decimal (mm)	Inside diameter classes A and B inches (mm)	Wire braid outside diameter	
				Type I classes A and B inches (mm)	Types II and III classes A and B inches (mm)
3	3/16	.188 (4.78)	0.188+.023 -.008 (4.78 +0.58 - 0.20)	0.375 ± .023 (9.53 ± 0.58)	0.438 ± .023 (11.13 ± 0.58)
4	1/4	.250 (6.35)	0.250+.023 -.008 (6.35 +0.58 - 0.20)	0.438 ± .023 (11.13 ± 0.58)	0.500 ± .023 (12.70 ± 0.58)
5	5/16	.313 (7.95)	0.313+.023 -.008 (7.95 +0.58 - 0.20)	0.500 ± .023 (12.70 ± 0.58)	0.563 ± .023 (14.30 ± 0.58)
6	3/8	.375 (9.53)	0.375+.023 -.008 (9.53 +0.58 - 0.20)	0.594 ± .023 (15.09 ± 0.58)	0.656 ± .023 (16.66 ± 0.58)
8	1/2	.500 (12.70)	0.500+.031 -.015 (12.70 +0.79 - 3.81)	0.719 ± .031 (18.26 ± 0.58)	0.781 ± .031 (19.84 ± 0.79)
10	5/8	.625 (15.88)	0.625+.031 -.015 (15.88 +0.79 - 3.81)	0.844 ± .031 (21.44 ± 0.58)	0.906 ± .031 (23.01 ± .079)
12	3/4	.750 (19.05)	0.750+.031 -.015 (19.05 +.031 -.015)	1.000 ± .031 (25.40 ± 0.58)	1.063 ± .031 (27.00 ± .079)
14	7/8	.875 (22.23)	0.875+.031 -.015 (22.23 +.031 -.015)	1.125 ± .031 (28.58 ± 0.58)	1.188 ± .031 (30.18 ± .079)
16	1	1.000 (25.40)	1.000+.040 -.015 (25.40 +1.02 - 0.38)	1.313 ± .031 (33.35 ± 0.58)	1.375 ± .047 (34.93 ± 1.19)
20	1-1/4	1.250 (31.75)	1.250+.047 -.015 (31.75 +1.19 -0.38)	1.594 ± .047 (40.49 ± 1.19)	1.750 ± .047 (44.45 ± 1.19)
24	1-1/2	1.5 (38.10)	1.500+.047 -.015 (38.10 +1.19 -0.38)	1.844 ± .047 (46.84 ± 1.19)	2.000 ± .047 (50.80 ± 1.19)
32	2	2.000 (50.80)	2.000+.047 -.015 (50.80 +1.19 -0.38)	2.375 ± .047 (60.33 ± 1.19)	2.500 ± .047 (63.50 ± 1.19)

See notes at end of table.

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TABLE I. Hose dimensions - Continued 1/ 2/

Designator	Overall outside diameter			
	Type I class A inches (mm)	Type I class B inches (mm)	Types II and III class A inches (mm)	Types II and III class B inches (mm)
3	0.500 ± .031 (12.70 ± 0.79)	0.465 ± .023 (11.81 ± 0.58)	0.625 ± .031 (15.88 ± 0.79)	0.535 ± .027 (13.59 ± 0.69)
4	0.625 ± .031 (15.88 ± 0.79)	0.527 ± .023 (13.39 ± 0.58)	0.687 ± .031 (17.45 ± 0.79)	0.593 ± .027 (15.06 ± 0.69)
5	0.688 ± .031 (17.48 ± 0.791)	0.590 ± .023 (14.99 ± 0.58)	0.750 ± .031 (19.05 ± 0.79)	0.660 ± .027 (16.76 ± 0.69)
6	0.781 ± .031 (19.84 ± 0.79)	0.684 ± .023 (17.37 ± 0.58)	0.843 ± .031 (21.41 ± 0.79)	0.754 ± .027 (19.15 ± 0.69)
8	0.906 ± .031 (23.01 ± 0.79)	0.805 ± .031 (20.45 ± 0.79)	0.968 ± .031 (24.59 ± 0.79)	0.874 ± .031 (22.20 ± 0.81)
10	1.031 ± .031 (26.19 ± 0.79)	0.930 ± .031 (23.62 ± 0.79)	1.093 ± .031 (27.76 ± 0.79)	1.000 ± .031 (25.40 ± 0.81)
12	1.187 ± .031 (30.15 ± 0.79)	1.086 ± .031 (27.58 ± 0.79)	1.250 ± .031 (31.75 ± 0.79)	1.156 ± .031 (29.36 ± 0.81)
14	1.313 ± .031 (33.35 ± 0.79)	1.211 ± .031 (30.76 ± 0.79)	1.375 ± .031 (34.93 ± 0.79)	1.281 ± .031 (32.54 ± 0.81)
16	1.500 ± .046 (38.10 ± 0.79)	1.430 ± .031 (36.32 ± 0.79)	1.562 ± .046 (39.67 ± 1.17)	1.500 ± .031 (38.10 ± 0.81)
20	1.812 ± .062 (46.02 ± 1.57)	1.741 ± .047 (44.22 ± 1.19)	2.000 ± .062 (50.80 ± 1.57)	1.867 ± .047 (47.42 ± 1.19)
24	2.062 ± .062 (52.37 ± 1.57)	1.968 ± .047 (49.99 ± 1.19)	2.250 ± .062 (57.15 ± 1.57)	2.148 ± .047 (54.56 ± 1.19)
32	2.625 ± .062 (66.68 ± 1.57)	2.500 ± .047 (63.50 ± 1.19)	2.750 ± .062 (69.85 ± 1.57)	2.648 ± .047 (67.26 ± 1.19)

1/ Dimensions are in inches.

2/ Metric equivalents are given for information only.

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3.4.5 Hose lengths. Only lengths greater than 3 feet (0.91 m) are permitted and their tolerance shall be  $\pm 1\%$  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 (3.05 to 6.10 m) and not more than an additional 10 percent may be furnished in random lengths between 3 and 10 feet (0.91 to 3.05 m).

3.5 Hose assembly construction. Hose assemblies shall consist of hose with fittings assembled on each end. Unless otherwise specified, one fitting in the hose assembly shall be of the male type and one of the female type. The female type shall incorporate a swivel. Hose assembly length and fitting dimensions and tolerances shall be in accordance with SAE-J517 or the applicable specification sheet (see 6.2).

3.5.1 Fitting material. Steel or Stainless steel.

3.5.2 Steel hose fittings finish.

a. Stainless steel - None.

b. Steel fittings:

- (1) Cadmium plate in accordance with SAE AMS-QQ-P-416, type II, class 2.
- (2) Zinc-plated in accordance with ASTM B633, type II or type III, Fe/Zn 5. Zinc platings in accordance with ASTM B633 type III shall meet the same 96 hour salt spray test endurance as zinc plating in accordance with ASTM B633, type II.

Note: Cadmium and zinc finishes shall not be stocked, stored or issued under the same national stock number (NSN).

3.5.3 Configuration and features.

3.5.3.1 Hose. Hose shall be constructed in accordance with SAE-J517.

3.5.3.2 Hose assemblies. Hose assemblies shall consist of hose with fittings assembled on each end. Unless otherwise specified fittings shall be constructed in accordance with SAE-J516. The female type shall incorporate a swivel nut. Dimensions and materials of fittings shall conform to the applicable drawings and as specified herein (see 3.1 and 6.2). Displacement angle shall be in accordance with SAE J517.

3.5.4 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.

3.5.4.1 Wrench flats. The nominal distance across wrench flats (hexagon or other) shall be in multiples of .0625 inch (1.588 mm). The tolerance shall not exceed the tolerance across flats for the semi-finished hexagon nut, nearest the fitting wrench flat size, in accordance with in ASME B18.2.2.

3.5.4.2 Swivel fittings. Swivel fittings shall swivel freely with applied hand torque when not coupled to an adapter.

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## 3.6 Performance requirements.

3.6.1 Resistance to impulse pressure. Hose and hose assemblies when subjected to resistance to impulse pressure testing in 4.8.3 shall withstand specified impulse pressures and cycling in accordance with SAE-ARP603 with the exception of the requirement in this specification and 4.8.3 (see table II, table III and figure 1) without hose leakage, leakage between the fitting and hose, leakage at the threaded connection, cracking, rupture or detachment of the fitting.

3.6.2 Length change. Bulk hose when tested in 4.8.4 hose length change shall not exceed the limit specified in table III.

TABLE II. Pressure requirements. 1/ 2/

Nominal hose size (ID) inches	Nominal hose size (ID) decimal (mm)	Burst pressure psig (bar)		Proof pressure psig (bar)		Recommended working pressure (maximum) psig (bar)	
		Type		Type		Type	
		I	II and III	I	II and III	I	II and III
3/16	.188 (4.78)	12,000 (827.37)	20,000 (1378.95)	6,000 (413.69)	10,000 (689.48)	3,000 (206.84)	5,000 (344.74)
1/4	.250 (6.35)	11,000 (758.42)	20,000 (1378.95)	5,500 (379.21)	10,000 (689.48)	2,750 (189.61)	5,000 (344.74)
5/16	.313 (7.95)	10,000 (689.48)	17,000 (1172.11)	5,000 (379.21)	8,500 (586.05)	2,500 (172.37)	4,250 (293.03)
3/8	.375 (9.53)	9,000 (620.53)	16,000 (1103.16)	4,500 (310.26)	8,000 (551.58)	2,250 (155.13)	4,000 (275.79)
1/2	.500 (12.70)	8,000 (551.58)	14,000 (965.27)	4,000 (275.79)	7,000 (482.63)	2,000 (151.68)	3,500 (241.32)
5/8	.625 (15.88)	6,000 (413.69)	11,000 (758.42)	3,000 (206.84)	5,500 (379.21)	1,500 (103.42)	2,750 (189.61)
3/4	.750 (19.05)	5,000 (344.74)	9,000 (620.53)	2,500 (172.37)	4,500 (310.26)	1,250 (86.18)	2,250 (155.13)
7/8	.875 (22.23)	4,500 (310.26)	8,000 (551.58)	2,250 (155.13)	4,000 (275.79)	1,125 (77.57)	2,000 (137.90)
1	1.00 (25.40)	4,000 (275.79)	8,000 (551.58)	2,000 (137.90)	4,000 (275.79)	1,000 (68.95)	2,000 (137.90)
1-1/4	1.250 (31.75)	2,500 (172.37)	6,500 (448.16)	1,250 (86.18)	3,250 (224.08)	625 (43.09)	1,625 (112.04)
1-1/2	1.5 (38.10)	2,000 (137.90)	5,000 (344.74)	1,000 (68.95)	2,500 (172.37)	500 (34.47)	1,250 (86.18)
2	2.000 (50.80)	1,500 (103.42)	4,500 (310.26)	750 (51.71)	2,000 (137.90)	375 (25.86)	1,000 (68.95)

1/ Dimensions are in inches.

2/ Metric equivalents are given for information only.

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TABLE III. Physical requirements. 1/ 2/

Nominal hose size inches fraction	Nominal hose size (ID) inches decimal	Nominal hose size (ID) metric (mm)	Allowable length change (percent)	Minimum bend radius (mandrel radius) Types I, II, and III inches (mm)	Impulse test hose length inches (mm)
3/16	.188	4.78	+0 -6	4 (101.60)	18 (457.20)
1/4	.250	6.35	+0 -6	4 (101.60)	18 (457.20)
5/16	.313	7.95	+2 -4	4.5 (114.30)	18 (457.20)
3/8	.375	9.53	+2 -4	5 (127.00)	18 (457.20)
1/2	.500	12.70	+2 -4	7 (177.80)	23 (584.20)
5/8	.625	15.88	+2 -4	8.5 (215.90)	28 (711.12)
3/4	.750	19.05	+2 -4	9.5 (241.30)	31 (787.40)
7/8	.875	22.23	+2 -4	10.5 (266.70)	18 (457.20)
1	1.00	25.40	+2 -4	11 (279.40)	18 (457.20)
1-1/4	1.250	31.75	+2 -4	16 (406.40)	18 (457.20)
1-1/2	1.500	38.10	+2 -4	20 (508.00)	18 (457.20)
2	2.000	50.80	+2 -4	22 (558.80)	18 (457.20)

1/ Dimensions are in inches.

2/ Metric equivalents are given for information only.

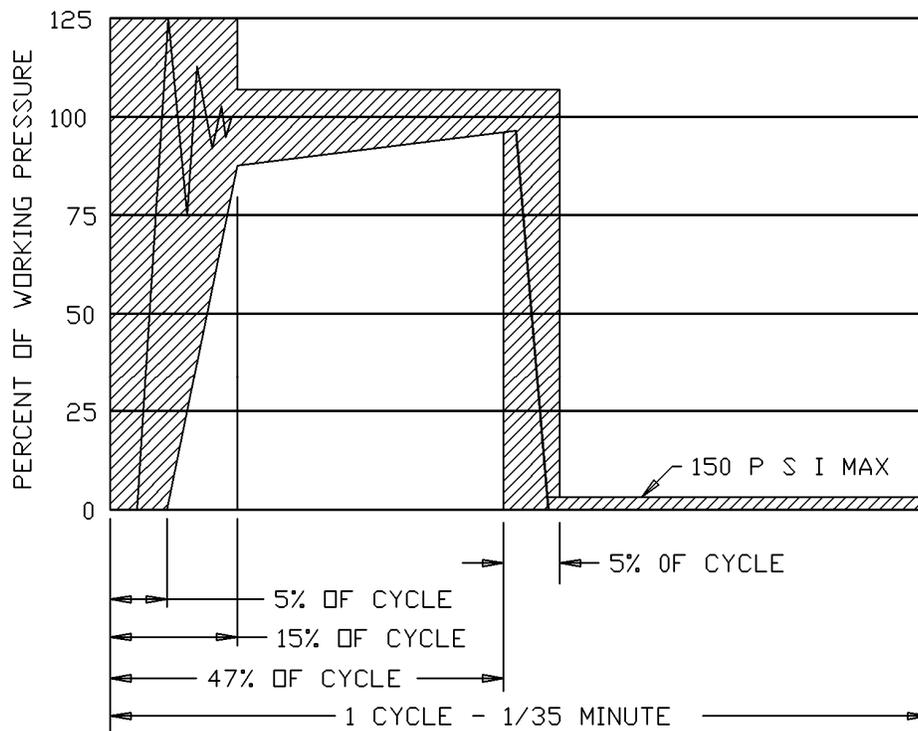


FIGURE 1. Impulse pressure cycle.

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3.6.3 Burst pressure. Hose or hose assemblies when subjected to burst pressure in 4.8.5 shall withstand, without evidence of leakage, rupture, or detachment of any applicable fittings, the applicable burst pressures specified in table II.

3.6.4 Low temperature flexibility. Hose or hose assemblies when subjected to low temperature flexibility in 4.8.6, the latter with a free length between fittings in accordance with ASTM D380, shall exhibit no cracks in the cover when bent over the applicable mandrel. The specimens shall subsequently meet the proof pressure requirements in 3.6.5.

3.6.5 Proof pressure. Hose and hose assemblies when subjected to proof pressure in 4.8.7 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.

3.6.6 Oil resistance. Hose, inner tube and outer cover, when subjected to oil resistance testing in 4.8.8 shall withstand immersion in oil with their average volume increasing not more than 30% and 100% respectively.

3.6.7 Ozone resistance. The hose outer cover when subjected to ozone resistance testing in 4.8.9 shall exhibit no cracking when elongated 12.5% and viewed at 7X power magnification.

3.6.8 Fungus resistance. Hose and hose assemblies when subjected fungus resistance testing in 4.8.10 shall exhibit no evidence of fungus growth.

### 3.7 Marking.

3.7.1 Hose cover marking (bulk hose). As a minimum, the hose cover material shall be marked at intervals of not more than 12 inches (304.80 mm). 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. Hose made to a previous issue may be used for a period equal to the age limits in 3.8, from the date of this revision to deplete existing stock. Marking for bulk hose shall contain the following:

PIN  
Date of manufacture (quarter of year and year)  
Capital letters "OZ"  
Bulk hose manufacturer's CAGE code

Example: M13531-B2A 3Q05 OZ XXXXX

3.7.2 Hose assembly marking. The hose assembly shall have a removable tag attached to each hose assembly. The tag marking shall contain the following:

PIN  
Date of manufacture (quarter of year and year)  
Capital letters "OZ"  
Assembly manufacturer's CAGE code

Example: Hose assembly: M13531-1080DF000-A 3Q05 OZ XXXXX

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

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3.9 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 foreign material and other defects that will affect life, serviceability, strength, assembly or durability (see table IV). Workmanship shall be such as to enable the hose and hose assemblies to meet the applicable performance requirements of this specification.

TABLE IV. Workmanship defects.

Defect	Inspection	Reference
Dimensions affecting interchangeability not within tolerance	Standard inspection equipment (SIE)	<a href="#">3.4</a> and <a href="#">3.5</a>
Ridge on tube - Severe	SIE	N/A
Bunching of tube - Severe	SIE	N/A
Loose tube	SIE	N/A
Off center -under gage cover	SIE	N/A
Hole in tube	SIE	N/A
Nad lap or delamination of tube	SIE	N/A
Wire through tube	SIE	N/A
Wire through cover	Visual	N/A
Poorly patched cover	Visual	N/A
Blistered or loose, patch on cover	Visual	N/A
Under gage cover area	Visual	N/A
Poor overlap, opening or lack of adhesion	Visual	N/A
Cover missing	Visual	N/A
Loose cover (wrinkles when bent)	Visual	N/A
Exposed wire braid	Visual	N/A
Depressed area, groove or hole in cover (exceeding specified tolerance)	Visual	N/A
Split, slit or break in cover	Visual	N/A
Blister under cover	Visual	N/A
Hose inside diameter at fitting junction out of tolerance	SIE (hose assembly only)	<a href="#">3.4.5</a>
Swivel fitting will not turn by hand	Visual (hose assembly only)	<a href="#">3.5.4.2</a>
Misbranding	Visual	<a href="#">3.7.1.</a> and <a href="#">3.7.2</a>

## 4. VERIFICATION

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

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

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4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in ASTM D413, ASTM D622, or in accordance with the applicable test method referenced in the test procedures. Unless otherwise specified, room temperature shall be defined as +60°F to +90°F (15.56°C to 32.22°C).

4.3 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be 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) shall be in accordance with NCSL Z540 -1 or equivalent.

4.4 Responsibility for compliance. All items shall meet all requirements of sections 3, 4, and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

4.5 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the qualifying activity on sample units produced with equipment and procedures used in production. Qualification inspection shall be performed on type I, type II, and type III hose and hose assemblies. Each nominal hose size (ID) shall be qualified individually.

4.5.1 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 and shall be of the quantity and length specified in the applicable test method.

4.5.1.1 Test specimen aging. Impulse pressure and low temperature flexibility test specimens to be aged shall consist of four untested hose assemblies. Each test specimen shall be filled with hydraulic fluid in accordance with MIL-PRF-5606, MIL-PRF-6083 or MIL-PRF-83282 and plugged at one end. The specimens shall be hung in an ambient air temperature of +250°F ±5°F (121.11°C ±2.77°C) for 24 hours ±1/2 hour. Following this heating, the specimens shall be allowed to cool to room temperature and the oil shall be drained.

4.5.2 Qualification inspection routine. All samples shall be subjected to qualification testing in table V the sequence is at the manufacturer's discretion.

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TABLE V. Qualification and verification of qualification inspection.

Qualification Inspection	Requirement paragraph	Inspection paragraph
Visual and mechanical inspection	3.4, 3.5, 3.7, 3.8, and 3.9	4.8.2
Hose assemblies (fittings)	3.5.3.2	4.8.2
Proof pressure	3.6.5	4.8.7
Length change	3.6.2	4.8.4
Burst pressure <u>1/</u>	3.6.3	4.8.5
Resistance to impulse pressure	3.6.1	4.8.3
Low temperature flexibility <u>1/</u> <u>2/</u> Proof pressure	3.6.4 3.6.5	4.8.6 4.8.7
Oil resistance <u>2/</u>	3.6.6	4.8.8
Ozone resistance <u>2/</u>	3.6.7	4.8.9
Fungus resistance <u>3/</u> Proof pressure (30, 60, 90 days)	3.6.8	4.8.10

1/ These are destructive tests.

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

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

4.5.3 Acceptance of qualification inspection data. Required qualification 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.

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

4.5.5 Test plans and qualification reports.

4.5.5.1 Test plans. Test plans shall be prepared and submitted in accordance with the requirements of the qualification activity. The method of qualification proposed by the contractor is subject to the approval of the qualifying activity. Manufacturers shall discuss with the qualifying activity the test specimens and test plans. These plans shall state specifically the component requirement to be verified during the test, such as test fixtures, setup, conditions, and identification of the successor failure criteria shall be included as appropriate.

4.5.5.2 Qualification reports. Qualification reports shall be submitted in accordance with requirements of the qualifying activity. The visual and mechanical inspection and the hose assembly fitting inspection will be 100% unless another sampling plan is approved in writing by the qualifying activity.

4.6 Conformance inspection. Applicable to both hose and hose assemblies.

4.6.1 Individual inspection. Individual inspection shall consist of the inspections specified in table VI in the order shown.

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TABLE VI. Individual inspections.

Inspections	Requirement paragraph	Inspection paragraph
Visual and mechanical inspection <u>1/</u>	3.4, 3.5, 3.7, 3.8, and 3.9	4.8.2
Hose assemblies (fittings) <u>1/</u>	3.5.3.2	4.8.2
Proof pressure <u>2/</u>	3.6.5	4.8.7

1/ 100 percent inspection unless an alternate sampling plan is approved in writing by the qualifying activity.

2/ 100 percent inspection of bulk hose length and each hose assembly.

4.6.2 Individual inspections sampling plan. Individual inspection tests specified in table VI shall be performed on a production lot basis. All defective material will be removed from the production lot and shall not be supplied to this specification.

4.6.3 Sampling inspection. Sampling inspections shall consist of the inspections specified in table VII and shall be made on test samples from production lots which have been subjected to and passed the individual inspections (see table VI).

4.6.3.1 Sampling for bulk hose. Sampling for bulk hose will be performed on each continuous run under essentially continuous conditions. Samples shall be selected at a rate of 1 sample for each full or partial increment of 750 feet (228.60 m) of hose produced in the continuous run, up to a maximum of 2 samples (for continuous runs greater than 1,500 feet (457.20 m)), 2 samples will be selected, but they shall be representative of the entire production run). Sampling tests for length change and burst shall be performed in the listed order on each sample as applicable.

4.6.3.2 Hose assemblies. For hose assemblies, the inspection lot shall be 8 items tested for each 3000 assemblies produced (large lot option). At the option of the manufacturer, one item may be tested for each 375 assemblies produced (small lot option). If there has been some production, but the number hose assemblies produced has not reached 375 for a specific size within three years, the manufacture shall perform sampling tests on one hose assembly of that size unless documented approval to not perform the tests has been obtained from the qualifying activity.

TABLE VII. Sampling inspections.

Inspections	Requirement paragraph	Inspection paragraph	Sampling
Length change <sup>1/</sup>	3.6.2	4.8.4	X
Burst pressure	3.6.3	4.8.5	X

<sup>1/</sup> Length change is for bulk hose only.

4.6.4 Acceptance of conformance inspection data. Required conformance 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.

4.6.5 Nonconformance.

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4.6.5.1 Failures. If a sample fails to pass sampling inspection, see table VII, the manufacturer shall immediately notify the qualifying activity and cognizant inspection activity of such failure. The manufacturer shall take corrective action on the materials or processes or both as warranted, 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.

4.6.5.2 Acceptance and shipment. 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 sampling inspection, see table VII, shall be repeated on additional samples. At the discretion of the qualifying activity this may include all inspections, or the inspection which the original sample failed. Individual and sampling and periodic inspections, if applicable, may be reinstated. However final acceptance of the hose or hose assemblies shall be withheld until the sampling and periodic inspection has shown that the corrective action was successful.

4.7 Additional QPL test and reporting requirements.

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

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

4.7.2 Loss of product qualification.

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

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

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

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

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4.8 Methods of inspection.

4.8.1 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.

4.8.2 Configuration and features (see 3.4 and 3.5). Hose and hose assemblies shall be examined to verify that the design, construction and physical dimensions are in accordance with the applicable requirements.

4.8.3 Resistance to impulse pressure (see 3.6.1). Hose assemblies when tested in accordance with SAE-ARP603 shall meet the requirements of 3.6.1. The following details shall apply:

- a. Test specimens shall consist of two hose assemblies, each with a free length between fittings as specified in [table III](#), which have been aged in accordance with [4.5.1.1](#).
- b. To determine conformance to [3.6.1](#), test each specimen as specified:
  - (1) 3/4 inch (.75 inch) (19.05 mm) 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](#).
  - (2) Each hose assembly of 7/8 inch (.875 inch) (22.23 mm) inside diameter or larger shall be straight when mounted on the impulse test machine.
- c. 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.
- d. Hydraulic fluid conforming to MIL-PRF-6083 or MIL-PRF-83282, maintained at a temperature of + 120°F ±10°F (49°C ± 5.56°C) shall be used as the impulse medium and shall circulate through the hose during the test.
- e. Each impulse cycle shall consist of a pressure rise from 0 pounds per square inch (psi) (tolerance + 150 psi, - 0 psi (+10.34 bar, -0 bar)) to 125% ± 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 (+10.34 bar, -0 bar)).
- f. The maximum impulse pressure shall not exceed 3,750 psi (258.55 bar) for type I or 5000 psi (344.74 bar) for type II or III. The shape of the pressure-time curve shall fall within the shaded area shown on [figure 1](#).
- g. Cycles shall occur at the rate of 35 ± 5 cycles per minute.
- h. The number of impulse cycles shall be 150,000 for type I hoses and 200,000 for type II and III hoses.
- i. Nonconformance to 3.6.1 shall constitute failure of this test.

4.8.4 Length change (see 3.6.2). Hose assemblies when subjected to the length change test in accordance with ASTM D380 shall meet the requirements of [3.6.2](#). The following details shall apply:

- a. Test specimens shall consist of three hose assemblies, each not less than 12 inches (304.8 mm) between fittings.
- b. Final pressure shall be the working pressure specified in [table II](#) for the type and size hose tested.

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4.8.5 Burst pressure (see 3.6.3). Test hose specimens used previously for the length change test in 4.8.4 shall be subjected to the burst pressure test specified in ASTM D380 and shall meet the requirements of 3.6.3. The following details shall apply:

- a. Pressure shall be increased until each specimen fails.
- b. Failure of the hose specimen shall consist of leakage, rupture, or detachment from a fitting.
- c. 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.

4.8.6 Low temperature flexibility (see 3.6.4). Hose assemblies when subjected to the low temperature flexibility in accordance with ASTM D380 shall meet the requirements of 3.6.4. The following details shall apply:

- a. Test specimens shall consist of three hose assemblies.
- b. Two specimens shall be selected from those previously conditioned in accordance with 4.5.1.1 and one specimen shall be unconditioned.
- c. The three specimens shall be subjected to the low temperature test for complete hose in accordance with ASTM D380, except as specified herein.
- d. To determine conformance to 3.6.4, test specimens and test fixture shall be temperature conditioned for not less than 70 hours at  $-67^{\circ}\text{F} \pm 5^{\circ}\text{F}$  ( $-55 \pm 2.78^{\circ}\text{C}$ ) ambient air temperature.
- e. The test shall then be conducted at the same temperature. Each specimen shall be examined during and after test to determine conformance to 3.6.4.
- f. After the low temperature flexibility tests the specimens shall be subjected to the proof pressure in accordance with 4.8.7 and shall meet the requirements of 3.6.5).

4.8.7 Proof pressure (see 3.6.5). Bulk hose and hose assemblies when subjected to the proof pressure test in accordance with ASTM D380 shall meet the requirements of 3.6.5. The following details shall apply:

- a. Each bulk hose length and each hose assembly shall be subjected to this test.
- b. Proof pressures shall be as specified in table II for the type and size tested.

4.8.8 Oil resistance (see 3.6.6). Bulk hose when subjected to the oil resistance test in accordance with ASTM D380 shall meet the requirements of 3.6.6. The following details shall apply:

- a. 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.
- b. Each specimen shall be approximately 2 square inches in area.
- c. Hydraulic fluids shall be in accordance with MIL-PRF-5606, MIL-PRF-6083 and MIL-PRF-83282
- d. Each specimen shall be immersed in the hydraulic fluid. The temperature shall be  $+158^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$  ( $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) for  $168 \pm .5$  hours.
- e. The change in volume reported for the outer cover shall be the average of the values obtained from the three outer cover specimens tested.
- f. The change in volume of the inner tube shall be the average of the values obtained from the three inner tube specimens tested.
- g. The change in volume of the outer cover and inner tube shall each be calculated to determine conformance to 3.6.6.

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4.8.9 Ozone resistance (see 3.6.7). A specimen of hose when subjected to the ozone test in accordance with ASTM D380 shall meet the requirements of 3.6.7. The following details shall apply:

- a. Exposure time shall be for a period of 168 hours at a temperature of  $+100^{\circ}\text{F} \pm 2^{\circ}\text{F}$  ( $37.78^{\circ}\text{C} \pm 1.11^{\circ}\text{C}$ ) to an ozone concentration maintained at  $50 \pm 5$  parts of ozone per hundred million parts of air.
- b. The specimen shall be examined daily for cracking, with a 7X magnification and without magnification, except area covered by tape or twine.
- c. The first observable cracking shall be recorded.
- d. After required exposure to ozone, the specimen shall again be examined with 7X magnification to determine conformance to 3.6.7.

4.8.10 Fungus resistance (see 3.6.8). Specimens of hose when subjected to the fungus resistance test in accordance with MIL-STD-810, procedure I shall meet the requirements of 3.6.8. The following details shall apply:

- a. Test specimens shall consist of six hose assemblies, each with hose length between fittings of not less than 24 inches (0.61 m).
- b. Two specimens shall be subjected to the proof pressure test (see 4.8.7) after each of the incubation periods (30, 60 and 90 days) to determine conformance to 3.6.8.

## 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 or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

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

6.1 Intended use. Hose and hose assemblies covered by this detail specification are intended for use in medium and high-pressure hydraulic systems at temperatures between  $-65^{\circ}\text{F}$  to  $+200^{\circ}\text{F}$  ( $-53.89^{\circ}\text{C}$  to  $+93.33^{\circ}\text{C}$ ).

6.1.1 Military unique rationale. The hose and hose assemblies covered by this specification are military unique because they must be able to operate satisfactorily in temperatures ranging from  $-65^{\circ}\text{F}$  to  $+200^{\circ}\text{F}$  ( $-53.89^{\circ}\text{C}$  to  $+93.33^{\circ}\text{C}$ ). Commercial components are not designed to withstand these extreme conditions or sudden environmental changes and would experience catastrophic failure.

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6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable specification sheet and the complete PIN.
- c. Level of preservation, packaging, and marking required (see section 5).
- d. Shelf life requirements (see 6.2.1).

6.2.1 Shelf life. This specification covers items where shelf life is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order. The shelf-life codes are contained in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4120.27-M, Shelf-Life Management Manual, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points (ICPs), and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf Life Management website: <http://shelflife.hq.dla.mil/>.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No.13531 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, P.O. Box 3990, ATTN: DSCC-VQ, Columbus, Ohio 43218-3990 or emailed to [vqp.chief@dla.mil](mailto:vqp.chief@dla.mil).

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

6.4 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. Table VIII lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

TABLE VIII. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and compounds	Lead and compounds	Toluene
Carbon Tetrachloride	Mercury and compounds	1,1,1 - Trichloroethane
Chloroform	Methyl Ethyl compounds	Trichloroethylene
Chromium and compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and compounds	Nickel and compounds	

6.5 Guidance on use of alternative parts with less hazardous or non-hazardous materials. This specification provides for a number of alternative plating materials via the PIN. Users should select the PIN with the least hazardous material that meets the form, fit, and function requirements of their application.

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### 6.6 Subject term (key word) listing.

Cadmium  
Fittings  
High Pressure  
Low Pressure  
Ozone  
Thread size  
Zinc

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

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

6.9 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

## CONCLUDING MATERIAL

### Custodians:

Army - AT  
Navy - SH  
Air Force - 99  
DLA - CC

### Preparing activity:

DLA - CC  
(Project 4720-2005-006)

### Review activities:

Army - AR, AV, MI  
Navy - AS, MC, SA  
Air Force - 71

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