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MEMORANDUM FOR MILITARY/INDUSTRY DISTRIBUTION

SUBJECT: Initial Drafts

Document	Action	Document Title	Project Number
MIL-DTL-13531F	Revision G	Hose, Rubber and Hose Assembly, Rubber (Hydraulic, Pneumatic, Flexible)	4720-0374-000
MIL-DTL-3992E	Revision F	Hose and Hose Assembly, Rubber: Air and Vacuum Brake, Systems	4720-0375-000
MIL-DTL-5593D	Revision E	Hose, Aircraft, Low Pressure, Flexible	4720-0361-000
MIL-DTL-13444G	Revision H	Hose and Hose Assemblies, Rubber: Fuel and Oil	4720-0296-000

These initial drafts are revisions to update any cancelled reference documents and to correct the paragraphs concerning the sampling inspections and finishes.

If these documents are of interest to you, please provide your comments to the project officer electronically. It is very important that you attempt to respond electronically to this draft. This can be in the form of a return e-mail, with or without an attached text file. Because we believe electronic coordination should be faster than hard copy distribution, we have allotted a 45-day coordination cycle from the date of this letter. Please provide your comments within that time period. If an electronic response is not possible, we will still accept comments via letter, facsimile, or phone call, but only after you have contacted the project officer listed below. The initial draft documents can be found at the following DSCC-VA web page:

<http://www.dsccl.dla.mil/Programs/MilSpec/initialdrafts.asp>

This process still requires military departments to identify their comments as "Essential" or "Suggested". Essential comments must be justified with supporting data. Military review activities should forward comments to their custodians or this office, as applicable, in sufficient time to allow for consolidating the department reply.

If there are any questions regarding this project, please contact Gail Dever (project officer) by the preferred method of electronic mail at gail.dever@dla.mil by telephone at commercial 614-692-8781, DSN 850-8781; or by facsimile at 614-692-6939. Our mailing address as a last resort is Defense Supply Center, Columbus, (DSCC-VAI), P.O. Box 3990, Columbus, OH 43216-5000. If you have further questions or concerns regarding this program, you may contact me at 614-692-0566 or richard.taylor@dla.mil.

Sincerely,

/signed/

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Parker-Hannifin
Thermoid HBD
JGB Enterprises
DWI, Inc.
NRP, Inc.
Southwest Radiator Shop

NOTE: This initial draft, dated 21 August 2003, prepared by the Defense Supply Center Columbus, has not been approved and is subject to modification. DO NOT USE FOR ACQUISITION PURPOSES. Project number 4720-0374-000).

INCH-POUND

MIL-DTL-~~43531F~~13531G
~~16 August 2002~~ddmmyyyy
SUPERSEDING
MIL-DTL-~~43531E~~13531F
~~26 October 1998~~16 Aug 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 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 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 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.

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

STANDARDS

DEPARTMENT OF DEFENSE

- MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests.
- MS500077 - Hose Assembly, Nonmetallic: Hydraulic and Pneumatic, Medium Pressure, Flared Tube.
- MS500083 - Hose Assembly, Nonmetallic: Hydraulic and Pneumatic, High Pressure, Flared Tube.

(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.)

2.3 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 - Screw Threads, Unified, (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~~117 - ~~Standard Specification for Electrodeposited Coating of Zinc on Iron and Steel. Salt Spray (FOG) Apparatus, Operating.~~
- 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.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

- SAE-J516 - Hose Fittings, Hydraulic.
- SAE-J517 - Hose, Hydraulic.
- SAE-AS1933 - Hose Containing Age-Sensitive Elastomeric Material, Age Controls for.
- SAE-ARP603 - Hose, Hydraulic, Tubing and Fitting Assemblies, Impulse Testing Of.

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

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

(Application for copies should be addressed to the American National Standard Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036.)

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 associated specifications, or 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, MS500077 or MS500083. 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 preparing 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 shall 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 ~~B633~~B117.

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.

3.3.4 Reinforcement.

3.3.4.1 Type I. Reinforcement of type I hose shall be similar to SAE-J517, type 1OORI.

3.3.4.2 Type II. Reinforcement of type II hose shall be similar to SAE-J517, type 1OOR2.

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 fittings shall be constructed similar to SAE-J516. Unless otherwise specified, only one fitting shall be the male type or a fixed type, non-swivel, type. 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.

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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. Only lengths greater than 3 feet is 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 and not more than an additional 10 percent may be furnished in random lengths between 3 and 10 feet.

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 (1.59 mm). 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 when not coupled to an adapter.

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 in accordance with SAE-ARP603 with the exception of the requirement in this specification and 4.7.3 (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.

3.5.2 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.

TABLE I. Critical interface hose dimensions.

Dash Number	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	7	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

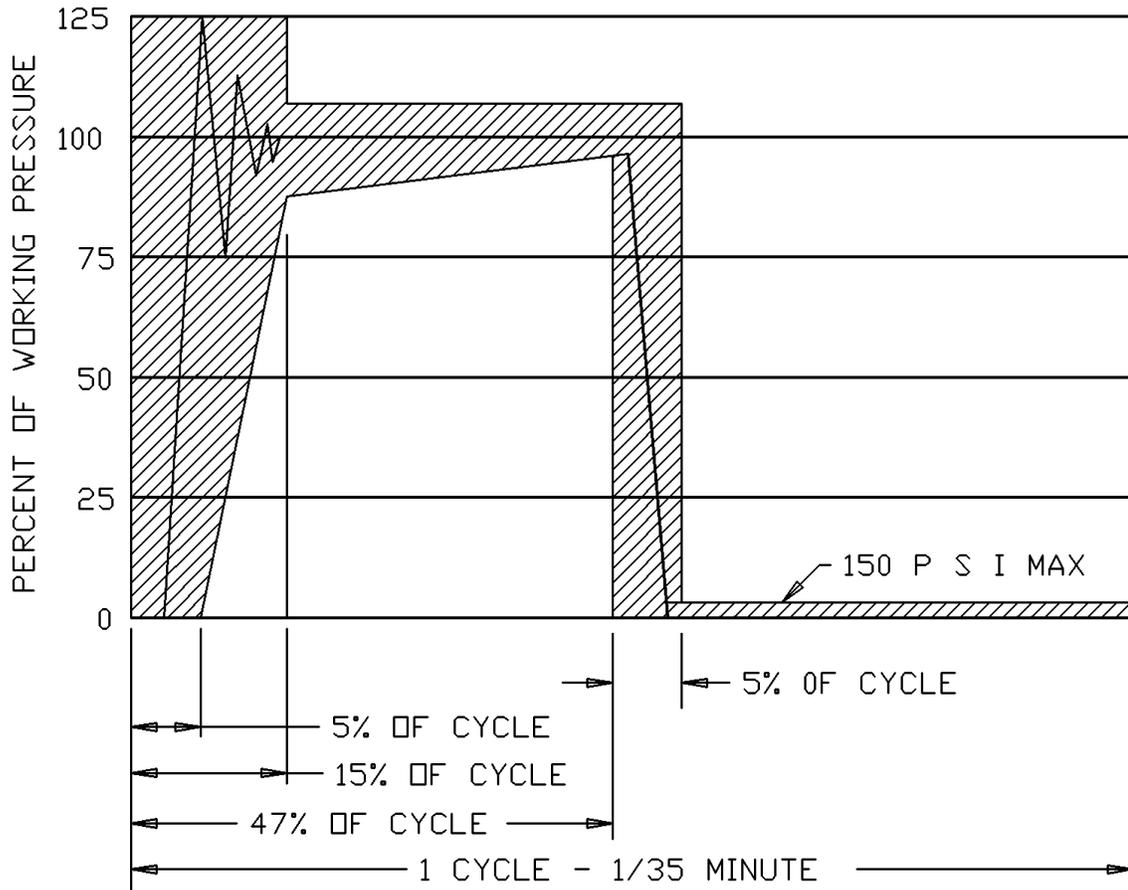


FIGURE 1. Impulse pressure cycle.

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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 or MIL-DTL-5606 or MIL-PRF-83282 at a temperature of $+158^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$ for 168 ± 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. Hose made to a previous issue may be used for a period equal to the age limits per paragraph 3.7, from the date of this revision to deplete existing stock.

Military designator "MIL-DTL-13531"
Type
Class
Nominal ID size (fraction or dash number in accordance with table I)
Date of manufacture (quarter of year and year)
Capital letters "OZ"
Manufacturer's CAGE code

*Example: "MIL-DTL-13531 II A 8 3Q98 OZ XXXX" or "MIL-DTL-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 in the 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.

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

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspection (see 4.6).
 - (1) Individual (see 4.6.2)
 - (2) Sampling tests (see 4.6.2.1)

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed as specified herein and in accordance with the test conditions specified in MIL-STD-810 and ASTM D380 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 (See 6.3).

4.4.1 Samples for qualification. Samples for qualification shall be on every ID size 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.

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

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 submit a report at 12-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. Each report shall contain a summary of the results obtained from both the sampling tests performed during the 12-month interval. The number of bulk hose lots and quantities of hose assemblies that have passed and failed shall be included. All reworked sampling lots shall be accounted for and identified.

If the summary of test results indicates nonconformance with the requirements specified herein but the corrective measures acceptable to the qualifying activity have not been taken, action may be taken to remove the failing product from the QPL.

Failure to submit the report within 30 days after the end of each 12-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the manufacturer shall immediately notify the qualifying activity at any time during the 12-month period that the inspection data indicates failure of the qualified product to meet the requirements specified herein. If there has been no production during the reporting period, a report shall be submitted certifying that the manufacturer still has the capabilities and the facilities necessary to produce the qualified product.

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 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 conforming to MIL-PRF-6083 or MIL-PRF-5606 or MIL-PRF-83282 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.

4.6 Quality Conformance inspection (QCI). Assembly QCI is based on assemblies produced and bulk hose QCI is based on feet produced. One assembly is considered to be the equivalent of two feet of bulk hose in arriving at the assembly count. For identical requirements and identical materials at the bulk hose and assembly level, one test shall satisfy both requirements if documented approval has been obtained from the qualifying activity. No testing is required for a specific size if there has been no production for that size in the reporting period. If there has been no production for a period of three years or longer, sampling (eight items for sampling) must be completed with items from the first production lot when production is resumed for the applicable size. This paragraph applies to bulk hose specifications and also to assembly specifications.

4.6.1 Inspection of product for delivery. Inspection of individual test product for delivery shall consist of individual tests.

4.6.2 Individual tests. Each hose and hose assembly shall have been subjected to and passed all the individual tests specified in table VI. Any hose or hose assembly which fails any test criteria in the individual tests 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.

4.6.2.1 Sampling tests inspection. Sampling test inspection shall consist of the inspections specified in table VI in the order shown.

4.6.2.1.1 Sampling QCI for assembly and hose specifications. The samples shall be eight 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 of hose assemblies produced has not reached 375 for a specific size within three years, the manufacturer shall perform sampling tests on one hose assembly of that size unless documented approval to not perform the tests has been obtained from the qualifying activity. Sampling QCI for bulk hose specifications shall be performed on each continuous run under essentially continuous conditions. Samples shall be selected at a rate of one sample for each full or partial increment of 750 feet of hose produced in the continuous run, up to a maximum of 4-2 samples (for continuous runs greater than 750-1500 feet, 4-2 samples shall be selected, but they must be representative of the entire production run). Sampling tests for length change, and burst shall be performed in the listed order on each of the eight samples as applicable.

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

Samples that have been subjected to any sampling are considered damaged and shall not be delivered as part of a contract or purchase order.

Each QPL manufacturer must notify the qualifying activity in writing, if any changes are made in regards to materials, equipment or processes involved in the production of a QPL item. Subsequently, the qualifying activity shall notify the manufacturer, in writing, if a full requalification, partial requalification or no additional testing is required as a result of the change to materials, equipment or processes.

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 in accordance with SAE-ARP603, with the exception of the following: 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. 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 or MIL-PRF-5606 or MIL-PRF-83282, 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.

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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 D380 except as modified herein. Test specimens shall consist of three hose assemblies, each not less than 12 inches between fittings. Final pressure shall be the working pressure specified in table II for the type and size hose tested.

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 D380. 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.

TABLE VI. Inspection table.

Inspection or test	Qualification		Individual tests <u>1/</u>		Sampling tests (Lot acceptance)	
	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> , <u>3/</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>4/</u>	3.5.1	4.7.3				
Low temperature flexibility <u>2/</u> , <u>3/</u> , <u>4/</u>	3.5.4	4.7.6				
Oil resistance <u>2/</u> , <u>3/</u> , <u>4/</u>	3.5.6	4.7.8				
Ozone resistance <u>2/</u> , <u>3/</u> , <u>4/</u>	3.5.7	4.7.9				
Fungus resistance <u>2/</u> , <u>3/</u> , <u>4/</u> , <u>5/</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 tests.

3/ Bulk hose tests.

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

5/ 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 D380, 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 D380. 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.

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 D380, 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 D380, 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 materiel 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 System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

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° 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.

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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 –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
High Pressure
Low Pressure
Rubber Hose
Rubber Hose Assembly

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-13531F are interchangeable with those of MIL-H-13531 and MIL-DTL-13531E, 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.

CONCLUDING MATERIAL

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

Preparing activity:
DLA - CC
(Project 4720-0279)0374-000) |

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

