

INCH-POUND

MIL-DTL-5593E
w/AMENDMENT 1
19 January 2010
SUPERSEDING
MIL-DTL-5593E
23 October 2006

DETAIL SPECIFICATION

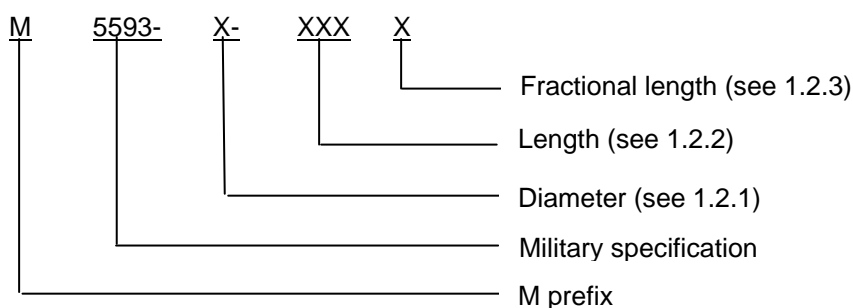
HOSE, AIRCRAFT, LOW PRESSURE AIR AND VACUUM, FLEXIBLE

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

1. SCOPE

1.1 Scope. This specification covers a low-pressure, flexible hose for use in aircraft applications.

1.2 Part or Identifying Number (PIN). The PIN includes an "M" prefix, general specification number, followed by a dash, a number for hose size, followed by a dash, a 3 digit number for length, and a single digit for fractional length.



PIN example: M5593-3-0964 (Size 3 hose 96 1/2 inches long.)

1.2.1 Hose inside diameter (ID): See [table I](#).

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

1.2.3 Fractional length. Fractional lengths are in eighths of an inch (0 through 7).

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 FluidFlow@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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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.

FEDERAL STANDARDS

FED-STD-595/13538- Yellow, Gloss

DEPARTMENT OF DEFENSE SPECIFICATIONS

AN6270	-	Hose Assembly - Detachable Swivel Fitting, Low Pressure
MIL-PRF-5606	-	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-DTL-38726	-	Adapter Assembly, Reusable, Flexible Hose, Low Pressure
MIL-PRF-83282	-	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537
MIL-PRF-87257	-	Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> 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 which are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM D380	-	Rubber Hose, Standard Test Methods for
ASTM D471	-	Rubber Property - Effect of Liquids, Standard Test Method for

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

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 17025	-	General requirements for the competence of testing and calibration laboratories
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(Copies of these documents are available online at <http://www.iso.ch> or from the International Organization for Standardization American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.)

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NCSL INTERNATIONAL

NCSL Z540.3 - Requirements for the Calibration of Measuring and Test Equipment

(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-AMS3002 - Alcohol, Denatured Ethyl
SAE-ARP6002 - Marking; Standard Hose, Aircraft
SAE-AS1933 - Age Controls for Hose Containing Age-Sensitive Elastomeric Material

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

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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 Qualification. Hoses furnished under this specification shall be a product that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.4 and 6.3).

3.2 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 assembly 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.

3.2.1 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.

3.2.2 Hazardous substances. The use of hazardous substances, toxic chemicals, or ozone depleting chemicals (ODC's) shall be avoided whenever feasible.

3.3 Design and construction. The hose shall consist of an inner tube that is reinforced and an outer cover fabricated to withstand the tests specified herein. Construction is described in 3.3.1 through 3.3.3 and the requirements shall be as specified in [table I](#). The operating temperature shall be -65°F to +160°F (-53.89°C to +71.11°C).

3.3.1 Inner tube. The inner tube shall consist of a non-blooming compound of seamless construction, uniform in gage, and resistant to aromatics. It shall be free from pitting, dirt, foreign material, and mandrel lubricants.

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3.3.2 Reinforcement. The reinforcement shall consist of yarn, cotton, or other material to provide added strength to the hose.

3.3.3 Outer cover. The outer cover shall consist of an abrasion-resistant compound of uniform thickness, free from cuts and breaks, and resistant to fuel and oil. The cover may incorporate longitudinal corrugations not exceeding .031 inch (0.79 mm) in depth and spaced no more than .031 inch (0.79 mm) apart around the entire periphery of the hose. Surface irregularities, such as mold marks and laps, as distinguished from cracks or cuts, shall not be cause for rejection.

3.3.4 Adapters. The hose specified herein shall be compatible with adapters in accordance with MIL-DTL-38726.

3.3.5 Dimensions.

3.3.5.1 Length. Unless otherwise specified (see 6.2), hose shall be furnished in lengths from 20 to 65 feet (6.10 to 19.81 m). However, not more than 10% of the order may be furnished in random lengths from 10 to 20 feet (3.05 to 6.10 m) and not more than an additional 10% may be furnished in random lengths from 3 to 10 feet (0.91 to 3.05 m). When hose length is specified, a tolerance of $\pm 1\%$ of the length shall be allowed.

3.3.5.2 Concentricity. The inside diameter and outside diameter of the hose shall be concentric within .030 inch (0.76 mm) full indicator movement for hose sizes -2 and -3 and within .040 inch (1.02 mm) full indicator movement for hose sizes -4, -6, -8, and -10. All readings shall be made on the end of lengths as supplied.

3.3.5.3 Tube bore. The inside diameter of the hose shall not be reduced by more than .020 inch (0.51 mm) less than the nipple inside diameter after installation of adapters as specified in 3.3.4.

TABLE I. Hose requirements. 1/ 2/

Hose size	Inside diameter (inch)	Outside diameter (inch)	Operating pressure, max (psig)	Proof pressure, min (psig)	Burst pressure, min (psig)	Flexibility test weight, max (lbs)	Kinking test diameter, max (inch)	Tensile strength of assembly, min (lbs)
-2	.125 $\pm .010$	.375 $\begin{smallmatrix} +.000 \\ -.047 \end{smallmatrix}$	300	600	2,000	.25	2	100
-3	.188 $\pm .016$	.438 $\begin{smallmatrix} +.000 \\ -.047 \end{smallmatrix}$	250	500	1,700	.25	2	100
-4	.250 $\pm .016$	.500 $\begin{smallmatrix} +.000 \\ -.047 \end{smallmatrix}$	200	400	1,250	.25	4	125
-6	.375 $\pm .016$	.625 $\begin{smallmatrix} +.000 \\ -.047 \end{smallmatrix}$	150	300	1,000	.56	4	150
-8	.500 $\pm .023$	.781 $\begin{smallmatrix} +.000 \\ -.063 \end{smallmatrix}$	150	300	600	1.00	6	200
-10	.625 $\pm .023$.906 $\begin{smallmatrix} +.000 \\ -.063 \end{smallmatrix}$	150	300	600	2.00	6	200

See foot notes at end of table.

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TABLE I. Hose requirements - Continued. 1/ 2/

Hose size	Inside diameter (mm)	Outside diameter (mm)	Operating pressure, max (bar)	Proof pressure, min (bar)	Burst pressure, min (bar)	Flexibility test weight, max (grams)	Kinking test diameter, max (mm)	Tensile strength of assembly, min (grams)
-2	3.18 ± 0.25	9.53 + .000 - 1.19	20.68	41.37	137.90	113.40	138	6.89
-3	4.78 ± 0.41	11.13 + .000 - 1.19	17.24	34.47	117.21	113.40	138	6.89
-4	6.35 ± 0.41	12.70 + .000 - 1.19	13.79	27.58	86.18	113.40	276	8.62
-6	9.53 ± 0.41	15.88 + .000 - 1.19	10.34	20.68	68.95	254.01	276	10.34
-8	12.70 ± 0.58	19.84 + .000 - 1.60	10.34	20.68	41.36	453.59	414	13.79
-10	15.88 ± 0.58	23.01 + .000 - 1.60	10.34	20.68	41.36	907.18	414	13.79

1/ Dimensions are in inches.

2/ Metric equivalents are given for information only.

3.4 Performance.

3.4.1 Proof pressure. When tested as specified in 4.6.2 with the applicable proof pressure as specified in table I, there shall be no evidence of leakage, damage, or permanent deformation.

3.4.2 Adhesion. When tested as specified in 4.6.3, the adhesion between all adjacent parts shall be not less than 6 pounds per inch (0.45 kg per 25.4mm).

3.4.3 Tensile strength.

3.4.3.1 Hose. When tested as specified in 4.6.4.1, the tensile strength of the inner tube and the outer cover shall be not less than 1,250 psig (86.18 bar).

3.4.3.2 Hose assembly. When tested as specified in 4.6.4.2, the end adapters shall not pull off nor shall the hose rupture at less than the value for tensile strength as specified in table I.

3.4.4 Elongation. When tested as specified in 4.6.5, the ultimate elongation of the inner tube and the outer cover shall be not less than 175%.

3.4.5 Burst pressure. When tested as specified in 4.6.6, there shall be no evidence of leakage or malfunction at any pressure that is less than the burst pressure as specified in table I.

3.4.6 Swelling. When tested as specified in 4.6.7, the volume change shall be within 0 and +65% for the inner tube and within 0 and +35% for the outer cover.

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3.4.7 Flexibility. When tested as specified in 4.6.8, the hose shall bend so that the weighted end of the hose drops to a position that is not lower than the fixed end.

3.4.8 Kinking. When tested as specified in 4.6.9, the hose shall not kink or show any evidence of deterioration.

3.4.9 Vacuum collapse. When tested as specified in 4.6.10, the decrease in the outside diameter of the bent hose shall be not greater than 20% of the original outside diameter.

3.4.10 Low temperature flexibility. When tested as specified in 4.6.11, the hose shall not leak or crack.

3.4.11 Water and alcohol resistance. When tested as specified in 4.6.12, the tensile strength loss of the inner tube and the outer cover shall be not greater than 35%.

3.4.12 Oil resistance. When tested as specified in 4.6.13, the tensile strength loss of the inner tube shall be not greater than 35% and its elongation loss shall be not greater than 50%.

3.5 Marking. The hose shall be marked on the outer cover in, parallel to the bore, with the following information (see 3.5.1 and 6.5):

- a. Capital letters "LP" (low pressure).
- b. Specification number PIN.
- c. Date of manufacture (quarter of year and year).
- d. Manufacturer's Commercial and Government Entity (CAGE) code.

Example: Size -4 hose (1/4 inch (.250 inch (6.35 mm) diameter) 8 feet long manufactured during the fourth quarter of 2009 shall be marked as;

LP-M5593-4-0960-4Q09-XXXXX

3.5.1 Marking color. The marking color shall be yellow in accordance with FED-STD-595/13538 (gasoline, oil, and water resistant), legible with normal vision at a minimum distance of 3 feet (0.91 m), and shall be repeated every 12 inches (30.5 cm) or less along the entire length of the hose. The marking shall withstand the tests as specified in SAE-ARP6002.

3.6 Age. The bulk hose that is covered by this specification shall not exceed the age limits as specified in SAE-AS1933.

3.7 Workmanship. Hose 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 II). Workmanship shall be such as to enable the hose to meet the applicable performance requirements of this specification.

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TABLE II. Workmanship defects.

Defect	Inspection	Reference
Dimensions affecting interchangeability not within tolerance	Standard inspection equipment (SIE)	3.3.5
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
Reinforcement through tube	SIE	N/A
Reinforcement 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 reinforcement braid	Visual	N/A
Depressed area, groove longitudinal corrugations (exceeding specified tolerance)	Visual	3.3.3
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)	3.3.5.3
Misbranding	Visual	3.5

4. VERIFICATION

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

- a. Qualification inspection (see 4.4).
- b. Conformance inspection (see 4.5).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test condition and test method specified herein or ASTM D380 as applicable.

4.2.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ISO 17025 and NCSL Z540.3 as applicable.

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4.3 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 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. Acceptance of qualification data in accordance with MIL-DTL-38726 or AN6270 (see 6.3.2).

4.4.1 Samples for qualification. Samples for qualification are shown in the individual test methods and in [table III](#). 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.

4.4.1.1 Hose assemblies for test purposes. Hose assemblies used for test purposes shall be made up with adapters in accordance with MIL-DTL-38726.

4.4.2 Qualification inspection routine. All samples shall be subjected to qualification testing in [table III](#). Unless otherwise specified, the sequence is at the manufacturer's discretion.

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TABLE III. Qualification and verification of qualification inspection.

Inspection	Requirement paragraph	Test method paragraph	Number of samples <u>2/</u>
Examination of product	3.3, 3.5, 3.6, and 3.7	4.6.1	All
Proof pressure	3.4.1	4.6.2	All
Adhesion	3.4.2	4.6.3	2 hoses
Tensile strength (hose)	3.4.3.1	4.6.4.1	3 hoses
Tensile strength (hose assembly)	3.4.3.2	4.6.4.2	3 hoses assemblies
Elongation <u>1/</u>	3.4.4	4.6.5	3 hoses assemblies
Burst pressure	3.4.5	4.6.6	3 hose assemblies
Swelling	3.4.6	4.6.7	<u>3/</u>
Flexibility	3.4.7	4.6.8	3 hose/ or hose assemblies
Kinking	3.4.8	4.6.9	1 hose
Vacuum collapse	3.4.9	4.6.10	1 hose
Low temperature flexibility	3.4.10	4.6.11	3 hose/ or hose assemblies
Water and alcohol resistance	3.4.11	4.6.12	<u>3/</u>
Oil resistance <u>1/</u>	3.4.12	4.6.13	3 <u>4/</u>

1/ Elongation performed at same time as tensile strength test.

2/ Reference the inspection paragraph for specimen sizes and hose or hose assembly sample lengths.

3/ 3 specimens taken from the outer and 3 specimens taken from the inner tube.

4/ 3 specimens taken from the inner tube only.

4.4.3 Acceptance of qualification inspection data. Required qualification tests at the hose assembly level that were already performed at the bulk hose level may be waived if documented approval has been obtained from the qualifying activity.

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

4.4.5 Test plans and qualification reports.

4.4.5.1 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 qualification 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.

4.4.5.2 Qualification reports. Qualification reports shall be submitted in accordance with requirements of the qualifying activity. As a minimum manufacturers shall submit a report identifying test specimens, and test results.

4.5. Conformance inspection.

4.5.1. Individual inspection. Individual inspection shall consist of the inspections specified in table IV in the order shown.

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TABLE IV. Individual inspections.

Inspections	Requirement paragraph	Inspection paragraph
Examination of product	3.3, 3.5, 3.6 and 3.7	4.6.1
Proof pressure 1/	3.4.1	4.6.2

1/ 100 percent inspection of bulk hose length.

4.5.2. Individual inspections sampling plan. Individual inspections specified in table IV shall be performed on a production lot. The examination of product shall be at 100% of the bulk hose length or at an inspection plan approved in writing by the qualifying activity, and the proof pressure shall be 100% of the bulk hose length.

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

TABLE V. Sampling and periodic inspections.

Inspection	Requirement	Inspection paragraph	Sampling	Periodic
Adhesion	3.4.2	4.6.3	---	X
Burst	3.4.5	4.6.6	X	
Vacuum collapse	3.4.9	4.6.10	---	X
Tensile strength(hose)	3.4.3.1	4.6.4.1	---	X
Elongation 1/	3.4.4	4.6.5	---	X

1/ Elongation performed at same time as tensile strength test.

4.5.4 Sampling inspections sampling. Hose lengths randomly selected from production runs shall be subjected to the sampling inspections specified in [table V](#).

4.5.4.1 Inspection sample (bulk hose). Sampling for bulk hose 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 1500 feet (2286 m), 2 samples, representative of the entire production run, shall be selected.

4.5.5 Periodic testing sampling plan. Hose length, randomly selected from production runs shall be subjected to the periodic tests specified in [table V](#).

4.5.5.1 Periodic conformance inspection (PCI). Unless otherwise specified, PCI shall be 4 samples tested for each 20,000 feet (6096 m) of bulk hose produced (large lot option) or at the option of the manufacturer, 1 sample may be tested for each 5,000 feet (1524 m) of bulk hose produced (small lot option).

4.5.5.2 Reduced production bulk hose. If there has been some production, but the footage of bulk hose produced has not reached 5,000 feet (1524 m) for a specific size within three years, the manufacturer shall perform periodic control tests on one sample of that size, for each required periodic test, unless documented approval to not perform the test has been obtained from the qualifying activity.

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4.5.5.3 Periodic samples. Manufacturers at their discretion may subject periodic test samples to more than one periodic test, see [table V](#). However, the manufacturer assumes all risk that the effect of one test on a periodic test sample(s) will not have a detrimental impact on the test sample(s) when subjected to the next test.

4.5.5.4 Disposition of test specimens. Test specimens that have been subjected to sampling and periodic inspection, see [table V](#), shall not be delivered on the contract or purchase order.

4.5.6 Acceptance of conformance inspection data. Required conformance tests at the hose assembly level that were already performed at the bulk hose level may be waived if documented approval has been obtained from the qualifying activity.

4.5.6.1 Acceptance of sampling and periodic inspection data. For identical requirements and test procedures, using an identical adapter, data from conformance inspection testing performed in accordance with MIL-DTL-38726 may be accepted as conformance inspection data for MIL-DTL-5593, provided that documented approval has been obtained from the qualifying activity. When data from conformance inspection testing performed in accordance with MIL-DTL-38726 is to be accepted as conformance inspection data for MIL-DTL-5593, one hose assembly shall be considered to be the equivalent of 2 feet (61 cm) of bulk hose.

4.5.7 Nonconformance.

4.5.7.1 Failures. If a sample fails to pass any sampling or periodic inspection, see [table V](#), 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.

4.5.7.2 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 and periodic inspection, see [table V](#), 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 reinstituted. 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.

4.5.8 Manufacturing issues.

4.5.8.1 Change to manufacturing process, materials or equipment. The manufacturer shall notify the qualifying activity of any changes in the manufacturing process, materials, or equipment used to manufacture a QPL product.

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4.5.8.2 Discontinuation and resumption of production of bulk hose (three years or more). If there has been no production of a specific size for a period of three years or more, three hose assemblies shall each be subjected to all individual tests ([table IV](#)) and all sampling tests ([table V](#)), and four samples shall be subjected to each periodic test ([table V](#)) before production is resumed.

4.6 Test methods.

4.6.1 Examination of product. Each length of hose shall be visually examined for conformance to the following requirements:

- a. Design and construction (see [3.3](#)).
- b. Marking (see [3.5](#)).
- c. Workmanship (see [3.7](#)).

4.6.2 Proof pressure (see 3.4.1). Hose and hose assemblies shall meet the proof pressure test in accordance with ASTM D380 and meet the requirements of [3.4.1](#). The hose or hose assembly shall be subjected to the applicable proof pressure specified in [table I](#) for not less than 60 seconds and not more than 5 minutes.

4.6.3 Adhesion (see 3.4.2). Hose shall meet the adhesion requirements of [3.4.2](#) when tested in accordance with ASTM D380.

4.6.4 Tensile strength.

4.6.4.1 Hose (see 3.4.3.1). The tensile strength of the inner tube and the outer cover shall meet the requirements in [3.4.3.1](#) when tested in accordance with ASTM D380.

4.6.4.2 Hose assembly (see 3.4.3.2). The tensile strength of the hose assembly shall meet the requirements in [3.4.3.2](#) when tested in accordance with ASTM D380.

4.6.5 Elongation (see 3.4.4). The ultimate elongation of the inner tube and the outer cover shall meet the requirements of [3.4.4](#) when tested in accordance with ASTM D380. Test shall be performed at the time of conducting the tensile test (see [3.4.3](#)).

4.6.6 Burst pressure (see 3.4.5). The hose or hose assembly shall meet the requirements of [3.4.5](#) when subjected to the burst pressure test in accordance to ASTM D380. The following details shall apply:

- a. Test sample hose: An 18-inch (45.7 cm) length of hose shall be tested.
- b. Hose assembly shall be subjected to pressure and the pressure increased until burst of the assembly occurs.
- c. Pressure shall be applied with a rate of pressure rise of 300 psig to 1,000 psig (20.68 bar to 68.945 bar) per minute.
- d. The test sample shall be observed throughout the test and the type of failure and the pressure at which it occurred shall be recorded.

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4.6.7 Swelling (see [3.4.6](#)). The outer and inner tubes shall be immersed in test fluids in accordance with ASTM D471 and shall meet the requirements of [3.4.6](#). The following details shall apply:

- a. Three test samples from the outer cover shall be immersed in fluid in accordance with ASTM D471 reference fuel A at room temperature for 24 hours.
- b. Three test samples from the inner tube shall be immersed in fluid accordance with ASTM D471 reference fuel B at room temperature for 24 hours.
- c. At the end of the immersion period, the samples shall be removed from the fuel and the change in volume shall be determined within 5 minutes in accordance with ASTM D380.

4.6.8 Flexibility (see [3.4.7](#)). Hose when subjected to the flexibility test shall meet the requirements of [3.4.7](#). The following details shall apply:

- a. A 12-inch (30 cm) length of hose shall be placed vertically in a vise.
- b. The lower end of the hose shall be gripped with a vice or other suitable device and a weight equal to the amount specified in table VI attached to the opposite end.
- c. The hose shall flex significantly to allow the weighted end to drop to a position not less than the fixed end.

TABLE VI. Flexibility test weight.

Dash number	Flexibility test weight Max pounds	Flexibility test weight Max kg
2	.25	0.11
3	.25	0.11
4	.25	0.11
6	.56	0.25
8	1.00	0.45
10	2.00	0.91

4.6.9 Kinking (see [3.4.8](#)). Hose when subjected to the kinking test shall meet the requirements of [3.4.8](#). The following details shall apply:

- a. A length of hose shall be bent around a mandrel, having a diameter conforming to the kinking test diameter specified in [table I](#).
- b. The hose shall be exposed to a temperature of 158°F ±2°F (70°C ± 1.11°C) for 3 hours.
- c. At the end of the 3-hour period, the hose shall meet the requirements specified in [3.4.8](#).

4.6.10 Vacuum collapse (see [3.4.9](#)). Hose when subjected to the vacuum collapse test shall meet the requirements of [3.4.9](#). The following details shall apply:

- a. A length of hose shall be bent around a mandrel having a diameter of 10 times the outside diameter of the hose.
- b. A vacuum of 20 inches of mercury (50.8 centimeters of mercury) shall be applied to hose with an inside diameter of less than .500 inch (12.70 mm).
- c. A vacuum of 10 inches of mercury (25.4 centimeters of mercury) shall be applied to hose with an inside diameter of .500 inch (12.70 mm) and larger.

4.6.11 Low temperature flexibility (see [3.4.10](#)). Hoses when subjected to the low temperature flexibility test shall meet the requirements of [3.4.10](#). The following details shall apply:

- a. Two sample hoses, each 12 inches (30.5 cm) long, are required for this test. One hose shall be oil aged and one hose shall be air aged.

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- (1) The sample to be oil-aged shall be filled with fluid or immersed in fluid in accordance with MIL-PRF-5606, MIL-PRF-87257, or MIL-PRF-83282.
- (2) The sample to be air aged shall be open to the oven atmosphere in step b.
- b. Both samples shall be conditioned in an oven at a temperature of $158^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($70^{\circ}\text{C} \pm 1.11^{\circ}\text{C}$) for a minimum of 168 continuous hours.
- c. After conditioning, both samples shall be placed in a cold chamber at $-65^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($-53.89^{\circ}\text{C} \pm 1.11^{\circ}\text{C}$) for 72 hours.
- d. After this time and while at $-65^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($-53.89^{\circ}\text{C} \pm 1.11^{\circ}\text{C}$), the test samples shall be flexed through 180° over a mandrel of the same temperature having a diameter of 10 times the outside diameter of the hose for 1 cycle.
- e. The rate of cycling is 1 cycle in 4 seconds.
- f. The samples shall then be subjected to the proof pressure test (see 4.6.2).

4.6.12 Water and alcohol resistance (see 3.4.11). Hose when subjected to the water and alcohol test shall meet the requirements of 3.4.11. The following details shall apply:

- a. Three test samples from the inner tube and three test samples from the outer cover shall be immersed in a solution of 50% water and 50% alcohol, in accordance with SAE-AMS3002 for 24 hours.
- b. The temperature of the water alcohol mix shall be at a temperature of $158 \pm 2^{\circ}\text{F}$ ($70^{\circ}\text{C} \pm 1.11^{\circ}\text{C}$).
- c. At the end of the immersion period, the samples shall be removed from the solution and the tensile strength shall be determined within 15 minutes in accordance with ASTM D380.

4.6.13 Oil resistance (see 3.4.12). The inner tube when subjected to oil shall meet the requirements of 3.4.12. The following details shall apply:

- a. Three test samples from the inner tube shall be immersed in fluid in accordance with MIL-PRF-5606, MIL-PRF-87257, or MIL-PRF-83282 at a temperature of $158^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($70^{\circ}\text{C} \pm 1.11^{\circ}\text{C}$) for 7 days.
- b. At the end of the immersion period, the samples shall be removed from the fluid and allowed to cool at room temperature for not less than 4 hours.
- c. Tensile strength and elongation shall be determined in accordance with ASTM D380.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel 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 that may be helpful, but is not mandatory.)

6.1 Intended use. The hose covered by this specification is intended to be coupled with adapters qualified to MIL-DTL-38726 to form hose assemblies in accordance with AN6270, for use as a flexible connection on low-pressure air and vacuum instrument systems, automatic pilots, and all types of pressure gages in use with these systems. The hose may be used with fitting, adapter hose to straight pipe in accordance with SAE-AS5183.

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6.1.1 Military unique rationale. The hose is a military-unique item because it is compatible with associated components and equipment in military flight control and aircraft vacuum systems and is capable of flexing and operating at temperatures ranging from -65°F to +160°F (-54°C to 71°C). Commercial hose are not designed to withstand these extreme conditions or sudden environmental changes, and would experience catastrophic failure.

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. Packaging (see section 5.1).
- d. Shelf life requirements (see 6.2.1).

6.2.1 Shelf life. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include as a minimum, shelf-life code, shelf-life package markings in accordance with MIL-STD-129 or FED-STD-123, preparation of a materiel qualify storage standard for type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at time of receipt by the government. These and other requirements, if necessary, are in DoD 4140.27-M, *Shelf-life Management Manual*. 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 4140.27-M, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points that manage the item 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://www.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.5593 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@dlm.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <http://assist.daps.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.

6.3.2 Acceptance of qualification data from MIL-DTL-38726. For identical requirements and test procedures, using an identical adapter, qualification test data from the manufacturer of MIL-DTL-5593 hose may be accepted as qualification test data for MIL-DTL-38726, and proof pressure test data from the manufacturer of MIL-DTL-5593 hose may be accepted as test data for AN6270, provided that documented approval has been obtained from the qualifying activity. Unless otherwise approved by the qualifying activity, qualification test data from one manufacturer will not be accepted for another.

6.4 Parts of previous issue. Hose made to the previous issue may be used for a period equal to the age limits in 3.6, from the date of this revision to deplete existing stock.

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6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

6.6 Subject term (key word) listing.

Alcohol resistant
Auto pilot
Denatured ethyl alcohol
Fuel system
Gasoline resistant
Hydraulic fluid
Instrumentation
Isooctane
Temperature
Oil resistant
System
Toluene
Water resistant

6.7 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodians:

Army - AV
Navy - AS
Air Force - 99
DLA - CC

Preparing activity:
DLA - CC

(Project 4720-2009-013)

Review activities:

Army - MI
Navy - MC, SA, SH
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>.