

INCH-POUND

MIL-DTL-6000D
w/AMENDMENT 1
19 March 2009
SUPERSEDING
MIL-DTL-6000D
20 September 2007

DETAIL SPECIFICATION

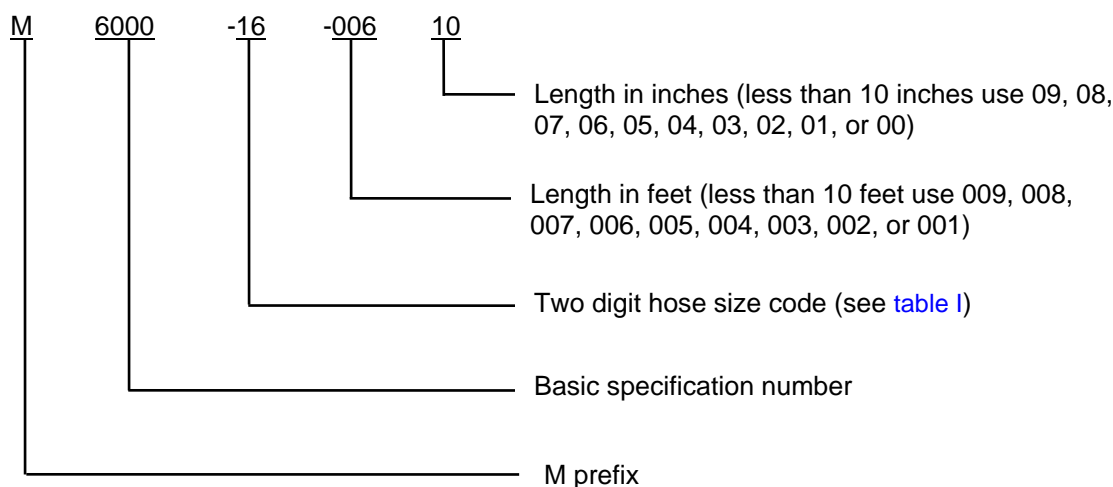
HOSE, RUBBER, AIRCRAFT,
FUEL, OIL, COOLANT, WATER, AND ALCOHOL

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 requirements for hose, rubber, aircraft, fuel, oil, coolant, water, and alcohol, for use in aircraft engine applications.

1.2 Part or Identifying Number (PIN). The PIN consists of the letter M, the basic specification number, a dash, a two digit hose size code, a dash, a three digit number for hose length in feet, and a two digit number for inches.



PIN example: M6000-16-00610 describes a 1-inch inside diameter hose that is 6 feet 10 inches long.

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@dsccl.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 issue of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-83133 - Turbine Fuels, Aviation, Kerosene Types, NATO F-34 (JP-8), and NATO F-35, and JP-8+100

(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.

AEROSPACE INDUSTRIES ASSOCIATION (AIA)

NAS 1925 - Clamp, Hose

(Copies of these documents are available online at <http://www.aia-aerospace.com> or from the Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3901.)

ASTM INTERNATIONAL

ASTM D380 - Rubber Hose, Standard Test Methods for
 ASTM D412 - Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic
 Elastomers - Tension, Standard Test Methods for
 ASTM D413 - Rubber Property - Adhesion to Flexible Substrate, Standard Test
 Methods for
 ASTM D471 - Rubber Property - Effect of Liquids, Standard Test Method for
 ASTM E1119 - Industrial Grade Ethylene Glycol, Standard Specification 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.)

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 17025 - General requirements for the competence of testing and calibration laboratories

(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.)

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
SAE-AS5131	-	Tube End - Beaded, Design Standard
SAE-AS5132	-	Fitting End - Hose Connection, Design Standard

(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 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. The 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).

3.2 Materials. The hose shall be uniform in quality and free from material defects. Materials shall be as specified herein and shall conform to all applicable specifications. Materials not specified herein shall be of the best quality and be capable of meeting all of the 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 cost.

3.3 Design and construction. The hose shall consist of a seamless compounded inner tube, ply or plies or reinforcement, and a protective outer coating. The hose end fitting shall be designed in accordance with SAE-AS5131 or SAE-AS5132 and shall be assembled with hose clamp conforming to NAS1925. These fittings have a beaded end design and held in place by a hose clamp with the bead end acting as a mechanical stop. The design shall facilitate servicing, adjustment, or replacement under field conditions.

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3.3.1 Inner tube. The inner tube of the hose shall be manufactured from synthetic rubber compounded with the necessary ingredients to meet the requirements of this specification. It shall be seamless and have a minimum thickness of .040 inch (1.02 mm). The bore shall be clean and free from pitting.

3.3.2 Reinforcement. The reinforcement shall consist of one or more plies with frictioning.

3.3.3 Outer coating. The outer coating shall consist of polychloroprene rubber reinforced and compounded to meet the requirements of this specification.

3.4 Size.

3.4.1 Diameters. The inside and outside diameters of the hose shall be as specified in [table I](#).

3.4.2 Length. Unless otherwise specified by the acquiring activity (see 6.2), the hose shall be furnished in any lengths 10 feet (3.05 m) or greater, except that not more than 10 percent of the order may be furnished in random lengths greater than 3 feet (0.91 m) and less than 10 feet (3.05 m). A tolerance of ± 1 inch (25.4 mm) shall be allowed for a specified length of from 3 feet (0.91 m) to 10 feet (3.05 m). All ends shall be squarely cut.

TABLE I. Hose diameters. 1/ 2/

Size code	Nominal hose size		Inside diameter (ID)		Outside diameter (OD)	
	Inches fraction	Inches decimal (mm)	Minimum inches (mm)	Maximum inches (mm)	Minimum inches (mm)	Maximum inches (mm)
04	1/4	.250 (6.35)	.234 (5.94)	.266 (6.76)	.563 (14.30)	.625 (15.88)
05	5/16	.313 (7.95)	.297 (7.54)	.328 (8.33)	.625 (15.88)	.688 (17.48)
06	3/8	.375 (9.53)	.359 (9.12)	.391 (9.93)	.688 (17.48)	.750 (19.05)
08	1/2	.500 (12.70)	.484 (12.29)	.516 (13.11)	.813 (20.65)	.875 (22.23)
10	5/8	.625 (15.88)	.609 (15.47)	.641 (16.28)	.938 (23.83)	1.000 (25.40)
12	3/4	.750 (19.05)	.719 (18.26)	.781 (19.84)	1.063 (27.00)	1.125 (28.58)
14	7/8	.875 (22.23)	.844 (21.44)	.906 (23.01)	1.188 (30.18)	1.250 (31.75)
16	1	1.000 (25.40)	.969 (24.61)	1.031 (26.19)	1.313 (33.35)	1.375 (34.93)
20	1-1/4	1.250 (31.75)	1.219 (30.96)	1.281 (32.54)	1.625 (41.28)	1.750 (44.45)
24	1-1/2	1.500 (38.10)	1.469 (37.31)	1.531 (38.89)	1.875 (47.63)	2.000 (50.80)
28	1-3/4	1.750 (44.45)	1.734 (44.04)	1.766 (44.86)	2.125 (53.98)	2.250 (57.15)
32	2	2.000 (50.80)	1.969 (50.01)	2.031 (51.59)	2.375 (60.33)	2.500 (63.50)
40	2-1/2	2.500 (63.50)	2.469 (62.71)	2.531 (64.29)	2.875 (73.03)	3.000 (76.20)
48	3	3.000 (76.20)	2.969 (75.41)	3.031 (76.99)	3.375 (85.73)	3.500 (88.90)
56	3-1/2	3.500 (88.90)	3.469 (88.11)	3.531 (89.69)	3.938 (100.03)	4.063 (103.20)
64	4	4.000 (101.60)	3.969 (100.81)	4.031 (102.39)	4.438 (112.73)	4.563 (115.90)

1/ Dimensions are in inches.

2/ Metric equivalents are given for general information only.

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3.5 Performance characteristics.

3.5.1 Examination of product. When visually examined and dimensionally checked as specified in 4.8.1, the hose shall meet the requirements specified in table I.

3.5.2 Hydrostatic pressures.

3.5.2.1 Proof pressure. When tested as specified in 4.8.2.1, the proof pressure shall be as specified in table II. The hose shall show no sign of leakage through the hose wall.

3.5.2.2 Burst pressure. When tested as specified in 4.8.2.2, the burst pressure of the hose shall be as specified in table II.

TABLE II. Hose pressure requirements.

Hose size, inches (based on ID)	Operating pressure psi (MPa)	Proof pressure minimum psi (MPa)	Burst pressure minimum psi (MPa)
1/4 to 1, inclusive	250 (1.7)	500 (3.4)	1,000 (6.9)
1-1/4 to 1-1/2, inclusive	200 (1.4)	400 (2.8)	800 (5.5)
1-3/4 to 2, inclusive	150 (1.0)	300 (2.1)	600 (4.1)
2-1/2 to 3, inclusive	100 (0.69)	200 (1.4)	400 (2.8)
3-1/2	87.5 (0.60)	175 (1.2)	350 (2.4)
4	75 (0.52)	150 (1.0)	300 (2.1)

3.5.2.3 Length change. When tested as specified in 4.8.2.3, the length of the hose shall not change by more than 10 percent.

3.5.3 Installation. When tested as specified in 4.8.3, the force necessary to install a fitting end in accordance with SAE-AS5132 into a 1 inch size hose shall not be greater than 50 pounds (22.7 kg).

3.5.4 Circulation.

3.5.4.1 High temperature - 200 hours. When tested as specified in 4.8.4.1, the hose and fitting shall not leak, crack, break, fitting blow out or detach from the hose.

3.5.4.2 High temperature - 50 hours. When tested as specified in 4.8.4.2, the hose and fitting shall not leak, crack, break, fitting blow out or detach from the hose.

3.5.5 Low-temperature flexibility. When tested as specified in 4.8.5, the hose shall not break or show cracks in the tube or coating.

3.5.6 Bend radii. When tested as specified in 4.8.6, the minimum outside diameter of the hose shall not be less than 75 percent of the original outside diameter of the hose.

3.5.7 Adhesion. When tested as specified in 4.8.7, the minimum tension required to cause separation between the tube and adjacent parts at the specified rate shall not be less than 15 pounds per inch of width (6.8 Kg per 2.54 mm of width).

3.5.7.1 Iso-octane. When tested as specified in 4.8.7.1, the minimum tension required to cause separation between the tube and adjacent parts at the specified rate shall not be less than 6 pounds per inch width.

3.5.8 Volume change.

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3.5.8.1 Ethylene glycol immersion. When tested as specified in 4.8.8.1, the decrease in tube volume shall not be greater than 10 percent.

3.5.8.2 Oil immersion. When tested as specified in 4.8.8.2, the tube shall show no decrease in volume.

3.5.8.3 Fuel immersion. When tested as specified in 4.8.8.3, the increase in tube volume shall not be greater than 85 percent.

3.5.9 Tensile strength. When tested as specified in 4.8.9, the original tensile strength of the tube shall not be less than 1,000 psi (6.9 MPa).

3.5.9.1 Fuel immersion. When tested as specified in 4.8.9.1, the tensile strength of the tube shall not be less than 45 percent of the original tensile strength.

3.5.10 Elongation. When tested as specified in 4.8.10, the original ultimate elongation of the tube shall not be less than 250 percent.

3.5.10.1 Ethylene glycol immersion. When tested as specified in 4.8.10.1, the elongation of the tube shall not be less than 40 percent of the original elongation and in no case be less than 140 percent.

3.5.10.2 Oil immersion. When tested as specified in 4.8.10.2, the elongation of the tube shall not be less than 40 percent of the original elongation and in no case be less than 140 percent.

3.5.10.3 Fuel immersion. When tested as specified in 4.8.10.3, the elongation of the tube shall not be less than 50 percent of the original elongation.

3.5.11 Crush resistance. When tested as specified in 4.8.11, the crush resistance of the hose shall not be greater than 35 pounds per linear inch to produce a 50 percent decrease of the inside diameter.

3.5.12 Water and alcohol resistance. When tested as specified in 4.8.12, the tensile loss of the tube shall not be greater than 35 percent.

3.6 Age limits. The age of the hose shall not exceed the age limits specified in SAE-AS1933.

3.7 Identification of product. The hose shall be marked for identification in accordance with SAE-ARP6002. In addition, each hose shall be legibly marked along the longitudinal axis with a red stripe consisting of the Commercial and Government Entity (CAGE) code and a white stripe consisting of the size, cure date in quarter and year, and specification (for example; Size 5/8 1Q09 6000) which shall be repeated at least every 6 inches (15.2 mm). The hose shall be rejected when any marking is not legible.

3.8 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 III). Workmanship shall be such as to enable the hose to meet the applicable performance requirements of this specification.

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TABLE III. Workmanship defects.

Defect	Inspection	Reference
Dimensions affecting interchangeability not within tolerance	Standard inspection equipment	3.4
Ends squarely cut	Visual	3.4.2
Ridge on tube - Severe	Standard inspection equipment	3.3.1
Bunching of tube - Severe	Standard inspection equipment	N/A
Loose tube	Standard inspection equipment	N/A
Off center -under gage cover	Standard inspection equipment	N/A
Hole in tube	Standard inspection equipment	N/A
Nad lap or delamination of tube	Standard inspection equipment	N/A
Reinforcement through tube	Standard inspection equipment	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 coverlap, 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
Split, slit or break in cover	Visual	N/A
Blister under cover	Visual	N/A
Misbranding	Visual	3.7

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).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in ASTM D380, ASTM D412 or in accordance with the applicable test method referenced in the test procedure. Unless otherwise specified, room temperature shall be 60°F to 90°F (15.56°C to 32.22°C). Where adhesion after immersion is specified, a section of hose approximately 4 inches long shall be immersed and test specimens shall be prepared from the center portion of this section after immersion.

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 shall be in accordance with ISO 17025 and NCSL Z540.3 as applicable.

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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. Qualification inspection shall be performed on each nominal hose size (ID) and shall be qualified individually.

4.4.1 Samples for qualification. Samples for qualification shall be representative of the products proposed to be furnished to the Government. Samples shall be of one type and nominal size of hose and shall be of the quantity and length specified in the applicable test method.

4.4.2 Qualification inspection routine. All samples shall be subjected to qualification test in table IV, the sequence is at the manufacturer's discretion.

TABLE IV. Qualification inspection.

Inspection	Requirement paragraph	Test paragraph
Examination of product	3.5.1	4.8.1
Proof pressure	3.5.2.1	4.8.2.1
Burst pressure	3.5.2.2	4.8.2.2
Length change	3.5.2.3	4.8.2.3
Installation	3.5.3	4.8.3
Circulation		
High temperature - 200 hours	3.5.4.1	4.8.4.1
High temperature - 50 hours	3.5.4.2	4.8.4.2
Low temperature flexibility	3.5.5	4.8.5
Bend radii	3.5.6	4.8.6
Adhesion	3.5.7	4.8.7
Iso-octane	3.5.7.1	4.8.7.1
Volume change		
Ethylene glycol immersion	3.5.8.1	4.8.8.1
Oil immersion	3.5.8.2	4.8.8.2
Fuel immersion	3.5.8.3	4.8.8.3
Tensile strength	3.5.9	4.8.9
Fuel immersion	3.5.9.1	4.8.9.1
Elongation	3.5.10	4.8.10
Ethylene glycol immersion	3.5.10.1	4.8.10.1
Oil immersion	3.5.10.2	4.8.10.2
Fuel immersion	3.5.10.3	4.8.10.3
Crush resistance	3.5.11	4.8.11
Water and alcohol resistance	3.5.12	4.8.12

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

4.5. Test plans and qualification reports.

4.5.1 Test plans. Test plans shall be prepared and submitted in accordance with the requirements of the qualifying 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.

4.5.2 Qualification reports. Qualification reports shall be submitted in accordance with requirements of the qualifying activity. The examination of product shall be 100% inspection unless another sampling plan is approved in writing by the qualifying activity.

4.6. Conformance inspection.

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

4.6.1.1 Individual inspections sampling plan.

4.6.1.1.1 Individual inspection tests. Individual inspection test specified in table V shall be performed on a production lot basis.

TABLE V. Individual inspection. 1/

Inspection	Requirement paragraph	Test paragraph
Examination of product	3.5.1	4.8.1
Proof pressure	3.5.2.1	4.8.2.1

1/ 100 percent inspection of bulk hose length

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

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

4.6.2.1 Sampling inspections sampling plan.

4.6.2.1.1 Bulk hose samples. For each hose size specified in [table I](#), samples shall be selected from each continuous production run at the rate of one sample to be subjected to all sampling tests for each full or partial increment of 750 feet of bulk hose produced in the continuous run, up to a maximum of 2 samples. For continuous runs greater than 1500 feet, 2 samples shall be selected, but they must be representative of the entire run.

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TABLE VI. Sampling inspection.

Inspection	Requirement paragraph	Test Paragraph
Length change	3.5.2.3	4.8.2.3
Burst pressure	3.5.2.2	4.8.2.2

4.6.2.2 Disposition of test specimens. Test specimens which have been tested to sampling inspection shall not be delivered on the contract or order.

4.6.2.3 Nonconformance. If a sample fails to pass any sampling inspection (see table VI), the manufacturer shall immediately notify the qualifying activity and cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action acceptable to the qualifying activity has been taken. After the corrective action has been taken, sampling inspection shall be repeated on additional samples (all inspections, or the inspection which the original sample failed, at the option of the qualifying activity). Individual, sampling inspections may be reinstituted; however, final acceptance of the hose or hose assemblies shall be withheld until the sampling inspection has shown that the corrective action was successful. In the event of failure after inspection, information concerning the failure and corrective action taken shall be furnished to the qualifying activity.

4.6.3 Discontinuation and resumption of production. If there has been no production of a specific size hose for a period of three years or more, three (3) samples shall be subjected to the sampling tests (see table VI). Samples for each test shall be randomly selected from the first lot produced when production of that size hose has been resumed.

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.

4.7.2.1 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.

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

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4.7.2.3 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 shall 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.

4.7.2.4 No production during reporting period. 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. If during two consecutive 12 month reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit QPL products to a full qualification inspection in accordance with this specification.

4.8 Methods of inspection. The following identified tests and test methods assure hose 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 performing the test. The test methods described herein are proven methods and shall be the referee method in case of dispute.

4.8.1 Visual inspection. Hose and hose assemblies shall be examined to ensure conformance with this specification. Continuous examination shall be performed to assure compliance with the following requirements:

- a. Materials (see [3.3](#)).
- b. Design, construction and physical dimensions (see [3.3](#) and [3.4.1](#)).
- c. Age (see [3.6](#))
- d. Marking (see [3.7](#)).
- e. Workmanship (see [3.8](#)).

4.8.2 Hydrostatic pressures.

4.8.2.1 Proof pressure (see [3.5.2.1](#)). Proof pressure test shall be conducted in accordance with ASTM D380, hydrostatic testing. The hose shall be subjected to a hydrostatic pressure of 50 percent of the minimum burst pressure specified in [table II](#) for not less than 30 seconds and not more than 3 minutes. The hose shall meet the requirements specified in [3.5.2.1](#).

4.8.2.2 Burst pressure (see [3.5.2.2](#)). Burst pressure test shall be conducted in accordance with ASTM D380, hydrostatic testing. The burst pressure of the hose shall meet the requirements specified in [3.5.2.2](#).

4.8.2.3 Length change (see [3.5.2.3](#)). A 10 inch (25.4 cm) length of hose (original) shall be subjected to a hydrostatic pressure of 50 percent of the burst pressure specified in [table II](#). The change in length of the hose shall meet the requirements specified in [3.5.2.3](#).

4.8.3 Installation (see [3.5.3](#)). The force to install a fitting end shall meet the requirements of [3.5.3](#). The following details shall apply:

- a. The tube of a 4 inch (10.2 cm) length of hose shall be lubricated with oil no. 1 in accordance with ASTM D471.
- b. A hose connection fitting end, in accordance with the nominal "B" and "C" dimensions, ± 0.001 inch (0.03 mm), of SAE-AS5132, shall be inserted .375 inch (9.53 mm) into the tube.
- c. The hose and fitting shall be placed upright in a compression jig mounted in a standard testing machine having a jaw speed of 1 inch per minute.
- d. The force necessary to install the fitting into the hose shall be determined and recorded.

4.8.4 Circulation (see [3.5.4](#)).

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4.8.4.1 High temperature - 200 hours (see 3.5.4.1). When subjected to 200 hours-high temperature circulation test, the hose shall meet the requirement of 3.5.4.1. The following details shall apply:

- a. A 9 inch (22.9 cm) or longer length of hose shall be used for this test.
- b. Fitting ends shall be in accordance with SAE-AS5132 and hose clamps shall be in accordance with NAS 1925.
- c. The hose clamp shall be tightened to 25 inch-pounds (2.8 Nm) torque initially.
- d. Ethylene glycol in accordance with ASTM E1119 and oil no. 1 in accordance with ASTM D471, shall be circulated through the hose for 16 hours followed by 8 hours of no circulation. This shall be continued until 200 hours of circulation time is accumulated. An ambient temperature of 140°F ±10°F (60°C ± 5.5 °C) shall be maintained during the circulation periods. The hose clamp shall not be torqued more than three times during this test.
- e. Ethylene glycol in accordance with ASTM E1119 shall be circulated through one hose while maintaining a hose inlet pressure of 75 psig (5.2 bar) and a temperature of 286°F to 300°F (141°C to 149°C).
- f. Oil no. 1 in accordance with ASTM D471 shall be circulated through the second hose while maintaining a hose inlet pressure of 50 psi gage and a temperature of 244°F to 261°F (118°C to 127 °C).
- g. Upon completion of the circulation test, the hose shall be proof pressure tested with water as specified in ASTM D380 (see 4.8.2.1) and the hose shall meet the requirements in 3.5.4.1.

4.8.4.2 High temperature - 50 hours (see 3.5.4.2). When subjected to 50 hours high temperature circulation test, the hose shall meet the requirement of 3.5.4.2. The following details shall apply:

- a. A 9 inch (22.9 cm) or longer length of hose shall be used for this test.
- b. Fitting ends, hose clamps, and torque shall be the same as specified in 4.8.4.1 except that the hose clamp shall not be torqued more than four times during this test.
- c. Ethylene glycol in accordance with ASTM E1119 shall be circulated through the hose for 50 continuous hours while maintaining a temperature of 286 to 300 °F (141 to 149 °C).
- d. Upon completion of the circulation test subject the hose to burst pressure, with water as specified in ASTM D380 (see 4.8.2.2) of the hose shall be determined and shall meet the requirements specified in 3.5.4.2.
- e. If the hose fails, two more samples shall be selected from the same length and tested. If these samples fail the lot shall be rejected and corrective action shall be required, see 4.7.2.1.

4.8.5 Low-temperature flexibility (see 3.5.5). Hose when subjected to low temperature flexibility shall meet the requirements of 3.5.5. The following details shall apply:

- a. Hose of 1 inch and less (inside diameter) shall be tested by conditioning a straight piece of hose at least 12 inches long in a cold chamber at -40°F ±4 °F (-40°C ±2°C) for 5 hours.
- b. Within 2 seconds of removal from the cold chamber, the hose shall be bent around a cooled mandrel having a diameter of 10 times the outside diameter of the hose.
- c. Bending shall be completed within 1 second.
- d. Hose over 1 inch (inside diameter) shall be tested in accordance with ASTM D380 at -40 ±4 °F (-40 ±2 °C).
- e. Requirements for hose of any inside diameter shall be as specified in 3.5.5.

4.8.6 Bend radii (see 3.5.6). A length of hose shall be bent so that the inside radius of the hose is equal to 12 times the inside diameter of the hose and shall meet the requirements in 3.5.6.

4.8.7 Adhesion (see 3.5.7). The adhesion shall be determined in accordance with the Static-Mass Method (for ring specimens) of ASTM D413 and shall meet the requirements specified in 3.5.7.

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4.8.7.1 Iso-octane (see [3.5.7.1](#)). Test samples when subjected to immersion in iso-octane shall meet the adhesion requirements of [3.5.7.1](#). The following details shall apply:

- a. A 4 inch (10.2 cm) length of hose shall be boiled for 1 hour, in reference fuel A in accordance with ASTM D471.
- b. The container in which the test is run shall be fitted with a reflux condenser.
- c. The fuel and hose shall be allowed to cool for at least 24 hours.
- d. For ring specimens, three 1 inch (25.4 mm) widths shall be cut from the center portion of the 4 inch (10.2 cm) length.
- e. The adhesion shall be determined as specified in [4.8.7](#) within 30 minutes after removal from the fuel.

4.8.8 Volume change.

4.8.8.1 Ethylene glycol immersion (see [3.5.8.1](#)). Hose when subjected to ethylene glycol immersion shall meet the requirements of [3.5.8.1](#). The following details shall apply:

- a. Test specimens shall be immersed in a solution of 97 percent ethylene glycol, in accordance with ASTM E1119, at a temperature of 286°F to 300 °F (141°C to 149°C) for 70 hours.
- b. At the end of the immersion period, the specimens shall be removed from the solution and cooled in fresh ethylene glycol at room temperature for 30 minutes.
- c. The specimens shall then be wiped to remove any ethylene glycol from the surface and the change in volume shall be immediately determined in accordance with ASTM D380.

4.8.8.2 Oil immersion (see [3.5.8.2](#)). Hose when subjected to oil immersion shall meet the requirements of [3.5.8.2](#). The following details shall apply:

- a. Test specimens shall be immersed in oil no. 1 in accordance with ASTM D471, at a temperature of 244°F to 261°F (118°C to 127°C) for 70 hours.
- b. The container in which the test is run shall be fitted with a reflux condenser.
- c. At the end of the immersion period, the specimens shall be removed from the oil and cooled in fresh oil at room temperature for 30 minutes.
- d. The specimens shall then be wiped to remove any oil from the surface and the change in volume shall be immediately determined in accordance with ASTM D380.

4.8.8.3 Fuel immersion (see [3.5.8.3](#)). Hose when subjected to fuel immersion shall meet the requirements of [3.5.8.3](#). The following details shall apply:

- a. Test specimens from the tube, in accordance with ASTM D380, shall be immersed in reference fuel B, in accordance with ASTM D471, and JP-8, in accordance with MIL-DTL-83133, at a temperature of 70°F to 81°F (21°C to 27°C) for 24 hours.
- b. At the end of the immersion period, the specimens shall be removed from the fuel and wiped to remove any fuel from the surface.
- c. The change in volume shall be determined within 5 minutes in accordance with ASTM D380.

4.8.9 Tensile strength (see [3.5.9](#)). The tensile strength shall be determined in accordance with ASTM D412 and shall meet the requirements specified in [3.5.9](#).

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4.8.9.1 Fuel immersion (see 3.5.9.1). Hose specimens when subjected to fuel immersion shall meet the requirements of 3.5.9.1. The following details shall apply:

- a. Dumbbell test specimens from the tube shall be suspended in reference fuel B, in accordance with ASTM D471, at a temperature of 70°F to 81°F (21°C to 27°C) for 48 hours.
- b. The specimens shall then be removed from the fluid and the tensile strength shall be determined within 5 minutes in accordance with ASTM D412.
- c. Tensile strength calculations shall be based on the original cross sectional area of the test specimens.

4.8.10 Elongation (see 3.5.10). The ultimate elongation shall be determined in accordance with ASTM D412 and shall meet the requirements specified in 3.5.10.

4.8.10.1 Ethylene glycol immersion (see 3.5.10.1). Hose specimens when subjected to ethylene glycol immersion shall meet the requirements of 3.5.10.1. The following details shall apply:

- a. Dumbbell test specimens shall be immersed in a solution of 97 percent ethylene glycol, in accordance with ASTM E1119, at a temperature of 286 to 300 °F (141 to 149 °C) for 70 hours.
- b. At the end of the immersion period, the specimens shall be removed from the solution and cooled in fresh ethylene glycol at room temperature for 30 minutes.
- c. The specimens shall then be wiped to remove any ethylene glycol from the surface and allowed to stand in air at room temperature for 4 hours ±15 minutes before the elongation of the tube is determined in accordance with ASTM D412.

4.8.10.2 Oil immersion (see 3.5.10.2). Hose specimens when subjected to oil immersion shall meet the requirements of 3.5.10.2. The following details shall apply:

- a. Dumbbell test specimens shall be immersed in oil no. 1, in accordance with ASTM D471, at a temperature of 244°F to 261°F (118°C to 127°C) for 70 hours.
- b. The container in which the test is run shall be fitted with a reflux condenser.
- c. At the end of the immersion period, the specimens shall be removed from the oil and cooled in fresh oil at room temperature for 30 minutes.
- d. The specimens shall then be wiped to remove any oil from the surface and allowed to stand in air at room temperature for 4 hours ±15 minutes before the elongation of the tube is determined in accordance with ASTM D412.

4.8.10.3 Fuel immersion (see 3.5.10.3). Hose specimens when subjected to fuel immersion shall meet the requirements of 3.5.10.3. The following details shall apply:

- a. Dumbbell test specimens from the tube shall be immersed in reference fuel B accordance with ASTM D471 at a temperature of 70 to 81 °F (21 to 27 °C) for 24 hours.
- b. At the end of the immersion period, the specimens shall be removed from the fuel and wiped to remove any fuel from the surface.
- c. The elongation shall be determined within 5 minutes in accordance with ASTM D412.

4.8.11 Crush resistance (see 3.5.11). A section of hose shall be subjected to crush resistance and shall meet the requirements of 3.5.11. The following details shall apply:

- a. Hose sample shall be a 3 inch (7.6 cm) length of hose.
- b. The hose shall be allowed to cool at room temperature for at least 4 hours before crush tests are performed. A force shall be applied at a rate of speed of 1 inch per minute.
- c. The inside diameter of the hose shall be measured with a "go or no-go" rod during the time the force is being applied and shall decrease at least 50 percent of the original inside diameter when a maximum load of 105 pounds (47.6 kg) has been applied.

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4.8.12 Water and alcohol resistance (see [3.5.12](#)). The hose shall be tested for resistance to exposure with water and alcohol and shall meet the requirements in [3.5.12](#). The following details shall apply:

- a. Test specimens from the tube shall be immersed in a solution of 50 percent water and 50 percent alcohol, in accordance with SAE-AMS3002, at a temperature of 158 °F (70 °C) for 24 hours under reflux.
- b. The samples shall be tested in accordance with ASTM D412 except that the tensile strength shall be determined within 15 minutes after they are removed from the solution.
- c. Tensile strength calculations shall be based on the original cross-sectional area of the test specimens.

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 activities 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. The intended use of the hose is for use in fuel, oil, coolant, water, and alcohol lines in aircraft engine installations. If used in lengths greater than 18 inches, however, the hose has a tendency to collapse. The rubber hose covered by this specification is a military unique item that is designed to withstand flexing at low temperature -40°F (-40°C), and be capable of high temperature circulation to various types of fluids.

6.1.1 Interoperability and compatibility. The interoperability and compatibility to new and existing systems has been assured through strict adherence to the military detail specification requirements. Manufacturers of these items and users place great reliance on the detailed technical requirements to ensure the products meet the interoperability and compatibility requirements while encountering rapid ambient temperature fluctuations.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Size and quantity of hose required.
- c. Length of hose when lengths greater than 10 feet are required.
- d. Shelf life (see [6.2.1](#))
- e. Packaging requirements (see [5.1](#)).

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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 quality 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 4120.27-M, *Shelf-life Management Manual*. The shelf-life codes are in the Federal Logistics Information System Total item Record. Additive information for shelf-life management may be obtained from DoD 4120.27-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: <https://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. 6000 whether or not such products have actually been so listed by that date. The attention of 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.

6.4 References to superseded specifications. All the requirements of MIL-DTL-6000D are interchangeable with those of MIL-H-6000D, therefore, previously existing documents (OEM drawings, etc.) referencing MIL-H-6000 need not be changed.

6.5 Age definition. Since hose is dated by the quarters of the year, it is necessary to judge hose age in terms of time after the quarter and year of manufacture. Hose manufactured during the first quarter of any year will not become one quarter old until the second quarter of that year.

6.6 Cross reference data. Table VII shows the cross reference data for size codes originally used in MIL-DTL-6000 and new size codes following the SAE convention (1/16 of an inch).

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TABLE VII. Cross reference data.

Size code SAE convention	Size code MIL-DTL-6000	Nominal hose size	
		Inch fraction	Inch decimal (mm)
04	A	1/4	.250 (6.35)
05	B	5/16	.313 (7.95)
06	C	3/8	.375 (9.53)
08	D	1/2	.500 (12.70)
10	E	5/8	.625 (15.88)
12	F	3/4	.750 (19.05)
14	G	7/8	.875 (22.23)
16	H	1	1.000 (25.40)
20	J	1-1/4	1.250 (31.75)
24	K	1-1/2	1.500 (38.10)
28	L	1-3/4	1.750 (44.45)
32	M	2	2.000 (50.80)
40	N	2-1/2	2.500 (63.50)
48	P	3	3.000 (76.20)
56	Q	3-1/2	3.500 (88.90)
64	R	4	4.000 (101.60)

6.7 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>. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see section 3).

6.8 Subject term (key word) listing.

Bead fittings
Fire
Inner tube
Outer coating
Reinforcement

6.9 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.

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CONCLUDING MATERIAL

Custodians:

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

Preparing activity:
DLA - CC

(Project 4720-2009-002)

Review activities:

Army - CR4, MI
Navy - CG, 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>.