

INCH-POUND

MIL-DTL-26521L
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 SUPERSEDING
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DETAIL SPECIFICATION

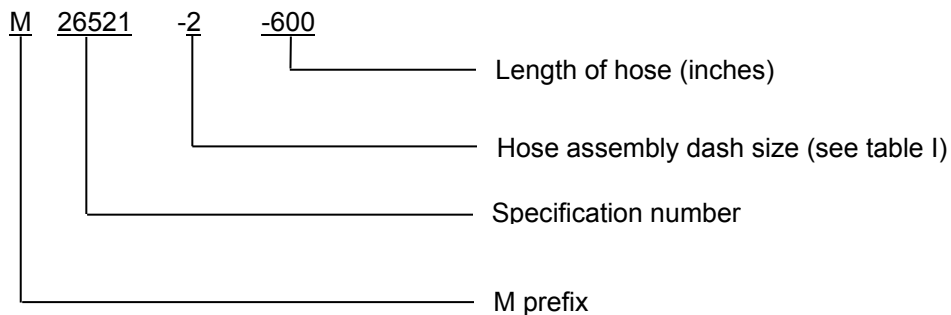
HOSE ASSEMBLY, NONMETALLIC, FUEL, COLLAPSIBLE, LOW TEMPERATURE WITH NON-REUSABLE COUPLINGS

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

1. SCOPE

1.1 Scope. This specification covers collapsible synthetic rubber hose assemblies for ground fueling of aircraft with hydrocarbon fuels or non-potable water where working pressures do not exceed 225 psi.

1.2 Part or Identifying Number (PIN). The hose assembly PIN consists of the M prefix, specification number, hose assembly size code, and length in inches as follows:



PIN example: M26521-2-600 is for a hose assembly 2.50 inch ID, 600 inches long.

TABLE I. Hose assembly ID size.

Hose assembly dash size	Hose ID ±.06 (1.52) inch (mm)
-1	2.00 (50.8)
-2	2.50 (63.5)
-3	3.00 (76.2)
-4	4.00 (101.6)

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Attn: 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 <https://assist.dla.mil>.

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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 APPLICABLE DOCUMENTS

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-H28/10 - Screw Thread Standards for Federal Services Section 10 Hose, Coupling and Fire Hose Coupling Screw Threads
- FED-STD-162 - Hose, Rubber, Visual Inspection Guide For

DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-DTL-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5
- MIL-DTL-83133 - Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)

(Copies of these documents are available online at <http://quicksearch.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.

AMERICAN PETROLEUM INSTITUTE (API)

- EI 1529 - Aviation Fueling Hose and Hose Assemblies

(Copies of this document are available online at <http://www.energyinstpubs.org.uk/> or from the Portland Customer Services, Whitehall Industrial Estate, Colchester CO2 9HP, UK.)

ASTM INTERNATIONAL

- ASTM B121/B121M - Standard Specification for Leaded Brass Plate, Strip, and Rolled Bar
- ASTM B124/B124M - Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes
- ASTM D156 - Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
- ASTM D380 - Standard Test Methods for Rubber Hose
- ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension

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- ASTM D413 - Standard Test Methods for Rubber Property-Adhesion to Flexible Substrate
- ASTM D471 - Standard Test Method for Rubber Property-Effects of Liquids
- ASTM D1149 - Standard Test Methods for Rubber Deterioration- Cracking in an Ozone Controlled Environment
- ASTM D1500 - Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)
- ASTM D2276 - Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling
- ASTM D3182 - Standard Practice for Rubber-Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets
- ASTM D3183 - Standard Practice for Rubber-Preparation of Pieces for Test Purposes from Products

(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 4649 - Rubber, Vulcanized or Thermoplastic - Determination of Abrasion Resistance Using a Rotating Cylindrical Drum Device
- ISO 8031 - Rubber and Plastics Hoses and Hose Assemblies -Determination of Electrical Resistance and Conductivity
- ISO/IEC 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.)

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

- 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-ARP6002 - Marking; Standard Hose, Aircraft
- SAE-AS1933 - Age Controls for Hose Containing Age-Sensitive Elastomeric Material

(Copies of these documents are available on line at www.sae.org from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, and Tel: 877-606-7323 [inside USA and Canada] or 724-776-4970 [outside USA], email at CustomerService@sae.org.)

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 (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 First article. When specified (see 6.2), samples shall be subjected to first article inspection in accordance with 4.4.

3.2 Materials. Materials shall be as specified herein and shall conform to all applicable specification sheets. When a definite material is not specified, a material shall be used which will enable the fitting or sleeve to meet the requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of acceptance of the finished product.

3.3 Components. The complete hose assembly shall consist of the basic hose and two non-reusable male connectors. Each male fitting is attached to each end of the hose and one-time use protective shipping caps shall be supplied for each male connector to prevent the entrance of dirt and other foreign matter (see figure 1).

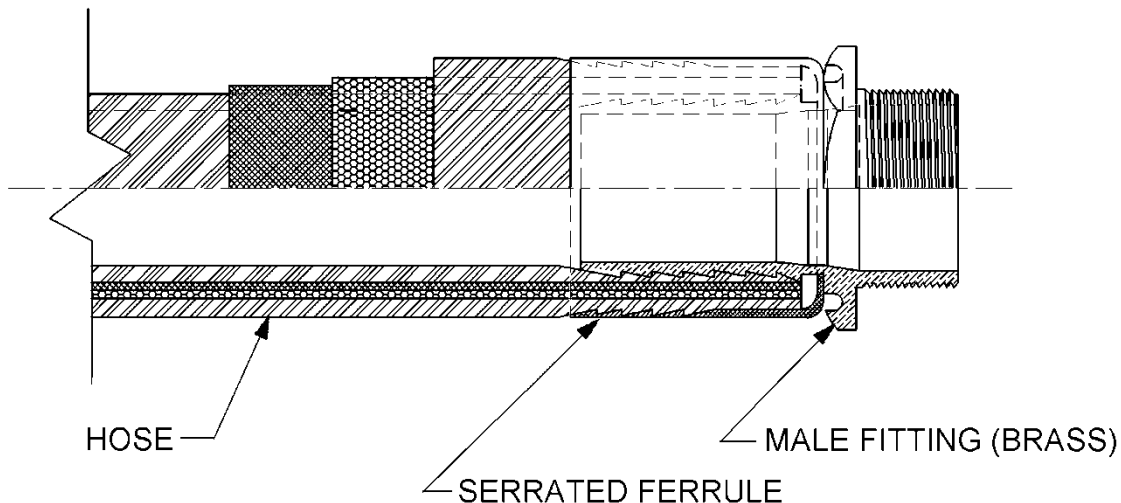


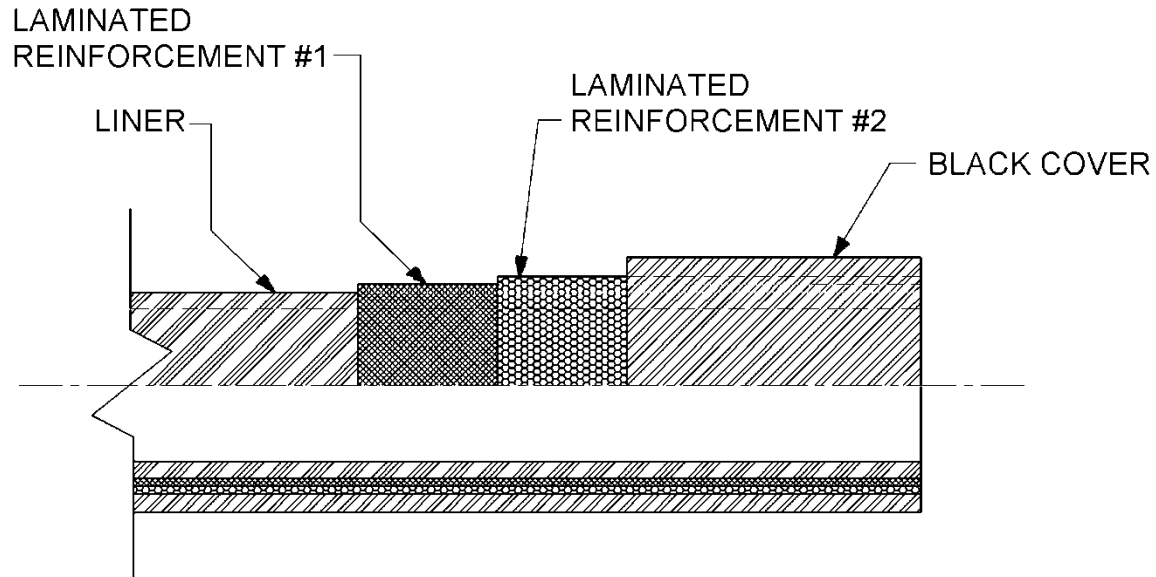
FIGURE 1. Permanent type coupler.

3.4 Recycled, recovered, environmentally preferable or biobased materials. Recycled, recovered, environmentally preferable, or biobased 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.

3.4.1 Recovered materials. For the purpose of this requirement, recovered materials are those materials that have been collected from solid waste and reprocessed to become a source of raw materials, as distinguished from virgin raw materials. The components, pieces and parts incorporated in the fittings may be newly fabricated from recovered materials to the maximum extent practicable, provided the fittings produced meets all other requirements of this specification. Used, rebuilt or remanufactured components, pieces and parts shall not be incorporated in the fittings.

3.5 Hose. The hose shall consist of a synthetic rubber inner liner, synthetic braided, loomed, or plied reinforcement laminated between rubber layers and a synthetic rubber cover (see figure 2).

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FIGURE 2. Hose section.

3.5.1 Liner

3.5.1.1 Liner material. The liner material shall be a fuel resistant synthetic rubber capable of meeting all the requirements of this specification. The liners (inner tube) material shall be continuous, either calendered or extruded. The liner shall be a smooth, continuous, free of pitting, blisters, depressions, grooves, holes, cuts, charge marks, slits, porosity, and foreign material. Spiral tube laps and die marks are acceptable. Cuts shall not exceed .03 inch (0.8 mm) in depth.

3.5.1.2 Liner thickness. The liner thickness shall be not less than .06 inch (15 mm) when measured in accordance with 4.6.1.1.

3.5.1.3 Liner tensile strength and elongation. The liner material shall have a tensile strength of not less than 1000 psi (6.9 Mpa) and an elongation of not less than 200% when tested in accordance with 4.6.1.2.

3.5.1.4 Liner volume change. The liner material shall not have more than 30% increase in volume when tested in accordance with 4.6.1.3.

3.5.1.5 Liner extractable material. The liner shall not have more than 6% of extractable matter when tested in accordance with 4.6.1.4.

3.5.1.6 Liner fuel contamination. The hose shall not contaminate fuel with more than 20 mg per 100 ml of extractable material when tested in accordance with 4.6.1.5.

3.5.1.7 Liner fuel discoloration. The color of the fuel following the fuel contamination test shall not be less than +15 saybolt when tested in accordance with 4.6.1.6.

3.5.1.8 Liner low temperature. The liner material shall not crack tested in accordance with 4.6.1.7.

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3.5.2 Cover material. The cover shall be constructed of a black, ozone resistant and fuel resistant synthetic rubber material compounded to meet all the requirements of this specification. The cover material shall be smooth, and free of pitting, blisters, depressions, grooves, holes, cuts, charge marks, slits, porosity, and foreign material. Wrap impressions are acceptable.

3.5.2.1 Cover thickness. The cover thickness shall be not less than .06 inch (1.5 mm). The dimensions shall be measured in accordance with 4.6.2.1.

3.5.2.2 Cover tensile and elongation. The cover material shall have a tensile strength of not less than 1000 psi (6.9 MPa) and an elongation of not less than 200% when tested in accordance with 4.6.2.2.

3.5.2.3 Cover ozone resistance. The cover material shall not show signs of cracking when tested in accordance with 4.6.2.3 and examined as specified in ASTM D1149.

3.5.2.3.1 Hazardous substances and ozone depleting chemicals. The ozone resistance test (see 4.6.2.3) may contain hazardous chemicals. This test shall be performed in accordance with Federal regulations and guidelines. For further information about toxic chemicals and hazardous materials lists, consult the Environmental Protection Agency web database at www.epa.gov/ebtpages/pollutants.html.

3.5.2.4 Cover volume change. The cover material shall not have more than 80% volume change when tested in accordance with 4.6.2.4.

3.5.2.5 Cover low temperature resistance. The cover material shall not crack when subjected to $-40 \pm 2^\circ \text{F}$ ($-40^\circ \text{C} \pm 1.1^\circ \text{C}$) and tested in accordance with 4.6.2.5.

3.5.2.6 Cover material abrasion resistance. The quantity of material abraded shall not exceed 160 mm³ when tested in accordance with 4.6.2.6.

3.5.3 Reinforcement material. The reinforcement material shall be a synthetic yarn, cord, or fabric that is braided, spiraled, or plied, and free of defects and geometrical irregularities. Two or more layers of reinforcement laminated between synthetic rubber layers not less than .03 inch (0.8 mm) thick shall be used in the hose construction. The reinforcement material weave construction shall be such that it will allow the rubber layer on one surface to flow through the reinforcement and vulcanize with the rubber layer on the other surface in such a manner as to encapsulate the reinforcement yarns with rubber. The reinforcement material shall not exist within the liner or cover thickness areas.

3.6 Hose.

3.6.1 Hose inside diameter. The hose inside diameter shall be as specified in table II.

TABLE II. Hose dimensional and physical requirements.

Hose ID inches (mm) ± .06 (1.5)	Pressure psi (MPa)		
	Maximum Working	Minimum Proof	Minimum Burst
2.00 (50.8)	225 (1.6)	400 (3)	900 (6)
2.50 (63.5)	225 (1.6)	400 (3)	900 (6)
3.00 (76.20)	225 (1.6)	400 (3)	900 (6)
4.00 (101.6)	225 (1.6)	340 (2)	900 (6)

3.6.2 Length. The length of the hose shall be as specified, with a tolerance of $\pm 1\%$. The length measurement shall not include the couplings.

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3.6.3 Hose assembly static dissipation test. Electrical resistance of the hose assembly shall not exceed 10^5 ohm/m (see 4.6.3.6).

3.6.4 Adhesion. Minimum force required to separate adjacent layers of the hose shall be not less than 17 lb/in (8 kg/24.5mm) width when pulled at 2 in/min (51mm/min). After bore aging the hose with JP-4 in accordance with MIL-DTL-5624, JP-8 in accordance with MIL-DTL-83133 or commercial jet A and A1 fuel for 168 ± 2 hours at $72^\circ\text{F} \pm 2^\circ\text{F}$ ($22.2^\circ\text{C} \pm 1.1^\circ\text{C}$), the minimum force required to separate adjacent layers shall be not less than 10 lb/in (5.5 kg/25.4 mm) width at 2 in/min (51 mm/min) pull rate. The test shall be conducted in accordance with 4.6.3.8.

3.6.5 Low temperature flexibility. The hose shall be flexible at temperatures ranging down to $-40^\circ\text{F} \pm 2^\circ\text{F}$ ($-40^\circ\text{C} \pm 1.1^\circ\text{C}$) and shall not break, crack, or have layer separation when tested in accordance with 4.6.3.7.

3.6.6 Working pressure. The hose assembly working pressure shall be as specified in table II when tested in accordance with 4.6.3.3.

3.6.7 Proof pressure. The hose assembly shall not leak, when tested in accordance with 4.6.3.4, shall not change in length more than 7% or show any imperfections when subjected to proof pressure specified in table II.

3.6.8 Burst resistance. The hose assembly shall not blow out the coupling, burst, or develop a blister at or below the burst pressure as specified in table II. The test shall be in accordance with 4.6.3.5.

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

3.6.10 Collapsibility. Hose having ID of 2 inches (51 mm) shall coil to a diameter of 27 ± 2 inches (686 ± 51 mm) and hoses having ID of 2.5 and 3 inches (64 and 76 mm) shall coil to a diameter of 30 ± 2 inches (762 ± 51 mm) when tested in accordance with 4.6.3.9. Four inch ID hoses shall coil to 32 ± 2 inches (813 ± 51 mm). Test length shall be 50 ft ± 6 inches (15240 ± 152 mm).

3.6.11 Durability. There shall be no evidence of leakage, pull off of fittings or other malfunctioning of the hose assemblies when tested in accordance with 4.6.3.10. After being cut the hose shall be examined, if the hose has tube separation or the inner tube has cracks, cuts or pits, it shall be cause for rejection.

3.6.12 Hose assembly cyclic surge. Hose assemblies when cyclic surge tested shall not have any leakage or visible coupling movement, not more than .03 inches (0.76 mm), when tested as specified in 4.6.3.11.

3.6.13 Coupler pressure cycling endurance test. A hose assembly when tested as specified in 4.6.3.12 assembly when no cuts exceeding .03 inch (0.75 mm) in depth or failure of the hose lining have occurred.

3.7 Hose identification requirements. Each hose shall be legibly marked along the longitudinal axis consisting of the following:

PIN
Manufacturer's Commercial and Government Entity (CAGE) code
Hose Cure Date (MMDDYYYY)
Contract Number

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3.7.1 Identification data. The identification data shall be applied, using a wear resistant material or embossed longitudinally and continuously along hose. The identification characters shall not be less than .2 inches (5.1 mm) high. The marking shall withstand marking tests in accordance with SAE-ARP6002 using MIL-DTL-5624 and MIL-DTL-83133 as test fluids.

3.7.2 Hose assembly serial number. Each hose assembly shall be identified with a serial number that is wear resistant and discernible to the naked eye. The serial number shall be placed 12 ± 2 ft (3658 ± 610 mm) from each hose end or on the nut.

3.8 Couplings. See figure 3.

3.8.1 Couplings. A hose sample that meets this specification's requirements shall be fitted with an EI 1529 male coupling at each end, see figure 3. Couplings on the ends of the hoses shall be internally expandable, non-reusable design, two-piece construction (see 6.2.). The following details shall apply:

- a. The male fitting body shall be high strength brass that meets or exceeds ASTM B121/B121M or ASTM B124/B124M specification requirements.
- b. The serrated ferrule shall be brass that meets or exceeds ASTM B121/B121M or ASTM B124/B124M specification requirements or 300 series corrosion resistance steel.
- c. The coupling shall be furnished with standard male NPT (American Standard Taper Thread) threads. The threads shall be in accordance with FED-STD-H28/10.
- d. When expanded, these fittings shall have an inside diameter conforming to the nominal inside diameter of the hose.
- e. Slippage of hose/coupling connection shall not exceed .03 inch (0.8 mm) due to hose pressurization to proof pressure when tested in accordance with 4.6.3.4. This measurement shall be made after hose assembly depressurization from proof pressure.
- f. Couplings shall be capable of performing free of failure for the expected life of the hose. The couplings used shall meet all of the requirements of this specification.

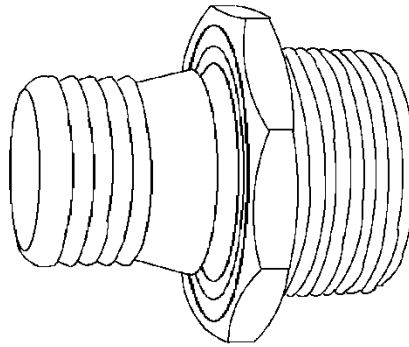


FIGURE 3. Coupling, internally expandable.

3.8.2 Couplings caps. The couplings shall be provided with protective one-time use, tapered or threaded caps for external threaded couplings. The caps shall be of a fuel and oil resistant polymer. The caps or plugs shall be securely attached and shall withstand normal strains, jarring, and vibrations encountered during shipping, storage, and handling. Hose assemblies without a cap or plug shall be rejected.

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3.8.3 Coupling identification. The coupling ferrule shall be permanently identified with the following:

Coupling Manufacturer CAGE Code
Coupling Manufacturer PIN

3.9 Cleanliness. All hose assemblies when inspected in accordance with 4.6.3.13 shall be free from oil, grease, dirt, moisture, cleaning solvents and other foreign material, both internally and externally.

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

TABLE III. Workmanship defects.

Examination	Inspection	Requirement paragraph
Liner workmanship ^{1/}	---	---
Liner not smooth, continuous, free of pitting, blisters, depressions, grooves, holes, cuts, charge marks, slits, porosity, and foreign material	Visual	3.5.1.1
Liner thickness not as specified	Standard inspection equipment (SIE)	3.5.1.2
Cover workmanship ^{1/}		
Cover material not as specified	SIE	3.5.2
Cover wrong color	Visual	3.5.2
Cover not smooth	Visual	3.5.2
Cover material is not free of cuts, nicks, pitting, blisters, bruises, depressions, lumps, grooves, holes, cuts, charge marks, slits, porosity, sharp edges, and foreign material	Visual	3.5.2
Cover thickness not as specified	SIE	3.5.2.1
Hose assembly workmanship		
Fitting slippage on hose	Visual	3.10
Damaged, cracked or charred hose	Visual	3.10
Cracked, damage or badly corroded fittings	Visual	3.10
Kinked, crushed, flattened or twisted hose	Visual	3.10
Blistered, soft, degraded or loose covers	Visual	3.10
Not within age requirements	Visual	3.6.9
Friction layers not vulcanize properly	Visual	3.5.3
Hose ID not as specified	SIE	3.6.1
Length not as specified	SIE	3.6.2
Couplings not as specified	Visual	3.8.1
Hose identification missing or incorrect	Visual	3.7
Coupling identification	Visual	3.8.3
Coupling caps missing	Visual	3.8.2
Cleanliness	Visual	3.9

^{1/} Hose inspections.

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4. VERIFICATION

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

- a. First article inspection (see [4.4](#)).
- b. Conformance inspection (see [4.5](#)).

4.2 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/EIC 17025 and NCSL Z540.3 as applicable.

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.

4.3.1 Lot records. Manufacturers shall keep lot records for 3 years minimum. Manufacturers shall monitor for compliance to the prescribed procedures, and observe that satisfactory manufacturing conditions and records on lots are maintained for these hose assemblies. The records, including as a minimum an attributes summary of all quality conformance inspections conducted on each lot, shall be available to review by customers at all times.

4.4 First article inspection. The first article inspection shall be performed at a laboratory acceptable to the acquiring activity on sample units produced with equipment and procedures used in production.

4.4.1 First article samples. The first article samples shall be representative of the products proposed to be furnished to the Government. The samples shall consist of the following hose lengths for each hose size.

- a. All samples shall be prepared as specified in ASTM D3182 and ASTM D3183.
- b. 12 inch (305 mm) length uncoupled - For adhesion tests (see [4.6.3.8](#)).
- c. 36 inch (914 mm) length with couplings - For working pressure test (see [4.6.3.3](#)), proof pressure test (see [4.6.3.4](#)), burst pressure test (see [4.6.3.5](#)), electrical resistance test (see [4.6.3.6](#)) and couplings tests (see [4.6.3.11](#)).
- d. 50 foot (1270 mm) length with couplings - For collapsibility test (see [4.6.3.9](#)) and durability test (see [4.6.3.10](#)).

4.4.2 Inspection routine. First article inspection shall consist of the inspections specified in [table IV](#), except where otherwise noted (see [6.4](#)). The test sequence shall be determined by the manufacturer unless otherwise specified.

4.4.2.1 Waivers or deviations to specification requirements. Waivers or deviations to specification requirements shall be coordinated through the preparing activity; DLA Land Maritime, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Fluidflow@dsc.dla.mil.

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4.4.3 First article hose assemblies. Hose assemblies subjected to first article inspection are not to be delivered on the contract or purchase order only as first article test samples (see 4.4.5). Only hose assemblies that have been subjected to non-destructive tests specified in table IV and 100 percent inspected shall be delivered on the contract or purchase order.

TABLE IV. First article inspections.

Inspection	Requirement paragraph	Test procedure
Liner inspections <u>1/</u>		---
Liner material	3.5.1.1	---
Liner thickness	3.5.1.2	4.6.1.1
Liner tensile strength and elongation	3.5.1.3	4.6.1.2
Liner volume change	3.5.1.4	4.6.1.3
Liner extractable material	3.5.1.5	4.6.1.4
Liner fuel contamination	3.5.1.6	4.6.1.5
Liner fuel discoloration	3.5.1.7	4.6.1.6
Liner low temperature	3.5.1.8	4.6.1.7
Cover inspections <u>1/</u>		
Cover material	3.5.2	
Cover thickness	3.5.2.1	4.6.2.1
Cover tensile and elongation	3.5.2.2	4.6.2.2
Cover ozone resistance	3.5.2.3	4.6.2.3
Cover volume change	3.5.2.4	4.6.2.4
Cover low temperature resistance	3.5.2.5	4.6.2.5
Cover material abrasion resistance	3.5.2.6	4.6.2.6
Hose inspections <u>1/</u>		
Marking durability	3.7.1	
Age limit	3.6.9	---
Hose ID	3.6.1	4.6.3.2
Length	3.6.2	4.6.3.2
Adhesion	3.6.4	4.6.3.8
Hose assembly inspections	3.10	
Working pressure	3.6.6	4.6.3.3
Proof pressure	3.6.7	4.6.3.4
Burst resistance	3.6.8	4.6.3.5
Hose assembly static dissipation test	3.6.3	4.6.3.6
Low temperature flexibility	3.6.5	4.6.3.7
Collapsibility	3.6.10	4.6.3.9
Durability <u>2/</u>	3.6.11	4.6.3.10
Hose assembly cyclic surge	3.6.12	4.6.3.11
Coupler pressure cycling endurance test	3.6.12	4.6.3.12
Examinations		
Couplings	3.8.1	---
Hose identification	3.7	---
Coupling identification	3.8.3	---
Coupling caps	3.8.2	---
Cleanliness	3.9	4.6.3.13

1/ Hose inspections without couplings.

2/ The 4 inch (102 mm) ID hose assemblies will not be subjected to this test.

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4.4.4 Failures. All samples shall meet all of the contract requirements. Failure of a sample unit to pass any test shall be cause for rejection of the entire lot and refusal to grant first article approval.

4.4.5 First article information. Upon completion of first article inspection, the Government activity responsible for conducting the inspection program (see 6.2), shall report the results of the inspection, with appropriate recommendation, to the contracting officer. Approval of the first article samples or the waiving of first article inspection does not preclude the requirements for performing conformance inspection.

4.4.5.1 Disposition of samples. First article samples shall be furnished to the Government as directed by the contracting officer (see 6.2). The samples shall be representative of the construction, workmanship, components, and materials to be used during production. When a manufacturer is in continuous production of the hose assemblies from one contract to another, submission of additional first article samples for a new contract may be waived at the discretion of the acquiring activity (see 6.2).

4.4.5.2 Acceptance of first article for hose sizes smaller than tested. Manufacturers who have successfully completed first article testing and whose production hoses have performed satisfactorily in the field should be waived for sizes smaller than originally tested.

4.4.6 First article information. Upon completion of first article inspection, the Government activity responsible for conducting the inspection program (see 6.2), shall report the results of the inspection, with appropriate recommendation, to the contracting officer. Approval of the first article samples or the waiving of first article inspection does not preclude the requirements for performing individual inspections.

4.5 Conformance inspection.

4.5.1 Individual tests. Inspection of the product for delivery shall consist of subjecting each hose assembly to the individual tests specified in table V.

TABLE V. Individual inspection. 1/

Test	Requirement paragraph	Inspection paragraph	Number of samples
Workmanship	3.10	4.6.3.1	100%
Cleanliness	3.9	4.6.3.1	100%
Configuration	3.7.1	4.6.3.1	100%
Cleanliness	3.9	4.6.3.13	100%
Proof pressure	3.6.7	4.6.3.4	100%
Hose assembly durability 2/ 3/	3.6.11	4.6.3.10	See 4.5.2
Burst resistance 1/	3.6.8	4.6.3.5	See 4.5.2

1/ Applies only to hose assembly inspections.

2/ Hose and hose assemblies subjected to destructive tests shall not be delivered on the contract or purchase order, see 4.5.2.

3/ The 4 inch (102 mm) ID hose assemblies will not be subjected to this test.

4.5.2 Sampling for tensile and burst test. The manufacturer shall test one hose for durability and one for burst resistance for each lot of 0 to 99 pieces. For lots over 100 pieces, one additional hose shall be tested for durability and one additional hose shall be tested for burst resistance for each full or partial increment of 100 pieces. The durability and burst tests shall be done prior to delivery and tested hoses shall not be shipped or considered part of the order.

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4.5.3 Individual test failures. Any item failing to meet the requirements of the individual tests shall be immediately removed from the lot. The entire lot shall be inspected for that particular defect and then the entire lot shall be re-inspected from the point where the failure occurred. Any additional hose assembly failing to meet the requirements of the individual inspections specified in [table V](#), the entire lot shall be rejected and not supplied to the contract.

4.6 Performance requirements.

4.6.1 Hose liner test methods.

4.6.1.1 Liner thickness (see 3.5.2.1). The liner thickness dimensions shall be measured in accordance with ASTM D380 and meet the requirements of [3.5.1.2](#).

4.6.1.2 Liner tensile strength and elongation (see 3.5.1.3). The liner material tensile strength and elongation shall be tested in accordance with ASTM D380 and ASTM D412 and meet the requirements of [3.5.1.3](#)

4.6.1.3 Liner volume change (see 3.5.1.4). The liner material volume change shall be tested in accordance with ASTM D380 and ASTM D471 and meet the requirements of [3.5.1.4](#). The following shall apply, the liner material shall be immersed for 70 hours in ASTM D471 reference fuel B at 72°F ±2°F (22°C ± 1.1°C).

4.6.1.4 Liner extractable material (see 3.5.1.5). The fuel-soluble matter test shall be performed based on ASTM D2276, the following details shall apply:

- a. A sample of hose liner shall be cut into pieces of approximately .12 in².
- b. 5 ± .01 grams of the sample shall be extracted into 100 ml of reference fuel B in accordance with ASTM D471.
- c. The test fluid and sample shall be stored in a glass flask for 96 hours at 104°F ±2° F (38°C ± 1.1°C). Suitable precaution should be taken to prevent loss by evaporation.
- d. The flask contents shall be filtered into a pre-weighed hemispherical glass dish of suitable size, while washing both the residue in the flask and the filter with a further quantity of fuel.
- e. The contents of the dish shall be evaporated on a boiling water bath and the residue shall be heated in a ventilated air oven for 2 hours at 302°F ± 5°F (150°C ± 2.7°C).
- f. The weight of the extractable residual matter shall be calculated as a percentage of the original test sample weight. The percentage of extractable residual matter shall not exceed the limit specified in [3.5.1.5](#).

4.6.1.5 Liner fuel contamination (see 3.5.1.6). The liner material when tested for fuel contamination shall meet the requirements of [3.5.1.6](#), the following details shall apply:

- a. Sample shall be a 3 inch diameter 12 inch long (76.2 mm diameter 305 mm long) hose.
- b. The liner material shall be extracted with ASTM D471 reference fuel B.
- c. The sample shall be plugged at one end with a glass or non-contaminating metal plug.
- d. The hose sample shall be filled with reference fuel B specified in ASTM D471 and shall be allowed to stand for three days at 72°F ±2°F (22°C ±1.1°C).
- e. The hose sample shall be drained and refilled with fresh ASTM D471 fuel B.
- f. The procedure shall be repeated daily for four additional days.
- g. On the eighth day the hose sample shall be drained and refilled with fresh ASTM D471 reference fuel B and shall be allowed to stand for three additional days at 72°F ±2°F (22°C ± 1.1°C).
- h. On the final cycle, the fuel from the sample hose shall be tested in accordance with ASTM D2276.

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- i. If sample hose with a diameter other than 3 inch diameter is used then the allowable amount of contaminate shall be adjusted as follows:

$$\frac{(\text{mg}/100\text{ml results})(\text{Hose sample ID adjusted})}{3 \text{ inch diameter of specified sample}} = \text{mg}/100\text{ml}$$

4.6.1.6 Liner fuel discoloration (see [3.5.1.7](#)). The liner shall be tested for fuel discoloration in accordance with ASTM D156 and ASTM D1500 and shall meet the requirement of [3.5.1.7](#).

4.6.1.7 Liner low temperature (see [3.5.1.8](#)). The liner material shall be low temperature tested in accordance with ASTM D380 and meet the requirement of [3.5.1.8](#). The following detail shall apply; the liner material shall be subjected to $-40^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($-40^{\circ}\text{C} \pm 1.1^{\circ}\text{C}$) for 5 hours.

4.6.2 Hose cover test methods.

4.6.2.1 Cover thickness (see [3.5.2.1](#)). The cover thickness, when measured in accordance with ASTM D380, shall meet the requirement of [3.5.2.1](#).

4.6.2.2 Cover tensile and elongation (see [3.5.2.2](#)). The cover material, when tested in accordance with ASTM D380 and ASTM D412, shall have a tensile strength of not less than 1000 psi (6.9 MPa) and an elongation on not less than 200% and meet the requirements of [3.5.2.2](#).

4.6.2.3 Cover ozone resistance (see [3.5.2.3](#)). The cover material shall not show signs of cracking when subjected to a 24-hour conditioning period and an exposure of $72 \pm .5$ hours at 104°F (40°C) to an atmosphere containing 100 ± 10 parts per hundred million of ozone in accordance with ASTM D1149. The specimen shall be examined as specified in [3.5.2.3](#).

4.6.2.4 Cover volume change (see [3.5.2.4](#)). The cover material when tested in accordance with ASTM D380 and ASTM D471, shall not have more than 80% volume change after a 70 hour immersion in ASTM D471 reference fuel B at $72 \pm 2^{\circ}\text{F}$ ($22^{\circ}\text{C} \pm 1.1^{\circ}\text{C}$) and shall meet the requirements of [3.5.2.4](#).

4.6.2.5 Cover low temperature resistance (see [3.5.2.5](#)). The cover material, when tested in accordance with ASTM D380, shall meet the requirement of [3.5.2](#). The following detail shall apply: the cover shall be subjected to $-40^{\circ}\text{F} \pm 2^{\circ}\text{F}$ ($-40^{\circ}\text{C} \pm 1.1^{\circ}\text{C}$) for 5 hours.

4.6.2.6 Cover material abrasion resistance (see [3.5.2.6](#)). The abrasion resistance shall be in accordance with ISO 4649, method A and the results shall be within the limit specified in [3.5.2.6](#).

4.6.3 Hose assembly test methods.

4.6.3.1 Examination of hose assemblies (see [3.9](#) and [3.10](#)). Hose assemblies shall be examined to determine compliance with the requirements of this specification with regard to cleanliness and workmanship (see [3.9](#) and [3.10](#)). Defects found during visual inspection of assemblies shall be identified, categorized, and referenced in accordance with FED-STD-162.

4.6.3.2 Hose dimensional requirements (see [3.6.1](#) and [3.6.2](#)). The hose length and diameter dimensions shall be measured in accordance with ASTM D380 and meet the requirements of [3.6.1](#) and [3.6.2](#).

4.6.3.3 Working pressure (see [3.6.6](#)). The hose assembly shall be tested in accordance with ASTM D380 and meet the requirements of [3.6.6](#).

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4.6.3.4 Proof pressure (see 3.6.7). The hose assembly proof pressure shall be tested in accordance with ASTM D380 and meet the requirements of 3.6.7.

4.6.3.5 Burst resistance (see 3.6.8). Hose assembly burst pressure resistance shall be tested in accordance with ASTM D380 and meet the requirements of 3.6.8.

4.6.3.6 Hose assembly static dissipation test (see 3.6.3). The electrical resistance when tested in accordance with ISO 8031 shall meet the requirement of 3.6.3. The following detail shall apply; the hose assembly shall be measured from coupling using a 500 volt source.

4.6.3.7 Low temperature flexibility (see 3.6.5). Hose assembly when subjected to the low temperature flexibility testing shall meet the requirements of 3.6.5; the following details shall apply:

- a. The flexibility tests shall be carried out with an empty length of hose, the length of which is calculated as follows:

$$\text{Hose Length} = 3.142D + 4d$$

Where: D = Test drum diameter
d = Hose ID

- b. Determine the external test drum diameter based on the hose diameter using table VI.

TABLE VI. Test drum external diameter in relation to hose diameter.

Hose ID (d) ± .06 (1.52) inch (mm)	Test drum external diameter (D) inch (mm)
2.00 (50.8)	20 (508)
2.50 (63.5)	25 (635)
3.00 (76.2)	30 (762)
4.00 (101.6)	40 (1016)

- c. Test samples shall be preconditioned at -40°F (-40°C) for at least 24 hours prior to testing.
d. Attach the hose to the test drum with the clamp as shown on figure 4.
e. Place the test drum and hose specimen in a cold box/bath to keep their temperature at -40°F (-40°C).

Note: The test drum and specimen for hoses with inside diameters of 3 inches (76 mm) and smaller shall be kept in the cold box/bath during the test to ensure the test temperature is maintained. For the hose with inside diameter of 4 inches (101 mm), the test drum and specimen must be at the test temperature but may be removed from the cold box/bath for the test procedure. In this case the test must be initiated within 30 seconds of removal from the cold box/bath.

- f. Rotate the test drum using a torque wrench with a dial indicator. The drum shall be rotated 180° within 10 seconds.
g. Record the maximum registered torque required to bend the hose around the test drum. Report the test result in foot-pounds (lb-ft). Results shall be submitted to the contracting activity in first article test results.
h. Verify that the hose is flexible.
i. Proof test, in accordance with 4.6.3.4, after completing this test.

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- j. Then split hose lengthwise and inspect for cracks, breaks and layers separation, see 3.6.5. Failure of this test shall be cause for rejection of the production lot.

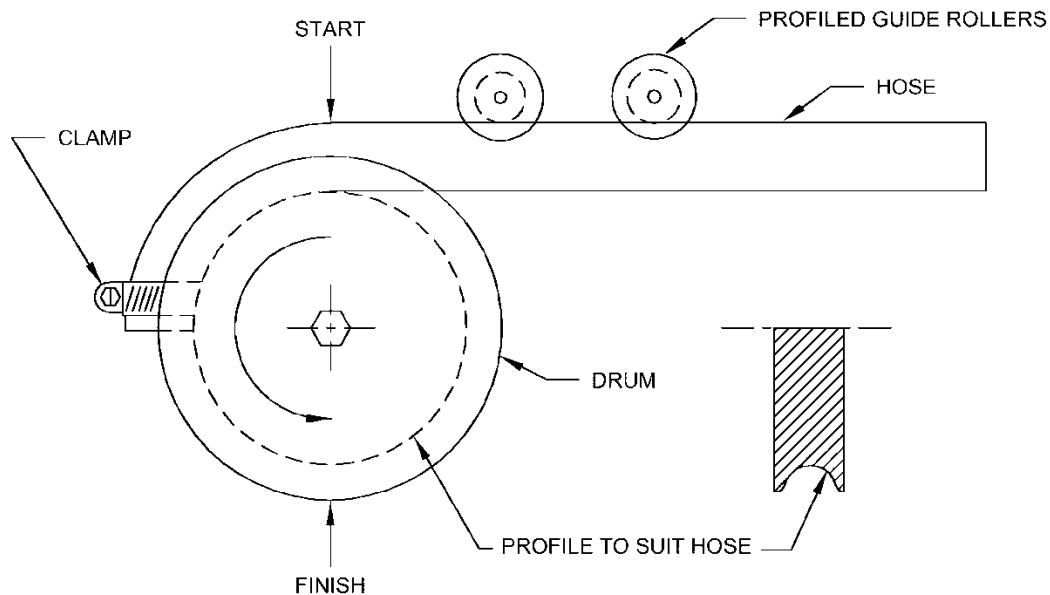


FIGURE 4. Test fixture for cold flexibility evaluation.

4.6.3.8 Adhesion test (see 3.6.4). A sample of the friction layers shall be tested for adhesion and meet the requirements of 3.6.4; the following details shall apply:

- Sample preparation and testing shall be in accordance with ASTM D380 and ASTM D413 using the "Ring" or "Strip 90 degrees" method.
- At a rate of 2 in/min (51mm/min), using a tension tester (stress strain machine), at 72°F ±2°F (22°C ±1.1°C).
- The test specimen shall be pulled completely around the circumference of the hose, with the average value around the circumference being 17 lb/in width, and 10 lb/in width after bore aging the hose with JP-4 in accordance with MIL-DTL-5624, JP-8 in accordance with MIL-DTL-83133 or commercial jet A and A1 fuel for 168 ±2 hours at 72°F ±2°F (22°C ±1.1°C).

4.6.3.9 Collapsibility test (see 3.6.10). Uncoupled hoses assemblies shall be collapsibility tested and meet the requirements of 3.6.10; the following details shall apply:

- Hoses uncoupled having a length of 50 ft ±6 inch (15240 mm) shall be tested by winding cylindrically (not spirally) around a reel having a diameter as specified below:
 - 2 inch ID (50.8 mm) hose shall use a reel diameter of 9 ± .125 inch (229 ±3.18 mm).
 - 2.5, 3, and 4 inch (63.5, 76.2, and 101.6 mm) ID hose shall use a reel diameter of 13 ± .125 inch (330 ±3.18 mm).
- The second coil and each succeeding coil shall be centered directly over the previous coil.
- After winding the diameter of the coils of hose shall be measured at the point of greatest diameter and meet the requirements of 3.6.10.

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4.6.3.10 Durability (see [3.6.11](#)). A hose assembly when subjected to durability testing shall meet the requirements of [3.6.11](#); the following details shall apply:

- a. A hose assembly shall be installed on a hose reel.
- b. The reel hub shall have a diameter of not more than 16 inches (406.4 mm) and shall be capable of accommodating the length of hose wound in multiple layers in a single hose width wide coil.
- c. The hose shall be unwrapped from the hose reel, filled with JP-4 in accordance with MIL-DTL-5624, JP-8 in accordance with MIL-DTL-83133 or commercial jet A and A1 fuel, and pressurized to a hydrostatic pressure of 50 ± 5 psi (345 ± 34 kPa).
- d. The hose shall then be evacuated through the hose reel (at least 95% of the fuel shall be removed) and rewound on the reel.
- e. Evacuation vacuum shall be 15 ± 2 inches (381 ± 51 mm) of mercury. An automotive vacuum gage shall be installed at the outboard or nozzle end of the hose.
- f. This cycle of unreeling pressurizing, evacuation and reeling shall be accomplished 1000 times.
- g. The hose shall then be unreeled, rotated 180° , filled with JP-4 in accordance with MIL-DTL-5624, JP-8 in accordance with MIL-DTL-83133, or commercial jet A and A1 fuel, and an additional 1000 cycles accomplished.
- h. The rewinding of the hose on the hose reel shall be accomplished neatly without twisting, with the hose wound tightly.
- i. At the completion of this test, the hose shall be subjected to a hydrostatic pressure of 50% of the proof pressure in [table I](#) for not less than 3 minutes.
- j. The hose shall then be destructive tested by cutting through one side of the hose longitudinally and examined in accordance with [3.6.11](#).

4.6.3.11 Hose assembly cyclic surge (see [3.6.12](#)). A hose assembly when subjected to cyclic surge shall meet the requirements of [3.6.12](#); the following details shall apply:

- a. A 3 foot (914 mm) hose sample that meets these specification requirements shall be fitted with a coupling at each end.
- b. After the sample is conditioned, the joint between the coupling and the hose shall withstand a maximum cyclic surge pressure of 0 to 225 psi (0 to 1.6 MPa) for not less than 15,000 cycles.
- c. Examination shall be in accordance with [3.6.12](#).

4.6.3.12 Coupler pressure cycling endurance test (see [3.6.13](#)). A hose assembly when subjected to coupler pressure cycling endurance testing shall meet the requirements of [3.6.13](#); the following details shall apply:

- a. The test sample shall be conditioned filling with ASTM D471 fuel B and allowing it to soak for not less than 24 hours.
- b. After the 24 hours soak period the ASTM D471 fuel B shall be drained prior to starting the cycling test.
- c. The pressure cycling test shall be started within 4 hours after draining the ASTM D471 fuel B.
- d. The pressure shall be 225 psi (1.6 MPa) alternately applied for 60 seconds and then released to 0 psi for 30 seconds at a rate of 30 cycles per hour.
- e. The test shall be conducted for 15,000 cycles on a 36 inch (914 mm) hose assembly at $72^\circ\text{F} \pm 2^\circ\text{F}$ ($22^\circ\text{C} \pm 1.1^\circ\text{C}$).
- f. Water may be used as the pressure test medium.
- g. At the end of the test the coupling shall be carefully removed and the hose examined in accordance with [3.6.13](#).

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4.6.3.13 Cleanliness inspection (see 3.9). A hose assembly when inspected for cleanliness shall meet the requirements of 3.9; the following details shall apply:

- a. Both ends of the hose assembly shall be visually inspected to determine if caps or plugs are installed at the fittings.
- b. The caps or plugs shall then be removed and a light source shall be placed at one end of the hose assembly.
- c. The interior of the hose shall be visually examined, without magnification, from the opposite end of the light source. If the length of the hose assembly precludes this, then examination shall be from one end of the hose assembly.

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

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 military unique hose assemblies covered by this specification are intended for use in exceptional fuel servicing of aircraft with aromatic hydrocarbon aviation fuel and require strict adherence to military requirements. Exceptional fuel servicing is defined for this specification as hot refueling and fueling of passenger aircraft with passengers on board. The hose assemblies will be used on pantographs, hydrant systems and fuel servicing mobile equipment where the 225 psi (1.6 Mpa) rated maximum working pressure includes peak surge pressure. These hose assemblies meet the strict flexibility test requirement at -40 °F (-40°C) and 225 psi (1.6Mpa), which complies with detailed military requirements.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. PIN (1.2).
- c. Marking (3.7, 3.8.3)
- d. Additional marking (3.7.2).
- e. Quantity required.
- f. Torque data from low temperature flexibility test, if required (4.6.3.7).
- g. If first article is waived (4.4.6 and 6.3.2).
- h. Lot records if required (4.3.1).
- i. Name and address of the first article inspection test facility to which first article samples are to be forwarded (see 4.4 and 4.4.5) and the name and address of the Government activity responsible for conducting the first article inspection program (see 6.3).
- j. Shelf life requirements (see 6.4).
- k. Packaging requirements (5.1).

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6.3 First article. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first article samples. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.3.1 First article test report. First article tests reports should be prepared in accordance with MIL-HDBK-831.

6.3.2 Defense Logistics Agency (DLA) waiver of first article test. A waiver of a first article testing will only be considered by DLA when the contractor has delivered the same item within the last 3 years, has no unfavorable quality history, has not changed processes, or changed any subcontractors. DLA will not accept first article testing results outside the stated requirements.

6.4 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 material 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 414.27-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 (ICPs) 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/>.

6.5 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 at <http://www.epa.gov/osw/hazard/wastemin/priority.htm>. Included in the 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 Certification. Hose assembly certification indicating the working pressure and passage of the proof pressure test should be retained.

6.7 Subject term (key word) listing.

- Calendered
- Cover
- Inner tube (liner)
- Non-potable water
- Ozone
- Pantographs
- Reinforcement
- Serrated ferrule
- Servicing

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6.8 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 - AR
Navy - SH
Air Force - 99
DLA - CC

Preparing activity:
DLA - CC

(Project 4720-2013-008)

Review activity:

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

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