MIL-H-6000B

22 March 1982

SUPERSEDING
MIL-H-6000A
7 January 1960

MILITARY SPECIFICATION

HOSE: RUBBER (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 one type of hose for use in fuel, oil, coolant, water, and for alcohol lines in engine installations.

* 1.2 Part number. Specification part numbers for items described in this document will be formulated as shown in Section 6.

2. APPLICABLE DOCUMENTS

2.1 Issue of documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification:

SPECIFICATIONS

FEDERAL

O-E-760	Alcohol; Ethyl, Specially Denatured, Aircraft.
TT-S-735	Standard Test Fluids Hydrocarbon.

MILITARY

MIL-H-775	Hose, Hose Assemblies, Rubber, Plastic, Fabric or Metal (including tubing) and Fittings, Nozzles and Strainers.
MIL-H-5559	Hydraulic Fluid, Arresting Gear.
MIL-H-6002	Marking; Standard Hose, Aircraft.
MIL-C-6985	Clamp, Hose.

STANDARDS

FEDERAL

FED-STD-601	Rubber, Sampling and Testing.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: HQ AFLC CASO/LODS, Federal Center, Battle Creek, MI 49016 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MILITARY

MIL-STD-129	Marking for Shipment and Storage.
MIL-STD-1523	Age Controls of Age-Sensitive Elastomeric Material.
MS33658	Fitting End, Hose Connection, Standard Dimensions for.

AIR FORCE-NAVY AERONAUTICAL

AN840	Adapter Straight Pipe to Hose.
* MS33660	Tubing End, Hose Connection, Standard Dimensions for.

PUBLICATIONS

OFFICE OF ASSISTANT SECRETARY OF DEFENSE (S&L)

Handbook No. H-4 Federal Supply Code for Manufacturers

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

* 2.2 Other publications. The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply:

AMERICAN SOCIETY FOR TESTING MATERIALS	
STANDARD METHOD OF TEST DESIGNATION D736	Tentative Method of Test for Low Temperature Brittleness of Rubber and Rubber-Like Materials.

(Application for copies should be addressed to the American Society for Testing Materials, 1916 Race St., Philadelphia, PA 19103.)

3. REQUIREMENTS

3.1 Qualification. The hose furnished under this specification shall be a product which has been tested, and passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable Qualified Products List.

3.2 Material. The hose shall be uniform in quality and free from defects in material. Materials shall conform to applicable specifications and to the requirements specified herein. All materials which are not specifically described herein shall be of the highest quality and suitable for the purpose intended.

* 3.3 Design and construction. Hose covered by this specification shall be suitable for use in fuel, oil, water or alcohol, or both, and liquid coolant lines. The hose shall be so constructed as to permit ready assembly with standard hose fitting connection ends, tubing ends, pipe threads, adapters, and hose clamps conforming to Standards AN840, MS33660 and MS33658, and Specification MIL-C-6985. Any design which renders servicing, adjustment, or replacement unduly difficult under field conditions will not be acceptable.

The hose shall consist of a seamless compounded inner tube, ply or plies or reinforcement, and a protective coating.

3.3.1 Inner tube. The tube of the hose shall be a seamless construction of suitable synthetic rubber compounded with the necessary ingredients to meet the requirements of this specification. The bore shall be clean and free from pitting in accordance with the best manufacturing practice. The tube shall have a minimum thickness of 0.040 inch.

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

3.3.3 Outer coating. The outer coating shall be predominantly polychloroprene rubber compounded to meet the requirements of this specification. This material shall be incorporated in the outer ply of the reinforcement.

* 3.3.4 Age. Hose shall meet the age requirements MIL-STD-1523.

3.4 Size.

* 3.4.1 Diameters. The inside and outside diameters of the hose shall be as specified in Table II. (See 6.5.1)

3.4.1.1 Tolerance. Tolerance on the inside diameter shall be as follows:

Inside Diameter (inches)	Tolerance (inch)
Less than 3/4	± 1/64
3/4 or more	± 1/32

3.4.2 Length. Unless otherwise specified by the procuring activity, the hose shall be furnished in 10-foot lengths, except that 10 percent of the order shall be furnished in random lengths over 3 feet. All ends shall be squarely cut.

3.4.2.1 Tolerance. For a specified length 3 to 10 feet inclusive, a tolerance of ±1 inch will be allowed.

3.5 Physical properties.

3.5.1 Hydrostatic pressures.

* 3.5.1.1 Burst. The burst pressure of the hose shall conform to Table I. The length of the hose shall not change more than 10 percent when subjected to a hydrostatic pressure of one half the burst pressure specified in Table I.

Table I. Hose performance requirements.

Size of hose (based on inside diameter)	Burst pressure (p.s.i.) (minimum)	Proof Pressure (p.s.i.) (minimum)
1/4 to 1 inch, inclusive	1,000	500
1-1/4 to 1-1/2 inches, inclusive	800	400
1-3/4 to 2 inches, inclusive	600	300
2-1/2 to 3 inches, inclusive	400	200
3-1/2 inches	350	175
4 inches	300	150

* 3.5.1.2 Proof. The hose shall show no signs of leaking through the hose wall while under a hydrostatic proof pressure of one-half the burst pressure specified in Table I for not less than 30 seconds and not more than 3 minutes.

3.5.2 Installation. The force necessary for installation of a 1-inch size hose on a MS33658 fitting shall not exceed 50 pounds originally.

3.5.3 Circulation.

* 3.5.3.1 High temperature - 200 hours. The burst pressures of the hose, after being subjected to high-temperature ethylene glycol and test fluid for 200 hours, shall be not less than 50 percent of the burst pressure specified in Table I.

3.5.3.2 High temperature - 50 hours. The burst pressure of the hose, after being subjected to high-temperature ethylene glycol, as specified herein for a period of 50 hours, shall be not less than 50 percent of the burst pressure specified in Table I.

3.5.4 Low-temperature flexibility. A 12-inch length sample of hose shall not break nor show cracks in tube or coating when cooled to -40°C (-40°F) and bent in a period of 1 second over a mandrel 10 times the outside diameter of the hose. The tube shall not crack or break when cooled to -40°C (-40°F) and bent as outlined in ASTM D736.

3.5.5 Bend radii. The minimum outside diameter of the hose shall be not less than 75 percent of the original outside diameter of the hose when bent as specified in 4.6.7.

3.5.6 Adhesion.

3.5.6.1 Tension. The minimum tension required to cause separation between the tube and adjacent parts at the specified rate shall be at least 15 pounds per inch of width.

3.5.6.2 Iso-octane. After being boiled for 1 hour in iso-octane as specified herein, the minimum tension required to cause separation between the tube and adjacent parts at the specified rate shall be at least 6 pounds per inch of width.

3.5.7 Volume change. The volume change of the tube shall conform to the following requirements.

3.5.7.1 Ethylene glycol. After being immersed in ethylene glycol solution for 70 hours at a temperature of 141° to 149°C (285° to 300°F), the decrease in tube volume shall not exceed 10 percent.

* 3.5.7.2 Oil. After being immersed in engine lubricating oil conforming to Federal Specification TT-S-735, Type IV, for 70 hours at a temperature of 118° to 127°C (245°to 259°F), the tube shall show no decrease in volume.

3.5.7.3 Fuel. After being immersed in test fuel conforming to Federal Specification TT-S-735 Type III, at a temperature of 21° to 27°C (70° to 80°F) for 24 hours, the volume increase shall be not more than 85 percent.

3.5.8 Tensile strength.

3.5.8.1 The original tensile strength of the tube shall be at least 1,000 psi.

3.5.8.2 After the fuel immersion test specified in 4.6.10, the tensile strength of the tube shall be at least 45 percent of the original.

3.5.9 Elongation.

3.5.9.1 The original ultimate elongation of the tube shall not be less than 250 percent.

3.5.9.2 The elongation of the tube, after immersion in ethylene glycol and test fluid as specified in 4.6.9.1 and 4.6.9.2, shall be at least 40 percent of the original elongation and in no case shall the elongation of the tube be less than 140 percent.

3.5.9.3 After the fuel immersion test specified in 4.6.9.3, the elongation of the tube shall be at least 50 percent of the original elongation.

3.5.10 Crush resistance. The crush resistance of 1-inch inside-diameter hose, after being subjected to high-temperature ethylene glycol as specified in 4.6.12, shall not be greater than 35 pounds per lineal inch to produce 50 percent decrease of the inside diameter.

3.5.11 Water and alcohol resistance. The tensile loss of the tube when tested as specified in 4.6.13 shall not exceed 35 percent.

3.6 Identification of product. In addition to the requirements of Specification MIL-M-6002, each hose shall be legibly marked along the longitudinal axis with a red stripe consisting of a manufacturer's code number in accordance with OASD Handbook H-4 and a white stripe consisting of the following information: Size, cure date in quarter and year and Specification MIL-H-6000 with these data being repeated at least every 6 inches, e.g., size 5/8 6000 1Q59. Hose shall be rejected when the cure date cannot be determined.

3.7 Workmanship. Workmanship shall be of the quality necessary to produce hose free from all defects which affect proper functioning in service.

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection responsibility. Unless otherwise specified herein the contractor is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the contractor may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.2 Classification of tests. The inspection and testing of hose shall be classified as follows:

(a) Qualification tests (4.3).
(b) Acceptance tests (4.4).

4.3 Qualification tests.

4.3.1 Sampling. The qualification test sample shall consist of not less than 30 feet of 1-inch inside diameter hose. The sample shall be identified as required and forwarded to the activity responsible for qualification, designated in the letter of authorization from that activity (see 6.3).

4.3.2 Tests. Qualification tests shall consist of all test described under 4.6. Qualification tests are not required for other sizes listed herein provided they are fabricated with the same materials and design as size 1-inch inside diameter hose.

4.4 Acceptance tests. Acceptance tests shall consist of tests specified in 4.6.3.1, 4.6.3.2, 4.6.3.3, 4.6.6, and volume change 4.6.9 in Type III.

4.4.1 Sampling. A 6-foot length sample of any inside diameter shall be selected at random from each day's run and shall be subjected to the acceptance tests.

4.4.2 Rejection and retest. Failure of any sample to satisfactorily meet any of the requirements of this specification shall be cause for rejection. Before resubmitting new samples for acceptance, full particulars concerning previous rejections and the action taken to correct the defects found in the original shall be furnished the inspector. Material rejected after retest shall not be resubmitted without the specific approval of the procuring activity.

4.5 Test conditions.

4.5.1 Unless otherwise specified for the particular test, all tests shall be accomplished in accordance with Federal Standard No. 601. Where adhesion after immersion is specified, a section of the hose approximately 4 inches long shall be immersed and the test specimens prepared from the center portion of this section after immersion.

4.6 Test methods.

4.6.1 Examination-workmanship, marking, and dimension. Hose shall be carefully examined to determine conformance to the specification with respect to workmanship and identification marking. Sufficient spot checks shall be made to insure conformance to the tolerances specified. On approval of the procuring activity, a system of statistical quality control may be used for dimensional, marking, and workmanship inspection.

4.6.2 Preparation for delivery. The preservation, packaging, packing, and marking shall be examined to determine compliance with requirements of Section 5.

4.6.3 Hydrostatic pressures.

* 4.6.3.1 Burst. Burst resistance shall be determined in accordance with Federal Standard No. 601, Method 10011.

4.6.3.2 Proof. Tests shall be conducted in accordance with Federal Standard No. 601, Method 10211.

4.6.3.3 Length change. The percentage change in a 10-inch gage length of hose (original) marked along the longitudinal axis of the hose shall be

determined when the hose is subjected to a hydrostatic proof pressure of 50 percent of the burst pressure specified in Table I.

* 4.6.4 Installation. The force necessary to insert hose connector fitting conforming to nominal "N" and "T" dimensions, ±0.001 inch of Standard MS33658 shall be determined for the 1-inch size hose with a compression jig mounted in a standard testing machine having a jaw speed of 1 inch per minute. The tube of a 4-inch length of hose shall be lubricated with fluid conforming to Federal Specification TT-S-735 Type IV and the hose connector inserted 3/8 inch. The hose and connector shall be placed upright in the jig and the force necessary to install the fitting into the hose shall be determined and recorded.

4.6.5 Circulation.

4.6.5.1 High temperature-200 hours. Two circulation tests shall be conducted on two 9-inch or longer samples of 1-inch (inside-diameter) hose. Tests shall be conducted as follows:

(a) The end fittings shall conform to Standard MS33658 and the hose clamps shall conform to Specifications MIL-C-6985. The hose clamp shall be tightened to 25-inch pounds torque initially.

* (b) Ethylene glycol and Federal Specification TT-S-735, Type IV, fluid shall be circulated through the samples of the hose as specified herein, for a period of 16 hours followed by an 8-hour period of no circulation. This shall be continued until 200 hours of circulation time is accumulated. An ambient temperature of 60° ±5.5°C (140° ±10°F) shall be maintained during the circualtion periods. The hose clamp shall not be torqued more than three times during this test.

(c) Ethylene glycol, conforming to Specification MIL-H-5559, shall be circulated through one hose, maintaining a hose inlet pressure of 75 psi gage and a temperature of 141° to 149°C (285° to 300°F).

* (d) Engine lubricating oil conforming to Federal Specification TT-S-735 Type IV shall be circulated through the second hose maintaining a hose inlet pressure of 50 psi gage and a temperature of 118° to 127°C (245° to 260°F).

4.6.5.2 High temperature-50 hours. Ethylene glycol conforming to Specification MIL-H-5559 shall be circulated through the hose for 50 continuous hours, maintaining a temperature of 141° to 149°C (285° to 300°F). The end fittings, hose clamps, and torque shall be the same as specified for the 200-hour circulation test with the exception that the hose clamp shall not be torqued more than four times during this test. If the sample fails, two more samples shall be selected from the same length and tested.

4.6.6 Low-temperature flexibility. For hose 1 inch and less (inside diameter), a straight piece of hose at least 12 inches long shall be conditioned at -40°C (-40°F) for 5 hours, within 2 seconds the hose shall be flexed around a cooled mandrel or cylinder 10 times the outside diameter of the hose. For hose over 1 inch (inside diameter), the tests shall be conducted at -40°C (-40°F) in accordance with method outlined in ASTM D736. Test specimens shall be prepared in accordance with Federal Standard No. 601, Method 4111.

4.6.7 Bend radii. 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.

4.6.8 Adhesion. The adhesion shall be determined in accordance with Federal Standard No. 601, Method 8011.

* 4.6.8.1 Iso-octane. A 4-inch length of hose shall be boiled for 1 hour in iso-octane, Federal Specification TT-S-735, Type I fluid. The container in which the test is run shall be fitted with a reflux condenser. Fuel and specimens shall be allowed to cool for at least 24 hours. For ring specimens, three 1-inch widths shall be cut from the center portion of the 4-inch length. The adhesion shall be determined in accordance with 4.6.8. Adhesion determination on the specimens shall be made within 30 minutes after removal from the fuel.

4.6.9 Volume change. The volume change shall be determined in accordance with Federal Standard No. 601, Method 6211.

4.6.9.1 Ethylene glycol immersion. Volume change and elongation test specimens shall be immersed in a solution of 97 percent of ethylene glycol, conforming to Specification MIL-H-5559, for a period of 70 hours. The solution shall be maintained at a temperature of 141° to 149°C (285° to 300°F). After immersion, the test specimens shall be removed and cooled in fresh ethylene glycol for 30 minutes and then wiped to remove any ethylene but elongation test specimens shall be allowed to stand in air at room temperature for 4 hours ±15 minutes before elongation tests (4.6.11) are performed.

* 4.6.9.2 Oil immersion. Volume change and elongation test specimens shall be suspended in fluid conforming to Federal Specification TT-S-735, Type IV. The specimens shall remain in the oil for a period of 70 hours and oil shall be maintained at a temperature of 118° to 127°C (245° to 250°F). The container in which the test is run shall be fitted with a reflux condenser. After immersion the test specimens shall be removed and cooled in fresh oil maintained at room temperature for 30 minutes and then wiped to remove oil film from the surface. Volume change tests shall be performed immediately but elongation test specimens shall be allowed to stand in air at room temperature for 4 hours ±15 minutes before elongation tests (4.6.11) are performed.

4.6.9.3 Fuel immersion. Volume change test specimens from the tube shall be suspended in fuel conforming to Federal Specification TT-S-735 Type III, at a temperature of 21° to 27°C (70° to 80°F) for 24 hours. The specimens shall then be removed and tested within 5 minutes to determine volume increase of the specimens.

* 4.6.10 Tensile. The tensile strength shall be determined in accordance with Federal Standard No. 601, Method 4111. The dumbbell test specimens from the tube shall be suspended in fuel conforming to Federal Specification TT-S-735, Type III, at a temperature of 21° to 27° (70° to 80°F) for 48 hours. The specimens shall be removed and tested within 5 minutes to determine volume increase, tensile strength and elongation of the specimens. All tensile calculations shall be based on the original cross-sectional area of the test specimens.

4.6.11 Elongation. Ultimate elongation determinations shall be determined on dumbbell specimens in accordance with Federal Standard No. 601, Method 4121 and as specified herein.

4.6.12 Crush resistance. Crush test specimens shall consist of a section of hose 3 inches long that have been subjected to 200 hours high temperature ethylene-glycol circulation tests. The specimens shall be allowed to cool at room temperature for at least 4 hours before crush tests. The force shall be applied at the rate of speed of 1 inch per minute. The inside diameter 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 has been applied.

* 4.6.13 Water and alcohol resistance. The tensile loss of the tube in 50 percent alcohol, Specification O-E-760, Grade IV and 50 percent water at a temperature of 70°C (158°F) for 24 hours under reflux shall not exceed 35 percent. The samples shall be tested as outlined in Federal Standard No. 601, Method 4111, except the tensile strength shall be taken within 15 minutes after removal from the solution. The tensile strength calculations shall be based upon the original cross-sectional area of the test specimens.

* 5. PACKAGING

5.1 Preservation-packaging. Preservation and packaging shall be Level A, B, or C in accordance with MIL-H-775.

5.2 Packing. Packing shall be Level A, B, or C in accordance with MIL-H-775 as specified (see 6.2).

5.3 Marking. In addition to any special marking required by the contract or order, unit packages, intermediate packages, and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

6.1 Intended use. The hose covered by this specification is intended for use in fuel, oil, coolant, water, and alcohol lines in engine installations. This hose has a tendency to collapse if used in lengths over 18 inches.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(b) Size and quantity of hose.

(c) Length of hose when lengths of more than 10 feet are procured.

(d) Selection of applicable levels of packaging and packing (see 5.2 and 5.3).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order for the products covered by this specification. The activity responsible for the Qualified Products List is the Department of the Air Force, San Antonio ALC/MMRICC, Kelly Air Force Base, TX 78241 and information pertaining to qualification of products may be obtained from that activity.

6.4 Age definition. Inasmuch as 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.

* 6.5 Definitive specification part number. The specification part number is a definitive part number which will be formulated to identify each item covered by this specification. The part number will be formulated by selecting from the requirements options available in this specification as follows:

M XXXX H XXXXX

- XXXXX: Length in inches (for lengths under 10 inches use 09, 08, etc).
- XXXXX: Length in feet (for lengths under 10 feet, use 009, 008, 007, 006, 005, 004, 003, 002, and 001).
- H: Size "H" is equal to 1 inch nominal inside diameter of the hose.
- XXXX: Specification number. Does not include the revision letter or activity symbol.
- M: M prefix - An item defined by inch-pound (US) units.

Example P/N: M6000-H-00610, 1" ID, 6 Feet 10 inches in length.

* 6.5.1 Diameters.

Table II Hose diameters.

Size Code	Nominal inside diameter (inches)	Outside diameter (Inches) Minimum	Maximum
A	1/4	9/16	5/8
B	5/16	5/8	11/16
C	3/8	11/16	3/4
D	1/2	13/16	7/8
E	5/8	15/16	1
F	3/4	1-1/16	1-1/8
G	7/8	1-3/16	1-1/4
H	1	1-5/16	1-3/8
J	1-1/4	1-5/8	1-3/4
K	1-1/2	1-7/8	2
L	1-3/4	2-1/8	2-1/4
M	2	2-3/8	2-1/2
N	2-1/2	2-7/8	3
P	3	3-3/8	3-1/2
Q	3-1/2	3-15/16	4-1/16
R	4	4-7/16	4-9/16

6.6 Changes from previous issue. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. 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 and relationship to the last previous issue.

Custodians:
Army - ME
Navy - AS
Air Force - 99

User activities:
Army - MI, AR

Review activities:
Army - EA
DSC - CS

Preparing activity:
Air Force - 99

Project No. 4720-0148

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional

b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional

c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional

8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

PREVIOUS EDITION IS OBSOLETE.