

MIL-H-62028A
 8 December 1987
SUPERSEDING
 MIL-H-62028(MO)
 1 September 1965

MILITARY SPECIFICATION

HOSE, AIR DUCT: HIGH-TEMPERATURE,
 FLEXIBLE, REINFORCED

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

1. SCOPE

1.1 Scope. This specification covers reinforced flexible hose used for transferring heat to crew compartments and preheating engine compartments, oil pans, batteries, fuel and coolant lines, and other components to assist in starting engines under extreme cold weather conditions.

1.2 Classification. The hose shall be classified as follows (see 6.2).

* 1.2.1 Types.

<u>Type</u>	<u>Working pressure</u>
I	Minus 5 to plus 5 pounds per square inch (psi)
II	Minus 5 to plus 16 psi.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A

FSC 4720

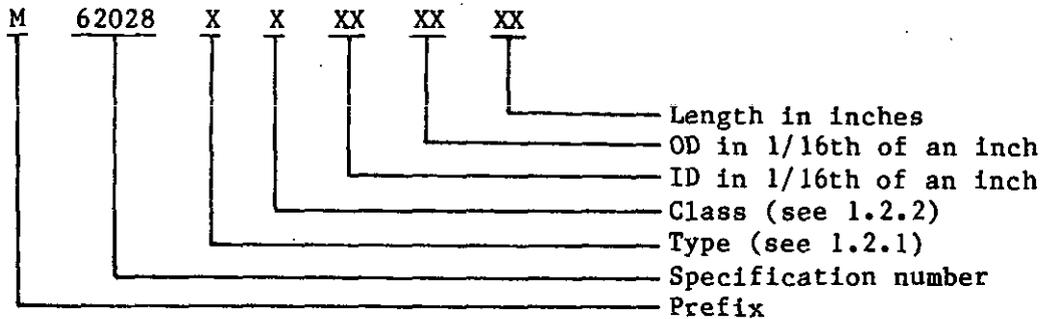
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1.2.2 Classes.

<u>Class</u>	<u>Operating temperature range</u>
1	Minus 65 degrees Fahrenheit (°F) to plus 300°F.
2	Minus 65°F to plus 450°F.
3	Minus 65°F to plus 600°F.

* 1.2.3 Part number. For items without a previously assigned part number, the part number shall be constructed as follows:



Example: M6202823162472

Signifies: type II, class 3, 1-inch ID, 1 1/2-inch OD, 72 inches in length.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specification and standards. The following specification and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATION
MILITARY

MIL-F-13927 - Fungus Resistance Test; Automotive Components.

STANDARDS
MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
 MIL-STD-130 - Identification Marking for US Military Property.
 MIL-STD-45662 - Calibration Systems Requirements.

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(Copies of specifications and standards required by the contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D380	- Rubber Hose.
ASTM D2000	- Rubber Products in Automotive Applications.

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

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The hose furnished under this specification shall be a product which is authorized by the qualifying activity for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.4 and 6.3).

* 3.2 Materials. The materials shall be as specified herein and in referenced documents. The materials shall be uniform in quality and free of defects and imperfections that might affect the serviceability and reliability of the finished product. All materials which are not specifically described herein shall be of the highest quality and suitable for the purpose intended (see 4.8.1).

* 3.2.1 Recycled, virgin, and reclaimed materials. There are no requirements for the exclusive use of virgin materials. The use of recycled or reclaimed (recovered) materials is acceptable provided that all other requirements of this specification are met (see 6.4.1).

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3.3 Design and construction.

* 3.3.1 Configuration. The configuration of the hose shall be as specified on the applicable drawing (see 4.8.2 and 6.2).

3.3.2 Construction. The hose shall be constructed of a smooth bore tube of flexible material, a wire reinforcement, and an outer cover (see 4.8.2).

3.4 Performance.

3.4.1 Leakage. When tested as specified in 4.8.3, the hose shall not leak more than 0.02 cubic foot of air per minute, per inch of inside diameter (ID), per foot length, at the maximum working pressure specified in table I for the applicable type.

3.4.2 Burst pressure. The hose shall withstand the burst pressure specified in table I for the applicable type without rupturing (see 4.8.4).

TABLE I. Pressure requirements.

*

Type	ID (inches)	Working pressure (psi)	Proof pressure (psi)	Burst pressure (psi)
I	3 $\frac{1}{2}$	minus 5 to 5	10	20
II	3	minus 5 to 16	32	64

$\frac{1}{2}$ Use 3-inch hose for test purposes for both types.

3.4.3 Vacuum resistance. When tested as specified in 4.8.5, the outside diameter (OD) of the hose shall not be reduced more than 5 percent and the inner tube shall not collapse or separate from the balance of the hose structure.

3.4.4 Flexibility. When tested as specified in 4.8.6, the hose shall not permanently kink, flatten, fracture, or deform.

3.4.5 Collapsing resistance. When tested as specified in 4.8.7, the OD of the hose shall not permanently set, distort, or deform more than 5 percent.

3.4.6 High-temperature resistance. When tested as specified in 4.8.8, the hose shall show no brittleness, cracks, or breaks and shall subsequently meet the requirements of 3.4.1 and 3.4.2.

3.4.7 Low-temperature resistance. When tested as specified in 4.8.9, the hose shall show no delamination, cracks, or deterioration and shall subsequently meet the requirements of 3.4.1 and 3.4.2.

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3.4.8 Vibration resistance. When tested as specified in 4.8.10, the hose shall show no delamination, cracks, or breaks and shall subsequently meet the requirements of 3.4.1 and 3.4.2.

3.4.9 Fungus resistance. After being tested as specified in 4.8.11, the hose shall meet the requirements of 3.4.1 and 3.4.2.

3.4.10 Ozone resistance. When tested as specified in 4.8.12, the hose shall show no cracks or breaks.

* 3.5 Identification marking. Identification marking shall be in accordance with MIL-STD-130 and shall include the following information marked on the exterior of the hose (see 4.8.2):

Manufacturer's Brand or Firm Name, or CAGE Number
Part Number
Date of Manufacture (Quarter and Year)

3.6 Date of manufacture. The hose shall not be more than 6 months old when submitted for acceptance (see 4.8.2).

3.7 Workmanship. Workmanship shall be such as to produce a finished product that is clean and free from blisters, pits, cracks, or any other defect that will affect its life, serviceability, or appearance. Workmanship shall be such as to ensure that the finished product is in conformance to this specification (see 4.8.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform or witness any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

* 4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 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 assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

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* 4.1.2 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment must be capable of repetitive measurements to an accuracy of 10 percent of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662.

* 4.2 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

- a. Air temperature $77 \pm 10^{\circ}\text{F}$.
- b. Barometric pressure 28.5 ± 2 inches mercury.
- 3
- c. Relative humidity 50 ± 30 percent.

* 4.3 Classification of inspections:

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspections (see 4.5).
 - (1) Examination (see 4.5.2).
 - (2) Acceptance tests (see 4.5.3).
- c. Control tests (see 4.6).

4.4 Qualification inspection. A qualification sample of nine hose samples (see 3.1) shall be submitted for qualification inspection. These shall be samples of the units proposed to be furnished under the contract. Qualification inspection shall be conducted by the Government at a place designated by the Government and shall consist of examination for the defects specified in table III and testing as specified in table II in the order listed.

4.4.1 Failure. Failure of any qualification sample to pass any of the examinations or tests specified herein may be cause, at the option of the Government, for refusal to conduct additional testing until the faults revealed by the test have been corrected.

TABLE II. Test schedule.

Sample no.	Paragraph no.	Test	Quali- fication	Accept- tance	Control
1	4.8.6	Flexibility	X	X	
	4.8.7	Collapsing resistance	X	X	X
2	4.8.9	Low temperature resistance	X		
	4.8.3	Leakage	X	X	
	4.8.4	Burst pressure	X	X	

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TABLE II. Test schedule - Continued.

Sample no.	Paragraph no.	Test	Quali- fication	Accept- tance	Control
3	4.8.8	High temperature resistance	X		
	4.8.3	Leakage	X		
	4.8.4	Burst pressure	X		
4	4.8.5	Vacuum resistance	X		X
5	4.8.10	Vibration resistance	X		
	4.8.3	Leakage	X		
	4.8.4	Burst pressure	X		
6,7,8	4.8.11	Fungus resistance	X		
	4.8.3	Leakage	X		
	4.8.4	Burst pressure	X		
9	4.8.12	Ozone resistance	X		

4.5 Quality conformance inspections.4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the hose of one type and part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

4.5.1.2 Sampling for examination. Samples for quality conformance examination shall be selected in accordance with general inspection level II of MIL-STD-105.

4.5.1.3 Sampling for acceptance tests. Samples for quality conformance acceptance tests shall be selected in accordance with general inspection level II of MIL-STD-105.

4.5.2 Examination.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL).

<u>Classification</u>	<u>AQL</u>
Major	1.0
Minor	2.5

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table III.

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TABLE III. Classification of defects.

Category	Defect	Method of examination
Critical	None	
<u>Major</u>	<u>AQL 1.0% Defective</u>	
101	Patch or spot, blistered or loose (see 3.2).	Visual
102	Dimensions affecting interchangeability, out of tolerance (see 3.3.1).	SIE <u>1/</u>
103	Ply distribution, improper (see 3.3.2).	Visual
104	Wire, showing through cover (see 3.3.2).	Visual
105	Cover, separated from carcass (see 3.3.2).	Visual
106	Identification marking, missing or improper (see 3.5).	Visual
107	Date of manufacture, not meeting age requirement (see 3.6).	Visual
108	Workmanship, faulty affecting performance (see 3.7).	Visual
<u>Minor</u>	<u>AQL 2.5% Defective</u>	
201	Dimensions not affecting interchangeability, out of tolerance (see 3.3.1).	SIE
202	Ramp in contour, out of round (see 3.3.1).	SIE
203	Surface depression, out of tolerance (see 3.3.1).	SIE
204	Surface, rough or wrinkled (see 3.3.2).	Visual
205	Workmanship, faulty affecting appearance (see 3.7).	Visual

1/ SIE = Standard Inspection Equipment.

4.5.3 Acceptance tests. Samples selected in accordance with 4.5.1.3 shall be subjected to the acceptance tests specified in table II, and shall conform to an AQL of 6.5.

4.6 Control tests. Control tests shall be conducted on 5 from each 5000 units consecutively produced, except that not more than 10 shall be selected in any 30-day period. The samples shall be identified as to production period, examined for the defects specified in table III, and subjected to the control tests specified in table II.

4.7 Failure. Failure of any sample to pass any of the specified quality conformance or control tests shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government.

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4.8 Methods of inspection.

* 4.8.1 Materials. Conformance to 3.2 shall be determined by inspection of contractor records providing proof or certification that materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

* 4.8.2 Defects. Conformance to 3.3.1, 3.3.2, 3.5, 3.6, and 3.7 shall be determined by examination for the defects listed in table III. Examination shall be visual, tactile, or by measurement with SIE.

4.8.3 Leakage. To determine conformance to 3.4.1, the hose shall be pressurized with air to the maximum working pressure specified in table I for the applicable type for a period of 1 minute. The leakage rate through the hose wall shall be measured and recorded.

* 4.8.4 Burst pressure. To determine conformance to 3.4.2, the hose shall be tested in accordance with ASTM D380, at the burst pressure specified in table I for the applicable type.

4.8.5 Vacuum resistance. To determine conformance to 3.4.3, a 36-inch length of hose shall be assembled with end couplings. One end shall be closed in such a manner as to prevent leakage of air, and the other end shall be connected to a vacuum pump. The OD of the hose shall be measured and recorded. The hose shall then be subjected to a vacuum of 10 inches of mercury while curved to a radius equal to 5 times the OD of the hose. After a period of 5 minutes and with the vacuum maintained, the OD of the hose shall be measured and the hose examined.

4.8.6 Flexibility. To determine conformance to 3.4.4, the hose shall be marked at four points spaced 90 degrees apart around the external perimeter. The hose shall then be bent successively on each of the four marked points for 180 degrees around a rigid cylinder with a diameter equal to the ID of the hose. The hose shall then be examined.

4.8.7 Collapsing resistance. To determine conformance to 3.4.5, the OD of the hose shall be measured and recorded. Any 6-inch longitudinal section in a 36-inch test specimen shall be subjected to a load of 50 pounds applied in 15 seconds for a period of 5 minutes. The load shall then be removed and the OD of the hose shall be measured.

4.8.8 High-temperature resistance. To determine conformance to 3.4.6, the hose shall be subjected to an internal flow of air at the maximum temperature specified in 1.2.2 for the applicable class. The air flow shall be maintained for a period of 72 hours with the ambient temperature at room temperature. The hose shall then be examined and subsequently tested as specified in 4.8.3 and 4.8.4.

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4.8.9 Low-temperature resistance. To determine conformance to 3.4.7, the hose shall be tested in accordance with ASTM D380 at minus 65°F. The hose shall then be examined and subsequently tested as specified in 4.8.3 and 4.8.4.

4.8.10 Vibration resistance. To determine conformance to 3.4.8, the hose shall be vibrated with a constant applied double amplitude of 0.060 inch, with the frequency cycling between 10 and 55 cycles per second in 1-minute cycles. The vibration shall be parallel to the hose axis for 50 hours, and then perpendicular to the hose axis for another 50 hours. The hose shall then be examined and subsequently tested as specified in 4.8.3 and 4.8.4.

4.8.11 Fungus resistance. To determine conformance to 3.4.9, the hose shall be tested in accordance with MIL-F-13927, class 3, method A; sample no. 6 for 30 days, sample no. 7 for 60 days, and sample no. 8 for 90 days, and upon completion of 90 days, sample no. 8 shall be tested as specified in 4.8.3 and 4.8.4.

* 4.8.12 Ozone resistance. To determine conformance to 3.4.10, the hose shall be tested in accordance with ASTM D2000. The hose shall then be examined.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging requirements specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. The hose covered by this specification is intended for use in heat-transfer applications in military vehicles.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and class of hose required (see 1.2).
- c. Applicable drawing number, title, and date (see 3.3.1) or part number (see 1.2.3).
- d. If responsibility for inspection shall be other than as specified (see 4.1).
- e. If responsibility for inspection equipment shall be other than as specified (see 4.1.2).
- f. If inspection conditions shall be other than as specified (see 4.2).
- g. Selection of applicable level, and packaging requirements (see 5.1).

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* 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 the applicable Qualified Products List whether or not such products have actually been so listed by the date. The attention of the contractors is called to this requirement, 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. The activity responsible for the Qualified Products List is US Army Tank-Automotive Command, Warren, Michigan 48397-5000 and information pertaining to qualification of products may be obtained from that activity.

* 6.4 Definitions.

* 6.4.1 Recovered materials. "Recovered materials" means materials that have been collected or recovered from solid waste (see 6.4.2).

* 6.4.2 Solid waste. "Solid waste" means (a) any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and (b) other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. It does not include solid or dissolved material in domestic sewage, or solid or dissolved material in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Clean Water Act, (33 U.S.C. 1342 et seq.), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) (Source: Federal Acquisition Regulations, section 23.402).

* 6.5 Subject term (key word) listing.

Air duct
Heat transfer
Hose

* 6.6 Changes from previous issue. The margins of this specification are marked with asterisks 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.

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Custodians:
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AF - 99

Preparing activity:
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(Project 4720-0763)

Review activities:
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1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)* VENDOR USER MANUFACTURER OTHER *(Specify):* _____b. ADDRESS *(Street, City, State, ZIP Code)*

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)* – Optionalb. WORK TELEPHONE NUMBER *(Include Area Code)* – Optionalc. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional8. DATE OF SUBMISSION *(YYMMDD)*