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SUPERSEDING
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FEDERAL SPECIFICATION

HOSE, METAL (FLEXIBLE, ALUMINUM ALLOY, AND
CORROSION-RESISTANT AND HEAT-RESISTANT STEEL)

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers flexible metal hose.

* 1.2 Classification.

1.2.1 Types and Classes. The metal hose shall be of the following classes, types and composition, as specified (see 6.2).

Class 1 - Aluminum Alloy
Type I - Unpacked

Class 2 - Corrosion - Resistant and Heat-Resistant Steel
Type I - Unpacked
Type II - Copper-Wire Packed

Composition A - Austenitic, Corrosion - resistant steel,
nonheat-treatable

Composition B - Martensitic, corrosion - resistant steel,
heat-treatable

Composition C - Ferritic, corrosion - resistant steel

AMSC N/A

FSC 4720

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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2. APPLICABLE DOCUMENTS.

* 2.1 Government publications. The issues of the following documents, in effect on date of invitation for bids or solicitation for offers, form a part of this specification to the extent specified herein.

Federal Specifications

QQ-A-250/2	Aluminum Alloy 3003, Plate and Sheet
QQ-S-766	Steel Plates, Sheets, and Strip - Corrosion Resisting
PPP-B-601	Boxes, Wood, Cleated Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-B-636	Boxes, Shipping, Fiberboard
PPP-B-640	Boxes, Fiberboard, Corrugated, Triple-Wall

Military Specifications

MIL-L-10547	Liner, Case, and Sheet, Overwrap; Water-Vaporproof or Waterproof, Flexible
MIL-C-52950	Crate, Wood, Open and Covered

Federal Standards

FED STD NO. 123	Marking for Shipment (Civil Agencies)
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Military Standards

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking and Waterproofing; With Appropriate Test Methods

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies.)

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under *General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions*. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

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(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

(Single copies of this specification, and other Federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Philadelphia, PA; Washington, D.C.; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Houston, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Seattle, WA.)

* 2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

Aerospace Material Specifications (AMS)

AMS 5510 - Steel Sheet, Strip, and Plate, Corrosion and Heat Resistant
(18 Cr - 10.5Ni - 0.40 Ti (SAE 30321) Solution Heat Treated

AMS 5512 - Steel Sheet, Strip and Plate, Corrosion and Heat Resistant
(18 Cr - 10.5Ni - (Cb and ta) (SAE 30347), Solution Heat Treated

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

3. REQUIREMENTS

3.1 Material.

3.1.1 Class 1. The aluminum metal hose shall be made from material conforming to QQ-A-250/2.

* 3.1.2 Class 2. The steel used in the fabrication of composition A metal hose shall conform to AMS 5510 and AMS 5512. Steel used in the fabrication of composition B metal hose shall conform to QQ-S-766, class 410. Steel used in the fabrication of composition C metal hose shall conform to QQ-S-766, class 430.

3.1.3 Packing materials.

3.1.3.1 Type II. The copper wire packing used in the construction of type II shall be of a proper size to fill the packing groove and to permit the bending diameter specified.

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3.2 Design. The hose shall be of the four-wall interlocking design made by helically coiling a continuously formed strip of the specified material. The width of the strip and the pitch of the helix shall be such as to allow the completed hose to meet the bending requirements specified herein. The hose shall not freely unravel or show loose ends when cut.

3.2.1 Thickness of strip metal. The thickness of strip metal for all sizes of metal hose which are 1 inch and larger shall be 0.012-inch minimum. The thickness of strip metal for all sizes of metal hose under 1 inch shall be 0.010-inch minimum.

3.3 Construction.

3.3.1 Type I hose. Type I hose shall be constructed as shown in figure 1.

* 3.3.2 Type II hose. Type II hose in sizes over $\frac{1}{2}$ -inch inside diameter, shall be so formed as to create a definite packing groove in the profile to hold the packing in its proper place. The hose construction shall be as shown in figure 2. For hose $\frac{1}{2}$ inch or less inside diameter, packing may be inserted without forming a definite packing groove.

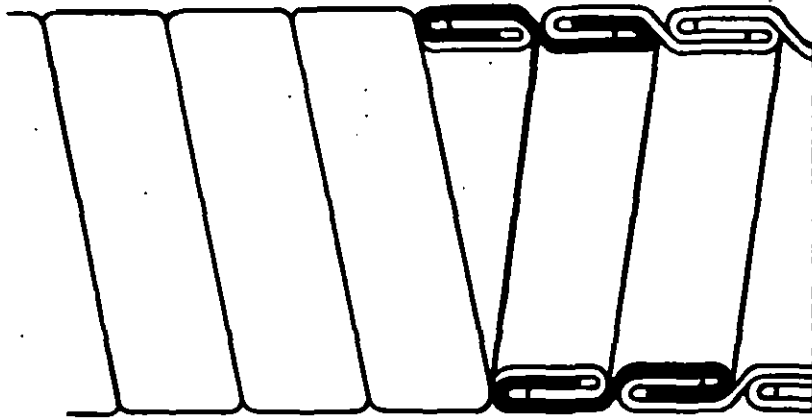


Figure 1. Type I Hose Construction

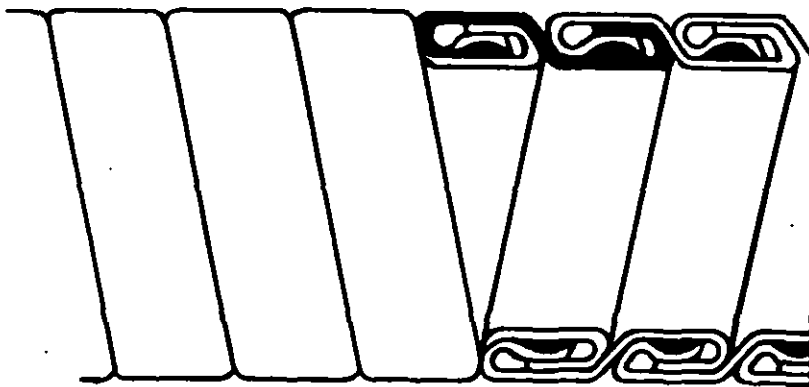


Figure 2. Type II Hose Construction

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3.4 Size and dimension.

3.4.1 Inside diameter. The inside diameter shall be as specified (see 6.2) within the tolerances specified in Table I (See 4.3.1.1).

TABLE I. Tolerances

Size inches	Tolerance			
	Inside diameter inch		Outside diameter (if specified) inch	
	Plus	Minus	Plus	Minus
2 and less	0.015	0.000	0.000	0.020
Over 2	0.020	0.000	0.000	0.030

3.4.2 Outside diameter. Unless otherwise specified (see 6.2), the outside diameter shall be the minimum at which conformance is possible with the other requirements of this specification (see 4.3.1.1).

3.4.3 Length. The hose shall be furnished in the lengths as specified (see 4.3.1.2).

3.5 Bending. The hose shall be sufficiently flexible to withstand the bending test specified in 4.5 without straining or permanent deformation of the hose.

* **3.6 Marking.** Each length of hose shall have a marking tag attached by wire at each end, providing the manufacturer's name or trademark, the size, class, type, composition, and specification number.

* **3.7 Workmanship.** Workmanship shall be of the quality necessary to produce metal hose that is free from all defects and functions properly in service.

4. QUALITY ASSURANCE PROVISIONS

* **4.1 Responsibility for inspection.** Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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

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to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

* 4.2 Lot. All hose of the same size, class, type, and composition offered to the Government under a specific contract, shall be considered a lot for purposes of inspection.

* 4.2.1 Sampling for examination. A random sample of metal hose shall be selected from each lot in accordance with MIL-STD-105 at inspection level II. The acceptable quality level shall be 4.0 percent defective units.

* 4.2.2 Sampling for tests. A random sample of metal hose shall be selected from each lot in accordance with MIL-STD-105 at inspection level S-4. The acceptable quality levels shall be based on 4.0 percent defective units.

* 4.3 Examination. Each sample selected in accordance with 4.2.1 shall be examined to verify conformance to this specification. Inspection shall be conducted as specified in Table II on the basis of percent defective. Any hose in the sample containing one or more defects shall be rejected, and if the number of defective hose in any one sample exceeds the acceptance number for the sample, the lot represented by the sample shall be rejected.

TABLE II. Classification of defects for hose in accordance with MIL-STD-105

Categories	Defects
<u>Major</u>	<u>AQL 2.0</u>
101	Material not as specified.
102	Construction not as specified.
103	Filler not as specified.
104	Shape and size not as specified.
105	Thickness of metal jacket not as specified.
<u>Minor</u>	<u>AQL 4.0</u>
201	Poor workmanship.

4.3.1 Dimensional examination. Each sample selected in accordance with 4.2.1 shall be dimensionally inspected for compliance with requirements of section 3. Samples failing to comply shall be rejected.

4.3.1.1 Diameter. The diameter shall be measured with the hose in its compressed state, without straining it to the extent that permanent deformation is produced (see 3.4).

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4.3.1.2 Length. The length shall be measured with the hose fully extended and without straining it to the extent that permanent deformation is produced (see 3.4.3).

4.4 Test methods.

4.4.1 Bending Test. Each sample selected in accordance with 4.2.2 shall be tested in accordance with 4.4.2 and any sample failing the test shall be rejected.

* 4.4.2 Representative samples. Representative samples of all sizes of Class 1, type I, Class 2, Types I and II, in sizes above $\frac{1}{2}$ -inch inside diameter, shall be bent at an angle of 180 degrees over a diameter of nine (9) times the specified inside diameter of the hose without straining or permanently deforming the walls of the hose. Class 2, type II, hose in sizes up to and including $\frac{1}{2}$ -inch inside diameter shall be tested over a diameter 12 times the specified size of the hose without straining or permanently deforming the walls of the metal hose.

4.5 Inspection of preparation for delivery. The packing and marking of the metal hose shall be inspected to determine conformance to the applicable requirements of section 5 of this specification. The packing and marking requirements of section 5 identified to referenced specifications and standards shall be inspected in accordance with the applicable requirements of these documents. The packing requirements of section 5 not identified to referenced specifications shall be examined for the defects listed in 4.5.1 in accordance with MIL-STD-105 using an AQL of 4.0 percent defective.

4.5.1 Classification of defects (Packing).Major

101	Fiberboard boxes not waterproof sealed with tape as specified.
102	Case liners missing when specified.
103	Shroud missing when specified.
104	Hose not cushioned, braced and blocked as specified.
105	Wood boxes not modified by addition of skids as specified.
106	Boxes and crates not closed and strapped as specified.
107	Flat steel strapping not zinc coated.

5. PREPARATION FOR DELIVERY.

5.1 Packing. Packing shall be level A, B, or C as specified (see 6.2).

* 5.1.1 Level A. The metal hose shall be packed in boxes conforming to PPP-B-636 (Weather-resistant), PPP-B-640 (class 2), PPP-B-621 (class 2), or PPP-B-601 (overseas type). The metal hose shall be cushioned, braced and blocked in accordance with MIL-STD-1186. Fiberboard boxes containing heat-resistant steel hose shall be waterproof sealed with tape in accordance

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with the appendix to the applicable box specification. Wood boxes containing heat-resistant steel hose shall be provided with case liners conforming to MIL-L-10547 sealed in accordance with the appendix thereto. Crates containing heat-resistant steel hose shall be shrouded in accordance with the appendix to MIL-C-52950). Wood boxes exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with the applicable box specification. Boxes and crates shall be closed and strapped in accordance with the applicable box or crate specification and the appendix thereto, except that flat steel strapping shall be type I, class B.

* 5.1.2 Level B. The metal hose shall be packed in boxes conforming to PPP-B-636 (weather-resistant), PPP-B-640 (class 2), PPP-B-621 (class 1) or PPP-B-601 (domestic type); or crates conforming to MIL-C-52950. The metal hose shall be cushioned, braced and blocked to prevent movement during shipment and storage. Boxes and crates shall be closed and strapped in accordance with the applicable box or crate specification and the appendix thereto.

5.1.3 Level C. The metal hose shall be packed to insure arrival at destination in satisfactory condition and be acceptable to the carrier of lowest rates.

5.2 Marking (see 6.2).

5.2.1 Civil agencies. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military agencies. In addition to any special marking required by the contract or order, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use.

6.1.1 Class 1. This class of metal hose is intended for air ducts or speaking tubes and other applications requiring flexible hose but not for the conveyance of liquids.

6.1.2 Class 2. This class of metal hose is intended for use with carburetor preheating systems, exhaust connections, and other applications requiring flexible metal hose with heat-resistant properties up to 1200° F.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

- a. Title, number, and date of this specification.
- b. Class, type, and composition of metal hose required (see 1.2).

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c. Specified size of tubing, either inside or outside diameter (see 3.4.1 and 3.4.2).

d. Length (hose shall be bought on a fully extended length basis, the unit being 1 foot) (see 3.4.3).

e. Selection of applicable level of packing required (see 5.1).

f. Marking required (see 5.2).

6.3 Hose in accordance with this specification is commercially available in all sizes $\frac{1}{4}$ -inch inside diameter to 8 inches inside diameter.

* 6.4 Subject term (key word) listing.

Hose, Aluminum Alloy, Flexible
Hose, Aluminum Alloy, Corrosion Resistant
Wire Packed
Wire Packed, Copper

6.5 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.

Custodian:
Army - MI

Preparing Activity:
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Review:
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