INCH-POUND

A-A-52440
March 10, 1993
SUPERSEDING
MIL-C-13909C
5 April 1976

COMMERCIAL ITEM DESCRIPTION

CONDUIT, METAL, FLEXIBLE: ELECTRICAL SHIELDED

The General Services Administration has authorized the use of this commercial item description (CID) as a replacement for MIL-C-13909C, which is canceled.

1.0 Abstract. This CID covers shielded, electrical, flexible metal conduit for use as protection of wiring in military vehicles from mechanical injury and, when properly installed and grounded, to prevent radiation that may cause interference with radio and other electronic equipment.

1.1 Classification. The conduit shall be furnished in the following types (see 5.2):

Type I - Waterproof
Type II - Non-waterproof

1.2 Grade. The conduit shall be furnished in the following grades (see 5.2):

Grade A - Double wire braid.
Grade B - Single wire braid.

2.0 Salient characteristics.

2.1 Description. The shielded, electrical, flexible, metal conduit (hereinafter referred to as conduit) consists of a core of flexible metal tubing with a covering of wire braid.

2.2 Materials. The material used shall be as specified herein. The use of recovered materials made in compliance with regulatory requirements is acceptable providing that all requirements of this commercial item description are met (see 5.6).

Beneficial comments, recommendations, additions, deletions clarifications, etc. and any other data which may improve this document should be sent by letter to: U.S. Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000.

AMSC N/A FSC 5975

2.3 Design and construction.

2.3.1 Dimensions. Conduit shall be furnished in the nominal sizes specified by the procuring activity (see 5.2), and shall conform to all dimensions shown in the applicable drawings.

2.3.2 Lengths. Conduit shall be furnished in the lengths specified by the procuring activity (see 5.2). When random lengths are specified, no less than 80 percent of the lengths shall be a minimum of 10 feet (ft) [304.8 centimeters (cm)] and no lengths shall be less than 6 ft (182.8 cm). All lengths shall be continuous and unspliced.

2.3.3 Ends.

2.3.3.1 Assemblies. When furnished with fittings, the ends of each length of conduit shall be cut squarely and shall be free of burrs and sharp edges. Fittings shall be soldered to the conduit as indicated in the applicable engineering part drawing. Unless otherwise specified in the engineering part drawing, conduit fittings and thread sizes for the corresponding nominal conduit inside diameter (I.D.) shall be as specified in the applicable drawing (see 5.2).

TABLE I. Conduit assembly nominal inside diameter (I.D.) for corresponding fitting size.

Nominal I.D. of conduit		Fittings and thread sizes
inches(in)	millimeters (mm)	
1/4	6.350	3/4 - 20
9/32	7.137	3/4 - 20
5/16	7.925	3/4 - 20
3/8	9.525	3/4 - 20
1/2	12.700	3/4 - 20
5/8	5.875	1 3/16 - 18
3/4	19.050	1 3/16 - 18
1 inch	25.400	1 3/16 - 18
Over 1 inch	Over 25.4 mm	as specified

2.3.3.2 Bulk. When not furnished with fittings, the ends of each length shall be cut squarely, shall be protected with either a removable spot-soldered ferrule or flushed with soft solder to a length of not more than 1/2 in (12.7 mm), and covered with seizing or tape to prevent unraveling of the braid.

2.3.4 Tubing. Tubing of type I conduit shall be of a corrugated or convoluted interlocking construction. Tubing of type II conduit shall be of a strip-wound, interlocked construction.

2.3.4.1 Interior. Interior of the tubing shall be free of any obstructions, protruding sharp edges, or burrs.

2.3.5 Braid. Grade A conduit shall have double wire braid covering and grade B conduit shall have single wire braid covering the tubing. The under layer of braid for grade A conduit may be constructed of flat ribbon wire. The outer layer of Grade A conduit braid shall provide no less than 95 percent coverage, and the outer layer of Grade B conduit braid shall provide no less than 85 percent coverage of the underlying components (see 5.5).

2.3.5.1 Carriers and wires. Each carrier of the outer layer of braid shall have no less than four parallel copper alloy or tinned copper wires, from .0075 to .016 in (.191 mm to .406 mm) O.D., with a minimum carrier width of 1/16 in (1.588 mm). Carrier shall be continuous throughout the entire length of the braid with no breaks and no splices other than splicing of individual wires. Splices shall cause no rough or sharp projection in the braid, and there shall be no more than 1 such splice in any 2 foot (60.960 cm) length of conduit. All loose ends of braid wire shall be trimmed.

2.3.5.2 Identification. Conduit, other than assembled lengths of conduit that are readily identified as part of an assembly, shall be marked with the PIN. Tracer wires, as approved by the procuring activity (see 5.2), shall be used with the regular wire of the braid to identify the manufacturer, distinguish the conduit from similar fuel and oil hose, and show the pitch of the brain.

2.4 Performance.

2.4.1 Leakage resistance. Conduit shall show no evidence of internal obstructions or damage of any kind to the tubing or the braid after being immersed in fresh water and subjected to an internal air pressure of 15 psi [103 kilopascal (kPa)] for a minimum of 5 minutes and following an interval vacuum of 6 psi for 30 minutes. Type I conduits shall show no evidence of leakage during and after this test as evidence by escape of air bubbles, by loss of volume of the bath, or by presence of water inside the specimen.

2.4.2 Flexibility. The conduit shall be capable of being bent around a mandrel (see table II) through an angle of 180 degrees (°), in about 10 seconds, while stabilized at a temperature of minus 65 degrees Fahrenheit (°F) [-54 degrees Celsius (°C)] without damage of any kind to the tubing or braiding. While bent around the mandrel, the conduit shall be allowed to return to room temperature. Type I conduit shall then be subjected to an internal hydraulic pressure of 15 psi (103 kPa) for five minutes and examined for leakage. After these tests, the conduit shall be straightened and examined for evidence of damage.

TABLE II. Mandrel diameters for flexibility tests.

Nominal inside diameter of conduit		Diameter of mandrel	
in	mm	in	mm
1/4	6.350	4	101.600
9/32	7.137	4	101.600
5/16	7.925	4	101.600
3/8	9.525	6	152.400
1/2	12.700	6	152.400
5/8	15.875	8	203.200
3/4	19.050	10	254.000
1 inch and over	25.4 mm and over	12	304.800

2.5 Environmental requirements.

2.5.1 Resistance to temperature extremes and temperature shock. The conduit shall evidence no damage after being subjected to 12 cycles of cooling and heating as specified in a. and b. following. After each cycle of cooling and heating, type I specimens shall be immediately immersed as specified in c. following and shall subsequently conform to 2.4.2.

a. Cooling. The specimens shall be cooled to a stabilized temperature of minus 65° ± 2°F (-54 ± 1°C), and maintained at minus 65° ± 2°F (-54 ± 1°C). Specimen shall be bent around a mandrel in the manner specified in 2.4.2.

b. Heating. Each cooled specimen (see a) shall be heated to a stabilized temperature of 200°F ± 2°F (93 ± 1°C), and maintained at that temperature for a period of not less than one hour.

c. Immersion. Each heated type I specimen (see b) shall be immersed in a fresh water bath maintained at a temperature of 77° ± 15°F (25 ± 8.5°C), and allowed to remain underwater for a period of 15 minutes. At the end of the 4th, 8th, and 12th cycles, and while still immersed in the fresh water bath, each specimen of type I conduit shall be subject to the leakage test specified in 2.4.1.

2.5.2 Corrosion resistance. The conduit shall evidence no corrosion affecting mechanical or electrical properties after being subjected to a salt spray test in accordance with ASTM B117 for 100 hours and shall subsequently conform to 2.4.1 and 2.4.2.

2.6 Identification and markings. Identification and marking for bulk conduits and conduit assemblies shall be permanent and legible. Tracer wires shall be used with the regular wire or braid to identify the manufacturer, distinguish the (electrical) conduit from similar fuel and oil hose, and show the pitch of the braid.

2.6.1 Bulk conduit. Bulk conduit, in addition to 2.6, shall be identified and marked with the PIN (see table III, 5.2, and 5.3), and the national stock number (NSN).

TABLE III. Bulk conduit dash number (no.) for association nominal conduit I.D. in inches.

Bulk conduit PIN dash no.	Nominal I.D. of conduit	
	in	mm
1	1/4	6.350
2	9/32	7.137
3	5/16	7.925
4	3/8	9.525
5	1/2	12.700
6	5/8	15.875
7	3/4	19.050
8	1 inch	25.4
1/	Over 1 inch	Over 25.4

1/ PIN dash no. shall be the same as the nominal I.D. of the conduit.

2.6.2 Conduit assemblies. Conduit assemblies, in addition to 2.6, shall be identified and marked in accordance with the engineering drawing part no., fitting and thread sizes (see table I), and NSN.

2.7 Workmanship. The workmanship shall be such as to produce finished conduits that are free of cracks or porosity in coating. Surfaces shall be smooth and free of burrs, blisters, and abrasions.

3.0 Quality assurance provisions.

3.1 Responsibility for inspection. The contractor is responsible for the performance of all inspections (examinations and tests).

3.2 Contractor certification. The contractor shall certify and maintain substantiating evidence that the product offered meets the salient characteristics of this commercial item description and that the product conforms to the producer's own drawings, specifications, standards, and quality assurance practices. Items with known defects shall not be submitted for Government acceptance. The Government reserves the right to require proof of such conformance prior to the first delivery and thereafter as may be otherwise provided for under the provisions of the contract.

4.0 Preservation, packaging, packing, labeling, and marking. Preservation, packaging, packing, labeling, and marking for the desired level shall be as specified in the contract (see 5.2).

5.0 Notes.

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

5.1 Addresses for obtaining copies of referenced documents.

5.1.1 Non-Government publications. Copies of ASTM B117 "Standard Test Method of Salt Spray (Fog) Testing", are available from the American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.

5.2 Ordering data. Acquisition documents must specify the following:

a. Title, number, and date of this commercial item description.
b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 5.1).
c. Title, number and revision letter of the applicable engineering drawing.
d. Type and grade of conduit to be furnished (see 1.1 and 1.2).
e. Dimensional requirements (see 2.3.1).
f. Bulk conduit lengths required and PIN (see 2.3.2, 2.6.1, and 5.3).
g. Thread size of fittings for conduit over 1 inch (see 2.3.3.1).
h. Tracer wires required for identification (see 2.3.5.2).
i. Engineering drawing part number for conduit assemblies (see 2.6).
j. Applicable level of preservation, packaging, packing, and marking (see 4.0).
k. Special marking, if required.

5.3 CID based part identification number. The PINs to be used for bulk conduit acquired to this CID are created as follows:

A 52440 - X X - X

- Bulk conduit PIN dash no. (see table III)
- Grade:
  - A - Double wire braid
  - B - Single wire braid
- Type:
  - 1 - Type I - Waterproof
  - 2 - Type II - Nonwaterproof
- CID number.
- CID designation.

5.4 Cross reference. This commercial item description is interchangeable/ substitutable with conduit, conforming to MIL-C-13909C, dated 5 April 1976.

5.5 Braid coverage. Coverage of the shielding (see 2.3.5) will be calculated as follows:

$$\text{Percent coverage} = (2F - F^2) \times 100$$

$$\text{When } F = \frac{N \times D}{P \times \text{Cos angle of advance}}$$

N = Number of parallel wires between successive turns of a selected marker wire plus the selected wire.
D = Diameter of a single wire.

Angle of advance = Angle whose tangent is P/C.

P = Pitch of braid measured along the axis of the conduit.
C = (Outside diameter of conduit - 2D) X 3.1416.

5.6 Regulatory requirements. The offeror/contractor is encouraged to use recovered materials in accordance with Public Law 94-580 to the maximum extent practicable.

5.7 Metric product. Conduits that are manufactured to metric dimensions will be considered on the following basis:

a. Products manufactured to metric dimensions will be considered on an equal basis with those manufactured using inch-pound units, provided they fall within specified tolerances using conversion tables contained in the latest revision of Federal Standard No. 376, and all other requirements of this CID are met.

b. If a product is manufactured to metric dimensions and those dimensions exceed the tolerances specified in the inch-pound units, a request should be made to the contracting officer to determine if the product is acceptable.

c. The contracting officer has the option of accepting or rejecting the product.

MILITARY INTERESTS:

Custodians
Army - AT
Navy - AS
Air Force - 85

Review Activities
Army - AR, EA
Air Force - 99
DLA - GS

CIVIL AGENCY COORDINATING ACTIVITIES:
GSA - FSS

PREPARING ACTIVITY:
Army - AT

(Project 5975-1108)