Designation: D 922 – 00a

An American National Standard

Standard Specification for Nonrigid Vinyl Chloride Polymer Tubing[1]

This standard is issued under the fixed designation D 922; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers nonrigid tubing of vinyl chloride polymer or its copolymers with other materials for use in electrical insulation in three grades, as follows:

1.1.1 *Grade A*—General-purpose.

1.1.2 *Grade B*—Low-temperature.

1.1.3 *Grade C*—High-temperature.

NOTE 1—This standard is similar but not identical to IEC 60684-3-100 to -105.

2. Referenced Documents

2.1 *ASTM Standards:*

D 876 Test Methods for Nonrigid Vinyl Chloride Polymer Tubing Used for Electrical Insulation[2]

D 1711 Terminology Relating to Electrical Insulation[2]

D 3636 Practice for Sampling and Judging Quality of Solid Electrical Insulating Materials[3]

E 176 Terminology of Fire Standards[4]

2.2 *IEC Standards:*

IEC-60684-3-100 to -105 Flexible insulating sleeving, Part 3, Sheets 100 to 105: Extruded PVC sleeving[5]

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions pertaining to electrical insulation, refer to Terminology D 1711.

3.1.2 For definitions pertaining to fire standards, refer to Terminology E 176.

4. Ordering Information

4.1 Orders for material covered by this specification shall include the following:

4.1.1 Grade of tubing,

4.1.2 Size and color,

4.1.3 Total length in feet (or metres),

4.1.4 Length of cut pieces in inches (or centimetres), if any, and

4.1.5 Amount of tubing on each spool or in each coil, if not standard packaging with the supplier.

5. Color

5.1 Clear transparent, black, white, yellow, green, blue, and red shall be considered standard colors. Other colors shall be considered special. The color desired shall be specified in the purchase order.

6. Dimensional Requirements

6.1 *Inside Diameter*—The inside diameter of the tubing shall conform to the requirements prescribed in Table 1 or Table 2.

6.2 *Wall Thickness*—The wall thickness of the tubing shall conform to the requirements prescribed in Table 1 or Table 2.

6.3 *Commercial Lengths*—The tubing shall be supplied in continuous lengths.

7. Workmanship, Finish, and Appearance

7.1 The surface shall be smooth, free of blisters, cracks, or any other defects that may detrimentally affect its suitability for the service intended. It shall not be subject to peeling, scaling, or flaking.

8. Physical and Electrical Requirements

8.1 Tubing shall conform to the following requirements for physical and electrical properties:

8.1.1 *Flammability*—The average duration of burning shall not exceed 15 s and the paper indicator shall show no evidence of being affected.

8.1.2 *Tensile Strength*—The average tensile strength shall be not less than 2000 psi (15 MPa) for Grades A and C, and not less than 1800 psi (13 MPa) for Grade B. The average ultimate elongation shall be not less than 200 % for Grades A and C and not less than 250 % for Grade B.

8.1.3 *Effect of Elevated Temperatures*— When Method A is used, the average loss of ultimate elongation after exposure to elevated temperatures shall be not greater than 35 % for Grades

[1] This specification is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D 09.07 on Flexible and Rigid Insulating Materials.

Current edition approved Sept. 10, 2000. Published November 2000. Originally published as D 922 – 47 T. Last previous edition D 922 – 00.

[2] *Annual Book of ASTM Standards*, Vol 10.01.

[3] *Annual Book of ASTM Standards*, Vol 10.02.

[4] *Annual Book of ASTM Standards*, Vol 04.07.

[5] Available from the American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

TABLE 1 Dimensional Tolerances of Tubing[A,B]

Specified Size	Inside Diameter, in.		Wall Thickness	
	max	min	Wall Thickness, in.	Tolerances, plus or minus, in.
No. 24 (0.022 in.)	0.027	0.020	0.012	0.002
No. 22 (0.027 in.)	0.032	0.025	0.012	0.002
No. 20 (0.034 in.)	0.039	0.032	0.016	0.003
No. 18 (0.042 in.)	0.049	0.040	0.016	0.003
No. 16 (0.053 in.)	0.061	0.051	0.016	0.003
No. 14 (0.066 in.)	0.074	0.064	0.016	0.003
No. 12 (0.085 in.)	0.091	0.081	0.016	0.003
No. 11 (0.095 in.)	0.101	0.091	0.016	0.003
No. 10 (0.106 in.)	0.112	0.102	0.016	0.003
No. 9 (0.118 in.)	0.124	0.114	0.020	0.003
No. 8 (0.133 in.)	0.141	0.129	0.020	0.003
No. 7 (0.148 in.)	0.158	0.144	0.020	0.003
No. 6 (0.166 in.)	0.178	0.162	0.020	0.003
No. 5 (0.186 in.)	0.198	0.182	0.020	0.003
No. 4 (0.208 in.)	0.224	0.204	0.020	0.003
No. 3 (0.234 in.)	0.249	0.229	0.020	0.003
No. 2 (0.263 in.)	0.278	0.258	0.020	0.003
No. 1 (0.294 in.)	0.311	0.289	0.020	0.003
No. 0 (0.330 in.)	0.347	0.325	0.020	0.003
5/16 in.	0.334	0.312	0.025	0.003
3/8 in.	0.399	0.375	0.025	0.003
7/16 in.	0.462	0.438	0.025	0.003
1/2 in.	0.524	0.500	0.025	0.003
5/8 in.	0.655	0.625	0.030	0.003
3/4 in.	0.786	0.750	0.035	0.005
7/8 in.	0.911	0.875	0.035	0.005
1 in.	1.036	1.000	0.035	0.005
1 1/4 in.	1.290	1.250	0.040	0.005
1 1/2 in.	1.550	1.500	0.045	0.006
1 3/4 in.	1.812	1.750	0.055	0.008
2 in.	2.070	2.000	0.060	0.010

[A] Multiply inches by 25.4 to get millimetres.
[B] For tubing sizes not listed in this table, the wall thickness of the nearest larger diameter shall apply.

A, B, and C. When Method B is used, the loss of weight after exposure to elevated temperatures shall be not greater than 15 % of the original weight for Grades A and B, and not greater than 10 % for Grade C.

8.1.4 After immersion in oil, the average ultimate elongation shall be within the following limits based on the average test value for the un-immersed tubing:

Grades A and B	+ 5 % to – 20 %
Grade C	± 20 %

8.1.5 *Brittleness Temperature*—The brittleness temperature shall be not above −30°C (−22°F) for Grade A, −55°C (−67°F) for Grade B, and −10°C (+14°F) for Grade C.

8.1.6 *Resistance to Penetration at Elevated Temperature*—The average temperature of failure shall be not less than those in Table 3.

8.1.7 *Volume Resistivity*—The volume resistivity shall be not less than 10^{12} Ω·cm for Grades A and C and not less than 10^{11} Ω·cm for Grade B.

8.1.8 *Dielectric Breakdown*—The average dielectric breakdown shall be not less than that prescribed for the corresponding wall thickness in Table 4.

8.1.9 *Dielectric Breakdown at High Humidity*—The average dielectric breakdown strength at 96 % relative humidity shall be not less than 90 % for Grade A, 75 % for Grade B, and 85 % for Grade C of the dry value obtained on test.

8.1.10 *Strain Relief*—The change in length (shrinkage) shall not exceed 18 % for sizes AWG No. 24 to No. 20, inclusive; 14 % for sizes AWG No. 18 to 10, inclusive; and 9 % for sizes AWG No. 9 to 2 in. (50 mm), inclusive.

8.1.11 *Corrosive Effect*—The resistance of the copper wire shall increase by not more than 2 %.

9. Sampling

9.1 For dimensional and visual tests, lots shall be sampled in accordance with Inspection Level II of Practice D 3636.

9.2 To determine conformity with the requirements for physical and electrical properties, lots shall be sampled in accordance with Inspection Level II. A quantity large enough to complete all of the required tests shall be selected at random from one fifth of the units sampled.

10. Test Methods

10.1 Determine the properties enumerated in this specification in accordance with Test Methods D 876.

11. Inspection

11.1 The tubing shall be inspected and tested within 3 weeks of the date of receipt by the purchaser, unless otherwise agreed upon by the purchaser and the seller.

12. Rejection

12.1 If the number of defects found in the dimensional and visual examination exceed the rejection number for AQL (acceptable quality level) = 2.5, or such levels as otherwise agreed upon the lot shall be subject to rejection at the option of the purchaser.

12.2 If the results of any test do not conform to the requirements prescribed in this specification, that test shall be repeated on two additional specimens from the same lot. If these two additional specimens fail to meet the prescribed requirements, the lot of tubing represented by that specimen may be rejected at the option of the purchaser.

13. Packaging and Package Marking

13.1 *Packaging*—All tubing shall be properly separated by size when packaged for shipment. In accordance with the best practice, all tubing shall be packaged to withstand shipment and shall be given ample protection against damage.

13.2 *Marking*—Each item of the order shall be marked with the name of the manufacturer, the total length in feet, size, and color.

14. Keywords

14.1 electrical insulation; nonrigid vinyl chloride polymer tubing