Designation: D 372 – 00

An American National Standard

Standard Specification for Flexible Treated Sleeving Used for Electrical Insulation[1]

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1. Scope

1.1 This specification covers electrical insulating sleeving suitable for use on lead wires and in connections in electrical apparatus, such as motors, transformers, and switch gears.

1.2 Materials under this specification are limited to a flexible tubular product made from a woven textile fiber base, such as cotton, rayon, nylon, or glass, thereafter impregnated, or coated, or impregnated and coated, with a suitable insulating material.

NOTE 1—This standard resembles IEC 60684-3-400 to 408 in title only. The content is significantly different.

2. Referenced Documents

2.1 *ASTM Standards:*

D 350 Test Methods for Flexible Treated Sleeving 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]

D 4088 Practice for Preparation for Shipment of Solid Electrical Insulating Materials[3]

2.2 *IEC Standard:*

IEC 60684-3 Specification for Flexible Insulating Sleeving[4]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, see Terminology D 1711.

4. Classification

4.1 Sleeving is categorized by the type of coating, base fabric material, dielectric breakdown voltage, temperature index, minimum wall thickness, and inside diameter, as follows:

4.1.1 *Type I*—A flexible treated sleeving made from organic-base fibers such as cotton, rayon, or nylon and impregnated or coated with an insulating material which can be shown by applicable experience or accepted test to have a temperature index of 105.

4.1.2 *Type II*—A flexible treated sleeving made from inorganic-base yarns such as fibrous glass and impregnated or coated with an insulating material which can be shown by applicable experience or accepted test to have a temperature index of 130.

4.1.3 *Type III*—A flexible treated sleeving made from inorganic-base yarns such as fibrous glass and impregnated or coated with an insulating material, such as poly(vinyl chloride), which can be shown by applicable experience or accepted test to have a temperature index of 105.

4.1.4 *Type IV*—A flexible treated sleeving made from inorganic-base yarns such as fibrous glass and impregnated or coated with an insulating material, such as silicone resin or polytetrafluoroethylene, which can be shown by applicable experience or accepted test to have a temperature index of 200.

4.1.5 *Type V*—A flexible treated sleeving made from inorganic-base yarns such as fibrous glass and impregnated or coated with an insulating material, such as silicone elastomer, which can be shown by experience or accepted test to have a temperature index of 200.

4.1.6 *Type VI*—A flexible treated sleeving made from inorganic-base yarns such as fibrous glass and impregnated or coated with an insulating material, such as epoxies, polyesters, or acrylics, which can be shown by experience or accepted test to have a temperature index of 155.

4.1.7 *Type VII*—A flexible treated sleeving made from inorganic-base yarns such as fibrous glass and impregnated or coated with an insulating material which can be shown by experience or accepted test to have a temperature index of 180.

4.2 Grades of sleeving are identified in terms of minimum average dielectric breakdown voltage, as shown in Table 1.

4.3 Sleeving sizes are shown in Table 2, and are based on the size of round conductors that will fit snugly into the product without distortion of the sleeving.

5. Ordering Information

5.1 Orders for sleeving shall include the following information:

5.1.1 Type and color (Sections 4 and 6),

5.1.2 Grade (Section 4),

5.1.3 Size (Table 2),

[1] This specification is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.07 on Flexible and Rigid Insulating Materials.

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

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

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

TABLE 1 Dielectric Breakdown Voltage Grade Requirements in Kilovolts

Grade	Conditioning		Types						
			1	2	3	4	5	6	7
A	C-48/23/50	min avg	7.0	7.0	8.0	7.0	8.0	7.0	7.0
		min ind	5.0	6.0	5.0	6.0	5.0	5.0	5.0
	C-96/23/93[A]	min avg	25	30	50	70	80	30	50
B	C-48/23/50	min avg	4.0	4.0	4.0	4.0	4.0	4.0	4.0
		min ind	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	C-96/23/93[A]	min avg	20	30	50	70	80	30	50
C	C-48/23/50	min avg	2.5	2.5	2.5	2.5	2.5	2.5	2.5
		min ind	1.5	1.5	1.5	1.5	1.5	1.5	1.5
C-2	C-48/23/50	min avg	1.5	1.5	1.5	1.5	1.5	1.5	1.5
		min ind	0.8	0.8	0.8	0.8	0.8	0.8	0.8

[A] Percentage of average test values found after C–48/23/50.

5.1.4 Type of put-up (coils, spools, cut lengths, and so forth),

5.1.5 Type of packing and packaging (see Practice D 4088), and

5.1.6 Marking, if other than specified in Practice D 4088.

6. General Requirements

6.1 Colors shall be as agreed upon between the purchaser and the supplier.

7. Dimensional Requirements

7.1 Sleeving shall conform to the inside diameter and wall thickness requirements shown in Table 2.

7.2 The length of product in any coil or spool shall not be less than declared. Spools or coils shall not contain more splices than are allowed in Table 3. The splices shall be minimum in length and conspicuously marked. They shall be strong enough to withstand normal handling during fabrication operations.

7.3 The length of cut pieces of sleeving shall conform to the tolerances shown in Table 4.

8. Chemical and Physical Requirements

8.1 The sleeving shall conform to the requirements for chemical, thermal, electrical, and mechanical properties shown in Table 5.

9. Number of Tests

9.1 Certain of the requirements specified, such as thermal endurance, hydrolytic stability, and effects of solvents, are considered to be related primarily to the composition of the coating rather than to the processing. The length of time required to evaluate these properties may make it impractical to use them for the purpose of lot acceptance. Therefore, the following tests are to be used for lot acceptance testing on all specimens taken (except as shown), unless otherwise agreed upon between the purchaser and the supplier:

9.1.1 Dimensions (inside diameter, wall thickness, length),

9.1.2 Color,

9.1.3 Visual examination for defects,

9.1.4 Dielectric breakdown voltage (C-48/23/50 and C-96/23/93),

9.1.5 Flammability (one specimen only),

9.1.6 Push-back resistance after heat aging (one specimen only), and

9.1.7 Flexibility after heat aging (one specimen only).

9.2 The number of specimens which are to be tested for each of these properties is specified in Test Methods D 350, unless otherwise noted.

10. Test Methods

10.1 Conditioning and testing shall be in accordance with Test Methods D 350.

NOTE 2—Table 6 contains typical values of breakdown voltage retention for compatibility of the sleeving of this specification with magnet wire.

11. Rejection and Rehearing

11.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

12. Packaging and Package Marking

12.1 Packaging, packing, and marking shall be in accordance with Practice D 4088 unless otherwise agreed upon between the purchaser and supplier.

13. Keywords

13.1 coated woven textile sleeving; electrical insulation; flexible treated sleeving

TABLE 2 Standard Sizes and Wall Thicknesses for Sleevings

Inside Diameter, in. (mm)			Minimum Wall Thickness[A], in. (mm)		
Size No.	Maximum	Minimum	Grade A	Grade B	Grade C
24	0.006 (0.15)	0.027 (0.69)	0.020 (0.51)	0.011 (0.28)	0.007 (0.18)
22	0.006 (0.15)	0.032 (0.81)	0.025 (0.64)	0.013 (0.33)	0.007 (0.18)
20	0.006 (0.15)	0.039 (0.99)	0.032 (0.81)	0.013 (0.33)	0.007 (0.18)
19	0.006 (0.15)	0.044 (1.12)	0.036 (0.91)	0.013 (0.33)	0.007 (0.18)
18	0.006 (0.15)	0.049 (1.24)	0.040 (1.02)	0.015 (0.38)	0.007 (0.18)
17	0.006 (0.15)	0.054 (1.37)	0.045 (1.14)	0.015 (0.38)	0.007 (0.18)
16	0.006 (0.15)	0.061 (1.55)	0.051 (1.30)	0.015 (0.38)	0.007 (0.18)
15	0.006 (0.15)	0.067 (1.70)	0.057 (1.45)	0.015 (0.38)	0.007 (0.18)
14	0.006 (0.15)	0.074 (1.88)	0.064 (1.63)	0.015 (0.38)	0.007 (0.18)
13	0.006 (0.15)	0.082 (2.08)	0.072 (1.83)	0.015 (0.38)	0.007 (0.18)
12	0.006 (0.15)	0.091 (2.31)	0.081 (2.06)	0.015 (0.38)	0.007 (0.18)
11	0.008 (0.20)	0.101 (2.6)	0.091 (2.31)	0.018 (0.46)	0.009 (0.23)
10	0.008 (0.20)	0.112 (2.8)	0.102 (2.6)	0.018 (0.46)	0.009 (0.23)
9	0.008 (0.20)	0.124 (3.1)	0.114 (2.9)	0.018 (0.46)	0.009 (0.23)
8	0.008 (0.20)	0.141 (3.6)	0.129 (3.3)	0.018 (0.46)	0.009 (0.23)
7	0.008 (0.20)	0.158 (4.0)	0.144 (3.7)	0.018 (0.46)	0.009 (0.23)
6	0.010 (0.25)	0.178 (4.5)	0.162 (4.1)	0.020 (0.51)	0.011 (0.28)
5	0.010 (0.25)	0.198 (5.0)	0.182 (4.6)	0.020 (0.51)	0.011 (0.28)
4	0.010 (0.25)	0.224 (5.7)	0.204 (5.2)	0.020 (0.51)	0.011 (0.28)
3	0.010 (0.25)	0.249 (6.3)	0.229 (5.8)	0.020 (0.51)	0.011 (0.28)
2	0.010 (0.25)	0.278 (7.1)	0.258 (6.6)	0.020 (0.51)	0.011 (0.28)
1	0.010 (0.25)	0.311 (7.9)	0.289 (7.3)	0.020 (0.51)	0.011 (0.28)
0	0.016 (0.41)	0.347 (8.8)	0.325 (8.3)	0.025 (0.64)	0.017 (0.43)
3/8 in.	0.016 (0.41)	0.399 (10.1)	0.375 (9.5)	0.025 (0.64)	0.017 (0.43)
7/16 in.	0.016 (0.41)	0.462 (11.7)	0.438 (11.1)	0.025 (0.64)	0.017 (0.43)
1/2 in.	0.016 (0.41)	0.524 (13.3)	0.500 (12.7)	0.025 (0.64)	0.017 (0.43)
5/8 in.	0.016 (0.41)	0.655 (16.6)	0.625 (15.9)	0.025 (0.64)	0.017 (0.43)
3/4 in.	0.016 (0.41)	0.786 (20.0)	0.750 (19.1)	0.025 (0.64)	0.017 (0.43)
7/8 in.	0.016 (0.41)	0.911 (23.1)	0.875 (22.2)	0.025 (0.64)	0.017 (0.43)
1 in.	0.016 (0.41)	1.036 (26.3)	1.000 (25.4)	0.025 (0.64)	0.017 (0.43)

[A] As agreed upon between the purchaser and the user, variations in wall thickness values may be allowed provided the electrical and mechanical properties are maintained.

TABLE 3 Number of Allowable Splices per Spool

Ft/Spool	No. of splices, max
50	2
100	3
250	4
500	7
1000	10
over 1000	[A]

[A] The number of allowable splices per spool for spools which contain over 1000 ft shall be as agreed upon between the purchaser and supplier.

TABLE 4 Cut Length Tolerances

Length of Cut, in. (mm)	Tolerance, in. (mm)
Up to 3 (76.2)	± 1/16 (± 1.59)
3 to less than 6 (152.4)	± 3/32 (± 2.38)
6 to less than 12 (304.8)	± 1/8 (± 3.17)
12 to less than 36 (914.4)	± 1/4 (± 6.35)
Over 36	+1/2 , − 0 (+12.7)

TABLE 5 Physical Requirements for All Grades

Property	Types						
	1	2	3	4	5	6	7
Brittleness temp., °C, min	...	...	−20	−10	−60	−10	−10
Flammability:							
Method A:							
Burn/glow-time, s, max	...	...	30	...	...	...	...
Cotton ignited	...	...	none	...	...	...	...
Percentage indicator burnt, max area	...	...	25	...	...	...	...
Flammability:							
Method B:							
Burn rate, s/in., min	...	45	...	45	45	45	45
Oil resistance:							
Blistering	none	none	...	none	...	...	...
Percentage swelling of wall, max	20	20	...	20	...	...	...
Solvent resistance:							
Visible effects	none	none	none	...	...	none	...
Percentage swelling of wall, max	20	20	20	...	...	20	...
Thermal endurance:							
Temp. index at 20 000 h, min (Grade A only)	105	130	105	200	200	155	180
Dielectric Breakdown Voltage:							
After push back test, straight specimens	...	...	...	...	5.0	...	...
After aging 96 h at 50°C overrated temperature	4.0	4.5	4.0	4.5	5.5	4.5	5.0

TABLE 6 Compatibility of Sleeving with Magnet Wire Insulation

Type	Grade	Method A[A]		Method B[B]	
		°C	Retention, %	°C	Retention, %
1	All	130	50	130	50
2	All	155	50	155	50
3	All	155	50	155	50
4	All	225	50	225	50
5	All	225	50	225	50
6	All	180	50	180	50
7	All	...	...	...	...

[A] Percentage retention (minimum) of breakdown voltage of twisted pairs after 672 h at temperatures shown (based on controls).

[B] Percentage retention (minimum) of breakdown voltage of twisted pairs after 72 h at temperatures shown (based on controls).