Designation: D3296 – 24

Standard Specification for FEP Resin Tube[1]

This standard is issued under the fixed designation D3296; 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.

1. Scope*

1.1 The tubing is intended for electrical, mechanical, chemical, and medical applications manufactured from extrusion resins made from the copolymer of tetrafluoroethylene and hexafluoropropylene or modified FEP resins containing no more than 2 % by weight of other fluoromonomers. This specification is for virgin material only and does not address recycled material as it is not appropriate for FEP tubing.

NOTE 1—Abbreviations are in accordance with Terminology D1600.
NOTE 2—There is no known ISO equivalent to this standard.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following safety hazards caveat pertains only to the test methods portion, Section 8, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D618 Practice for Conditioning Plastics for Testing

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics (Withdrawn 2024)[3]

D1675 Test Methods for Polytetrafluoroethylene Tubing

D2116 Specification for FEP Resin Molding and Extrusion Materials

IEEE/ASTM SI 10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

3. Terminology

3.1 *Definitions*—Definitions of terms used in this specification shall be in accordance with Terminology D883.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lot, n*—one production run or uniform blend of two or more production runs.

4. Classification

4.1 This specification provides for three types of FEP tubing differentiated by size schedules as follows:

4.1.1 *Type I*—Tubing based upon the American Wire Gage (AWG) sizes.

4.1.2 *Type II*—Tubing based upon fractional inch sizes (see Note 2).

4.1.3 *Type III*—Tubing of all other sizes, as agreed by buyer and seller. This type shall conform to the Dimensional Tolerances for FEP Tubing, as listed inTable 3.

4.2 The types are further differentiated in accordance with increasing wall thicknesses as follows:

4.2.1 *Class A*—Tubing having walls tabulated in Table 1 listed as light-weight wall.

4.2.2 *Class C*—Tubing having walls tabulated in Table 1 listed as standard wall (see Note 3).

4.2.3 *Class D*—Tubing having walls tabulated in Table 2 listed as chemical tubing.

4.2.4 *Class E*—Tubing having walls listed as heavy or conforming to the Dimensional Tolerances for FEP Tubing as listed in Table 3.

[1] This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.15 on Thermoplastic Materials (Section 20.15.12).

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

*A Summary of Changes section appears at the end of this standard

TABLE 1 Dimensions and Tolerances for Type I FEP Tubing—Dimensions, mm (in.)

AWG Size	Inside Diameter		Wall Thickness					
			Class A			Class C		
			Lightweight Wall			Standard Wall		
	min	max	nom	min	max	nom	min	max
24	0.51 (0.020)	0.69 (0.027)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.305 (0.012)	0.254 (0.010)	0.356 (0.014)
22	0.64 (0.025)	0.81 (0.032)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.305 (0.012)	0.254 (0.010)	0.356 (0.014)
20	0.81 (0.032)	1.02 (0.040)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
19	0.91 (0.036)	1.12 (0.044)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
18	1.02 (0.040)	1.25 (0.049)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
17	1.14 (0.045)	1.37 (0.054)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
16	1.30 (0.051)	1.55 (0.061)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
15	1.45 (0.057)	1.70 (0.067)	0.152 (0.006)	0.102 (0.004)	0.203 (0.008)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
14	1.63 (0.064)	1.88 (0.074)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
13	1.83 (0.072)	2.08 (0.082)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
12	2.06 (0.081)	2.31 (0.091)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
11	2.31 (0.091)	2.57 (0.101)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
10	2.59 (0.102)	2.85 (0.112)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.406 (0.016)	0.330 (0.013)	0.483 (0.019)
9	2.90 (0.114)	3.15 (0.124)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
8	3.28 (0.129)	3.58 (0.141)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
7	3.66 (0.144)	4.01 (0.158)	0.203 (0.008)	0.152 (0.006)	0.254 (0.010)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
6	4.12 (0.162)	4.52 (0.178)	0.254 (0.010)	0.178 (0.007)	0.330 (0.013)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
5	4.62 (0.182)	5.03 (0.198)	0.254 (0.010)	0.178 (0.007)	0.330 (0.013)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
4	5.18 (0.204)	5.69 (0.224)	0.254 (0.010)	0.178 (0.007)	0.330 (0.013)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
3	5.82 (0.229)	6.33 (0.249)	0.254 (0.010)	0.178 (0.007)	0.330 (0.013)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
2	6.55 (0.258)	7.06 (0.278)	0.254 (0.010)	0.178 (0.007)	0.330 (0.013)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
1	7.34 (0.289)	7.90 (0.311)	0.254 (0.010)	0.178 (0.007)	0.330 (0.013)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)
0	8.26 (0.325)	8.81 (0.347)	0.305 (0.012)	0.229 (0.009)	0.381 (0.015)	0.508 (0.020)	0.406 (0.016)	0.610 (0.024)

TABLE 2 Dimensions and Tolerances for Type II FEP Tubing—Dimensions, mm (in.)

ID Size Fractions	Class D			Class D	
	Inside Diameter			Wall Dimensions	
	nom	max	min	Thickness	Tolerances
0.79 (1/32)	0.79 (0.031)	0.89 (0.035)	0.69 (0.027)	0.41 (0.016)	±0.076 (±0.003)
1.59 (1/16)	1.59 (0.062)	1.70 (0.067)	1.45 (0.057)	0.76 (0.030)	±0.127 (±0.005)
2.38 (3/32)	2.38 (0.094)	2.51 (0.099)	2.26 (0.089)	0.76 (0.030)	±0.127 (±0.005)
3.18 (1/8)	3.18 (0.125)	3.30 (0.130)	3.05 (0.120)	0.76 (0.030)	±0.127 (±0.005)
4.76 (3/16)	4.76 (0.188)	4.90 (0.193)	4.65 (0.183)	0.76 (0.030)	±0.127 (±0.005)
6.35 (1/4)	6.35 (0.250)	6.53 (0.257)	6.17 (0.243)	0.76 (0.030)	±0.127 (±0.005)
7.94 (5/16)	7.94 (0.312)	8.13 (0.320)	7.72 (0.304)	0.76 (0.030)	±0.127 (±0.005)
9.52 (3/8)	9.52 (0.375)	9.73 (0.383)	9.32 (0.367)	0.76 (0.030)	±0.127 (±0.005)
11.11 (7/16)	11.11 (0.438)	11.38 (0.448)	10.87 (0.428)	0.76 (0.030)	±0.152 (±0.006)
12.70 (1/2)	12.70 (0.500)	12.95 (0.510)	12.45 (0.490)	0.76 (0.030)	±0.152 (±0.006)
14.29 (9/16)	14.29 (0.563)	14.58 (0.574)	14.02 (0.552)	0.76 (0.030)	±0.152 (±0.006)
15.88 (5/8)	15.88 (0.625)	16.18 (0.637)	15.57 (0.613)	0.76 (0.030)	±0.152 (±0.006)
17.46 (11/16)	17.46 (0.688)	17.78 (0.700)	17.17 (0.676)	0.81 (0.032)	±0.152 (±0.006)
19.05 (3/4)	19.05 (0.750)	19.41 (0.764)	18.69 (0.736)	1.02 (0.040)	±0.178 (±0.007)
22.23 (7/8)	22.23 (0.875)	22.63 (0.891)	21.82 (0.859)	1.14 (0.045)	±0.178 (±0.007)
25.40 (1)	25.40 (1.000)	25.91 (1.020)	24.89 (0.980)	1.27 (0.050)	±0.203 (±0.008)
31.75 (1 1/4)	31.75 (1.250)	32.26 (1.270)	31.24 (1.230)	1.27 (0.050)	±0.203 (±0.008)
38.10 (1 1/2)	38.10 (1.500)	38.74 (1.525)	37.47 (1.475)	1.27 (0.050)	±0.203 (±0.008)
50.80 (2)	50.80 (2.000)	51.44 (2.025)	50.17 (1.975)	1.27 (0.050)	±0.203 (±0.008)

NOTE 3—Tubing having electrical internal diameters and wall thickness dimensions were deleted because of lack of demand.

NOTE 4—Class B has been deleted because of lack of demand.

4.3 A one-line system is used to specify materials in this specification. The system uses predefined cells to refer to specific aspects of this specification, as illustrated as follows:

Specification						
Standard Number Block	:	Type	:	Class	:	Special Notes
:		:		:		:
Example: Specification D3296 – 14,		I		A		