



Designation: D3295 – 15

# Standard Specification for PTFE Tubing, Miniature Beading and Spiral Cut Tubing<sup>1</sup>

This standard is issued under the fixed designation D3295; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope\*

1.1 This specification covers PTFE tubing, miniature beading and spiral cut tubing—manufactured from PTFE resin produced from dispersion specified in Specification D4895.

NOTE 1—PTFE tube and rod manufactured from resin specified in Specification D4894 are covered in Specification D1710.

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

1.3 The following hazard caveat pertains only to the test method 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 and health practices and determine the applicability of regulatory limitations prior to use.*

1.4 As PTFE resin produced from dispersion is not a true thermoplastic material, any reuse for the specification referenced above is impossible. However, markets do exist for non-virgin PTFE as additives and fillers.

NOTE 2—There is no known ISO equivalent to this standard.

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

- D618 Practice for Conditioning Plastics for Testing
- D638 Test Method for Tensile Properties of Plastics
- 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
- D1675 Test Methods for Polytetrafluoroethylene Tubing

<sup>1</sup> 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 D20.15.12).

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<sup>2</sup> 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.

- D1708 Test Method for Tensile Properties of Plastics by Use of Microtensile Specimens
- D1710 Specification for Extruded Polytetrafluoroethylene (PTFE) Rod, Heavy Walled Tubing and Basic Shapes
- D3892 Practice for Packaging/Packing of Plastics
- D4894 Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials
- D4895 Specification for Polytetrafluoroethylene (PTFE) Resin Produced From Dispersion

## 3. Terminology

3.1 *Definitions*—The terminology given in Terminologies D883 and D1600 is applicable to this specification.

3.2 *Description of Term Specific to This Standard*:

3.2.1 *lot*—a single production run, or a uniform blend of two or more production runs.

## 4. Classification

4.1 This specification provides for five groups of PTFE tubing, miniature beading and spiral cut tubing, differentiated by size and type. The groups are further subdivided into classes based on wall thickness.

4.1.1 *Group 01*—Tubing based upon the American Wire Gage (AWG) sizes.

4.1.2 *Group 02*—Tubing based upon fractional inch sizes.

4.1.3 *Group 03*—Tubing specified by inner diameter and wall thickness in Table 6 referred to as “Custom or Metric.”

4.1.4 *Group 04*—Tubing cut to form spiral wrap as in Table 7.

4.1.5 *Group 05*—Miniature beading having diameters as listed in Table 8.

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

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

4.2.2 *Class 2*—Tubing having walls of greater thickness than Class 1 listed as thin wall.

4.2.3 *Class 3*—Tubing having walls tabulated in Table 2 listed as standard wall.

4.2.4 *Class 4*—Tubing having walls tabulated in Table 3 listed as chemical tubing.

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

**TABLE 1 Dimensions and Tolerances for Group 01 PTFE Tubing, mm (in.) (Classes 1 and 2)**

AWG Size Grade	Inside Diameter			Class 1	
				Light Wall	
	min	max	nom	min	max
30	0.25 (0.010)	0.38 (0.015)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
28	0.33 (0.013)	0.46 (0.018)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
26	0.41 (0.016)	0.53 (0.021)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
24	0.51 (0.020)	0.66 (0.026)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
22	0.64 (0.025)	0.81 (0.032)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
20	0.81 (0.032)	1.01 (0.040)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
19	0.91 (0.036)	1.12 (0.044)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
18	1.02 (0.040)	1.25 (0.049)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
17	1.14 (0.045)	1.37 (0.054)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
16	1.30 (0.051)	1.55 (0.061)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
15	1.45 (0.057)	1.70 (0.067)	0.15 (0.006)	0.10 (0.004)	0.20 (0.008)
14	1.65 (0.064)	1.88 (0.074)	0.20 (0.008)	0.15 (0.006)	0.25 (0.010)
13	1.83 (0.072)	2.08 (0.082)	0.20 (0.008)	0.15 (0.006)	0.25 (0.010)
12	2.06 (0.081)	2.31 (0.091)	0.20 (0.008)	0.15 (0.006)	0.25 (0.010)
11	2.31 (0.091)	2.57 (0.101)	0.20 (0.008)	0.15 (0.006)	0.25 (0.010)
10	2.59 (0.102)	2.85 (0.112)	0.20 (0.008)	0.15 (0.006)	0.25 (0.010)
9	2.90 (0.114)	3.15 (0.124)	0.20 (0.008)	0.15 (0.006)	0.25 (0.010)
8	3.28 (0.129)	3.58 (0.141)	0.20 (0.008)	0.15 (0.006)	0.25 (0.010)
7	3.66 (0.144)	4.01 (0.158)	0.20 (0.008)	0.15 (0.005)	0.25 (0.011)
6	4.12 (0.162)	4.52 (0.178)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
5	4.62 (0.182)	5.03 (0.198)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
4	5.18 (0.204)	5.69 (0.224)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
3	5.82 (0.229)	6.33 (0.249)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
2	6.55 (0.258)	7.06 (0.278)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
1	7.34 (0.289)	7.90 (0.311)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
0	8.26 (0.325)	8.81 (0.347)	0.25 (0.012)	0.22 (0.009)	0.38 (0.015)

  

AWG Size Grade	Inside Diameter			Class 2	
				Thin Wall	
	min	max	nom	min	max
30	0.25 (0.010)	0.38 (0.015)	0.23 (0.009)	0.19 (0.007)	0.28 (0.011)
28	0.33 (0.013)	0.48 (0.019)	0.23 (0.009)	0.18 (0.007)	0.28 (0.011)
26	0.41 (0.016)	0.56 (0.022)	0.23 (0.009)	0.18 (0.007)	0.28 (0.011)
24	0.51 (0.020)	0.69 (0.027)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
22	0.64 (0.025)	0.81 (0.032)	0.25 (0.010)	0.18 (0.007)	0.33 (0.013)
20	0.81 (0.032)	1.01 (0.040)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
19	0.91 (0.036)	1.11 (0.044)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
18	1.02 (0.040)	1.25 (0.049)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
17	1.14 (0.045)	1.38 (0.054)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
16	1.30 (0.051)	1.55 (0.061)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
15	1.45 (0.057)	1.70 (0.067)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
14	1.63 (0.064)	1.88 (0.074)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
13	1.83 (0.072)	2.08 (0.082)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
12	2.06 (0.081)	2.31 (0.091)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
11	2.31 (0.091)	2.57 (0.101)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
10	2.59 (0.102)	2.85 (0.112)	0.31 (0.012)	0.23 (0.009)	0.38 (0.015)
9	2.90 (0.114)	3.15 (0.124)	0.38 (0.015)	0.31 (0.012)	0.46 (0.018)
8	3.28 (0.129)	3.58 (0.141)	0.38 (0.015)	0.31 (0.012)	0.46 (0.018)
7	3.66 (0.144)	4.01 (0.158)	0.38 (0.015)	0.31 (0.012)	0.46 (0.018)
6	4.12 (0.162)	4.52 (0.178)	0.38 (0.015)	0.31 (0.012)	0.46 (0.018)
5	4.62 (0.182)	5.03 (0.198)	0.38 (0.015)	0.35 (0.012)	0.46 (0.018)
4	5.18 (0.204)	5.69 (0.224)	0.38 (0.015)	0.35 (0.012)	0.46 (0.018)
3	5.82 (0.229)	6.33 (0.249)	0.38 (0.015)	0.35 (0.012)	0.46 (0.018)
2	6.55 (0.258)	7.06 (0.278)	0.38 (0.015)	0.35 (0.012)	0.46 (0.018)
1	7.34 (0.289)	7.90 (0.311)	0.38 (0.015)	0.35 (0.012)	0.46 (0.018)
0	8.26 (0.325)	8.81 (0.347)	0.38 (0.015)	0.35 (0.012)	0.46 (0.018)

4.2.5 *Class 5*—Tubing having walls tabulated in **Table 2** and **Table 3** listed as heavy wall.

4.3 A one-line system may be used to specify materials covered by this specification. The system uses predefined cells to refer to specific aspects of this specification, as illustrated below.

Specification				
Standard Number:	Class:	Grade:	Special Notes	
Block	Group:			
Example: Specification D3295 – 01	01	1	24	

For this example, the line callout would be Specification D3295 – 01, 01124 and would specify tubing having walls

**TABLE 2 Dimensions and Tolerances for Group 01 PTFE Tubing, mm (in.) (Classes 3 and 4)**

AWG Size Grade	Inside Diameter			Class 3	
	min	max	nom	Standard Wall	
				min	max
30	0.25 (0.010)	0.38 (0.015)	0.23 (0.009)	0.18 (0.007)	0.28 (0.011)
28	0.33 (0.013)	0.48 (0.019)	0.23 (0.009)	0.18 (0.007)	0.28 (0.011)
26	0.41 (0.016)	0.56 (0.022)	0.23 (0.009)	0.18 (0.007)	0.28 (0.011)
24	0.51 (0.020)	0.67 (0.027)	0.31 (0.012)	0.25 (0.010)	0.36 (0.014)
22	0.64 (0.025)	0.81 (0.032)	0.31 (0.012)	0.25 (0.010)	0.36 (0.014)
20	0.81 (0.032)	1.02 (0.040)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
19	0.91 (0.036)	1.11 (0.044)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
18	1.02 (0.040)	1.25 (0.049)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
17	1.14 (0.045)	1.37 (0.054)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
16	1.30 (0.051)	1.55 (0.061)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
15	1.45 (0.057)	1.70 (0.067)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
14	1.63 (0.064)	1.88 (0.074)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
13	1.83 (0.072)	2.08 (0.082)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
12	2.06 (0.081)	2.31 (0.091)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
11	2.31 (0.091)	2.57 (0.101)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
10	2.59 (0.102)	2.85 (0.112)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
9	2.90 (0.114)	3.15 (0.124)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
8	3.28 (0.129)	3.58 (0.141)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
7	3.66 (0.144)	4.01 (0.158)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
6	4.12 (0.162)	4.52 (0.178)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
5	4.62 (0.182)	5.03 (0.198)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
4	5.18 (0.204)	5.69 (0.224)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
3	5.82 (0.229)	6.33 (0.249)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
2	6.55 (0.258)	7.06 (0.278)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
1	7.34 (0.289)	7.90 (0.311)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
0	8.26 (0.325)	8.81 (0.347)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)

  

AWG Size Grade	Inside Diameter			Class 5	
	min	max	nom	Heavy Wall	
				min	max
24	0.51 (0.020)	0.69 (0.027)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
22	0.64 (0.025)	0.81 (0.032)	0.41 (0.016)	0.33 (0.013)	0.48 (0.019)
20	0.81 (0.032)	1.02 (0.040)	0.46 (0.018)	0.38 (0.015)	0.53 (0.021)
19	0.91 (0.036)	1.12 (0.044)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
18	1.02 (0.040)	1.25 (0.049)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
17	1.14 (0.045)	1.37 (0.054)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
16	1.30 (0.051)	1.55 (0.061)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
15	1.45 (0.057)	1.70 (0.067)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
14	1.63 (0.064)	1.88 (0.074)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
13	1.83 (0.072)	2.08 (0.082)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
12	2.06 (0.081)	2.31 (0.091)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
11	2.31 (0.091)	2.57 (0.101)	0.51 (0.020)	0.41 (0.016)	0.61 (0.024)
10	2.59 (0.102)	2.85 (0.112)	0.64 (0.025)	0.51 (0.020)	0.76 (0.030)
9	2.90 (0.114)	3.15 (0.124)	0.64 (0.025)	0.51 (0.020)	0.76 (0.030)
8	3.28 (0.129)	3.58 (0.141)	0.76 (0.030)	0.64 (0.025)	0.89 (0.035)
7	3.65 (0.144)	4.01 (0.158)	0.76 (0.030)	0.64 (0.025)	0.89 (0.035)
6	4.12 (0.162)	4.52 (0.178)	0.76 (0.030)	0.64 (0.025)	0.89 (0.035)
5	4.62 (0.182)	5.03 (0.198)	0.81 (0.032)	0.69 (0.027)	0.94 (0.037)

listed as light wall that has all the properties listed for that group, class and grade in the appropriate specified properties, tables, or both, in the specification identified. These shall be based on AWG size within the group and class. Grade will be the AWG size designation. Only Groups 01 and 02 shall have requirements for Class and no separator is needed.

## 5. Physical Properties

5.1 The tubing and miniature beading shall be made of PTFE meeting the requirements of Specification **D4895** and may contain a maximum of two mass percentage of additive.

5.2 The melting point for all Groups of tubing, and miniature beading shall be  $327 \pm 10^\circ\text{C}$  ( $621 \pm 18^\circ\text{F}$ ) when measured in accordance with **8.1.4**.

5.3 The inside diameter, wall thickness, pitch and tolerances of the tubing, miniature beading and spiral cut tubing shall be as shown in **Tables 1-3** and **Tables 6-8** when determined in accordance with **8.1.3.1** and **8.1.3.2**.

5.4 The specific gravity of the tubing and miniature beading shall be as specified in **Table 4** when determined in accordance with **8.1.5**.

5.5 The weight loss of the tubing and miniature beading shall not exceed 0.05 % when determined in accordance with **8.1.6**.

5.6 The tubing and miniature beading shall have tensile properties as specified in **Table 4** and a minimum elongation of 200 % when determined in accordance with **8.1.7**.