



Designation: D2911 – 10

Standard Specification for Dimensions and Tolerances for Plastic Bottles¹

This standard is issued under the fixed designation D2911; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This specification covers the thread configuration and dimensions for finishes for plastic bottles with screw-type closures, having a maximum capacity of 18.9 L (5 gal) and a maximum bottle dimension of 305 mm (12 in.). Included are tolerances for bottle capacity and body dimensions.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 The following precautionary 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 and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards*:²

D618 Practice for Conditioning Plastics for Testing

D1898 Practice for Sampling of Plastics (Withdrawn 1998)³

3. Terminology

3.1 *Definitions*:

3.1.1 *bottle finish*—the configuration of the neck or opening of the bottle which serves to engage specific parts of the closure in order to securely attach it to the bottle.

3.1.2 *bottle height*—the maximum dimension of a bottle in a plane perpendicular to the bottle base when the bottle is setting in its normal upright position.

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.19 on Film, Sheeting, and Molded Products.

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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.

3.1.3 *bottle thickness*—the smaller dimension in a plane parallel to the bottle base.

3.1.4 *bottle width*—the larger dimension in a plane parallel to the bottle base.

4. Dimensions and Recommended Variations

4.1 *Recommended Variations in Overflow Capacity*—In overflow capacity recommended variations of plastic bottles up to 18.9 L (5 gal) in size shall be in accordance with Table 1.

4.2 *Recommended Variations in Body Dimensions*—The recommended variations in the body dimensions of plastic bottles covered by this specification shall be in accordance with Table 2.

4.3 *Finish Dimensions and Design*—The bottle finish dimensions and design for the nine finishes covered by this specification shall be in accordance with Figs. 1-8 and Tables 3-10.

5. Sampling

5.1 A batch or lot shall be considered as a unit of manufacture.

5.2 Unless otherwise agreed upon between manufacturer and purchaser, the material shall be sampled in accordance with the procedure described in Section 9 of Practice D1898. Adequate statistical sampling prior to packaging shall be considered an acceptable alternative.

6. Conditioning

6.1 *Conditioning*—Condition the test specimens at $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 5\%$ relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice D618 for those tests where conditioning is required. In cases of disagreement, the tolerances shall be $\pm 1^\circ\text{C}$ ($\pm 1.8^\circ\text{F}$) and $\pm 2\%$ relative humidity.

6.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of $23 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) and $50 \pm 5\%$ relative humidity, unless otherwise specified in the test methods or in this specification. In cases of disagreement, the tolerances shall be $\pm 1^\circ\text{C}$ ($\pm 1.8^\circ\text{F}$) and $\pm 2\%$ relative humidity.

7. Apparatus

7.1 *For Determining Bottle Capacity:*

TABLE 1 Bottle Overflow Capacity Tolerances for Plastic Bottles

Fluid Ounces				Millilitres			
Bottle Overflow Capacity		Tolerance (±)		Bottle Overflow Capacity		Tolerance (±)	
0.75	less than	0.75	0.05	22	less than	22	1.5
	and less than	1.2	0.07		and less than	35	2.0
1.2		1.6	0.08	35		47	2.5
1.6		2.1	0.10	47		62	3.0
2.1		2.8	0.12	62		83	3.5
2.8		3.9	0.14	83		115	4
3.9		5.4	0.17	115		159	5
5.4		7.4	0.20	159		218	6
7.4		9.8	0.24	218		289	7
9.8		13	0.30	289		384	9
13		18	0.37	384		531	11
18		26	0.44	531		767	13
26		37	0.51	767		1092	15
37		51	0.68	1092		1505	20
51		72	0.81	1505		2125	24
72		98	1.01	2125		2892	30
98		119	1.30	2892		3512	38
119		139	1.50	3512		4103	44
139		160	1.80	4103		4723	53
160		180	2.00	4723		5313	59
180		210	2.20	5313		6199	65
210	to 5 gallons		1 % of capacity	6199	to 18.89 litres		1 % of capacity

TABLE 2 Body Dimensional Tolerance

Range of Specific Dimensions		Height Dimensions		Width and Depth Dimensions	
in.	mm	in.	mm	in.	mm
0 up to but not including 1	0 to 25.40	0.030	0.76	0.030	0.76
1 up to but not including 2	25.40 to 50.80	0.030	0.76	0.050	1.27
2 up to but not including 4	50.80 to 101.60	0.050	1.27	0.060	1.52
4 up to but not including 6	101.60 to 152.40	0.050	1.27	0.080	2.03
6 up to but not including 8	152.40 to 203.20	0.060	1.52	0.090	2.29
8 up to but not including 10	203.20 to 254.00	0.060	1.52	0.110	2.79
10 up to but not including 12	254.00 to 304.80	0.080	2.03	0.120	3.05
12 up to but not including 15	304.80 to 381.00	0.090	2.29	0.150	3.81
15 up to but not including 18	381.00 to 457.20	0.110	2.79	0.150	3.81

7.1.1 *Balance*, having an accuracy of ±0.1 % or better at rated capacity (full scale).

7.1.2 *Pipet, Graduated Cylinder, and Beaker*, as required.

7.1.3 Conditioned water at 23 ± 2.0°C (73.4 ± 3.6°F) containing a wetting agent sufficient to flatten the meniscus and eliminate air bubbles.

NOTE 2—It is acceptable to use any liquid detergent as the wetting agent.

7.1.4 *Stop Watch*.

7.2 *For Determining Finish and Body Dimensions:*

7.2.1 *Micrometers, Vernier Height Gages, or Vernier Calipers* with an accuracy of ±0.025 mm (±0.001 in.).

7.2.2 *Internal Micrometers or Telescoping Gages* with an accuracy of ±0.025 mm (±0.001 in.).

7.2.3 *Commercial Scale*, good quality calibrated in 1-mm or 1/32-in. increments.

8. Test Methods

8.1 *Bottle Capacity:*

8.1.1 Weigh the empty bottle and record the weight in grams.

8.1.2 Fill the bottle to overflow capacity with conditioned water containing the wetting agent, adjusting the meniscus by use of a pipet, if necessary, until the meniscus is tangent to the

top of the finish surface. No more than 2 min shall be allowed for filling the bottle and no additional water shall be added after the bottle is filled to overflow and free of air bubbles.

8.1.3 If the time exceeds 2 min, discard the sample and start over.

NOTE 3—The capacity of the container is somewhat time-dependent in that the force of the water in the container will cause the container sides to bulge with time and additional water will be needed to adjust to overflow capacity.

8.1.4 Weigh the filled bottle and record the weight in grams.

8.1.5 Calculate the bottle volume as follows:

$$B_v \text{ (mL)} = (B_f - B_e)/0.997$$

where:

B_v = volume of bottle, mL,

B_f = weight of filled bottle, g,

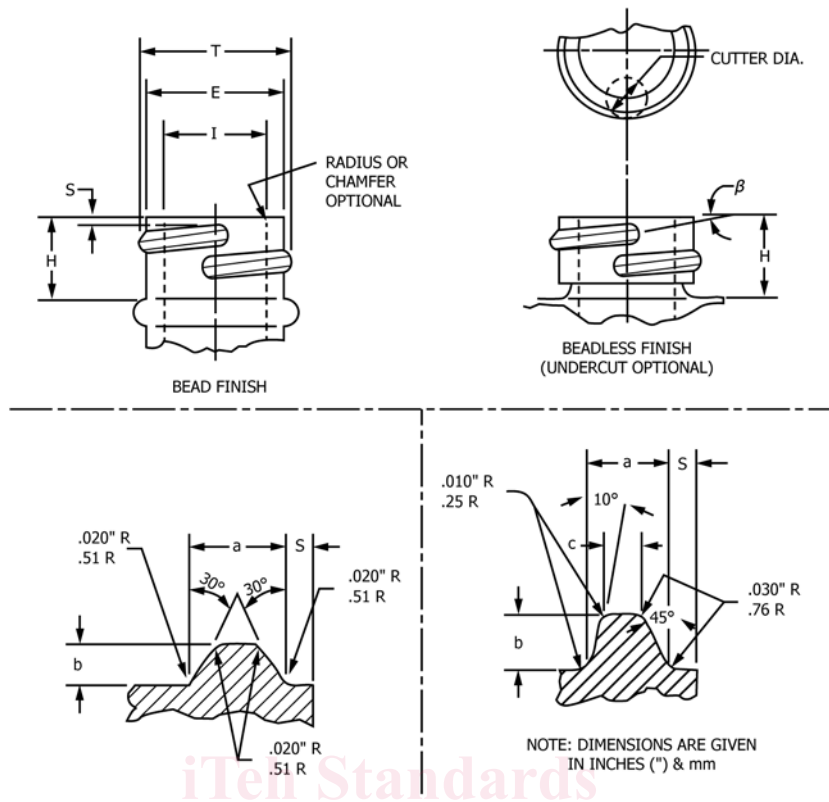
B_e = weight of empty bottle, g, and

0.997 = weight of water (g/mL) at 23 ± 2.0°C (73.4 ± 3.6°F).

$$B_v \text{ (fluid oz)} = (B_f - B_e)/29.50$$

where: 29.50 = weight of water (g/fluid oz) at 23 ± 2.0°C (73.4 ± 3.6°F).

8.1.6 Determine the volume in millilitres (fluid ounces) for each test specimen.



"L" Style All-Purpose Thread (Plastic or Metal Closures)				"M" Style Modified Buttress Thread (Plastic Closures)					
Threads/in.		a	b	c	Threads/in.	a	b	c	
5	in.	0.120	0.060	0.051	5	in.	0.120	0.060	0.049
	mm	3.05	1.52	1.30		mm	3.05	1.52	1.24
6	in.	0.094	0.047	0.040	6	in.	0.094	0.047	0.039
	mm	2.39	1.19	1.02		mm	2.39	1.19	0.99
8	in.	0.084	0.042	0.036	8	in.	0.084	0.042	0.035
	mm	2.13	1.07	0.91		mm	2.13	1.07	0.89

Example Thread Nomenclature
 "L" Style: L28SP400
 "M" Style: M28SP400

NOTE 1—*T* and *E* dimensions are the average of two measurements across the major and minor axis. The limits of ovality will be determined by the container supplier and container customer, as necessary.

NOTE 2—Dimension *H* is measured from the top of the finish to the point where diameter *T*, extended parallel to the centerline, intersects the bead or shoulder.

NOTE 3—Contour of bead, undercut or shoulder is optional.

NOTE 4—Unless otherwise specified, *I* min applies to the full length of the opening.

NOTE 5—Concentricity of *I* min with respect to diameters *T* and *E* is not included. *I* min is specified for filler tube only.

NOTE 6—A minimum of 1 full turn of thread shall be maintained.

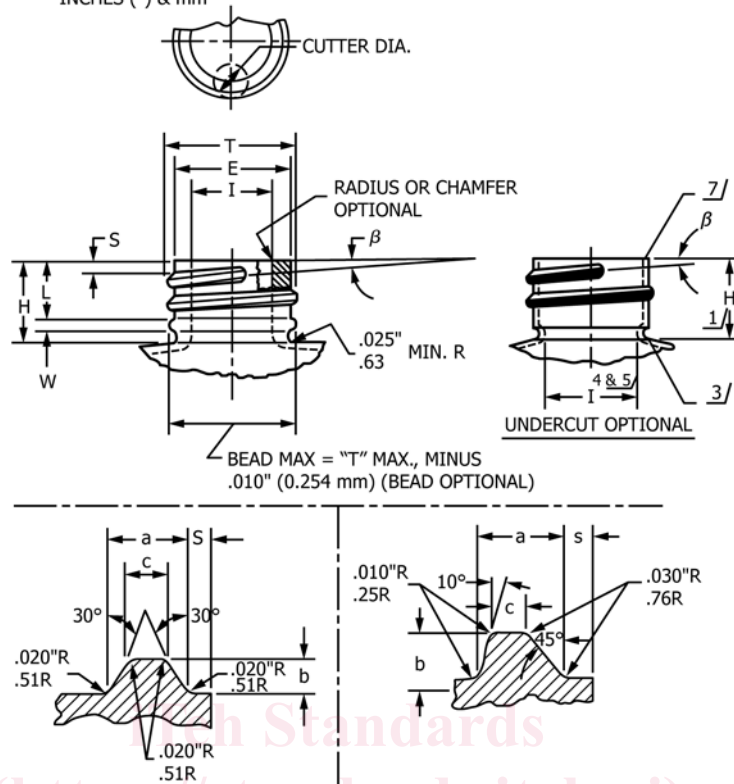
NOTE 7—Corresponding dimensions and finish details are shown in Table 3.

NOTE 8—Consideration must be given to the sealing surface width for the sealing system being used.

NOTE 9—Many child resistant closures, etc.

FIG. 1 SP 400 Finish Thread Cross Sections

NOTE: DIMENSIONS ARE GIVEN IN INCHES (") & mm



"L" Style All-Purpose Thread (Plastic or Metal Closures)					"M" Style Modified Buttress Thread (Plastic Closures)				
Threads/in.		a	b	c	Threads/in.		a	b	c
6	in.	0.094	0.047	0.040	6	in.	0.094	0.047	0.039
	mm	2.39	1.19	1.02		mm	2.39	1.19	0.99
8	in.	0.084	0.042	0.036	8	in.	0.084	0.042	0.035
	mm	2.13	1.07	0.91		mm	2.13	1.07	0.89

Example Thread Nomenclature:
 "L" Style: L22SP410
 "M" Style: M22SP410

- NOTE 1—Construction of neck from B to D must be held within the shaded area shown.
- NOTE 2—A minimum of 1½ turns of thread shall be maintained.
- NOTE 3—Unless otherwise specified, I min applies to the full length of the opening.
- NOTE 4—Concentricity of I min with respect to diameters T and E is not included. I min is specified for filler tube only.
- NOTE 5—T and E dimensions are the average of two measurements across the major and minor axis. The limits of ovality will be determined by the container supplier and container customer, as necessary.
- NOTE 6—Consideration must be given to the sealing surface width for the sealing system being used.
- NOTE 7—When valve style closures are used with this finish, special consideration must be given to a specific controlled inside diameter. In addition, it is acceptable to vary the dimensions indicated with asterisk (*) to ensure adequate material for finishing the inside diameter.
- NOTE 8—Corresponding dimensions and details shown in Table 4.

FIG. 2 SP 410 Finish Thread Cross Sections

8.1.7 Report the arithmetic average volume of the specimens tested as the bottle capacity of the batch or lot from which the samples were chosen.

8.2 Body Dimensions:

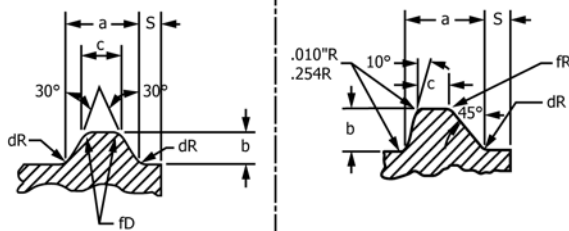
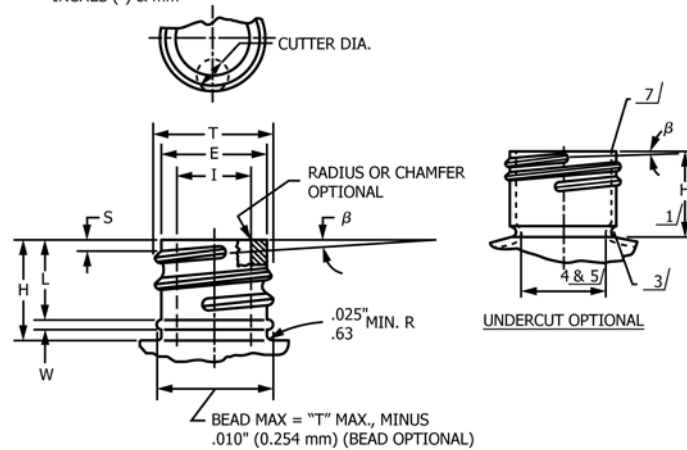
8.2.1 Using a suitable micrometer, a vernier height gauge, or a scale, measure the height of the bottle.

8.2.1.1 If the top of the finish is parallel to the base of the container and the height must be measured from the top of the

finish, and a commercial scale is used, one method is to place the bottle on a flat surface and a straightedge across the top of the bottle finish. Then measure the perpendicular distance between the straightedge and the surface upon which the bottle is setting. Make four measurements, each 90° apart, and use the maximum as the bottle height.

8.2.2 Using a suitable micrometer or vernier caliper, measure the width and thickness of the bottle.

NOTE: DIMENSIONS ARE GIVEN IN INCHES (") & mm



"L" Style All-Purpose Thread (Plastic or Metal Closures)						"M" Style Modified Buttress Thread (Plastic Closures)					
Threads/in.	a	b	c	d	f	Threads/in.	a	b	c	d	f
6	in. 0.094	0.047	0.040	0.020	0.020	6	in. 0.094	0.047	0.039	0.030	0.030
	mm 2.39	1.19	1.02	0.51	0.51		mm 2.39	1.19	0.99	0.76	0.76
8	in. 0.084	0.042	0.036	0.020	0.020	8	in. 0.084	0.042	0.035	0.030	0.030
	mm 2.13	1.07	0.91	0.51	0.51		mm 2.13	1.07	0.89	0.76	0.76
12	in. 0.045	0.030	0.011	0.015	0.005	12	in. 0.051	0.030	0.016	0.020	0.008
	mm 1.14	0.76	0.28	0.38	0.13		mm 1.29	0.76	0.41	0.51	0.22

Example Thread Nomenclature:
 "L" Style: L22SP415
 "M" Style: M22SP415

NOTE 1—Construction of neck from B to D must be held within the shaded area shown.

NOTE 2—A minimum of 2 turns of thread shall be maintained.

NOTE 3—Unless otherwise specified, I min applies to the full length of the opening.

NOTE 4—Concentricity of I min with respect to diameters T and E is not included. I min is specified for filler tube only.

NOTE 5—T and E dimensions are the average of two measurements across the major and minor axis. The limits of ovality will be determined by the container supplier and container customer, as necessary.

NOTE 6—Consideration must be given to the sealing surface width for the sealing system being used.

NOTE 7—When valve style closures are used with this finish, special consideration must be given to a specific controlled inside diameter. In addition, it is acceptable to vary the dimensions indicated with asterisk (*) to ensure adequate material for finishing the inside diameter.

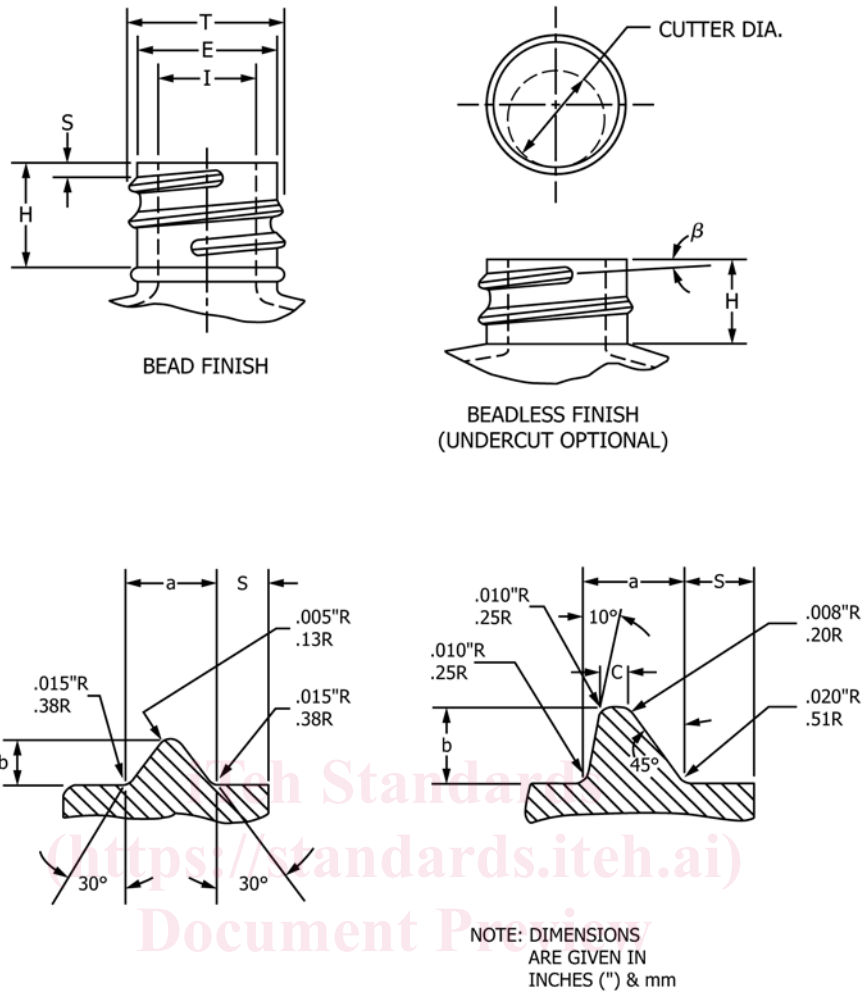
NOTE 8—Corresponding dimensions and finish details are shown in Table 5.

FIG. 3 SP 415 Finish Thread Cross Sections

8.2.2.1 In the case of a rectangular container, use the midpoints of the sides as the measuring points.

8.2.2.2 For a cylindrical container, make one measurement on the parting line and another measurement 90° from the parting line. Use the average of these two measurements as the container width.

(I) If, because of the shape of the container, there is some question about where the measurements are to be taken, agreement shall be reached between the purchaser and the seller.



NOTE 1—Contour of bead, undercut, or shoulder is optional.

"L" Style All-Purpose Thread (Plastic or Metal Closures)				"M" Style Modified Buttress Thread (Plastic Closures)			
Threads/in.		a	b	Threads/in.	a	b	c
12	in.	0.045	0.030	12	in.	0.051	0.016
	mm	1.14	0.76		mm	1.29	0.76
12	in.	0.045	0.030	12	in.	0.051	0.016
	mm	1.14	0.76		mm	1.29	0.76

NOTE 2—Example Thread Nomenclature
 "L" Style: L15SP425 or "M" Style M15SP425

NOTE 3—Corresponding dimensions and finish details are shown in Table 6.

FIG. 4 SP 425 Finish Thread Cross Sections

8.3 *Finish Dimensions*—Using suitable micrometers, vernier calipers, or telescoping gages, measure the finish dimensions of the bottle.

determine conformity to be performed as agreed upon between the purchaser and the seller.

9. Retest and Rejection

9.1 If the results of any test do not conform to the requirements of this specification, it is acceptable for retesting to