



Designation: C 599 – 91 (Reapproved 1995)^{ε1}

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
Reprinted from the Annual Book of ASTM Standards. Copyright ASTM

Standard Specification for Conical Process Glass Pipe and Fittings¹

This standard is issued under the fixed designation C 599; 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.

^{ε1} NOTE—Section 13 was added editorially in September 1995.

1. Scope

1.1 This specification covers chemically resistant, low-expansion Type-I borosilicate glass, Glass A, (see Specification E 438) used to manufacture conical end flanged-glass pipe and fittings.

2. Referenced Documents

2.1 ASTM Standards:

- B 26/B26M Specification for Aluminum-Alloy Sand Castings²
- B 85 Specification for Aluminum-Alloy Die Castings²
- C 162 Terminology of Glass and Glass Products³
- C 600 Method of Thermal Shock Test on Glass Pipe³
- C 601 Method for Pressure Test on Glass Pipe³
- C 623 Test Method for Young's Modulus, Shear Modulus, and Poisson's Ratio for Glass and Glass-Ceramics by Resonance³
- C 693 Test Method for Density of Glass by Buoyancy³
- E 438 Specification for Glasses in Laboratory Apparatus⁴

3. Terminology Definitions

3.1 For definitions of terms used in this specification, refer to Terminology C 162.

4. Materials and Manufacture

4.1 The glass shall be reasonably free of surface defects, such as open blisters or airlines and scratches, and shall be completely free of chips and checks. This is applicable to both the inside and outside surfaces. It shall represent good workmanship as consistent with standard glass process capabilities.

4.2 *Heat Treatment and Annealing*—Pipe and fittings must be suitably heat-treated (tempered) or annealed as specified.

5. Chemical Requirements

5.1 The chemical requirements shall be as described in Specification E 438.

¹ This specification is under the jurisdiction of ASTM Committee C-14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.05 on Glass Pipe.

Current edition approved Nov. 15, 1991. Published January 1992. Originally published as C 599 – 67 T. Last previous edition C 599 – 70 (1984)^{ε 1}.

² *Annual Book of ASTM Standards*, Vol 02.02

³ *Annual Book of ASTM Standards*, Vol 15.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

6. Physical Requirements

6.1 The physical requirements shall be as described in Specification E 438.

6.2 Refer also to Annex A1 for additional physical requirements.

7. Operating Temperatures

7.1 *Minimum Operating Temperature*— The minimum rated operating temperature for all sizes shall be -50°F (-46°C) provided that the temperature of the material being conveyed is above the freezing point and aluminum alloy flanges consisting of alloys designated in Specifications B 26 and B 85 are used.

7.2 *Maximum Operating Temperature*— The maximum rated operating temperature for all sizes shall be 450°F (232°C).

7.3 *Thermal Endurance*—The maximum allowable sudden temperature differential for properly installed systems shall be in accordance with Table 1 for the various pipe sizes.

7.3.1 Maximum temperature differential refers to an almost instantaneous temperature change, such as low-pressure steam followed directly by a flush of ice cold water, or the reverse. Maximum temperature differential pertains to either inside or outside pipe surfaces.

7.3.2 The test method for thermal shock is not ordinarily performed, but in those cases where thermal shock resistance may be questioned, it may be performed in accordance with Method C 600. Acceptance of this test shall be that all tested ware shall pass. If one or more failures do occur, a second sampling twice the percentage of the first one shall be made, and the ware tested. If there are any failures, the entire shipment shall be rejected.

8. Pressure Rating

8.1 Maximum recommended working pressure for conical glass process pipe and fittings shall be in accordance with Table 2, when the pipe is installed in accordance with manufacturers' recommendations, and when operated within the maximum temperature differential and temperature limit. See 8.3 for vacuum service.

8.2 *Acceptance Pressure Test*—Individual lengths of conical pipe or fittings shall withstand an internal hydrostatic pressure test when tested in accordance with Method C 601. Acceptance

TABLE 1 Maximum Temperature for Thermal Endurance

Nominal Pipe Size, in.	Sudden Temperature Difference, max °F (°C)
1 to 2	200 (93)
3	140 (78)
4	122 (68)
6	180 (82)

TABLE 2 Maximum Working Pressure for Glass Process Pipe and Fittings

Nominal Pipe Size, in.	Recommended Working Pressure, max, psi (kPa)
1 to 2	50 (345)
3	40 (276)
4	35 (241)
6	20 (138)

of this test shall be that all tested ware shall pass. If one or more failures do occur, a second sampling twice the percentage of the first one shall be made and the ware tested. If there are any failures in the second sampling, the entire sampling shall be rejected.

8.3 All pipe sizes are suitable for vacuum applications.

9. Dimensions and Permissible Variations

9.1 *Flanges:*

9.1.1 *Flange Face Flatness*—Maximum permissible deviation from a flat plane across the face of the flange on all sizes shall be 1/64 in. (0.4 mm).

9.1.2 *Flange Face Squareness*—Flange faces of both pipe and fittings shall be square to the pipe centerline within the limits prescribed in Table 3.

TABLE 3 Flange Face Squareness

Nominal Pipe Size, in.	Squareness Measurement, max, in. (mm)
1 to 2	1/32 (0.8)
3	3/64 (1.19)
4	1/16 (1.59)
6	3/32 (2.38)

9.1.2.1 Squareness of straight pipe lengths shall be measured by placing the pipe on rollers, located approximately 2 in. (51 mm) from each end, and butting one end against a flat plate perpendicular to the axis of the rollers. The pipe shall be rotated and the length variation at the sealing surface shall be read with a suitable mechanism, such as a dial indicator. The maximum reading shall not exceed that shown in 9.1.1 for the respective pipe size.

9.1.2.2 Pipe fittings shall be measured for flange squareness by a gage having flat plates constructed at the angle required by that fitting. One flange shall be firmly placed on one plate and the difference between the remaining flange face and the other surface plate shall not exceed the amount shown in 9.1.1 for the respective fitting size.

9.1.3 *Flange Out-Of-Round*—Out-of-round of the flanges shall be measured on the conical portion of the flange at the distance from the plane of the flange face indicated in Table 4,

TABLE 4 Out-of-Round of Flanges

Nominal Size, in.	Measurement Point (Distance from Plane of Flange Face), in. (mm)	Out-of-Round, max, in. (mm)
1 to 3	1/2(12.7)	0.020 (0.51)
4 to 6	1/2(12.7)	0.030 (0.76)

and shall be within the requirements prescribed in Table 4.

9.2 *Bow:*

9.2.1 *Bow for Pipe Diameters 1 in. and Up*—Bow shall be measured at the midpoint of the pipe on a flat supporting surface so as to permit no bending due to mass. Bow shall not exceed 0.0015 times the length of the pipe. The representative maximum bow tolerances in Table 5 indicate the range.

10. Dimensions of All Pipe and Fittings

10.1 *Straight Pipe (Dimensions)*—Dimensional specifications for straight lengths shall be in accordance with Table 6.

10.2 *Dimensions of Flange Groove*—Dimensional specifications for the flange groove shall be in accordance with Table 7.

10.3 *Spacers (Standard)*—Dimensional specifications for spacers (standard) shall be in accordance with Table 8.

10.4 *Spacer (Beveled)*—Dimensional specifications of spacers (beveled) shall be in accordance with Table 9.

10.5 *Fittings (Dimensions)*—Dimensional specifications for common fittings shall be in accordance with Tables 10-20.

11. Inspection

11.1 Inspection of the material shall be made at the point of delivery, unless otherwise agreed upon between the purchaser and the seller.

12. Packaging

12.1 Pipe, fittings, and hardware shall be so packaged as to prevent injury to them during transportation and handling. Those items packed in containers conforming to all construction requirements of Consolidated Freight Classification as to bursting tests, size limit, and gross mass shall be considered as being properly packed.

12.2 All hardware items shall be packed in boxes separate from the pipe and fittings.

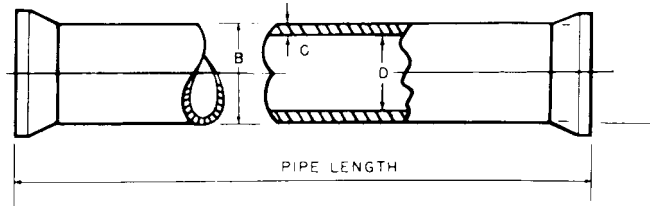
13. Keywords

13.1 borosilicate; glass; pipe

TABLE 5 Bow for Pipe Diameters 1 in. and Up

Length, ft (m)	Bow, max, in. (mm)
1/2 (0.75)	0.045 (1.14)
5 (1.5)	0.090 (2.29)
10 (3)	0.180 (4.57)

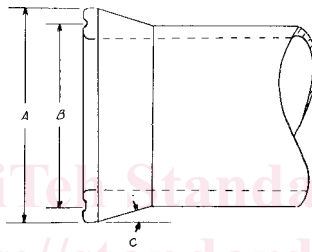
TABLE 6 Dimensional Specifications for Straight Lengths



Length $\pm \frac{1}{8}$ in. (3.2 mm)

Nominal Size, in.	B (Outside Diameter), in. (mm)		C (Wall), in. (mm)	
	Dimension	Tolerances	Dimension	Tolerances
1	1 $\frac{9}{16}$ (3.33)	$\pm \frac{3}{64}$ (1.2)	$\frac{5}{32}$ (4.0)	$\pm \frac{1}{32}$ (0.8)
1 $\frac{1}{2}$	1 $\frac{27}{32}$ (46.8)	$\pm \frac{1}{16}$ (1.6)	1 $\frac{1}{64}$ (4.4)	$\pm \frac{1}{32}$ (0.8)
2	2 $\frac{11}{32}$ (59.5)	$\pm \frac{5}{64}$ (2.0)	1 $\frac{1}{64}$ (4.4)	$\pm \frac{1}{32}$ (0.8)
3	3 $\frac{13}{32}$ (86.5)	$\pm \frac{3}{32}$ (2.4)	1 $\frac{3}{64}$ (5.2)	$\pm \frac{1}{32}$ (0.8)
4	4 $\frac{17}{32}$ (115.1)	$\pm \frac{7}{64}$ (2.8)	1 $\frac{7}{64}$ (6.7)	$\pm \frac{3}{64}$ (1.2)
6	6 $\frac{5}{8}$ (168.3)	$\pm \frac{5}{32}$ (4.0)	2 $\frac{1}{64}$ (8.3)	$\pm \frac{3}{64}$ (1.2)

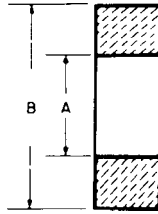
TABLE 7 Dimensional Specifications for the Flange Groove



Nominal Size, in.	A, in. (mm)		B, in. (mm)		C, °	
	Dimension	Tolerances	Dimension	Tolerances	Dimension	Tolerances
1	1 $\frac{9}{16}$ (39.7)	$\pm \frac{1}{32}$ (0.8)	1 $\frac{9}{32}$ (32.5)	$\pm \frac{1}{32}$ (0.8)	12	± 2
1 $\frac{1}{2}$	2 $\frac{1}{8}$ (54.0)	$\pm \frac{1}{32}$ (0.8)	1 $\frac{13}{16}$ (46.0)	$\pm \frac{1}{32}$ (0.8)	12	± 2
2	2 $\frac{5}{8}$ (66.7)	$\pm \frac{3}{64}$ (1.2)	2 $\frac{5}{16}$ (58.7)	$\pm \frac{1}{32}$ (0.8)	12	± 2
3	3 $\frac{25}{32}$ (96.0)	$\pm \frac{3}{64}$ (1.2)	3 $\frac{25}{64}$ (86.1)	$\pm \frac{1}{32}$ (0.8)	12	± 2
4	5 $\frac{11}{32}$ (135.7)	$\pm \frac{3}{64}$ (1.2)	4 $\frac{27}{64}$ (112.3)	$\pm \frac{1}{32}$ (0.8)	21	± 2
6	7 $\frac{31}{64}$ (190.1)	$\pm \frac{1}{16}$ (1.6)	6 $\frac{27}{64}$ (163.1)	$\pm \frac{1}{32}$ (0.8)	21	± 2

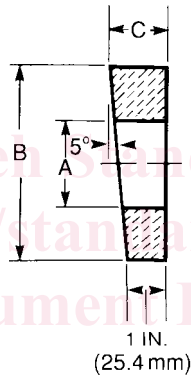
ASTM C 599

TABLE 8 Dimensional Specifications for the Spacers (Standard)



Nominal Pipe Size, in.	B, in. (mm)		A, in. (mm)	
	Outside Diameter	Outside Diameter Tolerance	Inside Diameter	Inside Diameter Tolerance
1	1 ⁹ / ₁₆ (39.7)	± ¹ / ₁₆ (1.6)	1 (25.4)	± ¹ / ₁₆ (1.6)
1 ¹ / ₂	2 ⁵ / ₃₂ (54.8)	± ¹ / ₁₆ (1.6)	1 ¹ / ₂ (38.1)	± ¹ / ₁₆ (1.6)
2	2 ²¹ / ₃₂ (67.5)	± ³ / ₃₂ (2.4)	2 (50.8)	± ³ / ₃₂ (2.4)
3	3 ³ / ₄ (95.3)	± ¹ / ₈ (3.2)	3 (76.2)	± ³ / ₃₂ (2.4)
4	5 ⁵ / ₁₆ (134.9)	± ⁵ / ₃₂ (4.0)	4 (101.6)	± ¹ / ₈ (3.2)
6	7 ¹ / ₂ (190.5)	± ⁵ / ₃₂ (4.0)	6 (152.4)	± ¹ / ₈ (3.2)

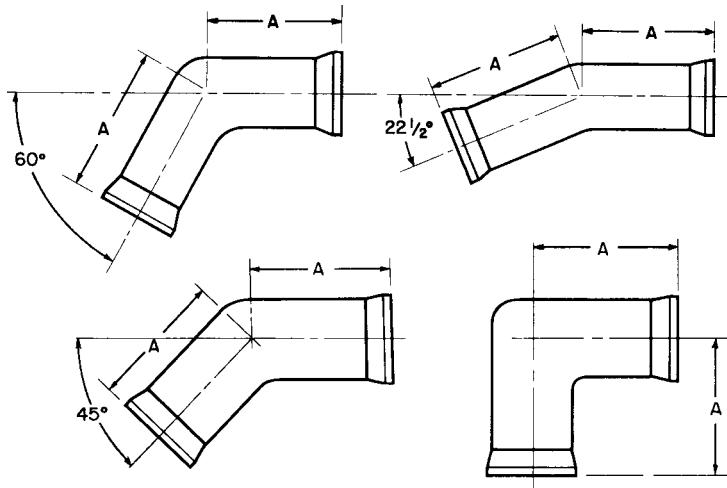
TABLE 9 Dimensional Specifications for the Spacers (Beveled)



Nominal Pipe Size, in.	B, in. (mm)		A, in. (mm)		C
	Outside Diameter	Outside Diameter Tolerance	Inside Diameter	Inside Diameter Tolerance	
1	1 ⁹ / ₁₆ (39.7)	± ¹ / ₁₆ (1.6)	1 (25.4)	± ¹ / ₁₆ (1.6)	1 ¹ / ₄ (29.0)
1 ¹ / ₂	2 ⁵ / ₃₂ (54.8)	± ¹ / ₁₆ (1.6)	1 ¹ / ₂ (38.1)	± ¹ / ₁₆ (1.6)	1 ³ / ₁₆ (30.2)
2	2 ²¹ / ₃₂ (67.5)	± ³ / ₃₂ (2.4)	2 (50.8)	± ³ / ₃₂ (2.4)	1 ¹⁵ / ₆₄ (31.4)
3	3 ²⁷ / ₃₂ (97.6)	± ³ / ₃₂ (2.4)	3 (76.2)	± ³ / ₃₂ (2.4)	1 ² / ₆₄ (33.7)
4	5 ¹ / ₃₂ (135.7)	± ¹ / ₈ (3.2)	4 (101.6)	± ¹ / ₈ (3.2)	1 ¹⁵ / ₃₂ (37.3)
6	not manufactured				

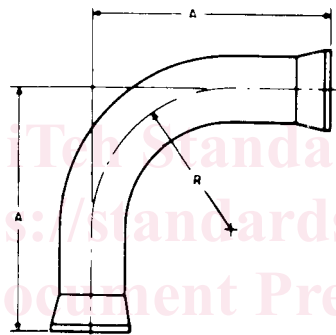
ASTM C 599

TABLE 10 Ells



Nominal Size, in.	A, in. (mm) ± 1/8 in. (3.2 mm)
1	2 3/4 (69.9)
1 1/2	3 1/2 (88.9)
2	4 (101.6)
3	5 (127)
4	7 (177.8)
6	9 (228.6)

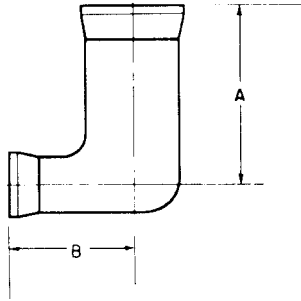
TABLE 11 Sweep Ells



Nominal Size, in.	A, in. (mm) ± 1/8 in. (3.2 mm)	R, in. (mm) ± 1/2 in. (12.7 mm)
1	4 3/4 (120.7)	2 3/4 (69.9)
1 1/2	5 (127.9)	3 1/2 (88.9)
2	6 (152.4)	3 1/2 (88.9)
3	7 (177.8)	4 1/2 (114.3)
4	10 (254.0)	6 (152.4)

ASTM C 599

TABLE 12 Reducer Ells



Nominal Size, in.	A, in. (mm) ± 1/8 in. (3.2 mm)	B, in. (mm) ± 1/8 in. (3.2 mm)	Nominal Size, in.	A, in. (mm) ± 1/8 in. (3.2 mm)	B, in. (mm) ± 1/8 in. (3.2 mm)	Nominal Size, in.	A, in. (mm) ± 1/8 in. (3.2 mm)	B, in. (mm) ± 1/8 in. (3.2 mm)
1 1/2 by 1	3 1/2 (88.9)	3 (76.2)	3 by 2	5 (127.0)	4 1/2 (114.3)	6 by 1	9 (228.6)	5 (127.0)
2 by 1	4 (101.6)	3 (76.2)	4 by 1	7 (177.8)	4 (101.6)	6 by 1 1/2	9 (228.6)	5 1/2 (139.7)
2 by 1 1/2	4 (101.6)	3 1/2 (88.9)	4 by 1 1/2	7 (177.8)	4 1/2 (114.3)	6 by 2	9 (228.6)	6 (152.4)
3 by 1	5 (127.0)	3 1/2 (88.9)	4 by 2	7 (177.8)	5 (127.0)	6 by 3	9 (228.6)	6 1/2 (165.1)
3 by 1 1/2	5 (127.0)	4 (101.6)	4 by 3	7 (177.8)	5 1/2 (139.7)	6 by 4	9 (228.6)	8 (203.2)

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[ASTM C599-91\(1995\)e1](#)

<https://standards.itih.ai/catalog/standards/sist/34d86d67-d826-4260-ba66-f5726d10f3e7/astm-c599-911995e1>