

Swaged(d) Nipples and Bull Plugs

Standard Practice
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This Standard Practice has been substantially revised from the previous 2006a edition. It is suggested that if the user is interested in knowing what changes have been made, that direct page by page comparison should be made of this document and that of the previous edition.

Non-toleranced dimensions in this Standard Practice are nominal unless otherwise specified.

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FOREWORD

This document establishes a Standard Practice for Swaged (also known as Swage) Nipples and Bull Plugs, produced for a number of years by various manufacturers to varying dimensions, although basically similar in principle. Users should note that Swaged Nipples, and Bull Plugs furnished from existing stocks may have slightly different dimensions than shown herein.

The values stated in either inch units or metric units are to be regarded separately as standard. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Within the text, the (SI) metric units are shown in parenthesis or within applicable tables; however, Bull Plug and Swaged Nipple sizes, within this Standard Practice, are identified by the “nominal pipe size” (NPS) only.

Tables 1 through 3 show fittings with dimensional requirements and tolerances in U.S. Customary (i.e., inch) units. Tables A1 through A3 show the dimensional fitting requirements and tolerances in (SI) metric (i.e., millimeter) units.

NOTE: The drawings included within this Standard Practice are for the purpose of illustration only and not intended to exclude or limit any other design meeting this Standard Practice.

In Memory of:
Alfred “Fred” S. Gilly
1929 – 2013

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SWAGE(D) NIPPLES AND BULL PLUGS

1. SCOPE

1.1 This Standard Practice covers dimensions, finish, tolerances, marking, and material for carbon steel and alloy steel Swaged⁽¹⁾ Nipples (male end reducing fittings), NPS 1/4 through NPS 12 and Bull Plugs (hollow or solid male closures) NPS 1/8 through NPS 12. These fittings are made with ends that are threaded, beveled, square cut, grooved, or any combination of these. Both concentric and eccentric Swaged Nipples are included.

1.2 **Partial Compliance Fittings** Fittings with special dimensions and fittings made from non-standard materials may be designed and manufactured by agreement between the manufacturer and the purchaser, provided they are marked in accordance with the requirements for partial compliance fittings of Section 4.1e.

2. PRESSURE RATINGS

2.1 The allowable working pressure for fittings designed in accordance with this Standard Practice shall be calculated as for straight seamless pipe of equal end preparation, in accordance with the applicable sections of ASME B31.1, Power Piping, or ASME B31.3, Process Piping. The pipe wall thickness and type material shall be that for which the fittings have been ordered. Fittings shall be identified by pipe wall thickness and material grade in lieu of pressure rating.

2.2 The design of fittings may be established by mathematical analyses contained in nationally recognized pressure vessel or piping codes, or at the manufacturer's option, by proof testing in accordance with Section 9. Records of design or successful proof tests shall be available at the manufacturer's facility for inspection by the purchaser. Bull Plugs shall meet the additional requirement that the minimum thickness of the head shall

be at least 1.5 times the thickness of the corresponding pipe schedule. For Bull Plugs that are drilled and tapped, the minimum thickness of the head shall be increased to accommodate the minimum L2 thread length as specified in ASME B1.20.1

3. SIZE

3.1 Within this Standard Practice, Bull Plug size is identified by the "nominal pipe size" (NPS) only. Swaged Nipples are also indicated by NPS only and are further identified with the large end size listed first, followed by the small end size (see Section 4.1d).

4. MARKING

4.1 Each fitting shall be marked with prescribed information by raised lettering, electro-etching, vibro-etching, laser etching or other permanent method which will not result in harmful contamination or sharp discontinuities as follows:

- a) Manufacturer's name or trademark
- b) **Material Identification**
 - Fittings shall be marked with the material grade in accordance with the applicable ASTM Fittings Specifications A234/A234M, A403/A403M, A420/A420M, A815/A815M, or A858/A858M (e.g., WPB, WP304, WPL6).
 - The material lot or heat number traceable to the material shall be part of the material identification.
- c) Schedule number or nominal wall thickness designation of Swaged Nipple or Bull Plug.
- d) **Size**
 - Nominal pipe size (NPS) of Bull Plug
 - Nominal pipe size (NPS) – Large end x small end of Swaged Nipples

Example: 2 x 1

NOTE: (1) Both "Swage" and "Swaged" are used within Industry terminology. Only "Swaged" is used in the body of this Standard Practice.

- e) **Product Conformance** Fittings shall be marked with the symbol "SP95" to denote full conformance with this Standard Practice. Partial compliance fittings covered in Section 1.2 shall not be marked "SP95". If marked with an ASTM designation, such marking shall be followed by the symbol "S58" as required by the "Supplementary Requirements" for Special Fittings in ASTM A960/A960M.

4.2 Where size and shape of fittings do not permit all the above markings, they may be omitted in the reverse order given above.

4.3 Minimum permanent marking is the manufacturer's name or trademark, material grade, heat number, and schedule number or nominal wall thickness.

4.4 Where steel stamps are used, care must be taken so that marking is not deep enough to reduce wall thickness of the fitting below minimum allowed.

5. MATERIAL

5.1 The steel for Swaged Nipples and Bull Plugs shall consist of forgings, round or hex bars or seamless pipe or tube which conform to the requirements of ASTM A234/A234M, A403/A403M, A420/A420M, A815/A815M, A858/A858M or the corresponding ASME Specification.

When Swaged Nipples and Bull Plugs are made of materials other than those referenced in this Standard Practice, they should be appropriately marked as agreed upon between the manufacturer and purchaser.

6. DIMENSIONS

6.1 The dimensions of Swaged Nipples and Bull Plugs shall conform to Tables 1 or A1 and Tables 2 or A2, respectively. U.S. customary (inch) tolerances shall conform to Table 3 and metric (millimeter) tolerances shall conform to Table A3.

7. END PREPARATION

7.1 Pipe ends may be threaded, beveled for butt-welding, square cut (plain) for socket welding, grooved, or any combination thereof.

7.2 Threaded ends shall be in accordance with ASME B1.20.1. Threads shall be chamfered at the ends of the fitting to protect the first thread. The reference point for gauging threads is the last thread scratch on the chamfer cone.

7.3 Butt-welding ends shall be in accordance with ASME B16.25.

7.4 Grooved ends shall be by agreement between the manufacturer and purchaser.

8. SURFACE QUALITY

8.1 Fittings supplied under this specification shall be in accordance with surface quality requirements of ASTM A960/A960M.

9. DESIGN PROOF TEST

9.1 Proof tests shall be performed as set forth herein, when the manufacturer chooses proof testing to qualify the fitting design.

9.2 *Test Assembly*

9.2.1 Fittings selected for testing shall be representative of production and shall meet all the requirements of this Standard Practice and the applicable material specification. The fittings shall be inspected for dimensional compliance to this Standard Practice. Full material specification test reports, including chemical analysis, tensile properties, and hardness property results shall be included in the records of these proof tests.

9.2.2 Straight seamless or welded pipe sections, whose calculated bursting strength is at least as great as the computed proof test pressure as calculated in Section 9.3 shall be welded to each end of the fitting to be tested. Any internal misalignment greater than 0.06 inch (1.6 mm) shall be reduced by taper boring at a slope of $\leq 1:3$.

Length of pipe sections for closures shall be at least twice the pipe outside diameter (O.D.).

9.3 *Test Procedure*

9.3.1 The test fluid shall be water or other fluid used for hydrostatic testing.

9.3.2 Hydrostatic pressure shall be applied to the test assembly. The test is successful if the

assembly withstands, without rupture, 105 percent (105%) of the computed test pressure defined below:

$$P = \frac{2 St}{D}$$

Where:

P = computed test pressure

S = minimum tensile strength of the test fitting

t = minimum wall thickness of the pipe that the fitting marking identifies

D = specified outside diameter of the pipe

NOTE: Any dimensionally consistent system of units may be used.

9.3.3 As an alternative, if the pipe ruptures, or if sufficient pressure to rupture a part of the assembly cannot be attained, the test pressure is acceptable if a final test pressure is at least 105 percent (105%) of the computed proof test pressure.

9.4 **Applicability of Test Results** It is not necessary to conduct an individual test of fittings with all combinations of sizes, wall thickness, end connections and grade of steel. A successful proof test on one prototype fitting may represent others to the extent described herein.

9.4.1 One test fitting may be used to qualify similar ones, no smaller than one-half, nor larger than two times the nominal pipe size of the test fitting.

9.4.2 The untested fittings shall have a t/D ratio not less than one-half, nor more than three times the t/D ratio of the test fitting.

9.4.3 The pressure retaining capacity of a fitting made of various grades of material with similar mechanical properties will be directly proportional to the tensile properties of the various grades, provided the yield-to-tensile ratio is 0.84 or less for the material to be extended under the proof test data. Hence, it is necessary to test a prototype in only a single grade to prove the geometric design of the fittings.

10. TESTING

10.1 Hydrostatic testing of fittings is not required in this Standard Practice. All fittings shall be capable of withstanding without leakage, a test pressure equal to that prescribed in the specification for the pipe of equal end preparation, with which the fitting's marking identifies.

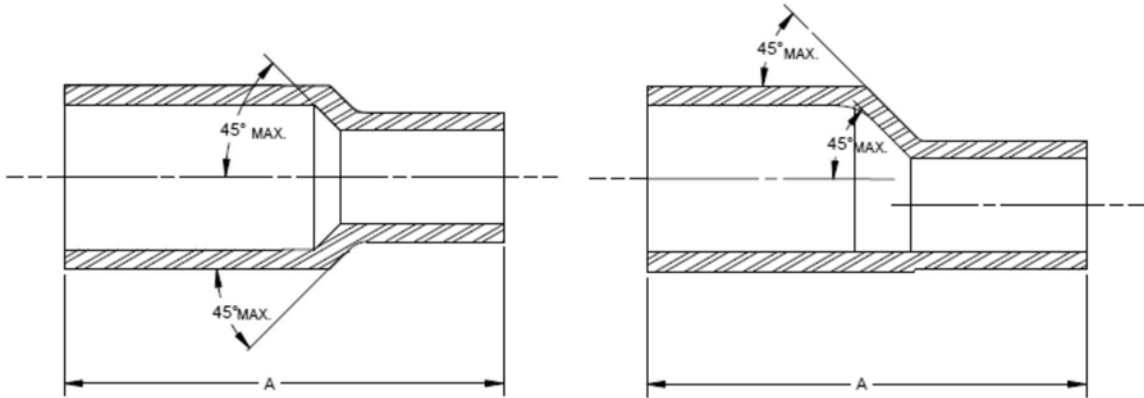


TABLE 1
Swaged Nipple Dimensions

Dimensions are in inches

| NPS | Outside Diameter | | End-to-End "A" |
|---------------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 1/4 x 1/8 | 0.540 | 0.405 | 2.25 |
| 3/8 x 1/4 | 0.675 | 0.540 | 2.50 |
| 3/8 x 1/8 | 0.675 | 0.405 | 2.50 |
| 1/2 x 3/8 | 0.840 | 0.675 | 2.75 |
| 1/2 x 1/4 | 0.840 | 0.540 | 2.75 |
| 1/2 x 1/8 | 0.840 | 0.405 | 2.75 |
| 3/4 x 1/2 | 1.050 | 0.840 | 3.00 |
| 3/4 x 3/8 | 1.050 | 0.675 | 3.00 |
| 3/4 x 1/4 | 1.050 | 0.540 | 3.00 |
| 3/4 x 1/8 | 1.050 | 0.405 | 3.00 |
| 1 x 3/4 | 1.315 | 1.050 | 3.50 |
| 1 x 1/2 | 1.315 | 0.840 | 3.50 |
| 1 x 3/8 | 1.315 | 0.675 | 3.50 |
| 1 x 1/4 | 1.315 | 0.540 | 3.50 |
| 1 x 1/8 | 1.315 | 0.405 | 3.50 |
| 1 1/4 x 1 | 1.660 | 1.315 | 4.00 |
| 1 1/4 x 3/4 | 1.660 | 1.050 | 4.00 |
| 1 1/4 x 1/2 | 1.660 | 0.840 | 4.00 |
| 1 1/4 x 3/8 | 1.660 | 0.675 | 4.00 |
| 1 1/4 x 1/4 | 1.660 | 0.540 | 4.00 |
| 1 1/4 x 1/8 | 1.660 | 0.405 | 4.00 |
| 1 1/2 x 1 1/4 | 1.900 | 1.660 | 4.50 |
| 1 1/2 x 1 | 1.900 | 1.315 | 4.50 |
| 1 1/2 x 3/4 | 1.900 | 1.050 | 4.50 |
| 1 1/2 x 1/2 | 1.900 | 0.840 | 4.50 |
| 1 1/2 x 3/8 | 1.900 | 0.675 | 4.50 |
| 1 1/2 x 1/4 | 1.900 | 0.540 | 4.50 |
| 1 1/2 x 1/8 | 1.900 | 0.405 | 4.50 |

| NPS | Outside Diameter | | End-to-End "A" |
|---------------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 2 x 1 1/2 | 2.375 | 1.900 | 6.50 |
| 2 x 1 1/4 | 2.375 | 1.660 | 6.50 |
| 2 x 1 | 2.375 | 1.315 | 6.50 |
| 2 x 3/4 | 2.375 | 1.050 | 6.50 |
| 2 x 1/2 | 2.375 | 0.840 | 6.50 |
| 2 x 3/8 | 2.375 | 0.675 | 6.50 |
| 2 x 1/4 | 2.375 | 0.540 | 6.50 |
| 2 x 1/8 | 2.375 | 0.405 | 6.50 |
| 2 1/2 x 2 | 2.875 | 2.375 | 7.00 |
| 2 1/2 x 1 1/2 | 2.875 | 1.900 | 7.00 |
| 2 1/2 x 1 1/4 | 2.875 | 1.660 | 7.00 |
| 2 1/2 x 1 | 2.875 | 1.315 | 7.00 |
| 2 1/2 x 3/4 | 2.875 | 1.050 | 7.00 |
| 2 1/2 x 1/2 | 2.875 | 0.840 | 7.00 |
| 2 1/2 x 3/8 | 2.875 | 0.675 | 7.00 |
| 2 1/2 x 1/4 | 2.875 | 0.540 | 7.00 |
| 2 1/2 x 1/8 | 2.875 | 0.405 | 7.00 |
| 3 x 2 1/2 | 3.500 | 2.875 | 8.00 |
| 3 x 2 | 3.500 | 2.375 | 8.00 |
| 3 x 1 1/2 | 3.500 | 1.900 | 8.00 |
| 3 x 1 1/4 | 3.500 | 1.660 | 8.00 |
| 3 x 1 | 3.500 | 1.315 | 8.00 |
| 3 x 3/4 | 3.500 | 1.050 | 8.00 |
| 3 x 1/2 | 3.500 | 0.840 | 8.00 |
| 3 x 3/8 | 3.500 | 0.675 | 8.00 |
| 3 x 1/4 | 3.500 | 0.540 | 8.00 |
| 3 x 1/8 | 3.500 | 0.405 | 8.00 |

(Continued on next page)

NOTE: See Table 1M for dimensions in millimeters.

TABLE 1 (Continued)
Swaged Nipple Dimensions

Dimensions are in inches

| NPS | Outside Diameter | | End-to-End "A" |
|---------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 3½ x 3 | 4.000 | 3.500 | 8.00 |
| 3½ x 2½ | 4.000 | 2.875 | 8.00 |
| 3½ x 2 | 4.000 | 2.375 | 8.00 |
| 3½ x 1½ | 4.000 | 1.900 | 8.00 |
| 3½ x 1¼ | 4.000 | 1.660 | 8.00 |
| 3½ x 1 | 4.000 | 1.315 | 8.00 |
| 3½ x ¾ | 4.000 | 1.050 | 8.00 |
| 3½ x ½ | 4.000 | 0.840 | 8.00 |
| 3½ x ⅜ | 4.000 | 0.675 | 8.00 |
| 3½ x ¼ | 4.000 | 0.540 | 8.00 |
| 3½ x ⅛ | 4.000 | 0.405 | 8.00 |
| 4 x 3½ | 4.500 | 4.000 | 9.00 |
| 4 x 3 | 4.500 | 3.500 | 9.00 |
| 4 x 2½ | 4.500 | 2.875 | 9.00 |
| 4 x 2 | 4.500 | 2.375 | 9.00 |
| 4 x 1½ | 4.500 | 1.900 | 9.00 |
| 4 x 1¼ | 4.500 | 1.660 | 9.00 |
| 4 x 1 | 4.500 | 1.315 | 9.00 |
| 4 x ¾ | 4.500 | 1.050 | 9.00 |
| 4 x ½ | 4.500 | 0.840 | 9.00 |
| 4 x ⅜ | 4.500 | 0.675 | 9.00 |
| 4 x ¼ | 4.500 | 0.540 | 9.00 |
| 5 x 4 | 5.563 | 4.500 | 11.00 |
| 5 x 3½ | 5.563 | 4.000 | 11.00 |
| 5 x 3 | 5.563 | 3.500 | 11.00 |
| 5 x 2½ | 5.563 | 2.875 | 11.00 |
| 5 x 2 | 5.563 | 2.375 | 11.00 |
| 5 x 1½ | 5.563 | 1.900 | 11.00 |
| 5 x 1¼ | 5.563 | 1.660 | 11.00 |
| 5 x 1 | 5.563 | 1.315 | 11.00 |
| 5 x ¾ | 5.563 | 1.050 | 11.00 |
| 5 x ½ | 5.563 | 0.840 | 11.00 |
| 5 x ⅜ | 5.563 | 0.675 | 11.00 |
| 5 x ¼ | 5.563 | 0.540 | 11.00 |
| 6 x 5 | 6.625 | 5.563 | 12.00 |
| 6 x 4 | 6.625 | 4.500 | 12.00 |

| NPS | Outside Diameter | | End-to-End "A" |
|---------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 6 x 3½ | 6.625 | 4.000 | 12.00 |
| 6 x 3 | 6.625 | 3.500 | 12.00 |
| 6 x 2½ | 6.625 | 2.875 | 12.00 |
| 6 x 2 | 6.625 | 2.375 | 12.00 |
| 6 x 1½ | 6.625 | 1.900 | 12.00 |
| 6 x 1¼ | 6.625 | 1.660 | 12.00 |
| 6 x 1 | 6.625 | 1.315 | 12.00 |
| 6 x ¾ | 6.625 | 1.050 | 12.00 |
| 6 x ½ | 6.625 | 0.840 | 12.00 |
| 8 x 6 | 8.625 | 6.625 | 13.00 |
| 8 x 5 | 8.625 | 5.563 | 13.00 |
| 8 x 4 | 8.625 | 4.500 | 13.00 |
| 8 x 3½ | 8.625 | 4.000 | 13.00 |
| 8 x 3 | 8.625 | 3.500 | 13.00 |
| 8 x 2½ | 8.625 | 2.875 | 13.00 |
| 8 x 2 | 8.625 | 2.375 | 13.00 |
| 8 x 1½ | 8.625 | 1.900 | 13.00 |
| 8 x 1¼ | 8.625 | 1.660 | 13.00 |
| 8 x 1 | 8.625 | 1.315 | 13.00 |
| 10 x 8 | 10.750 | 8.625 | 15.00 |
| 10 x 6 | 10.750 | 6.625 | 15.00 |
| 10 x 5 | 10.750 | 5.563 | 15.00 |
| 10 x 4 | 10.750 | 4.500 | 15.00 |
| 10 x 3½ | 10.750 | 4.000 | 15.00 |
| 10 x 3 | 10.750 | 3.500 | 15.00 |
| 10 x 2½ | 10.750 | 2.875 | 15.00 |
| 10 x 2 | 10.750 | 2.375 | 15.00 |
| 12 x 10 | 12.750 | 10.750 | 16.00 |
| 12 x 8 | 12.750 | 8.625 | 16.00 |
| 12 x 6 | 12.750 | 6.625 | 16.00 |
| 12 x 5 | 12.750 | 5.563 | 16.00 |
| 12 x 4 | 12.750 | 4.500 | 16.00 |
| 12 x 3½ | 12.750 | 4.000 | 16.00 |
| 12 x 3 | 12.750 | 3.500 | 16.00 |
| 12 x 2½ | 12.750 | 2.875 | 16.00 |
| 12 x 2 | 12.750 | 2.375 | 16.00 |

NOTE: See Table 1M for dimensions in millimeters.

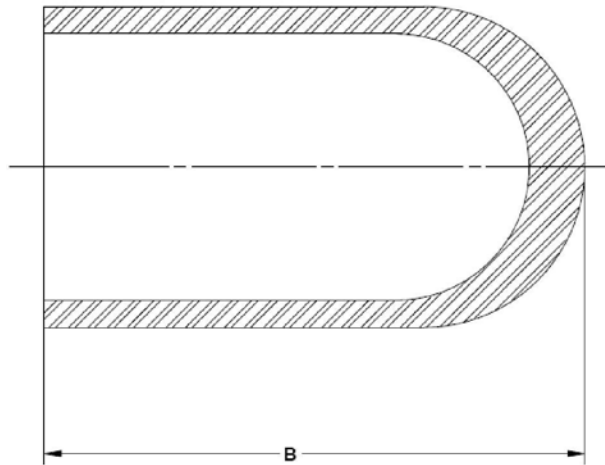


TABLE 2
Bull Plug Dimensions

Dimensions are in inches

| NPS | Outside Diameter | End-to-End "B" |
|-----|------------------|----------------|
| 1/8 | 0.405 | 2.00 |
| 1/4 | 0.540 | 2.00 |
| 3/8 | 0.675 | 2.25 |
| 1/2 | 0.840 | 2.50 |
| 3/4 | 1.050 | 2.75 |
| 1 | 1.315 | 3.00 |
| 1¼ | 1.660 | 3.25 |
| 1½ | 1.900 | 3.50 |
| 2 | 2.375 | 4.00 |

| NPS | Outside Diameter | End-to-End "B" |
|-----|------------------|----------------|
| 2½ | 2.875 | 5.00 |
| 3 | 3.500 | 6.00 |
| 3½ | 4.000 | 6.50 |
| 4 | 4.500 | 7.00 |
| 5 | 5.563 | 8.50 |
| 6 | 6.625 | 10.00 |
| 8 | 8.625 | 11.00 |
| 10 | 10.750 | 13.00 |
| 12 | 12.750 | 14.00 |

NOTE: See Table 2M for dimensions in millimeters.

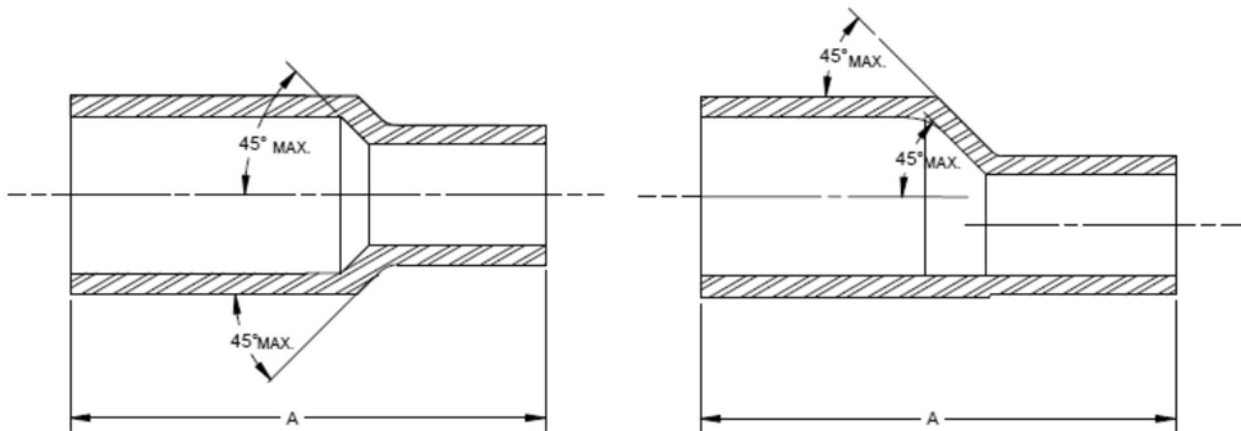
NOTE: The Bull Plug drawing above is for the purpose of illustration only and not intended to exclude or limit any other design meeting this Standard Practice.

TABLE 3
Tolerances

Dimensions are in inches

| NPS | Outside Diameter at End | | | Fitting Wall Thickness ^(a) | Inside Diameter and Outside Diameter Swage-Down Angles (degrees) |
|-----------|-------------------------|------------------|-----------------------|--|--|
| | Overall Length | Square Cut Ends | Other End Connections | | |
| 1/4 – 3/8 | ± 1/16 | + 1/64 - 1/32 | ± 1/32 | Not less than 87.5% Nominal Wall Thickness | 45° Maximum (see diagram below) |
| 1/2 – 1½ | ± 1/16 | + 1/64 - 1/32 | + 1/16 - 1/32 | | |
| 2 – 2½ | ± 1/8 | ± 1/32 | + 1/16 - 1/32 | | |
| 3 – 4 | ± 1/8 | ± 1/32 | ± 1/16 | | |
| 5 – 6 | ± 3/16 | + 3/32 - 1/16 | + 3/32 - 1/16 | | |
| 8 – 12 | ± 1/4 | + 5/32 - 1/8 | + 5/32 - 1/8 | | |

NOTES: (a) Prior to threading or grooving.
See Table 3M for dimensions in millimeters.



Inside Diameter and Outside Diameter Maximum Swage-Down Angles

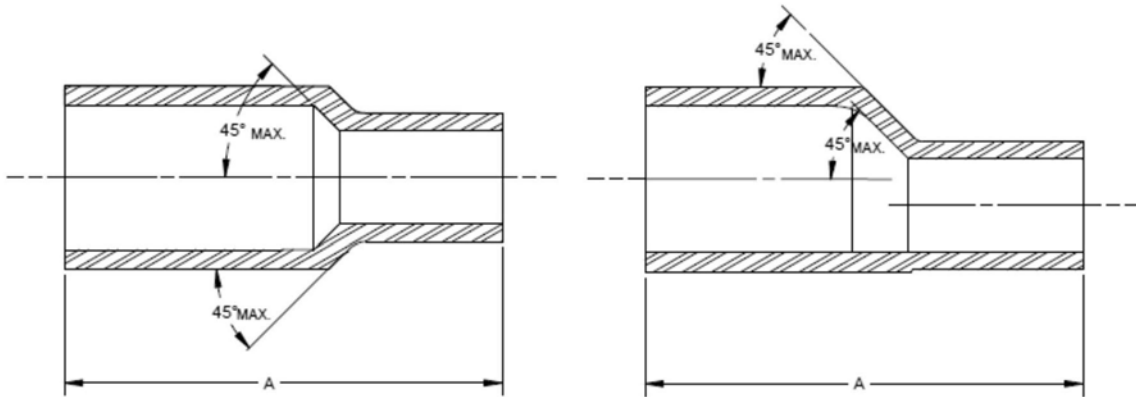


TABLE 1M
Swaged Nipple Dimensions (millimeters)

Dimensions are in millimeters

| NPS | Outside Diameter | | End-to-End "A" |
|---------------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 1/4 x 1/8 | 13.7 | 10.3 | 57 |
| 3/8 x 1/4 | 17.1 | 13.7 | 64 |
| 3/8 x 1/8 | 17.1 | 10.3 | 64 |
| 1/2 x 3/8 | 21.3 | 17.1 | 70 |
| 1/2 x 1/4 | 21.3 | 13.7 | 70 |
| 1/2 x 1/8 | 21.3 | 10.3 | 70 |
| 3/4 x 1/2 | 26.7 | 21.3 | 76 |
| 3/4 x 3/8 | 26.7 | 17.1 | 76 |
| 3/4 x 1/4 | 26.7 | 13.7 | 76 |
| 3/4 x 1/8 | 26.7 | 10.3 | 76 |
| 1 x 3/4 | 33.4 | 26.7 | 89 |
| 1 x 1/2 | 33.4 | 21.3 | 89 |
| 1 x 3/8 | 33.4 | 17.1 | 89 |
| 1 x 1/4 | 33.4 | 13.7 | 89 |
| 1 x 1/8 | 33.4 | 10.3 | 89 |
| 1 1/4 x 1 | 42.2 | 33.4 | 102 |
| 1 1/4 x 3/4 | 42.2 | 26.7 | 102 |
| 1 1/4 x 1/2 | 42.2 | 21.3 | 102 |
| 1 1/4 x 3/8 | 42.2 | 17.1 | 102 |
| 1 1/4 x 1/4 | 42.2 | 13.7 | 102 |
| 1 1/4 x 1/8 | 42.2 | 10.3 | 102 |
| 1 1/2 x 1 1/4 | 48.3 | 42.2 | 114 |
| 1 1/2 x 1 | 48.3 | 33.4 | 114 |
| 1 1/2 x 3/4 | 48.3 | 26.7 | 114 |
| 1 1/2 x 1/2 | 48.3 | 21.3 | 114 |
| 1 1/2 x 3/8 | 48.3 | 17.1 | 114 |
| 1 1/2 x 1/4 | 48.3 | 13.7 | 114 |
| 1 1/2 x 1/8 | 48.3 | 10.3 | 114 |

| NPS | Outside Diameter | | End-to-End "A" |
|---------------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 2 x 1 1/2 | 60.3 | 48.3 | 165 |
| 2 x 1 1/4 | 60.3 | 42.2 | 165 |
| 2 x 1 | 60.3 | 33.4 | 165 |
| 2 x 3/4 | 60.3 | 26.7 | 165 |
| 2 x 1/2 | 60.3 | 21.3 | 165 |
| 2 x 3/8 | 60.3 | 17.1 | 165 |
| 2 x 1/4 | 60.3 | 13.7 | 165 |
| 2 x 1/8 | 60.3 | 10.3 | 165 |
| 2 1/2 x 2 | 73.0 | 60.3 | 178 |
| 2 1/2 x 1 1/2 | 73.0 | 48.3 | 178 |
| 2 1/2 x 1 1/4 | 73.0 | 42.2 | 178 |
| 2 1/2 x 1 | 73.0 | 33.4 | 178 |
| 2 1/2 x 3/4 | 73.0 | 26.7 | 178 |
| 2 1/2 x 1/2 | 73.0 | 21.3 | 178 |
| 2 1/2 x 3/8 | 73.0 | 17.1 | 178 |
| 2 1/2 x 1/4 | 73.0 | 13.7 | 178 |
| 2 1/2 x 1/8 | 73.0 | 10.3 | 178 |
| 3 x 2 1/2 | 88.9 | 73.0 | 203 |
| 3 x 2 | 88.9 | 60.3 | 203 |
| 3 x 1 1/2 | 88.9 | 48.3 | 203 |
| 3 x 1 1/4 | 88.9 | 42.2 | 203 |
| 3 x 1 | 88.9 | 33.4 | 203 |
| 3 x 3/4 | 88.9 | 26.7 | 203 |
| 3 x 1/2 | 88.9 | 21.3 | 203 |
| 3 x 3/8 | 88.9 | 17.1 | 203 |
| 3 x 1/4 | 88.9 | 13.7 | 203 |
| 3 x 1/8 | 88.9 | 10.3 | 203 |

(Continued on next page)

NOTE: See Table 1 for dimensions in inches.

TABLE 1M (Continued)
Swaged Nipple Dimensions (millimeters)

Dimensions are in millimeters

| NPS | Outside Diameter | | End-to-End "A" |
|----------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 3½ x 3 | 101.6 | 88.9 | 203 |
| 3½ x 2½ | 101.6 | 73.0 | 203 |
| 3½ x 2 | 101.6 | 60.3 | 203 |
| 3½ x 1½ | 101.6 | 48.3 | 203 |
| 3½ x 1¼ | 101.6 | 42.2 | 203 |
| 3½ x 1 | 101.6 | 33.4 | 203 |
| 3½ x ¾ | 101.6 | 26.7 | 203 |
| 3½ x ½ | 101.6 | 21.3 | 203 |
| 3½ x 3/8 | 101.6 | 17.1 | 203 |
| 3½ x ¼ | 101.6 | 13.7 | 203 |
| 3½ x 1/8 | 101.6 | 10.3 | 203 |
| 4 x 3½ | 114.3 | 101.6 | 229 |
| 4 x 3 | 114.3 | 88.9 | 229 |
| 4 x 2½ | 114.3 | 73.0 | 229 |
| 4 x 2 | 114.3 | 60.3 | 229 |
| 4 x 1½ | 114.3 | 48.3 | 229 |
| 4 x 1¼ | 114.3 | 42.2 | 229 |
| 4 x 1 | 114.3 | 33.4 | 229 |
| 4 x ¾ | 114.3 | 26.7 | 229 |
| 4 x ½ | 114.3 | 21.3 | 229 |
| 4 x 3/8 | 114.3 | 17.1 | 229 |
| 4 x ¼ | 114.3 | 13.7 | 229 |
| 5 x 4 | 141.3 | 114.3 | 279 |
| 5 x 3½ | 141.3 | 101.6 | 279 |
| 5 x 3 | 141.3 | 88.9 | 279 |
| 5 x 2½ | 141.3 | 73.0 | 279 |
| 5 x 2 | 141.3 | 60.3 | 279 |
| 5 x 1½ | 141.3 | 48.3 | 279 |
| 5 x 1¼ | 141.3 | 42.2 | 279 |
| 5 x 1 | 141.3 | 33.4 | 279 |
| 5 x ¾ | 141.3 | 26.7 | 279 |
| 5 x ½ | 141.3 | 21.3 | 279 |
| 5 x 3/8 | 141.3 | 17.1 | 279 |
| 5 x ¼ | 141.3 | 13.7 | 279 |
| 6 x 5 | 168.3 | 141.3 | 305 |
| 6 x 4 | 168.3 | 114.3 | 305 |

| NPS | Outside Diameter | | End-to-End "A" |
|---------|------------------|-----------|-------------------|
| | Large End | Small End | |
| 6 x 3½ | 168.3 | 101.6 | 305 |
| 6 x 3 | 168.3 | 88.9 | 305 |
| 6 x 2½ | 168.3 | 73.0 | 305 |
| 6 x 2 | 168.3 | 60.3 | 305 |
| 6 x 1½ | 168.3 | 48.3 | 305 |
| 6 x 1¼ | 168.3 | 42.2 | 305 |
| 6 x 1 | 168.3 | 33.4 | 305 |
| 6 x ¾ | 168.3 | 26.7 | 305 |
| 6 x ½ | 168.3 | 21.3 | 305 |
| 8 x 6 | 219.1 | 168.3 | 330 |
| 8 x 5 | 219.1 | 141.3 | 330 |
| 8 x 4 | 219.1 | 114.3 | 330 |
| 8 x 3½ | 219.1 | 101.6 | 330 |
| 8 x 3 | 219.1 | 88.9 | 330 |
| 8 x 2½ | 219.1 | 73.0 | 330 |
| 8 x 2 | 219.1 | 60.3 | 330 |
| 8 x 1½ | 219.1 | 48.3 | 330 |
| 8 x 1¼ | 219.1 | 42.2 | 330 |
| 8 x 1 | 219.1 | 33.4 | 330 |
| 10 x 8 | 273.0 | 219.1 | 381 |
| 10 x 6 | 273.0 | 168.3 | 381 |
| 10 x 5 | 273.0 | 141.3 | 381 |
| 10 x 4 | 273.0 | 114.3 | 381 |
| 10 x 3½ | 273.0 | 101.6 | 381 |
| 10 x 3 | 273.0 | 88.9 | 381 |
| 10 x 2½ | 273.0 | 73.0 | 381 |
| 10 x 2 | 273.0 | 60.3 | 381 |
| 12 x 10 | 323.8 | 273.0 | 406 |
| 12 x 8 | 323.8 | 219.1 | 406 |
| 12 x 6 | 323.8 | 168.3 | 406 |
| 12 x 5 | 323.8 | 141.3 | 406 |
| 12 x 4 | 323.8 | 114.3 | 406 |
| 12 x 3½ | 323.8 | 101.6 | 406 |
| 12 x 3 | 323.8 | 88.9 | 406 |
| 12 x 2½ | 323.8 | 73.0 | 406 |
| 12 x 2 | 323.8 | 60.3 | 406 |

NOTE: See Table 1 for dimensions in inches.

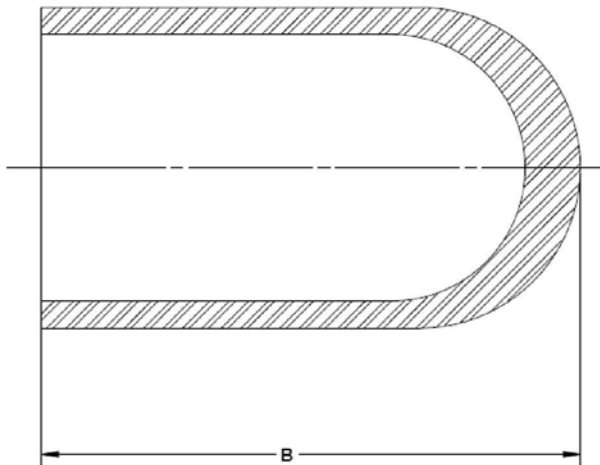


TABLE 2M
Bull Plug Dimensions (millimeters)

Dimensions are in millimeters

| NPS | Outside Diameter | End-to-End "B" |
|-----|------------------|----------------|
| 1/8 | 10.3 | 51 |
| 1/4 | 13.7 | 51 |
| 3/8 | 17.1 | 57 |
| 1/2 | 21.3 | 64 |
| 3/4 | 26.7 | 70 |
| 1 | 33.4 | 76 |
| 1¼ | 42.2 | 83 |
| 1½ | 48.3 | 89 |
| 2 | 60.3 | 102 |

| NPS | Outside Diameter | End-to-End "B" |
|-----|------------------|----------------|
| 2½ | 73.0 | 127 |
| 3 | 88.9 | 152 |
| 3½ | 101.6 | 165 |
| 4 | 114.3 | 178 |
| 5 | 141.3 | 216 |
| 6 | 168.3 | 254 |
| 8 | 219.1 | 279 |
| 10 | 273.0 | 330 |
| 12 | 323.8 | 356 |

NOTE: See Table 2 for dimensions in inches.

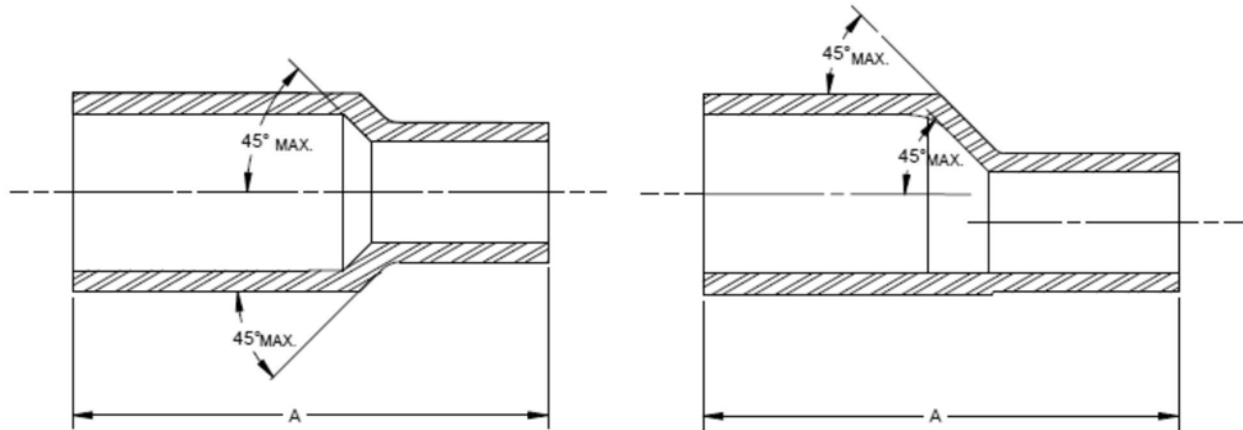
NOTE: The Bull Plug drawing above is for the purpose of illustration only and not intended to exclude or limit any other design meeting this Standard Practice.

TABLE 3M
Tolerances (millimeters)

Dimensions are in millimeters

| NPS | Outside Diameter at End | | | Fitting Wall Thickness ^(a) | Inside Diameter and Outside Diameter Swage-Down Angles (degrees) |
|-----------|-------------------------|-----------------|-----------------------|--|--|
| | Overall Length | Square Cut Ends | Other End Connections | | |
| 1/4 – 3/8 | ± 1.6 | + 0.4 - 0.8 | ± 0.8 | Not less than 87.5% Nominal Wall Thickness | 45° Maximum (see diagram below) |
| 1/2 – 1½ | ± 1.6 | + 0.4 - 0.8 | +1.6 -0.8 | | |
| 2 – 2½ | ± 3.2 | ± 0.8 | + 1.6 - 0.8 | | |
| 3 – 4 | ± 3.2 | ± 0.8 | ± 1.6 | | |
| 5 – 6 | ± 4.8 | + 2.4 - 1.6 | + 2.4 - 1.6 | | |
| 8 – 12 | ± 6.4 | + 4.0 - 3.2 | + 4.0 - 3.2 | | |

NOTE: (a) Prior to threading or grooving.
See Table 3 for dimensions in inches.



Inside Diameter and Outside Diameter Maximum Swage-Down Angles

ANNEX A

Referenced Standards and Applicable Dates

This Annex is an integral part of this Standard Practice and is placed after the main text for convenience.

| Standard Name | Description |
|-------------------------------|---|
| <u>ASME; ANSI/ASME</u> | |
| B1.20.1-2013 | Pipe Threads, General Purpose (Inch) |
| B16.25-2012 | Buttwelding Ends |
| B31.1-2012 | Power Piping |
| B31.3-2012 | Process Piping |
| <u>ASTM</u> | |
| A234/A234M-13 | Standard Specification for: Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service |
| A403/A403M-13a | Wrought Austenitic Stainless Steel Piping Fittings |
| A420/A420M-13 | Pipe Fitting of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service |
| A815/A815M-13a | Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings |
| A858/A858M-13 | Heat-Treated Carbon Steel Fittings for Low-Temperature and Corrosive Service |
| A960/A960M-13 | Common Requirements for Wrought Steel Piping Fittings |

The following organizations appear on the above list:

| | |
|------|---|
| ANSI | American National Standards Institute, Inc. 25 West 43rd Street, Fourth Floor New York, NY 10036-7406 |
| ASME | American Society of Mechanical Engineers (ASME International) Two Park Avenue New York, NY 10016-5990 |
| ASTM | ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken, PA 19428-2959 |

Listing of MSS Standard Practices (as of September, 2014)

| TITLE | |
|--------------|--|
| SP-6-2012 | Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings |
| SP-9-2013 | Spot Facing for Bronze, Iron, and Steel Flanges |
| SP-25-2013 | Standard Marking System for Valves, Fittings, Flanges, and Unions |
| SP-42-2013 | Corrosion-Resistant Gate, Globe, Angle, and Check Valves with Flanged and Butt Weld Ends (Classes 150, 300 & 600) |
| SP-43-2013 | Wrought and Fabricated Butt-Welding Fittings for Low Pressure, Corrosion Resistant Applications |
| SP-44-2010 | Steel Pipeline Flanges (incl. 2011 Errata Sheet) |
| SP-45-2003 | (R 2008) Bypass and Drain Connections |
| SP-51-2012 | Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings |
| SP-53-2012 | Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components – Magnetic Particle Examination Method |
| SP-54-2013 | Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components – Radiographic Examination Method |
| SP-55-2011 | Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components – Visual Method for Evaluation of Surface Irregularities (ANSI-approved American National Standard) |
| SP-58-2009 | Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation (incorporates content of SP-69, 77, 89, and 90) (ANSI-approved American National Standard) |
| SP-60-2012 | Connecting Flange Joints between Tapping Sleeves and Tapping Valves |
| SP-61-2013 | Pressure Testing of Valves |
| SP-65-2012 | High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets |
| SP-67-2011 | Butterfly Valves |
| SP-68-2011 | High Pressure Butterfly Valves with Offset Design |
| SP-70-2011 | Gray Iron Gate Valves, Flanged and Threaded Ends |
| SP-71-2011 | Gray Iron Swing Check Valves, Flanged and Threaded Ends (incl. 2013 Errata Sheet) |
| SP-72-2010a | Ball Valves with Flanged or Butt-Welding Ends for General Service |
| SP-75-2014 | High-Strength, Wrought, Butt-Welding Fittings |
| SP-78-2011 | Gray Iron Plug Valves, Flanged and Threaded Ends |
| SP-79-2011 | Socket Welding Reducer Inserts |
| SP-80-2013 | Bronze Gate, Globe, Angle, and Check Valves |
| SP-81-2013 | Stainless-Steel or Stainless-Steel-Lined, Bonnetless, Knife Gate Valves with Flanged Ends |
| SP-83-2006 | Class 3000 Steel Pipe Unions Socket Welding and Threaded |
| SP-85-2011 | Gray Iron Globe & Angle Valves, Flanged and Threaded Ends |
| SP-86-2009 | Guidelines for Metric Data in Standards for Valves, Flanges, Fittings, and Actuators (Incl. 2011 Errata Sheet) |
| SP-87-1991 | (R 1996 – Reinstated 2011) Factory-Made Butt-Welding Fittings for Class I Nuclear Piping Applications |
| SP-88-2010 | Diaphragm Valves |
| SP-91-2009 | Guidelines for Manual Operation of Valves |
| SP-92-2012 | MSS Valve User Guide |
| SP-93-2014 | Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components – Liquid Penetrant Examination Method |
| SP-94-2008 | Quality Standard for Ferritic and Martensitic Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components – Ultrasonic Examination Method |
| SP-95-2014 | Swage(d) Nipples and Bull Plugs |
| SP-96-2011 | Guidelines on Terminology for Valves and Fittings |
| SP-97-2012 | Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Buttwelding Ends |
| SP-98-2012 | Protective Coatings for the Interior of Valves, Hydrants, and Fittings |
| SP-99-2010 | Instrument Valves |
| SP-100-2009 | Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Valves |
| SP-101-2014 | Part-Turn Valve Actuator Attachment – FA Flange and Driving Component Dimensions and Performance Characteristics |
| SP-102-1989 | (R 2001) Multi-Turn Valve Actuator Attachment – Flange and Driving Component Dimensions and Performance Characteristics |
| SP-104-2012 | Wrought Copper Solder-Joint Pressure Fittings |
| SP-105-2010 | Instrument Valves for Code Applications |
| SP-106-2012 | Cast Copper Alloy Flanges and Flanged Fittings: Class 125, 150, and 300 |
| SP-108-2012 | Resilient-Seated Cast Iron Eccentric Plug Valves |
| SP-109-2012 | Weld-Fabricated Copper Solder-Joint Pressure Fittings (incl. 2012 Errata Sheet) |
| SP-110-2010 | Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends (incl. 2010 Errata Sheet) |
| SP-111-2012 | Gray-Iron and Ductile-Iron Tapping Sleeves |
| SP-112-2010 | Quality Standard for Evaluation of Cast Surface Finishes – Visual and Tactile Method. This SP must be used with a 10-surface, three dimensional Cast Surface Comparator, which is a necessary part of the standard. Additional Comparators available separately. |
| SP-113-2012 | Connecting Joints between Tapping Machines and Tapping Valves |
| SP-114-2007 | Corrosion Resistant Pipe Fittings Threaded and Socket Welding Class 150 and 1000 (ANSI-approved American National Standard) |
| SP-115-2010 | Excess Flow Valves, 1½ NPS and Smaller, for Fuel Gas Service |
| SP-116-2011 | Service-Line Valves and Fittings for Drinking Water Systems |
| SP-117-2011 | Bellows Seals for Globe and Gate Valves |
| SP-119-2010 | Factory-Made Wrought Belled End Pipe Fittings for Socket-Welding |
| SP-120-2011 | Flexible Graphite Packing System for Rising Stem Valves – Design Requirements |
| SP-121-2006 | Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves |
| SP-122-2012 | Plastic Industrial Ball Valves |
| SP-123-2013 | Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube |
| SP-124-2012 | Fabricated Tapping Sleeves |
| SP-125-2010 | Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves |
| SP-126-2013 | In-Line, Spring-Assisted, Center-Guided Check Valves (Carbon, Alloy Steel, Stainless Steel, & Nickel Alloys) |
| SP-127-2014a | Bracing for Piping Systems: Seismic-Wind-Dynamic Design, Selection, and Application |
| SP-128-2012 | Ductile Iron Gate Valves |
| SP-129-2014 | Copper-Nickel Socket-Welding, Fittings and Unions |
| SP-130-2013 | Bellows Seals for Instrument Valves |
| SP-131-2010 | Metallic Manually Operated Gas Distribution Valves |
| SP-132-2010 | Compression Packing Systems for Instrument Valves |
| SP-133-2010 | Excess Flow Valves for Low Pressure Fuel Gas Appliances |
| SP-134-2012 | Valves for Cryogenic Service, including Requirements for Body/Bonnet Extensions |
| SP-135-2010 | High Pressure Knife Gate Valves |
| SP-136-2014 | Ductile Iron Swing Check Valves |
| SP-137-2013 | Quality Standard for Positive Material Identification of Metal Valves, Flanges, Fittings, and Other Piping Components |
| SP-138-2009 | Quality Standard Practice for Oxygen Cleaning of Valves & Fittings |
| SP-139-2014 | Copper Alloy Gate, Globe, Angle, and Check Valves for Low Pressure/Low Temperature Plumbing Applications |
| SP-140-2012 | Quality Standard Practice for Preparation of Valves and Fittings for Silicone-Free Service |
| SP-141-2012 | Multi-Turn and Check Valve Modifications |
| SP-142-2012 | Excess Flow Valves for Fuel Gas Service, NPS 1½ through 12 |
| SP-143-2012 | Live-Loaded Valve Stem Packing Systems |
| SP-144-2013 | Pressure Seal Bonnet Valves |
| SP-145-2013 | Metal Ball Valves for Low Pressure/Low Temperature Plumbing Applications |
| SP-146-2014 | High Pressure, Lug- and Wafer-Type, Iron and Ductile Iron Knife Gate Valves |
| SP-147-2014 | Quality Standard for Steel Castings Used in Standard Class Steel Valves – Sampling Method for Evaluating Casting Quality |
| SP-148-2014 | Low Pressure Flanged or Lugged Carbon Steel and Iron or Ductile Iron, Cast or Fabricated, Bonnetless, Knife Gate Valves without Liners |

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