



AN AMERICAN NATIONAL STANDARD

# Factory-Made Wrought Steel Buttwelding Fittings

**ASME B16.9-1993**  
(REVISION OF ASME/ANSI B16.9-1986)



The American Society of  
Mechanical Engineers

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## FOREWORD

(This Foreword is not part of ASME B16.9-1993.)

In 1921, the American Engineering Standards Committee, later American Standards Association (ASA), organized Sectional Committee B16 to unify and further develop national standards for pipe flanges and fittings (and, later, for valves, gaskets, and valve actuators). Cosponsors of the B16 Committee were the American Society of Mechanical Engineers (ASME), the Heating and Piping Contractors National Association [now the Mechanical Contractors Association of America (MCAA)], and the Manufacturers Standardization Society of the Valve and Fittings Industry (MSS). Cosponsors were later designated as cosecretariat organizations.

Standardization of welding fittings was initiated in 1937 by a subgroup (designated Subgroup 6) of Subcommittee No. 3. After consideration of several drafts, a standard was approved by the Committee, cosponsors, and ASA, and published with the designation ASA B16.9-1940.

Revisions were made in 1950 and 1955 to add sizes up to NPS 24 and to complete coverage of fittings in some sizes. These revisions were approved and published as ASA B16.9-1951 and ASA B16.9-1958. With the subgroup now designated Subcommittee No. 6 (later Subcommittee F), further revisions were begun to clarify the intent of the standard, to add angularity tolerances, and to include fittings of different types (long radius reducing elbows and crosses) and smaller sizes (NPS  $\frac{1}{4}$  and  $\frac{1}{2}$ ). This revision was published as ASA B16.9-1964 after ASA approval.

After reorganization of ASA, first as the United States of America Standards Institute (USASI), then as the American National Standards Institute (ANSI), with the Sectional Committee being redesignated as an American National Standards Committee, another revision increasing the size range to NPS 48 and revising the text for clarity was approved and published as ANSI B16.9-1971.

In 1975, Subcommittee F began a major revision to bring the standard up to date with current practice and usage. Common fractions were expressed as decimals (but without intending higher precision) and metric dimensional equivalents were added. Provisions for step-wise change of radius for NPS  $\frac{3}{4}$  long radius elbows and 180 deg. returns were introduced. Following Standards Committee, cosecretariat, and ANSI approval, the revision was published as ANSI B16.9-1978. It was updated by a corrective addendum, B16.9a-1981, issued in February 1982.

In 1982, American National Standards Committee B16 was reorganized as an ASME Committee operating under procedures accredited by ANSI. In this edition, the text has been revised and inch dimensions are established as the standard. Following approval by the Standards Committee and ASME, approval as an American National Standard was given by ANSI on November 12, 1986 with the new designation ASME/ANSI B16.9-1986.

In 1991 the Subcommittee reviewed the document and made a number of revisions. Dimensions for short pattern lap joints were also added to this 1993 Edition of the Standard.

Requests for interpretation or suggestions for revision should be sent to the Secretary, B16 Committee, The American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.

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## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

### 1 SCOPE

#### 1.1 General

This Standard covers overall dimensions, tolerances, ratings, testing, and markings for wrought carbon and alloy steel factory-made butt welding fittings of NPS ½ through 48. It covers fittings of any producible wall thickness.

#### 1.2 Exclusions

This Standard does not cover low pressure corrosion resistant butt welding fittings. See MSS SP-43, Wrought Stainless Steel Butt-Welding Fittings.

#### 1.3 Partial Compliance Fittings

Fittings may be made to special dimensions, sizes, shapes, tolerances, or of wrought materials other than those covered by this Standard by agreement between the manufacturer and the purchaser. When such fittings meet all other stipulations of this Standard, they shall be considered as being in partial compliance therewith, provided they are appropriately marked. (See para. 4.4.)

#### 1.4 Fabricated Fittings

Fabricated laterals and other fittings employing circumferential or intersection welds are considered pipe fabrication, and shall be manufactured in accordance with the applicable section of ASME B31, Code for Pressure Piping.

#### 1.5 Standard Units

The inch is the standard unit for linear dimensions. Values in millimeters are for information and reference only. See Annex A.

#### NOTES:

- (1) Tolerance values shown in Table 1 in decimal inches are common fractions rounded as follows:

|                       |                       |
|-----------------------|-----------------------|
| 0.03 = $\frac{1}{32}$ | 0.12 = $\frac{1}{8}$  |
| 0.06 = $\frac{1}{16}$ | 0.16 = $\frac{3}{32}$ |
| 0.09 = $\frac{3}{32}$ | 0.19 = $\frac{3}{16}$ |
| 0.22 = $\frac{7}{32}$ | 0.38 = $\frac{3}{8}$  |
| 0.25 = $\frac{1}{4}$  |                       |

- (2) Dimensions in Tables 2 through 9 are common fractions or dimensions from ANSI/ASME B36.10M, rounded to two-place decimal fractions.

### 1.6 References

**1.6.1 Referenced Standards.** Standards and specifications adopted by reference in this Standard are shown in Annex B, which is part of this Standard. It is not considered practical to identify the specific edition of each standard and specification in the individual references. Instead, the specific edition reference is identified in Annex B. A product made in conformance with a prior edition of reference standards and in all other respects conforming to this Standard will be considered to be in conformance.

**1.6.2 Codes and Regulations.** A fitting used under the jurisdiction of the ASME Boiler and Pressure Vessel Code, the ASME Code for Pressure Piping, or a governmental regulation is subject to any limitation of that code or regulation. This includes any maximum temperature limitation, or rule governing the use of a material at low temperature.

### 1.7 Service Conditions

Criteria for selection of fitting types and materials suitable for particular fluid service are not within the scope of this Standard.

### 1.8 Welding

Installation welding requirements are outside the scope of this Standard. Installation welding shall be done in accordance with the applicable piping code or regulation covering the piping system into which the fittings are installed.

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**2 PRESSURE RATINGS****2.1 Basis of Ratings**

The allowable pressure ratings for fittings designed in accordance with this Standard may be calculated as for straight seamless pipe of equivalent material (as shown by comparison of composition and mechanical properties in the respective material specifications) in accordance with the rules established in the applicable sections of ASME B31, Code for Pressure Piping. For the calculation, applicable data for the NPS, wall thickness (or schedule number), and material equivalent to that of the fitting material shall be used. NPS, wall thickness (or schedule number), and material identity on the fittings are in lieu of pressure rating markings.

**2.2 Design of Fittings**

The design of fittings shall 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 of this Standard. In order to meet design or manufacturing requirements it is expected that some portion of formed fittings may have to be thicker than the pipe wall with which the fitting is intended to be used. The mathematical analyses, if used, may take into account such thicker sections. Records of mathematical analysis and/or successful proof test data shall be available at the manufacturer's facility for inspection by the purchaser.

**3 SIZE**

The size of fittings in Tables 1 through 9 is identified by the corresponding nominal pipe size (NPS) as defined in ANSI/ASME B36.10M.

**4 MARKING****4.1 Standard Marking**

Each fitting shall be permanently marked to show the following:

- (a) manufacturer's name or trademark;
- (b) material and product identification (ASTM or ASME grade symbol). Conformance to this standard is indicated by the prefix "WP" in the grade symbol;
- (c) schedule number or nominal wall thickness designation;
- (d) NPS.

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Where the size of the fitting does not permit complete marking, the identification marks may be omitted in reverse of the order presented above.

**4.3 Depth of Stamping**

Where steel stamps are used, care shall be taken so that the marking is not deep enough or sharp enough to cause cracks or to reduce the wall thickness of the fitting below the minimum allowed.

**4.4 Partial Compliance Fittings**

Fittings meeting all requirements of ASTM A 234, A 403, or A 420 except for dimensions, sizes, shapes, or tolerances shall be identified by the marking symbol of the specification followed by the applicable Supplementary Requirement number thereof. Fittings in partial compliance with the requirements of the specification shall not use the marking prefix "WP," and shall be identified as agreed upon between manufacturer and purchaser.

**5 MATERIAL**

Wrought fittings covered by this Standard shall be in accordance with ASTM A 234, A 403, A 420, or the corresponding ASME standard except as provided in para. 1.3. The term *wrought* denotes fittings made of pipe, tubing, plate, or forgings. Fittings made from block forgings may only be supplied subject to agreement between manufacturer and purchaser. Such fittings need not meet the requirements of Section 7, Surface Contours.

**6 FITTINGS DIMENSIONS****6.1 General**

This Standard provides for a fixed position for the welding ends with reference to either the center line of the fittings or the overall dimensions. Dimensional standards for these fittings will be found in Tables 2 through 9 and Tables A2 through A9 of Annex A.

**6.2 Special Dimensions**

For applications where fatigue loading is a concern, required minimum dimensions shall be furnished by the purchaser.

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**7 SURFACE CONTOURS**

Where adjacent openings in fittings are not in parallel planes, they shall be joined by a circular arc on the external surfaces. The arc may be terminated in tangents.

**8 END PREPARATION**

The standard welding bevels and root face are shown in Fig. 1. Transitions from the welding bevel to outside surface of the fitting and from the root face to the inside surface of the fitting lying within the maximum envelope shown in Fig. 2 are at the manufacturer's option except as covered in Note (5) of Fig. 2 or unless otherwise specifically ordered.

**9 DESIGN PROOF TEST****9.1 Required Tests**

Proof tests shall be made as set forth herein when the manufacturer chooses proof testing to qualify the fitting design. Unless otherwise agreed upon between manufacturer and purchaser, the only required type of proof test is a bursting strength test.

**9.2 Test Assembly**

**9.2.1 Representative Components.** Fittings that are representative of production and selected for test shall be identified as to material, grade, and lot, including heat treatment. They shall be inspected for dimensional compliance to this Standard.

**9.2.2 Other Components.** Straight seamless or welded pipe sections whose calculated bursting strength is at least as great as the proof test pressure as calculated in para. 9.3 shall be welded to each end of the fitting to be tested. Any internal misalignment greater than 0.06 in. (1.6 mm) shall be reduced by taper boring at a slope not over 1:3. Length of pipe sections for closures shall be as follows.

(a) Minimum length of pipe shall be one pipe O.D. for NPS 14 and smaller.

(b) Minimum length of pipe shall be one-half pipe O.D. for NPS greater than 14 in.

**9.3 Test Procedure**

Test fluid shall be water or other liquid used for hydrostatic testing. Hydrostatic pressure shall be applied to the assembly. The test is successful if the assembly

withstands, without rupture, 105% of the computed proof test pressure defined below.

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

where

$P$  = computed proof of test pressure

$S$  = actual tensile strength of the test fitting, determined on a specimen representative of the test fitting, which shall meet the tensile strength requirements of the applicable material of para. 5.0

$t$  = nominal pipe wall thickness of the pipe that the fitting marking identifies

$D$  = specified outside diameter of pipe

**9.4 Applicability of Test Results**

It is not necessary to conduct an individual test of fittings with all combinations of sizes, wall thicknesses, and materials. A successful proof test on one representative fitting may represent others to the extent described herein.

**9.4.1 Size Range.** One test fitting may be used to qualify similarly proportioned fittings with an NPS range from one-half to twice that for the tested fitting. The test of a non-reducing fitting qualifies reducing fittings of the same pattern. The test of a reducing fitting qualifies reductions to smaller sizes.

**9.4.2 Thickness Range.** One test fitting may be used to qualify similarly proportioned fittings with  $t/D$  ranges from one-half to three times that for the tested fitting.

**9.4.3 Material Grades.** The pressure retaining capacity of a geometrically identical fitting made of various grades of steel will be directly proportional to the tensile properties of the various grades. Therefore, it is necessary to test only a single material grade in a representative fitting to prove the design of the fitting.

**10 PRODUCTION TESTS**

Hydrostatic testing of wrought fittings is not required by this Standard. All fittings shall be capable of withstanding, without leakage or impairment of serviceability, a hydrostatic test pressure required by the applicable piping code for seamless pipe of material equivalent to the fitting material and of the NPS and wall thickness the fitting marking identifies.



## 11 TOLERANCES

Tolerances for fittings are shown in Tables 1 and A1, and apply to the nominal dimensions given in Tables 2 through 9 and A2 through A9. Where given in the tables, the minimum and maximum dimensions are based on these tolerances. The listings with decimals do not imply precision measurement such as use of vernier, micrometer, electronic readout equipment, etc.





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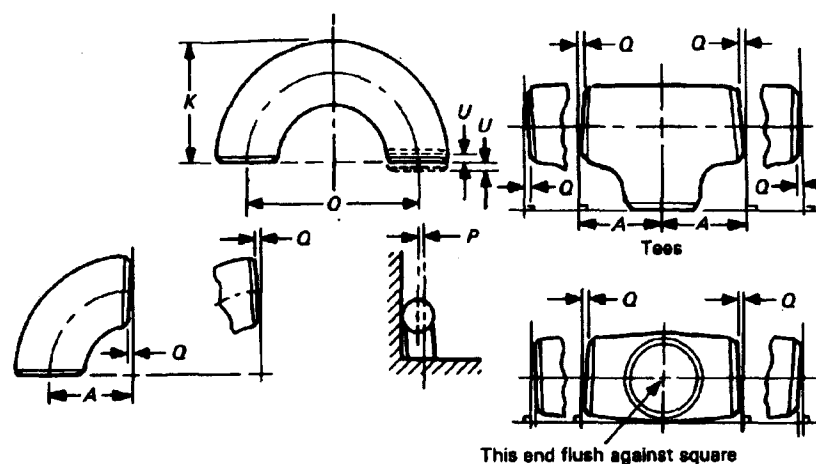
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TABLE 1 TOLERANCES

| All Fittings                     |                                                     |                                             |                                                            | 90 deg.<br>and<br>45 deg.<br>Elbows<br>and Tees  | Reducers<br>and<br>Lap<br>Joint<br>Stub Ends | Caps                          | 180 deg. Returns                              |                                           |                                       | Lap Joint Stub Ends                       |                                        |                                                 |
|----------------------------------|-----------------------------------------------------|---------------------------------------------|------------------------------------------------------------|--------------------------------------------------|----------------------------------------------|-------------------------------|-----------------------------------------------|-------------------------------------------|---------------------------------------|-------------------------------------------|----------------------------------------|-------------------------------------------------|
| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter at<br>Bevel (1),(2)<br><i>D</i> | Inside<br>Diameter<br>at End<br>(1),(3),(4) | Wall<br>Thick-<br>ness (3)<br><i>t</i>                     | Center-to-<br>End<br>Dimension<br><i>A,B,C,M</i> | Overall<br>Length<br><i>F,H</i>              | Overall<br>Length<br><i>E</i> | Center-<br>to-Center<br>Dimension<br><i>O</i> | Back-to-<br>Face<br>Dimension<br><i>K</i> | Align-<br>ment of<br>Ends<br><i>U</i> | Outside<br>Diameter<br>of Lap<br><i>G</i> | Fillet<br>Radius<br>of Lap<br><i>R</i> | Outside<br>Diameter<br>of<br>Barrel             |
| 1/2 to 2 1/2                     | +0.06<br>-0.03                                      | 0.03                                        | Not<br>less<br>than<br>87.5%<br>of<br>nominal<br>thickness | 0.06                                             | 0.06                                         | 0.12                          | 0.25                                          | 0.25                                      | 0.03                                  | +0<br>-0.03                               | +0<br>-0.03                            | See<br>Table 7<br>for<br>limiting<br>dimensions |
| 3 to 3 1/2                       | 0.06                                                | 0.06                                        |                                                            | 0.06                                             | 0.06                                         | 0.12                          | 0.25                                          | 0.25                                      | 0.03                                  | +0<br>-0.03                               | +0<br>-0.03                            |                                                 |
| 4                                | 0.06                                                | 0.06                                        |                                                            | 0.06                                             | 0.06                                         | 0.12                          | 0.25                                          | 0.25                                      | 0.03                                  | +0<br>-0.03                               | +0<br>-0.06                            |                                                 |
| 5 to 8                           | +0.09<br>-0.06                                      | 0.06                                        |                                                            | 0.06                                             | 0.06                                         | 0.25                          | 0.25                                          | 0.25                                      | 0.03                                  | +0<br>-0.03                               | +0<br>-0.06                            |                                                 |
| 10 to 18                         | +0.16<br>-0.12                                      | 0.12                                        |                                                            | 0.09                                             | 0.09                                         | 0.25                          | 0.38                                          | 0.25                                      | 0.06                                  | +0<br>-0.06                               | +0<br>-0.06                            |                                                 |
| 20 to 24                         | +0.25<br>-0.19                                      | 0.19                                        |                                                            | 0.09                                             | 0.09                                         | 0.25                          | 0.38                                          | 0.25                                      | 0.06                                  | +0<br>-0.06                               | +0<br>-0.06                            |                                                 |
| 26 to 30                         | +0.25<br>0.19                                       | 0.19                                        |                                                            | 0.12                                             | 0.19                                         | 0.38                          | ...                                           | ...                                       | ...                                   | ...                                       | ...                                    |                                                 |
| 32 to 48                         | +0.25<br>0.19                                       | 0.19                                        |                                                            | 0.19                                             | 0.19                                         | 0.38                          | ...                                           | ...                                       | ...                                   | ...                                       | ...                                    |                                                 |

TABLE 1 TOLERANCES (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | Angularity Tol.          |                          |
|----------------------------------|--------------------------|--------------------------|
|                                  | Off<br>Angle<br><i>Q</i> | Off<br>Plane<br><i>P</i> |
| 1/2 to 4                         | 0.03                     | 0.06                     |
| 5 to 8                           | 0.06                     | 0.12                     |
| 10 to 12                         | 0.09                     | 0.19                     |
| 14 to 16                         | 0.09                     | 0.25                     |
| 18 to 24                         | 0.12                     | 0.38                     |
| 26 to 30                         | 0.19                     | 0.38                     |
| 32 to 42                         | 0.19                     | 0.50                     |
| 44 to 48                         | 0.19                     | 0.75                     |



GENERAL NOTE: Dimensions are in inches. Tolerances are equal plus and minus except as noted.

NOTES:

- (1) Out-of-round is the sum of absolute values of plus and minus tolerance.
- (2) This tolerance may be exceeded in localized areas of formed fittings where increased wall thickness is required to meet design requirements of para. 2.2.
- (3) The inside diameter and the nominal wall thicknesses at ends are to be specified by the purchaser.
- (4) Unless otherwise specified by the purchaser, these tolerances apply to the nominal inside diameter, which equals the difference between the nominal outside diameter and twice the nominal wall thickness.

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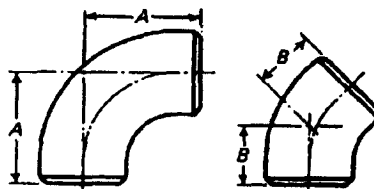


TABLE 2 DIMENSIONS OF LONG RADIUS ELBOWS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> | Center-to-End                 |                               |
|----------------------------------|---------------------------------------------|-------------------------------|-------------------------------|
|                                  |                                             | 90 deg.<br>Elbows<br><i>A</i> | 45 deg.<br>Elbows<br><i>B</i> |
| 1/2                              | 0.84                                        | 1.50                          | 0.62                          |
| 3/4 (1)                          | 1.05                                        | 1.50                          | 0.75                          |
| 1                                | 1.32                                        | 1.50                          | 0.88                          |
| 1 1/4                            | 1.66                                        | 1.88                          | 1.00                          |
| 1 1/2                            | 1.90                                        | 2.25                          | 1.12                          |
| 2                                | 2.38                                        | 3.00                          | 1.38                          |
| 2 1/2                            | 2.88                                        | 3.75                          | 1.75                          |
| 3                                | 3.50                                        | 4.50                          | 2.00                          |
| 3 1/2                            | 4.00                                        | 5.25                          | 2.25                          |
| 4                                | 4.50                                        | 6.00                          | 2.50                          |
| 5                                | 5.56                                        | 7.50                          | 3.12                          |
| 6                                | 6.62                                        | 9.00                          | 3.75                          |
| 8                                | 8.62                                        | 12.00                         | 5.00                          |
| 10                               | 10.75                                       | 15.00                         | 6.25                          |
| 12                               | 12.75                                       | 18.00                         | 7.50                          |
| 14                               | 14.00                                       | 21.00                         | 8.75                          |
| 16                               | 16.00                                       | 24.00                         | 10.00                         |
| 18                               | 18.00                                       | 27.00                         | 11.25                         |
| 20                               | 20.00                                       | 30.00                         | 12.50                         |
| 22                               | 22.00                                       | 33.00                         | 13.50                         |
| 24                               | 24.00                                       | 36.00                         | 15.00                         |
| 26                               | 28.00                                       | 39.00                         | 16.00                         |
| 28                               | 28.00                                       | 42.00                         | 17.25                         |
| 30                               | 30.00                                       | 45.00                         | 18.50                         |
| 32                               | 32.00                                       | 48.00                         | 19.75                         |
| 34                               | 34.00                                       | 51.00                         | 21.00                         |
| 36                               | 36.00                                       | 54.00                         | 22.25                         |
| 38                               | 38.00                                       | 57.00                         | 23.62                         |
| 40                               | 40.00                                       | 60.00                         | 24.88                         |
| 42                               | 42.00                                       | 63.00                         | 26.00                         |
| 44                               | 44.00                                       | 66.00                         | 27.38                         |
| 46                               | 46.00                                       | 69.00                         | 28.62                         |
| 48                               | 48.00                                       | 72.00                         | 29.88                         |

GENERAL NOTE: Dimensions are in inches.

## NOTE:

(1) *A* and *B* dimensions of 1.12 in. and 0.44 in. respectively may be furnished for NPS 3/4 at the manufacturer's option.

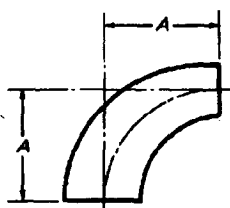


TABLE 3 DIMENSIONS OF LONG RADIUS REDUCING ELBOWS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter<br>at Bevel<br>D |           | Center-<br>to-<br>End<br>A | Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter<br>at Bevel<br>D |           | Center-<br>to-<br>End<br>A |
|----------------------------------|-----------------------------------|-----------|----------------------------|----------------------------------|-----------------------------------|-----------|----------------------------|
|                                  | Large End                         | Small End |                            |                                  | Large End                         | Small End |                            |
| 2 x 1½                           | 2.38                              | 1.90      | 3.00                       | 10 x 8                           | 10.75                             | 8.62      | 15.00                      |
| 2 x 1¼                           | 2.38                              | 1.66      | 3.00                       | 10 x 6                           | 10.75                             | 6.62      | 15.00                      |
| 2 x 1                            | 2.38                              | 1.32      | 3.00                       | 10 x 5                           | 10.75                             | 5.56      | 15.00                      |
| 2½ x 2                           | 2.88                              | 2.38      | 3.75                       | 12 x 10                          | 12.75                             | 10.75     | 18.00                      |
| 2½ x 1½                          | 2.88                              | 1.90      | 3.75                       | 12 x 8                           | 12.75                             | 8.62      | 18.00                      |
| 2½ x 1¼                          | 2.88                              | 1.66      | 3.75                       | 12 x 6                           | 12.75                             | 6.62      | 18.00                      |
| 3 x 2½                           | 3.50                              | 2.88      | 4.50                       | 14 x 12                          | 14.00                             | 12.75     | 21.00                      |
| 3 x 2                            | 3.50                              | 2.38      | 4.50                       | 14 x 10                          | 14.00                             | 10.75     | 21.00                      |
| 3 x 1½                           | 3.50                              | 1.90      | 4.50                       | 14 x 8                           | 14.00                             | 8.62      | 21.00                      |
| 3½ x 3                           | 4.00                              | 3.50      | 5.25                       | 16 x 14                          | 16.00                             | 14.00     | 24.00                      |
| 3½ x 2½                          | 4.00                              | 2.88      | 5.25                       | 16 x 12                          | 16.00                             | 12.75     | 24.00                      |
| 3½ x 2                           | 4.00                              | 2.38      | 5.25                       | 16 x 10                          | 16.00                             | 10.75     | 24.00                      |
| 4 x 3½                           | 4.50                              | 4.00      | 6.00                       | 18 x 16                          | 18.00                             | 16.00     | 27.00                      |
| 4 x 3                            | 4.50                              | 3.50      | 6.00                       | 18 x 14                          | 18.00                             | 14.00     | 27.00                      |
| 4 x 2½                           | 4.50                              | 2.88      | 6.00                       | 18 x 12                          | 18.00                             | 12.75     | 27.00                      |
| 4 x 2                            | 4.50                              | 2.38      | 6.00                       | 18 x 10                          | 18.00                             | 10.75     | 27.00                      |
| 5 x 4                            | 5.56                              | 4.50      | 7.50                       | 20 x 18                          | 20.00                             | 18.00     | 30.00                      |
| 5 x 3½                           | 5.56                              | 4.00      | 7.50                       | 20 x 16                          | 20.00                             | 16.00     | 30.00                      |
| 5 x 3                            | 5.56                              | 3.50      | 7.50                       | 20 x 14                          | 20.00                             | 14.00     | 30.00                      |
| 5 x 2½                           | 5.56                              | 2.88      | 7.50                       | 20 x 12                          | 20.00                             | 12.75     | 30.00                      |
| 6 x 5                            | 6.62                              | 5.56      | 9.00                       | 20 x 10                          | 20.00                             | 10.75     | 30.00                      |
| 6 x 4                            | 6.62                              | 4.50      | 9.00                       | 24 x 22                          | 24.00                             | 22.00     | 36.00                      |
| 6 x 3½                           | 6.62                              | 4.00      | 9.00                       | 24 x 20                          | 24.00                             | 20.00     | 36.00                      |
| 6 x 3                            | 6.62                              | 3.50      | 9.00                       | 24 x 18                          | 24.00                             | 18.00     | 36.00                      |
| 8 x 6                            | 8.62                              | 6.62      | 12.00                      | 24 x 16                          | 24.00                             | 16.00     | 36.00                      |
| 8 x 5                            | 8.62                              | 5.56      | 12.00                      | 24 x 14                          | 24.00                             | 14.00     | 36.00                      |
| 8 x 4                            | 8.62                              | 4.50      | 12.00                      | 24 x 12                          | 24.00                             | 12.75     | 36.00                      |

GENERAL NOTE: Dimensions are in inches.

## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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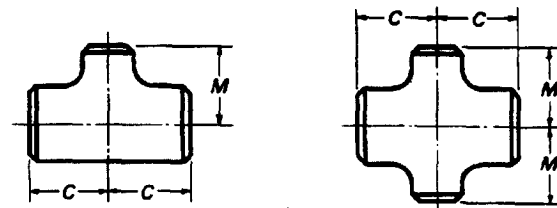
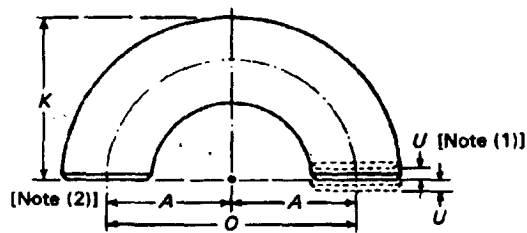


TABLE 4 DIMENSIONS OF LONG RADIUS RETURNS

| Nominal Pipe Size (NPS) | Outside Diameter at Bevel <i>D</i> | Center-to-Center <i>O</i> | Back-to-Face <i>K</i> |
|-------------------------|------------------------------------|---------------------------|-----------------------|
| 1/2                     | 0.84                               | 3.00                      | 1.88                  |
| 3/4 (3)                 | 1.05                               | 3.00                      | 2.00                  |
| 1                       | 1.32                               | 3.00                      | 2.19                  |
| 1 1/4                   | 1.66                               | 3.75                      | 2.75                  |
| 1 1/2                   | 1.90                               | 4.50                      | 3.25                  |
| 2                       | 2.38                               | 6.00                      | 4.19                  |
| 2 1/2                   | 2.88                               | 7.50                      | 5.19                  |
| 3                       | 3.50                               | 9.00                      | 6.25                  |
| 3 1/2                   | 4.00                               | 10.50                     | 7.25                  |
| 4                       | 4.50                               | 12.00                     | 8.25                  |
| 5                       | 5.56                               | 15.00                     | 10.31                 |
| 6                       | 6.62                               | 18.00                     | 12.31                 |
| 8                       | 8.62                               | 24.00                     | 16.31                 |
| 10                      | 10.75                              | 30.00                     | 20.38                 |
| 12                      | 12.75                              | 36.00                     | 24.38                 |
| 14                      | 14.00                              | 42.00                     | 28.00                 |
| 16                      | 16.00                              | 48.00                     | 32.00                 |
| 18                      | 18.00                              | 54.00                     | 36.00                 |
| 20                      | 20.00                              | 60.00                     | 40.00                 |
| 22                      | 22.00                              | 66.00                     | 44.00                 |
| 24                      | 24.00                              | 72.00                     | 48.00                 |

GENERAL NOTE: Dimensions are in inches.

## NOTES:

- (1) See Table 1 for tolerance for alignment of ends, *U*.  
 (2) Dimension *A* is equal to one-half of dimension *O*.  
 (3) *O* and *K* dimensions of 2.25 in. and 1.89 in. respectively may be furnished for NPS 3/4 at the manufacturer's option.

TABLE 5 DIMENSIONS OF STRAIGHT TEES AND CROSSES

| Nominal Pipe Size (NPS) | Outside Diameter at Bevel <i>D</i> | Center-to-End |                         |
|-------------------------|------------------------------------|---------------|-------------------------|
|                         |                                    | Run <i>C</i>  | Outlet (1),(2) <i>M</i> |
| 1/2                     | 0.84                               | 1.00          | 1.00                    |
| 3/4                     | 1.05                               | 1.12          | 1.12                    |
| 1                       | 1.32                               | 1.50          | 1.50                    |
| 1 1/4                   | 1.66                               | 1.88          | 1.88                    |
| 1 1/2                   | 1.90                               | 2.25          | 2.25                    |
| 2                       | 2.38                               | 2.50          | 2.50                    |
| 2 1/2                   | 2.88                               | 3.00          | 3.00                    |
| 3                       | 3.50                               | 3.38          | 3.38                    |
| 3 1/2                   | 4.00                               | 3.75          | 3.75                    |
| 4                       | 4.50                               | 4.12          | 4.12                    |
| 5                       | 5.56                               | 4.88          | 4.88                    |
| 6                       | 6.62                               | 5.62          | 5.62                    |
| 8                       | 8.62                               | 7.00          | 7.00                    |
| 10                      | 10.75                              | 8.50          | 8.50                    |
| 12                      | 12.75                              | 10.00         | 10.00                   |
| 14                      | 14.00                              | 11.00         | 11.00                   |
| 16                      | 16.00                              | 12.00         | 12.00                   |
| 18                      | 18.00                              | 13.50         | 13.50                   |
| 20                      | 20.00                              | 15.00         | 15.00                   |
| 22                      | 22.00                              | 16.50         | 16.50                   |
| 24                      | 24.00                              | 17.00         | 17.00                   |
| 26                      | 26.00                              | 19.50         | 19.50                   |
| 28                      | 28.00                              | 20.50         | 20.50                   |
| 30                      | 30.00                              | 22.00         | 22.00                   |
| 32                      | 32.00                              | 23.50         | 23.50                   |
| 34                      | 34.00                              | 25.00         | 25.00                   |
| 36                      | 36.00                              | 26.50         | 26.50                   |
| 38                      | 38.00                              | 28.00         | 28.00                   |
| 40                      | 40.00                              | 29.50         | 29.50                   |
| 42                      | 42.00                              | 30.00         | 28.00                   |
| 44                      | 44.00                              | 32.00         | 30.00                   |
| 46                      | 46.00                              | 33.50         | 31.50                   |
| 48                      | 48.00                              | 35.00         | 33.00                   |

GENERAL NOTE: Dimensions are in inches.

## NOTES:

- (1) Outlet dimension *M* for NPS 26 and larger is recommended but not required.  
 (2) Dimensions applicable to crosses NPS 24 and smaller.



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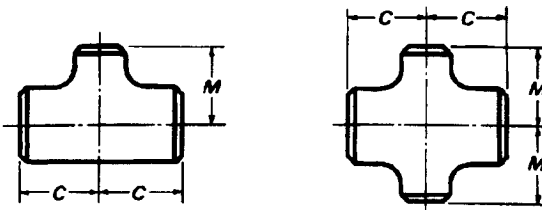


TABLE 6 DIMENSIONS OF REDUCING OUTLET TEES AND REDUCING OUTLET CROSSES

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> |        | Center-to-End   |                        | Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> |        | Center-to-End   |                        |
|----------------------------------|---------------------------------------------|--------|-----------------|------------------------|----------------------------------|---------------------------------------------|--------|-----------------|------------------------|
|                                  | Run                                         | Outlet | Run<br><i>C</i> | Outlet (1)<br><i>M</i> |                                  | Run                                         | Outlet | Run<br><i>C</i> | Outlet (1)<br><i>M</i> |
|                                  |                                             |        |                 |                        |                                  |                                             |        |                 |                        |
| 1/2 x 1/2 x 3/8                  | 0.84                                        | 0.68   | 1.00            | 1.00                   | 6 x 6 x 5                        | 6.62                                        | 5.56   | 5.62            | 5.38                   |
| 1/2 x 1/2 x 1/4                  | 0.84                                        | 0.54   | 1.00            | 1.00                   | 6 x 6 x 4                        | 6.62                                        | 4.50   | 5.62            | 5.12                   |
| 3/4 x 3/4 x 1/2                  | 1.05                                        | 0.84   | 1.12            | 1.12                   | 6 x 6 x 3 1/2                    | 6.62                                        | 4.00   | 5.62            | 5.00                   |
| 3/4 x 3/4 x 3/8                  | 1.05                                        | 0.68   | 1.12            | 1.12                   | 6 x 6 x 3                        | 6.62                                        | 3.50   | 5.62            | 4.88                   |
| 1 x 1 x 3/4                      | 1.32                                        | 1.05   | 1.50            | 1.50                   | 6 x 6 x 2 1/2                    | 6.62                                        | 2.88   | 5.62            | 4.75                   |
| 1 x 1 x 1/2                      | 1.32                                        | 0.84   | 1.50            | 1.50                   | 8 x 8 x 6                        | 8.62                                        | 6.62   | 7.00            | 6.62                   |
| 1 1/4 x 1 1/4 x 1                | 1.66                                        | 1.32   | 1.88            | 1.88                   | 8 x 8 x 5                        | 8.62                                        | 5.56   | 7.00            | 6.38                   |
| 1 1/4 x 1 1/4 x 3/4              | 1.66                                        | 1.05   | 1.88            | 1.88                   | 8 x 8 x 4                        | 8.62                                        | 4.50   | 7.00            | 6.12                   |
| 1 1/4 x 1 1/4 x 1/2              | 1.66                                        | 0.84   | 1.88            | 1.88                   | 8 x 8 x 3 1/2                    | 8.62                                        | 4.00   | 7.00            | 6.00                   |
| 1 1/2 x 1 1/2 x 1 1/4            | 1.90                                        | 1.66   | 2.25            | 2.25                   | 10 x 10 x 8                      | 10.75                                       | 8.62   | 8.50            | 8.00                   |
| 1 1/2 x 1 1/2 x 1                | 1.90                                        | 1.32   | 2.25            | 2.25                   | 10 x 10 x 6                      | 10.75                                       | 6.62   | 8.50            | 7.62                   |
| 1 1/2 x 1 1/2 x 3/4              | 1.90                                        | 1.05   | 2.25            | 2.25                   | 10 x 10 x 5                      | 10.75                                       | 5.56   | 8.50            | 7.50                   |
| 1 1/2 x 1 1/2 x 1/2              | 1.90                                        | 0.84   | 2.25            | 2.25                   | 10 x 10 x 4                      | 10.75                                       | 4.50   | 8.50            | 7.25                   |
| 2 x 2 x 1 1/2                    | 2.38                                        | 1.90   | 2.50            | 2.38                   | 12 x 12 x 10                     | 12.75                                       | 10.75  | 10.00           | 9.50                   |
| 2 x 2 x 1 1/4                    | 2.38                                        | 1.66   | 2.50            | 2.25                   | 12 x 12 x 8                      | 12.75                                       | 8.62   | 10.00           | 9.00                   |
| 2 x 2 x 1                        | 2.38                                        | 1.32   | 2.50            | 2.00                   | 12 x 12 x 6                      | 12.75                                       | 6.62   | 10.00           | 8.62                   |
| 2 x 2 x 3/4                      | 2.38                                        | 1.05   | 2.50            | 1.75                   | 12 x 12 x 5                      | 12.75                                       | 5.56   | 10.00           | 8.50                   |
| 2 1/2 x 2 1/2 x 2                | 2.88                                        | 2.38   | 3.00            | 2.75                   | 14 x 14 x 12                     | 14.00                                       | 12.75  | 11.00           | 10.62                  |
| 2 1/2 x 2 1/2 x 1 1/2            | 2.88                                        | 1.90   | 3.00            | 2.62                   | 14 x 14 x 10                     | 14.00                                       | 10.75  | 11.00           | 10.12                  |
| 2 1/2 x 2 1/2 x 1 1/4            | 2.88                                        | 1.66   | 3.00            | 2.50                   | 14 x 14 x 8                      | 14.00                                       | 8.62   | 11.00           | 9.75                   |
| 2 1/2 x 2 1/2 x 1                | 2.88                                        | 1.32   | 3.00            | 2.25                   | 14 x 14 x 6                      | 14.00                                       | 6.62   | 11.00           | 9.38                   |
| 3 x 3 x 2 1/2                    | 3.50                                        | 2.88   | 3.38            | 3.25                   | 16 x 16 x 14                     | 16.00                                       | 14.00  | 12.00           | 12.00                  |
| 3 x 3 x 2                        | 3.50                                        | 2.38   | 3.38            | 3.00                   | 16 x 16 x 12                     | 16.00                                       | 12.75  | 12.00           | 11.62                  |
| 3 x 3 x 1 1/2                    | 3.50                                        | 1.90   | 3.38            | 2.88                   | 16 x 16 x 10                     | 16.00                                       | 10.75  | 12.00           | 11.12                  |
| 3 x 3 x 1 1/4                    | 3.50                                        | 1.66   | 3.38            | 2.75                   | 16 x 16 x 8                      | 16.00                                       | 8.62   | 12.00           | 10.75                  |
| 3 1/2 x 3 1/2 x 3                | 4.00                                        | 3.50   | 3.75            | 3.62                   | 16 x 16 x 6                      | 16.00                                       | 6.62   | 12.00           | 10.38                  |
| 3 1/2 x 3 1/2 x 2 1/2            | 4.00                                        | 2.88   | 3.75            | 3.50                   | 18 x 18 x 16                     | 18.00                                       | 16.00  | 13.50           | 13.00                  |
| 3 1/2 x 3 1/2 x 2                | 4.00                                        | 2.38   | 3.75            | 3.25                   | 18 x 18 x 14                     | 18.00                                       | 14.00  | 13.50           | 13.00                  |
| 3 1/2 x 3 1/2 x 1 1/2            | 4.00                                        | 1.90   | 3.75            | 3.12                   | 18 x 18 x 12                     | 18.00                                       | 12.75  | 13.50           | 12.62                  |
|                                  |                                             |        |                 |                        | 18 x 18 x 10                     | 18.00                                       | 10.75  | 13.50           | 12.12                  |
| 4 x 4 x 3 1/2                    | 4.50                                        | 4.00   | 4.12            | 4.00                   | 18 x 18 x 8                      | 18.00                                       | 8.62   | 13.50           | 11.75                  |
| 4 x 4 x 3                        | 4.50                                        | 3.50   | 4.12            | 3.88                   |                                  |                                             |        |                 |                        |
| 4 x 4 x 2 1/2                    | 4.50                                        | 2.88   | 4.12            | 3.75                   | 20 x 20 x 18                     | 20.00                                       | 18.00  | 15.00           | 14.50                  |
| 4 x 4 x 2                        | 4.50                                        | 2.38   | 4.12            | 3.50                   | 20 x 20 x 16                     | 20.00                                       | 16.00  | 15.00           | 14.00                  |
| 4 x 4 x 1 1/2                    | 4.50                                        | 1.90   | 4.12            | 3.38                   | 20 x 20 x 14                     | 20.00                                       | 14.00  | 15.00           | 14.00                  |
|                                  |                                             |        |                 |                        | 20 x 20 x 12                     | 20.00                                       | 12.75  | 15.00           | 13.62                  |
| 5 x 5 x 4                        | 5.56                                        | 4.50   | 4.88            | 4.62                   | 20 x 20 x 10                     | 20.00                                       | 10.75  | 15.00           | 13.12                  |
| 5 x 5 x 3 1/2                    | 5.56                                        | 4.00   | 4.88            | 4.50                   | 20 x 20 x 8                      | 20.00                                       | 8.62   | 15.00           | 12.75                  |
| 5 x 5 x 3                        | 5.56                                        | 3.50   | 4.88            | 4.38                   |                                  |                                             |        |                 |                        |
| 5 x 5 x 2 1/2                    | 5.56                                        | 2.88   | 4.88            | 4.25                   | 22 x 22 x 20                     | 22.00                                       | 20.00  | 16.50           | 16.00                  |
| 5 x 5 x 2                        | 5.56                                        | 2.38   | 4.88            | 4.12                   | 22 x 22 x 18                     | 22.00                                       | 18.00  | 16.50           | 15.50                  |

(Notes follow at end of table)

## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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TABLE 6 DIMENSIONS OF REDUCING OUTLET TEES AND REDUCING OUTLET CROSSES (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> |        | Center-to-End   |                        | Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> |        | Center-to-End   |                        |
|----------------------------------|---------------------------------------------|--------|-----------------|------------------------|----------------------------------|---------------------------------------------|--------|-----------------|------------------------|
|                                  | Run                                         | Outlet | Run<br><i>C</i> | Outlet (1)<br><i>M</i> |                                  | Run                                         | Outlet | Run<br><i>C</i> | Outlet (1)<br><i>M</i> |
|                                  |                                             |        |                 |                        |                                  |                                             |        |                 |                        |
| 22 x 22 x 16                     | 22.00                                       | 16.00  | 16.50           | 15.00                  | 34 x 34 x 24                     | 34.00                                       | 24.00  | 25.00           | 23.00                  |
| 22 x 22 x 14                     | 22.00                                       | 14.00  | 16.50           | 15.00                  | 34 x 34 x 22                     | 34.00                                       | 22.00  | 25.00           | 22.50                  |
| 22 x 22 x 12                     | 22.00                                       | 12.75  | 16.50           | 14.62                  | 34 x 34 x 20                     | 34.00                                       | 20.00  | 25.00           | 22.00                  |
| 22 x 22 x 10                     | 22.00                                       | 10.75  | 16.50           | 14.12                  | 34 x 34 x 18                     | 34.00                                       | 18.00  | 25.00           | 21.50                  |
| 24 x 24 x 22                     | 24.00                                       | 22.00  | 17.00           | 17.00                  | 34 x 34 x 16                     | 34.00                                       | 16.00  | 25.00           | 21.00                  |
| 24 x 24 x 20                     | 24.00                                       | 20.00  | 17.00           | 17.00                  | 36 x 36 x 34                     | 36.00                                       | 34.00  | 26.50           | 26.00                  |
| 24 x 24 x 18                     | 24.00                                       | 18.00  | 17.00           | 16.50                  | 36 x 36 x 32                     | 36.00                                       | 32.00  | 26.50           | 25.50                  |
| 24 x 24 x 16                     | 24.00                                       | 16.00  | 17.00           | 16.00                  | 36 x 36 x 30                     | 36.00                                       | 30.00  | 26.50           | 25.00                  |
| 24 x 24 x 14                     | 24.00                                       | 14.00  | 17.00           | 16.00                  | 36 x 36 x 28                     | 36.00                                       | 28.00  | 26.50           | 24.50                  |
| 24 x 24 x 12                     | 24.00                                       | 12.75  | 17.00           | 15.62                  | 36 x 36 x 26                     | 36.00                                       | 26.00  | 26.50           | 24.50                  |
| 24 x 24 x 10                     | 24.00                                       | 10.75  | 17.00           | 15.12                  | 36 x 36 x 24                     | 36.00                                       | 24.00  | 26.50           | 24.00                  |
| 26 x 26 x 24                     | 26.00                                       | 24.00  | 19.50           | 19.00                  | 36 x 36 x 22                     | 36.00                                       | 22.00  | 26.50           | 23.50                  |
| 26 x 26 x 22                     | 26.00                                       | 22.00  | 19.50           | 18.50                  | 36 x 36 x 20                     | 36.00                                       | 20.00  | 26.50           | 23.00                  |
| 26 x 26 x 20                     | 26.00                                       | 20.00  | 19.50           | 18.00                  | 36 x 36 x 18                     | 36.00                                       | 18.00  | 26.50           | 22.50                  |
| 26 x 26 x 18                     | 26.00                                       | 18.00  | 19.50           | 17.50                  | 36 x 36 x 16                     | 36.00                                       | 16.00  | 26.50           | 22.00                  |
| 26 x 26 x 16                     | 26.00                                       | 16.00  | 19.50           | 17.00                  | 38 x 38 x 36                     | 38.00                                       | 36.00  | 28.00           | 28.00                  |
| 26 x 26 x 14                     | 26.00                                       | 14.00  | 19.50           | 17.00                  | 38 x 38 x 34                     | 38.00                                       | 34.00  | 28.00           | 27.50                  |
| 26 x 26 x 12                     | 26.00                                       | 12.75  | 19.50           | 16.62                  | 38 x 38 x 32                     | 38.00                                       | 32.00  | 28.00           | 27.00                  |
| 28 x 28 x 26                     | 28.00                                       | 26.00  | 20.50           | 20.50                  | 38 x 38 x 30                     | 38.00                                       | 30.00  | 28.00           | 26.50                  |
| 28 x 28 x 24                     | 28.00                                       | 24.00  | 20.50           | 20.00                  | 38 x 38 x 28                     | 38.00                                       | 28.00  | 28.00           | 25.50                  |
| 28 x 28 x 22                     | 28.00                                       | 22.00  | 20.50           | 19.50                  | 38 x 38 x 26                     | 38.00                                       | 26.00  | 28.00           | 25.50                  |
| 28 x 28 x 20                     | 28.00                                       | 20.00  | 20.50           | 19.00                  | 38 x 38 x 24                     | 38.00                                       | 24.00  | 28.00           | 25.00                  |
| 28 x 28 x 18                     | 28.00                                       | 18.00  | 20.50           | 18.50                  | 38 x 38 x 22                     | 38.00                                       | 22.00  | 28.00           | 24.50                  |
| 28 x 28 x 16                     | 28.00                                       | 16.00  | 20.50           | 18.00                  | 38 x 38 x 20                     | 38.00                                       | 20.00  | 28.00           | 24.00                  |
| 28 x 28 x 14                     | 28.00                                       | 14.00  | 20.50           | 18.00                  | 38 x 38 x 18                     | 38.00                                       | 18.00  | 28.00           | 23.50                  |
| 28 x 28 x 12                     | 28.00                                       | 12.75  | 20.50           | 17.62                  | 40 x 40 x 38                     | 40.00                                       | 38.00  | 29.50           | 29.50                  |
| 30 x 30 x 28                     | 30.00                                       | 28.00  | 22.00           | 21.50                  | 40 x 40 x 36                     | 40.00                                       | 36.00  | 29.50           | 29.00                  |
| 30 x 30 x 26                     | 30.00                                       | 26.00  | 22.00           | 21.50                  | 40 x 40 x 34                     | 40.00                                       | 34.00  | 29.50           | 28.50                  |
| 30 x 30 x 24                     | 30.00                                       | 24.00  | 22.00           | 21.00                  | 40 x 40 x 32                     | 40.00                                       | 32.00  | 29.50           | 28.00                  |
| 30 x 30 x 22                     | 30.00                                       | 22.00  | 22.00           | 20.50                  | 40 x 40 x 30                     | 40.00                                       | 30.00  | 29.50           | 27.50                  |
| 30 x 30 x 20                     | 30.00                                       | 20.00  | 22.00           | 20.00                  | 40 x 40 x 28                     | 40.00                                       | 28.00  | 29.50           | 26.50                  |
| 30 x 30 x 18                     | 30.00                                       | 18.00  | 22.00           | 19.50                  | 40 x 40 x 26                     | 40.00                                       | 26.00  | 29.50           | 26.50                  |
| 30 x 30 x 16                     | 30.00                                       | 16.00  | 22.00           | 19.00                  | 40 x 40 x 24                     | 40.00                                       | 24.00  | 29.50           | 26.00                  |
| 30 x 30 x 14                     | 30.00                                       | 14.00  | 22.00           | 19.00                  | 40 x 40 x 22                     | 40.00                                       | 22.00  | 29.50           | 25.50                  |
| 30 x 30 x 12                     | 30.00                                       | 12.75  | 22.00           | 18.62                  | 40 x 40 x 20                     | 40.00                                       | 20.00  | 29.50           | 25.00                  |
| 30 x 30 x 10                     | 30.00                                       | 10.75  | 22.00           | 18.12                  | 40 x 40 x 18                     | 40.00                                       | 18.00  | 29.50           | 24.50                  |
| 32 x 32 x 30                     | 32.00                                       | 30.00  | 23.50           | 23.00                  | 42 x 42 x 40                     | 42.00                                       | 40.00  | 30.00           | 28.00                  |
| 32 x 32 x 28                     | 32.00                                       | 28.00  | 23.50           | 22.50                  | 42 x 42 x 38                     | 42.00                                       | 38.00  | 30.00           | 28.00                  |
| 32 x 32 x 26                     | 32.00                                       | 26.00  | 23.50           | 22.50                  | 42 x 42 x 36                     | 42.00                                       | 36.00  | 30.00           | 28.00                  |
| 32 x 32 x 24                     | 32.00                                       | 24.00  | 23.50           | 22.00                  | 42 x 42 x 34                     | 42.00                                       | 34.00  | 30.00           | 28.00                  |
| 32 x 32 x 22                     | 32.00                                       | 22.00  | 23.50           | 21.50                  | 42 x 42 x 32                     | 42.00                                       | 32.00  | 30.00           | 28.00                  |
| 32 x 32 x 20                     | 32.00                                       | 20.00  | 23.50           | 21.00                  | 42 x 42 x 30                     | 42.00                                       | 30.00  | 30.00           | 28.00                  |
| 32 x 32 x 18                     | 32.00                                       | 18.00  | 23.50           | 20.50                  | 42 x 42 x 28                     | 42.00                                       | 28.00  | 30.00           | 27.50                  |
| 32 x 32 x 16                     | 32.00                                       | 16.00  | 23.50           | 20.00                  | 42 x 42 x 26                     | 42.00                                       | 26.00  | 30.00           | 27.50                  |
| 32 x 32 x 14                     | 32.00                                       | 14.00  | 23.50           | 20.00                  | 42 x 42 x 24                     | 42.00                                       | 24.00  | 30.00           | 26.00                  |
| 34 x 34 x 32                     | 34.00                                       | 32.00  | 25.00           | 24.50                  | 42 x 42 x 22                     | 42.00                                       | 22.00  | 30.00           | 26.00                  |
| 34 x 34 x 30                     | 34.00                                       | 30.00  | 25.00           | 24.00                  | 42 x 42 x 20                     | 42.00                                       | 20.00  | 30.00           | 26.00                  |
| 34 x 34 x 28                     | 34.00                                       | 28.00  | 25.00           | 23.50                  | 42 x 42 x 18                     | 42.00                                       | 18.00  | 30.00           | 25.50                  |
| 34 x 34 x 26                     | 34.00                                       | 26.00  | 25.00           | 23.50                  | 42 x 42 x 16                     | 42.00                                       | 16.00  | 30.00           | 25.00                  |

(Table 6 continues on next page)

**TABLE 6 DIMENSIONS OF REDUCING  
OUTLET TEES AND REDUCING OUTLET  
CROSSES (CONT'D)**

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> |        | Center-to-End   |                        |
|----------------------------------|---------------------------------------------|--------|-----------------|------------------------|
|                                  | Run                                         | Outlet | Run<br><i>C</i> | Outlet (1)<br><i>M</i> |
| 44 x 44 x 42                     | 44.00                                       | 42.00  | 32.00           | 30.00                  |
| 44 x 44 x 40                     | 44.00                                       | 40.00  | 32.00           | 29.50                  |
| 44 x 44 x 38                     | 44.00                                       | 38.00  | 32.00           | 29.00                  |
| 44 x 44 x 36                     | 44.00                                       | 36.00  | 32.00           | 28.50                  |
| 44 x 44 x 34                     | 44.00                                       | 34.00  | 32.00           | 28.50                  |
| 44 x 44 x 32                     | 44.00                                       | 32.00  | 32.00           | 28.00                  |
| 44 x 44 x 30                     | 44.00                                       | 30.00  | 32.00           | 28.00                  |
| 44 x 44 x 28                     | 44.00                                       | 28.00  | 32.00           | 27.50                  |
| 44 x 44 x 26                     | 44.00                                       | 26.00  | 32.00           | 27.50                  |
| 44 x 44 x 24                     | 44.00                                       | 24.00  | 32.00           | 27.50                  |
| 44 x 44 x 22                     | 44.00                                       | 22.00  | 32.00           | 27.00                  |
| 44 x 44 x 20                     | 44.00                                       | 20.00  | 32.00           | 27.00                  |
| 46 x 46 x 44                     | 46.00                                       | 44.00  | 33.50           | 31.50                  |
| 46 x 46 x 42                     | 46.00                                       | 42.00  | 33.50           | 31.00                  |
| 46 x 46 x 40                     | 46.00                                       | 40.00  | 33.50           | 30.50                  |
| 46 x 46 x 38                     | 46.00                                       | 38.00  | 33.50           | 30.00                  |
| 46 x 46 x 36                     | 46.00                                       | 36.00  | 33.50           | 30.00                  |
| 46 x 46 x 34                     | 46.00                                       | 34.00  | 33.50           | 29.50                  |
| 46 x 46 x 32                     | 46.00                                       | 32.00  | 33.50           | 29.50                  |
| 46 x 46 x 30                     | 46.00                                       | 30.00  | 33.50           | 29.00                  |
| 46 x 46 x 28                     | 46.00                                       | 28.00  | 33.50           | 29.00                  |
| 46 x 46 x 26                     | 46.00                                       | 26.00  | 33.50           | 29.00                  |
| 46 x 46 x 24                     | 46.00                                       | 24.00  | 33.50           | 28.50                  |
| 46 x 46 x 22                     | 46.00                                       | 22.00  | 33.50           | 28.50                  |
| 48 x 48 x 46                     | 48.00                                       | 46.00  | 35.00           | 33.00                  |
| 48 x 48 x 44                     | 48.00                                       | 44.00  | 35.00           | 33.00                  |
| 48 x 48 x 42                     | 48.00                                       | 42.00  | 35.00           | 32.00                  |
| 48 x 48 x 40                     | 48.00                                       | 40.00  | 35.00           | 32.00                  |
| 48 x 48 x 38                     | 48.00                                       | 38.00  | 35.00           | 32.00                  |
| 48 x 48 x 36                     | 48.00                                       | 36.00  | 35.00           | 31.00                  |
| 48 x 48 x 34                     | 48.00                                       | 34.00  | 35.00           | 31.00                  |
| 48 x 48 x 32                     | 48.00                                       | 32.00  | 35.00           | 31.00                  |
| 48 x 48 x 30                     | 48.00                                       | 30.00  | 35.00           | 30.00                  |
| 48 x 48 x 28                     | 48.00                                       | 28.00  | 35.00           | 30.00                  |
| 48 x 48 x 26                     | 48.00                                       | 26.00  | 35.00           | 30.00                  |
| 48 x 48 x 24                     | 48.00                                       | 24.00  | 35.00           | 29.00                  |
| 48 x 48 x 22                     | 48.00                                       | 22.00  | 35.00           | 29.00                  |

GENERAL NOTE: Dimensions are in inches.

NOTE:

- (1) Outlet dimension *M* for run sizes 14 and larger is recommended but not required.

## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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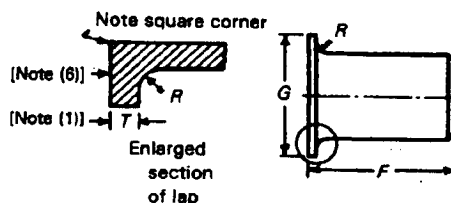


TABLE 7 DIMENSIONS OF LAP JOINT STUB ENDS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> | Long<br>Pattern<br>Length<br>(2),(3),(7)<br><i>F</i> | Short<br>Pattern<br>Length<br>(2),(3),(7)<br><i>F</i> | Radius<br>of<br>Fillet (4)<br><i>R</i> | Diameter<br>of<br>Lap (5)<br><i>G</i> | Outside<br>Diameter<br>of Barrel |        |
|----------------------------------|---------------------------------------------|------------------------------------------------------|-------------------------------------------------------|----------------------------------------|---------------------------------------|----------------------------------|--------|
|                                  |                                             |                                                      |                                                       |                                        |                                       | Max.                             | Min.   |
| 1/2                              | 0.84                                        | 3.00                                                 | 2.00                                                  | 0.12                                   | 1.38                                  | 0.896                            | 0.809  |
| 3/4                              | 1.05                                        | 3.00                                                 | 2.00                                                  | 0.12                                   | 1.69                                  | 1.106                            | 1.019  |
| 1                                | 1.32                                        | 4.00                                                 | 2.00                                                  | 0.12                                   | 2.00                                  | 1.376                            | 1.284  |
| 1 1/4                            | 1.66                                        | 4.00                                                 | 2.00                                                  | 0.19                                   | 2.50                                  | 1.716                            | 1.629  |
| 1 1/2                            | 1.90                                        | 4.00                                                 | 2.00                                                  | 0.25                                   | 2.88                                  | 1.965                            | 1.869  |
| 2                                | 2.38                                        | 6.00                                                 | 2.50                                                  | 0.31                                   | 3.62                                  | 2.456                            | 2.344  |
| 2 1/2                            | 2.88                                        | 6.00                                                 | 2.50                                                  | 0.31                                   | 4.12                                  | 2.966                            | 2.844  |
| 3                                | 3.50                                        | 6.00                                                 | 2.50                                                  | 0.38                                   | 5.00                                  | 3.596                            | 3.469  |
| 3 1/2                            | 4.00                                        | 6.00                                                 | 3.00                                                  | 0.38                                   | 5.50                                  | 4.086                            | 3.969  |
| 4                                | 4.50                                        | 6.00                                                 | 3.00                                                  | 0.44                                   | 6.19                                  | 4.593                            | 4.469  |
| 5                                | 5.56                                        | 8.00                                                 | 3.00                                                  | 0.44                                   | 7.31                                  | 5.683                            | 5.532  |
| 6                                | 6.62                                        | 8.00                                                 | 3.50                                                  | 0.50                                   | 8.50                                  | 6.743                            | 6.594  |
| 8                                | 8.62                                        | 8.00                                                 | 4.00                                                  | 0.50                                   | 10.62                                 | 8.743                            | 8.594  |
| 10                               | 10.75                                       | 10.00                                                | 5.00                                                  | 0.50                                   | 12.75                                 | 10.913                           | 10.719 |
| 12                               | 12.75                                       | 10.00                                                | 6.00                                                  | 0.50                                   | 15.00                                 | 12.913                           | 12.719 |
| 14                               | 14.00                                       | 12.00                                                | 6.00                                                  | 0.50                                   | 16.25                                 | 14.170                           | 13.969 |
| 16                               | 16.00                                       | 12.00                                                | 6.00                                                  | 0.50                                   | 18.50                                 | 16.180                           | 15.969 |
| 18                               | 18.00                                       | 12.00                                                | 6.00                                                  | 0.50                                   | 21.00                                 | 18.190                           | 17.969 |
| 20                               | 20.00                                       | 12.00                                                | 6.00                                                  | 0.50                                   | 23.00                                 | 20.240                           | 19.969 |
| 22                               | 22.00                                       | 12.00                                                | 6.00                                                  | 0.50                                   | 25.25                                 | 22.240                           | 21.969 |
| 24                               | 24.00                                       | 12.00                                                | 6.00                                                  | 0.50                                   | 27.25                                 | 24.240                           | 23.969 |

## GENERAL NOTES:

- (a) Dimensions are in inches.  
(b) See Table 1 for tolerances.

## NOTES:

- (1) The lap thickness *T* shall not be less than nominal pipe wall thickness.  
(2) When short pattern stub ends are used with larger flanges in Classes 300 and 600, and with most sizes in Classes 900 and higher, and when long pattern stub ends are used with larger flanges in Classes 1500 and 2500, it may be necessary to increase the length of the stub ends in order to avoid covering the weld with the flange. Such increases in length shall be a matter of agreement between the manufacturer and the purchaser.  
(3) When special facings such as tongue and groove, male and female, etc., are employed, additional lap thickness must be provided and such additional thickness shall be in addition to (not included in) the basic length *F*.  
(4) These dimensions conform to the radius established for lap joint flanges in ASME/ANSI B16.5, Pipe Flanges and Flanged Fittings.  
(5) This dimension conforms to standard machine facings shown in ASME/ANSI B16.5. The back face of the lap shall be machined to conform to the surface on which it seats. Where ring joint facings are to be applied use dimension *K* as given in ASME/ANSI B16.5.  
(6) Gasket face finish shall be in accordance with ASME/ANSI B16.5 for raised face flanges.  
(7) The long pattern shall be the standard when not specified by the purchaser. The short pattern shall be specified by the purchaser.

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## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS



TABLE 8 DIMENSIONS OF CAPS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter<br>at Bevel<br><i>D</i> | Length (1)<br><i>E</i> | Limiting<br>Wall Thick-<br>ness for<br>Length <i>E</i> | Length (2)<br><i>E</i> <sub>1</sub> |
|----------------------------------|---------------------------------------------|------------------------|--------------------------------------------------------|-------------------------------------|
| 1/2                              | 0.84                                        | 1.00                   | 0.18                                                   | 1.00                                |
| 3/4                              | 1.05                                        | 1.00                   | 0.15                                                   | 1.00                                |
| 1                                | 1.32                                        | 1.50                   | 0.18                                                   | 1.50                                |
| 1 1/4                            | 1.66                                        | 1.50                   | 0.19                                                   | 1.50                                |
| 1 1/2                            | 1.90                                        | 1.50                   | 0.20                                                   | 1.50                                |
| 2                                | 2.38                                        | 1.50                   | 0.22                                                   | 1.75                                |
| 2 1/2                            | 2.88                                        | 1.50                   | 0.28                                                   | 2.00                                |
| 3                                | 3.50                                        | 2.00                   | 0.30                                                   | 2.50                                |
| 3 1/2                            | 4.00                                        | 2.50                   | 0.32                                                   | 3.00                                |
| 4                                | 4.50                                        | 2.50                   | 0.34                                                   | 3.00                                |
| 5                                | 5.56                                        | 3.00                   | 0.38                                                   | 3.50                                |
| 6                                | 6.62                                        | 3.50                   | 0.43                                                   | 4.00                                |
| 8                                | 8.62                                        | 4.00                   | 0.50                                                   | 5.00                                |
| 10                               | 10.75                                       | 5.00                   | 0.50                                                   | 6.00                                |
| 12                               | 12.75                                       | 6.00                   | 0.50                                                   | 7.00                                |
| 14                               | 14.00                                       | 6.50                   | 0.50                                                   | 7.50                                |
| 16                               | 16.00                                       | 7.00                   | 0.50                                                   | 8.00                                |
| 18                               | 18.00                                       | 8.00                   | 0.50                                                   | 9.00                                |
| 20                               | 20.00                                       | 9.00                   | 0.50                                                   | 10.00                               |
| 22                               | 22.00                                       | 10.00                  | 0.50                                                   | 10.00                               |
| 24                               | 24.00                                       | 10.50                  | 0.50                                                   | 12.00                               |
| 26                               | 26.00                                       | 10.50                  | ...                                                    | ...                                 |
| 28                               | 28.00                                       | 10.50                  | ...                                                    | ...                                 |
| 30                               | 30.00                                       | 10.50                  | ...                                                    | ...                                 |
| 32                               | 32.00                                       | 10.50                  | ...                                                    | ...                                 |
| 34                               | 34.00                                       | 10.50                  | ...                                                    | ...                                 |
| 36                               | 36.00                                       | 10.50                  | ...                                                    | ...                                 |
| 38                               | 38.00                                       | 12.00                  | ...                                                    | ...                                 |
| 40                               | 40.00                                       | 12.00                  | ...                                                    | ...                                 |
| 42                               | 42.00                                       | 12.00                  | ...                                                    | ...                                 |
| 44                               | 44.00                                       | 13.50                  | ...                                                    | ...                                 |
| 46                               | 46.00                                       | 13.50                  | ...                                                    | ...                                 |
| 48                               | 48.00                                       | 13.50                  | ...                                                    | ...                                 |

## GENERAL NOTES:

- (a) Dimensions are in inches.  
 (b) The shape of these caps shall be ellipsoidal and shall conform to the shape requirements as given in the ASME Boiler and Pressure Vessel Code.

## NOTES:

- (1) Length *E* applies for thickness not exceeding that given in column "Limiting Wall Thickness for Length *E*."  
 (2) Length *E*<sub>1</sub> applies for thickness greater than that given in column "Limiting Wall Thickness" for NPS 24 and smaller. For NPS 26 and larger, length *E*<sub>1</sub> shall be by agreement between manufacturer and purchaser.

## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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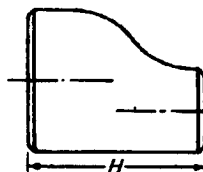
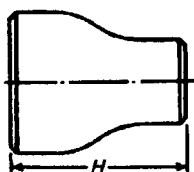


TABLE 9 DIMENSIONS OF REDUCERS

| Nominal Pipe<br>Size<br>(NPS) | Outside Diameter at Bevel<br>D |              | End-to-End<br>H | Nominal Pipe<br>Size<br>(NPS) | Outside Diameter at Bevel<br>D |              | End-to-End<br>H |
|-------------------------------|--------------------------------|--------------|-----------------|-------------------------------|--------------------------------|--------------|-----------------|
|                               | Large<br>End                   | Small<br>End |                 |                               | Large<br>End                   | Small<br>End |                 |
| 3/4 x 1/2                     | 1.05                           | 0.84         | 1.50            | 8 x 5                         | 6.62                           | 5.56         | 5.50            |
| 3/4 x 3/8                     | 1.05                           | 0.68         | 1.50            | 6 x 4                         | 6.62                           | 4.50         | 5.50            |
| 1 x 3/4                       | 1.32                           | 1.05         | 2.00            | 6 x 3 1/2                     | 6.62                           | 4.00         | 5.50            |
| 1 x 1/2                       | 1.32                           | 0.84         | 2.00            | 6 x 3                         | 6.62                           | 3.50         | 5.50            |
|                               |                                |              |                 | 6 x 2 1/2                     | 6.62                           | 2.88         | 5.50            |
| 1 1/4 x 1                     | 1.66                           | 1.32         | 2.00            | 8 x 6                         | 8.62                           | 6.62         | 6.00            |
| 1 1/4 x 3/4                   | 1.66                           | 1.05         | 2.00            | 8 x 5                         | 8.62                           | 5.56         | 6.00            |
| 1 1/4 x 1/2                   | 1.66                           | 0.84         | 2.00            | 8 x 4                         | 8.62                           | 4.50         | 6.00            |
|                               |                                |              |                 | 8 x 3 1/2                     | 8.62                           | 4.00         | 6.00            |
| 1 1/2 x 1 1/4                 | 1.90                           | 1.66         | 2.50            |                               |                                |              |                 |
| 1 1/2 x 1                     | 1.90                           | 1.32         | 2.50            | 10 x 8                        | 10.75                          | 8.62         | 7.00            |
| 1 1/2 x 3/4                   | 1.90                           | 1.05         | 2.50            | 10 x 6                        | 10.75                          | 6.62         | 7.00            |
| 1 1/2 x 1/2                   | 1.90                           | 0.84         | 2.50            | 10 x 5                        | 10.75                          | 5.56         | 7.00            |
|                               |                                |              |                 | 10 x 4                        | 10.75                          | 4.50         | 7.00            |
| 2 x 1 1/2                     | 2.38                           | 1.90         | 3.00            |                               |                                |              |                 |
| 2 x 1 1/4                     | 2.38                           | 1.66         | 3.00            | 12 x 10                       | 12.75                          | 10.75        | 8.00            |
| 2 x 1                         | 2.38                           | 1.32         | 3.00            | 12 x 8                        | 12.75                          | 8.62         | 8.00            |
| 2 x 3/4                       | 2.38                           | 1.05         | 3.00            | 12 x 6                        | 12.75                          | 6.62         | 8.00            |
|                               |                                |              |                 | 12 x 5                        | 12.75                          | 5.56         | 8.00            |
| 2 1/2 x 2                     | 2.88                           | 2.38         | 3.50            |                               |                                |              |                 |
| 2 1/2 x 1 1/2                 | 2.88                           | 1.90         | 3.50            | 14 x 12                       | 14.00                          | 12.75        | 13.00           |
| 2 1/2 x 1 1/4                 | 2.88                           | 1.66         | 3.50            | 14 x 10                       | 14.00                          | 10.75        | 13.00           |
| 2 1/2 x 1                     | 2.88                           | 1.32         | 3.50            | 14 x 8                        | 14.00                          | 8.62         | 13.00           |
|                               |                                |              |                 | 14 x 6                        | 14.00                          | 6.62         | 13.00           |
| 3 x 2 1/2                     | 3.50                           | 2.88         | 3.50            |                               |                                |              |                 |
| 3 x 2                         | 3.50                           | 2.38         | 3.50            | 16 x 14                       | 16.00                          | 14.00        | 14.00           |
| 3 x 1 1/2                     | 3.50                           | 1.90         | 3.50            | 16 x 12                       | 16.00                          | 12.75        | 14.00           |
| 3 x 1 1/4                     | 3.50                           | 1.66         | 3.50            | 16 x 10                       | 16.00                          | 10.75        | 14.00           |
|                               |                                |              |                 | 16 x 8                        | 16.00                          | 8.62         | 14.00           |
| 3 1/2 x 3                     | 4.00                           | 3.50         | 4.00            |                               |                                |              |                 |
| 3 1/2 x 2 1/2                 | 4.00                           | 2.88         | 4.00            | 18 x 16                       | 18.00                          | 16.00        | 15.00           |
| 3 1/2 x 2                     | 4.00                           | 2.38         | 4.00            | 18 x 14                       | 18.00                          | 14.00        | 15.00           |
| 3 1/2 x 1 1/2                 | 4.00                           | 1.90         | 4.00            | 18 x 12                       | 18.00                          | 12.75        | 15.00           |
| 3 1/2 x 1 1/4                 | 4.00                           | 1.66         | 4.00            | 18 x 10                       | 18.00                          | 10.75        | 15.00           |
|                               |                                |              |                 |                               |                                |              |                 |
| 4 x 3 1/2                     | 4.50                           | 4.00         | 4.00            | 20 x 18                       | 20.00                          | 18.00        | 20.00           |
| 4 x 3                         | 4.50                           | 3.50         | 4.00            | 20 x 16                       | 20.00                          | 16.00        | 20.00           |
| 4 x 2 1/2                     | 4.50                           | 2.88         | 4.00            | 20 x 14                       | 20.00                          | 14.00        | 20.00           |
| 4 x 2                         | 4.50                           | 2.38         | 4.00            | 20 x 12                       | 20.00                          | 12.75        | 20.00           |
| 4 x 1 1/2                     | 4.50                           | 1.90         | 4.00            |                               |                                |              |                 |
|                               |                                |              |                 | 22 x 20                       | 22.00                          | 20.00        | 20.00           |
| 5 x 4                         | 5.56                           | 4.50         | 5.00            | 22 x 18                       | 22.00                          | 18.00        | 20.00           |
| 5 x 3 1/2                     | 5.56                           | 4.00         | 5.00            | 22 x 16                       | 22.00                          | 16.00        | 20.00           |
| 5 x 3                         | 5.56                           | 3.50         | 5.00            | 22 x 14                       | 22.00                          | 14.00        | 20.00           |
| 5 x 2 1/2                     | 5.56                           | 2.88         | 5.00            |                               |                                |              |                 |
| 5 x 2                         | 5.56                           | 2.38         | 5.00            |                               |                                |              |                 |

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TABLE 9 DIMENSIONS OF REDUCERS (CONT'D)

| Nominal Pipe<br>Size<br>(NPS) | Outside Diameter at Bevel<br><i>D</i> |              | End-to-End<br><i>H</i> | Nominal Pipe<br>Size<br>(NPS) | Outside Diameter at Bevel<br><i>D</i> |              | End-to-End<br><i>H</i> |
|-------------------------------|---------------------------------------|--------------|------------------------|-------------------------------|---------------------------------------|--------------|------------------------|
|                               | Large<br>End                          | Small<br>End |                        |                               | Large<br>End                          | Small<br>End |                        |
| 24 x 22                       | 24.00                                 | 22.00        | 20.00                  | 38 x 36                       | 38.00                                 | 36.00        | 24.00                  |
| 24 x 20                       | 24.00                                 | 20.00        | 20.00                  | 38 x 34                       | 38.00                                 | 34.00        | 24.00                  |
| 24 x 18                       | 24.00                                 | 18.00        | 20.00                  | 38 x 32                       | 38.00                                 | 32.00        | 24.00                  |
| 24 x 16                       | 24.00                                 | 16.00        | 20.00                  | 38 x 30                       | 38.00                                 | 30.00        | 24.00                  |
|                               |                                       |              |                        | 38 x 28                       | 38.00                                 | 28.00        | 24.00                  |
| 26 x 24                       | 26.00                                 | 24.00        | 24.00                  | 38 x 26                       | 38.00                                 | 26.00        | 24.00                  |
| 26 x 22                       | 26.00                                 | 22.00        | 24.00                  |                               |                                       |              |                        |
| 26 x 20                       | 26.00                                 | 20.00        | 24.00                  | 40 x 38                       | 40.00                                 | 38.00        | 24.00                  |
| 26 x 18                       | 26.00                                 | 18.00        | 24.00                  | 40 x 36                       | 40.00                                 | 36.00        | 24.00                  |
|                               |                                       |              |                        | 40 x 34                       | 40.00                                 | 34.00        | 24.00                  |
| 28 x 26                       | 28.00                                 | 26.00        | 24.00                  | 40 x 32                       | 40.00                                 | 32.00        | 24.00                  |
| 28 x 24                       | 28.00                                 | 24.00        | 24.00                  | 40 x 30                       | 40.00                                 | 30.00        | 24.00                  |
| 28 x 20                       | 28.00                                 | 20.00        | 24.00                  |                               |                                       |              |                        |
| 28 x 18                       | 28.00                                 | 18.00        | 24.00                  | 42 x 40                       | 42.00                                 | 40.00        | 24.00                  |
|                               |                                       |              |                        | 42 x 38                       | 42.00                                 | 38.00        | 24.00                  |
| 30 x 28                       | 30.00                                 | 28.00        | 24.00                  | 42 x 36                       | 42.00                                 | 36.00        | 24.00                  |
| 30 x 26                       | 30.00                                 | 26.00        | 24.00                  | 42 x 34                       | 42.00                                 | 34.00        | 24.00                  |
| 30 x 24                       | 30.00                                 | 24.00        | 24.00                  | 42 x 32                       | 42.00                                 | 32.00        | 24.00                  |
| 30 x 20                       | 30.00                                 | 20.00        | 24.00                  | 42 x 30                       | 42.00                                 | 30.00        | 24.00                  |
|                               |                                       |              |                        |                               |                                       |              |                        |
| 32 x 30                       | 32.00                                 | 30.00        | 24.00                  | 44 x 42                       | 44.00                                 | 42.00        | 24.00                  |
| 32 x 28                       | 32.00                                 | 28.00        | 24.00                  | 44 x 40                       | 44.00                                 | 40.00        | 24.00                  |
| 32 x 26                       | 32.00                                 | 26.00        | 24.00                  | 44 x 38                       | 44.00                                 | 38.00        | 24.00                  |
| 32 x 24                       | 32.00                                 | 24.00        | 24.00                  | 44 x 36                       | 44.00                                 | 36.00        | 24.00                  |
|                               |                                       |              |                        |                               |                                       |              |                        |
| 34 x 32                       | 34.00                                 | 32.00        | 24.00                  | 46 x 44                       | 46.00                                 | 44.00        | 28.00                  |
| 34 x 30                       | 34.00                                 | 30.00        | 24.00                  | 46 x 42                       | 46.00                                 | 42.00        | 28.00                  |
| 34 x 26                       | 34.00                                 | 26.00        | 24.00                  | 46 x 40                       | 46.00                                 | 40.00        | 28.00                  |
| 34 x 24                       | 34.00                                 | 24.00        | 24.00                  | 46 x 38                       | 46.00                                 | 38.00        | 28.00                  |
|                               |                                       |              |                        |                               |                                       |              |                        |
| 36 x 34                       | 36.00                                 | 34.00        | 24.00                  | 48 x 46                       | 48.00                                 | 46.00        | 28.00                  |
| 36 x 32                       | 36.00                                 | 32.00        | 24.00                  | 48 x 44                       | 48.00                                 | 44.00        | 28.00                  |
| 36 x 30                       | 36.00                                 | 30.00        | 24.00                  | 48 x 42                       | 48.00                                 | 42.00        | 28.00                  |
| 36 x 26                       | 36.00                                 | 26.00        | 24.00                  | 48 x 40                       | 48.00                                 | 40.00        | 28.00                  |
| 36 x 24                       | 36.00                                 | 24.00        | 24.00                  |                               |                                       |              |                        |

GENERAL NOTE: Dimensions are in inches.

## ANNEX A

### METRIC (SI) TABLES

(This Annex is an integral part of ASME B16.9-1993 and is placed after the main text for convenience.)

The technique of rounding the metric conversions of the inch dimensions recognized two basic categories of dimensions occurring in this Standard, based upon the function or safety significance of variations in the dimensions.

Where some slight shift of the absolute value of the minimum and maximum dimensions permitted by the inch dimensions and those provided by the converted metric dimensions do not unacceptably affect the functional or safety characteristics of the fitting, the metric conversions have been rounded to whole millimeter values in order to facilitate ease of measurement by ordinary measuring tapes or rulers with nonmagnified vision. Furthermore, the rounding has not always been made to the nearest whole millimeter. In some cases it has been made to the whole millimeter, which would facilitate tables manifesting logical increments in both the dimensions and their tolerances. It is recognized that the introduction of such variances will create a conflict in the acceptance dimensions or gaging between the inch and metric data. Experience indicates a probability that no serious difficulties will result from this conflict. Hence it is the intent of this Standard that any dimension that is within tolerance by either metric or inch measurement is considered to be in conformance with this Standard.

Where it was considered advisable to limit the variance between the minimum and maximum dimensions permitted by the existing tolerances and those permitted by the converted metric dimensions, closer rounding was utilized.

The metric dimensions shown in Tables A1 through A9 are for information and reference. They are not exact equivalents of the dimensions in Tables 1 through 9. If used by agreement between manufacturer and purchaser, complete dimensional interchangeability with standard components cannot be assured. Use of a combination of standard and metric values is contrary to the intent of this Standard.

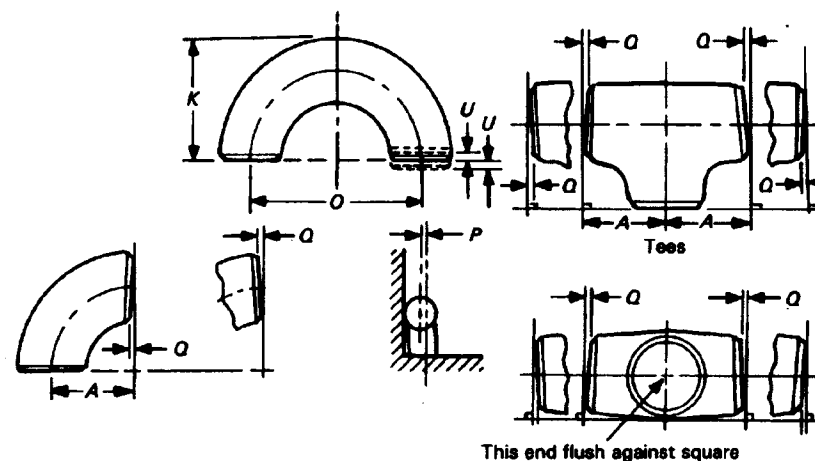


TABLE A1 TOLERANCES

| All Fittings                     |                                                     |                                             |                                                            | 90 deg.<br>and<br>45 deg.<br>Elbows<br>and Tees  | Reducers<br>and<br>Lap<br>Joint<br>Stub Ends | Caps                          | 180 deg. Returns                              |                                           |                                       | Lap Joint Stub Ends                       |                                        |                                                  |
|----------------------------------|-----------------------------------------------------|---------------------------------------------|------------------------------------------------------------|--------------------------------------------------|----------------------------------------------|-------------------------------|-----------------------------------------------|-------------------------------------------|---------------------------------------|-------------------------------------------|----------------------------------------|--------------------------------------------------|
| Nominal<br>Pipe<br>Size<br>(NPS) | Outside<br>Diameter at<br>Bevel (1),(2)<br><i>D</i> | Inside<br>Diameter<br>at End<br>(1),(3),(4) | Wall<br>Thick-<br>ness (3)<br><i>t</i>                     | Center-to-<br>End<br>Dimension<br><i>A,B,C,M</i> | Overall<br>Length<br><i>F,H</i>              | Overall<br>Length<br><i>E</i> | Center-<br>to-Center<br>Dimension<br><i>O</i> | Back-to-<br>Face<br>Dimension<br><i>K</i> | Align-<br>ment of<br>Ends<br><i>U</i> | Outside<br>Diameter<br>of Lap<br><i>G</i> | Fillet<br>Radius<br>of Lap<br><i>R</i> | Outside<br>Diameter<br>of<br>Barrel              |
| 1/2 to 2 1/2                     | 1                                                   | 0.8                                         | Not<br>less<br>than<br>87.5%<br>of<br>nominal<br>thickness | 2                                                | 2                                            | 4                             | 7                                             | 7                                         | 1                                     | +0-1                                      | +0-1                                   | See<br>Table A7<br>for<br>limiting<br>dimensions |
| 3 to 3 1/2                       | 1                                                   | 1.6                                         |                                                            | 2                                                | 2                                            | 4                             | 7                                             | 7                                         | 1                                     | +0-1                                      | +0-1                                   |                                                  |
| 4                                | +2-1                                                | 1.6                                         |                                                            | 2                                                | 2                                            | 4                             | 7                                             | 7                                         | 1                                     | +0-1                                      | +0-2                                   |                                                  |
| 5 to 6                           | +3-1                                                | 1.6                                         |                                                            | 2                                                | 2                                            | 7                             | 7                                             | 7                                         | 1                                     | +0-1                                      | +0-2                                   |                                                  |
| 8                                | 2                                                   | 1.6                                         |                                                            | 2                                                | 2                                            | 7                             | 7                                             | 7                                         | 1                                     | +0-1                                      | +0-2                                   |                                                  |
| 10                               | +4-3                                                | 3.2                                         |                                                            | 2                                                | 2                                            | 7                             | 10                                            | 7                                         | 2                                     | +0-2                                      | +0-2                                   |                                                  |
| 12 to 18                         | +4-3                                                | 3.2                                         |                                                            | 3                                                | 3                                            | 7                             | 10                                            | 7                                         | 2                                     | +0-2                                      | +0-2                                   |                                                  |
| 20 to 24                         | +6-5                                                | 4.8                                         |                                                            | 3                                                | 3                                            | 7                             | 10                                            | 7                                         | 2                                     | +0-2                                      | +0-2                                   |                                                  |
| 26 to 30                         | +7-5                                                | 4.8                                         |                                                            | 3                                                | 3                                            | 10                            | ...                                           | ...                                       | ...                                   | ...                                       | ...                                    |                                                  |
| 32 to 48                         | +7-5                                                | 4.8                                         |                                                            | 5                                                | 5                                            | 10                            | ...                                           | ...                                       | ...                                   | ...                                       | ...                                    |                                                  |

TABLE A1 TOLERANCES (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | Angularity Tol.     |                     |
|----------------------------------|---------------------|---------------------|
|                                  | Off<br>Angle<br>$Q$ | Off<br>Plane<br>$P$ |
| 1/2 to 4                         | 1                   | 2                   |
| 5 to 8                           | 2                   | 4                   |
| 10 to 12                         | 3                   | 5                   |
| 14 to 16                         | 3                   | 7                   |
| 18 to 24                         | 4                   | 10                  |
| 26 to 30                         | 5                   | 10                  |
| 32 to 42                         | 5                   | 13                  |
| 44 to 48                         | 5                   | 20                  |



GENERAL NOTE: Dimensions are in millimeters (except NPS). Tolerances are equal plus and minus except as noted.

NOTES:

- (1) Out-of-round is the sum of absolute values of plus and minus tolerance.
- (2) This tolerance may be exceeded in localized areas of formed fittings where increased wall thickness is required to meet design requirements of para. 2.2
- (3) The inside diameter and the nominal wall thicknesses at ends are to be specified by the purchaser.
- (4) Unless otherwise specified by the purchaser, these tolerances apply to the nominal inside diameter, which equals the difference between the nominal outside diameter and twice the nominal wall thickness.

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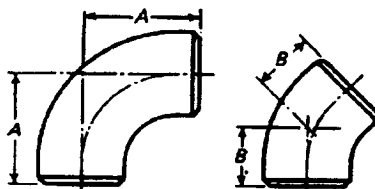


TABLE A2 DIMENSIONS OF LONG RADIUS ELBOWS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter<br>at Bevel<br>D |      |      | Center-to-End       |      |      |                     |      |      |
|----------------------------------|-----------------------------------|------|------|---------------------|------|------|---------------------|------|------|
|                                  |                                   |      |      | 90 deg. Elbows<br>A |      |      | 45 deg. Elbows<br>B |      |      |
|                                  | Min.                              | Nom. | Max. | Min.                | Nom. | Max. | Min.                | Nom. | Max. |
| 1/2                              | 20                                | 21   | 22   | 36                  | 38   | 40   | 14                  | 16   | 18   |
| 3/4 (1)                          | 26                                | 27   | 28   | 36                  | 38   | 40   | 17                  | 19   | 21   |
| 1                                | 32                                | 33   | 34   | 36                  | 38   | 40   | 20                  | 22   | 24   |
| 1 1/4                            | 41                                | 42   | 43   | 46                  | 48   | 50   | 23                  | 25   | 27   |
| 1 1/2                            | 47                                | 48   | 49   | 55                  | 57   | 59   | 27                  | 29   | 31   |
| 2                                | 59                                | 60   | 61   | 74                  | 76   | 78   | 33                  | 35   | 37   |
| 2 1/2                            | 72                                | 73   | 74   | 93                  | 95   | 97   | 42                  | 44   | 46   |
| 3                                | 88                                | 89   | 90   | 112                 | 114  | 116  | 49                  | 51   | 53   |
| 3 1/2                            | 101                               | 102  | 103  | 131                 | 133  | 135  | 55                  | 57   | 59   |
| 4                                | 113                               | 114  | 116  | 150                 | 152  | 154  | 62                  | 64   | 66   |
| 5                                | 140                               | 141  | 144  | 188                 | 190  | 192  | 77                  | 79   | 81   |
| 6                                | 167                               | 168  | 171  | 227                 | 229  | 231  | 93                  | 95   | 97   |
| 8                                | 217                               | 219  | 221  | 303                 | 305  | 307  | 125                 | 127  | 129  |
| 10                               | 270                               | 273  | 277  | 379                 | 381  | 383  | 167                 | 169  | 181  |
| 12                               | 321                               | 324  | 328  | 454                 | 457  | 460  | 187                 | 190  | 193  |
| 14                               | 353                               | 356  | 360  | 530                 | 533  | 536  | 219                 | 222  | 225  |
| 16                               | 403                               | 406  | 410  | 607                 | 610  | 613  | 251                 | 254  | 257  |
| 18                               | 454                               | 457  | 461  | 683                 | 686  | 689  | 283                 | 286  | 289  |
| 20                               | 503                               | 508  | 514  | 759                 | 762  | 765  | 315                 | 318  | 321  |
| 22                               | 554                               | 559  | 565  | 835                 | 838  | 841  | 340                 | 343  | 346  |
| 24                               | 605                               | 610  | 616  | 911                 | 914  | 917  | 378                 | 381  | 384  |
| 26                               | 655                               | 660  | 667  | 988                 | 991  | 994  | 403                 | 406  | 409  |
| 28                               | 706                               | 711  | 718  | 1064                | 1067 | 1070 | 435                 | 438  | 441  |
| 30                               | 757                               | 762  | 769  | 1140                | 1143 | 1146 | 467                 | 470  | 473  |
| 32                               | 808                               | 813  | 820  | 1214                | 1219 | 1224 | 497                 | 502  | 507  |
| 34                               | 859                               | 864  | 871  | 1290                | 1295 | 1300 | 528                 | 533  | 538  |
| 36                               | 909                               | 914  | 921  | 1367                | 1372 | 1377 | 560                 | 565  | 570  |
| 38                               | 960                               | 965  | 972  | 1443                | 1448 | 1453 | 595                 | 600  | 605  |
| 40                               | 1011                              | 1016 | 1023 | 1519                | 1524 | 1529 | 627                 | 632  | 637  |
| 42                               | 1062                              | 1067 | 1074 | 1595                | 1600 | 1605 | 655                 | 660  | 665  |
| 44                               | 1113                              | 1118 | 1125 | 1671                | 1676 | 1681 | 690                 | 695  | 700  |
| 46                               | 1163                              | 1168 | 1175 | 1748                | 1753 | 1758 | 722                 | 727  | 732  |
| 48                               | 1214                              | 1219 | 1226 | 1824                | 1829 | 1834 | 754                 | 759  | 764  |

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## NOTES TO TABLE A2

GENERAL NOTE: Dimensions are in millimeters.

NOTE: --

(1) *A* and *B* dimensions for NPS  $\frac{3}{4}$  may be as shown below at the manufacturer's option.

| Center-to-End              |      |      |                            |      |      |
|----------------------------|------|------|----------------------------|------|------|
| 90 deg. Elbows<br><i>A</i> |      |      | 45 deg. Elbows<br><i>B</i> |      |      |
| Min.                       | Nom. | Max. | Min.                       | Nom. | Max. |
| 27                         | 29   | 31   | 9                          | 11   | 13   |

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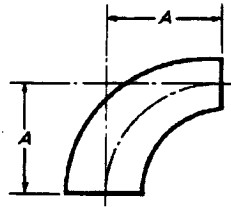


TABLE A3 DIMENSIONS OF LONG RADIUS REDUCING ELBOWS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter<br>at Bevel<br>D |      |      | Nominal<br>Pipe<br>Size<br>(NPS) | Center-to-End<br>A |      |      | Nominal<br>Pipe<br>Size<br>(NPS) | Center-to-End<br>A |      |      |
|----------------------------------|-----------------------------------|------|------|----------------------------------|--------------------|------|------|----------------------------------|--------------------|------|------|
|                                  | Min.                              | Nom. | Max. |                                  | Min.               | Nom. | Max. |                                  | Min.               | Nom. | Max. |
| 1                                | 32                                | 33   | 34   | 2 x 1 1/2                        | 74                 | 76   | 78   | 10 x 8                           | 379                | 381  | 383  |
| 1 1/4                            | 41                                | 42   | 43   | 2 x 1 1/4                        | 74                 | 76   | 78   | 10 x 6                           | 379                | 381  | 383  |
| 1 1/2                            | 47                                | 48   | 49   | 2 x 1                            | 74                 | 76   | 78   | 10 x 5                           | 379                | 381  | 383  |
| 2                                | 59                                | 60   | 61   |                                  |                    |      |      |                                  |                    |      |      |
| 2 1/2                            | 72                                | 73   | 74   | 2 1/2 x 2                        | 93                 | 95   | 97   | 12 x 10                          | 454                | 457  | 460  |
|                                  |                                   |      |      | 2 1/2 x 1 1/2                    | 93                 | 95   | 97   | 12 x 8                           | 454                | 457  | 460  |
| 3                                | 88                                | 89   | 90   | 2 1/2 x 1 1/4                    | 93                 | 95   | 97   | 12 x 6                           | 454                | 457  | 460  |
| 3 1/2                            | 101                               | 102  | 103  |                                  |                    |      |      |                                  |                    |      |      |
| 4                                | 113                               | 114  | 116  | 3 x 2 1/2                        | 112                | 114  | 116  | 14 x 12                          | 530                | 533  | 536  |
| 5                                | 140                               | 141  | 144  | 3 x 2                            | 112                | 114  | 116  | 14 x 10                          | 530                | 533  | 536  |
| 6                                | 167                               | 168  | 171  | 3 x 1 1/2                        | 112                | 114  | 116  | 14 x 8                           | 530                | 533  | 536  |
|                                  |                                   |      |      |                                  |                    |      |      |                                  |                    |      |      |
| 8                                | 217                               | 219  | 221  | 3 1/2 x 3                        | 131                | 133  | 135  | 16 x 14                          | 607                | 610  | 613  |
| 10                               | 270                               | 273  | 277  | 3 1/2 x 2 1/2                    | 131                | 133  | 135  | 16 x 12                          | 607                | 610  | 613  |
| 12                               | 321                               | 324  | 328  | 3 1/2 x 2                        | 131                | 133  | 135  | 16 x 10                          | 607                | 610  | 613  |
| 14                               | 353                               | 356  | 360  |                                  |                    |      |      |                                  |                    |      |      |
| 16                               | 403                               | 406  | 410  | 4 x 3 1/2                        | 150                | 152  | 154  | 18 x 16                          | 683                | 686  | 689  |
|                                  |                                   |      |      | 4 x 3                            | 150                | 152  | 154  | 18 x 14                          | 683                | 686  | 689  |
| 18                               | 454                               | 457  | 461  | 4 x 2 1/2                        | 150                | 152  | 154  | 18 x 12                          | 683                | 686  | 689  |
| 20                               | 503                               | 508  | 514  | 4 x 2                            | 150                | 152  | 154  | 18 x 10                          | 683                | 686  | 689  |
| 22                               | 554                               | 559  | 565  |                                  |                    |      |      |                                  |                    |      |      |
| 24                               | 605                               | 610  | 616  | 5 x 4                            | 188                | 190  | 192  | 20 x 18                          | 759                | 762  | 765  |
|                                  |                                   |      |      | 5 x 3 1/2                        | 188                | 190  | 192  | 20 x 16                          | 759                | 762  | 765  |
|                                  |                                   |      |      | 5 x 3                            | 188                | 190  | 192  | 20 x 14                          | 759                | 762  | 765  |
|                                  |                                   |      |      | 5 x 2 1/2                        | 188                | 190  | 192  | 20 x 12                          | 759                | 762  | 765  |
|                                  |                                   |      |      |                                  |                    |      |      | 20 x 10                          | 759                | 762  | 765  |
|                                  |                                   |      |      | 6 x 5                            | 227                | 229  | 231  |                                  |                    |      |      |
|                                  |                                   |      |      | 6 x 4                            | 227                | 229  | 231  | 24 x 22                          | 911                | 914  | 917  |
|                                  |                                   |      |      | 6 x 3 1/2                        | 227                | 229  | 231  | 24 x 20                          | 911                | 914  | 917  |
|                                  |                                   |      |      | 6 x 3                            | 227                | 229  | 231  | 24 x 18                          | 911                | 914  | 917  |
|                                  |                                   |      |      |                                  |                    |      |      | 24 x 16                          | 911                | 914  | 917  |
|                                  |                                   |      |      | 8 x 6                            | 303                | 305  | 307  | 24 x 14                          | 911                | 914  | 917  |
|                                  |                                   |      |      | 8 x 5                            | 303                | 305  | 307  | 24 x 12                          | 911                | 914  | 917  |
|                                  |                                   |      |      | 8 x 4                            | 303                | 305  | 307  |                                  |                    |      |      |

GENERAL NOTE: Dimensions are in millimeters.

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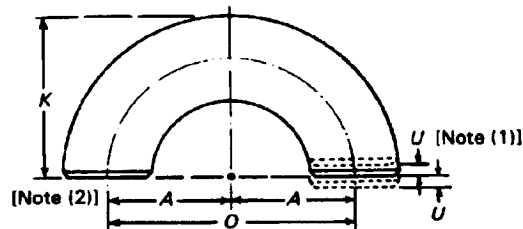


TABLE A4 DIMENSIONS OF LONG RADIUS RETURNS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter<br>at Bevel<br>$D$ |      |      | Center-to-Center<br>$O$ |      |      | Back-to-Face<br>$K$ |      |      |
|----------------------------------|-------------------------------------|------|------|-------------------------|------|------|---------------------|------|------|
|                                  | Min.                                | Nom. | Max. | Min.                    | Nom. | Max. | Min.                | Nom. | Max. |
| 1/2                              | 20                                  | 21   | 22   | 69                      | 76   | 83   | 41                  | 48   | 55   |
| 3/4 (3)                          | 26                                  | 27   | 28   | 69                      | 76   | 83   | 44                  | 51   | 58   |
| 1                                | 32                                  | 33   | 34   | 69                      | 76   | 83   | 49                  | 56   | 63   |
| 1 1/4                            | 41                                  | 42   | 43   | 88                      | 95   | 102  | 63                  | 70   | 77   |
| 1 1/2                            | 47                                  | 48   | 49   | 107                     | 114  | 121  | 76                  | 83   | 90   |
| 2                                | 59                                  | 60   | 61   | 145                     | 152  | 159  | 99                  | 106  | 113  |
| 2 1/2                            | 72                                  | 73   | 74   | 184                     | 191  | 198  | 125                 | 132  | 139  |
| 3                                | 88                                  | 89   | 90   | 222                     | 229  | 236  | 152                 | 159  | 166  |
| 3 1/2                            | 101                                 | 102  | 103  | 260                     | 267  | 274  | 177                 | 184  | 191  |
| 4                                | 113                                 | 114  | 116  | 298                     | 305  | 312  | 203                 | 210  | 217  |
| 5                                | 140                                 | 141  | 144  | 374                     | 381  | 388  | 255                 | 262  | 269  |
| 6                                | 167                                 | 168  | 171  | 450                     | 457  | 464  | 306                 | 313  | 320  |
| 8                                | 217                                 | 219  | 221  | 603                     | 610  | 617  | 407                 | 414  | 421  |
| 10                               | 270                                 | 273  | 277  | 752                     | 762  | 772  | 511                 | 518  | 525  |
| 12                               | 321                                 | 324  | 328  | 904                     | 914  | 924  | 612                 | 619  | 626  |
| 14                               | 353                                 | 356  | 360  | 1057                    | 1067 | 1077 | 704                 | 711  | 718  |
| 16                               | 403                                 | 406  | 410  | 1209                    | 1219 | 1229 | 806                 | 813  | 820  |
| 18                               | 454                                 | 457  | 461  | 1362                    | 1372 | 1382 | 907                 | 914  | 921  |
| 20                               | 503                                 | 506  | 514  | 1514                    | 1524 | 1534 | 1009                | 1016 | 1023 |
| 22                               | 554                                 | 559  | 565  | 1666                    | 1676 | 1686 | 1111                | 1118 | 1125 |
| 24                               | 605                                 | 610  | 616  | 1819                    | 1829 | 1839 | 1212                | 1219 | 1226 |

GENERAL NOTE: Dimensions are in millimeters.

## NOTES:

- (1) See Table A1 for tolerance for alignment of ends  $U$ .  
 (2) Dimension  $A$  is equal to one-half of dimension  $O$ .  
 (3)  $O$  and  $K$  dimensions for size NPS 3/4 may be as shown below at the manufacturer's option.

| Center-to-Center<br>$O$ |      |      | Back-to-Face<br>$K$ |      |      |
|-------------------------|------|------|---------------------|------|------|
| Min.                    | Nom. | Max. | Min.                | Nom. | Max. |
| 50                      | 57   | 64   | 36                  | 43   | 50   |

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## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

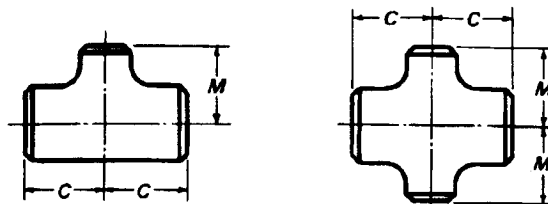


TABLE A5 DIMENSIONS OF STRAIGHT TEES AND CROSSES

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter<br>at Bevel<br><i>D</i> |      |      | Center-to-End   |      |      |                             |      |      |
|----------------------------------|------------------------------------------|------|------|-----------------|------|------|-----------------------------|------|------|
|                                  |                                          |      |      | Run<br><i>C</i> |      |      | Outlet (1), (2)<br><i>M</i> |      |      |
|                                  | Min.                                     | Nom. | Max. | Min.            | Nom. | Max. | Min.                        | Nom. | Max. |
| 1/2                              | 20                                       | 21   | 22   | 23              | 25   | 27   | 23                          | 25   | 27   |
| 3/4                              | 26                                       | 27   | 28   | 27              | 29   | 31   | 27                          | 29   | 31   |
| 1                                | 32                                       | 33   | 34   | 36              | 38   | 40   | 36                          | 38   | 40   |
| 1 1/4                            | 41                                       | 42   | 43   | 46              | 48   | 50   | 46                          | 48   | 50   |
| 1 1/2                            | 47                                       | 48   | 49   | 55              | 57   | 59   | 55                          | 57   | 59   |
| 2                                | 59                                       | 60   | 61   | 62              | 64   | 66   | 62                          | 64   | 66   |
| 2 1/2                            | 72                                       | 73   | 74   | 74              | 76   | 78   | 74                          | 76   | 78   |
| 3                                | 88                                       | 89   | 90   | 84              | 86   | 88   | 84                          | 86   | 88   |
| 3 1/2                            | 101                                      | 102  | 103  | 93              | 95   | 97   | 93                          | 95   | 97   |
| 4                                | 113                                      | 114  | 116  | 103             | 105  | 107  | 103                         | 105  | 107  |
| 5                                | 140                                      | 141  | 144  | 122             | 124  | 126  | 122                         | 124  | 126  |
| 6                                | 167                                      | 168  | 171  | 141             | 143  | 145  | 141                         | 143  | 145  |
| 8                                | 217                                      | 219  | 221  | 176             | 178  | 180  | 176                         | 178  | 180  |
| 10                               | 270                                      | 273  | 277  | 214             | 216  | 218  | 214                         | 216  | 218  |
| 12                               | 321                                      | 324  | 328  | 251             | 254  | 257  | 251                         | 254  | 257  |
| 14                               | 353                                      | 356  | 360  | 276             | 279  | 282  | 276                         | 279  | 282  |
| 16                               | 403                                      | 406  | 410  | 302             | 305  | 308  | 302                         | 305  | 308  |
| 18                               | 454                                      | 457  | 461  | 340             | 343  | 346  | 340                         | 343  | 346  |
| 20                               | 503                                      | 508  | 514  | 378             | 381  | 384  | 378                         | 381  | 384  |
| 22                               | 554                                      | 559  | 565  | 416             | 419  | 422  | 416                         | 419  | 422  |
| 24                               | 605                                      | 610  | 616  | 429             | 432  | 435  | 429                         | 432  | 435  |
| 26                               | 655                                      | 660  | 667  | 492             | 495  | 498  | 492                         | 495  | 498  |
| 28                               | 706                                      | 711  | 718  | 518             | 521  | 524  | 518                         | 521  | 524  |
| 30                               | 757                                      | 762  | 769  | 556             | 559  | 562  | 556                         | 559  | 562  |
| 32                               | 808                                      | 813  | 820  | 592             | 597  | 602  | 592                         | 597  | 602  |
| 34                               | 859                                      | 864  | 871  | 630             | 635  | 640  | 630                         | 635  | 640  |
| 36                               | 909                                      | 914  | 921  | 668             | 673  | 678  | 668                         | 673  | 678  |
| 38                               | 960                                      | 965  | 972  | 706             | 711  | 716  | 706                         | 711  | 716  |
| 40                               | 1011                                     | 1016 | 1023 | 744             | 749  | 754  | 744                         | 749  | 754  |
| 42                               | 1062                                     | 1067 | 1074 | 757             | 762  | 767  | 706                         | 711  | 716  |
| 44                               | 1113                                     | 1118 | 1125 | 808             | 813  | 818  | 757                         | 762  | 767  |
| 46                               | 1163                                     | 1168 | 1175 | 846             | 851  | 856  | 795                         | 800  | 805  |
| 48                               | 1214                                     | 1219 | 1226 | 884             | 889  | 894  | 833                         | 838  | 843  |

GENERAL NOTE: Dimensions are in millimeters.

## NOTES:

- (1) Outlet dimension *M* for NPS 26 and larger is recommended but not required.  
 (2) Dimensions applicable to crosses NPS 24 and smaller.

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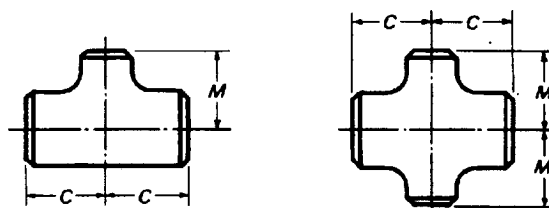


TABLE A6 DIMENSIONS OF REDUCING OUTLET TEES AND REDUCING OUTLET CROSSES

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter of Reducing Tees and Crosses |      |      |             |      |      | Center-to-End Lengths of Tees and Crosses |      |      |                 |      |      |
|----------------------------------|-----------------------------------------------|------|------|-------------|------|------|-------------------------------------------|------|------|-----------------|------|------|
|                                  | Run<br>D                                      |      |      | Outlet<br>D |      |      | Run<br>C                                  |      |      | Outlet (1)<br>M |      |      |
|                                  | Min.                                          | Nom. | Max. | Min.        | Nom. | Max. | Min.                                      | Nom. | Max. | Min.            | Nom. | Max. |
| 1/2 x 1/2 x 3/8                  | 20                                            | 21   | 22   | 16          | 17   | 18   | 23                                        | 25   | 27   | 23              | 25   | 27   |
| 1/2 x 1/2 x 1/4                  | 20                                            | 21   | 22   | 13          | 14   | 15   | 23                                        | 25   | 27   | 23              | 25   | 27   |
| 3/4 x 3/4 x 1/2                  | 26                                            | 27   | 28   | 20          | 21   | 22   | 27                                        | 29   | 31   | 27              | 29   | 31   |
| 3/4 x 3/4 x 3/8                  | 26                                            | 27   | 28   | 16          | 17   | 18   | 27                                        | 29   | 31   | 27              | 29   | 31   |
| 1 x 1 x 3/4                      | 32                                            | 33   | 34   | 26          | 27   | 28   | 36                                        | 38   | 40   | 36              | 38   | 40   |
| 1 x 1 x 1/2                      | 32                                            | 33   | 34   | 20          | 21   | 22   | 36                                        | 38   | 40   | 36              | 38   | 40   |
| 1 1/4 x 1 1/4 x 1                | 41                                            | 42   | 43   | 32          | 33   | 34   | 46                                        | 48   | 50   | 46              | 48   | 50   |
| 1 1/4 x 1 1/4 x 3/4              | 41                                            | 42   | 43   | 26          | 27   | 28   | 46                                        | 48   | 50   | 46              | 48   | 50   |
| 1 1/4 x 1 1/4 x 1/2              | 41                                            | 42   | 43   | 20          | 21   | 22   | 46                                        | 48   | 50   | 46              | 48   | 50   |
| 1 1/2 x 1 1/2 x 1 1/4            | 47                                            | 48   | 49   | 41          | 42   | 43   | 55                                        | 57   | 59   | 55              | 57   | 59   |
| 1 1/2 x 1 1/2 x 1                | 47                                            | 48   | 49   | 32          | 33   | 34   | 55                                        | 57   | 59   | 55              | 57   | 59   |
| 1 1/2 x 1 1/2 x 3/4              | 47                                            | 48   | 49   | 26          | 27   | 28   | 55                                        | 57   | 59   | 55              | 57   | 59   |
| 1 1/2 x 1 1/2 x 1/2              | 47                                            | 48   | 49   | 20          | 21   | 22   | 55                                        | 57   | 59   | 55              | 57   | 59   |
| 2 x 2 x 1 1/2                    | 59                                            | 60   | 61   | 47          | 48   | 49   | 62                                        | 64   | 66   | 58              | 60   | 62   |
| 2 x 2 x 1 1/4                    | 59                                            | 60   | 61   | 41          | 42   | 43   | 62                                        | 64   | 66   | 55              | 57   | 59   |
| 2 x 2 x 1                        | 59                                            | 60   | 61   | 32          | 33   | 34   | 62                                        | 64   | 66   | 49              | 51   | 53   |
| 2 x 2 x 3/4                      | 59                                            | 60   | 61   | 26          | 27   | 28   | 62                                        | 64   | 66   | 42              | 44   | 46   |
| 2 1/2 x 2 1/2 x 2                | 72                                            | 73   | 74   | 59          | 60   | 61   | 74                                        | 76   | 78   | 68              | 70   | 72   |
| 2 1/2 x 2 1/2 x 1 1/2            | 72                                            | 73   | 74   | 47          | 48   | 49   | 74                                        | 76   | 78   | 65              | 67   | 69   |
| 2 1/2 x 2 1/2 x 1 1/4            | 72                                            | 73   | 74   | 41          | 42   | 43   | 74                                        | 76   | 78   | 62              | 64   | 66   |
| 2 1/2 x 2 1/2 x 1                | 72                                            | 73   | 74   | 32          | 33   | 34   | 74                                        | 76   | 78   | 55              | 57   | 59   |
| 3 x 3 x 2 1/2                    | 88                                            | 89   | 90   | 72          | 73   | 74   | 84                                        | 86   | 88   | 81              | 83   | 85   |
| 3 x 3 x 2                        | 88                                            | 89   | 90   | 59          | 60   | 61   | 84                                        | 86   | 88   | 74              | 76   | 78   |
| 3 x 3 x 1 1/2                    | 88                                            | 89   | 90   | 47          | 48   | 49   | 84                                        | 86   | 88   | 71              | 73   | 75   |
| 3 x 3 x 1 1/4                    | 88                                            | 89   | 90   | 41          | 42   | 43   | 84                                        | 86   | 88   | 68              | 70   | 72   |
| 3 1/2 x 3 1/2 x 3                | 101                                           | 102  | 103  | 88          | 89   | 90   | 93                                        | 95   | 97   | 90              | 92   | 94   |
| 3 1/2 x 3 1/2 x 2 1/2            | 101                                           | 102  | 103  | 72          | 73   | 74   | 93                                        | 95   | 97   | 87              | 89   | 91   |
| 3 1/2 x 3 1/2 x 2                | 101                                           | 102  | 103  | 59          | 60   | 61   | 93                                        | 95   | 97   | 81              | 83   | 85   |
| 3 1/2 x 3 1/2 x 1 1/2            | 101                                           | 102  | 103  | 47          | 48   | 49   | 93                                        | 95   | 97   | 77              | 79   | 81   |
| 4 x 4 x 3 1/2                    | 113                                           | 114  | 116  | 101         | 102  | 103  | 103                                       | 105  | 107  | 100             | 102  | 104  |
| 4 x 4 x 3                        | 113                                           | 114  | 116  | 88          | 89   | 90   | 103                                       | 105  | 107  | 96              | 98   | 100  |
| 4 x 4 x 2 1/2                    | 113                                           | 113  | 116  | 72          | 73   | 74   | 103                                       | 105  | 107  | 93              | 95   | 97   |
| 4 x 4 x 2                        | 113                                           | 114  | 116  | 59          | 60   | 61   | 103                                       | 105  | 107  | 87              | 89   | 91   |
| 4 x 4 x 1 1/2                    | 113                                           | 114  | 116  | 47          | 48   | 49   | 103                                       | 105  | 107  | 84              | 86   | 88   |

(Notes follow at end of table)

(Table A6 continues on next page)



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FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

TABLE A6 DIMENSIONS OF REDUCING OUTLET TEES AND REDUCING OUTLET CROSSES (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter of Reducing Tees and Crosses |      |      |             |      |      | Center-to-End Lengths of Tees and Crosses |      |      |                 |      |      |
|----------------------------------|-----------------------------------------------|------|------|-------------|------|------|-------------------------------------------|------|------|-----------------|------|------|
|                                  | Run<br>D                                      |      |      | Outlet<br>D |      |      | Run<br>C                                  |      |      | Outlet (1)<br>M |      |      |
|                                  | Min.                                          | Nom. | Max. | Min.        | Nom. | Max. | Min.                                      | Nom. | Max. | Min.            | Nom. | Max. |
| 5 x 5 x 4                        | 140                                           | 141  | 144  | 113         | 114  | 116  | 122                                       | 124  | 126  | 115             | 117  | 119  |
| 5 x 5 x 3½                       | 140                                           | 141  | 144  | 101         | 102  | 103  | 122                                       | 124  | 126  | 112             | 114  | 116  |
| 5 x 5 x 3                        | 140                                           | 141  | 144  | 88          | 89   | 90   | 122                                       | 124  | 126  | 109             | 111  | 113  |
| 5 x 5 x 2½                       | 140                                           | 141  | 144  | 72          | 73   | 74   | 122                                       | 124  | 126  | 106             | 108  | 110  |
| 5 x 5 x 2                        | 140                                           | 141  | 144  | 59          | 60   | 61   | 122                                       | 124  | 126  | 103             | 105  | 107  |
| 6 x 6 x 5                        | 167                                           | 168  | 171  | 140         | 141  | 144  | 141                                       | 143  | 145  | 135             | 137  | 139  |
| 6 x 6 x 4                        | 167                                           | 168  | 171  | 113         | 114  | 116  | 141                                       | 143  | 145  | 128             | 130  | 132  |
| 6 x 6 x 3½                       | 167                                           | 168  | 171  | 101         | 102  | 103  | 141                                       | 143  | 145  | 125             | 127  | 129  |
| 6 x 6 x 3                        | 167                                           | 168  | 171  | 88          | 89   | 90   | 141                                       | 143  | 145  | 122             | 124  | 126  |
| 6 x 6 x 2½                       | 167                                           | 168  | 171  | 72          | 73   | 74   | 141                                       | 143  | 145  | 119             | 121  | 123  |
| 8 x 8 x 6                        | 217                                           | 219  | 221  | 167         | 168  | 171  | 176                                       | 178  | 180  | 166             | 168  | 170  |
| 8 x 8 x 5                        | 217                                           | 219  | 221  | 140         | 141  | 144  | 176                                       | 178  | 180  | 160             | 162  | 164  |
| 8 x 8 x 4                        | 217                                           | 219  | 221  | 113         | 114  | 116  | 176                                       | 178  | 180  | 154             | 156  | 158  |
| 8 x 8 x 3½                       | 217                                           | 219  | 221  | 101         | 102  | 103  | 176                                       | 178  | 180  | 150             | 152  | 154  |
| 10 x 10 x 8                      | 270                                           | 273  | 277  | 217         | 219  | 221  | 214                                       | 216  | 218  | 201             | 203  | 205  |
| 10 x 10 x 6                      | 270                                           | 273  | 277  | 167         | 168  | 171  | 214                                       | 216  | 218  | 192             | 194  | 196  |
| 10 x 10 x 5                      | 270                                           | 273  | 277  | 140         | 141  | 144  | 214                                       | 216  | 218  | 189             | 191  | 193  |
| 10 x 10 x 4                      | 270                                           | 273  | 277  | 113         | 114  | 116  | 214                                       | 216  | 218  | 182             | 184  | 186  |
| 12 x 12 x 10                     | 321                                           | 324  | 328  | 270         | 273  | 277  | 251                                       | 254  | 257  | 238             | 241  | 244  |
| 12 x 12 x 8                      | 321                                           | 324  | 328  | 217         | 219  | 221  | 251                                       | 254  | 257  | 226             | 229  | 232  |
| 12 x 12 x 6                      | 321                                           | 324  | 328  | 167         | 168  | 171  | 251                                       | 254  | 257  | 216             | 219  | 222  |
| 12 x 12 x 5                      | 321                                           | 324  | 328  | 140         | 140  | 144  | 251                                       | 254  | 257  | 213             | 216  | 219  |
| 14 x 14 x 12                     | 353                                           | 356  | 360  | 321         | 324  | 328  | 276                                       | 279  | 282  | 267             | 270  | 273  |
| 14 x 14 x 10                     | 353                                           | 356  | 360  | 270         | 273  | 277  | 276                                       | 279  | 282  | 254             | 257  | 260  |
| 14 x 14 x 8                      | 353                                           | 356  | 360  | 217         | 219  | 221  | 276                                       | 279  | 282  | 245             | 248  | 251  |
| 14 x 14 x 6                      | 353                                           | 356  | 360  | 167         | 168  | 171  | 276                                       | 279  | 282  | 235             | 238  | 241  |
| 16 x 16 x 14                     | 403                                           | 406  | 410  | 353         | 356  | 360  | 302                                       | 305  | 308  | 302             | 305  | 308  |
| 16 x 16 x 12                     | 403                                           | 406  | 410  | 321         | 324  | 328  | 302                                       | 305  | 308  | 292             | 295  | 298  |
| 16 x 16 x 10                     | 403                                           | 406  | 410  | 270         | 273  | 277  | 302                                       | 305  | 308  | 280             | 283  | 286  |
| 16 x 16 x 8                      | 403                                           | 406  | 410  | 217         | 219  | 221  | 302                                       | 305  | 308  | 270             | 273  | 276  |
| 16 x 16 x 6                      | 403                                           | 406  | 410  | 167         | 168  | 171  | 302                                       | 305  | 308  | 261             | 264  | 267  |
| 18 x 18 x 16                     | 454                                           | 457  | 461  | 403         | 406  | 410  | 340                                       | 343  | 346  | 327             | 330  | 333  |
| 18 x 18 x 14                     | 454                                           | 457  | 461  | 353         | 356  | 360  | 340                                       | 343  | 346  | 327             | 330  | 333  |
| 18 x 18 x 12                     | 454                                           | 457  | 461  | 321         | 324  | 328  | 340                                       | 343  | 346  | 318             | 321  | 324  |
| 18 x 18 x 10                     | 454                                           | 457  | 461  | 270         | 273  | 277  | 340                                       | 343  | 346  | 305             | 308  | 311  |
| 18 x 18 x 8                      | 454                                           | 457  | 461  | 217         | 219  | 221  | 340                                       | 343  | 346  | 295             | 298  | 301  |
| 20 x 20 x 18                     | 503                                           | 508  | 514  | 454         | 457  | 461  | 378                                       | 381  | 384  | 365             | 368  | 371  |
| 20 x 20 x 16                     | 503                                           | 508  | 514  | 403         | 406  | 410  | 378                                       | 381  | 384  | 353             | 356  | 359  |
| 20 x 20 x 14                     | 503                                           | 508  | 514  | 353         | 356  | 360  | 378                                       | 381  | 384  | 353             | 356  | 359  |
| 20 x 20 x 12                     | 503                                           | 508  | 514  | 321         | 324  | 328  | 378                                       | 381  | 384  | 343             | 346  | 349  |
| 20 x 20 x 10                     | 503                                           | 508  | 514  | 270         | 273  | 277  | 378                                       | 381  | 384  | 330             | 333  | 336  |
| 20 x 20 x 8                      | 503                                           | 508  | 514  | 217         | 219  | 221  | 378                                       | 381  | 384  | 321             | 324  | 327  |
| 22 x 22 x 20                     | 554                                           | 559  | 565  | 503         | 508  | 514  | 416                                       | 419  | 422  | 403             | 406  | 409  |
| 22 x 22 x 18                     | 554                                           | 559  | 565  | 454         | 457  | 461  | 416                                       | 419  | 422  | 391             | 394  | 397  |
| 22 x 22 x 16                     | 554                                           | 559  | 565  | 403         | 406  | 410  | 416                                       | 419  | 422  | 378             | 381  | 384  |
| 22 x 22 x 14                     | 554                                           | 559  | 565  | 353         | 356  | 360  | 416                                       | 419  | 422  | 378             | 381  | 384  |
| 22 x 22 x 12                     | 554                                           | 559  | 565  | 321         | 324  | 328  | 416                                       | 419  | 422  | 368             | 371  | 374  |
| 22 x 22 x 10                     | 554                                           | 559  | 565  | 270         | 273  | 277  | 416                                       | 419  | 422  | 356             | 359  | 362  |

(Notes follow at end of table)

FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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TABLE A6 DIMENSIONS OF REDUCING OUTLET TEES AND REDUCING OUTLET CROSSES (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter of Reducing Tees and Crosses |      |      |             |      |      | Center-to-End Lengths of Tees and Crosses |      |      |                 |      |      |
|----------------------------------|-----------------------------------------------|------|------|-------------|------|------|-------------------------------------------|------|------|-----------------|------|------|
|                                  | Run<br>D                                      |      |      | Outlet<br>D |      |      | Run<br>C                                  |      |      | Outlet (1)<br>M |      |      |
|                                  | Min.                                          | Nom. | Max. | Min.        | Nom. | Max. | Min.                                      | Nom. | Max. | Min.            | Nom. | Max. |
| 24 x 24 x 22                     | 605                                           | 610  | 616  | 554         | 559  | 565  | 429                                       | 432  | 435  | 429             | 432  | 435  |
| 24 x 24 x 20                     | 605                                           | 610  | 616  | 503         | 508  | 514  | 429                                       | 432  | 435  | 429             | 432  | 435  |
| 24 x 24 x 18                     | 605                                           | 610  | 616  | 454         | 457  | 461  | 429                                       | 432  | 435  | 416             | 419  | 422  |
| 24 x 24 x 16                     | 605                                           | 610  | 616  | 403         | 406  | 410  | 429                                       | 432  | 435  | 403             | 406  | 409  |
| 24 x 24 x 14                     | 605                                           | 610  | 616  | 353         | 356  | 360  | 429                                       | 432  | 435  | 403             | 406  | 409  |
| 24 x 24 x 12                     | 605                                           | 610  | 616  | 321         | 324  | 328  | 429                                       | 432  | 435  | 394             | 397  | 400  |
| 24 x 24 x 10                     | 605                                           | 610  | 616  | 270         | 273  | 277  | 429                                       | 432  | 435  | 381             | 384  | 387  |
| 26 x 26 x 24                     | 655                                           | 660  | 667  | 605         | 610  | 616  | 492                                       | 495  | 498  | 480             | 483  | 486  |
| 26 x 26 x 22                     | 655                                           | 660  | 667  | 554         | 559  | 565  | 492                                       | 495  | 498  | 467             | 470  | 473  |
| 26 x 26 x 20                     | 655                                           | 660  | 667  | 503         | 508  | 514  | 492                                       | 495  | 498  | 454             | 457  | 460  |
| 26 x 26 x 18                     | 655                                           | 660  | 667  | 454         | 457  | 461  | 492                                       | 495  | 498  | 441             | 444  | 447  |
| 26 x 26 x 16                     | 655                                           | 660  | 667  | 403         | 406  | 410  | 492                                       | 495  | 498  | 429             | 432  | 435  |
| 26 x 26 x 14                     | 655                                           | 660  | 667  | 353         | 356  | 360  | 492                                       | 495  | 498  | 429             | 432  | 435  |
| 26 x 26 x 12                     | 655                                           | 660  | 667  | 321         | 324  | 328  | 492                                       | 495  | 498  | 419             | 422  | 425  |
| 28 x 28 x 26                     | 706                                           | 711  | 718  | 655         | 660  | 667  | 518                                       | 521  | 524  | 518             | 521  | 524  |
| 28 x 28 x 24                     | 706                                           | 711  | 718  | 605         | 610  | 616  | 518                                       | 521  | 524  | 505             | 508  | 511  |
| 28 x 28 x 22                     | 706                                           | 711  | 718  | 554         | 559  | 565  | 518                                       | 521  | 524  | 492             | 495  | 498  |
| 28 x 28 x 20                     | 706                                           | 711  | 718  | 503         | 508  | 514  | 518                                       | 521  | 524  | 480             | 483  | 486  |
| 28 x 28 x 18                     | 706                                           | 711  | 718  | 454         | 457  | 461  | 518                                       | 521  | 524  | 467             | 470  | 473  |
| 28 x 28 x 16                     | 706                                           | 711  | 718  | 403         | 406  | 410  | 518                                       | 521  | 524  | 454             | 457  | 460  |
| 28 x 28 x 14                     | 706                                           | 711  | 718  | 353         | 356  | 360  | 518                                       | 521  | 524  | 454             | 457  | 460  |
| 28 x 28 x 12                     | 706                                           | 711  | 718  | 321         | 324  | 328  | 518                                       | 521  | 524  | 445             | 448  | 451  |
| 30 x 30 x 28                     | 757                                           | 762  | 769  | 706         | 711  | 718  | 556                                       | 559  | 562  | 543             | 546  | 549  |
| 30 x 30 x 26                     | 757                                           | 762  | 769  | 655         | 660  | 667  | 556                                       | 559  | 562  | 543             | 546  | 549  |
| 30 x 30 x 24                     | 757                                           | 762  | 769  | 605         | 610  | 616  | 556                                       | 559  | 562  | 530             | 533  | 536  |
| 30 x 30 x 22                     | 757                                           | 762  | 769  | 554         | 559  | 565  | 556                                       | 559  | 562  | 518             | 521  | 524  |
| 30 x 30 x 20                     | 757                                           | 762  | 769  | 503         | 508  | 514  | 556                                       | 559  | 562  | 505             | 508  | 511  |
| 30 x 30 x 18                     | 757                                           | 762  | 769  | 454         | 457  | 461  | 556                                       | 559  | 562  | 492             | 495  | 498  |
| 30 x 30 x 16                     | 757                                           | 762  | 769  | 403         | 406  | 410  | 556                                       | 559  | 562  | 480             | 483  | 486  |
| 30 x 30 x 14                     | 757                                           | 762  | 769  | 353         | 356  | 360  | 556                                       | 559  | 562  | 480             | 483  | 486  |
| 30 x 30 x 12                     | 757                                           | 762  | 769  | 321         | 324  | 328  | 556                                       | 559  | 562  | 470             | 473  | 476  |
| 30 x 30 x 10                     | 757                                           | 762  | 769  | 270         | 273  | 277  | 556                                       | 559  | 562  | 457             | 460  | 463  |
| 32 x 32 x 30                     | 808                                           | 813  | 820  | 757         | 762  | 769  | 592                                       | 597  | 602  | 579             | 584  | 589  |
| 32 x 32 x 28                     | 808                                           | 813  | 820  | 706         | 711  | 718  | 592                                       | 597  | 602  | 567             | 572  | 577  |
| 32 x 32 x 26                     | 808                                           | 813  | 820  | 655         | 660  | 667  | 592                                       | 597  | 602  | 567             | 572  | 577  |
| 32 x 32 x 24                     | 808                                           | 813  | 820  | 605         | 610  | 616  | 592                                       | 597  | 602  | 554             | 559  | 564  |
| 32 x 32 x 22                     | 808                                           | 813  | 820  | 554         | 559  | 565  | 592                                       | 597  | 602  | 541             | 546  | 551  |
| 32 x 32 x 20                     | 808                                           | 813  | 820  | 503         | 508  | 514  | 592                                       | 597  | 602  | 528             | 533  | 538  |
| 32 x 32 x 18                     | 808                                           | 813  | 820  | 454         | 457  | 461  | 592                                       | 597  | 602  | 516             | 521  | 526  |
| 32 x 32 x 16                     | 808                                           | 813  | 820  | 403         | 406  | 410  | 592                                       | 597  | 602  | 503             | 508  | 513  |
| 32 x 32 x 14                     | 808                                           | 813  | 820  | 353         | 356  | 360  | 592                                       | 597  | 602  | 503             | 508  | 513  |
| 34 x 34 x 32                     | 859                                           | 864  | 871  | 808         | 813  | 820  | 630                                       | 635  | 640  | 617             | 622  | 627  |
| 34 x 34 x 30                     | 859                                           | 864  | 871  | 757         | 762  | 769  | 630                                       | 635  | 640  | 605             | 610  | 615  |
| 34 x 34 x 28                     | 859                                           | 864  | 871  | 706         | 711  | 718  | 630                                       | 635  | 640  | 592             | 597  | 602  |
| 34 x 34 x 26                     | 859                                           | 864  | 871  | 655         | 660  | 667  | 630                                       | 635  | 640  | 592             | 597  | 602  |
| 34 x 34 x 24                     | 859                                           | 864  | 871  | 605         | 610  | 616  | 630                                       | 635  | 640  | 579             | 584  | 589  |
| 34 x 34 x 22                     | 859                                           | 864  | 871  | 554         | 559  | 565  | 630                                       | 635  | 640  | 567             | 572  | 577  |
| 34 x 34 x 20                     | 859                                           | 864  | 871  | 503         | 508  | 514  | 630                                       | 635  | 640  | 554             | 559  | 564  |
| 34 x 34 x 18                     | 859                                           | 864  | 871  | 454         | 457  | 461  | 630                                       | 635  | 640  | 541             | 546  | 551  |
| 34 x 34 x 16                     | 859                                           | 864  | 871  | 403         | 406  | 410  | 630                                       | 635  | 640  | 528             | 533  | 538  |

(Table A6 continues on next page)

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FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

TABLE A6 DIMENSIONS OF REDUCING OUTLET TEES AND REDUCING OUTLET CROSSES (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter of Reducing Tees and Crosses |      |      |             |      |      | Center-to-End Lengths of Tees and Crosses |      |      |                 |      |      |
|----------------------------------|-----------------------------------------------|------|------|-------------|------|------|-------------------------------------------|------|------|-----------------|------|------|
|                                  | Run<br>D                                      |      |      | Outlet<br>D |      |      | Run<br>C                                  |      |      | Outlet (1)<br>M |      |      |
|                                  | Min.                                          | Nom. | Max. | Min.        | Nom. | Max. | Min.                                      | Nom. | Max. | Min.            | Nom. | Max. |
| 36 x 36 x 34                     | 909                                           | 914  | 921  | 859         | 864  | 871  | 668                                       | 673  | 678  | 655             | 660  | 666  |
| 36 x 36 x 32                     | 909                                           | 914  | 921  | 808         | 813  | 820  | 668                                       | 673  | 678  | 643             | 648  | 653  |
| 36 x 36 x 30                     | 909                                           | 914  | 921  | 757         | 762  | 769  | 668                                       | 673  | 678  | 630             | 635  | 640  |
| 36 x 36 x 28                     | 909                                           | 914  | 921  | 706         | 711  | 718  | 668                                       | 673  | 678  | 617             | 622  | 627  |
| 36 x 36 x 26                     | 909                                           | 914  | 921  | 655         | 660  | 667  | 668                                       | 673  | 678  | 617             | 622  | 627  |
| 36 x 36 x 24                     | 909                                           | 914  | 921  | 605         | 610  | 616  | 668                                       | 673  | 678  | 605             | 610  | 615  |
| 36 x 36 x 22                     | 909                                           | 914  | 921  | 554         | 559  | 565  | 668                                       | 673  | 678  | 592             | 597  | 602  |
| 36 x 36 x 20                     | 909                                           | 914  | 921  | 503         | 508  | 514  | 668                                       | 673  | 678  | 579             | 584  | 589  |
| 36 x 36 x 18                     | 909                                           | 914  | 921  | 454         | 457  | 461  | 668                                       | 673  | 678  | 567             | 572  | 577  |
| 36 x 36 x 16                     | 909                                           | 914  | 921  | 403         | 406  | 410  | 668                                       | 673  | 678  | 554             | 559  | 564  |
| 38 x 38 x 36                     | 960                                           | 965  | 972  | 909         | 914  | 921  | 706                                       | 711  | 716  | 706             | 711  | 716  |
| 38 x 38 x 34                     | 960                                           | 965  | 972  | 859         | 864  | 871  | 706                                       | 711  | 716  | 693             | 698  | 703  |
| 38 x 38 x 32                     | 960                                           | 965  | 972  | 808         | 813  | 820  | 706                                       | 711  | 716  | 681             | 686  | 691  |
| 38 x 38 x 30                     | 960                                           | 965  | 972  | 757         | 762  | 769  | 706                                       | 711  | 716  | 668             | 673  | 678  |
| 38 x 38 x 28                     | 960                                           | 965  | 972  | 706         | 711  | 718  | 706                                       | 711  | 716  | 643             | 648  | 653  |
| 38 x 38 x 26                     | 960                                           | 965  | 972  | 655         | 660  | 667  | 706                                       | 711  | 716  | 643             | 648  | 653  |
| 38 x 38 x 24                     | 960                                           | 965  | 972  | 605         | 610  | 616  | 706                                       | 711  | 716  | 630             | 635  | 640  |
| 38 x 38 x 22                     | 960                                           | 965  | 972  | 554         | 559  | 565  | 706                                       | 711  | 716  | 617             | 622  | 627  |
| 38 x 38 x 20                     | 960                                           | 965  | 972  | 503         | 508  | 514  | 706                                       | 711  | 716  | 605             | 610  | 615  |
| 38 x 38 x 18                     | 960                                           | 965  | 972  | 454         | 457  | 461  | 706                                       | 711  | 716  | 592             | 597  | 602  |
| 40 x 40 x 38                     | 1011                                          | 1016 | 1023 | 960         | 965  | 972  | 744                                       | 749  | 754  | 744             | 749  | 754  |
| 40 x 40 x 36                     | 1011                                          | 1016 | 1023 | 909         | 914  | 921  | 744                                       | 749  | 754  | 732             | 737  | 742  |
| 40 x 40 x 34                     | 1011                                          | 1016 | 1023 | 859         | 864  | 871  | 744                                       | 749  | 754  | 719             | 724  | 729  |
| 40 x 40 x 32                     | 1011                                          | 1016 | 1023 | 808         | 813  | 820  | 744                                       | 749  | 754  | 706             | 711  | 716  |
| 40 x 40 x 30                     | 1011                                          | 1016 | 1023 | 757         | 762  | 769  | 744                                       | 749  | 754  | 693             | 698  | 703  |
| 40 x 40 x 28                     | 1011                                          | 1016 | 1023 | 706         | 711  | 718  | 744                                       | 749  | 754  | 668             | 673  | 678  |
| 40 x 40 x 26                     | 1011                                          | 1016 | 1023 | 655         | 660  | 667  | 744                                       | 749  | 754  | 668             | 673  | 678  |
| 40 x 40 x 24                     | 1011                                          | 1016 | 1023 | 605         | 610  | 616  | 744                                       | 749  | 754  | 655             | 660  | 665  |
| 40 x 40 x 22                     | 1011                                          | 1016 | 1023 | 554         | 559  | 565  | 744                                       | 749  | 754  | 643             | 648  | 653  |
| 40 x 40 x 20                     | 1011                                          | 1016 | 1023 | 503         | 508  | 514  | 744                                       | 749  | 754  | 630             | 635  | 640  |
| 40 x 40 x 18                     | 1011                                          | 1016 | 1023 | 454         | 457  | 461  | 744                                       | 749  | 754  | 617             | 622  | 627  |
| 42 x 42 x 40                     | 1062                                          | 1067 | 1074 | 1011        | 1016 | 1023 | 767                                       | 762  | 767  | 706             | 711  | 716  |
| 42 x 42 x 38                     | 1062                                          | 1067 | 1074 | 960         | 965  | 972  | 767                                       | 762  | 767  | 706             | 711  | 716  |
| 42 x 42 x 36                     | 1062                                          | 1067 | 1074 | 909         | 914  | 921  | 767                                       | 762  | 767  | 706             | 711  | 716  |
| 42 x 42 x 34                     | 1062                                          | 1067 | 1074 | 859         | 864  | 871  | 767                                       | 762  | 767  | 706             | 711  | 716  |
| 42 x 42 x 32                     | 1062                                          | 1067 | 1074 | 808         | 813  | 820  | 767                                       | 762  | 767  | 706             | 711  | 716  |
| 42 x 42 x 30                     | 1062                                          | 1067 | 1074 | 757         | 762  | 769  | 767                                       | 762  | 767  | 706             | 711  | 716  |
| 42 x 42 x 28                     | 1062                                          | 1067 | 1074 | 706         | 711  | 718  | 767                                       | 762  | 767  | 693             | 698  | 703  |
| 42 x 42 x 26                     | 1062                                          | 1067 | 1074 | 655         | 660  | 667  | 767                                       | 762  | 767  | 693             | 698  | 703  |
| 42 x 42 x 24                     | 1062                                          | 1067 | 1074 | 605         | 610  | 616  | 767                                       | 762  | 767  | 655             | 660  | 665  |
| 42 x 42 x 22                     | 1062                                          | 1067 | 1074 | 554         | 559  | 565  | 767                                       | 762  | 767  | 655             | 660  | 665  |
| 42 x 42 x 20                     | 1062                                          | 1067 | 1074 | 503         | 508  | 514  | 767                                       | 762  | 767  | 655             | 660  | 665  |
| 42 x 42 x 18                     | 1062                                          | 1067 | 1074 | 454         | 457  | 461  | 767                                       | 762  | 767  | 643             | 648  | 653  |
| 42 x 42 x 16                     | 1062                                          | 1067 | 1074 | 403         | 406  | 410  | 767                                       | 762  | 767  | 630             | 635  | 640  |
| 44 x 44 x 42                     | 1113                                          | 1118 | 1125 | 1062        | 1067 | 1074 | 808                                       | 813  | 818  | 757             | 762  | 767  |
| 44 x 44 x 40                     | 1113                                          | 1118 | 1125 | 1011        | 1016 | 1023 | 808                                       | 813  | 818  | 744             | 749  | 754  |
| 44 x 44 x 38                     | 1113                                          | 1118 | 1125 | 960         | 965  | 972  | 808                                       | 813  | 818  | 732             | 737  | 742  |
| 44 x 44 x 36                     | 1113                                          | 1118 | 1125 | 909         | 914  | 921  | 808                                       | 813  | 818  | 719             | 724  | 729  |
| 44 x 44 x 34                     | 1113                                          | 1118 | 1125 | 859         | 864  | 871  | 808                                       | 813  | 818  | 719             | 724  | 729  |
| 44 x 44 x 32                     | 1113                                          | 1118 | 1125 | 808         | 813  | 820  | 808                                       | 813  | 818  | 706             | 711  | 716  |

## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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TABLE A6 DIMENSIONS OF REDUCING OUTLET TEES AND REDUCING OUTLET CROSSES (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter of Reducing Tees and Crosses |      |      |                    |      |      | Center-to-End Lengths of Tees and Crosses |      |      |                        |      |      |
|----------------------------------|-----------------------------------------------|------|------|--------------------|------|------|-------------------------------------------|------|------|------------------------|------|------|
|                                  | Run<br><i>D</i>                               |      |      | Outlet<br><i>D</i> |      |      | Run<br><i>C</i>                           |      |      | Outlet (1)<br><i>M</i> |      |      |
|                                  | Min.                                          | Nom. | Max. | Min.               | Nom. | Max. | Min.                                      | Nom. | Max. | Min.                   | Nom. | Max. |
| 44 x 44 x 30                     | 1113                                          | 1118 | 1125 | 757                | 762  | 764  | 808                                       | 813  | 818  | 706                    | 711  | 716  |
| 44 x 44 x 28                     | 1113                                          | 1118 | 1125 | 706                | 711  | 718  | 808                                       | 813  | 818  | 693                    | 698  | 703  |
| 44 x 44 x 26                     | 1113                                          | 1118 | 1125 | 655                | 660  | 667  | 808                                       | 813  | 818  | 683                    | 688  | 703  |
| 44 x 44 x 24                     | 1113                                          | 1118 | 1125 | 605                | 610  | 616  | 808                                       | 813  | 818  | 683                    | 688  | 703  |
| 44 x 44 x 22                     | 1113                                          | 1118 | 1125 | 554                | 559  | 565  | 808                                       | 813  | 818  | 681                    | 686  | 691  |
| 44 x 44 x 20                     | 1113                                          | 1118 | 1125 | 503                | 508  | 514  | 808                                       | 813  | 818  | 681                    | 686  | 691  |
| 46 x 46 x 44                     | 1163                                          | 1168 | 1175 | 1113               | 1118 | 1125 | 846                                       | 851  | 856  | 795                    | 800  | 805  |
| 46 x 46 x 42                     | 1163                                          | 1168 | 1175 | 1062               | 1067 | 1074 | 846                                       | 851  | 856  | 782                    | 787  | 792  |
| 46 x 46 x 40                     | 1163                                          | 1168 | 1175 | 1011               | 1016 | 1023 | 846                                       | 851  | 856  | 770                    | 775  | 780  |
| 46 x 46 x 38                     | 1163                                          | 1168 | 1175 | 960                | 965  | 972  | 846                                       | 851  | 856  | 757                    | 762  | 767  |
| 46 x 46 x 36                     | 1163                                          | 1168 | 1175 | 909                | 914  | 921  | 846                                       | 851  | 856  | 757                    | 762  | 767  |
| 46 x 46 x 34                     | 1163                                          | 1168 | 1175 | 859                | 864  | 871  | 846                                       | 851  | 856  | 744                    | 749  | 754  |
| 46 x 46 x 32                     | 1163                                          | 1168 | 1175 | 808                | 813  | 820  | 846                                       | 851  | 856  | 744                    | 749  | 754  |
| 46 x 46 x 30                     | 1163                                          | 1168 | 1175 | 757                | 762  | 764  | 846                                       | 851  | 856  | 732                    | 737  | 742  |
| 46 x 46 x 28                     | 1163                                          | 1168 | 1175 | 706                | 711  | 718  | 846                                       | 851  | 856  | 732                    | 737  | 742  |
| 46 x 46 x 26                     | 1163                                          | 1168 | 1175 | 655                | 660  | 667  | 846                                       | 851  | 856  | 732                    | 737  | 742  |
| 46 x 46 x 24                     | 1163                                          | 1168 | 1175 | 605                | 610  | 616  | 846                                       | 851  | 856  | 719                    | 724  | 729  |
| 46 x 46 x 22                     | 1163                                          | 1168 | 1175 | 554                | 559  | 565  | 846                                       | 851  | 856  | 719                    | 724  | 729  |
| 48 x 48 x 46                     | 1214                                          | 1219 | 1226 | 1163               | 1168 | 1175 | 884                                       | 889  | 894  | 833                    | 838  | 843  |
| 48 x 48 x 44                     | 1214                                          | 1219 | 1226 | 1113               | 1118 | 1125 | 884                                       | 889  | 894  | 833                    | 838  | 843  |
| 48 x 48 x 42                     | 1214                                          | 1219 | 1226 | 1062               | 1067 | 1074 | 884                                       | 889  | 894  | 808                    | 813  | 818  |
| 48 x 48 x 40                     | 1214                                          | 1219 | 1226 | 1011               | 1016 | 1023 | 884                                       | 889  | 894  | 808                    | 813  | 818  |
| 48 x 48 x 38                     | 1214                                          | 1219 | 1226 | 960                | 965  | 972  | 884                                       | 889  | 894  | 808                    | 813  | 818  |
| 48 x 48 x 36                     | 1214                                          | 1219 | 1226 | 909                | 914  | 921  | 884                                       | 889  | 894  | 782                    | 787  | 792  |
| 48 x 48 x 34                     | 1214                                          | 1219 | 1226 | 859                | 864  | 871  | 884                                       | 889  | 894  | 782                    | 787  | 792  |
| 48 x 48 x 32                     | 1214                                          | 1219 | 1226 | 808                | 813  | 820  | 884                                       | 889  | 894  | 782                    | 787  | 792  |
| 48 x 48 x 30                     | 1214                                          | 1219 | 1226 | 757                | 762  | 769  | 884                                       | 889  | 894  | 757                    | 762  | 767  |
| 48 x 48 x 28                     | 1214                                          | 1219 | 1226 | 706                | 711  | 718  | 884                                       | 889  | 894  | 757                    | 762  | 767  |
| 48 x 48 x 26                     | 1214                                          | 1219 | 1226 | 655                | 660  | 667  | 884                                       | 889  | 894  | 757                    | 762  | 767  |
| 48 x 48 x 24                     | 1214                                          | 1219 | 1226 | 605                | 610  | 616  | 884                                       | 889  | 894  | 732                    | 737  | 742  |
| 48 x 48 x 22                     | 1214                                          | 1219 | 1226 | 554                | 559  | 565  | 884                                       | 889  | 894  | 732                    | 737  | 742  |

GENERAL NOTE: Dimensions are in millimeters.

## NOTE:

(1) Outlet dimension *M* for run sizes 14 and larger is recommended but not required.

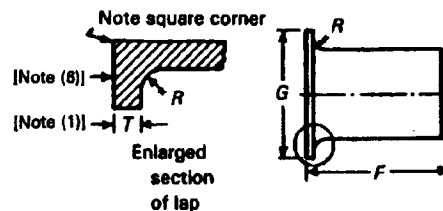


TABLE A7 DIMENSIONS OF LAP JOINT STUB ENDS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter at<br>Bevel<br>D |      |      | Long Pattern Length<br>(2), (3), (7)<br>F |      |      | Short Pattern Length<br>(2), (3), (7)<br>F |      |      | Radius of<br>Fillet (3)<br>R |                     | Diameter of<br>Lap (4)<br>G |                     | Outside Diameter<br>of Barrel |        |
|----------------------------------|-----------------------------------|------|------|-------------------------------------------|------|------|--------------------------------------------|------|------|------------------------------|---------------------|-----------------------------|---------------------|-------------------------------|--------|
|                                  | Min.                              | Nom. | Max. | Min.                                      | Nom. | Max. | Min.                                       | Nom. | Max. | Min.                         | Nom.<br>and<br>Max. | Min.                        | Nom.<br>and<br>Max. | Min.                          | Max.   |
|                                  |                                   |      |      |                                           |      |      |                                            |      |      |                              |                     |                             |                     |                               |        |
| 1/2                              | 20                                | 21   | 22   | 74                                        | 76   | 78   | 49                                         | 51   | 53   | 2                            | 3                   | 34                          | 35                  | 20.55                         | 22.76  |
| 3/4                              | 26                                | 27   | 28   | 74                                        | 76   | 78   | 49                                         | 51   | 53   | 2                            | 3                   | 42                          | 43                  | 25.88                         | 28.09  |
| 1                                | 32                                | 33   | 34   | 100                                       | 102  | 104  | 49                                         | 51   | 53   | 2                            | 3                   | 50                          | 51                  | 32.61                         | 34.95  |
| 1 1/4                            | 41                                | 42   | 43   | 100                                       | 102  | 104  | 49                                         | 51   | 53   | 4                            | 5                   | 63                          | 64                  | 41.38                         | 43.59  |
| 1 1/2                            | 47                                | 48   | 49   | 100                                       | 102  | 104  | 49                                         | 51   | 53   | 5                            | 6                   | 72                          | 73                  | 47.47                         | 49.94  |
| 2                                | 59                                | 60   | 61   | 150                                       | 152  | 154  | 62                                         | 64   | 66   | 7                            | 8                   | 91                          | 92                  | 59.54                         | 62.38  |
| 2 1/2                            | 72                                | 73   | 74   | 150                                       | 152  | 154  | 62                                         | 64   | 66   | 7                            | 8                   | 104                         | 106                 | 72.24                         | 75.34  |
| 3                                | 88                                | 89   | 90   | 150                                       | 152  | 154  | 62                                         | 64   | 66   | 9                            | 10                  | 126                         | 127                 | 88.11                         | 91.34  |
| 3 1/2                            | 101                               | 102  | 103  | 150                                       | 152  | 154  | 74                                         | 76   | 78   | 9                            | 10                  | 139                         | 140                 | 100.81                        | 104.04 |
| 4                                | 113                               | 114  | 116  | 150                                       | 152  | 154  | 74                                         | 76   | 78   | 9                            | 11                  | 156                         | 157                 | 113.51                        | 116.66 |
| 5                                | 140                               | 141  | 144  | 201                                       | 203  | 205  | 74                                         | 76   | 78   | 9                            | 11                  | 185                         | 186                 | 140.51                        | 144.35 |
| 6                                | 167                               | 168  | 171  | 201                                       | 203  | 205  | 87                                         | 89   | 91   | 11                           | 13                  | 215                         | 216                 | 167.49                        | 171.27 |
| 8                                | 217                               | 219  | 221  | 201                                       | 203  | 205  | 100                                        | 102  | 104  | 11                           | 13                  | 269                         | 270                 | 218.29                        | 222.07 |
| 10                               | 270                               | 273  | 277  | 252                                       | 254  | 256  | 125                                        | 127  | 129  | 11                           | 13                  | 322                         | 324                 | 272.26                        | 277.19 |
| 12                               | 321                               | 324  | 328  | 251                                       | 254  | 257  | 149                                        | 152  | 155  | 11                           | 13                  | 379                         | 381                 | 323.06                        | 327.99 |
| 14                               | 353                               | 356  | 360  | 302                                       | 305  | 308  | 149                                        | 152  | 155  | 11                           | 13                  | 411                         | 413                 | 354.81                        | 359.92 |
| 16                               | 403                               | 406  | 410  | 302                                       | 305  | 308  | 149                                        | 152  | 155  | 11                           | 13                  | 468                         | 470                 | 405.61                        | 410.97 |
| 18                               | 454                               | 457  | 461  | 302                                       | 305  | 308  | 149                                        | 152  | 155  | 11                           | 13                  | 531                         | 533                 | 456.41                        | 462.03 |
| 20                               | 503                               | 508  | 514  | 302                                       | 305  | 308  | 149                                        | 152  | 155  | 11                           | 13                  | 582                         | 584                 | 507.21                        | 514.10 |
| 22                               | 554                               | 559  | 565  | 302                                       | 305  | 308  | 149                                        | 152  | 155  | 11                           | 13                  | 639                         | 641                 | 558.01                        | 564.90 |
| 24                               | 606                               | 610  | 616  | 302                                       | 305  | 308  | 149                                        | 152  | 155  | 11                           | 13                  | 690                         | 692                 | 608.81                        | 615.70 |

## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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## NOTES TO TABLE A7

## GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) See Table A1 for tolerances.

## NOTES:

- (1) The lap thickness  $T$  shall not be less than nominal pipe wall thickness.
- (2) When short pattern stub ends are used with larger flanges in Classes 300 and 600, and with most sizes in Classes 900 and higher, and when long pattern stub ends are used with larger flanges in Classes 1500 and 2500, it may be necessary to increase the length of the stub ends in order to avoid covering the weld with the flange. Such increases in length shall be a matter of agreement between the manufacturer and purchaser.
- (3) When special facings such as tongue and groove, male and female, etc., are employed, additional lap thickness must be provided and such additional thickness shall be in addition to (not included in) the basic length  $F$ .
- (4) These dimensions conform to the radius established for lap joint flanges in ASME/ANSI B16.5, Pipe Flanges and Flanged Fittings.
- (5) This dimension conforms to standard machined facings shown in ASME/ANSI B16.5. The back face of the lap shall be machined to conform to the surface on which it seats. Where ring joint facings are to be applied, use dimension  $K$  as given in ASME/ANSI B16.5.
- (6) Gasket face finish shall be in accordance with ASME/ANSI B16.5 for raised face flanges.
- (7) The long pattern shall be the standard when not specified by the purchaser. The short pattern shall be specified by the purchaser.

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FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS



TABLE A8 DIMENSIONS OF CAPS

| Nominal<br>Pipe<br>Size<br>(NPS) | Outside Diameter at<br>Bevel<br>D |      |      | Length (1)<br>E |      |      | Limiting<br>Wall Thick-<br>ness For<br>Length E | Length (2)<br>E <sub>1</sub> |      |      |
|----------------------------------|-----------------------------------|------|------|-----------------|------|------|-------------------------------------------------|------------------------------|------|------|
|                                  | Min.                              | Nom. | Max. | Min.            | Nom. | Max. |                                                 | Min.                         | Nom. | Max. |
| 1/2                              | 20                                | 21   | 22   | 21              | 25   | 29   | 3.73                                            | 21                           | 25   | 29   |
| 3/4                              | 26                                | 27   | 28   | 21              | 25   | 29   | 3.91                                            | 21                           | 25   | 29   |
| 1                                | 32                                | 33   | 34   | 34              | 38   | 42   | 4.55                                            | 34                           | 38   | 42   |
| 1 1/4                            | 41                                | 42   | 43   | 34              | 38   | 42   | 4.85                                            | 34                           | 38   | 42   |
| 1 1/2                            | 47                                | 48   | 49   | 34              | 38   | 42   | 5.08                                            | 34                           | 38   | 42   |
| 2                                | 59                                | 60   | 61   | 34              | 38   | 42   | 5.54                                            | 40                           | 44   | 48   |
| 2 1/2                            | 72                                | 73   | 74   | 34              | 38   | 42   | 7.01                                            | 47                           | 51   | 55   |
| 3                                | 88                                | 89   | 90   | 47              | 51   | 55   | 7.62                                            | 60                           | 64   | 68   |
| 3 1/2                            | 101                               | 102  | 103  | 60              | 64   | 68   | 8.08                                            | 72                           | 76   | 80   |
| 4                                | 113                               | 114  | 116  | 60              | 64   | 68   | 8.56                                            | 72                           | 76   | 80   |
| 5                                | 140                               | 141  | 144  | 69              | 76   | 83   | 9.53                                            | 82                           | 89   | 96   |
| 6                                | 167                               | 168  | 171  | 82              | 89   | 96   | 10.97                                           | 95                           | 102  | 109  |
| 8                                | 217                               | 219  | 221  | 95              | 102  | 109  | 12.70                                           | 120                          | 127  | 134  |
| 10                               | 270                               | 273  | 277  | 120             | 127  | 134  | 12.70                                           | 146                          | 152  | 159  |
| 12                               | 321                               | 324  | 328  | 145             | 152  | 159  | 12.70                                           | 171                          | 178  | 185  |
| 14                               | 353                               | 356  | 360  | 158             | 165  | 172  | 12.70                                           | 184                          | 191  | 198  |
| 16                               | 403                               | 406  | 410  | 171             | 178  | 185  | 12.70                                           | 198                          | 203  | 210  |
| 18                               | 454                               | 457  | 461  | 196             | 203  | 210  | 12.70                                           | 222                          | 229  | 236  |
| 20                               | 503                               | 508  | 514  | 222             | 229  | 236  | 12.70                                           | 247                          | 254  | 261  |
| 22                               | 554                               | 559  | 565  | 247             | 254  | 261  | 12.70                                           | 247                          | 254  | 261  |
| 24                               | 605                               | 610  | 616  | 260             | 267  | 274  | 12.70                                           | 298                          | 305  | 312  |
| 26                               | 655                               | 660  | 667  | 257             | 267  | 277  | ...                                             | ...                          | ...  | ...  |
| 28                               | 706                               | 711  | 718  | 257             | 267  | 277  | ...                                             | ...                          | ...  | ...  |
| 30                               | 757                               | 762  | 769  | 257             | 267  | 277  | ...                                             | ...                          | ...  | ...  |
| 32                               | 808                               | 813  | 820  | 257             | 267  | 277  | ...                                             | ...                          | ...  | ...  |
| 34                               | 859                               | 864  | 871  | 257             | 267  | 277  | ...                                             | ...                          | ...  | ...  |
| 36                               | 909                               | 914  | 921  | 257             | 267  | 277  | ...                                             | ...                          | ...  | ...  |
| 38                               | 960                               | 965  | 972  | 295             | 305  | 315  | ...                                             | ...                          | ...  | ...  |
| 40                               | 1011                              | 1016 | 1023 | 295             | 305  | 315  | ...                                             | ...                          | ...  | ...  |
| 42                               | 1062                              | 1067 | 1074 | 295             | 305  | 315  | ...                                             | ...                          | ...  | ...  |
| 44                               | 1113                              | 1118 | 1125 | 333             | 343  | 353  | ...                                             | ...                          | ...  | ...  |
| 46                               | 1163                              | 1168 | 1175 | 333             | 343  | 353  | ...                                             | ...                          | ...  | ...  |
| 48                               | 1214                              | 1219 | 1226 | 333             | 343  | 353  | ...                                             | ...                          | ...  | ...  |

## GENERAL NOTES:

- (a) Dimensions are in millimeters.  
 (b) The shape of these caps shall be ellipsoidal and shall conform to the shape requirements as given in the ASME Boiler and Pressure Vessel Code.

## NOTES:

- (1) Length E applies for thickness not exceeding that given in column "Limiting Wall Thickness for Length E."  
 (2) Length E<sub>1</sub> applies for thickness greater than that given in column "Limiting Wall Thickness" for NPS 24 and smaller. For NPS 26 and larger, length E<sub>1</sub> shall be by agreement between manufacturer and purchaser.

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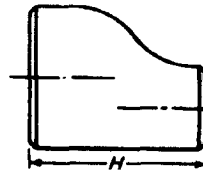
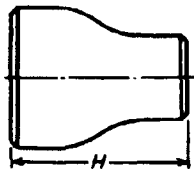


TABLE A9 DIMENSIONS OF REDUCERS

| Nominal<br>Pipe<br>Size<br>(NPS) | O.D. of Large End<br><i>D</i> |      |      | O.D. of Small End<br><i>D</i> |      |      | End-to-End Length of Reducers<br><i>H</i> |      |      |
|----------------------------------|-------------------------------|------|------|-------------------------------|------|------|-------------------------------------------|------|------|
|                                  | Min.                          | Nom. | Max. | Min.                          | Nom. | Max. | Min.                                      | Nom. | Max. |
| 3/4 x 1/2                        | 26                            | 27   | 28   | 20                            | 21   | 23   | 36                                        | 38   | 40   |
| 3/4 x 3/8                        | 26                            | 27   | 28   | 16                            | 17   | 18   | 36                                        | 38   | 40   |
| 1 x 3/4                          | 32                            | 33   | 34   | 26                            | 27   | 28   | 49                                        | 51   | 53   |
| 1 x 1/2                          | 32                            | 33   | 34   | 20                            | 21   | 22   | 49                                        | 51   | 53   |
| 1 1/4 x 1                        | 41                            | 42   | 43   | 32                            | 33   | 34   | 49                                        | 51   | 53   |
| 1 1/4 x 3/4                      | 41                            | 42   | 43   | 26                            | 27   | 28   | 49                                        | 51   | 53   |
| 1 1/4 x 1/2                      | 41                            | 42   | 43   | 20                            | 21   | 22   | 49                                        | 51   | 53   |
| 1 1/2 x 1 1/4                    | 47                            | 48   | 49   | 41                            | 42   | 43   | 62                                        | 64   | 66   |
| 1 1/2 x 1                        | 47                            | 48   | 49   | 32                            | 33   | 34   | 62                                        | 64   | 66   |
| 1 1/2 x 3/4                      | 47                            | 48   | 49   | 26                            | 27   | 28   | 62                                        | 64   | 66   |
| 1 1/2 x 1/2                      | 47                            | 48   | 49   | 20                            | 21   | 22   | 62                                        | 64   | 66   |
| 2 x 1 1/2                        | 59                            | 60   | 61   | 47                            | 48   | 49   | 74                                        | 76   | 78   |
| 2 x 1 1/4                        | 59                            | 60   | 61   | 41                            | 42   | 43   | 74                                        | 76   | 78   |
| 2 x 1                            | 59                            | 60   | 61   | 32                            | 33   | 34   | 74                                        | 76   | 78   |
| 2 x 3/4                          | 59                            | 60   | 61   | 26                            | 27   | 28   | 74                                        | 76   | 78   |
| 2 1/2 x 2                        | 72                            | 73   | 74   | 59                            | 60   | 61   | 87                                        | 89   | 91   |
| 2 1/2 x 1 1/2                    | 72                            | 73   | 74   | 47                            | 48   | 49   | 87                                        | 89   | 91   |
| 2 1/2 x 1 1/4                    | 72                            | 73   | 74   | 41                            | 42   | 43   | 87                                        | 89   | 91   |
| 2 1/2 x 1                        | 72                            | 73   | 74   | 32                            | 33   | 34   | 87                                        | 89   | 91   |
| 3 x 2 1/2                        | 88                            | 89   | 90   | 72                            | 73   | 74   | 87                                        | 89   | 91   |
| 3 x 2                            | 88                            | 89   | 90   | 59                            | 60   | 61   | 87                                        | 89   | 91   |
| 3 x 1 1/2                        | 88                            | 89   | 90   | 47                            | 48   | 49   | 87                                        | 89   | 91   |
| 3 x 1 1/4                        | 88                            | 89   | 90   | 41                            | 42   | 43   | 87                                        | 89   | 91   |
| 3 1/2 x 3                        | 100                           | 102  | 103  | 88                            | 89   | 90   | 100                                       | 102  | 104  |
| 3 1/2 x 2 1/2                    | 100                           | 102  | 103  | 72                            | 73   | 74   | 100                                       | 102  | 104  |
| 3 1/2 x 2                        | 100                           | 102  | 103  | 59                            | 60   | 61   | 100                                       | 102  | 104  |
| 3 1/2 x 1 1/2                    | 100                           | 102  | 103  | 47                            | 48   | 49   | 100                                       | 102  | 104  |
| 3 1/2 x 1 1/4                    | 100                           | 102  | 103  | 41                            | 42   | 43   | 100                                       | 102  | 104  |
| 4 x 3 1/2                        | 113                           | 114  | 116  | 101                           | 102  | 103  | 100                                       | 102  | 104  |
| 4 x 3                            | 113                           | 114  | 116  | 88                            | 89   | 90   | 100                                       | 102  | 104  |
| 4 x 2 1/2                        | 113                           | 114  | 116  | 72                            | 73   | 74   | 100                                       | 102  | 104  |
| 4 x 2                            | 113                           | 114  | 116  | 59                            | 60   | 61   | 100                                       | 102  | 104  |
| 4 x 1 1/2                        | 113                           | 114  | 116  | 47                            | 48   | 49   | 100                                       | 102  | 104  |
| 5 x 4                            | 140                           | 141  | 144  | 113                           | 114  | 116  | 125                                       | 127  | 129  |
| 5 x 3 1/2                        | 140                           | 141  | 144  | 101                           | 102  | 103  | 125                                       | 127  | 129  |
| 5 x 3                            | 140                           | 141  | 144  | 88                            | 89   | 90   | 125                                       | 127  | 129  |
| 5 x 2 1/2                        | 140                           | 141  | 144  | 72                            | 73   | 74   | 125                                       | 127  | 129  |
| 5 x 2                            | 140                           | 141  | 144  | 59                            | 60   | 61   | 125                                       | 127  | 129  |

(Note follows at end of table)

(Table A9 continues on next page)



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TABLE A9 DIMENSIONS OF REDUCERS (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | O.D. of Large End<br><i>D</i> |      |      | O.D. of Small End<br><i>D</i> |      |      | End-to-End Length of Reducers<br><i>H</i> |      |      |
|----------------------------------|-------------------------------|------|------|-------------------------------|------|------|-------------------------------------------|------|------|
|                                  | Min.                          | Nom. | Max. | Min.                          | Nom. | Max. | Min.                                      | Nom. | Max. |
| 6 × 5                            | 167                           | 168  | 171  | 140                           | 141  | 142  | 138                                       | 140  | 142  |
| 6 × 4                            | 167                           | 168  | 171  | 113                           | 114  | 116  | 138                                       | 140  | 142  |
| 6 × 3½                           | 167                           | 168  | 171  | 101                           | 102  | 103  | 138                                       | 140  | 142  |
| 6 × 3                            | 167                           | 168  | 171  | 88                            | 89   | 90   | 138                                       | 140  | 142  |
| 6 × 2½                           | 167                           | 168  | 171  | 72                            | 73   | 74   | 138                                       | 140  | 142  |
| 8 × 6                            | 217                           | 219  | 221  | 167                           | 168  | 171  | 150                                       | 152  | 154  |
| 8 × 5                            | 217                           | 219  | 221  | 140                           | 141  | 144  | 150                                       | 152  | 154  |
| 8 × 4                            | 217                           | 219  | 221  | 113                           | 114  | 116  | 150                                       | 152  | 154  |
| 8 × 3½                           | 217                           | 219  | 221  | 101                           | 102  | 103  | 150                                       | 152  | 154  |
| 10 × 8                           | 270                           | 273  | 277  | 217                           | 219  | 221  | 176                                       | 178  | 180  |
| 10 × 6                           | 270                           | 273  | 277  | 167                           | 168  | 171  | 176                                       | 178  | 180  |
| 10 × 5                           | 270                           | 273  | 277  | 140                           | 141  | 144  | 176                                       | 178  | 180  |
| 10 × 4                           | 270                           | 273  | 277  | 113                           | 114  | 116  | 176                                       | 178  | 180  |
| 12 × 10                          | 321                           | 324  | 328  | 270                           | 273  | 277  | 200                                       | 203  | 206  |
| 12 × 8                           | 321                           | 324  | 328  | 217                           | 219  | 221  | 200                                       | 203  | 206  |
| 12 × 6                           | 321                           | 324  | 328  | 167                           | 168  | 171  | 200                                       | 203  | 206  |
| 12 × 5                           | 321                           | 324  | 328  | 140                           | 141  | 144  | 200                                       | 203  | 206  |
| 14 × 12                          | 353                           | 356  | 360  | 321                           | 324  | 328  | 327                                       | 330  | 333  |
| 14 × 10                          | 353                           | 356  | 360  | 270                           | 273  | 277  | 327                                       | 330  | 333  |
| 14 × 8                           | 353                           | 356  | 360  | 217                           | 219  | 221  | 327                                       | 330  | 333  |
| 14 × 6                           | 353                           | 356  | 360  | 167                           | 168  | 171  | 327                                       | 330  | 333  |
| 16 × 14                          | 403                           | 406  | 410  | 353                           | 356  | 360  | 353                                       | 356  | 359  |
| 16 × 12                          | 403                           | 406  | 410  | 321                           | 324  | 328  | 353                                       | 356  | 359  |
| 16 × 10                          | 403                           | 406  | 410  | 270                           | 273  | 277  | 353                                       | 356  | 359  |
| 16 × 8                           | 403                           | 406  | 410  | 217                           | 219  | 221  | 353                                       | 356  | 359  |
| 18 × 18                          | 454                           | 457  | 461  | 403                           | 406  | 410  | 378                                       | 381  | 384  |
| 18 × 14                          | 454                           | 457  | 461  | 353                           | 356  | 360  | 378                                       | 381  | 384  |
| 18 × 12                          | 454                           | 457  | 461  | 321                           | 324  | 328  | 378                                       | 381  | 384  |
| 18 × 10                          | 454                           | 457  | 461  | 270                           | 273  | 277  | 378                                       | 381  | 384  |
| 20 × 18                          | 503                           | 508  | 514  | 454                           | 457  | 461  | 505                                       | 508  | 511  |
| 20 × 16                          | 503                           | 508  | 514  | 403                           | 406  | 410  | 505                                       | 508  | 511  |
| 20 × 14                          | 503                           | 508  | 514  | 353                           | 356  | 360  | 505                                       | 508  | 511  |
| 20 × 12                          | 503                           | 508  | 514  | 321                           | 324  | 328  | 505                                       | 508  | 511  |
| 22 × 20                          | 554                           | 559  | 565  | 503                           | 508  | 514  | 505                                       | 508  | 511  |
| 22 × 18                          | 554                           | 559  | 565  | 454                           | 457  | 461  | 505                                       | 508  | 511  |
| 22 × 16                          | 554                           | 559  | 565  | 403                           | 406  | 410  | 505                                       | 508  | 511  |
| 22 × 14                          | 554                           | 559  | 565  | 353                           | 356  | 360  | 505                                       | 508  | 511  |
| 24 × 22                          | 605                           | 610  | 616  | 554                           | 559  | 565  | 505                                       | 508  | 511  |
| 24 × 20                          | 605                           | 610  | 616  | 503                           | 508  | 514  | 505                                       | 508  | 511  |
| 24 × 18                          | 605                           | 610  | 616  | 454                           | 457  | 461  | 505                                       | 508  | 511  |
| 24 × 16                          | 605                           | 610  | 616  | 403                           | 406  | 410  | 505                                       | 508  | 511  |
| 26 × 24                          | 655                           | 660  | 667  | 605                           | 610  | 616  | 607                                       | 610  | 613  |
| 26 × 22                          | 655                           | 660  | 667  | 554                           | 559  | 565  | 607                                       | 610  | 613  |
| 26 × 20                          | 655                           | 660  | 667  | 503                           | 508  | 514  | 607                                       | 610  | 613  |
| 26 × 18                          | 655                           | 660  | 667  | 454                           | 457  | 461  | 607                                       | 610  | 613  |

## FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

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TABLE A9 DIMENSIONS OF REDUCERS (CONT'D)

| Nominal<br>Pipe<br>Size<br>(NPS) | O.D. of Large End<br><i>D</i> |      |      | O.D. of Small End<br><i>D</i> |      |      | End-to-End Length of Reducers<br><i>H</i> |      |      |
|----------------------------------|-------------------------------|------|------|-------------------------------|------|------|-------------------------------------------|------|------|
|                                  | Min.                          | Nom. | Max. | Min.                          | Nom. | Max. | Min.                                      | Nom. | Max. |
| 28 x 26                          | 706                           | 711  | 718  | 655                           | 660  | 667  | 607                                       | 610  | 613  |
| 28 x 24                          | 706                           | 711  | 718  | 605                           | 610  | 616  | 607                                       | 610  | 613  |
| 28 x 20                          | 706                           | 711  | 718  | 503                           | 508  | 514  | 607                                       | 610  | 613  |
| 28 x 18                          | 706                           | 711  | 718  | 454                           | 457  | 461  | 607                                       | 610  | 613  |
| 30 x 28                          | 757                           | 762  | 769  | 706                           | 711  | 718  | 607                                       | 610  | 613  |
| 30 x 26                          | 757                           | 762  | 769  | 655                           | 660  | 667  | 607                                       | 610  | 613  |
| 30 x 24                          | 757                           | 762  | 769  | 605                           | 610  | 616  | 607                                       | 610  | 613  |
| 30 x 20                          | 757                           | 762  | 769  | 503                           | 508  | 514  | 607                                       | 610  | 613  |
| 32 x 30                          | 808                           | 813  | 820  | 757                           | 762  | 769  | 605                                       | 610  | 615  |
| 32 x 28                          | 808                           | 813  | 820  | 706                           | 711  | 718  | 605                                       | 610  | 615  |
| 32 x 26                          | 808                           | 813  | 820  | 655                           | 660  | 667  | 605                                       | 610  | 615  |
| 32 x 24                          | 808                           | 813  | 820  | 605                           | 610  | 616  | 605                                       | 610  | 615  |
| 34 x 32                          | 859                           | 864  | 871  | 808                           | 813  | 820  | 605                                       | 610  | 615  |
| 34 x 30                          | 859                           | 864  | 871  | 757                           | 762  | 769  | 605                                       | 610  | 615  |
| 34 x 26                          | 859                           | 864  | 871  | 655                           | 660  | 667  | 605                                       | 610  | 615  |
| 34 x 24                          | 859                           | 864  | 871  | 605                           | 610  | 616  | 605                                       | 610  | 615  |
| 36 x 34                          | 909                           | 914  | 921  | 859                           | 864  | 871  | 605                                       | 610  | 615  |
| 36 x 32                          | 909                           | 914  | 921  | 808                           | 813  | 820  | 605                                       | 610  | 615  |
| 36 x 30                          | 909                           | 914  | 921  | 757                           | 762  | 769  | 605                                       | 610  | 615  |
| 36 x 26                          | 909                           | 914  | 921  | 655                           | 660  | 667  | 605                                       | 610  | 615  |
| 36 x 24                          | 909                           | 914  | 921  | 605                           | 610  | 616  | 605                                       | 610  | 615  |
| 38 x 36                          | 960                           | 965  | 972  | 909                           | 914  | 921  | 605                                       | 610  | 615  |
| 38 x 34                          | 960                           | 965  | 972  | 859                           | 864  | 871  | 605                                       | 610  | 615  |
| 38 x 32                          | 960                           | 965  | 972  | 808                           | 813  | 820  | 605                                       | 610  | 615  |
| 38 x 30                          | 960                           | 965  | 972  | 757                           | 762  | 769  | 605                                       | 610  | 615  |
| 38 x 28                          | 960                           | 965  | 972  | 706                           | 711  | 718  | 605                                       | 610  | 615  |
| 38 x 26                          | 960                           | 965  | 972  | 655                           | 660  | 667  | 605                                       | 610  | 615  |
| 40 x 38                          | 1011                          | 1016 | 1023 | 960                           | 965  | 972  | 605                                       | 610  | 615  |
| 40 x 36                          | 1011                          | 1016 | 1023 | 909                           | 914  | 921  | 605                                       | 610  | 615  |
| 40 x 34                          | 1011                          | 1016 | 1023 | 859                           | 864  | 871  | 605                                       | 610  | 615  |
| 40 x 32                          | 1011                          | 1016 | 1023 | 808                           | 813  | 820  | 605                                       | 610  | 615  |
| 40 x 30                          | 1011                          | 1016 | 1023 | 757                           | 762  | 769  | 605                                       | 610  | 615  |
| 42 x 40                          | 1062                          | 1067 | 1074 | 1011                          | 1016 | 1023 | 605                                       | 610  | 615  |
| 42 x 38                          | 1062                          | 1067 | 1074 | 960                           | 965  | 972  | 605                                       | 610  | 615  |
| 42 x 36                          | 1062                          | 1067 | 1074 | 909                           | 914  | 921  | 605                                       | 610  | 615  |
| 42 x 34                          | 1062                          | 1067 | 1074 | 859                           | 864  | 871  | 605                                       | 610  | 615  |
| 42 x 32                          | 1062                          | 1067 | 1074 | 808                           | 813  | 820  | 605                                       | 610  | 615  |
| 42 x 30                          | 1062                          | 1067 | 1074 | 757                           | 762  | 769  | 605                                       | 610  | 615  |
| 44 x 42                          | 1113                          | 1118 | 1125 | 1062                          | 1067 | 1074 | 605                                       | 610  | 615  |
| 44 x 40                          | 1113                          | 1118 | 1125 | 1011                          | 1016 | 1023 | 605                                       | 610  | 615  |
| 44 x 38                          | 1113                          | 1118 | 1125 | 960                           | 965  | 972  | 605                                       | 610  | 615  |
| 44 x 36                          | 1113                          | 1118 | 1125 | 909                           | 914  | 921  | 605                                       | 610  | 615  |
| 46 x 44                          | 1163                          | 1168 | 1175 | 1113                          | 1118 | 1125 | 706                                       | 711  | 716  |
| 46 x 42                          | 1163                          | 1168 | 1175 | 1062                          | 1067 | 1074 | 706                                       | 711  | 716  |
| 46 x 40                          | 1163                          | 1168 | 1175 | 1011                          | 1016 | 1023 | 706                                       | 711  | 716  |
| 46 x 38                          | 1163                          | 1168 | 1175 | 960                           | 965  | 972  | 706                                       | 711  | 716  |
| 48 x 46                          | 1214                          | 1219 | 1226 | 1163                          | 1168 | 1175 | 706                                       | 711  | 716  |
| 48 x 44                          | 1214                          | 1219 | 1226 | 1113                          | 1118 | 1125 | 706                                       | 711  | 716  |
| 48 x 42                          | 1214                          | 1219 | 1226 | 1062                          | 1067 | 1074 | 706                                       | 711  | 716  |
| 48 x 40                          | 1214                          | 1219 | 1226 | 1011                          | 1016 | 1023 | 706                                       | 711  | 716  |

GENERAL NOTE: Dimensions are in millimeters.

## ANNEX B

### REFERENCES

(This Annex is an integral part of ASME B16.9-1993 and is placed after the main text for convenience.)

The following is a list of standards and specifications referenced in this Standard showing the year of approval.

#### ASME Publications (Approved as American National Standards)

|                        |                                         |
|------------------------|-----------------------------------------|
| ASME/ANSI B16.5-1988   | Pipe Flanges and Flanged Fittings       |
| ASME B16.25-1992       | Buttwelding Ends                        |
| ASME B31               | Code for Pressure Piping                |
| ANSI/ASME B36.10M-1985 | Welded and Seamless Wrought Steel Pipes |
| ASME BPV-1992          | ASME Boiler and Pressure Vessel Code    |

#### ASTM Publications

|                |                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------|
| ASTM A 234-91c | Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures |
| ASTM A 403-91  | Specification for Wrought Austenitic Stainless Steel Piping Fittings                                             |
| ASTM A 420-91  | Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service            |

#### MSS Publications

|                |                                               |
|----------------|-----------------------------------------------|
| MSS SP-43-1991 | Wrought Stainless Steel Butt-Welding Fittings |
|----------------|-----------------------------------------------|

Publications of the following organizations appear on the above list:

|      |                                                                                                                                                                                       |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASME | The American Society of Mechanical Engineers<br>345 East 47th Street, New York, New York 10017<br>ASME Order Department<br>22 Law Drive, Box 2300<br>Fairfield, New Jersey 07007-2300 |
| ASTM | American Society of Testing and Materials<br>1916 Race Street, Philadelphia, Pennsylvania 19103                                                                                       |

ASME B16.9-1993

FACTORY-MADE WROUGHT STEEL BUTTWELDING FITTINGS

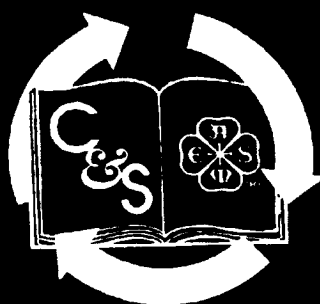
MSS

Manufacturers Standardization Society of the Valve  
and Fittings Industry  
127 Park Street NE, Vienna, VA 22180

Publications appearing above which have been approved as American National Standards may also be obtained from

ANSI

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