

ASME B16.3-2011
(Revision of ASME B16.3-2006)

Malleable Iron Threaded Fittings

Classes 150 and 300

AN AMERICAN NATIONAL STANDARD



**The American Society of
Mechanical Engineers**

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FOREWORD

In 1921, the American Engineering Standards Committee, later the American Standards Association (ASA) and currently the American National Standards Institute (ANSI), authorized the organization of a Sectional Committee on the Standardization of Pipe Flanges and Flanged Fittings, with the following organizations as joint sponsors: Heating, Piping, and Air Conditioning Contractors National Association (later the Mechanical Contractors Association of America, MCAA), Manufacturers Standardization Society of the Valves and Fittings Industry (MSS), and The American Society of Mechanical Engineers (ASME).

Threaded fittings were also included in the scope of the B16 Committee, and Subcommittee Number 2 (now Subcommittee B) was made responsible for threaded fittings other than steel. The first edition of a standard covering malleable iron fittings, 150 lb, was approved as American Tentative Standard by ASA in December 1927. In 1936, a revision was undertaken to add hydraulic service ratings, material specifications, alignment tolerances, and dimensions for additional sizes. It was approved with the designation American Standard B16c-1939.

Pipe plugs, bushings, and locknuts, included in the first editions, are now covered in a separate standard, B16.14.

A revision begun in 1947 amplified the sections on threading, inspection, and tolerances, and added dimensions for additional sizes of elbows, reducing crosses, reducing tees, straight and reducing couplings, caps, and return bends. It was approved as ASA B16.3-1951.

Meanwhile, MSS, in cooperation with the Association of American Railroads (AAR), developed the first standard for 300 lb malleable iron threaded fittings, published as MSS SP-31 of 1932. The 1950 edition of SP-31, which agreed with AAR Purchase Specification M-404, was submitted to ASA Sectional Committee B16 and assigned to Subcommittee Number 2. After balloting, it was approved as a separate standard, ASA B16.19-1951.

Work was begun to combine the two standards (for 150 lb and 300 lb) into a single document in 1961. The resulting Standard was approved as ASA B16.3-1963. Subsequent reviews of the Standard, leading to revisions approved as ANSI B16.3-1971 and ANSI B16.3-1977, involved updating referenced standards and the introduction of metric (SI) dimensions and ratings. In the 1977 edition, 150 lb and 300 lb were redesignated as Class 150 and Class 300.

In 1982, American National Standards Committee B16 became the ASME B16 Standards Committee, operating with the same scope under ASME procedures accredited by ANSI. A further revision of the standard, approved and published as ANSI/ASME B16.3-1985, provided for electrodeposition as an alternative to hot dipping when zinc coating was required.

The 1992 edition of B16.3 omits metric units, establishing U.S. Customary units as the standard. Clarifications and editorial revisions were made in order to improve the text. Following approval by the Standards Committee and ASME, the 1992 edition received approval as an American National Standard on December 2, 1992, with the designation ASME B16.3-1992.

In the 1998 edition of ASME B16.3, the References section was updated; a Quality System Program Annex was added; and several editorial revisions were made. Following approval by ASME B16 Subcommittee B and B16 Main Committee, ANSI approved this American National Standard on November 20, 1998.

In the 2006 edition, metric dimensions became the primary units and inch dimensions were incorporated into this Standard as secondary units and shown in parentheses. The added metric dimensions constitute an independent but equal standard to the inch units. Following approval by the Standards Committee and the ASME Board, this revision to the 1998 edition of this Standard was approved as an American National Standard by ANSI on November 9, 2006 with the new designation, ASME B16.3-2006.

In this edition, references to ASME standards were revised to no longer list specific edition years; the latest edition of ASME publications applies unless stated otherwise. Materials manufactured to other editions of the referenced ASTM standards have been permitted to be used to manufacture fittings meeting the requirements of this Standard as long as the fitting manufacturer verifies

the material meets the requirements of the referenced edition. Following approval by the Standards Committee and the ASME Board on PTCS, this revision to the 2006 edition was approved as an American National Standard by ANSI on August 9, 2011 with the new designation, ASME B16.3-2011.

Requests for interpretation and suggestions for revision should be sent to The American Society of Mechanical Engineers, Secretary, B16 Committee, Three Park Avenue, New York, NY 10016-5990.

ASME B16 COMMITTEE

Standardization of Valves, Flanges, Fittings, and Gaskets

(The following is the roster of the Committee at the time of approval of this Standard.)

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CORRESPONDENCE WITH THE B16 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B16 Standards Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

As an alternative, inquiries may be submitted via e-mail to: SecretaryB16@asme.org.

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Interpretations. Upon request, the B16 Committee will render an interpretation of any requirement of the Standard. Interpretations can only be rendered in response to a written request sent to the Secretary of the B16 Standards Committee.

The request for interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

| | |
|-----------|--|
| Subject: | Cite the applicable paragraph number(s) and the topic of the inquiry. |
| Edition: | Cite the applicable edition of the Standard for which the interpretation is being requested. |
| Question: | Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information. |

Requests that are not in this format will be rewritten in this format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The B16 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B16 Standards Committee.

ASME B16.3-2011 SUMMARY OF CHANGES

Following approval by the ASME B16 Committee and ASME, and after public review, ASME B16.3-2011 was approved by the American National Standards Institute on August 9, 2011.

ASME B16.3-2011 includes the following changes identified by a margin note, **(11)**. In addition, in the main text, the "General" section was moved to section 2, and the subsequent sections and their paragraphs were renumbered accordingly.

| <i>Page</i> | <i>Location</i> | <i>Change</i> |
|-------------|-----------------------|---------------|
| 38 | Mandatory Appendix II | Updated |

MALLEABLE IRON THREADED FITTINGS

Classes 150 and 300

1 SCOPE

This Standard covers malleable iron threaded fittings, Classes 150 and 300. It also contains provisions for using steel for caps and couplings in Class 150 for NPS $\frac{3}{8}$ and smaller. This Standard includes

- (a) pressure–temperature ratings
- (b) size and method of designating openings of reducing fittings
- (c) marking
- (d) material
- (e) dimensions and tolerances
- (f) threading
- (g) coatings

Mandatory Appendix I provides table values in U.S. Customary units.

2 GENERAL

2.1 References

Standards and specifications adopted by reference in this Standard are shown in Mandatory Appendix II. It is not considered practical to identify the specific edition of each referenced standard and specification in the text. Instead, the specific editions of the referenced standards and specifications are listed in Mandatory Appendix II.

2.2 Quality Systems

Requirements relating to the product manufacturers' quality system programs are described in Nonmandatory Appendix A.

2.3 Relevant Units

This Standard states values in both SI (Metric) and U.S. Customary units. These systems of units are to be regarded separately as standard. Within the text, the U.S. Customary units are shown in parentheses or in separate tables that appear in Mandatory Appendix I. The values stated in each system are not exact equivalents; therefore, it is required that each system of units be used independently of the other. Combining values from the two systems constitutes nonconformance with the Standard.

2.4 Service Conditions

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

2.5 Convention

For determining conformance with this Standard, the convention for fixing significant digits where limits (maximum and minimum values) are specified shall be as defined in ASTM E29. This requires that an observed or calculated value be rounded off to the nearest unit in the last right-hand digit used for expressing the limit. Decimal values and tolerances do not imply a particular method of measurement.

2.6 Denotation

2.6.1 Pressure Rating Designation. Class, followed by a dimensionless number, is the designation for pressure–temperature ratings as follows: Class 150 and Class 300.

2.6.2 Size. NPS, followed by a dimensionless number, is the designation for nominal fitting size. NPS is related to the referenced nominal diameter, DN, used in international standards. The relationship is, typically, as follows:

| NPS | DN |
|----------------|-----|
| $\frac{1}{4}$ | 8 |
| $\frac{1}{2}$ | 15 |
| 1 | 25 |
| $1\frac{1}{4}$ | 32 |
| $1\frac{1}{2}$ | 40 |
| 2 | 50 |
| $2\frac{1}{2}$ | 65 |
| 3 | 80 |
| 4 | 100 |

GENERAL NOTE: For NPS ≥ 4 , the related DN = 25 \times NPS.

3 PRESSURE–TEMPERATURE RATINGS

(a) Pressure–temperature ratings for these fittings are shown in Tables 1 and I-1.

(b) All ratings are independent of the contained fluid and are the maximum allowable working gage pressures at the tabulated temperatures. Intermediate ratings may be obtained by linear interpolation between the temperatures shown.

(c) The temperatures shown for the corresponding pressure rating shall be the material temperature of the pressure-retaining structure. It may be assumed that the

material temperature is the same as the fluid temperature. Use of a pressure rating at a material temperature other than that of the contained fluid is the responsibility of the user and subject to the requirements of any applicable code.

(d) Class 300 street elbows are not recommended for pressures above 600 psi.

4 SIZE

4.1 Nominal Pipe Size

As applied in this Standard, the use of the phrase “nominal pipe size” or the designation NPS followed by a dimensionless number is for the purpose of identifying the end connection of fittings. The number is not necessarily the same as the fitting inside diameter.

4.2 Reducing Fittings

For reducing tees, crosses, and Y-branches (laterals), the size of the largest run opening shall be given first, followed by the size of the opening at the opposite end of the run. Where the fitting is a tee or Y-branch (lateral), the size of the outlet is given last. Where the fitting is a cross, the largest side-outlet opening is the third dimension given, followed by the opposite opening. The straight-line sketches of Fig. 1 illustrate how the reducing fittings are read.

5 MARKING

5.1 Class 150 Fittings

Each Class 150 fitting shall be marked for identification with the manufacturer’s name or trademark.

5.2 Class 300 Fittings

Each Class 300 fitting shall be marked for identification with

- (a) the manufacturer’s name or trademark
- (b) the numerals “300”
- (c) the letters “MI” to designate malleable iron
- (d) the size
- (e) other markings as permitted by MSS SP-25

6 MATERIAL

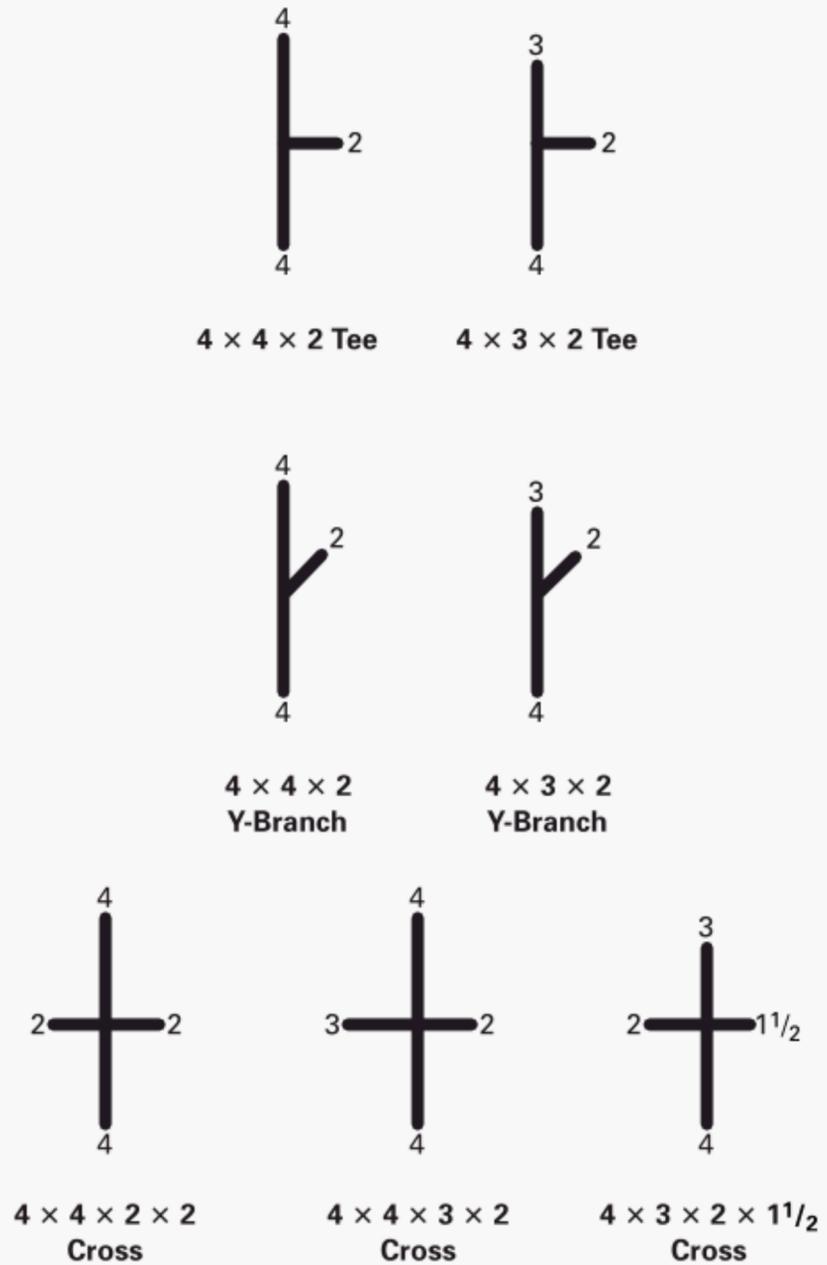
6.1 Malleable Iron

The chemical and physical properties of the castings shall be in accordance with ASTM A197. The manufacturer shall be prepared to certify that the product has been so produced.

6.2 Steel

Class 150 couplings and caps in NPS 1/8, 1/4, and 3/8 may be made from steel rod or bar with a minimum yield strength of 30 ksi at the manufacturer’s option.

Fig. 1 Identification of Reducing Fittings



7 DIMENSIONS AND TOLERANCES

7.1 General

The tolerances in Tables 2 and I-2 are for center-to-end dimensions of the fittings. Center-to-end dimensions in millimeters are given for both straight and reducing fittings in Tables 3 through 18 (Tables I-3 through I-18 are in U.S. Customary units). The sketches of fittings shown in this Standard are representative and for the purpose of illustration.

7.2 Reducing Fittings

The dimensions in Tables 3 through 18 (Tables I-3 through I-18) of reducing fittings are for use only when making patterns for the specific reducing fitting in question and do not apply when a larger size pattern is bushed to make the reducing fitting wanted.

7.3 Tolerances

It is recognized that some variations are absolutely unavoidable in the making of patterns and castings. The following tolerances shall apply.

(a) *Metal Thickness Tolerances.* Metal thickness at no point in the castings shall be less than 90% of the value given in the tables.

(b) *Center-to-End Tolerances.* Permitted tolerances on the center-to-end dimensions of the fittings are shown in Tables 2 and I-2. Tolerances for end-to-end dimensions and lengths of couplings and reducers shall be twice those given. The largest opening in a reducing fitting governs the tolerances to be applied to all openings. These tolerances do not apply to return bends and caps.

8 THREADING

8.1 Types of Threads

All fittings shall be threaded according to ANSI/ASME B1.20.1, and shall have taper threads, except wrought couplings (Tables 8 and I-8) and wrought caps (Tables 9 and I-9) in NPS $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{3}{8}$, which may have straight threads.

8.2 Tolerances

Variations in taper threading shall be limited to one turn large or one turn small from the gaging face on ring and gaging notch on plug when using working gages. The variations in straight threading shall be limited to one and one-half turns large or small from the gaging notch on plug when using a taper pipe thread working gage. The reference point for gaging internal fittings threads depends upon the chamfer diameter. When the internal chamfer diameter exceeds the major diameter of the internal thread, the reference point is the last thread scratch on the chamfer cone. When the internal chamfer diameter does not exceed the major diameter of the internal thread, the reference point is the end of the fitting (see Fig. 2).

8.3 Countersink or Chamfer

For the purpose of easier entrance in making a joint and for protection of the thread, all internal threads shall be countersunk a distance of not less than one-half the pitch of the thread at an angle of approximately 45 deg with the axis of the thread; all external threads shall be chamfered at an angle of 30 deg to 45 deg with the axis. Countersinking and chamfering shall be concentric with the threads.

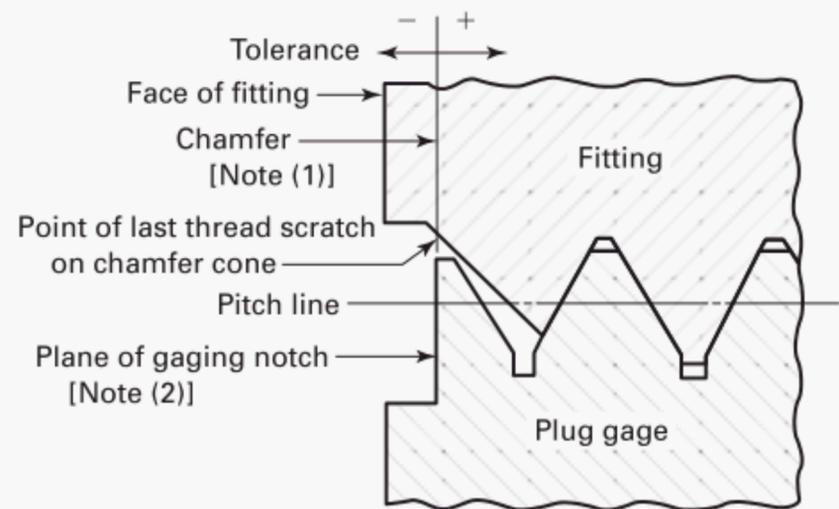
8.4 Thread Length

The length of threads specified in all tables shall be measured to include the countersink or chamfer.

8.5 Alignment

The maximum allowable variation in the alignment of threads of all openings of threaded fittings shall be 5.0 mm/m (0.06 in./ft) (0.5% slope).

Fig. 2 Gaging of Chamfered Internal Threads



GENERAL NOTE: Enlarged view showing chamfered internal thread of basic size with chamfer exceeding the major diameter.

NOTES:

- (1) The chamfer illustrated is at a 45-deg angle and is approximately $\frac{3}{8}$ pitch in depth. However, these details are not requirements and are given only for information on the illustration shown.
- (2) Plane of gaging notch should intersect crest of thread on gage.

9 RIBS

9.1 General

The addition of ribs or lugs is permitted on threaded fittings. Where ribs are used, it is recommended that their thickness be the same as specified for metal thickness of the fitting. Right-hand couplings shall have not more than two ribs.

9.2 Special Couplings

Right- and left-hand couplings shall have four or more ribs unless the left-hand opening is clearly marked, in which case the use of ribs is optional with the manufacturer.

10 PLUGS, BUSHINGS, AND LOCKNUTS

For dimensions of plugs, bushings, and locknuts to be used in connection with Classes 150 and 300 malleable iron threaded fittings, see ASME B16.14.

11 FACE BEVEL

A bevel not exceeding 5 deg is permitted on the faces of fitting openings. Center-to-end, end-to-end, and width of band dimensions may include or exclude the bevel.

12 COATINGS

12.1 Malleable Iron Fittings

When malleable iron fittings are zinc coated, they shall be hot dipped in accordance with ASTM A153 or

have an electrodeposited zinc coating conforming to ASTM B633, Type I, Service Condition 4. Hot-dipped coatings shall be 0.0034 in. minimum thickness and applied prior to threading. Electrodeposited zinc shall be 0.001 in. minimum thickness and may be applied either before or after threading.

12.2 Steel Fittings

Couplings and caps made from steel rod or bar may have electrodeposited zinc coatings conforming to

ASTM B633, Type I, Service Condition 4. The electrodeposited coatings may be applied either before or after threading.

12.3 Other Coatings

Other coatings specified by the purchaser shall be furnished meeting the agreed requirements.

Table 1 Pressure–Temperature Ratings

| Temperature, °C | Working Pressure, bar | | | |
|--------------------|-----------------------|-----------|---------|---------|
| | Class 150 | Class 300 | | |
| | | NPS | | |
| | | 1/4–1 | 1 1/4–2 | 2 1/2–3 |
| –29 to 66 | 20.7 | 137.9 | 103.4 | 69.0 |
| 100 | 17.5 | 119.6 | 90.5 | 61.5 |
| 125 | 15.2 | 106.4 | 81.1 | 56.1 |
| 150 | 12.8 | 93.1 | 71.8 | 50.7 |
| 175 | 10.5 [Note (1)] | 79.9 | 62.5 | 45.2 |
| 200 | ... | 66.6 | 53.1 | 39.8 |
| 225 | ... | 53.4 | 43.8 | 34.3 |
| 250 | ... | 40.1 | 34.5 | 28.9 |
| 275 | ... | 26.9 | 25.2 | 23.4 |
| 288 | ... | 20.7 | 20.7 | 20.7 |

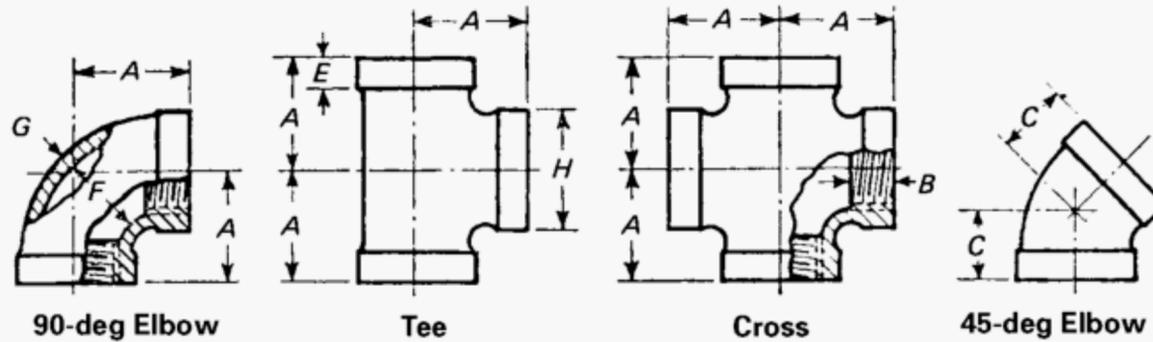
NOTE:

- (1) Permissible for service temperature up to 186°C, reflecting the temperature of saturated steam at 10.3 bar.

Table 2 Inspection Tolerances

| NPS | Tolerance, mm |
|-----------------|---------------|
| 1/8 | ±0.8 |
| 1/4 | ±1.0 |
| 3/8 | ±1.3 |
| 1/2, 3/4 | ±1.5 |
| 1, 1 1/4 | ±1.8 |
| 1 1/2, 2 | ±2.0 |
| 2 1/2, 3, 3 1/2 | ±2.5 |
| 4, 5 | ±3.0 |
| 6 | ±3.6 |

Table 3 Dimensions of Class 150, 90-deg Elbows, Tees, and Crosses, and 45-deg Elbows (Straight Sizes)



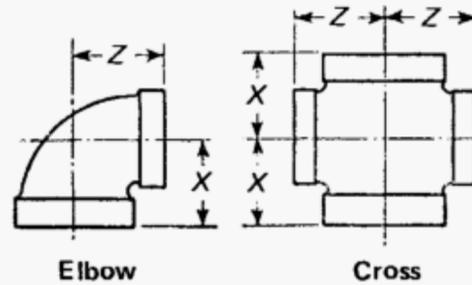
| NPS | Center-to-End Elbows, Tees, and Crosses, <i>A</i> [Note (1)] | Center-to-End 45-deg Elbows, <i>C</i> | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fitting, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> |
|-------|--|---------------------------------------|------------------------------------|---------------------------------|--------------------------------------|-------|---------------------------|--|
| | | | | | Min. | Max. | | |
| 1/8 | 17.5 | ... | 6.4 | 5.1 | 10.3 | 11.0 | 2.29 | 17.6 |
| 1/4 | 20.6 | 18.5 | 8.1 | 5.5 | 13.7 | 14.8 | 2.41 | 21.4 |
| 3/8 | 24.1 | 20.3 | 9.1 | 5.8 | 17.1 | 18.3 | 2.54 | 35.8 |
| 1/2 | 28.5 | 22.4 | 10.9 | 6.3 | 21.3 | 22.8 | 2.67 | 30.4 |
| 3/4 | 33.3 | 24.9 | 12.7 | 6.9 | 26.7 | 28.1 | 3.05 | 37.0 |
| 1 | 38.1 | 28.5 | 14.7 | 7.7 | 33.4 | 35.2 | 3.40 | 45.0 |
| 1 1/4 | 44.5 | 32.8 | 17.0 | 8.7 | 42.2 | 43.9 | 3.68 | 54.7 |
| 1 1/2 | 49.3 | 36.3 | 17.8 | 9.3 | 48.3 | 50.0 | 3.94 | 61.6 |
| 2 | 57.2 | 42.7 | 19.1 | 10.7 | 60.3 | 62.1 | 4.39 | 75.3 |
| 2 1/2 | 68.6 | 49.5 | 23.4 | 12.1 | 73.0 | 75.6 | 5.33 | 91.2 |
| 3 | 78.2 | 55.1 | 24.9 | 13.9 | 88.9 | 91.4 | 5.87 | 108.8 |
| 3 1/2 | 86.9 | 60.7 | 26.2 | 15.3 | 101.6 | 104.1 | 6.30 | 123.0 |
| 4 | 96.3 | 66.3 | 27.4 | 16.8 | 114.4 | 116.8 | 6.73 | 137.2 |
| 5 | 114.3 | 77.5 | 30.0 | 19.8 | 141.3 | 143.8 | 7.62 | 167.2 |
| 6 | 130.3 | 87.9 | 32.5 | 22.9 | 168.3 | 170.8 | 8.53 | 197.3 |

GENERAL NOTE: Dimensions are in millimeters.

NOTE:

(1) Dimensions for reducing elbows and reducing crosses are given in Table 4 and dimensions for reducing tees in Table 5.

Table 4 Dimensions of Class 150, 90-deg Elbows and Crosses (Reducing Sizes)

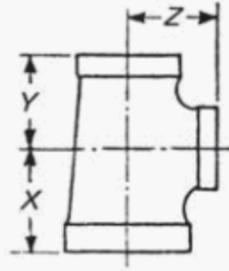


| Elbows | | | Crosses | | |
|------------------------------------|---------------|------|--|---------------|------|
| NPS | Center-to-End | | NPS | Center-to-End | |
| | X | Z | | X | Z |
| $\frac{1}{4} \times \frac{1}{8}$ | 18.8 | 19.3 | $\frac{3}{4} \times \frac{3}{4} \times \frac{1}{2} \times \frac{1}{2}$ | 30.5 | 31.0 |
| $\frac{3}{8} \times \frac{1}{4}$ | 22.4 | 22.9 | $1 \times 1 \times \frac{3}{4} \times \frac{3}{4}$ | 34.8 | 36.8 |
| $\frac{3}{8} \times \frac{1}{8}$ | 20.5 | 21.6 | $1 \times 1 \times \frac{1}{2} \times \frac{1}{2}$ | 32.0 | 35.5 |
| $\frac{1}{2} \times \frac{3}{8}$ | 26.4 | 26.2 | $1\frac{1}{4} \times 1\frac{1}{4} \times 1 \times 1$ | 40.1 | 42.4 |
| $\frac{1}{2} \times \frac{1}{4}$ | 24.6 | 24.9 | $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{3}{4} \times \frac{3}{4}$ | 36.8 | 41.2 |
| $\frac{3}{4} \times \frac{1}{2}$ | 30.5 | 31.0 | $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{4} \times 1\frac{1}{4}$ | 46.2 | 47.8 |
| $\frac{3}{4} \times \frac{3}{8}$ | 28.5 | 28.7 | $1\frac{1}{2} \times 1\frac{1}{2} \times 1 \times 1$ | 41.9 | 45.7 |
| $\frac{3}{4} \times \frac{1}{4}$ | 26.7 | 27.4 | $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4} \times \frac{3}{4}$ | 38.6 | 44.5 |
| $1 \times \frac{3}{4}$ | 34.8 | 36.8 | $2 \times 2 \times 1\frac{1}{2} \times 1\frac{1}{2}$ | 51.3 | 54.9 |
| $1 \times \frac{1}{2}$ | 32.0 | 35.5 | $2 \times 2 \times 1\frac{1}{4} \times 1\frac{1}{4}$ | 48.3 | 53.3 |
| $1 \times \frac{3}{8}$ | 30.0 | 32.3 | $2 \times 2 \times 1 \times 1$ | 43.9 | 51.3 |
| $1\frac{1}{4} \times 1$ | 40.1 | 42.4 | $2 \times 2 \times \frac{3}{4} \times \frac{3}{4}$ | 40.6 | 50.0 |
| $1\frac{1}{4} \times \frac{3}{4}$ | 36.8 | 41.2 | $2\frac{1}{2} \times 2\frac{1}{2} \times 2 \times 2$ | 60.7 | 66.0 |
| $1\frac{1}{4} \times \frac{1}{2}$ | 34.0 | 38.9 | $3 \times 3 \times 2 \times 2$ | 64.0 | 73.4 |
| $1\frac{1}{2} \times 1\frac{1}{4}$ | 46.2 | 47.8 | | | |
| $1\frac{1}{2} \times 1$ | 41.9 | 45.7 | | | |
| $1\frac{1}{2} \times \frac{3}{4}$ | 38.6 | 44.5 | | | |
| $2 \times 1\frac{1}{2}$ | 51.3 | 54.9 | | | |
| $2 \times 1\frac{1}{4}$ | 48.3 | 53.3 | | | |
| 2×1 | 43.9 | 51.3 | | | |
| $2 \times \frac{3}{4}$ | 40.6 | 50.0 | | | |
| $2\frac{1}{2} \times 2$ | 60.7 | 66.0 | | | |
| $2\frac{1}{2} \times 1\frac{1}{2}$ | 54.9 | 63.8 | | | |
| $3 \times 2\frac{1}{2}$ | 71.9 | 75.9 | | | |
| 3×2 | 64.0 | 73.4 | | | |
| 4×3 | 83.8 | 91.4 | | | |

GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) For dimensions not given, see Table 3.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

Table 5 Dimensions of Class 150 Tees (Reducing Sizes)

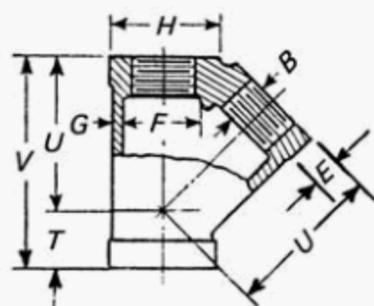


| NPS | Center-to-End | | | NPS | Center-to-End | | | NPS | Center-to-End | | |
|---------------------|---------------|------|------|-----------------------|---------------|------|------|-----------------------|---------------|-------|-------|
| | X | Y | Z | | X | Y | Z | | X | Y | Z |
| 1/4 x 1/4 x 1/8 | 18.8 | 18.8 | 19.3 | 1 1/4 x 1 x 1 | 40.1 | 38.1 | 42.4 | 2 x 3/4 x 2 | 57.2 | 50.0 | 57.2 |
| 1/8 x 1/8 x 1/4 | 19.3 | 19.3 | 18.8 | 1 1/4 x 1 x 3/4 | 36.8 | 34.8 | 41.2 | 2 x 1/2 x 2 | 57.2 | 47.8 | 57.2 |
| 3/8 x 3/8 x 1/4 | 22.4 | 22.4 | 22.9 | 1 1/4 x 1 x 1/2 | 34.0 | 32.0 | 38.9 | 1 1/2 x 1 1/2 x 2 | 54.9 | 54.9 | 51.3 |
| 3/8 x 3/8 x 1/8 | 20.6 | 20.6 | 21.6 | 1 1/4 x 3/4 x 1 1/4 | 44.5 | 41.2 | 44.5 | 1 1/4 x 1 1/4 x 2 | 53.3 | 58.3 | 48.3 |
| 3/8 x 1/4 x 3/8 | 24.1 | 22.9 | 24.1 | 1 1/4 x 3/4 x 1 | 40.1 | 36.8 | 42.4 | 1 x 1 x 2 | 51.3 | 51.3 | 48.9 |
| 3/8 x 1/4 x 1/4 | 22.4 | 20.6 | 22.9 | 1 1/4 x 3/4 x 3/4 | 36.8 | 33.3 | 41.2 | 2 1/2 x 2 1/2 x 2 | 60.7 | 60.7 | 66.0 |
| 1/4 x 1/4 x 3/8 | 22.9 | 22.9 | 22.4 | 1 1/4 x 1/2 x 1 1/4 | 44.5 | 38.9 | 44.5 | 2 1/2 x 2 1/2 x 1 1/2 | 54.9 | 54.9 | 63.8 |
| 1/2 x 1/2 x 3/8 | 26.4 | 26.4 | 26.2 | 1 1/4 x 1/2 x 1 | 40.1 | 34.5 | 42.4 | 2 1/2 x 2 1/2 x 1 1/4 | 51.8 | 51.8 | 62.2 |
| 1/2 x 1/2 x 1/4 | 24.6 | 24.6 | 24.9 | 1 x 1 x 1 1/4 | 42.4 | 42.4 | 40.1 | 2 1/2 x 2 1/2 x 1 | 47.5 | 47.5 | 60.2 |
| 1/2 x 3/8 x 1/2 | 28.5 | 26.2 | 28.5 | 3/4 x 3/4 x 1 1/4 | 41.2 | 41.2 | 36.8 | 2 1/2 x 2 1/2 x 3/4 | 44.2 | 44.2 | 58.9 |
| 1/2 x 3/8 x 3/8 | 26.4 | 24.1 | 26.2 | 1 1/2 x 1 1/2 x 1 1/4 | 46.2 | 46.2 | 47.8 | 2 1/2 x 2 x 2 1/2 | 68.6 | 66.0 | 68.6 |
| 1/2 x 1/4 x 1/2 | 28.5 | 24.9 | 28.5 | 1 1/2 x 1 1/2 x 1 | 41.9 | 41.9 | 45.7 | 2 1/2 x 2 x 2 | 60.7 | 57.2 | 66.0 |
| 3/8 x 3/8 x 1/2 | 26.2 | 26.2 | 26.4 | 1 1/2 x 1 1/2 x 3/4 | 38.6 | 38.6 | 44.5 | 2 1/2 x 1 1/2 x 2 1/2 | 68.6 | 63.8 | 68.6 |
| 3/4 x 3/4 x 1/2 | 30.5 | 30.5 | 31.0 | 1 1/2 x 1 1/2 x 1/2 | 35.8 | 35.8 | 42.2 | 2 1/2 x 1 1/2 x 2 | 60.7 | 54.9 | 66.0 |
| 3/4 x 3/4 x 3/8 | 28.5 | 28.5 | 28.7 | 1 1/2 x 1 1/4 x 1 1/2 | 49.3 | 47.8 | 49.3 | 2 x 2 x 2 1/2 | 66.0 | 66.0 | 60.7 |
| 3/4 x 3/4 x 1/4 | 26.7 | 26.7 | 27.4 | 1 1/2 x 1 1/4 x 1 1/4 | 46.2 | 44.5 | 47.8 | 3 x 3 x 2 1/2 | 71.9 | 71.9 | 76.0 |
| 3/4 x 1/2 x 3/4 | 33.3 | 31.0 | 33.3 | 1 1/2 x 1 1/4 x 1 | 41.9 | 40.1 | 45.7 | 3 x 3 x 2 | 64.0 | 64.0 | 73.4 |
| 3/4 x 1/2 x 1/2 | 30.5 | 28.5 | 31.0 | 1 1/2 x 1 1/4 x 3/4 | 38.6 | 36.3 | 44.5 | 3 x 3 x 1 1/2 | 58.2 | 58.2 | 71.1 |
| 3/4 x 1/2 x 3/8 | 28.5 | 26.4 | 28.7 | 1 1/2 x 1 1/4 x 1/2 | 35.8 | 34.0 | 42.2 | 3 x 3 x 1 1/4 | 55.1 | 55.1 | 69.6 |
| 3/4 x 3/8 x 3/4 | 33.3 | 28.7 | 33.3 | 1 1/2 x 1 x 1 1/2 | 49.3 | 45.7 | 49.3 | 3 x 3 x 1 | 50.8 | 50.8 | 67.6 |
| 3/4 x 3/8 x 3/8 | 28.5 | 24.1 | 28.7 | 1 1/2 x 1 x 1 1/4 | 46.2 | 42.4 | 47.8 | 3 x 3 x 3/4 | 47.5 | 47.5 | 66.3 |
| 3/4 x 1/4 x 3/4 | 33.3 | 27.4 | 33.3 | 1 1/2 x 1 x 1 | 41.9 | 38.1 | 45.7 | 3 x 2 1/2 x 3 | 78.2 | 76.0 | 78.2 |
| 1/2 x 1/2 x 3/4 | 31.0 | 31.0 | 30.5 | 1 1/2 x 3/4 x 1 1/2 | 49.3 | 44.5 | 49.3 | 3 x 2 1/2 x 2 1/2 | 71.9 | 68.6 | 76.0 |
| 1 x 1 x 3/4 | 34.8 | 34.8 | 36.8 | 1 1/2 x 1/2 x 1 1/2 | 49.3 | 42.2 | 49.3 | 3 x 2 1/2 x 2 | 64.0 | 60.7 | 73.4 |
| 1 x 1 x 1/2 | 32.0 | 32.0 | 35.5 | 1 1/4 x 1 1/4 x 1 1/2 | 47.8 | 47.8 | 46.2 | 3 x 2 x 3 | 78.2 | 73.4 | 78.2 |
| 1 x 1 x 3/8 | 30.0 | 30.0 | 32.3 | 1 x 1 x 1 1/2 | 45.7 | 45.7 | 41.9 | 3 x 2 x 2 | 64.0 | 57.2 | 73.4 |
| 1 x 1 x 1/4 | 28.2 | 28.2 | 31.0 | 2 x 2 x 1 1/2 | 51.3 | 51.3 | 54.9 | 2 1/2 x 2 1/2 x 3 | 76.0 | 76.0 | 71.9 |
| 1 x 3/4 x 1 | 38.1 | 36.8 | 38.1 | 2 x 2 x 1 1/4 | 48.3 | 48.3 | 53.3 | 3 1/2 x 3 1/2 x 2 1/2 | 74.4 | 74.4 | 82.3 |
| 1 x 3/4 x 3/4 | 34.8 | 33.3 | 36.8 | 2 x 2 x 1 | 43.9 | 43.9 | 51.3 | 4 x 4 x 3 | 83.8 | 83.8 | 91.4 |
| 1 x 3/4 x 1/2 | 32.0 | 30.5 | 35.5 | 2 x 2 x 3/4 | 40.6 | 40.6 | 50.0 | 4 x 4 x 2 1/2 | 77.5 | 77.5 | 89.2 |
| 1 x 1/2 x 1 | 38.1 | 35.5 | 38.1 | 2 x 2 x 1/2 | 37.9 | 37.9 | 47.8 | 4 x 4 x 2 | 69.6 | 69.6 | 86.6 |
| 1 x 1/2 x 3/4 | 34.8 | 31.0 | 36.8 | 2 x 1 1/2 x 2 | 57.2 | 54.8 | 57.2 | 4 x 4 x 1 1/2 | 63.8 | 63.8 | 84.3 |
| 1 x 1/2 x 1/2 | 32.0 | 38.5 | 35.5 | 2 x 1 1/2 x 1 1/2 | 51.3 | 49.3 | 54.9 | 4 x 3 x 4 | 96.3 | 91.4 | 96.3 |
| 3/4 x 3/4 x 1 | 36.8 | 36.8 | 34.8 | 2 x 1 1/2 x 1 1/4 | 48.3 | 46.2 | 53.3 | 3 x 3 x 4 | 91.4 | 91.4 | 83.8 |
| 1/2 x 1/2 x 1 | 34.6 | 34.6 | 32.0 | 2 x 1 1/2 x 1 | 43.9 | 41.9 | 51.3 | 5 x 5 x 3 | 89.2 | 89.2 | 107.2 |
| 1 1/4 x 1 1/4 x 1 | 40.1 | 40.1 | 42.4 | 2 x 1 1/4 x 2 | 57.2 | 53.3 | 57.2 | 6 x 6 x 4 | 104.9 | 104.9 | 125.5 |
| 1 1/4 x 1 1/4 x 3/4 | 36.8 | 36.8 | 41.2 | 2 x 1 1/4 x 1 1/2 | 51.3 | 47.8 | 54.9 | 6 x 6 x 3 | 92.5 | 92.5 | 120.7 |
| 1 1/4 x 1 1/4 x 1/2 | 34.0 | 34.0 | 38.9 | 2 x 1 1/4 x 1 1/4 | 48.3 | 44.5 | 53.3 | 6 x 6 x 2 1/2 | 86.1 | 86.1 | 118.4 |
| 1 1/4 x 1 1/4 x 3/8 | 32.0 | 32.0 | 36.6 | 2 x 1 x 2 | 57.2 | 51.3 | 57.2 | 6 x 6 x 2 | 78.2 | 78.2 | 115.8 |
| 1 1/4 x 1 x 1 1/4 | 44.5 | 42.4 | 44.5 | 2 x 1 x 1 1/2 | 51.3 | 45.7 | 54.9 | | | | |

GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) For dimensions not given, see Table 3.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

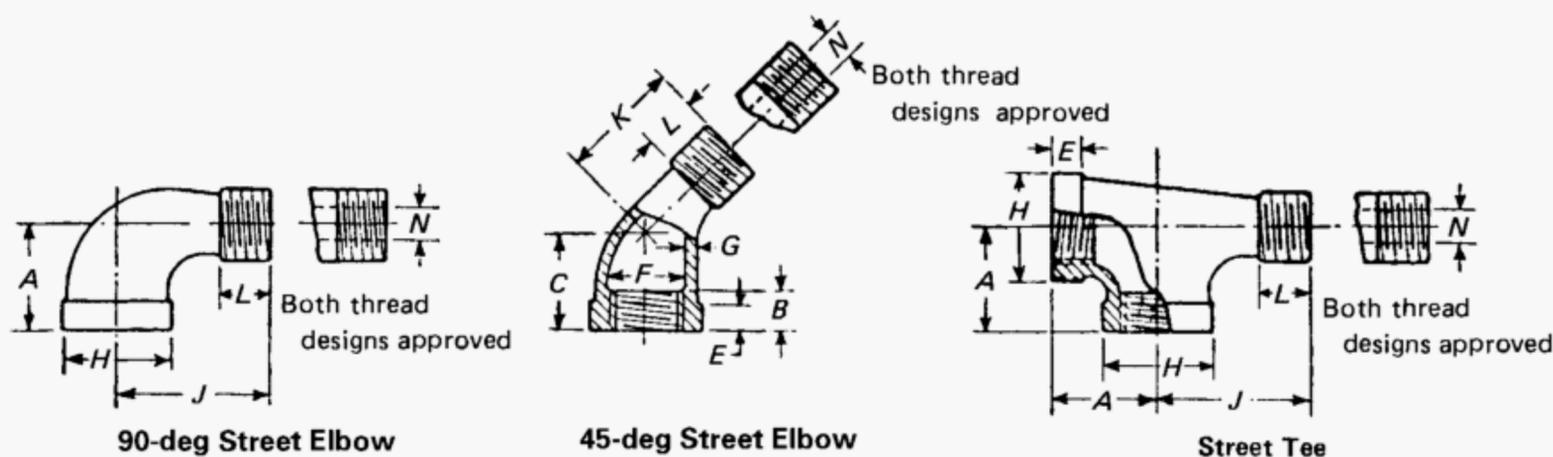
Table 6 Dimensions of Class 150, 45-deg Y-Branches (Straight Sizes)



| NPS | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fittings, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> | Center-to-End Inlet, <i>T</i> | Center-to-End Outlet, <i>U</i> | End-to-End, <i>V</i> |
|-------|------------------------------------|---------------------------------|---------------------------------------|-------|---------------------------|--|-------------------------------|--------------------------------|----------------------|
| | | | Min. | Max. | | | | | |
| 3/8 | 9.1 | 5.8 | 17.1 | 18.3 | 2.54 | 25.8 | 12.7 | 36.3 | 49.0 |
| 1/2 | 10.9 | 6.3 | 21.3 | 22.8 | 2.67 | 30.4 | 15.5 | 43.4 | 58.9 |
| 3/4 | 12.7 | 6.9 | 26.7 | 28.1 | 3.05 | 37.0 | 18.3 | 52.1 | 70.4 |
| 1 | 14.7 | 7.6 | 33.4 | 35.2 | 3.40 | 45.0 | 21.6 | 61.7 | 83.3 |
| 1 1/4 | 17.0 | 8.7 | 42.2 | 43.9 | 3.68 | 54.7 | 25.9 | 74.2 | 100.1 |
| 1 1/2 | 17.8 | 9.3 | 48.3 | 50.0 | 3.94 | 61.6 | 27.9 | 83.3 | 111.3 |
| 2 | 19.1 | 10.7 | 60.3 | 62.1 | 4.39 | 75.3 | 37.5 | 99.8 | 131.3 |
| 2 1/2 | 23.4 | 12.1 | 73.0 | 75.6 | 5.33 | 91.2 | 38.6 | 120.1 | 158.8 |
| 3 | 24.9 | 13.9 | 88.9 | 91.4 | 5.87 | 108.8 | 43.4 | 141.0 | 184.4 |
| 4 | 27.4 | 16.8 | 114.4 | 116.8 | 6.73 | 137.2 | 51.1 | 177.0 | 228.1 |

GENERAL NOTE: Dimensions are in millimeters.

Table 7 Dimensions of Class 150 Street Tees and 90-deg and 45-deg Street Elbows



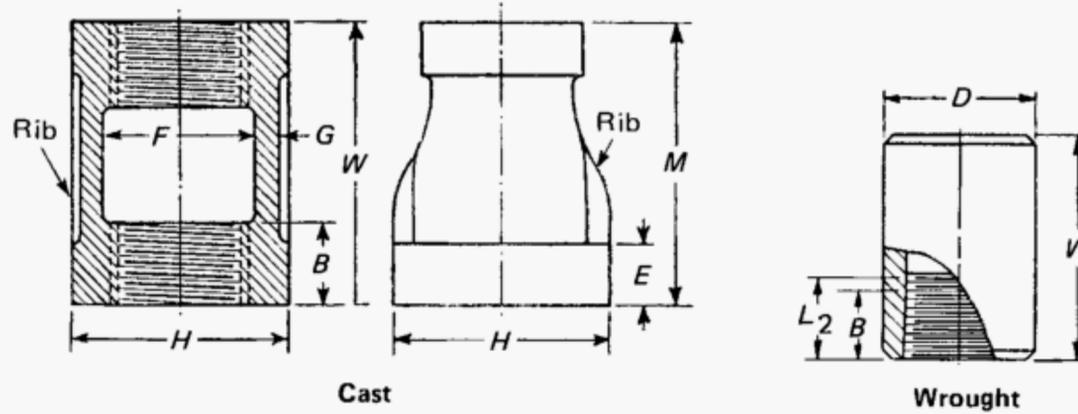
| NPS | Center-to-End, Elbows and Tees, A | Center-to-End 45-deg Elbows, C | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fittings, F | | Metal Thickness, G | Minimum Outside Diameter of Band, H | Center-to-Male End Elbows and Tees, J | Center-to-Male End 45-deg Elbows, K | Minimum Length of External Thread, L | Maximum Port Diameter Male End, N |
|-------|-----------------------------------|--------------------------------|-----------------------------|--------------------------|--------------------------------|-------|--------------------|-------------------------------------|---------------------------------------|-------------------------------------|--------------------------------------|-----------------------------------|
| | | | | | Min. | Max. | | | | | | |
| 1/8 | 17.5 | ... | 6.4 | 5.1 | 10.3 | 11.0 | 2.29 | 17.6 | 25.4 | ... | 6.70 | 5.1 |
| | [Note (1)] | | | | | | | | [Note (1)] | | | |
| 1/4 | 20.6 | 18.5 | 8.1 | 5.5 | 13.7 | 14.8 | 2.41 | 21.4 | 30.2 | 23.9 | 10.20 | 6.6 |
| 3/8 | 24.1 | 20.3 | 9.1 | 5.8 | 17.1 | 18.3 | 2.54 | 25.8 | 36.6 | 26.2 | 10.36 | 9.4 |
| 1/2 | 28.5 | 22.4 | 10.9 | 6.3 | 21.3 | 22.8 | 2.67 | 30.4 | 41.2 | 29.2 | 13.56 | 13.0 |
| 3/4 | 33.3 | 24.9 | 12.7 | 6.9 | 26.7 | 28.1 | 3.05 | 37.0 | 48.0 | 32.8 | 13.86 | 17.5 |
| 1 | 38.1 | 28.5 | 14.7 | 7.7 | 33.4 | 35.2 | 3.40 | 45.0 | 54.4 | 37.3 | 17.34 | 23.1 |
| 1 1/4 | 44.5 | 32.8 | 17.0 | 8.7 | 42.2 | 43.9 | 3.68 | 54.7 | 62.2 | 43.4 | 17.94 | 30.2 |
| 1 1/2 | 49.3 | 36.3 | 17.8 | 9.3 | 48.3 | 50.0 | 3.94 | 61.6 | 68.3 | 47.8 | 18.38 | 35.3 |
| 2 | 57.2 | 42.7 | 19.1 | 10.7 | 60.3 | 62.1 | 4.39 | 75.3 | 82.8 | 56.4 | 19.22 | 45.5 |
| 2 1/2 | 68.6 | 49.5 | 23.4 | 12.1 | 73.0 | 75.6 | 5.33 | 91.2 | 98.0 | 65.3 | 28.96 | 55.9 |
| | [Note (1)] | | | | | | | | [Note (1)] | | | |
| 3 | 78.2 | 55.1 | 24.9 | 13.9 | 88.9 | 91.4 | 5.87 | 108.8 | 114.6 | 76.2 | 30.48 | 70.6 |
| | [Note (1)] | | | | | | | | [Note (1)] | | | |
| 4 | 96.3 | 66.3 | 27.4 | 16.8 | 114.4 | 116.8 | 6.73 | 137.2 | 144.5 | 94.0 | 33.02 | 94.0 |
| 5 | 114.3 | ... | 30.0 | 19.8 | 141.3 | 143.8 | 7.62 | 167.2 | 174.2 | ... | 35.72 | 119.1 |
| | [Note (1)] | | | | | | | | [Note (1)] | | | |
| 6 | 130.3 | ... | 32.5 | 22.9 | 168.3 | 170.8 | 8.53 | 197.4 | 204.0 | ... | 38.42 | 144.0 |
| | [Note (1)] | | | | | | | | [Note (1)] | | | |

GENERAL NOTE: Dimensions are in millimeters.

NOTE:

(1) This dimension applies to street elbows only. Street tees are not made in these sizes.

Table 8 Dimensions of Class 150 Couplings (Straight and Reducing Sizes)



| NPS | Minimum Length of Thread | | Minimum Width of Band, <i>E</i> | Inside Diameter of Fittings, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> | Thickness of Ribs | Length of Straight Couplings, <i>W</i> | Length of Reducing Concentric Couplings, <i>M</i> [Notes (1) and (2)] | Steel Couplings [Notes (2) and (3)] | |
|-------|--------------------------|-----------------------|---------------------------------|---------------------------------------|-------|---------------------------|--|-------------------|--|---|-------------------------------------|----------------------------|
| | <i>B</i> | <i>L</i> ₂ | | Min. | Max. | | | | | | Length, <i>W</i> | Outside Diameter, <i>D</i> |
| 1/8 | 6.4 | 6.7 | 5.1 | 10.3 | 11.0 | 2.29 | 17.6 | 2.29 | 24.2 | ... | 20.7 | 14.3 |
| 1/4 | 8.1 | 10.2 | 5.5 | 13.7 | 14.8 | 2.41 | 21.4 | 2.41 | 26.9 | 25.4 | 30.2 | 18.3 |
| 3/8 | 9.1 | 10.4 | 5.8 | 17.1 | 18.3 | 2.54 | 25.8 | 2.54 | 29.5 | 28.7 | 30.2 | 22.2 |
| 1/2 | 10.9 | ... | 6.3 | 21.3 | 22.8 | 2.67 | 30.4 | 2.67 | 34.0 | 31.8 | ... | ... |
| 3/4 | 12.7 | ... | 6.9 | 26.7 | 28.1 | 3.05 | 37.0 | 3.05 | 38.6 | 36.6 | ... | ... |
| 1 | 14.7 | ... | 7.7 | 33.4 | 35.2 | 3.40 | 45.0 | 3.40 | 42.4 | 42.9 | ... | ... |
| 1 1/4 | 17.0 | ... | 8.7 | 42.2 | 43.9 | 3.68 | 54.7 | 3.60 | 49.0 | 52.3 | ... | ... |
| 1 1/2 | 17.8 | ... | 9.3 | 48.3 | 50.0 | 3.94 | 61.6 | 3.84 | 54.6 | 58.7 | ... | ... |
| 2 | 19.1 | ... | 10.7 | 60.3 | 62.1 | 4.39 | 75.3 | 4.39 | 64.3 | 71.4 | ... | ... |
| 2 1/2 | 23.4 | ... | 12.1 | 73.0 | 75.6 | 5.33 | 91.2 | 5.33 | 73.2 | 82.6 | ... | ... |
| 3 | 24.9 | ... | 13.9 | 88.9 | 91.4 | 5.87 | 108.8 | 5.87 | 80.8 | 93.7 | ... | ... |
| 4 | 27.4 | ... | 16.8 | 114.4 | 116.8 | 6.73 | 137.2 | 6.73 | 93.7 | 111.3 | ... | ... |

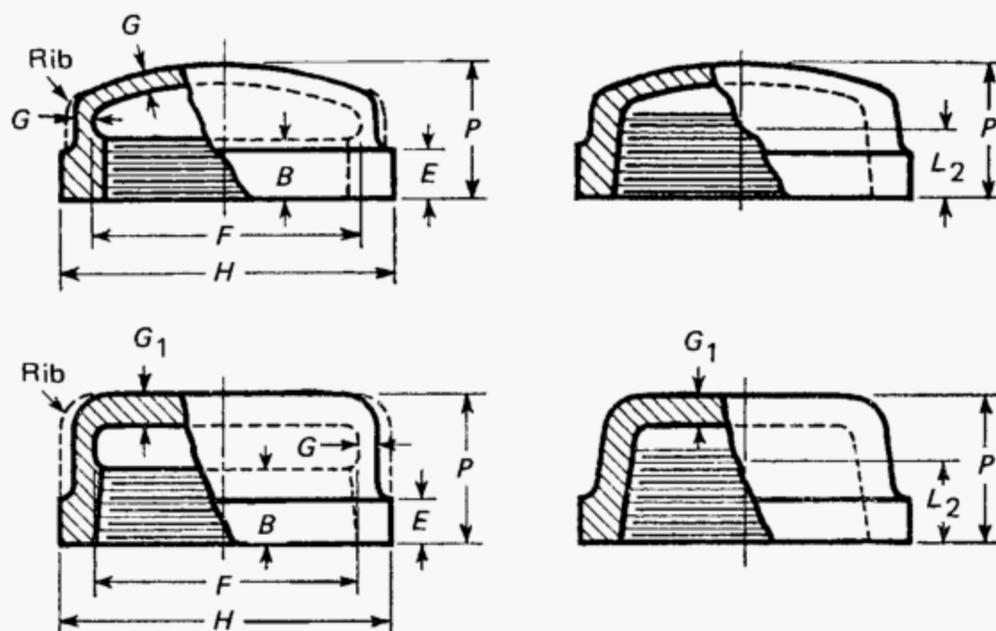
GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) Right- and left-hand pattern couplings are standard only in sizes up to and including NPS 2.

NOTES:

- (1) Dimension *M* for all reduction of reducing couplings (concentric only) shall be the same as shown for the largest opening. Dimension *M* for eccentric couplings is not standard; such information should be obtained from the manufacturer.
- (2) Couplings NPS 3/8 and smaller may be cast or made from steel rod with a minimum yield strength of 207 MPa at the option of the manufacturer.
- (3) Steel couplings are made without recess. Dimension *B* for steel couplings is the minimum length of perfect thread, and the length of useful thread (*B* plus threads with fully formed roots and flat crests) shall be not less than *L*₂ (effective length of external thread) required by ANSI/ASME B1.20.1. See section 8.

Table 9 Dimensions of Class 150 Caps



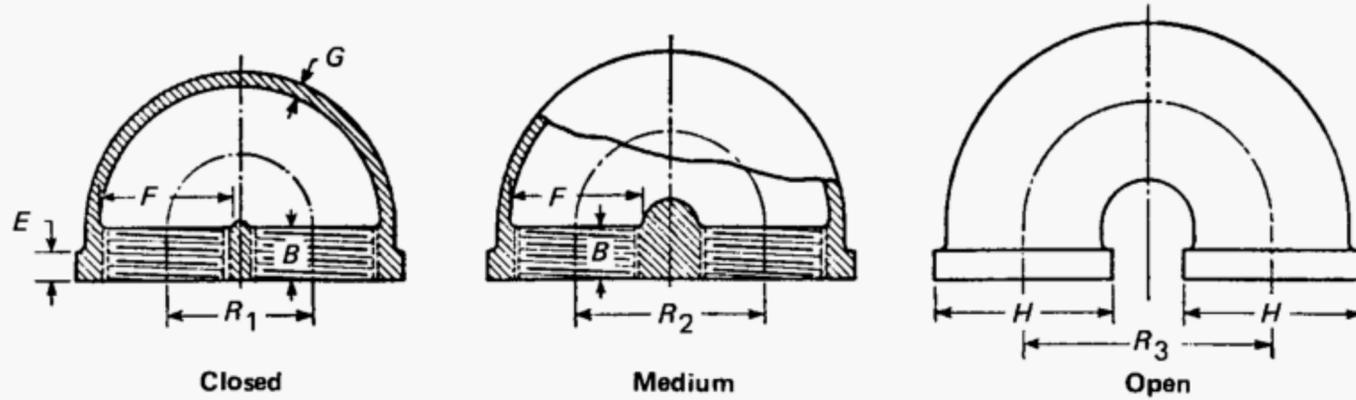
| NPS | Minimum Length of Thread | | Minimum Width of Band, E | Inside Diameter of Fittings, F | | Metal Thickness of Side, G | Minimum Outside Diameter of Band, H [Note (1)] | Minimum Height, P [Note (2)] | Thickness of Ribs | Thickness of Flat Top Caps, G ₁ |
|-------|--------------------------|----------------|--------------------------|--------------------------------|-------|----------------------------|--|------------------------------|-------------------|--|
| | B | L ₂ | | Min. | Max. | | | | | |
| 1/8 | 6.4 | 6.7 | 5.1 | 10.3 | 11.0 | 2.29 | 17.6 | 13.5 | ... | ... |
| 1/4 | 8.1 | 10.2 | 5.5 | 13.7 | 14.8 | 2.41 | 21.4 | 16.0 | ... | ... |
| 3/8 | 9.1 | 10.4 | 5.8 | 17.1 | 18.3 | 2.54 | 25.8 | 18.8 | ... | ... |
| 1/2 | 10.9 | 13.6 | 6.3 | 21.3 | 22.8 | 2.67 | 30.4 | 22.1 | 3.67 | ... |
| 3/4 | 12.7 | 13.9 | 6.9 | 26.7 | 28.1 | 3.05 | 37.0 | 24.6 | 3.05 | 3.30 |
| 1 | 14.7 | 17.3 | 7.7 | 33.4 | 35.2 | 3.40 | 45.0 | 29.5 | 3.40 | 3.81 |
| 1 1/4 | 17.0 | 18.0 | 8.7 | 42.2 | 43.9 | 3.68 | 54.7 | 32.5 | 3.68 | 4.32 |
| 1 1/2 | 17.8 | 18.4 | 9.3 | 48.3 | 50.0 | 3.94 | 61.6 | 33.8 | 3.94 | 4.83 |
| 2 | 19.1 | 19.2 | 10.7 | 60.3 | 62.1 | 4.39 | 75.3 | 36.8 | 4.39 | 5.59 |
| 2 1/2 | 23.4 | 28.9 | 12.1 | 73.0 | 75.6 | 5.33 | 91.3 | 43.2 | 5.33 | 6.35 |
| 3 | 24.9 | 30.5 | 13.9 | 88.9 | 91.4 | 5.87 | 108.8 | 45.7 | 5.87 | 7.37 |
| 3 1/2 | 26.2 | 31.8 | 15.3 | 101.6 | 104.1 | 6.30 | 123.0 | 48.3 | 6.30 | 7.62 |
| 4 | 27.4 | 33.0 | 16.9 | 114.4 | 116.8 | 6.73 | 137.2 | 52.8 | 6.73 | 9.14 |
| 5 | 30.0 | 35.7 | 19.8 | 141.3 | 143.8 | 7.62 | 167.2 | 58.9 | 7.62 | ... |
| 6 | 32.5 | 38.4 | 22.9 | 168.3 | 170.8 | 8.53 | 197.3 | 64.8 | 8.53 | ... |

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

- (1) Caps sizes 1/8, 1/4, and 3/8 may be malleable castings or made from steel rod with a minimum yield strength of 207 MPa at the option of the manufacturer. When made from steel rod, diameters shall be 14.3, 17.4, and 21.4, respectively. Caps made from steel rod have no recess.
- (2) Caps may be made without recess. Caps so made shall be of such height, P, that the length of perfect thread shall be not less than B, and the length of useful thread (B plus threads with fully formed roots and flat crests) shall be not less than L₂ (effective length of external thread) required by ANSI/ASME B1.20.1.

Table 10 Dimensions of Class 150, Closed-, Medium-, and Open-Pattern Return Bends

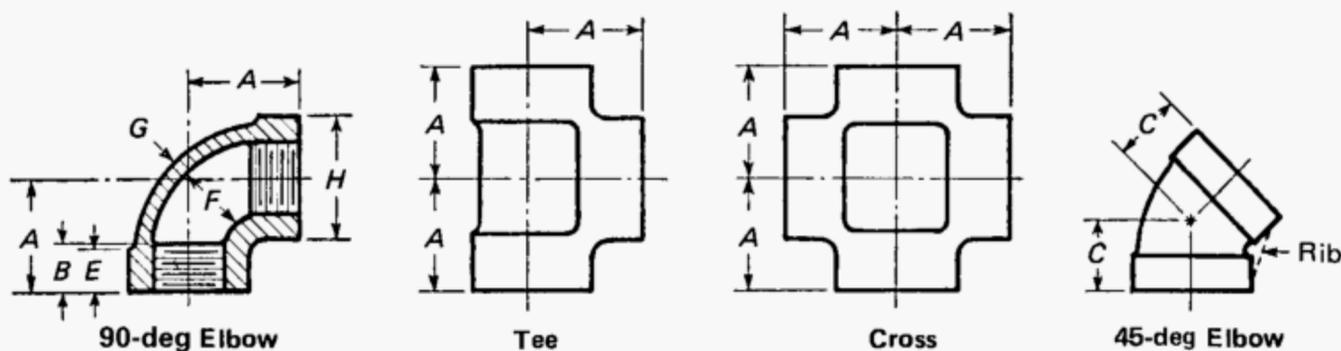


| NPS | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fittings, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> | Center-to-Center (Closed Pattern), <i>R</i> ₁ | Center-to-Center (Medium Pattern), <i>R</i> ₂ | Center-to-Center (Open Pattern), <i>R</i> ₃ |
|-------|------------------------------------|---------------------------------|---------------------------------------|-------|---------------------------|--|--|--|--|
| | | | Min. | Max. | | | | | |
| 1/2 | 10.9 | 6.3 | 21.3 | 22.8 | 2.95 | 30.4 | 25.4 | 31.8 | 38.1 |
| 3/4 | 12.7 | 6.9 | 26.7 | 28.1 | 3.38 | 37.0 | 31.6 | 38.1 | 50.8 |
| 1 | 14.7 | 7.7 | 33.3 | 35.2 | 3.81 | 45.0 | 38.1 | 47.6 | 63.5 |
| 1 1/4 | 17.0 | 8.7 | 42.2 | 43.9 | 4.19 | 54.7 | 44.5 | 57.2 | 76.2 |
| 1 1/2 | 17.8 | 9.3 | 48.3 | 50.0 | 4.52 | 61.6 | 55.6 | 63.5 | 88.9 |
| 2 | 19.1 | 10.7 | 60.3 | 62.1 | 5.11 | 75.3 | 66.8 | 76.2 | 101.6 |
| 2 1/2 | 23.4 | 12.1 | 73.0 | 75.8 | 6.20 | 91.2 | ... | ... | 114.3 |
| 3 | 24.9 | 13.9 | 88.9 | 91.4 | 6.91 | 108.8 | ... | ... | 127.0 |
| 4 | 27.4 | 16.8 | 114.4 | 116.8 | 7.87 | 137.2 | ... | ... | 152.4 |

GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) It is permissible to furnish closed-pattern return bends not banded. Closed-pattern return bends will not make up equally spaced coils, as the distance center-to-center of two adjacent bends is greater than the center-to-center of openings of a single bend.

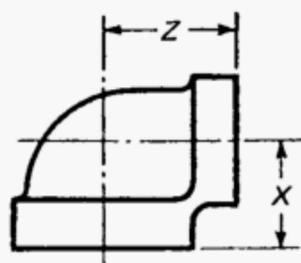
Table 11 Dimensions of Class 300, 90-deg Elbows, Tees, and Crosses, and 45-deg Elbows (Straight Sizes)



| NPS | Center-to-End Elbows, Tees, and Crosses, A | Center-to-End 45-deg Elbows, C | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fitting, F | | Metal Thickness, G | Minimum Outside Diameter of Band, H |
|-------|--|--------------------------------|-----------------------------|--------------------------|-------------------------------|------|--------------------|-------------------------------------|
| | | | | | Min. | Max. | | |
| 1/4 | 23.9 | 20.6 | 10.9 | 9.7 | 13.7 | 14.8 | 3.6 | 23.6 |
| 3/8 | 26.9 | 22.4 | 11.9 | 11.2 | 17.1 | 18.3 | 3.8 | 28.5 |
| 1/2 | 31.8 | 25.4 | 14.5 | 12.7 | 21.3 | 22.8 | 4.1 | 34.0 |
| 3/4 | 35.6 | 28.7 | 16.3 | 14.2 | 26.7 | 28.1 | 4.6 | 41.4 |
| 1 | 41.4 | 33.3 | 19.1 | 15.8 | 33.4 | 35.2 | 5.1 | 49.5 |
| 1 1/4 | 49.3 | 38.1 | 21.3 | 17.5 | 42.2 | 43.9 | 5.6 | 60.7 |
| 1 1/2 | 54.1 | 42.9 | 22.1 | 19.1 | 48.3 | 50.0 | 6.1 | 68.1 |
| 2 | 63.5 | 50.8 | 25.4 | 21.3 | 60.3 | 62.1 | 6.6 | 83.3 |
| 2 1/2 | 74.7 | 57.2 | 29.7 | 23.9 | 73.0 | 75.6 | 7.9 | 98.0 |
| 3 | 85.9 | 63.5 | 31.2 | 25.4 | 88.9 | 91.4 | 8.9 | 117.3 |

GENERAL NOTE: Dimensions are in millimeters.

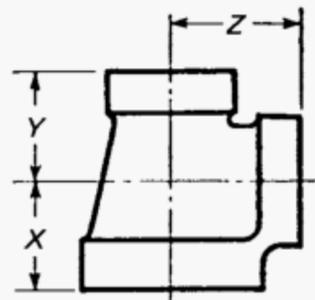
Table 12 Center-to-End Dimensions of Class 300, 90-deg Elbows (Reducing Sizes)



| NPS | Center-to-End | |
|---------------|---------------|------|
| | X | Z |
| 1/2 x 3/8 | 30.2 | 30.2 |
| 3/4 x 1/2 | 33.3 | 35.1 |
| 1 x 3/4 | 38.1 | 39.6 |
| 1 1/4 x 1 | 44.5 | 46.0 |
| 1 1/2 x 1 1/4 | 50.8 | 52.3 |
| 2 x 1 1/2 | 57.2 | 60.5 |
| 2 1/2 x 2 | 68.3 | 69.9 |
| 3 x 2 1/2 | 77.7 | 84.1 |

GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) For dimensions not given, see Table 11.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

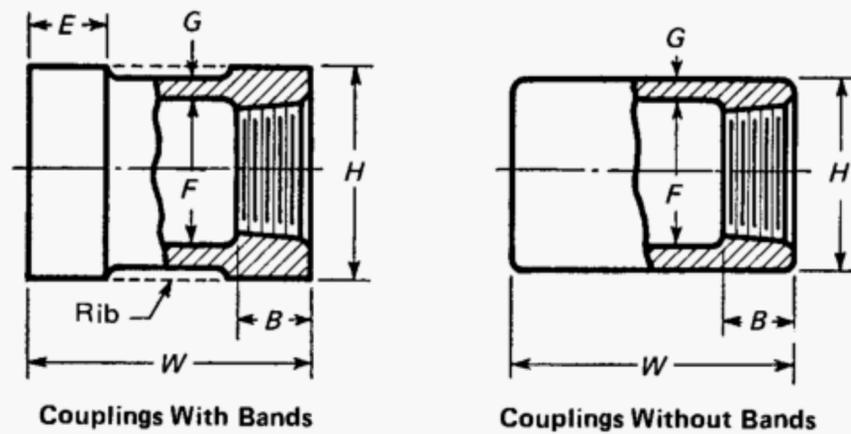
Table 13 Center-to-End Dimensions of Class 300 Tees (Reducing Sizes)

| NPS | Center-to-End | | |
|--|---------------|------|------|
| | X | Y | Z |
| $\frac{1}{2} \times \frac{1}{2} \times \frac{3}{8}$ | 30.2 | 30.2 | 30.2 |
| $\frac{1}{2} \times \frac{3}{8} \times \frac{1}{2}$ | 31.8 | 30.2 | 31.8 |
| $\frac{3}{4} \times \frac{3}{4} \times \frac{1}{2}$ | 33.3 | 33.3 | 35.1 |
| $\frac{3}{4} \times \frac{1}{2} \times \frac{3}{4}$ | 36.6 | 35.1 | 36.6 |
| $1 \times 1 \times \frac{3}{4}$ | 38.1 | 38.1 | 39.6 |
| $1 \times 1 \times \frac{1}{2}$ | 36.6 | 36.6 | 38.1 |
| $1 \times 1 \times \frac{3}{8}$ | 33.3 | 33.3 | 36.6 |
| $1 \times \frac{3}{4} \times 1$ | 41.4 | 39.6 | 41.4 |
| $1\frac{1}{4} \times 1\frac{1}{4} \times 1$ | 44.5 | 44.5 | 46.0 |
| $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{3}{4}$ | 41.4 | 41.4 | 44.5 |
| $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{2}$ | 38.1 | 38.1 | 42.9 |
| $1\frac{1}{4} \times 1 \times 1\frac{1}{4}$ | 49.3 | 46.0 | 49.3 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{4}$ | 50.8 | 50.8 | 52.3 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times 1$ | 46.0 | 46.0 | 50.8 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4}$ | 42.9 | 42.9 | 47.6 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$ | 41.4 | 41.4 | 46.0 |
| $1\frac{1}{2} \times 1\frac{1}{4} \times 1\frac{1}{2}$ | 54.1 | 52.3 | 54.1 |
| $2 \times 2 \times 1\frac{1}{2}$ | 57.2 | 57.2 | 60.5 |
| $2 \times 2 \times 1\frac{1}{4}$ | 54.1 | 54.1 | 58.7 |
| $2 \times 2 \times 1$ | 50.8 | 50.8 | 57.2 |
| $2 \times 2 \times \frac{3}{4}$ | 46.0 | 46.0 | 54.1 |
| $2 \times 2 \times \frac{1}{2}$ | 44.5 | 44.5 | 52.3 |
| $2 \times 1\frac{1}{2} \times 2$ | 63.5 | 60.5 | 63.5 |
| $2\frac{1}{2} \times 2\frac{1}{2} \times 2$ | 68.3 | 68.3 | 70.0 |
| $2\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$ | 62.0 | 62.0 | 66.8 |
| $2\frac{1}{2} \times 2 \times 2\frac{1}{2}$ | 74.7 | 70.0 | 74.7 |
| $3 \times 3 \times 2\frac{1}{2}$ | 77.7 | 77.7 | 84.1 |
| $3 \times 3 \times 2$ | 71.4 | 71.4 | 79.5 |
| $3 \times 2\frac{1}{2} \times 3$ | 85.9 | 84.1 | 85.9 |

GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) For dimensions not given, see Table 11.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

Table 14 Dimensions of Class 300 Couplings

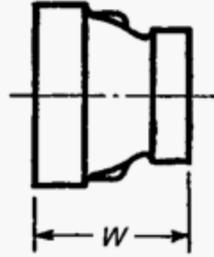


| NPS | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fittings, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Coupling, <i>H</i> ₁ [Note (1)] | Minimum Outside Diameter of Band, <i>H</i> [Note (2)] | Length of Straight Coupling, <i>W</i> |
|-------|------------------------------------|---------------------------------|---------------------------------------|------|---------------------------|--|---|---------------------------------------|
| | | | Min. | Max. | | | | |
| 1/4 | 10.9 | 9.7 | 13.7 | 14.8 | 3.6 | 20.8 | 23.6 | 35.1 |
| 3/8 | 11.9 | 11.2 | 17.1 | 18.3 | 3.8 | 24.7 | 28.5 | 41.4 |
| 1/2 | 14.5 | 12.7 | 21.3 | 22.8 | 4.1 | 29.5 | 34.0 | 47.8 |
| 3/4 | 16.3 | 14.2 | 26.7 | 28.2 | 4.6 | 35.8 | 41.4 | 54.1 |
| 1 | 19.1 | 15.8 | 33.4 | 35.0 | 5.1 | 43.7 | 49.5 | 60.5 |
| 1 1/4 | 21.3 | 17.5 | 42.2 | 43.9 | 5.6 | 53.4 | 60.7 | 73.2 |
| 1 1/2 | 22.1 | 19.1 | 48.3 | 50.0 | 6.1 | 60.5 | 68.1 | 73.2 |
| 2 | 25.4 | 21.3 | 60.3 | 62.0 | 6.6 | 73.4 | 83.3 | 92.2 |
| 2 1/2 | 29.7 | 23.9 | 73.0 | 75.4 | 7.9 | 88.7 | 98.0 | 104.9 |
| 3 | 31.2 | 25.4 | 88.9 | 91.4 | 8.9 | 106.7 | 117.3 | 104.9 |

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

- (1) *H*₁ diameter is standard for coupling without bands; $H_1 = F \text{ min.} + 2G$.
- (2) Minimum *H* is for couplings with bands and is optional with the manufacturer. For information on ribs, see section 9.

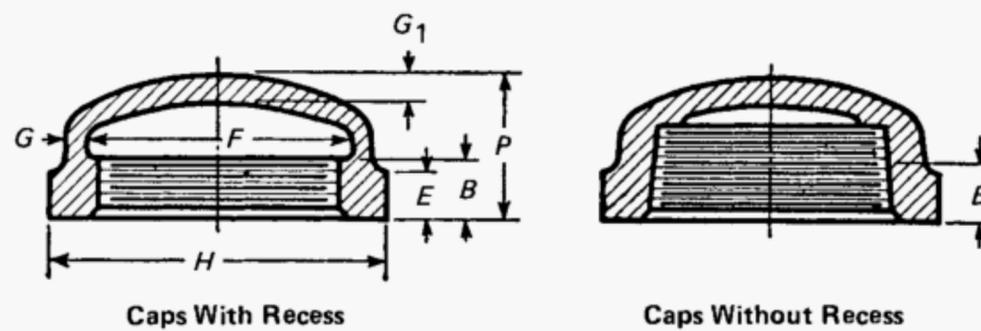
Table 15 Dimensions of Class 300 Reducing Couplings

| NPS | Length, W |
|------------------------------------|-----------|
| $\frac{3}{8} \times \frac{1}{4}$ | 36.6 |
| $\frac{1}{2} \times \frac{3}{8}$ | 42.9 |
| $\frac{1}{2} \times \frac{1}{4}$ | 42.9 |
| $\frac{3}{4} \times \frac{1}{2}$ | 44.5 |
| $\frac{3}{4} \times \frac{3}{8}$ | 44.5 |
| $\frac{3}{4} \times \frac{1}{4}$ | 44.5 |
| $1 \times \frac{3}{4}$ | 50.8 |
| $1 \times \frac{1}{2}$ | 50.8 |
| $1 \times \frac{3}{8}$ | 50.8 |
| $1 \times \frac{1}{4}$ | 50.8 |
| $1\frac{1}{4} \times 1$ | 60.5 |
| $1\frac{1}{4} \times \frac{3}{4}$ | 60.5 |
| $1\frac{1}{4} \times \frac{1}{2}$ | 60.5 |
| $1\frac{1}{2} \times 1\frac{1}{4}$ | 68.3 |
| $1\frac{1}{2} \times 1$ | 68.3 |
| $1\frac{1}{2} \times \frac{3}{4}$ | 68.3 |
| $1\frac{1}{2} \times \frac{1}{2}$ | 68.3 |
| $2 \times 1\frac{1}{2}$ | 81.0 |
| $2 \times 1\frac{1}{4}$ | 81.0 |
| 2×1 | 81.0 |
| $2 \times \frac{3}{4}$ | 81.0 |
| $2 \times \frac{1}{2}$ | 81.0 |
| $2\frac{1}{2} \times 2$ | 93.7 |
| $2\frac{1}{2} \times 1\frac{1}{2}$ | 93.7 |
| $3 \times 2\frac{1}{2}$ | 103.1 |
| 3×2 | 103.1 |
| $3 \times 1\frac{1}{2}$ | 103.1 |

GENERAL NOTES:

- (a) Dimensions are in millimeters.
- (b) For dimensions not given, see Table 11.
- (c) Reducing sizes of fittings for which dimensions are not given in the tables may be produced from regular patterns for listed sizes by sand bushing.

Table 16 Dimensions of Class 300 Caps



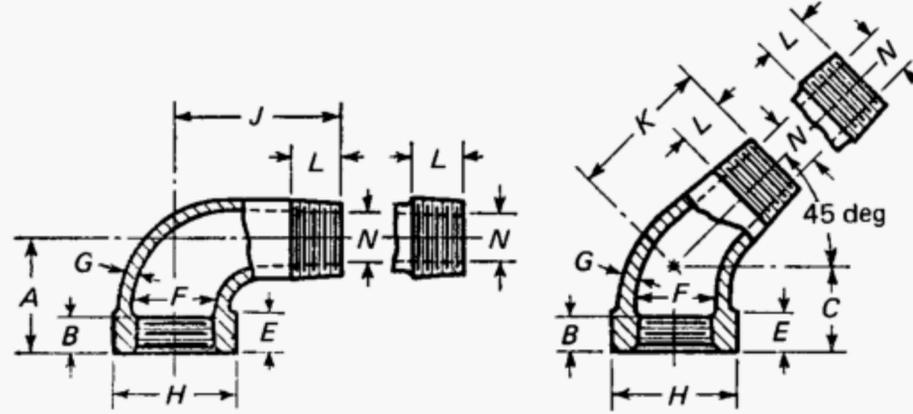
| NPS | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fittings, F | | Metal Thickness | | Minimum Outside Diameter of Band, H | Minimum Height, P [Note (2)] |
|----------------|-------------------------------|----------------------------|----------------------------------|------|-----------------|------------------------------|---------------------------------------|--------------------------------|
| | | | Min. | Max. | Minimum G | Recommended G_1 [Note (1)] | | |
| $\frac{1}{4}$ | 10.9 | 9.7 | 13.7 | 14.8 | 3.6 | 4.6 | 23.6 | 19.8 |
| $\frac{3}{8}$ | 11.9 | 11.2 | 17.1 | 18.3 | 3.8 | 4.8 | 28.5 | 21.1 |
| $\frac{1}{2}$ | 14.5 | 12.7 | 21.3 | 22.8 | 4.1 | 5.1 | 34.0 | 24.9 |
| $\frac{3}{4}$ | 16.3 | 14.2 | 26.7 | 28.2 | 4.6 | 5.8 | 41.4 | 27.4 |
| 1 | 19.1 | 15.8 | 33.4 | 35.0 | 5.1 | 6.4 | 48.5 | 32.0 |
| $1\frac{1}{4}$ | 21.3 | 17.5 | 42.2 | 43.9 | 5.6 | 7.1 | 60.7 | 35.1 |
| $1\frac{1}{2}$ | 22.1 | 19.1 | 48.3 | 50.0 | 6.1 | 7.6 | 68.1 | 36.3 |
| 2 | 25.4 | 21.3 | 60.3 | 62.1 | 6.6 | 8.4 | 83.3 | 42.7 |
| $2\frac{1}{2}$ | 29.7 | 23.9 | 73.0 | 75.6 | 7.9 | 9.9 | 98.0 | 52.3 |
| 3 | 31.2 | 25.4 | 88.9 | 91.4 | 8.9 | 11.2 | 117.3 | 55.1 |

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

- (1) Dimension G_1 is recommended but shall in no case be less than dimension G .
- (2) Dimension P may be varied to comply with manufacturer's practice, and, for caps without recess, shall be of such height that the length of effective thread shall be not less than B .

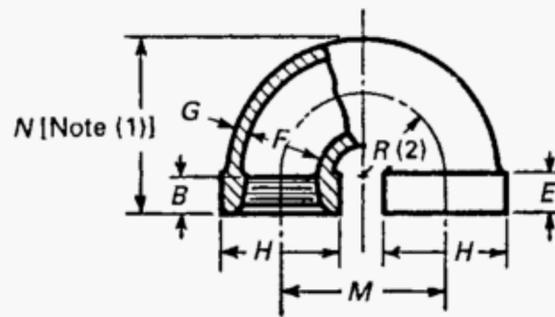
Table 17 Dimensions of Class 300, 90-deg and 45-deg Street Elbows



| NPS | 90-deg Elbows | | 45-deg Elbows | | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fitting, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> | Minimum Length of External Thread, <i>L</i> | Maximum Port Diameter Male End, <i>N</i> |
|-------|-------------------------|------------------------------|-------------------------|------------------------------|------------------------------------|---------------------------------|--------------------------------------|------|---------------------------|--|---|--|
| | Center-to-End, <i>A</i> | Center-to-Male End, <i>J</i> | Center-to-End, <i>C</i> | Center-to-Male End, <i>K</i> | | | Min. | Max. | | | | |
| 1/4 | 23.9 | 36.6 | ... | ... | 10.9 | 9.7 | 13.7 | 14.8 | 3.6 | 23.6 | 10.2 | 6.6 |
| 3/8 | 26.9 | 41.4 | ... | ... | 11.9 | 11.2 | 17.1 | 18.3 | 3.8 | 28.5 | 10.4 | 9.1 |
| 1/2 | 31.8 | 50.8 | 25.4 | 35.1 | 14.5 | 12.7 | 21.3 | 22.8 | 4.1 | 34.0 | 13.5 | 12.5 |
| 3/4 | 36.6 | 55.6 | 28.7 | 39.6 | 16.3 | 14.2 | 26.7 | 28.1 | 4.6 | 41.4 | 14.0 | 17.0 |
| 1 | 41.4 | 65.0 | 33.3 | 46.0 | 19.1 | 15.8 | 33.4 | 35.2 | 5.1 | 49.5 | 17.3 | 22.4 |
| 1 1/4 | 49.3 | 73.2 | 38.1 | 54.1 | 21.3 | 17.5 | 42.2 | 43.9 | 5.6 | 60.7 | 18.0 | 29.5 |
| 1 1/2 | 54.1 | 79.5 | 42.9 | 58.7 | 22.1 | 19.1 | 48.3 | 50.0 | 6.1 | 68.1 | 18.3 | 34.3 |
| 2 | 63.5 | 93.7 | 50.8 | 68.3 | 25.4 | 21.3 | 60.3 | 62.1 | 6.6 | 83.3 | 19.3 | 44.5 |
| 2 1/2 | 74.7 | 114.3 | ... | ... | 29.7 | 23.9 | 73.0 | 75.6 | 7.9 | 98.0 | 29.0 | 54.9 |
| 3 | 85.9 | 130.3 | ... | ... | 31.2 | 25.4 | 88.9 | 91.4 | 8.9 | 117.3 | 30.5 | 67.8 |

GENERAL NOTE: Dimensions are in millimeters.

Table 18 Dimensions of Class 300 Return Bends



| NPS | Center-to-Center, <i>M</i> | | | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fitting, <i>F</i> | | Metal Thickness, <i>G</i> [Note (3)] | Minimum Outside Diameter of Band, <i>H</i> |
|-------|----------------------------|----------------|--------------|------------------------------------|---------------------------------|--------------------------------------|------|--------------------------------------|--|
| | Closed Pattern | Medium Pattern | Open Pattern | | | Min. | Max. | | |
| 1 | 44.5 | 63.5 | 76.2 | 19.1 | 15.8 | 33.4 | 35.2 | 5.1 | 49.5 |
| 1 1/4 | 57.2 | 63.5 | 76.2 | 21.3 | 17.5 | 42.2 | 43.9 | 5.6 | 60.7 |
| 1 1/2 | 76.2 | 88.9 | 152.4 | 22.1 | 18.1 | 48.3 | 50.0 | 6.1 | 68.1 |
| 2 | 101.6 | 152.4 | 203.2 | 25.4 | 21.3 | 60.3 | 62.1 | 6.6 | 83.3 |

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

- (1) Dimension *N* may be varied to comply with manufacturer's practice.
- (2) It is recommended that the distance from the end of the fitting to the center of the radius, *R*, be approximately equal to the dimension *B*; radius, *R*, is recommended as being one-half of dimension *M*.
- (3) It is recommended that *G* for return bends be increased by 10% or more.

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MANDATORY APPENDIX I

DIMENSIONS OF FITTINGS IN U.S. CUSTOMARY UNITS

This Appendix provides tables of the standard inch dimensions for fittings (Tables I-1 through I-18).

Table I-1 Pressure–Temperature Ratings

| Temperature, °F | Working Pressure, psi | | | |
|-----------------|-----------------------|-----------|---------|---------|
| | Class 150 | Class 300 | | |
| | | NPS | | |
| | | 1/4-1 | 1 1/4-2 | 2 1/2-3 |
| -20 to 150 | 300 | 2,000 | 1,500 | 1,000 |
| 200 | 265 | 1,785 | 1,350 | 910 |
| 250 | 225 | 1,575 | 1,200 | 825 |
| 300 | 185 | 1,360 | 1,050 | 735 |
| 350 | 150 [Note (1)] | 1,150 | 900 | 650 |
| 400 | ... | 935 | 750 | 560 |
| 450 | ... | 725 | 600 | 475 |
| 500 | ... | 510 | 450 | 385 |
| 550 | ... | 300 | 300 | 300 |

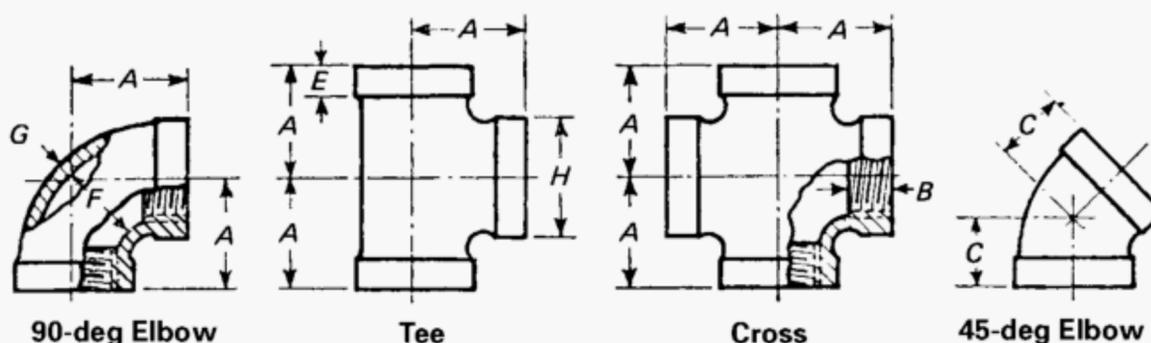
NOTE:

- (1) Permissible for service temperature up to 366°F, reflecting the temperature of saturated steam at 150 psi.

Table I-2 Inspection Tolerances

| NPS | Tolerance, in. |
|-----------------|----------------|
| 1/8 | ±0.03 |
| 1/4 | ±0.04 |
| 3/8 | ±0.05 |
| 1/2, 3/4 | ±0.06 |
| 1, 1 1/4 | ±0.07 |
| 1 1/2, 2 | ±0.08 |
| 2 1/2, 3, 3 1/2 | ±0.10 |
| 4, 5 | ±0.12 |
| 6 | ±0.14 |

Table I-3 Dimensions of Class 150, 90-deg Elbows, Tees, and Crosses, and 45-deg Elbows (Straight Sizes)



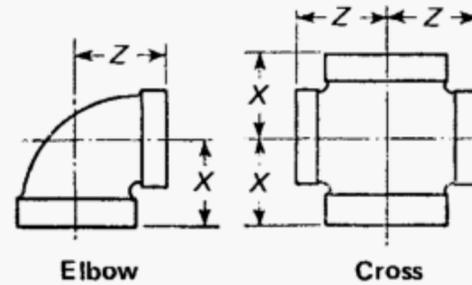
| NPS | Center-to-End, Elbows, Tees, and Crosses, A [Note (1)] | Center-to-End 45-deg Elbows, C | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fitting, F | | Metal Thickness, G | Minimum Outside Diameter of Band, H |
|-------|--|--------------------------------|-----------------------------|--------------------------|-------------------------------|------|--------------------|-------------------------------------|
| | | | | | Min. | Max. | | |
| 1/8 | 0.69 | ... | 0.25 | 0.20 | 0.40 | 0.43 | 0.09 | 0.69 |
| 1/4 | 0.81 | 0.73 | 0.32 | 0.21 | 0.54 | 0.58 | 0.09 | 0.84 |
| 3/8 | 0.95 | 0.80 | 0.36 | 0.23 | 0.67 | 0.72 | 0.10 | 1.01 |
| 1/2 | 1.12 | 0.88 | 0.43 | 0.25 | 0.84 | 0.90 | 0.10 | 1.20 |
| 3/4 | 1.31 | 0.98 | 0.50 | 0.27 | 1.05 | 1.11 | 0.12 | 1.46 |
| 1 | 1.50 | 1.12 | 0.58 | 0.30 | 1.31 | 1.38 | 0.13 | 1.77 |
| 1 1/4 | 1.75 | 1.29 | 0.67 | 0.34 | 1.66 | 1.73 | 0.14 | 2.15 |
| 1 1/2 | 1.94 | 1.43 | 0.70 | 0.37 | 1.90 | 1.97 | 0.15 | 2.43 |
| 2 | 2.25 | 1.68 | 0.75 | 0.42 | 2.37 | 2.44 | 0.17 | 2.96 |
| 2 1/2 | 2.70 | 1.95 | 0.92 | 0.48 | 2.87 | 2.97 | 0.21 | 3.59 |
| 3 | 3.08 | 2.17 | 0.98 | 0.55 | 3.50 | 3.60 | 0.23 | 4.28 |
| 3 1/2 | 3.42 | 2.39 | 1.03 | 0.60 | 4.00 | 4.10 | 0.25 | 4.84 |
| 4 | 3.79 | 2.61 | 1.08 | 0.66 | 4.50 | 4.60 | 0.26 | 5.40 |
| 5 | 4.50 | 3.05 | 1.18 | 0.78 | 5.56 | 5.66 | 0.30 | 6.58 |
| 6 | 5.13 | 3.46 | 1.28 | 0.90 | 6.62 | 6.72 | 0.34 | 7.77 |

GENERAL NOTE: Dimensions are in inches.

NOTE:

(1) Dimensions for reducing elbows and reducing crosses are given in Table I-4 and dimensions for reducing tees in Table I-5.

Table I-4 Dimensions of Class 150, 90-deg Elbows and Crosses (Reducing Sizes)

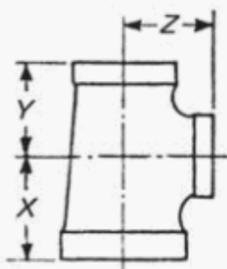


| Elbows | | | Crosses | | |
|------------------------------------|---------------|------|--|---------------|------|
| NPS | Center-to-End | | NPS | Center-to-End | |
| | X | Z | | X | Z |
| $\frac{1}{4} \times \frac{1}{8}$ | 0.74 | 0.76 | $\frac{3}{4} \times \frac{3}{4} \times \frac{1}{2} \times \frac{1}{2}$ | 1.20 | 1.22 |
| $\frac{3}{8} \times \frac{1}{4}$ | 0.88 | 0.90 | $1 \times 1 \times \frac{3}{4} \times \frac{3}{4}$ | 1.37 | 1.45 |
| $\frac{3}{8} \times \frac{1}{8}$ | 0.81 | 0.85 | $1 \times 1 \times \frac{1}{2} \times \frac{1}{2}$ | 1.26 | 1.36 |
| $\frac{1}{2} \times \frac{3}{8}$ | 1.04 | 1.03 | $1\frac{1}{4} \times 1\frac{1}{4} \times 1 \times 1$ | 1.58 | 1.67 |
| $\frac{1}{2} \times \frac{1}{4}$ | 0.97 | 0.98 | $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{3}{4} \times \frac{3}{4}$ | 1.45 | 1.62 |
| $\frac{3}{4} \times \frac{1}{2}$ | 1.20 | 1.22 | $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{4} \times 1\frac{1}{4}$ | 1.82 | 1.88 |
| $\frac{3}{4} \times \frac{3}{8}$ | 1.12 | 1.13 | $1\frac{1}{2} \times 1\frac{1}{2} \times 1 \times 1$ | 1.65 | 1.80 |
| $\frac{3}{4} \times \frac{1}{4}$ | 1.05 | 1.08 | $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4} \times \frac{3}{4}$ | 1.52 | 1.75 |
| $1 \times \frac{3}{4}$ | 1.37 | 1.45 | $2 \times 2 \times 1\frac{1}{2} \times 1\frac{1}{2}$ | 2.02 | 2.16 |
| $1 \times \frac{1}{2}$ | 1.26 | 1.36 | $2 \times 2 \times 1\frac{1}{4} \times 1\frac{1}{4}$ | 1.90 | 2.10 |
| $1 \times \frac{3}{8}$ | 1.18 | 1.27 | $2 \times 2 \times 1 \times 1$ | 1.73 | 2.02 |
| $1\frac{1}{4} \times 1$ | 1.58 | 1.67 | $2 \times 2 \times \frac{3}{4} \times \frac{3}{4}$ | 1.60 | 1.97 |
| $1\frac{1}{4} \times \frac{3}{4}$ | 1.45 | 1.62 | $2\frac{1}{2} \times 2\frac{1}{2} \times 2 \times 2$ | 2.39 | 2.60 |
| $1\frac{1}{4} \times \frac{1}{2}$ | 1.34 | 1.53 | $3 \times 3 \times 2 \times 2$ | 2.52 | 2.89 |
| $1\frac{1}{2} \times 1\frac{1}{4}$ | 1.82 | 1.88 | | | |
| $1\frac{1}{2} \times 1$ | 1.65 | 1.80 | | | |
| $1\frac{1}{2} \times \frac{3}{4}$ | 1.52 | 1.75 | | | |
| $2 \times 1\frac{1}{2}$ | 2.02 | 2.16 | | | |
| $2 \times 1\frac{1}{4}$ | 1.90 | 2.10 | | | |
| 2×1 | 1.73 | 2.02 | | | |
| $2 \times \frac{3}{4}$ | 1.60 | 1.97 | | | |
| $2\frac{1}{2} \times 2$ | 2.39 | 2.60 | | | |
| $2\frac{1}{2} \times 1\frac{1}{2}$ | 2.16 | 2.51 | | | |
| $3 \times 2\frac{1}{2}$ | 2.83 | 2.99 | | | |
| 3×2 | 2.52 | 2.89 | | | |
| 4×3 | 3.30 | 3.60 | | | |

GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For dimensions not given, see Table I-3.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

Table I-5 Dimensions of Class 150 Tees (Reducing Sizes)

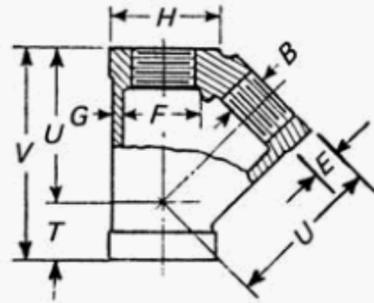


| NPS | Center-to-End | | | NPS | Center-to-End | | | | NPS | Center-to-End | | |
|---------------------|---------------|------|------|-----------------------|---------------|------|------|-----------------------|------|---------------|------|--|
| | X | Y | Z | | X | Y | Z | X | | Y | Z | |
| 1/4 x 1/4 x 1/8 | 0.74 | 0.74 | 0.76 | 1 1/4 x 1 x 1 | 1.58 | 1.50 | 1.67 | 2 x 3/4 x 2 | 2.25 | 1.97 | 2.25 | |
| 1/8 x 1/8 x 1/4 | 0.76 | 0.76 | 0.74 | 1 1/4 x 1 x 3/4 | 1.45 | 1.37 | 1.62 | 2 x 1/2 x 2 | 2.25 | 1.88 | 2.25 | |
| 3/8 x 3/8 x 1/4 | 0.88 | 0.88 | 0.90 | 1 1/4 x 1 x 1/2 | 1.34 | 1.26 | 1.53 | 1 1/2 x 1 1/2 x 2 | 2.16 | 2.16 | 2.02 | |
| 3/8 x 3/8 x 1/8 | 0.81 | 0.81 | 0.85 | 1 1/4 x 3/4 x 1 1/4 | 1.75 | 1.62 | 1.75 | 1 1/4 x 1 1/4 x 2 | 2.10 | 2.10 | 1.90 | |
| 3/8 x 1/4 x 3/8 | 0.95 | 0.90 | 0.95 | 1 1/4 x 3/4 x 1 | 1.58 | 1.45 | 1.67 | 1 x 1 x 2 | 2.02 | 2.02 | 1.73 | |
| 3/8 x 1/4 x 1/4 | 0.88 | 0.81 | 0.90 | 1 1/4 x 3/4 x 3/4 | 1.45 | 1.31 | 1.62 | 2 1/2 x 2 1/2 x 2 | 2.39 | 2.39 | 2.60 | |
| 1/4 x 1/4 x 3/8 | 0.90 | 0.90 | 0.88 | 1 1/4 x 1/2 x 1 1/4 | 1.75 | 1.53 | 1.75 | 2 1/2 x 2 1/2 x 1 1/2 | 2.16 | 2.16 | 2.51 | |
| 1/2 x 1/2 x 3/8 | 1.04 | 1.04 | 1.03 | 1 1/4 x 1/2 x 1 | 1.58 | 1.36 | 1.67 | 2 1/2 x 2 1/2 x 1 1/4 | 2.04 | 2.04 | 2.45 | |
| 1/2 x 1/2 x 1/4 | 0.97 | 0.97 | 0.98 | 1 x 1 x 1 1/4 | 1.67 | 1.67 | 1.58 | 2 1/2 x 2 1/2 x 1 | 1.87 | 1.87 | 2.37 | |
| 1/2 x 3/8 x 1/2 | 1.12 | 1.03 | 1.12 | 3/4 x 3/4 x 1 1/4 | 1.62 | 1.62 | 1.45 | 2 1/2 x 2 1/2 x 3/4 | 1.74 | 1.74 | 2.32 | |
| 1/2 x 3/8 x 3/8 | 1.04 | 0.95 | 1.03 | 1 1/2 x 1 1/2 x 1 1/4 | 1.82 | 1.82 | 1.88 | 2 1/2 x 2 x 2 1/2 | 2.70 | 2.60 | 2.70 | |
| 1/2 x 1/4 x 1/2 | 1.12 | 0.98 | 1.12 | 1 1/2 x 1 1/2 x 1 | 1.65 | 1.65 | 1.80 | 2 1/2 x 2 x 2 | 2.39 | 2.25 | 2.60 | |
| 3/8 x 3/8 x 1/2 | 1.03 | 1.03 | 1.04 | 1 1/2 x 1 1/2 x 3/4 | 1.52 | 1.52 | 1.75 | 2 1/2 x 1 1/2 x 2 1/2 | 2.70 | 2.51 | 2.70 | |
| 3/4 x 3/4 x 1/2 | 1.20 | 1.20 | 1.22 | 1 1/2 x 1 1/2 x 1/2 | 1.41 | 1.41 | 1.66 | 2 1/2 x 1 1/2 x 2 | 2.39 | 2.16 | 2.60 | |
| 3/4 x 3/4 x 3/8 | 1.12 | 1.12 | 1.13 | 1 1/2 x 1 1/4 x 1 1/2 | 1.94 | 1.88 | 1.94 | 2 x 2 x 2 1/2 | 2.60 | 2.60 | 2.39 | |
| 3/4 x 3/4 x 1/4 | 1.05 | 1.05 | 1.08 | 1 1/2 x 1 1/4 x 1 1/4 | 1.82 | 1.75 | 1.88 | 3 x 3 x 2 1/2 | 2.83 | 2.83 | 2.99 | |
| 3/4 x 1/2 x 3/4 | 1.31 | 1.22 | 1.31 | 1 1/2 x 1 1/4 x 1 | 1.65 | 1.58 | 1.80 | 3 x 3 x 2 | 2.52 | 2.52 | 2.89 | |
| 3/4 x 1/2 x 1/2 | 1.20 | 1.12 | 1.22 | 1 1/2 x 1 1/4 x 3/4 | 1.52 | 1.45 | 1.75 | 3 x 3 x 1 1/2 | 2.29 | 2.29 | 2.80 | |
| 3/4 x 1/2 x 3/8 | 1.12 | 1.04 | 1.13 | 1 1/2 x 1 1/4 x 1/2 | 1.41 | 1.34 | 1.66 | 3 x 3 x 1 1/4 | 2.17 | 2.17 | 2.74 | |
| 3/4 x 3/8 x 3/4 | 1.31 | 1.13 | 1.31 | 1 1/2 x 1 x 1 1/2 | 1.94 | 1.80 | 1.94 | 3 x 3 x 1 | 2.00 | 2.00 | 2.66 | |
| 3/4 x 3/8 x 3/8 | 1.12 | 0.95 | 1.13 | 1 1/2 x 1 x 1 1/4 | 1.82 | 1.67 | 1.88 | 3 x 3 x 3/4 | 1.87 | 1.87 | 2.61 | |
| 3/4 x 1/4 x 3/4 | 1.31 | 1.08 | 1.31 | 1 1/2 x 1 x 1 | 1.65 | 1.50 | 1.80 | 3 x 2 1/2 x 3 | 3.08 | 2.99 | 3.08 | |
| 1/2 x 1/2 x 3/4 | 1.22 | 1.22 | 1.20 | 1 1/2 x 3/4 x 1 1/2 | 1.94 | 1.75 | 1.94 | 3 x 2 1/2 x 2 1/2 | 2.83 | 2.70 | 2.99 | |
| 1 x 1 x 3/4 | 1.37 | 1.37 | 1.45 | 1 1/2 x 1/2 x 1 1/2 | 1.94 | 1.66 | 1.94 | 3 x 2 1/2 x 2 | 2.52 | 2.39 | 2.89 | |
| 1 x 1 x 1/2 | 1.26 | 1.26 | 1.36 | 1 1/4 x 1 1/4 x 1 1/2 | 1.88 | 1.88 | 1.82 | 3 x 2 x 3 | 3.08 | 2.89 | 3.08 | |
| 1 x 1 x 3/8 | 1.18 | 1.18 | 1.27 | 1 x 1 x 1 1/2 | 1.80 | 1.80 | 1.65 | 3 x 2 x 2 | 2.52 | 2.25 | 2.89 | |
| 1 x 1 x 1/4 | 1.11 | 1.11 | 1.22 | 2 x 2 x 1 1/2 | 2.02 | 2.02 | 2.16 | 2 1/2 x 2 1/2 x 3 | 2.99 | 2.99 | 2.83 | |
| 1 x 3/4 x 1 | 1.50 | 1.45 | 1.50 | 2 x 2 x 1 1/4 | 1.90 | 1.90 | 2.10 | 3 1/2 x 3 1/2 x 2 1/2 | 2.93 | 2.93 | 3.24 | |
| 1 x 3/4 x 3/4 | 1.37 | 1.31 | 1.45 | 2 x 2 x 1 | 1.73 | 1.73 | 2.02 | 4 x 4 x 3 | 3.30 | 3.30 | 3.60 | |
| 1 x 3/4 x 1/2 | 1.26 | 1.20 | 1.36 | 2 x 2 x 3/4 | 1.60 | 1.60 | 1.97 | 4 x 4 x 2 1/2 | 3.05 | 3.05 | 3.51 | |
| 1 x 1/2 x 1 | 1.50 | 1.36 | 1.50 | 2 x 2 x 1/2 | 1.49 | 1.49 | 1.88 | 4 x 4 x 2 | 2.74 | 2.74 | 3.41 | |
| 1 x 1/2 x 3/4 | 1.37 | 1.22 | 1.45 | 2 x 1 1/2 x 2 | 2.25 | 2.16 | 2.25 | 4 x 4 x 1 1/2 | 2.51 | 2.51 | 3.32 | |
| 1 x 1/2 x 1/2 | 1.26 | 1.12 | 1.36 | 2 x 1 1/2 x 1 1/2 | 2.02 | 1.94 | 2.16 | 4 x 3 x 4 | 3.79 | 3.60 | 3.79 | |
| 3/4 x 3/4 x 1 | 1.45 | 1.45 | 1.37 | 2 x 1 1/2 x 1 1/4 | 1.90 | 1.82 | 2.10 | 3 x 3 x 4 | 3.60 | 3.60 | 3.30 | |
| 1/2 x 1/2 x 1 | 1.36 | 1.36 | 1.26 | 2 x 1 1/2 x 1 | 1.73 | 1.65 | 2.02 | 5 x 5 x 3 | 3.51 | 3.51 | 4.22 | |
| 1 1/4 x 1 1/4 x 1 | 1.58 | 1.58 | 1.67 | 2 x 1 1/4 x 2 | 2.25 | 2.10 | 2.25 | 6 x 6 x 4 | 4.13 | 4.13 | 4.94 | |
| 1 1/4 x 1 1/4 x 3/4 | 1.45 | 1.45 | 1.62 | 2 x 1 1/4 x 1 1/2 | 2.02 | 1.88 | 2.16 | 6 x 6 x 3 | 3.64 | 3.64 | 4.75 | |
| 1 1/4 x 1 1/4 x 1/2 | 1.34 | 1.34 | 1.53 | 2 x 1 1/4 x 1 1/4 | 1.90 | 1.75 | 2.10 | 6 x 6 x 2 1/2 | 3.39 | 3.39 | 4.66 | |
| 1 1/4 x 1 1/4 x 3/8 | 1.26 | 1.26 | 1.44 | 2 x 1 x 2 | 2.25 | 2.02 | 2.25 | 6 x 6 x 2 | 3.08 | 3.08 | 4.56 | |
| 1 1/4 x 1 x 1 1/4 | 1.75 | 1.67 | 1.75 | 2 x 1 x 1 1/2 | 2.02 | 1.80 | 2.16 | | | | | |

GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For dimensions not given, see Table I-3.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

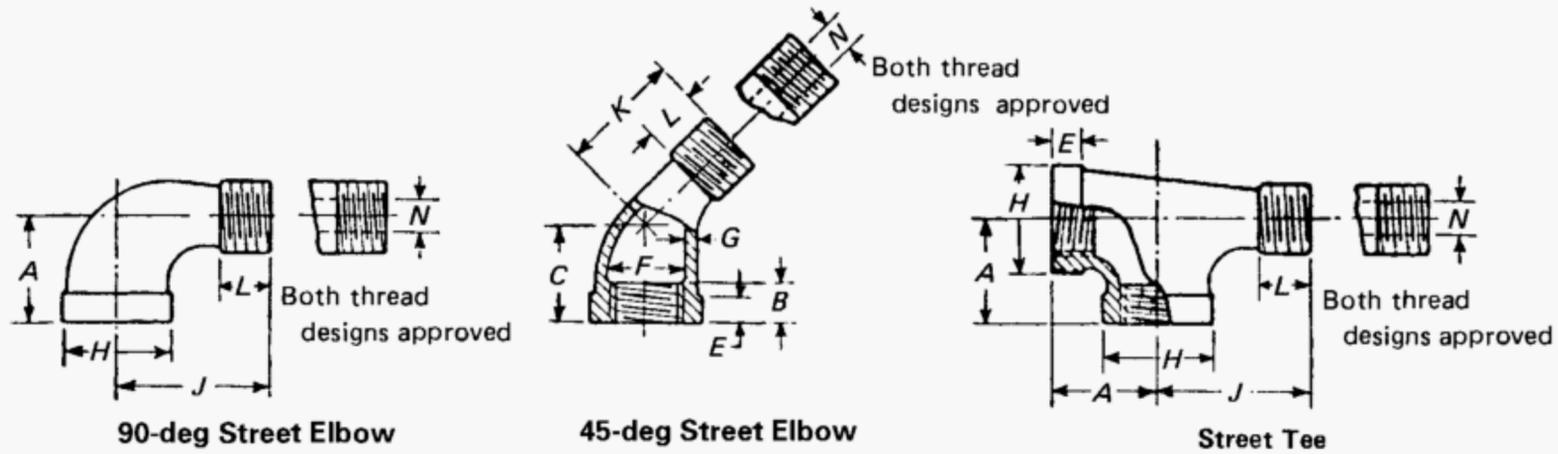
Table I-6 Dimensions of Class 150, 45-deg Y-Branches (Straight Sizes)



| NPS | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fittings, F | | Metal Thickness, G | Minimum Outside Diameter of Band, H | Center-to-End Inlet, T | Center-to-End Outlet, U | End-to-End, V |
|----------------|-------------------------------|----------------------------|----------------------------------|------|----------------------|---------------------------------------|--------------------------|---------------------------|-----------------|
| | | | Min. | Max. | | | | | |
| $\frac{3}{8}$ | 0.36 | 0.23 | 0.67 | 0.72 | 0.10 | 1.01 | 0.50 | 1.43 | 1.93 |
| $\frac{1}{2}$ | 0.43 | 0.25 | 0.84 | 0.90 | 0.10 | 1.20 | 0.61 | 1.71 | 2.32 |
| $\frac{3}{4}$ | 0.50 | 0.27 | 1.05 | 1.11 | 0.12 | 1.46 | 0.72 | 2.05 | 2.77 |
| 1 | 0.58 | 0.30 | 1.31 | 1.38 | 0.13 | 1.77 | 0.85 | 2.43 | 3.28 |
| $1\frac{1}{4}$ | 0.67 | 0.34 | 1.66 | 1.73 | 0.14 | 2.15 | 1.02 | 2.92 | 3.94 |
| $1\frac{1}{2}$ | 0.70 | 0.37 | 1.90 | 1.97 | 0.15 | 2.43 | 1.10 | 3.28 | 4.38 |
| 2 | 0.75 | 0.42 | 2.37 | 2.44 | 0.17 | 2.96 | 1.24 | 3.93 | 5.17 |
| $2\frac{1}{2}$ | 0.92 | 0.48 | 2.87 | 2.97 | 0.21 | 3.59 | 1.52 | 4.73 | 6.25 |
| 3 | 0.98 | 0.55 | 3.50 | 3.60 | 0.23 | 4.28 | 1.71 | 5.55 | 7.26 |
| 4 | 1.08 | 0.66 | 4.50 | 4.60 | 0.26 | 5.40 | 2.01 | 6.97 | 8.98 |

GENERAL NOTE: Dimensions are in inches.

Table I-7 Dimensions of Class 150 Street Tees and 90-deg and 45-deg Street Elbows



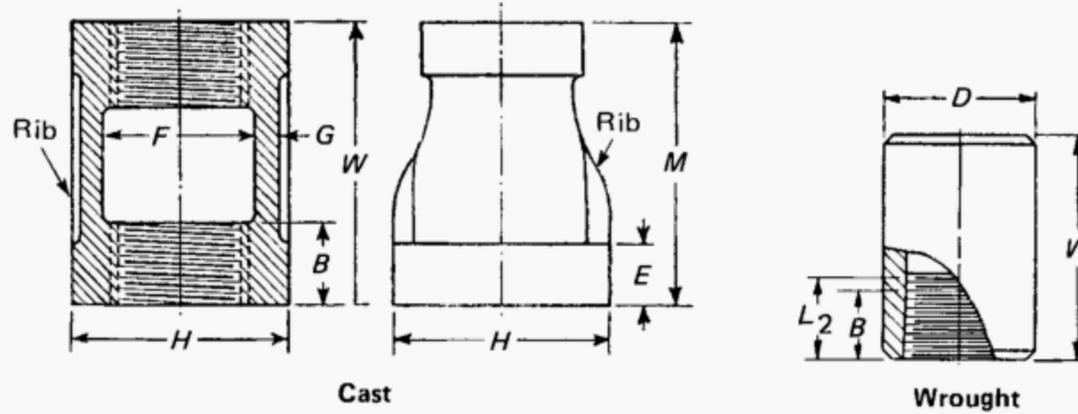
| NPS | Center-to-End, Elbows and Tees, A | Center-to-End 45-deg Elbows, C | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fittings, F | | Metal Thickness, G | Minimum Outside Diameter of Band, H | Center-to-Male End Elbows and Tees, J | Center-to-Male End 45-deg Elbows, K | Minimum Length of External Thread, L | Maximum Port Diameter Male End, N |
|-------|-----------------------------------|--------------------------------|-----------------------------|--------------------------|--------------------------------|------|--------------------|-------------------------------------|---------------------------------------|-------------------------------------|--------------------------------------|-----------------------------------|
| | | | | | Min. | Max. | | | | | | |
| 1/8 | 0.69 [Note (1)] | ... | 0.25 | 0.20 | 0.40 | 0.43 | 0.09 | 0.69 | 1.00 [Note (1)] | ... | 0.26 | 0.20 |
| 1/4 | 0.81 | 0.73 | 0.32 | 0.21 | 0.54 | 0.58 | 0.09 | 0.84 | 1.19 | 0.94 | 0.40 | 0.26 |
| 3/8 | 0.95 | 0.80 | 0.36 | 0.23 | 0.67 | 0.72 | 0.10 | 1.01 | 1.44 | 1.03 | 0.41 | 0.37 |
| 1/2 | 1.12 | 0.88 | 0.43 | 0.25 | 0.84 | 0.90 | 0.10 | 1.20 | 1.63 | 1.15 | 0.53 | 0.51 |
| 3/4 | 1.31 | 0.98 | 0.50 | 0.27 | 1.05 | 1.11 | 0.12 | 1.46 | 1.89 | 1.29 | 0.55 | 0.69 |
| 1 | 1.50 | 1.12 | 0.58 | 0.30 | 1.31 | 1.38 | 0.13 | 1.77 | 2.14 | 1.47 | 0.68 | 0.91 |
| 1 1/4 | 1.75 | 1.29 | 0.67 | 0.34 | 1.66 | 1.73 | 0.14 | 2.15 | 2.45 | 1.71 | 0.71 | 1.19 |
| 1 1/2 | 1.94 | 1.43 | 0.70 | 0.37 | 1.90 | 1.97 | 0.15 | 2.43 | 2.69 | 1.88 | 0.72 | 1.39 |
| 2 | 2.25 | 1.68 | 0.75 | 0.42 | 2.37 | 2.44 | 0.17 | 2.96 | 3.26 | 2.22 | 0.76 | 1.79 |
| 2 1/2 | 2.70 [Note (1)] | 1.95 | 0.92 | 0.48 | 2.87 | 2.97 | 0.21 | 3.59 | 3.86 [Note (1)] | 2.57 | 1.14 | 2.20 |
| 3 | 3.08 [Note (1)] | 2.17 | 0.98 | 0.55 | 3.50 | 3.60 | 0.23 | 4.28 | 4.51 [Note (1)] | 3.00 | 1.20 | 2.78 |
| 4 | 3.79 | 2.61 | 1.08 | 0.66 | 4.50 | 4.60 | 0.26 | 5.40 | 5.69 | 3.70 | 1.30 | 3.70 |
| 5 | 4.50 [Note (1)] | ... | 1.18 | 0.78 | 5.56 | 5.66 | 0.30 | 6.58 | 6.86 [Note (1)] | ... | 1.41 | 4.69 |
| 6 | 5.13 [Note (1)] | ... | 1.28 | 0.90 | 6.62 | 6.72 | 0.34 | 7.77 | 8.03 [Note (1)] | ... | 1.51 | 5.67 |

GENERAL NOTE: Dimensions are in inches.

NOTE:

(1) This dimension applies to street elbows only. Street tees are not made in these sizes.

Table I-8 Dimensions of Class 150 Couplings (Straight and Reducing Sizes)



| NPS | Minimum Length of Thread, | | Minimum Width of Band, <i>E</i> | Inside Diameter of Fittings, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> | Thick-ness of Ribs | Length of Straight Couplings, <i>W</i> | Length of Reducing Concentric Couplings, <i>M</i> [Notes (1) and (2)] | Steel Couplings [Notes (2) and (3)] | |
|-------|---------------------------|-----------------------|---------------------------------|---------------------------------------|------|---------------------------|--|--------------------|--|---|-------------------------------------|----------------------------|
| | <i>B</i> | <i>L</i> ₂ | | Min. | Max. | | | | | | Length, <i>W</i> | Outside Diameter, <i>D</i> |
| 1/8 | 0.25 | 0.2639 | 0.20 | 0.40 | 0.43 | 0.09 | 0.69 | 0.09 | 0.96 | ... | 0.81 | 0.56 |
| 1/4 | 0.32 | 0.4018 | 0.21 | 0.54 | 0.58 | 0.09 | 0.84 | 0.09 | 1.06 | 1.00 | 1.19 | 0.72 |
| 3/8 | 0.36 | 0.4078 | 0.23 | 0.67 | 0.72 | 0.10 | 1.01 | 0.10 | 1.16 | 1.13 | 1.19 | 0.87 |
| 1/2 | 0.43 | ... | 0.25 | 0.84 | 0.90 | 0.10 | 1.20 | 0.10 | 1.34 | 1.25 | ... | ... |
| 3/4 | 0.50 | ... | 0.27 | 1.05 | 1.11 | 0.12 | 1.46 | 0.12 | 1.52 | 1.44 | ... | ... |
| 1 | 0.58 | ... | 0.30 | 1.31 | 1.38 | 0.13 | 1.77 | 0.13 | 1.67 | 1.69 | ... | ... |
| 1 1/4 | 0.67 | ... | 0.34 | 1.66 | 1.73 | 0.14 | 2.15 | 0.14 | 1.93 | 2.06 | ... | ... |
| 1 1/2 | 0.70 | ... | 0.37 | 1.90 | 1.97 | 0.15 | 2.43 | 0.15 | 2.15 | 2.31 | ... | ... |
| 2 | 0.75 | ... | 0.42 | 2.37 | 2.44 | 0.17 | 2.96 | 0.17 | 2.53 | 2.81 | ... | ... |
| 2 1/2 | 0.92 | ... | 0.48 | 2.87 | 2.97 | 0.21 | 3.59 | 0.21 | 2.88 | 3.25 | ... | ... |
| 3 | 0.98 | ... | 0.55 | 3.50 | 3.60 | 0.23 | 4.28 | 0.23 | 3.18 | 3.69 | ... | ... |
| 4 | 1.08 | ... | 0.66 | 4.50 | 4.60 | 0.26 | 5.40 | 0.26 | 3.69 | 4.38 | ... | ... |

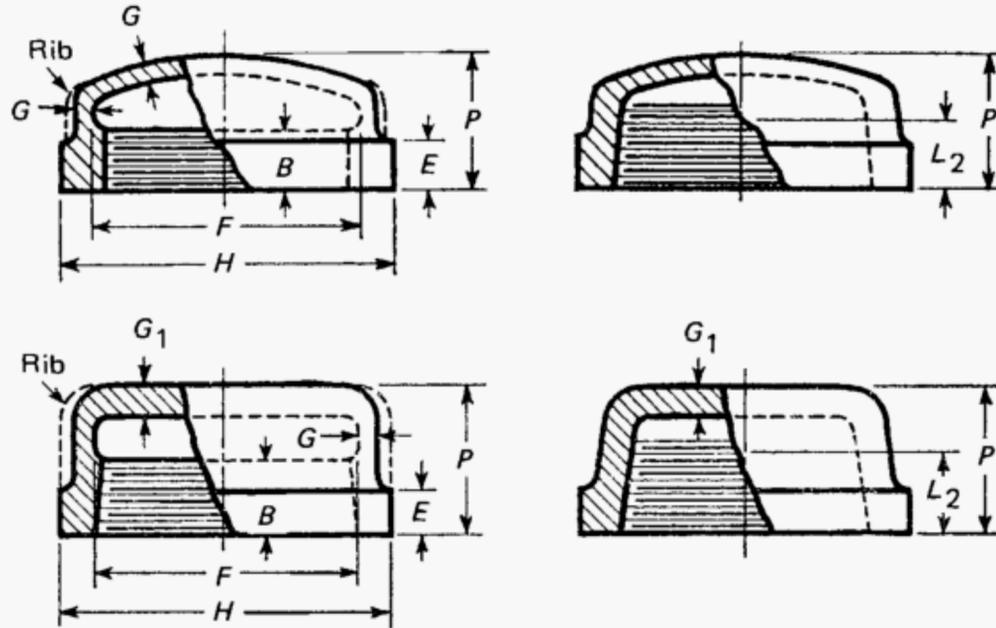
GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) Right- and left-hand pattern couplings are standard only in sizes up to and including NPS 2.

NOTES:

- (1) Dimension *M* for all reduction of reducing couplings (concentric only) shall be the same as shown for the largest opening. Dimension *M* for eccentric couplings is not standard; such information should be obtained from the manufacturer.
- (2) Couplings NPS 3/8 and smaller may be cast or made from steel rod with a minimum yield strength of 30 ksi at the option of the manufacturer.
- (3) Steel couplings are made without recess. Dimension *B* for steel couplings is the minimum length of perfect thread, and the length of useful thread (*B* plus threads with fully formed roots and flat crests) shall be not less than *L*₂ (effective length of external thread) required by ANSI/ASME B1.20.1. See section 8.

Table I-9 Dimensions of Class 150 Caps



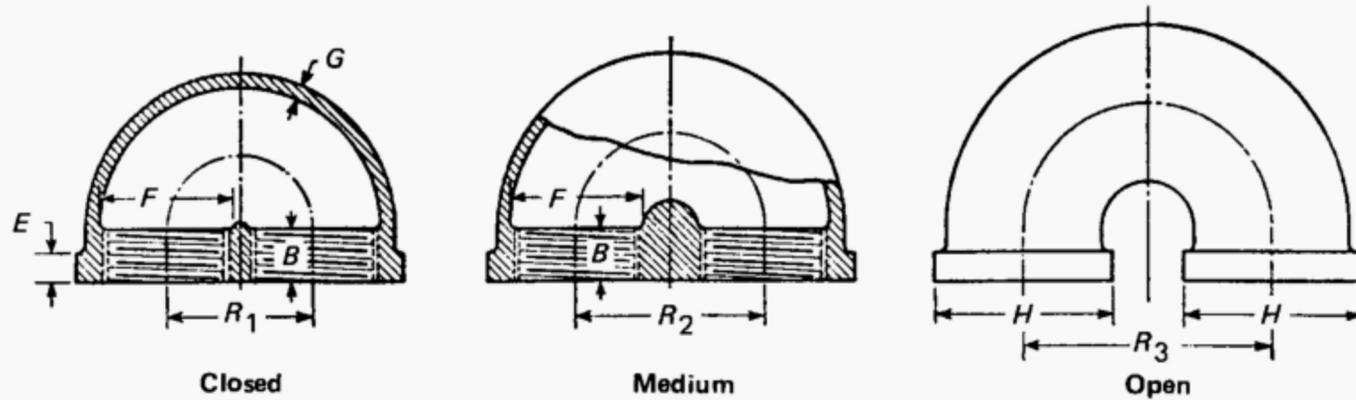
| NPS | Minimum Length of Thread | | Minimum Width of Band, E | Inside Diameter of Fittings, F | | Metal Thickness of Side, G | Minimum Outside Diameter of Band, H [Note (1)] | Minimum Height, P [Note (2)] | Thickness of Ribs | Thickness of Flat Top Caps, G ₁ |
|-------|--------------------------|----------------|--------------------------|--------------------------------|------|----------------------------|--|------------------------------|-------------------|--|
| | B | L ₂ | | Min. | Max. | | | | | |
| 1/8 | 0.25 | 0.2639 | 0.20 | 0.40 | 0.43 | 0.09 | 0.69 | 0.53 | ... | ... |
| 1/4 | 0.32 | 0.4018 | 0.21 | 0.54 | 0.58 | 0.09 | 0.84 | 0.63 | ... | ... |
| 3/8 | 0.36 | 0.4078 | 0.23 | 0.67 | 0.72 | 0.10 | 1.01 | 0.74 | ... | ... |
| 1/2 | 0.43 | 0.5337 | 0.25 | 0.84 | 0.90 | 0.10 | 1.20 | 0.87 | 0.10 | ... |
| 3/4 | 0.50 | 0.5457 | 0.27 | 1.05 | 1.11 | 0.12 | 1.46 | 0.97 | 0.12 | 0.13 |
| 1 | 0.58 | 0.6828 | 0.30 | 1.31 | 1.38 | 0.13 | 1.77 | 1.16 | 0.13 | 0.15 |
| 1 1/4 | 0.67 | 0.7068 | 0.34 | 1.66 | 1.73 | 0.14 | 2.15 | 1.28 | 0.14 | 0.17 |
| 1 1/2 | 0.70 | 0.7235 | 0.37 | 1.90 | 1.97 | 0.15 | 2.43 | 1.33 | 0.15 | 0.19 |
| 2 | 0.75 | 0.7565 | 0.42 | 2.37 | 2.44 | 0.17 | 2.46 | 1.45 | 0.17 | 0.22 |
| 2 1/2 | 0.92 | 1.1375 | 0.48 | 2.87 | 2.97 | 0.21 | 3.59 | 1.70 | 0.21 | 0.25 |
| 3 | 0.98 | 1.2000 | 0.55 | 3.50 | 3.60 | 0.23 | 4.28 | 1.80 | 0.23 | 0.29 |
| 3 1/2 | 1.03 | 1.2500 | 0.60 | 4.00 | 4.10 | 0.25 | 4.84 | 1.90 | 0.25 | 0.30 |
| 4 | 1.08 | 1.3000 | 0.66 | 4.50 | 4.60 | 0.26 | 5.40 | 2.08 | 0.26 | 0.36 |
| 5 | 1.18 | 1.4063 | 0.78 | 5.56 | 5.66 | 0.30 | 6.58 | 2.32 | 0.30 | ... |
| 6 | 1.28 | 1.5125 | 0.90 | 6.62 | 6.72 | 0.34 | 7.77 | 2.55 | 0.34 | ... |

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) Caps sizes 1/8, 1/4, and 3/8 may be malleable castings or made from steel rod with a minimum yield strength of 30 ksi at the option of the manufacturer. When made from steel rod, diameters shall be 0.50, 0.69, and 0.84, respectively. Caps made from steel rod have no recess.
- (2) Caps may be made without recess. Caps so made shall be of such height, P, that the length of perfect thread shall be not less than B, and the length of useful thread (B plus threads with fully formed roots and flat crests) shall be not less than L₂ (effective length of external thread) required by ANSI/ASME B1.20.1.

Table I-10 Dimensions of Class 150, Closed-, Medium-, and Open-Pattern Return Bends

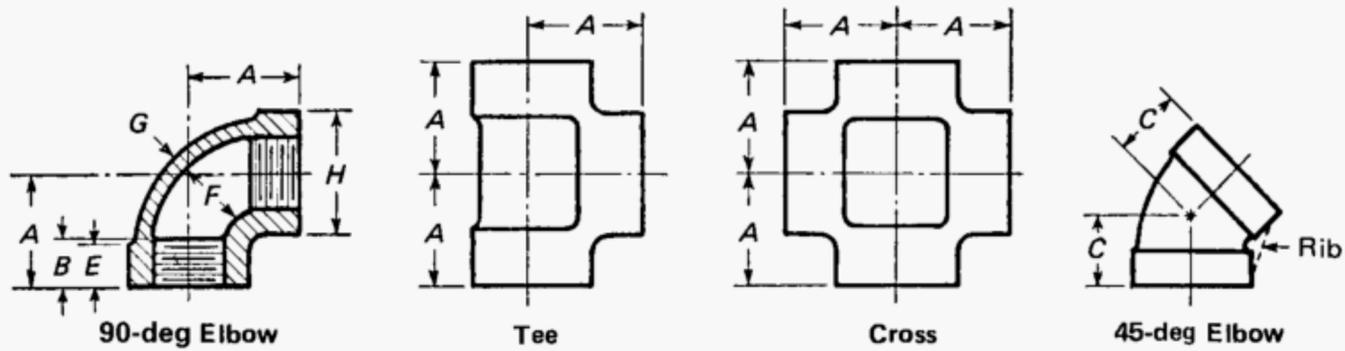


| NPS | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fittings, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> | Center-to-Center (Closed Pattern), <i>R</i> ₁ | Center-to-Center (Medium Pattern), <i>R</i> ₂ | Center-to-Center (Open Pattern), <i>R</i> ₃ |
|-------|------------------------------------|---------------------------------|---------------------------------------|------|---------------------------|--|--|--|--|
| | | | Min. | Max. | | | | | |
| 1/2 | 0.43 | 0.25 | 0.84 | 0.90 | 0.12 | 1.20 | 1.00 | 1.25 | 1.50 |
| 3/4 | 0.50 | 0.27 | 1.05 | 1.11 | 0.13 | 1.46 | 1.25 | 1.50 | 2.00 |
| 1 | 0.58 | 0.30 | 1.31 | 1.38 | 0.15 | 1.77 | 1.50 | 1.87 | 2.50 |
| 1 1/4 | 0.67 | 0.34 | 1.66 | 1.73 | 0.16 | 2.15 | 1.75 | 2.25 | 3.00 |
| 1 1/2 | 0.70 | 0.37 | 1.90 | 1.97 | 0.18 | 2.43 | 2.19 | 2.50 | 3.50 |
| 2 | 0.75 | 0.42 | 2.37 | 2.44 | 0.20 | 2.96 | 2.62 | 3.00 | 4.00 |
| 2 1/2 | 0.92 | 0.48 | 2.87 | 2.97 | 0.24 | 3.59 | ... | ... | 4.50 |
| 3 | 0.98 | 0.55 | 3.50 | 3.60 | 0.27 | 4.28 | ... | ... | 5.00 |
| 4 | 1.08 | 0.66 | 4.50 | 4.60 | 0.31 | 5.40 | ... | ... | 6.00 |

GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) It is permissible to furnish closed-pattern return bends not banded. Closed-pattern return bends will not make up equally spaced coils, as the distance center-to-center of two adjacent bends is greater than the center-to-center of openings of a single bend.

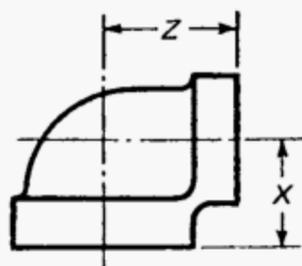
Table I-11 Dimensions of Class 300, 90-deg Elbows, Tees, and Crosses, and 45-deg Elbows (Straight Sizes)



| NPS | Center-to-End, Elbows, Tees, and Crosses, A | Center-to-End 45-deg Elbows, C | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fitting, F | | Metal Thickness, G | Minimum Outside Diameter of Band, H |
|-------|--|--------------------------------------|---|-----------------------------------|----------------------------------|------|--------------------------|---|
| | | | | | Min. | Max. | | |
| 1/4 | 0.94 | 0.81 | 0.43 | 0.38 | 0.54 | 0.58 | 0.14 | 0.93 |
| 3/8 | 1.06 | 0.88 | 0.47 | 0.44 | 0.67 | 0.72 | 0.15 | 1.12 |
| 1/2 | 1.25 | 1.00 | 0.57 | 0.50 | 0.84 | 0.90 | 0.16 | 1.34 |
| 3/4 | 1.44 | 1.13 | 0.64 | 0.56 | 1.05 | 1.11 | 0.18 | 1.63 |
| 1 | 1.63 | 1.31 | 0.75 | 0.62 | 1.31 | 1.38 | 0.20 | 1.95 |
| 1 1/4 | 1.94 | 1.50 | 0.84 | 0.69 | 1.66 | 1.73 | 0.22 | 2.39 |
| 1 1/2 | 2.13 | 1.69 | 0.87 | 0.75 | 1.90 | 1.97 | 0.24 | 2.68 |
| 2 | 2.50 | 2.00 | 1.00 | 0.84 | 2.37 | 2.44 | 0.26 | 3.28 |
| 2 1/2 | 2.94 | 2.25 | 1.17 | 0.94 | 2.87 | 2.97 | 0.31 | 3.86 |
| 3 | 3.38 | 2.50 | 1.23 | 1.00 | 3.50 | 3.60 | 0.35 | 4.62 |

GENERAL NOTE: Dimensions are in inches.

Table I-12 Center-to-End Dimensions of Class 300, 90-deg Elbows (Reducing Sizes)

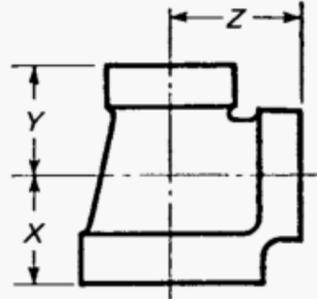


| NPS | Center-to-End | |
|------------------------------------|---------------|------|
| | X | Z |
| $\frac{1}{2} \times \frac{3}{8}$ | 1.19 | 1.19 |
| $\frac{3}{4} \times \frac{1}{2}$ | 1.31 | 1.38 |
| $1 \times \frac{3}{4}$ | 1.50 | 1.56 |
| $1\frac{1}{4} \times 1$ | 1.75 | 1.81 |
| $1\frac{1}{2} \times 1\frac{1}{4}$ | 2.00 | 2.06 |
| $2 \times 1\frac{1}{2}$ | 2.25 | 2.38 |
| $2\frac{1}{2} \times 2$ | 2.69 | 2.75 |
| $3 \times 2\frac{1}{2}$ | 3.06 | 3.31 |

GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For dimensions not given, see Table I-11.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

Table I-13 Center-to-End Dimensions of Class 300 Tees (Reducing Sizes)

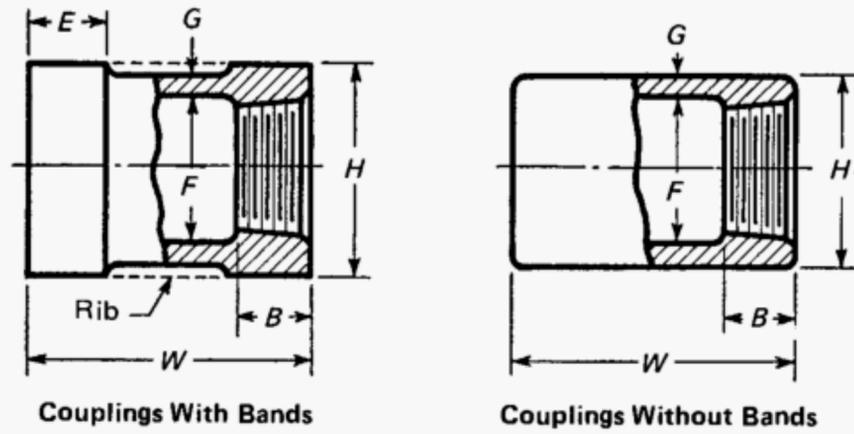


| NPS | Center-to-End | | |
|--|---------------|------|------|
| | X | Y | Z |
| $\frac{1}{2} \times \frac{1}{2} \times \frac{3}{8}$ | 1.19 | 1.19 | 1.19 |
| $\frac{1}{2} \times \frac{3}{8} \times \frac{1}{2}$ | 1.25 | 1.19 | 1.25 |
| $\frac{3}{4} \times \frac{3}{4} \times \frac{1}{2}$ | 1.31 | 1.31 | 1.38 |
| $\frac{3}{4} \times \frac{1}{2} \times \frac{3}{4}$ | 1.44 | 1.38 | 1.44 |
| $1 \times 1 \times \frac{3}{4}$ | 1.50 | 1.50 | 1.56 |
| $1 \times 1 \times \frac{1}{2}$ | 1.44 | 1.44 | 1.50 |
| $1 \times 1 \times \frac{3}{8}$ | 1.31 | 1.31 | 1.44 |
| $1 \times \frac{3}{4} \times 1$ | 1.63 | 1.56 | 1.63 |
| $1\frac{1}{4} \times 1\frac{1}{4} \times 1$ | 1.75 | 1.75 | 1.81 |
| $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{3}{4}$ | 1.63 | 1.63 | 1.75 |
| $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{2}$ | 1.50 | 1.50 | 1.69 |
| $1\frac{1}{4} \times 1 \times 1\frac{1}{4}$ | 1.94 | 1.81 | 1.94 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{4}$ | 2.00 | 2.00 | 2.06 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times 1$ | 1.81 | 1.81 | 2.00 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{3}{4}$ | 1.69 | 1.69 | 1.88 |
| $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{2}$ | 1.63 | 1.63 | 1.81 |
| $1\frac{1}{2} \times 1\frac{1}{4} \times 1\frac{1}{2}$ | 2.13 | 2.06 | 2.13 |
| $2 \times 2 \times 1\frac{1}{2}$ | 2.25 | 2.25 | 2.38 |
| $2 \times 2 \times 1\frac{1}{4}$ | 2.13 | 2.13 | 2.31 |
| $2 \times 2 \times 1$ | 2.00 | 2.00 | 2.25 |
| $2 \times 2 \times \frac{3}{4}$ | 1.81 | 1.81 | 2.13 |
| $2 \times 2 \times \frac{1}{2}$ | 1.75 | 1.75 | 2.06 |
| $2 \times 1\frac{1}{2} \times 2$ | 2.50 | 2.38 | 2.50 |
| $2\frac{1}{2} \times 2\frac{1}{2} \times 2$ | 2.69 | 2.69 | 2.75 |
| $2\frac{1}{2} \times 2\frac{1}{2} \times 1\frac{1}{2}$ | 2.44 | 2.44 | 2.63 |
| $2\frac{1}{2} \times 2 \times 2\frac{1}{2}$ | 2.94 | 2.75 | 2.94 |
| $3 \times 3 \times 2\frac{1}{2}$ | 3.06 | 3.06 | 3.31 |
| $3 \times 3 \times 2$ | 2.81 | 2.81 | 3.13 |
| $3 \times 2\frac{1}{2} \times 3$ | 3.38 | 3.31 | 3.38 |

GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For dimensions not given, see Table I-11.
- (c) Reducing sizes of fittings for which dimensions are not given in tables may be produced from regular patterns for listed sizes by sand bushing.

Table I-14 Dimensions of Class 300 Couplings

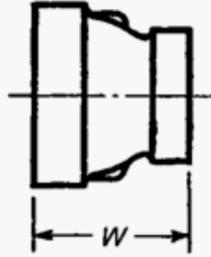


| NPS | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fitting, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Coupling, <i>H</i> ₁ [Note (1)] | Minimum Outside Diameter of Band, <i>H</i> [Note (2)] | Length of Straight Coupling, <i>W</i> |
|-------|------------------------------------|---------------------------------|--------------------------------------|------|---------------------------|--|---|---------------------------------------|
| | | | Min. | Max. | | | | |
| 1/4 | 0.43 | 0.38 | 0.54 | 0.58 | 0.14 | 0.82 | 0.93 | 1.37 |
| 3/8 | 0.47 | 0.44 | 0.67 | 0.72 | 0.15 | 0.97 | 1.12 | 1.62 |
| 1/2 | 0.57 | 0.50 | 0.84 | 0.90 | 0.16 | 1.16 | 1.34 | 1.87 |
| 3/4 | 0.64 | 0.56 | 1.05 | 1.11 | 0.18 | 1.41 | 1.63 | 2.12 |
| 1 | 0.75 | 0.62 | 1.31 | 1.38 | 0.20 | 1.71 | 1.95 | 2.37 |
| 1 1/4 | 0.84 | 0.69 | 1.66 | 1.73 | 0.22 | 2.10 | 2.39 | 2.87 |
| 1 1/2 | 0.87 | 0.75 | 1.90 | 1.97 | 0.24 | 2.38 | 2.68 | 2.87 |
| 2 | 1.00 | 0.84 | 2.37 | 2.44 | 0.26 | 2.89 | 3.28 | 3.62 |
| 2 1/2 | 1.17 | 0.94 | 2.87 | 2.97 | 0.31 | 3.49 | 3.86 | 4.12 |
| 3 | 1.23 | 1.00 | 3.50 | 3.60 | 0.35 | 4.20 | 4.62 | 4.12 |

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) *H*₁ diameter is standard for couplings without bands; *H*₁ = *F* min. + 2*G*.
- (2) Minimum *H* is for couplings with bands and is optional with the manufacturer. For information on ribs, see section 9.

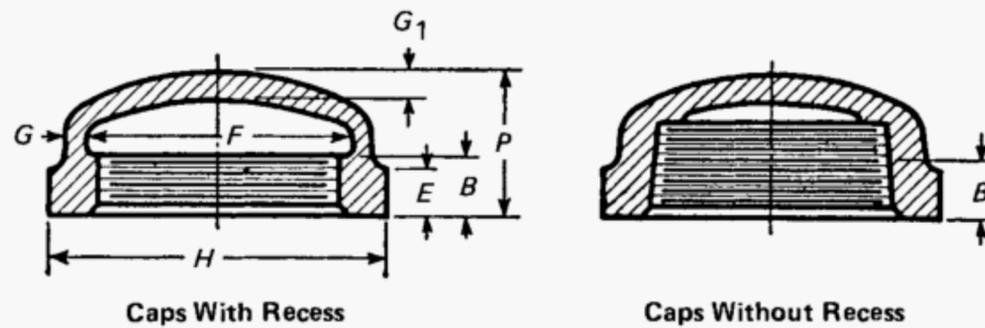
Table I-15 Dimensions of Class 300 Reducing Couplings

| NPS | Length, <i>W</i> |
|------------------------------------|------------------|
| $\frac{3}{8} \times \frac{1}{4}$ | 1.44 |
| $\frac{1}{2} \times \frac{3}{8}$ | 1.69 |
| $\frac{1}{2} \times \frac{1}{4}$ | 1.69 |
| $\frac{3}{4} \times \frac{1}{2}$ | 1.75 |
| $\frac{3}{4} \times \frac{3}{8}$ | 1.75 |
| $\frac{3}{4} \times \frac{1}{4}$ | 1.75 |
| $1 \times \frac{3}{4}$ | 2.00 |
| $1 \times \frac{1}{2}$ | 2.00 |
| $1 \times \frac{3}{8}$ | 2.00 |
| $1 \times \frac{1}{4}$ | 2.00 |
| $1\frac{1}{4} \times 1$ | 2.38 |
| $1\frac{1}{4} \times \frac{3}{4}$ | 2.38 |
| $1\frac{1}{4} \times \frac{1}{2}$ | 2.38 |
| $1\frac{1}{2} \times 1\frac{1}{4}$ | 2.69 |
| $1\frac{1}{2} \times 1$ | 2.69 |
| $1\frac{1}{2} \times \frac{3}{4}$ | 2.69 |
| $1\frac{1}{2} \times \frac{1}{2}$ | 2.69 |
| $2 \times 1\frac{1}{2}$ | 3.19 |
| $2 \times 1\frac{1}{4}$ | 3.19 |
| 2×1 | 3.19 |
| $2 \times \frac{3}{4}$ | 3.19 |
| $2 \times \frac{1}{2}$ | 3.19 |
| $2\frac{1}{2} \times 2$ | 3.69 |
| $2\frac{1}{2} \times 1\frac{1}{2}$ | 3.69 |
| $3 \times 2\frac{1}{2}$ | 4.06 |
| 3×2 | 4.06 |
| $3 \times 1\frac{1}{2}$ | 4.06 |

GENERAL NOTES:

- (a) Dimensions are in inches.
- (b) For dimensions not given, see Table I-11.
- (c) Reducing sizes of fittings for which dimensions are not given in the tables may be produced from regular patterns for listed sizes by sand bushing.

Table I-16 Dimensions of Class 300 Caps



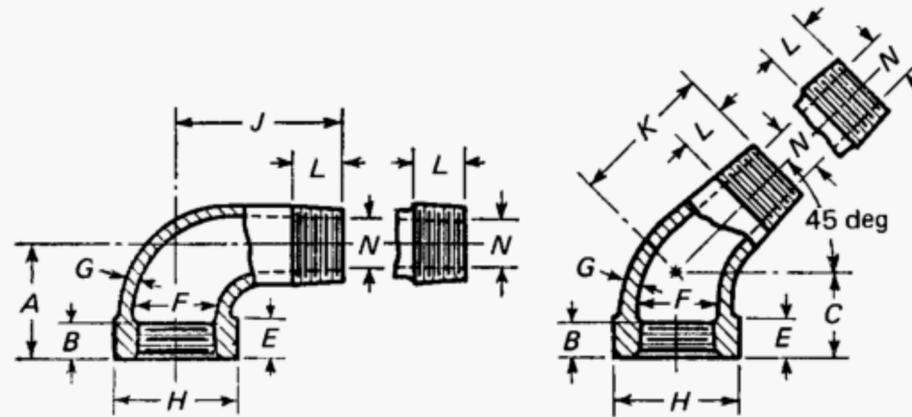
| NPS | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fitting, <i>F</i> | | Metal Thickness | | Minimum Outside Diameter of Band, <i>H</i> | Minimum Height, <i>P</i> [Note (2)] |
|-------|------------------------------------|---------------------------------|--------------------------------------|------|------------------|--|--|-------------------------------------|
| | | | Min. | Max. | Minimum <i>G</i> | Recommended <i>G</i> ₁ [Note (1)] | | |
| 1/4 | 0.43 | 0.38 | 0.54 | 0.58 | 0.14 | 0.18 | 0.93 | 0.78 |
| 3/8 | 0.47 | 0.44 | 0.67 | 0.72 | 0.15 | 0.19 | 1.12 | 0.83 |
| 1/2 | 0.57 | 0.50 | 0.84 | 0.90 | 0.16 | 0.20 | 1.34 | 0.98 |
| 3/4 | 0.64 | 0.56 | 1.05 | 1.11 | 0.18 | 0.23 | 1.63 | 1.08 |
| 1 | 0.75 | 0.62 | 1.31 | 1.38 | 0.20 | 0.25 | 1.95 | 1.26 |
| 1 1/4 | 0.84 | 0.69 | 1.66 | 1.73 | 0.22 | 0.28 | 2.39 | 1.38 |
| 1 1/2 | 0.87 | 0.75 | 1.90 | 1.97 | 0.24 | 0.30 | 2.68 | 1.43 |
| 2 | 1.00 | 0.84 | 2.37 | 2.44 | 0.26 | 0.33 | 3.28 | 1.68 |
| 2 1/2 | 1.17 | 0.94 | 2.87 | 2.97 | 0.31 | 0.39 | 3.86 | 2.06 |
| 3 | 1.23 | 1.00 | 3.50 | 3.60 | 0.35 | 0.44 | 4.62 | 2.17 |

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) Dimension *G*₁ is recommended but shall in no case be less than dimension *G*.
- (2) Dimension *P* may be varied to comply with manufacturer's practice, and, for caps without recess, shall be of such height that the length of effective thread shall be not less than *B*.

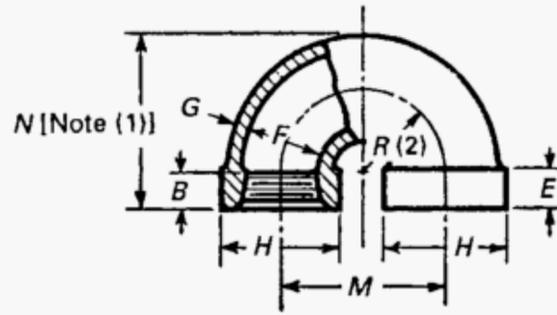
Table I-17 Dimensions of Class 300, 90-deg and 45-deg Street Elbows



| NPS | 90-deg Elbows | | 45-deg Elbows | | Minimum Length of Thread, <i>B</i> | Minimum Width of Band, <i>E</i> | Inside Diameter of Fitting, <i>F</i> | | Metal Thickness, <i>G</i> | Minimum Outside Diameter of Band, <i>H</i> | Minimum Length of External Thread, <i>L</i> | Maximum Port Diameter Male End, <i>N</i> |
|-------|-------------------------|------------------------------|-------------------------|------------------------------|------------------------------------|---------------------------------|--------------------------------------|------|---------------------------|--|---|--|
| | Center-to-End, <i>A</i> | Center-to-Male End, <i>J</i> | Center-to-End, <i>C</i> | Center-to-Male End, <i>K</i> | | | Min. | Max. | | | | |
| 1/4 | 0.94 | 1.44 | ... | ... | 0.43 | 0.38 | 0.54 | 0.58 | 0.14 | 0.93 | 0.40 | 0.26 |
| 3/8 | 1.06 | 1.63 | ... | ... | 0.47 | 0.44 | 0.67 | 0.72 | 0.15 | 1.12 | 0.41 | 0.36 |
| 1/2 | 1.25 | 2.00 | 1.00 | 1.38 | 0.57 | 0.50 | 0.84 | 0.90 | 0.16 | 1.34 | 0.53 | 0.49 |
| 3/4 | 1.44 | 2.19 | 1.13 | 1.56 | 0.64 | 0.56 | 1.05 | 1.11 | 0.18 | 1.63 | 0.55 | 0.67 |
| 1 | 1.63 | 2.56 | 1.31 | 1.81 | 0.75 | 0.62 | 1.31 | 1.38 | 0.20 | 1.95 | 0.68 | 0.88 |
| 1 1/4 | 1.94 | 2.88 | 1.50 | 2.13 | 0.84 | 0.69 | 1.66 | 1.73 | 0.22 | 2.39 | 0.71 | 1.16 |
| 1 1/2 | 2.13 | 3.13 | 1.69 | 2.31 | 0.87 | 0.75 | 1.90 | 1.97 | 0.24 | 2.68 | 0.72 | 1.35 |
| 2 | 2.50 | 3.69 | 2.00 | 2.69 | 1.00 | 0.84 | 2.37 | 2.44 | 0.26 | 3.28 | 0.76 | 1.75 |
| 2 1/2 | 2.94 | 4.50 | ... | ... | 1.17 | 0.94 | 2.87 | 2.97 | 0.31 | 3.86 | 1.14 | 2.16 |
| 3 | 3.38 | 5.13 | ... | ... | 1.23 | 1.00 | 3.50 | 3.60 | 0.35 | 4.62 | 1.20 | 2.67 |

GENERAL NOTE: Dimensions are in inches.

Table I-18 Dimensions of Class 300 Return Bends



| NPS | Center-to-Center, M | | | Minimum Length of Thread, B | Minimum Width of Band, E | Inside Diameter of Fitting, F | | Metal Thickness, G [Note (3)] | Minimum Outside Diameter of Band, H |
|-----------------|-----------------------|----------------|--------------|-------------------------------|----------------------------|---------------------------------|------|---------------------------------|---------------------------------------|
| | Closed Pattern | Medium Pattern | Open Pattern | | | Min. | Max. | | |
| 1 | 1.75 | 2.50 | 3.00 | 0.75 | 0.62 | 1.31 | 1.38 | 0.20 | 1.95 |
| 1 $\frac{1}{4}$ | 2.25 | 2.50 | 3.00 | 0.84 | 0.69 | 1.66 | 1.73 | 0.22 | 2.39 |
| 1 $\frac{1}{2}$ | 3.00 | 3.50 | 6.00 | 0.87 | 0.75 | 1.90 | 1.97 | 0.24 | 2.68 |
| 2 | 4.00 | 6.00 | 8.00 | 1.00 | 0.84 | 2.37 | 2.44 | 0.26 | 3.28 |

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) Dimension N may be varied to comply with manufacturer's practice.
- (2) It is recommended that the distance from the end of the fitting to the center of the radius, R , be approximately equal to the dimension B ; radius, R , is recommended as being one-half of dimension M .
- (3) It is recommended that G for return bends be increased by 10% or more.

(11)

MANDATORY APPENDIX II REFERENCES

The following is a list of publications referenced in this Standard. Unless otherwise stated, the latest edition of ASME publications shall apply. Materials manufactured to other editions of the referenced ASTM standard shall be permitted to be used to manufacture fittings meeting the requirements of this Standard as long as the fitting manufacturer verifies the material meets the requirements of the referenced edition.

ASME B1.20.1, Pipe Threads, General Purpose (Inch)
ASME B16.14, Ferrous Pipe Plugs, Bushings, and Locknuts With Pipe Threads

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM A153/A153M-09, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A197/A197M-00 (2006), Specification for Cupola Malleable Iron

ASTM B633-98^{e1}, Specification for Electrodeposited Coatings of Zinc on Iron and Steel

ASTM E29-08, Standard Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

ISO 9000:2005, Quality management systems — Fundamentals and vocabulary¹

ISO 9001:2008, Quality management systems — Requirements¹

ISO 9004:2009, Managing for the sustained success of an organization — A quality management approach¹

Publisher: International Organization for Standardization (ISO) Central Secretariat, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Genève 20, Switzerland/Suisse (www.iso.org)

MSS SP-25-2008, Standard Practice Marking System for Valves, Fittings, Flanges, and Unions

Publisher: Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS), 127 Park Street, NE, Vienna, VA 22180 (www.mss-hq.org)

¹ May also be obtained from the American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.

NONMANDATORY APPENDIX A QUALITY SYSTEM PROGRAM

The products manufactured in accordance with this Standard shall be produced under a quality system program following the principles of the ISO 9000 series.¹ A determination of the need for registration and/or

¹ The series is also available from the American National Standards Institute (ANSI) and the American Society for Quality (ASQ) as American National Standards that are identified by the prefix "Q," replacing the prefix "ISO." Each standard of the series is listed under References in Mandatory Appendix II.

certification of the product manufacturer's quality system program by an independent organization shall be the responsibility of the manufacturer. The detailed documentation demonstrating program compliance shall be available to the purchaser at the manufacturer's facility. A written summary description of the program utilized by the product manufacturer shall be available to the purchaser upon request. The product manufacturer is defined as the entity whose name or trademark appears on the product in accordance with the marking or identification requirements of this Standard.

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