

**ASME B16.11-2016**  
(Revision of ASME B16.11-2011)

# Forged Fittings, Socket-Welding and Threaded



**ORGANIZACIÓN  
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**VAL, S.A. DE C.V.**

**AN AMERICAN NATIONAL STANDARD**



**The American Society of  
Mechanical Engineers**

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# FORGED FITTINGS, SOCKET-WELDING AND THREADED

## 1 SCOPE AND GENERAL

### 1.1 Scope

This Standard covers ratings, dimensions, tolerances, marking, and material requirements for forged fittings, both socket-welding and threaded, as illustrated in Tables 1 through 6 and Tables I-1 through I-6, inclusive.

**1.1.1 Fitting Types/Configuration.** Types of fittings covered by this Standard are shown in Table 7, by class and size range. Fittings shown in Tables 1 through 6 and Tables I-1 through I-6 may also be made with combinations of socket-welding and threaded ends.

**1.1.2 Special Fittings.** Fittings with special dimensions, threads, or counterbores may be made by agreement between the manufacturer and purchaser. When such fittings meet all other stipulations of this Standard, they shall be considered in compliance therewith, provided they are appropriately marked (see section 4).

**1.1.3 Welding.** Installation welding requirements are not within the scope of this Standard. Installation welding shall be in accordance with the applicable piping Code or regulation covering the piping system into which the fittings are installed.

### 1.2 General

**1.2.1 Referenced Standards.** 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 standard and specification in the individual references. Instead, the specific edition reference is identified in Mandatory Appendix II. A fitting made in conformance and conforming to this Standard, in all other respects, will be considered to be in conformance to the Standard, even though the edition reference may be changed in a subsequent revision of the Standard.

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

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

**1.2.4 Quality Systems.** Nonmandatory requirements relating to the product manufacturer's quality system program are described in Nonmandatory Appendix A.

**1.2.5 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.

Tables 1 through 6 show fittings dimensional requirements in millimeters. Tables I-1 through I-6 show the dimensional requirements for inch dimensioned fittings.

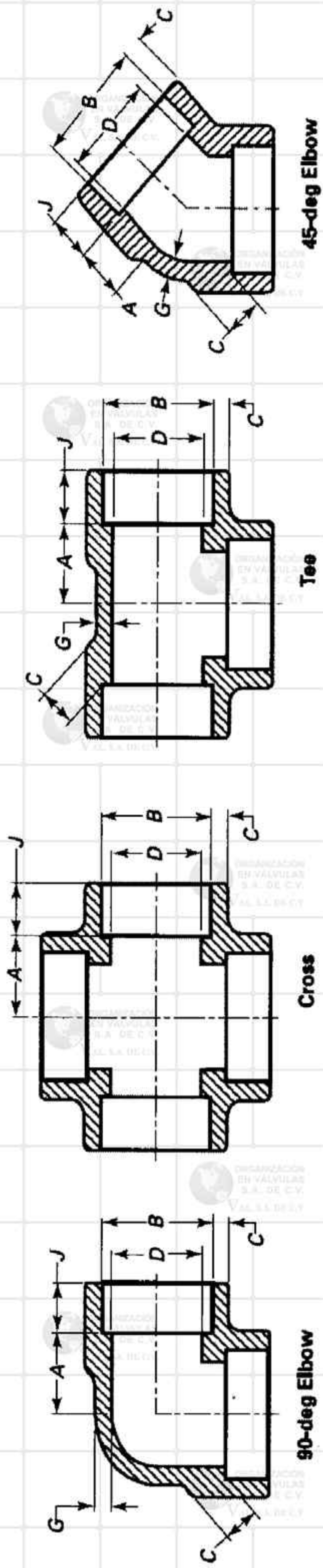
## 2 PRESSURE RATINGS

### 2.1 General

Fittings under this Standard shall be designated as Class 2000, 3000, and 6000 for threaded end fittings and Class 3000, 6000, and 9000 for socket-weld end fittings.

**2.1.1 Basis of Rating.** The schedule of pipe corresponding to each Class designation of fitting for rating purposes is shown in Table 8. Design temperature and other service conditions shall be limited as provided by the applicable piping code or regulation for the material of construction of the fitting. Within these limits, the minimum wall thickness for pipe to be used with a Table 8 Class designated fitting shall be computed based on appropriate size straight seamless pipe of equivalent material as the fitting (as shown by comparison of composition and mechanical properties in the respective material specifications). The minimum pipe wall thickness calculation shall include pressure design and all applicable additional allowances (e.g., erosion, corrosion, and thread depth for threaded pipe). The minimum wall thickness for selected pipe, considering manufacturing minus wall thickness tolerance (typically 12.5%), shall not be less than the minimum wall calculation. The fitting is suitable for the application if the wall thickness of the selected pipe equals or is less than the ASME B36.10M Schedule No. or Wall Designation pipe wall thickness correlated with the fitting in Table 8 [see Note (1) in Table 8].

Table 1 Socket-Welding Elbows, Tees, and Crosses

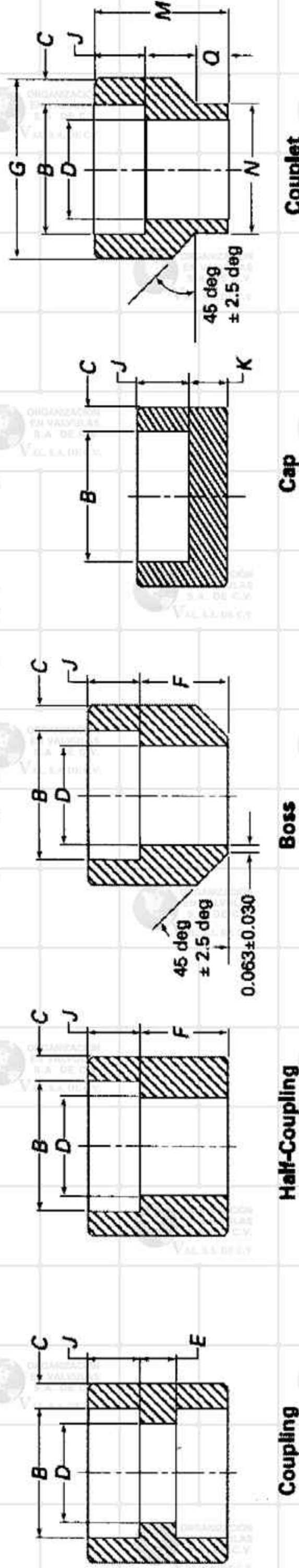


| Nominal Pipe Size | Socket Bore Diam., B |       | Bore Diameter of Fittings, D |       | Socket Wall Thickness, C [Note (1)] |      |      | Body Wall, G |       | Socket Depth, J |      | Center-to-Bottom of Socket, A |       |      |       | Tol ± |      |      |      |      |      |      |     |
|-------------------|----------------------|-------|------------------------------|-------|-------------------------------------|------|------|--------------|-------|-----------------|------|-------------------------------|-------|------|-------|-------|------|------|------|------|------|------|-----|
|                   | Max.                 | Min.  | Max.                         | Min.  | 3000                                | 6000 | 9000 | 3000         | 6000  | 9000            | Min. | 3000                          | 6000  | 9000 | 3000  |       | 6000 | 9000 |      |      |      |      |     |
|                   | Min.                 | Max.  | Min.                         | Max.  | Avg.                                | Min. | Avg. | Min.         | Min.  | Min.            | Min. | Min.                          | Min.  | Min. | Min.  |       | Min. | Min. |      |      |      |      |     |
| 1/8               | 11.2                 | 10.8  | 7.6                          | 6.1   | 4.8                                 | 3.2  | ...  | 3.18         | 3.18  | 3.96            | 3.43 | ...                           | 2.41  | 3.15 | ...   | 9.5   | 11.0 | 11.0 | ...  | 8.0  | 8.0  | ...  | 1.0 |
| 1/4               | 14.6                 | 14.2  | 10.0                         | 8.5   | 7.1                                 | 5.6  | ...  | 3.78         | 3.30  | 4.60            | 4.01 | ...                           | 3.02  | 3.68 | ...   | 9.5   | 11.0 | 13.5 | ...  | 8.0  | 8.0  | ...  | 1.0 |
| 3/8               | 18.0                 | 17.6  | 13.3                         | 11.8  | 9.9                                 | 8.4  | ...  | 4.01         | 3.50  | 5.03            | 4.37 | ...                           | 3.20  | 4.01 | ...   | 9.5   | 13.5 | 15.5 | ...  | 8.0  | 11.0 | ...  | 1.5 |
| 1/2               | 22.2                 | 21.8  | 16.6                         | 15.0  | 12.5                                | 11.0 | 7.2  | 5.6          | 4.67  | 5.97            | 5.18 | 9.35                          | 8.18  | 4.78 | 7.47  | 9.5   | 15.5 | 19.0 | 25.5 | 11.0 | 12.5 | 15.5 | 1.5 |
| 3/4               | 27.6                 | 27.2  | 21.7                         | 20.2  | 16.3                                | 14.8 | 11.8 | 10.3         | 4.90  | 6.96            | 6.04 | 9.78                          | 8.56  | 5.56 | 7.82  | 12.5  | 19.0 | 22.5 | 28.5 | 13.0 | 14.0 | 19.0 | 1.5 |
| 1                 | 34.3                 | 33.9  | 27.4                         | 25.9  | 21.5                                | 19.9 | 16.0 | 14.4         | 5.69  | 7.92            | 6.93 | 11.38                         | 9.96  | 6.35 | 9.09  | 12.5  | 22.5 | 27.0 | 32.0 | 14.0 | 17.5 | 20.5 | 2.0 |
| 1 1/4             | 43.1                 | 42.7  | 35.8                         | 34.3  | 30.2                                | 28.7 | 23.5 | 22.0         | 6.07  | 7.92            | 6.93 | 12.14                         | 10.62 | 6.35 | 9.70  | 12.5  | 27.0 | 32.0 | 35.0 | 17.5 | 20.5 | 22.5 | 2.0 |
| 1 1/2             | 49.2                 | 48.8  | 41.6                         | 40.1  | 34.7                                | 33.2 | 28.7 | 27.2         | 6.35  | 8.92            | 7.80 | 12.70                         | 11.12 | 7.14 | 10.15 | 12.5  | 32.0 | 38.0 | 38.0 | 20.5 | 25.5 | 25.5 | 2.0 |
| 2                 | 61.7                 | 61.2  | 53.3                         | 51.7  | 43.6                                | 42.1 | 38.9 | 37.4         | 6.93  | 10.92           | 9.50 | 13.84                         | 12.12 | 8.74 | 11.07 | 16.0  | 38.0 | 41.0 | 54.0 | 25.5 | 28.5 | 28.5 | 2.0 |
| 2 1/2             | 74.4                 | 73.9  | 64.2                         | 61.2  | ...                                 | ...  | ...  | ...          | 8.76  | 7.67            | ...  | ...                           | ...   | 7.01 | ...   | 16.0  | 41.0 | ...  | ...  | 28.5 | ...  | ...  | 2.5 |
| 3                 | 90.3                 | 89.8  | 79.4                         | 76.4  | ...                                 | ...  | ...  | ...          | 9.52  | 8.30            | ...  | ...                           | ...   | 7.62 | ...   | 16.0  | 57.0 | ...  | ...  | 32.0 | ...  | ...  | 2.5 |
| 4                 | 115.7                | 115.2 | 103.8                        | 100.7 | ...                                 | ...  | ...  | ...          | 10.69 | 9.35            | ...  | ...                           | ...   | 8.56 | ...   | 19.0  | 66.5 | ...  | ...  | 41.0 | ...  | ...  | 2.5 |

GENERAL NOTE: Dimensions are in millimeters.

NOTE: (1) Average of socket wall thickness around periphery shall not be less than listed values. The minimum values are permitted in localized areas.

Table 2 Socket-Welding Couplings, Bosses, Caps, and Couplets



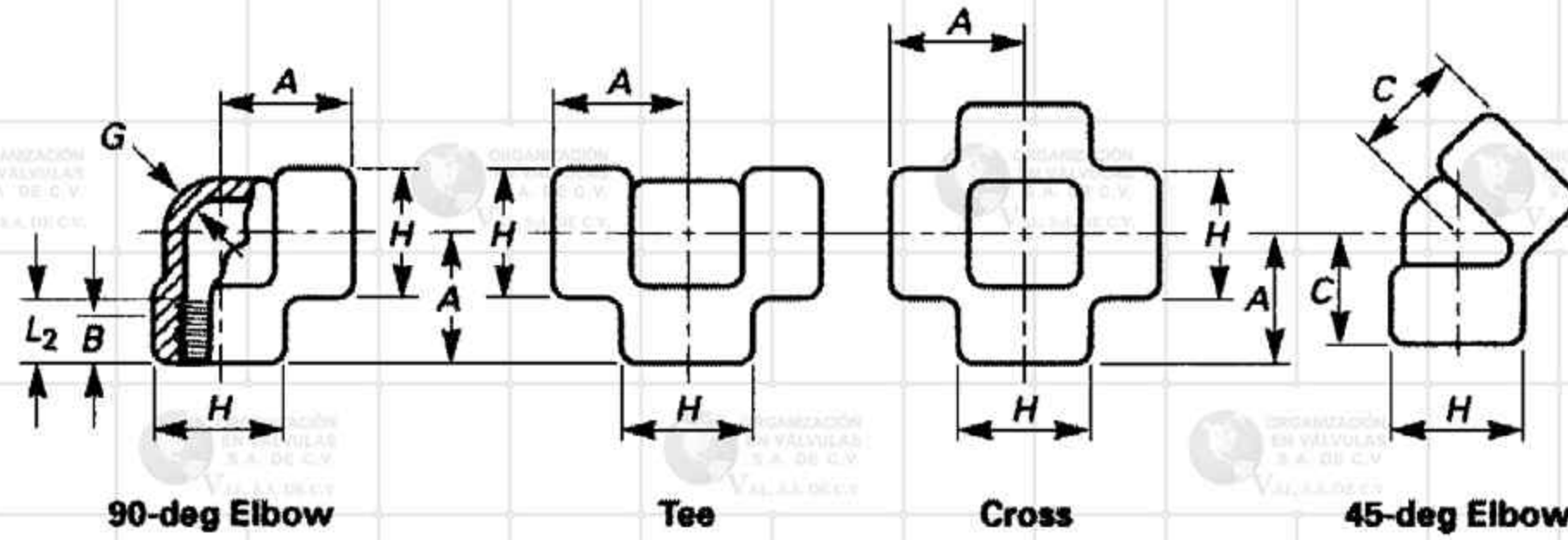
| Nominal Pipe Size | Socket Bore Dia., B |       | Coupling Bore Dia., C |       | Fitting Bore Dia., D |      | Socket Wall Thickness, [Note (1)], E |      |       | Outside Dia. Couplet, G |       | Socket Depth, F |       | Laying Lgth., E Tol. |      | Laying Lgth., F Tol. |      | End Wall Thickness, K |      | End to End Couplet, M |      | Weld Ring Diameter, N |           | Weld Ring Length, Q |           |      |     |
|-------------------|---------------------|-------|-----------------------|-------|----------------------|------|--------------------------------------|------|-------|-------------------------|-------|-----------------|-------|----------------------|------|----------------------|------|-----------------------|------|-----------------------|------|-----------------------|-----------|---------------------|-----------|------|-----|
|                   | Max.                | Min.  | Max.                  | Min.  | Max.                 | Min. | Avg.                                 | Min. | Avg.  | Min.                    | Avg.  | Min.            | Avg.  | Min.                 | Avg. | Min.                 | Avg. | Min.                  | Avg. | Min.                  | Avg. | Min.                  | Avg.      | Min.                | Avg.      |      |     |
|                   | 3000                | 6000  | 9000                  | 3000  | 6000                 | 9000 | 3000                                 | 6000 | 9000  | 3000                    | 6000  | 9000            | 3000  | 6000                 | 9000 | 3000                 | 6000 | 3000                  | 6000 | 3000                  | 6000 | 3000                  | 6000      | 3000                | 6000      |      |     |
| 1/8               | 11.2                | 10.8  | 7.6                   | 6.1   | 4.8                  | 3.2  | 3.18                                 | 3.18 | 3.96  | 3.43                    | ...   | ...             | ...   | 9.5                  | 6.5  | 1.5                  | 16.0 | 1.5                   | 4.8  | 6.4                   | ...  | ...                   | ...       | ...                 | 3000      | 6000 |     |
| 1/4               | 14.6                | 14.2  | 10.0                  | 8.5   | 7.1                  | 5.6  | 3.78                                 | 3.30 | 4.60  | 4.01                    | ...   | ...             | ...   | 9.5                  | 6.5  | 1.5                  | 16.0 | 1.5                   | 4.8  | 6.4                   | ...  | ...                   | ...       | ...                 | 3000      | 6000 |     |
| 3/8               | 18.0                | 17.6  | 13.3                  | 11.8  | 9.9                  | 8.4  | 4.01                                 | 3.50 | 5.03  | 4.37                    | ...   | ...             | ...   | 9.5                  | 6.5  | 3.0                  | 17.5 | 3.0                   | 4.8  | 6.4                   | ...  | ...                   | ...       | ...                 | 3000      | 6000 |     |
| 1/2               | 22.2                | 21.8  | 16.6                  | 15.0  | 12.5                 | 11.0 | 4.67                                 | 4.09 | 5.97  | 5.18                    | 9.35  | 8.18            | 33.4  | 9.5                  | 9.5  | 3.0                  | 22.5 | 3.0                   | 6.4  | 7.9                   | 11.2 | 33.4                  | ±0.8/-0.0 | 23.8                | ±1.5/-0.0 | 9.5  | 0.8 |
| 3/4               | 27.6                | 27.2  | 21.7                  | 20.2  | 16.3                 | 14.8 | 4.90                                 | 4.27 | 6.96  | 6.04                    | 9.78  | 8.56            | 38.1  | 12.5                 | 9.5  | 3.0                  | 24.0 | 3.0                   | 6.4  | 7.9                   | 12.7 | 34.9                  | ±0.8/-0.0 | 27.0                | ±1.5/-0.0 | 9.5  | 0.8 |
| 1                 | 34.3                | 33.9  | 27.4                  | 25.9  | 21.5                 | 19.9 | 5.69                                 | 4.98 | 7.92  | 6.93                    | 11.38 | 9.96            | 46.1  | 12.5                 | 12.5 | 4.0                  | 28.5 | 4.0                   | 9.6  | 11.2                  | 14.2 | 47.6                  | ±0.8/-0.0 | 42.9                | ±1.5/-0.0 | 9.5  | 0.8 |
| 1 1/4             | 43.1                | 42.7  | 35.8                  | 34.3  | 30.2                 | 28.7 | 6.07                                 | 5.28 | 7.92  | 6.93                    | 12.14 | 10.62           | 55.6  | 12.5                 | 12.5 | 4.0                  | 30.0 | 4.0                   | 9.6  | 11.2                  | 14.2 | 47.6                  | ±0.8/-0.0 | 42.9                | ±1.5/-0.0 | 9.5  | 0.8 |
| 1 1/2             | 49.2                | 48.8  | 41.6                  | 40.1  | 34.7                 | 33.2 | 6.35                                 | 5.54 | 8.92  | 7.80                    | 12.70 | 11.12           | 63.5  | 12.5                 | 12.5 | 4.0                  | 32.0 | 4.0                   | 11.2 | 12.7                  | 15.7 | 50.8                  | ±0.8/-0.0 | 49.2                | ±1.5/-0.0 | 9.5  | 0.8 |
| 2                 | 61.7                | 61.2  | 53.3                  | 51.7  | 43.6                 | 42.1 | 6.93                                 | 6.04 | 10.92 | 9.50                    | 13.84 | 12.21           | 79.4  | 16.0                 | 19.0 | 4.0                  | 41.0 | 4.0                   | 12.7 | 15.7                  | 19.0 | 57.2                  | ±1.5/-0.0 | 61.9                | ±1.5/-0.0 | 9.5  | 0.8 |
| 2 1/2             | 74.4                | 73.9  | 64.2                  | 61.2  | ...                  | ...  | 8.76                                 | 7.67 | ...   | ...                     | ...   | ...             | 92.1  | 16.0                 | 19.0 | 5.0                  | 43.0 | 5.0                   | 15.7 | 19.0                  | ...  | 63.5                  | ±1.5/-0.0 | 73.0                | ±1.5/-0.0 | 9.5  | 0.8 |
| 3                 | 90.3                | 89.8  | 79.4                  | 76.4  | ...                  | ...  | 9.52                                 | 8.30 | ...   | ...                     | ...   | ...             | 111.1 | 16.0                 | 19.0 | 5.0                  | 44.5 | 5.0                   | 19.0 | 22.4                  | ...  | 69.9                  | ±1.5/-0.0 | 88.9                | ±1.5/-0.0 | 9.5  | 0.8 |
| 4                 | 115.7               | 115.2 | 103.8                 | 100.7 | ...                  | ...  | 10.69                                | 9.35 | ...   | ...                     | ...   | ...             | 141.3 | 19.0                 | 19.0 | 5.0                  | 48.0 | 5.0                   | 22.4 | 28.4                  | ...  | 76.2                  | ±1.5/-0.0 | 114.3               | ±1.5/-0.0 | 9.5  | 0.8 |

GENERAL NOTE: Dimensions are in millimeters.

NOTE: (1) Average of socket wall thickness around periphery shall not be less than listed values. The minimum values are permitted in localized areas.

(16)

Table 3 Threaded Elbows, Tees, and Crosses



| Nominal Pipe Size | Center-to-End Elbows, Tees, and Crosses, A |      |      | Center-to-End 45-deg Elbow, C |      |      | Outside Diameter of Band, H |      |      | Minimum Wall Thickness, G |       |       | Minimum Length of Thread [Note (1)] |                |
|-------------------|--|------|------|-------------------------------|------|------|-----------------------------|------|------|---------------------------|-------|-------|-------------------------------------|----------------|
|                   | 2000                                       | 3000 | 6000 | 2000                          | 3000 | 6000 | 2000                        | 3000 | 6000 | 2000                      | 3000  | 6000  | B                                   | L <sub>2</sub> |
| 1/8               | 21   | 21   | 25   | 17                            | 17   | 19   | 22                          | 22   | 25   | 3.18                      | 3.18  | 6.35  | 6.4                                 | 6.7            |
| 1/4               | 21   | 25   | 28   | 17                            | 19   | 22   | 22                          | 25   | 33   | 3.18                      | 3.30  | 6.60  | 8.1                                 | 10.2           |
| 3/8               | 25   | 28   | 33   | 19                            | 22   | 25   | 25                          | 33   | 38   | 3.18                      | 3.51  | 6.98  | 9.1                                 | 10.4           |
| 1/2               | 28   | 33   | 38   | 22                            | 25   | 28   | 33                          | 38   | 46   | 3.18                      | 4.09  | 8.15  | 10.9                                | 13.6           |
| 3/4               | 33   | 38   | 44   | 25                            | 28   | 33   | 38                          | 46   | 56   | 3.18                      | 4.32  | 8.53  | 12.7                                | 13.9           |
| 1                 | 38   | 44   | 51   | 28                            | 33   | 35   | 46                          | 56   | 62   | 3.68                      | 4.98  | 9.93  | 14.7                                | 17.3           |
| 1 1/4             | 44   | 51   | 60   | 33                            | 35   | 43   | 56                          | 62   | 75   | 3.89                      | 5.28  | 10.59 | 17.0                                | 18.0           |
| 1 1/2             | 51   | 60   | 64   | 35                            | 43   | 44   | 62                          | 75   | 84   | 4.01                      | 5.56  | 11.07 | 17.8                                | 18.4           |
| 2                 | 60   | 64   | 83   | 43                            | 44   | 52   | 75                          | 84   | 102  | 4.27                      | 7.14  | 12.09 | 19.0                                | 19.2           |
| 2 1/2             | 76   | 83   | 95   | 52                            | 52   | 64   | 92                          | 102  | 121  | 5.61                      | 7.65  | 15.29 | 23.6                                | 28.9           |
| 3                 | 86   | 95   | 106  | 64                            | 64   | 79   | 109                         | 121  | 146  | 5.99                      | 8.84  | 16.64 | 25.9                                | 30.5           |
| 4                 | 106  | 114  | 114  | 79                            | 79   | 79   | 146                         | 152  | 152  | 6.55                      | 11.18 | 18.67 | 27.7                                | 33.0           |

GENERAL NOTE: Dimensions are in millimeters.

NOTE: (1) Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L<sub>2</sub> (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

**2.1.2 Nonstandard Pipe Wall Thickness.** Since ASME B36.10M does not include Schedule 160 nor Double Extra Strong thickness for NPS 1/8, 1/4, and 3/8, the values in Table 9 shall be used as the nominal wall thicknesses of the pipe for rating purposes.

**2.1.3 Combination End Fittings.** The Class designation for fittings made with combinations of socket-welding and threaded ends shall be based on the end configuration that has the lowest rating from Table 8.

**2.2.2** The average socket wall thickness shall at least equal 1.25 times the nominal thickness of the corresponding pipe, and at no point shall the minimum thickness be less than 1.09 times the nominal pipe wall thickness (which is 1.25 × 0.875 × nominal pipe wall).

**2.2.3** The minimum body wall thickness for threaded fittings shall be equal to or greater than the nominal wall thickness of the pipe with which they are used.

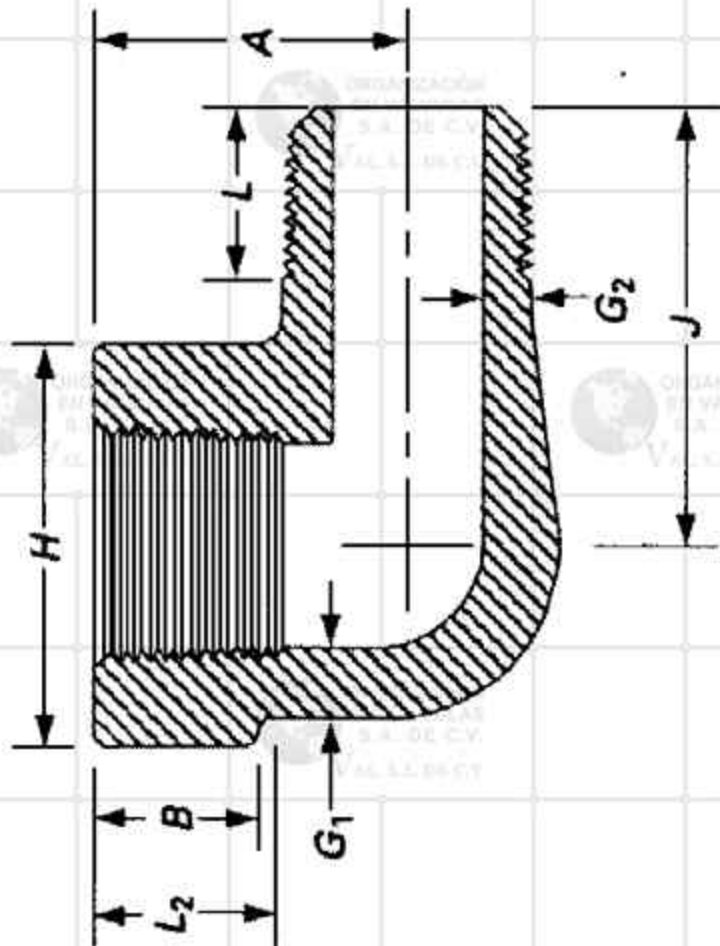
**2.3 Pressure Test Capability**

Pressure testing is not required by this Standard, but the fittings shall be capable of withstanding a hydrostatic test pressure required by the applicable piping code for seamless pipe of material equivalent to the fitting forging and of the schedule or wall thickness correlated with the fitting Class and end connection of Table 8.

**2.2 Wall Thickness Design for Special Dimension Pipe**

**2.2.1** As these fittings are to be used in connection with pipe, the minimum body wall thickness for socket-welding fittings must be equal to or greater than the nominal wall thickness of the pipe with which they are used.

Table 4 Threaded Street Elbows



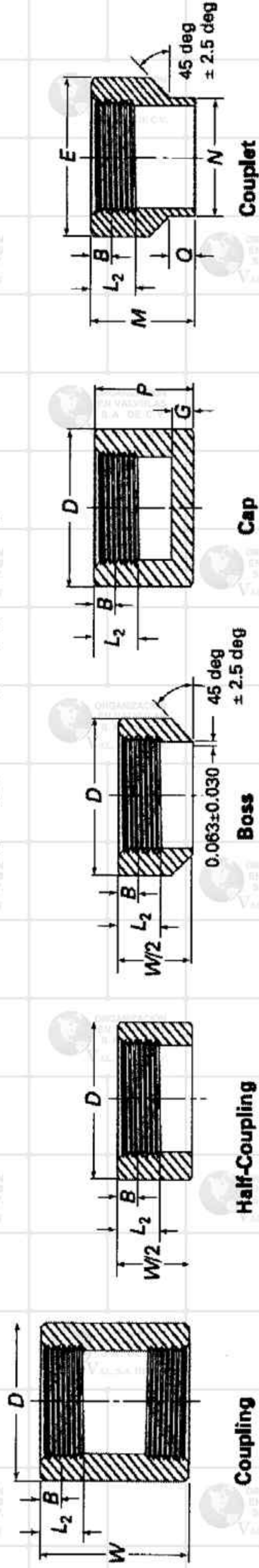
| Nominal Pipe Size, NPS | Center-to-Female End Street Ells, A [Note (1)] |      | Center-to-Male End Street Ells, J |      | Outside Diameter of Band, H [Note (2)] |      | Minimum Wall Thickness, G <sub>1</sub> |       | Minimum Wall Thickness, G <sub>2</sub> [Note (3)] |      | Minimum Length Internal Thread [Note (4)] |                | Minimum Length Male Thread, L |
|------------------------|--|------|-----------------------------------|------|--|------|--|-------|---|------|---|----------------|-------------------------------|
|                        | Class Designation                              |      | Class Designation                 |      | Class Designation                      |      | Class Designation                      |       | Class Designation                                 |      | [Note (4)]                                |                |                               |
|                        | 3000   | 6000 | 3000                              | 6000 | 3000                                   | 6000 | 3000                                   | 6000  | 3000  | 6000 | B   | L <sub>2</sub> |                               |
| 1/8                    | 19   | 22   | 25                                | 32   | 19                                     | 25   | 3.18                                   | 5.08  | 2.74  | 4.22 | 6.4                                       | 6.7            | 10                            |
| 1/4                    | 22   | 25   | 32                                | 38   | 25                                     | 32   | 3.30                                   | 5.66  | 3.22  | 5.28 | 8.1                                       | 10.2           | 11                            |
| 3/8                    | 25   | 28   | 38                                | 41   | 32                                     | 38   | 3.51                                   | 6.98  | 3.50  | 5.59 | 9.1                                       | 10.4           | 13                            |
| 1/2                    | 28   | 35   | 41                                | 48   | 38                                     | 44   | 4.09                                   | 8.15  | 4.16  | 6.53 | 10.9                                      | 13.6           | 14                            |
| 3/4                    | 35   | 44   | 48                                | 57   | 44                                     | 51   | 4.32                                   | 8.53  | 4.88  | 6.86 | 12.7                                      | 13.9           | 16                            |
| 1                      | 44   | 51   | 57                                | 66   | 51                                     | 62   | 4.98                                   | 9.93  | 5.56  | 7.95 | 14.7                                      | 17.3           | 19                            |
| 1 1/4                  | 51   | 54   | 66                                | 71   | 62                                     | 70   | 5.28                                   | 10.59 | 5.56  | 8.48 | 17.0                                      | 18.0           | 21                            |
| 1 1/2                  | 54   | 64   | 71                                | 84   | 70                                     | 84   | 5.56                                   | 11.07 | 6.25  | 8.89 | 17.8                                      | 18.4           | 21                            |
| 2                      | 64   | 83   | 84                                | 105  | 84                                     | 102  | 7.14                                   | 12.09 | 7.64  | 9.70 | 19.0                                      | 19.2           | 22                            |

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

- (1) Dimension A of Table 2 for the appropriate fitting size may also be used at the option of the manufacturer.
- (2) Dimension H of Table 2 for the appropriate fitting size may also be used at the option of the manufacturer.
- (3) Wall thickness before threading.
- (4) Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L<sub>2</sub> (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

Table 5 Threaded Couplings, Bosses, Caps, and Couplets



| Nominal Pipe Size | Outside Diameter, D |      | End-to-End Coupling, W |           | End-to-End Caps, P |      | End-to-End Coupling, Tol. |           | Minimum End Wall Thickness, G |      | Weld Ring Length, Q |     | Weld Ring Diameter, N |           | Minimum Length of Thread [Note (1)] |                |
|-------------------|---------------------|------|------------------------|-----------|--------------------|------|---------------------------|-----------|-------------------------------|------|---------------------|-----|-----------------------|-----------|-------------------------------------|----------------|
|                   | 3000                | 6000 | 3000/6000              | Tol.      | 3000               | 6000 | 3000/6000                 | ±         | 3000                          | 6000 | 3000/6000           | ±   | 3000/6000             | ±         | B                                   | L <sub>2</sub> |
| 1/8               | 16                  | 22   | ...                    | ...       | 19                 | 22   | ...                       | ...       | 4.8                           | 6.4  | ...                 | ... | ...                   | ...       | 6.4                                 | 6.7            |
| 1/4               | 19                  | 25   | 23.8                   | ±1.5/-0.0 | 25                 | 27   | 30.2                      | ±0.8/-0.0 | 4.8                           | 6.4  | 9.5                 | 0.8 | 17.5                  | ±1.5/-0.0 | 8.1                                 | 10.2           |
| 3/8               | 22                  | 32   | 27.0                   | ±1.5/-0.0 | 32                 | 27   | 30.2                      | ±0.8/-0.0 | 4.8                           | 6.4  | 9.5                 | 0.8 | 20.7                  | ±1.5/-0.0 | 9.1                                 | 10.4           |
| 1/2               | 28                  | 38   | 33.4                   | ±1.5/-0.0 | 32                 | 33   | 33.4                      | ±0.8/-0.0 | 6.4                           | 7.9  | 9.5                 | 0.8 | 23.8                  | ±1.5/-0.0 | 10.9                                | 13.6           |
| 3/4               | 35                  | 44   | 38.1                   | ±1.5/-0.0 | 37                 | 38   | 34.9                      | ±0.8/-0.0 | 6.4                           | 7.9  | 9.5                 | 0.8 | 27.0                  | ±1.5/-0.0 | 12.7                                | 13.9           |
| 1                 | 44                  | 57   | 46.1                   | ±1.5/-0.0 | 41                 | 43   | 42.9                      | ±0.8/-0.0 | 9.7                           | 11.2 | 9.5                 | 0.8 | 33.4                  | ±1.5/-0.0 | 14.7                                | 17.3           |
| 1 1/4             | 57                  | 64   | 55.6                   | ±1.5/-0.0 | 44                 | 46   | 47.6                      | ±0.8/-0.0 | 9.7                           | 11.2 | 9.5                 | 0.8 | 42.9                  | ±1.5/-0.0 | 17.0                                | 18.4           |
| 1 1/2             | 64                  | 76   | 63.5                   | ±1.5/-0.0 | 44                 | 48   | 50.8                      | ±0.8/-0.0 | 11.2                          | 12.7 | 9.5                 | 0.8 | 49.2                  | ±1.5/-0.0 | 17.8                                | 18.4           |
| 2                 | 76                  | 92   | 79.4                   | ±1.5/-0.0 | 48                 | 51   | 57.2                      | ±1.5/-0.0 | 12.7                          | 15.7 | 9.5                 | 0.8 | 61.9                  | ±1.5/-0.0 | 19.0                                | 19.2           |
| 2 1/2             | 92                  | 108  | 92.1                   | ±1.5/-0.0 | 60                 | 64   | 63.5                      | ±1.5/-0.0 | 15.7                          | 19.0 | 9.5                 | 0.8 | 73.0                  | ±1.5/-0.0 | 23.6                                | 28.9           |
| 3                 | 108                 | 127  | 111.1                  | ±1.5/-0.0 | 65                 | 68   | 69.9                      | ±1.5/-0.0 | 19.0                          | 22.4 | 9.5                 | 0.8 | 114.3                 | ±1.5/-0.0 | 25.9                                | 30.5           |
| 4                 | 140                 | 159  | 141.3                  | ±1.5/-0.0 | 68                 | 75   | 76.2                      | ±1.5/-0.0 | 22.4                          | 28.4 | 9.5                 | 0.8 | 114.3                 | ±1.5/-0.0 | 27.7                                | 33.0           |

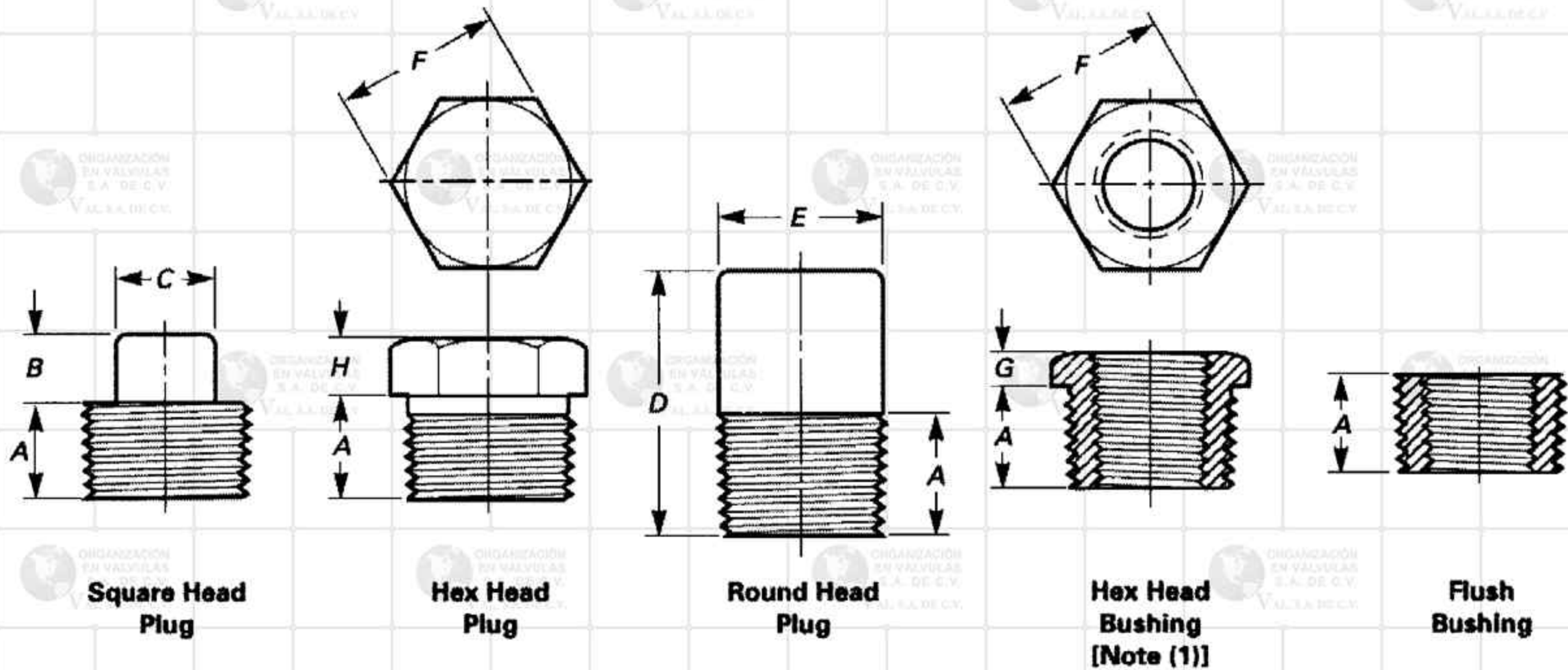
GENERAL NOTES:

(a) Dimensions are in millimeters.

(b) The wall thickness away from the threaded ends shall meet the minimum wall thickness requirements of Table 1-2 for the appropriate NPS and Class Designation fitting.

NOTE: (1) Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L<sub>2</sub> (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

Table 6 Plugs and Bushings



| Nominal Pipe Size | Minimum Length, A | Square Head Plugs        |                                   | Round Head Plugs         |                   | Hex Plugs and Bushings            |                    |         |
|-------------------|-------------------|--------------------------|-----------------------------------|--------------------------|-------------------|-----------------------------------|--------------------|---------|
|                   |                   | Minimum Square Height, B | Minimum Width Flats, C [Note (2)] | Nominal Head Diameter, E | Minimum Length, D | Nominal Width Flats, F [Note (2)] | Minimum Hex Height |         |
|                   |                   |                          |                                   |                          |                   |                                   | Bushing, G         | Plug, H |
| 1/8               | 10                | 6                        | 7.15                              | 10                       | 35                | 11.11                             | ...                | 6       |
| 1/4               | 11                | 6                        | 9.55                              | 14                       | 41                | 15.88                             | 3                  | 6       |
| 3/8               | 13                | 8                        | 11.11                             | 18                       | 41                | 17.46                             | 4                  | 8       |
| 1/2               | 14                | 10                       | 14.29                             | 21                       | 44                | 22.23                             | 5                  | 8       |
| 3/4               | 16                | 11                       | 15.88                             | 27                       | 44                | 26.99                             | 6                  | 10      |
| 1                 | 19                | 13                       | 20.64                             | 33                       | 51                | 34.93                             | 6                  | 10      |
| 1 1/4             | 21                | 14                       | 23.81                             | 43                       | 51                | 44.45                             | 7                  | 14      |
| 1 1/2             | 21                | 16                       | 28.58                             | 48                       | 51                | 50.80                             | 8                  | 16      |
| 2                 | 22                | 18                       | 33.27                             | 60                       | 64                | 63.50                             | 9                  | 18      |
| 2 1/2             | 27                | 19                       | 38.10                             | 73                       | 70                | 76.20                             | 10                 | 19      |
| 3                 | 28                | 21                       | 42.86                             | 89                       | 70                | 88.90                             | 10                 | 21      |
| 4                 | 32                | 25                       | 63.50                             | 114                      | 76                | 117.48                            | 13                 | 25      |

GENERAL NOTE: Dimensions are in millimeters.

NOTES:

- (1) *Cautionary Note Regarding Hex Bushings:* Hex head bushings of one-size reduction should not be used in services where they might be subject to harmful loads and forces other than internal pressures.
- (2) Manufacturer's applied tolerance shall ensure dimension will fit U.S. Customary tooling.



(16)

**Table 7 Types of Fittings by Class Designation and NPS Size Range**

| Description   | Socket-Welding    |       |       | Threaded          |                  |                  |
|---|-------------------|-------|-------|-------------------|------------------|------------------|
|   | Class Designation |       |       | Class Designation |                  |                  |
|   | 3000              | 6000  | 9000  | 2000              | 3000             | 6000             |
| 45-deg, 90-deg elbows, tees, crosses, couplings, half-couplings, caps, bosses, and couplers | 1/8-4             | 1/8-2 | 1/2-2 | 1/8-4             | 1/8-4            | 1/8-4            |
|   | 1/8-4             | 1/8-2 | 1/2-2 | 1/8-4             | 1/8-4            | 1/8-4            |
|   | 1/8-4             | 1/8-2 | 1/2-2 | ...               | 1/8-4            | 1/8-4            |
|   | 1/8-4             | 1/8-2 | 1/2-2 | ...               | 1/8-4            | 1/4-2            |
| Street elbows   | ...               | ...   | ...   | ...               | 1/8-2            | 1/8-2            |
| Square, hex, round plug, hex, and flush bushing   | ...               | ...   | ...   | 1/8-4 [Note (1)]  | 1/8-4 [Note (1)] | 1/8-4 [Note (1)] |
|   | ...               | ...   | ...   | 1/8-4 [Note (1)]  | 1/8-4 [Note (1)] | 1/8-4 [Note (1)] |

NOTE: (1) Plugs and bushings are not identified by class designation. They may be used for ratings up to Class 6000 designation.

**3 SIZE AND TYPE**

**3.1 General**

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

| NPS   | DN  |
|-------|-----|
| 1/8   | 6   |
| 1/4   | 8   |
| 3/8   | 10  |
| 1/2   | 15  |
| 3/4   | 20  |
| 1     | 25  |
| 1 1/4 | 32  |
| 1 1/2 | 40  |
| 2     | 50  |
| 2 1/2 | 65  |
| 3     | 80  |
| 4     | 100 |

**3.2 Reducing Fitting Size**

In the case of reducing tees and crosses, 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, the size of the branch is given last. Where the fitting is a cross, the largest side-outlet is the third dimension given, followed by the opening opposite. The line sketches, Figure 1, illustrate how the reducing fittings are read.

**4 MARKING**

**4.1 General**

Each fitting shall be permanently marked with the required identification by raised lettering and/or stamping, electro-etching, or vibro-tool marking on the collar portion, raised pad, or raised boss portion of the

forging. Cylindrical fittings shall be marked on the O.D. or end of the fitting in a location such that the marking will not be obliterated as a result of welding installation. The marking of bushings and plugs is not required by this Standard.

**4.1.1 Specific Marking.** The marking shall include (but is not limited to) the following:

- (a) *Manufacturer's Name or Trademark*
- (b) *Material Identification.* Material shall be identified in accordance with the marking requirements of either the appropriate ASTM Fitting or Forging Specifications (see para. 5.1).

**Table 8 Correlation of Fittings Class With Schedule Number or Wall Designation of Pipe for Calculation of Ratings** (16)

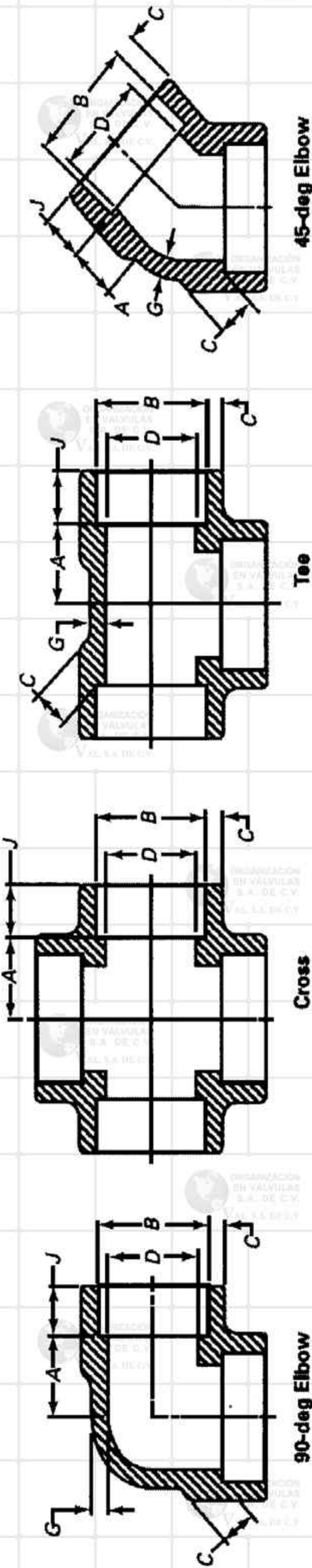
| Class Designation of Fitting | Type of Fitting | Pipe Used for Rating Basis [Note (1)] |                  |
|------------------------------|-----------------|---------------------------------------|------------------|
|                              |                 | Schedule No.                          | Wall Designation |
| 2000                         | Threaded        | 80                                    | XS               |
| 3000                         | Threaded        | 160                                   | ...              |
| 6000                         | Threaded        | ...                                   | XXS              |
| 3000                         | Socket-welding  | 80                                    | XS               |
| 6000                         | Socket-welding  | 160                                   | ...              |
| 9000                         | Socket-welding  | ...                                   | XXS              |

NOTE: (1) This Table is not intended to restrict the use of pipe of thinner or thicker wall with fittings. Pipe actually used may be thinner or thicker in nominal wall than that shown in Table 8. When thinner pipe is used, its strength may govern the rating. When thicker pipe is used (e.g., for mechanical strength), the strength of the fitting governs the rating.

**Table 9 Nominal Wall Thickness of Schedule 160 and Double Extra Strong Pipe** (16)

| NPS | Schedule 160 |       | XXS  |       |
|-----|--------------|-------|------|-------|
|     | mm           | in.   | mm   | in.   |
| 1/8 | 3.15         | 0.124 | 4.83 | 0.190 |
| 1/4 | 3.68         | 0.145 | 6.05 | 0.238 |
| 3/8 | 4.01         | 0.158 | 6.40 | 0.252 |

Table I-1 Socket-Welding Elbows, Tees, and Crosses



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| Nominal Pipe Size | Socket Bore Dia., B |       | Bore Diameter of Fittings, D |       |       |       | Socket Wall Thickness, [Note (1)], C |       |       |       | Body Wall, G |       |       |       | Center-to-Bottom of Socket, A |       |              |       | Tol ± |       |       |       |
|-------------------|---------------------|-------|------------------------------|-------|-------|-------|--------------------------------------|-------|-------|-------|--------------|-------|-------|-------|-------------------------------|-------|--------------|-------|-------|-------|-------|-------|
|                   | Max.                | Min.  | 3000                         |       | 6000  |       | 9000                                 |       | 3000  |       | 6000         |       | 9000  |       | 90 Elbows, Tees, and Crosses  |       | 45-deg Elbow |       |       |       |       |       |
|                   |                     |       | Max.                         | Min.  | Max.  | Min.  | Avg.                                 | Min.  | Avg.  | Min.  | Avg.         | Min.  | Min.  | Min.  | 3000                          | 6000  | 9000         | 3000  |       | 6000  | 9000  |       |
| 1/8               | 0.440               | 0.420 | 0.299                        | 0.239 | 0.189 | 0.126 | ...                                  | 0.125 | 0.125 | 0.156 | 0.135        | ...   | 0.095 | 0.124 | ...                           | 0.380 | 0.440        | 0.440 | 0.310 | 0.310 | 0.310 | 0.030 |
| 1/4               | 0.575               | 0.555 | 0.394                        | 0.334 | 0.280 | 0.220 | ...                                  | 0.149 | 0.130 | 0.181 | 0.158        | ...   | 0.119 | 0.145 | ...                           | 0.380 | 0.440        | 0.530 | 0.310 | 0.310 | 0.310 | 0.030 |
| 3/8               | 0.710               | 0.690 | 0.523                        | 0.463 | 0.389 | 0.329 | ...                                  | 0.158 | 0.138 | 0.198 | 0.172        | ...   | 0.126 | 0.158 | ...                           | 0.380 | 0.530        | 0.620 | 0.310 | 0.440 | 0.440 | 0.060 |
| 1/2               | 0.875               | 0.855 | 0.652                        | 0.592 | 0.494 | 0.434 | 0.282                                | 0.222 | 0.184 | 0.235 | 0.204        | 0.368 | 0.294 | 0.188 | 0.294                         | 0.380 | 0.620        | 0.750 | 0.440 | 0.500 | 0.500 | 0.060 |
| 3/4               | 1.085               | 1.065 | 0.854                        | 0.794 | 0.642 | 0.582 | 0.464                                | 0.404 | 0.193 | 0.168 | 0.274        | 0.238 | 0.385 | 0.219 | 0.308                         | 0.500 | 0.750        | 0.880 | 0.500 | 0.560 | 0.560 | 0.060 |
| 1                 | 1.350               | 1.330 | 1.079                        | 1.019 | 0.845 | 0.785 | 0.629                                | 0.569 | 0.224 | 0.196 | 0.312        | 0.273 | 0.448 | 0.250 | 0.358                         | 0.500 | 0.880        | 1.060 | 0.500 | 0.560 | 0.690 | 0.080 |
| 1 1/4             | 1.695               | 1.675 | 1.410                        | 1.350 | 1.190 | 1.130 | 0.926                                | 0.866 | 0.239 | 0.208 | 0.312        | 0.273 | 0.478 | 0.250 | 0.382                         | 0.500 | 1.060        | 1.250 | 0.500 | 0.560 | 0.810 | 0.080 |
| 1 1/2             | 1.935               | 1.915 | 1.640                        | 1.580 | 1.368 | 1.308 | 1.130                                | 1.070 | 0.250 | 0.218 | 0.351        | 0.307 | 0.500 | 0.281 | 0.400                         | 0.500 | 1.250        | 1.500 | 0.500 | 0.560 | 1.000 | 0.080 |
| 2                 | 2.426               | 2.406 | 2.097                        | 2.037 | 1.717 | 1.657 | 1.533                                | 1.473 | 0.273 | 0.238 | 0.430        | 0.374 | 0.545 | 0.344 | 0.436                         | 0.620 | 1.500        | 1.620 | 0.620 | 0.560 | 1.120 | 0.080 |
| 2 1/2             | 2.931               | 2.906 | 2.529                        | 2.409 | ...   | ...   | ...                                  | ...   | 0.345 | 0.302 | ...          | ...   | 0.276 | ...   | 0.620                         | 1.620 | ...          | 1.120 | ...   | ...   | ...   | 0.100 |
| 3                 | 3.560               | 3.535 | 3.128                        | 3.008 | ...   | ...   | ...                                  | ...   | 0.375 | 0.327 | ...          | ...   | 0.300 | ...   | 0.620                         | 2.250 | ...          | 1.250 | ...   | ...   | ...   | 0.100 |
| 4                 | 4.570               | 4.545 | 4.086                        | 3.966 | ...   | ...   | ...                                  | ...   | 0.421 | 0.368 | ...          | ...   | 0.337 | ...   | 0.750                         | 2.620 | ...          | 1.620 | ...   | ...   | ...   | 0.100 |

GENERAL NOTE: Dimensions are in inches.

NOTE: (1) Average of socket wall thickness around periphery shall not be less than listed values. The minimum values are permitted in localized areas.

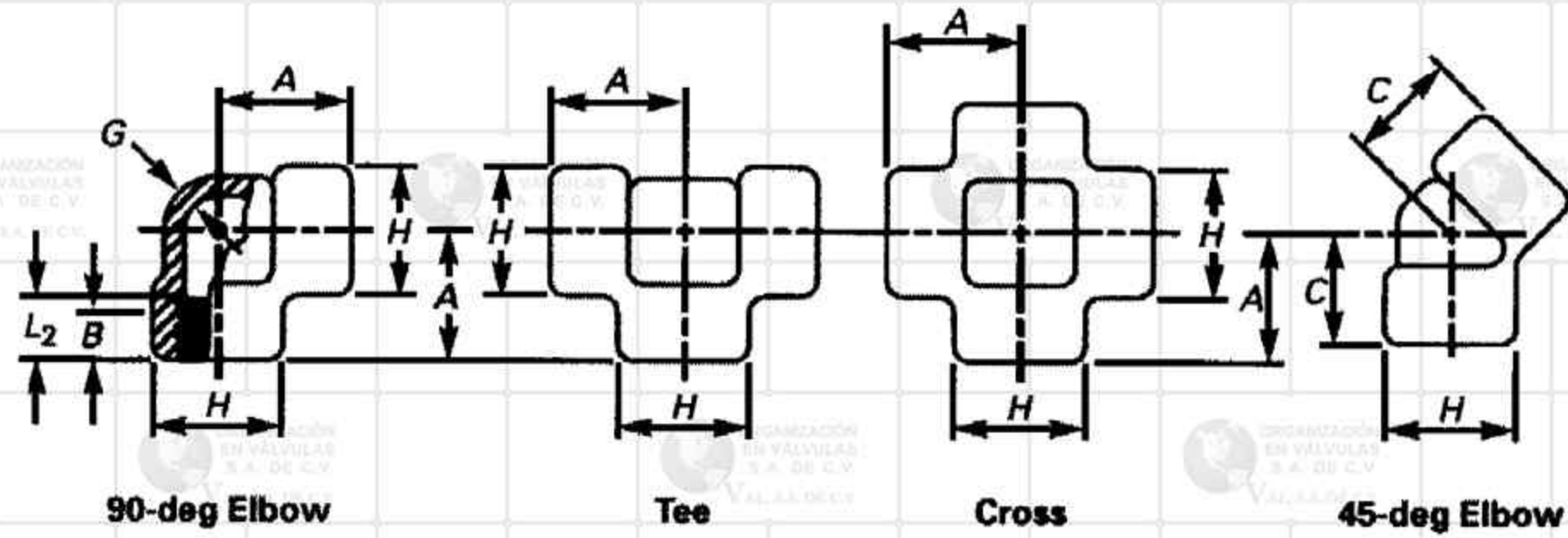
**Table I-2 Socket-Welding Couplings, Bosses, Caps, and Couplets**

| Nominal Pipe Size | Bore Diameter of Fittings, D |       |       |       |       |       | Socket Wall Thickness, [Note (1)], C |       |       |       |       |       | Socket Laying Depth, f |       |      |      |      |      | End Wall Thickness, K |      |      |      |      |      | End to End Couplet, M |      |      |      |           |      | Weld Ring Diameter, N |      |      |      |      |      | Weld Ring Length, Q |  |  |  |  |  |
|-------------------|------------------------------|-------|-------|-------|-------|-------|--------------------------------------|-------|-------|-------|-------|-------|------------------------|-------|------|------|------|------|-----------------------|------|------|------|------|------|-----------------------|------|------|------|-----------|------|-----------------------|------|------|------|------|------|---------------------|--|--|--|--|--|
|                   | 3000                         |       | 6000  |       | 9000  |       | 3000                                 |       | 6000  |       | 9000  |       | Min.                   |       | ±    |      | Min. |      | ±                     |      | Min. |      | ±    |      | 3000/6000             |      | ±    |      | 3000/6000 |      | ±                     |      |      |      |      |      |                     |  |  |  |  |  |
|                   | Max.                         | Min.  | Max.  | Min.  | Max.  | Min.  | Avg.                                 | Min.  | Avg.  | Min.  | Avg.  | Min.  | Avg.                   | Min.  | Avg. | Min. | Avg. | Min. | Avg.                  | Min. | Avg. | Min. | Avg. | Min. | Avg.                  | Min. | Avg. | Min. | Avg.      | Min. | Avg.                  |      |      |      |      |      |                     |  |  |  |  |  |
| 1/8               | 0.440                        | 0.420 | 0.299 | 0.239 | 0.189 | 0.126 | ...                                  | 0.125 | 0.125 | 0.156 | 0.135 | ...   | ...                    | 0.06/ | 0.38 | 0.25 | 0.06 | 0.62 | 0.03                  | 0.19 | 0.25 | ...  | ...  | ...  | ...                   | ...  | ...  | ...  | ...       | ...  | ...                   | ...  | ...  |      |      |      |                     |  |  |  |  |  |
| 1/4               | 0.575                        | 0.555 | 0.394 | 0.334 | 0.280 | 0.220 | ...                                  | 3.78  | 0.130 | 0.181 | 0.158 | ...   | 0.94                   | 1.00  | 0.25 | 0.06 | 0.62 | 0.03 | 0.19                  | 0.25 | ...  | ...  | ...  | ...  | ...                   | ...  | ...  | ...  | ...       | ...  | ...                   | ...  | ...  |      |      |      |                     |  |  |  |  |  |
| 3/8               | 0.710                        | 0.690 | 0.523 | 0.463 | 0.389 | 0.329 | ...                                  | 0.158 | 0.138 | 0.198 | 0.172 | ...   | 1.06                   | 1.25  | 0.25 | 0.12 | 0.69 | 0.06 | 0.19                  | 0.25 | ...  | ...  | ...  | ...  | ...                   | ...  | ...  | ...  | ...       | ...  | ...                   | ...  | ...  |      |      |      |                     |  |  |  |  |  |
| 1/2               | 0.875                        | 0.855 | 0.652 | 0.592 | 0.494 | 0.434 | 0.282                                | 0.222 | 0.184 | 0.235 | 0.204 | 0.368 | 0.322                  | 1.31  | 1.50 | 0.38 | 0.12 | 0.88 | 0.06                  | 0.25 | 0.31 | 0.44 | 1.31 | 1.31 | 1.31                  | 1.31 | 1.31 | 1.31 | 1.31      | 1.31 | 1.31                  | 1.31 | 1.31 |      |      |      |                     |  |  |  |  |  |
| 3/4               | 1.085                        | 1.065 | 0.854 | 0.794 | 0.642 | 0.582 | 0.464                                | 0.404 | 0.193 | 0.168 | 0.274 | 0.238 | 0.385                  | 0.337 | 1.50 | 1.75 | 0.38 | 0.12 | 0.94                  | 0.06 | 0.25 | 0.31 | 0.50 | 1.38 | 1.38                  | 1.38 | 1.38 | 1.38 | 1.38      | 1.38 | 1.38                  | 1.38 | 1.38 | 1.38 |      |      |                     |  |  |  |  |  |
| 1                 | 1.350                        | 1.330 | 1.079 | 1.019 | 0.845 | 0.785 | 0.629                                | 0.569 | 0.224 | 0.196 | 0.312 | 0.273 | 0.448                  | 0.392 | 1.81 | 2.25 | 0.50 | 0.16 | 1.12                  | 0.08 | 0.38 | 0.44 | 0.56 | 1.69 | 1.69                  | 1.69 | 1.69 | 1.69 | 1.69      | 1.69 | 1.69                  | 1.69 | 1.69 | 1.69 | 1.69 |      |                     |  |  |  |  |  |
| 1 1/4             | 1.695                        | 1.675 | 1.410 | 1.350 | 1.190 | 1.130 | 0.926                                | 0.866 | 0.239 | 0.208 | 0.312 | 0.273 | 0.478                  | 0.418 | 2.19 | 2.50 | 0.50 | 0.16 | 1.19                  | 0.08 | 0.38 | 0.44 | 0.56 | 1.88 | 1.88                  | 1.88 | 1.88 | 1.88 | 1.88      | 1.88 | 1.88                  | 1.88 | 1.88 | 1.88 | 1.88 | 1.88 |                     |  |  |  |  |  |
| 1 1/2             | 1.935                        | 1.915 | 1.640 | 1.580 | 1.368 | 1.308 | 1.130                                | 1.070 | 0.250 | 0.218 | 0.351 | 0.307 | 0.500                  | 0.438 | 2.50 | 3.00 | 0.50 | 0.16 | 1.25                  | 0.08 | 0.44 | 0.50 | 0.62 | 2.00 | 2.00                  | 2.00 | 2.00 | 2.00 | 2.00      | 2.00 | 2.00                  | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |                     |  |  |  |  |  |
| 2                 | 2.426                        | 2.406 | 2.097 | 2.037 | 1.717 | 1.657 | 1.533                                | 1.473 | 0.273 | 0.238 | 0.430 | 0.374 | 0.545                  | 0.477 | 3.13 | 3.63 | 0.62 | 0.16 | 1.62                  | 0.08 | 0.50 | 0.62 | 0.75 | 2.25 | 2.25                  | 2.25 | 2.25 | 2.25 | 2.25      | 2.25 | 2.25                  | 2.25 | 2.25 | 2.25 | 2.25 | 2.25 |                     |  |  |  |  |  |
| 2 1/2             | 2.931                        | 2.906 | 2.529 | 2.409 | ...   | ...   | ...                                  | 0.345 | 0.302 | ...   | ...   | ...   | ...                    | 3.63  | 4.25 | 0.62 | 0.20 | 1.69 | 0.10                  | 0.62 | 0.75 | ...  | 2.50 | 2.50 | 2.50                  | 2.50 | 2.50 | 2.50 | 2.50      | 2.50 | 2.50                  | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |                     |  |  |  |  |  |
| 3                 | 3.560                        | 3.535 | 3.128 | 3.008 | ...   | ...   | ...                                  | 0.375 | 0.327 | ...   | ...   | ...   | ...                    | 4.38  | 5.00 | 0.62 | 0.20 | 1.75 | 0.10                  | 0.75 | 0.88 | ...  | 2.75 | 2.75 | 2.75                  | 2.75 | 2.75 | 2.75 | 2.75      | 2.75 | 2.75                  | 2.75 | 2.75 | 2.75 | 2.75 | 2.75 |                     |  |  |  |  |  |
| 4                 | 4.570                        | 4.545 | 4.086 | 3.966 | ...   | ...   | ...                                  | 0.421 | 0.368 | ...   | ...   | ...   | ...                    | 5.56  | 6.25 | 0.75 | 0.20 | 1.88 | 0.10                  | 0.88 | 1.12 | ...  | 3.00 | 3.00 | 3.00                  | 3.00 | 3.00 | 3.00 | 3.00      | 3.00 | 3.00                  | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |                     |  |  |  |  |  |

GENERAL NOTE: Dimensions are in inches.  
 NOTE: (1) Average of socket wall thickness around periphery shall not be less than listed values. The minimum values are permitted in localized areas.

(16)

Table I-3 Threaded Elbows, Tees, and Crosses



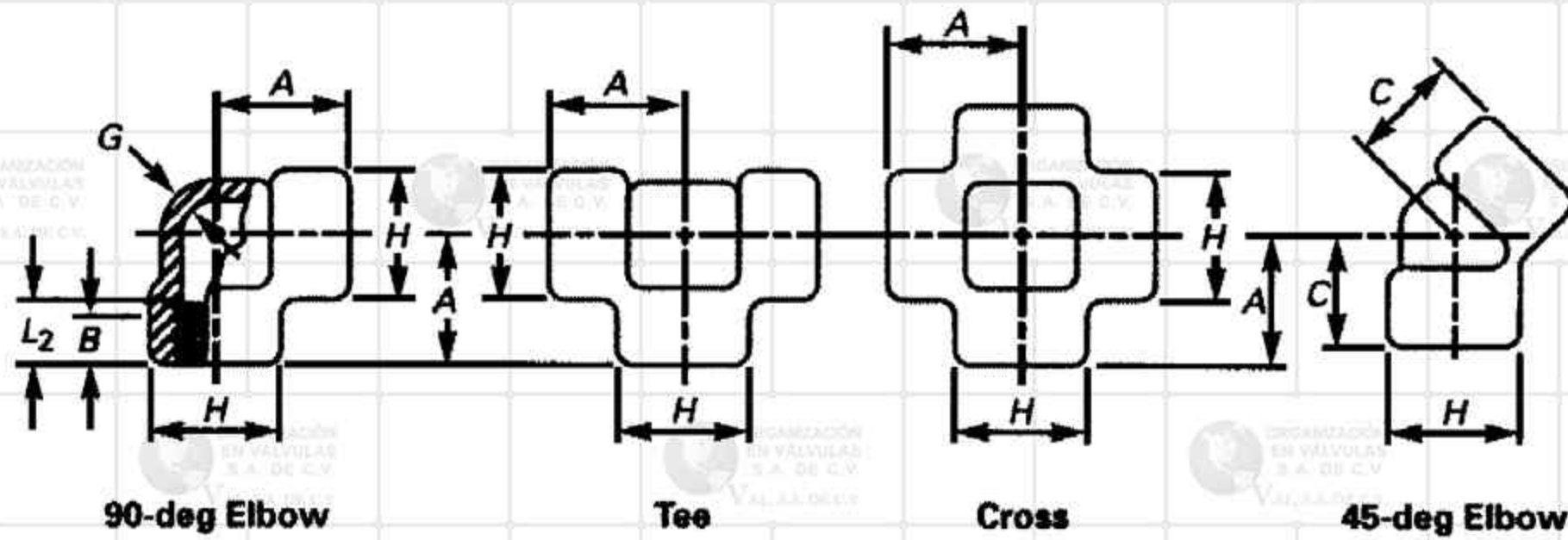
| Nominal Pipe Size | Center-to-End Elbows, Tees, and Crosses, <i>A</i> |      |      | Center-to-End 45-deg Elbow, <i>C</i> |      |      | Outside Diameter of Band, <i>H</i> |      |      | Minimum Wall Thickness, <i>G</i> |       |       | Minimum Length of Thread [Note (1)] |                      |
|-------------------|---|------|------|--------------------------------------|------|------|------------------------------------|------|------|----------------------------------|-------|-------|-------------------------------------|----------------------|
|                   | 2000  | 3000 | 6000 | 2000                                 | 3000 | 6000 | 2000                               | 3000 | 6000 | 2000                             | 3000  | 6000  | <i>B</i>                            | <i>L<sub>2</sub></i> |
| 1/8               | 0.81  | 0.81 | 0.97 | 0.69                                 | 0.69 | 0.75 | 0.88                               | 0.88 | 1.00 | 0.125                            | 0.125 | 0.250 | 0.25                                | 0.2639               |
| 1/4               | 0.81  | 0.97 | 1.12 | 0.69                                 | 0.75 | 0.88 | 0.88                               | 1.00 | 1.31 | 0.125                            | 0.130 | 0.260 | 0.32                                | 0.4018               |
| 3/8               | 0.97  | 1.12 | 1.31 | 0.75                                 | 0.88 | 1.00 | 1.00                               | 1.31 | 1.50 | 0.125                            | 0.138 | 0.275 | 0.36                                | 0.4078               |
| 1/2               | 1.12  | 1.31 | 1.50 | 0.88                                 | 1.00 | 1.12 | 1.31                               | 1.50 | 1.81 | 0.125                            | 0.161 | 0.321 | 0.43                                | 0.5337               |
| 3/4               | 1.31  | 1.50 | 1.75 | 1.00                                 | 1.12 | 1.31 | 1.50                               | 1.81 | 2.19 | 0.125                            | 0.170 | 0.336 | 0.50                                | 0.5457               |
| 1                 | 1.50  | 1.75 | 2.00 | 1.12                                 | 1.31 | 1.38 | 1.81                               | 2.19 | 2.44 | 0.145                            | 0.196 | 0.391 | 0.58                                | 0.6828               |
| 1 1/4             | 1.75  | 2.00 | 2.38 | 1.31                                 | 1.38 | 1.69 | 2.19                               | 2.44 | 2.97 | 0.153                            | 0.208 | 0.417 | 0.67                                | 0.7068               |
| 1 1/2             | 2.00  | 2.38 | 2.50 | 1.38                                 | 1.69 | 1.72 | 2.44                               | 2.97 | 3.31 | 0.158                            | 0.219 | 0.436 | 0.70                                | 0.7235               |
| 2                 | 2.38  | 2.50 | 3.25 | 1.69                                 | 1.72 | 2.06 | 2.97                               | 3.31 | 4.00 | 0.168                            | 0.281 | 0.476 | 0.75                                | 0.7565               |
| 2 1/2             | 3.00  | 3.25 | 3.75 | 2.06                                 | 2.06 | 2.50 | 3.62                               | 4.00 | 4.75 | 0.221                            | 0.301 | 0.602 | 0.93                                | 1.1380               |
| 3                 | 3.38  | 3.75 | 4.19 | 2.50                                 | 2.50 | 3.12 | 4.31                               | 4.75 | 5.75 | 0.236                            | 0.348 | 0.655 | 1.02                                | 1.2000               |
| 4                 | 4.19  | 4.50 | 4.50 | 3.12                                 | 3.12 | 3.12 | 5.75                               | 6.00 | 6.00 | 0.258                            | 0.440 | 0.735 | 1.09                                | 1.3000               |

GENERAL NOTE: Dimensions are in inches.

NOTE: (1) Dimension *B* is minimum length of perfect thread. The length of useful thread (*B* plus threads with fully formed roots and flat crests) shall not be less than *L<sub>2</sub>* (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

(16)

Table I-3 Threaded Elbows, Tees, and Crosses

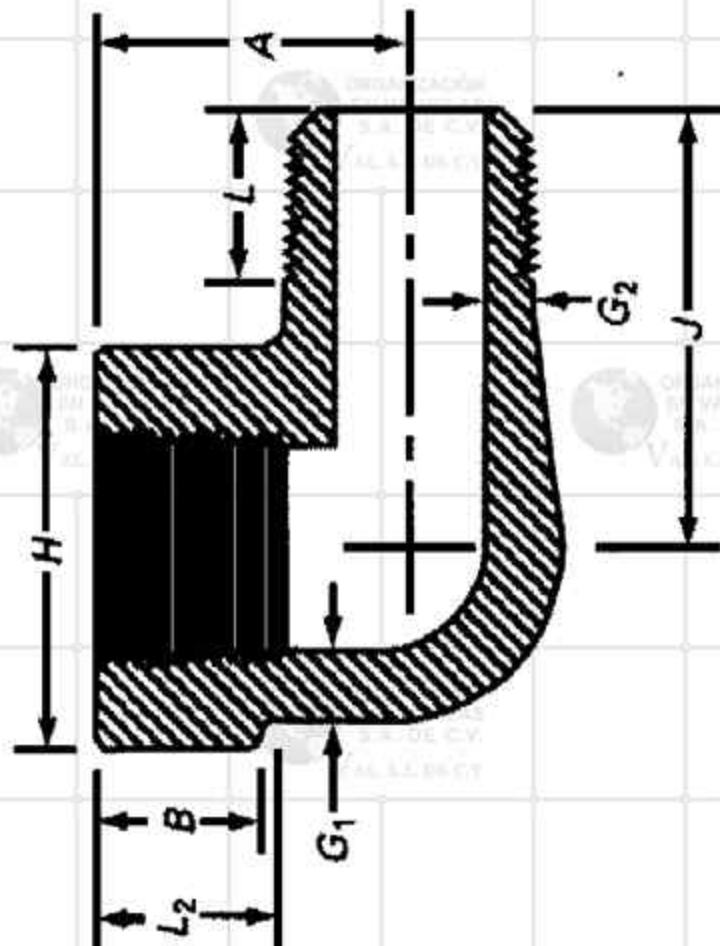


| Nominal Pipe Size | Center-to-End Elbows, Tees, and Crosses, A |      |      | Center-to-End 45-deg Elbow, C |      |      | Outside Diameter of Band, H |      |      | Minimum Wall Thickness, G |       |       | Minimum Length of Thread [Note (1)] |                |
|-------------------|--|------|------|-------------------------------|------|------|-----------------------------|------|------|---------------------------|-------|-------|-------------------------------------|----------------|
|                   | 2000                                       | 3000 | 6000 | 2000                          | 3000 | 6000 | 2000                        | 3000 | 6000 | 2000                      | 3000  | 6000  | B                                   | L <sub>2</sub> |
| 1/8               | 0.81                                       | 0.81 | 0.97 | 0.69                          | 0.69 | 0.75 | 0.88                        | 0.88 | 1.00 | 0.125                     | 0.125 | 0.250 | 0.25                                | 0.2639         |
| 1/4               | 0.81                                       | 0.97 | 1.12 | 0.69                          | 0.75 | 0.88 | 0.88                        | 1.00 | 1.31 | 0.125                     | 0.130 | 0.260 | 0.32                                | 0.4018         |
| 3/8               | 0.97                                       | 1.12 | 1.31 | 0.75                          | 0.88 | 1.00 | 1.00                        | 1.31 | 1.50 | 0.125                     | 0.138 | 0.275 | 0.36                                | 0.4078         |
| 1/2               | 1.12                                       | 1.31 | 1.50 | 0.88                          | 1.00 | 1.12 | 1.31                        | 1.50 | 1.81 | 0.125                     | 0.161 | 0.321 | 0.43                                | 0.5337         |
| 3/4               | 1.31                                       | 1.50 | 1.75 | 1.00                          | 1.12 | 1.31 | 1.50                        | 1.81 | 2.19 | 0.125                     | 0.170 | 0.336 | 0.50                                | 0.5457         |
| 1                 | 1.50                                       | 1.75 | 2.00 | 1.12                          | 1.31 | 1.38 | 1.81                        | 2.19 | 2.44 | 0.145                     | 0.196 | 0.391 | 0.58                                | 0.6828         |
| 1 1/4             | 1.75                                       | 2.00 | 2.38 | 1.31                          | 1.38 | 1.69 | 2.19                        | 2.44 | 2.97 | 0.153                     | 0.208 | 0.417 | 0.67                                | 0.7068         |
| 1 1/2             | 2.00                                       | 2.38 | 2.50 | 1.38                          | 1.69 | 1.72 | 2.44                        | 2.97 | 3.31 | 0.158                     | 0.219 | 0.436 | 0.70                                | 0.7235         |
| 2                 | 2.38                                       | 2.50 | 3.25 | 1.69                          | 1.72 | 2.06 | 2.97                        | 3.31 | 4.00 | 0.168                     | 0.281 | 0.476 | 0.75                                | 0.7565         |
| 2 1/2             | 3.00                                       | 3.25 | 3.75 | 2.06                          | 2.06 | 2.50 | 3.62                        | 4.00 | 4.75 | 0.221                     | 0.301 | 0.602 | 0.93                                | 1.1380         |
| 3                 | 3.38                                       | 3.75 | 4.19 | 2.50                          | 2.50 | 3.12 | 4.31                        | 4.75 | 5.75 | 0.236                     | 0.348 | 0.655 | 1.02                                | 1.2000         |
| 4                 | 4.19                                       | 4.50 | 4.50 | 3.12                          | 3.12 | 3.12 | 5.75                        | 6.00 | 6.00 | 0.258                     | 0.440 | 0.735 | 1.09                                | 1.3000         |

GENERAL NOTE: Dimensions are in inches.

NOTE: (1) Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L<sub>2</sub> (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

Table I-4 Threaded Street Elbows



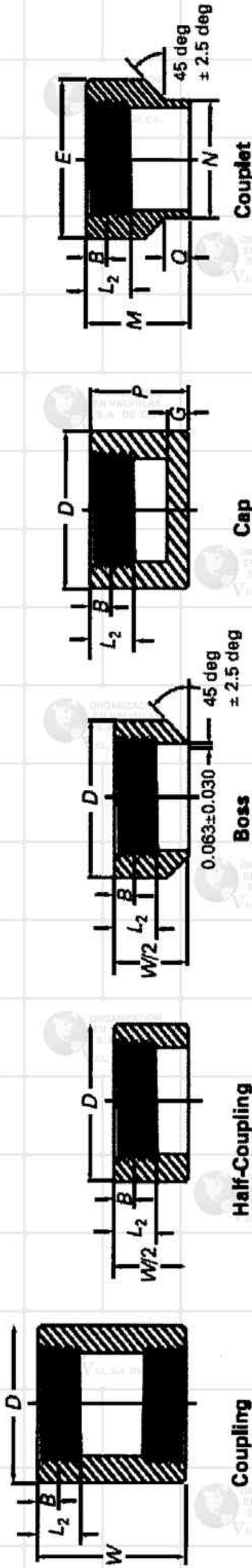
| Nominal Pipe Size, NPS | Center-to-Female End Street Ells, A [Note (1)] |      | Center-to-Male End Street Ells, J |      | Outside Diameter of Band, H [Note (2)] |      | Minimum Wall Thickness, G <sub>1</sub> |       | Minimum Wall Thickness, G <sub>2</sub> [Note (3)] |       | Minimum Length Internal Thread [Note (4)] |        | Minimum Length Male Thread, L |
|------------------------|--|------|-----------------------------------|------|--|------|--|-------|---|-------|---|--------|-------------------------------|
|                        | Class Designation                              |      | Class Designation                 |      | Class Designation                      |      | Class Designation                      |       | Class Designation                                 |       | B   |        |                               |
|                        | 3000   | 6000 | 3000                              | 6000 | 3000                                   | 6000 | 3000                                   | 6000  | 3000  | 6000  | 3000                                      | 6000   |                               |
| 1/8                    | 0.75   | 0.88 | 1.00                              | 1.25 | 0.75                                   | 1.00 | 0.125                                  | 0.200 | 0.108   | 0.166 | 0.25                                      | 0.2639 | 0.38                          |
| 1/4                    | 0.88   | 1.00 | 1.25                              | 1.50 | 1.00                                   | 1.25 | 0.130                                  | 0.223 | 0.127   | 0.208 | 0.32                                      | 0.4018 | 0.44                          |
| 3/8                    | 1.00   | 1.12 | 1.50                              | 1.62 | 1.25                                   | 1.50 | 0.138                                  | 0.275 | 0.138   | 0.220 | 0.36                                      | 0.4078 | 0.50                          |
| 1/2                    | 1.12   | 1.38 | 1.62                              | 1.88 | 1.50                                   | 1.75 | 0.161                                  | 0.321 | 0.164   | 0.257 | 0.43                                      | 0.5337 | 0.56                          |
| 3/4                    | 1.38   | 1.75 | 1.88                              | 2.25 | 1.75                                   | 2.00 | 0.170                                  | 0.336 | 0.192   | 0.270 | 0.50                                      | 0.5457 | 0.62                          |
| 1                      | 1.75   | 2.00 | 2.25                              | 2.62 | 2.00                                   | 2.44 | 0.196                                  | 0.391 | 0.219   | 0.313 | 0.58                                      | 0.6828 | 0.75                          |
| 1 1/4                  | 2.00   | 2.12 | 2.62                              | 2.81 | 2.44                                   | 2.75 | 0.208                                  | 0.417 | 0.219   | 0.334 | 0.67                                      | 0.7068 | 0.81                          |
| 1 1/2                  | 2.12   | 2.50 | 2.81                              | 3.31 | 2.75                                   | 3.31 | 0.219                                  | 0.436 | 0.246   | 0.350 | 0.70                                      | 0.7235 | 0.81                          |
| 2                      | 2.50   | 3.25 | 3.31                              | 4.13 | 3.31                                   | 4.00 | 0.281                                  | 0.476 | 0.301   | 0.382 | 0.75                                      | 0.7565 | 0.88                          |

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) Dimension A of Table 1-3 for the appropriate fitting size may also be used at the option of the manufacturer.
- (2) Dimension H of Table 1-3 for the appropriate fitting size may also be used at the option of the manufacturer.
- (3) Wall thickness before threading.
- (4) Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L<sub>2</sub> (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

Table I-5 Threaded Couplings, Bosses, Caps, and Couplets



| Nominal Pipe Size | Coupling            |                        | Half-Coupling          |                        | Boss                   |                        | Cap                           |                               | Couplet             |                       | Minimum Length of Thread [Note (1)] |                          |
|-------------------|---------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-------------------------------|-------------------------------|---------------------|-----------------------|-------------------------------------|--------------------------|
|                   | Outside Diameter, D | End-to-End Coupling, W | End-to-End Coupling, W | End-to-End Coupling, W | End-to-End Coupling, M | End-to-End Coupling, M | Minimum End Wall Thickness, G | Minimum End Wall Thickness, G | Weld Ring Length, Q | Weld Ring Diameter, N | Weld Ring Diameter, N               | Minimum Length of Thread |
|                   | 3000                | 6000                   | 3000                   | 6000                   | 3000                   | 6000                   | 3000                          | 6000                          | 3000                | 6000                  | 3000                                | 6000                     |
| 1/8               | 0.62                | 0.88                   | 1.25                   | 0.75                   | 0.88                   | 1.188                  | 0.19                          | 0.25                          | ...                 | ...                   | ...                                 | 0.25                     |
| 1/4               | 0.75                | 1.00                   | 1.38                   | 1.00                   | 1.06                   | 1.188                  | 0.19                          | 0.25                          | ...                 | 0.688                 | 0.688                               | 0.32                     |
| 3/8               | 0.88                | 1.25                   | 1.50                   | 1.00                   | 1.06                   | 1.188                  | 0.19                          | 0.25                          | ...                 | 0.813                 | 0.813                               | 0.36                     |
| 1/2               | 1.12                | 1.50                   | 1.88                   | 1.25                   | 1.31                   | 1.313                  | 0.25                          | 0.31                          | ...                 | 0.938                 | 0.938                               | 0.43                     |
| 3/4               | 1.38                | 1.75                   | 2.00                   | 1.44                   | 1.50                   | 1.375                  | 0.25                          | 0.31                          | ...                 | 1.063                 | 1.063                               | 0.50                     |
| 1                 | 1.75                | 2.25                   | 2.38                   | 1.62                   | 1.69                   | 1.688                  | 0.38                          | 0.44                          | ...                 | 1.313                 | 1.313                               | 0.58                     |
| 1 1/4             | 2.25                | 2.50                   | 2.62                   | 1.75                   | 1.81                   | 1.875                  | 0.38                          | 0.44                          | ...                 | 1.688                 | 1.688                               | 0.67                     |
| 1 1/2             | 2.50                | 3.00                   | 3.12                   | 1.75                   | 1.88                   | 2.000                  | 0.44                          | 0.50                          | ...                 | 1.938                 | 1.938                               | 0.70                     |
| 2                 | 3.00                | 3.62                   | 3.38                   | 1.88                   | 2.00                   | 2.250                  | 0.50                          | 0.62                          | ...                 | 2.438                 | 2.438                               | 0.75                     |
| 2 1/2             | 3.62                | 4.25                   | 3.62                   | 2.38                   | 2.50                   | 2.500                  | 0.62                          | 0.75                          | ...                 | 2.875                 | 2.875                               | 0.93                     |
| 3                 | 4.25                | 5.00                   | 4.25                   | 2.56                   | 2.69                   | 2.750                  | 0.75                          | 0.88                          | ...                 | 3.500                 | 3.500                               | 1.02                     |
| 4                 | 5.00                | 6.25                   | 4.75                   | 2.69                   | 2.94                   | 3.000                  | 0.88                          | 1.12                          | ...                 | 4.500                 | 4.500                               | 1.09                     |

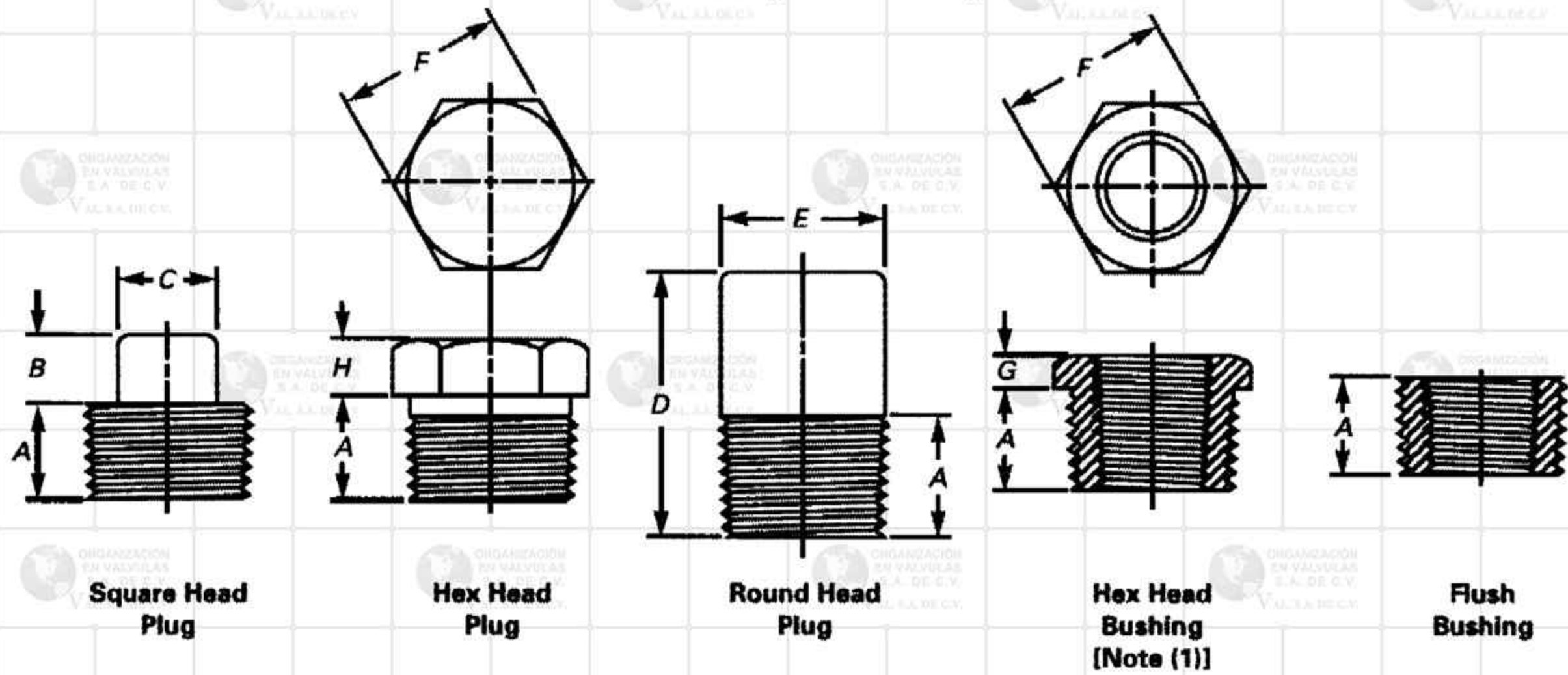
GENERAL NOTES:

(a) Dimensions are in millimeters.

(b) The wall thickness away from the threaded ends shall meet the minimum wall thickness requirements of Table I-2 for the appropriate NPS and class Designation fitting.

NOTE: (1) Dimension B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall be less than L<sub>2</sub> (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1; see para. 6.3).

Table I-6 Plugs and Bushings



| Nominal Pipe Size | Square Head Plugs        |                                 |  | Round Head Plugs                |                          | Hex Plugs and Bushings                   |                   |                |
|-------------------|--------------------------|---------------------------------|--|---------------------------------|--------------------------|--|-------------------|----------------|
|                   | Minimum Length, <i>A</i> | Minimum Square Height, <i>B</i> | Minimum Width Flats, <i>C</i> [Note (2)] | Nominal Head Diameter, <i>E</i> | Minimum Length, <i>D</i> | Nominal Width Flats, <i>F</i> [Note (2)] | Bushing, <i>G</i> | Plug, <i>H</i> |
| 1/8               | 0.38                     | 0.25                            | 0.28                                     | 0.41                            | 1.38                     | 0.44                                     | ...               | 0.25           |
| 1/4               | 0.44                     | 0.25                            | 0.38                                     | 0.53                            | 1.62                     | 0.62                                     | 0.12              | 0.25           |
| 3/8               | 0.50                     | 0.31                            | 0.44                                     | 0.69                            | 1.62                     | 0.69                                     | 0.16              | 0.31           |
| 1/2               | 0.56                     | 0.38                            | 0.56                                     | 0.84                            | 1.75                     | 0.88                                     | 0.19              | 0.31           |
| 3/4               | 0.62                     | 0.44                            | 0.62                                     | 1.06                            | 1.75                     | 1.06                                     | 0.22              | 0.38           |
| 1                 | 0.75                     | 0.50                            | 0.81                                     | 1.31                            | 2.00                     | 1.38                                     | 0.25              | 0.38           |
| 1 1/4             | 0.81                     | 0.56                            | 0.94                                     | 1.69                            | 2.00                     | 1.75                                     | 0.28              | 0.56           |
| 1 1/2             | 0.81                     | 0.62                            | 1.12                                     | 1.91                            | 2.00                     | 2.00                                     | 0.31              | 0.62           |
| 2                 | 0.88                     | 0.69                            | 1.31                                     | 2.38                            | 2.50                     | 2.50                                     | 0.34              | 0.69           |
| 2 1/2             | 1.06                     | 0.75                            | 1.50                                     | 2.88                            | 2.75                     | 3.00                                     | 0.38              | 0.75           |
| 3                 | 1.12                     | 0.81                            | 1.69                                     | 3.50                            | 2.75                     | 3.50                                     | 0.41              | 0.81           |
| 4                 | 1.25                     | 1.00                            | 2.50                                     | 4.50                            | 3.00                     | 4.62                                     | 0.50              | 1.00           |

GENERAL NOTE: Dimensions are in inches.

NOTES:

- (1) *Cautionary Note Regarding Hex Bushings:* Hex head bushings of one-size reduction should not be used in services where they might be subject to harmful loads and forces other than internal pressures.
- (2) Manufacturer's applied tolerance shall ensure dimension will fit U.S. Customary tooling.