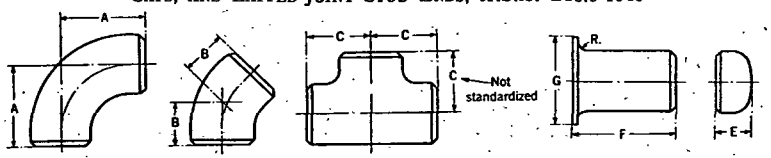
all of the responsibility. Thus the employer should select his welding mechanics with good judgment, provide them with first-class equipment and tools; arrange for their training and use of acceptable workmanship standards, and at regular intervals subject their work to prescribed tests.

For piping which is to be operated at pressures in excess of 15 psi, rules for fusion welding of pipe joints and the qualification of welders and

TABLE 8. AMERICAN STANDARD DIMENSIONS FOR BUTT-WELDING ELBOWS, TEES, CAPS, AND LAPPED-JOINT STUB ENDS, *A.S.A.* B16.9-1940




| NOMINAL PIPE SIZE | OUTSIDE DIAMETER | CENTER-TO-END | | | CAPS Eb-c | LAPPED-JOINT STUB ENDS | | |
|---|---|---|---|---|---|---|---|---|
| | | 90-Deg Elbows A | 45-Deg Elbows B | Of Run Tee Cc | | Length Fb | Radius of Fillet R | Diam. of Lap Gd |
| 1 | 1.315 | 1½ | ⅞ | 1½ | 1½ | 4 | ⅛ | 2 |
| 1¼ | 1.660 | 1⅞ | 1 | 1⅞ | 1½ | 4 | 3/16 | 2½ |
| 1½ | 1.900 | 2¼ | 1⅛ | 2¼ | 1½ | 4 | ¼ | 2⅞ |
| 2 | 2.375 | 3 | 1⅜ | 2½ | 1½ | 6 | 5/16 | 3⅝ |
| 2½ | 2.875 | 3¾ | 1¾ | 3 | 1½ | 6 | 5/16 | 4⅛ |
| 3 | 3.500 | 4½ | 2 | 3⅜ | 2 | 6 | ⅜ | 5 |
| 3½ | 4.000 | 5¼ | 2¼ | 3¾ | 2½ | 6 | ⅜ | 5½ |
| 4 | 4.500 | 6 | 2½ | 4⅛ | 2½ | 6 | 7/16 | 6 3/16 |
| 5 | 5.563 | 7½ | 3⅛ | 4⅞ | 3 | 8 | 7/16 | 7 5/16 |
| 6 | 6.625 | 9 | 3¾ | 5⅝ | 3½ | 8 | ½ | 8½ |
| 8 | 8 625 | 12 | 5 | 7 | 4 | 8 | ½ | 10 5/8 |
| 10 | 10.750 | 15 | 6¼ | 8½ | 5 | 10 | ½ | 12¾ |
| 12 | 12.750 | 18 | 7½ | 10 | 6 | 10 | ½ | 15 |

All dimensions given in inches.

[a]The dimensions of welding tees cover those which have side outlets from one size less than half the size of the run-way opening of the tees to full size.

[b]Dimensions *E* and *F* are applicable only to these fittings in schedules up to and including Schedule 80, *A.S.A.* Standard B36.10-1939..

[c]The shape of these caps shall be ellipsoidal and shall conform to the requirements of the *A.S.M.E.* Boiler Construction Code.

[d]This dimension is for standard machined facings in accordance with American Standard for Steel Pipe Flanges and Flanged Fittings (*A.S.A.* B16e-1939). The back face of the lap shall be machined to conform to the surface of the flange on which it seats. Where ring joint facings are to be applied, use dimension *K* as given in *A.S.A.* B16e-1939.

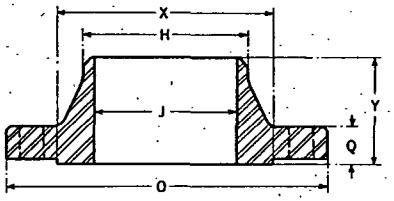
welding procedures as contained in the *American Standard Code for Pressure Piping* should be observed. U. S. Navy specifications for welding and qualification of operators are available [4]. For pressures 15 psi or below, the foregoing rules or those set forth in the *Standard Manual on Pipe Welding* of the *Heating, Piping and Air Conditioning Contractors National Association* should be followed to insure a satisfactory welded joint.

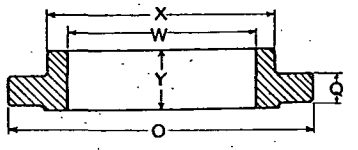
A complete line of manufactured steel welding fittings is now available and a dimensional standard has been prepared under the procedure of the *American Standards Association* to unify heretofore divergent dimensions for the same type welding fittings as produced by different manufacturers. Standard dimensions for steel butt-welding elbows, tees, caps, and lapped-joint stub ends are given in Table 8. Dimensions for eccentric and concentric reducers, and 180-deg return bends are not shown in Table 8 but



are included in the American Standard. Larger sizes also are available in some types of fittings. The welding bevel which is a straight 37½-deg V for wall thickness ¾ in. and below, and a U-bevel for thicknesses heavier than ¾ in., conforms to the recommended practice of *A.S.A.*

TABLE 9. AMERICAN STANDARD DIMENSIONS OF STEEL WELDING NECK AND SLIP-ON WELDING FLANGES FOR STEAM SERVICE PRESSURE RATING OF 150 PSI (GAGE) AT A TEMPERATURE OF 500 F, AND 100 PSI (GAGE) AT 750 F, *A.S.A.* B16e-1939




| NOMINAL PIPE SIZE | DIAMETER OF FLANGE | THICKNESS OF FLG.[a] MIN. | DIAMETER OF HUB | HUB DIAM. BEGINNING OF CHAMFER[b-c] | LENGTH THRU HUB[a] | INSIDE DIAM. OF PIPE SCHEDULE 40[c] | BORE OF SLIP-ON FLANGES MIN. | DIAM. OF BOLT CIRCLE | NO. OF BOLTS | SIZE OF BOLTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | O | Q | X | H | Y | J | W | | | |
| ½ | 3½ | 7/16 | 1 3/16 | 0.84 | 1⅞ | 0.62* | 0.88 | 2⅜ | 4 | ½ |
| ¾ | 3⅞ | ½ | 1½ | 1.05 | 2 1/16 | 0.82* | 1.09 | 2¾ | 4 | ½ |
| 1 | 4¼ | 9/16 | 1 15/16 | 1.32 | 2 3/16 | 1.05* | 1.38 | 3⅛ | 4 | ½ |
| 1¼ | 4⅝ | ⅝ | 2 5/16 | 1.66 | 2¼ | 1.38* | 1.72 | 3½ | 4 | ½ |
| 1½ | 5 | 11/16 | 2 9/16 | 1.90 | 2 7/16 | 1.61* | 1.97 | 3⅞ | 4 | ½ |
| 2 | 6 | ¾ | 3 1/16 | 2.38 | 2½ | 2.07* | 2.44 | 4¾ | 4 | ⅝ |
| 2½ | 7 | ⅞ | 3 9/16 | 2.88 | 2¾ | 2.47* | 2.94 | 5½ | 4 | ⅝ |
| 3 | 7½ | 15/16 | 4¼ | 3.50 | 2¾ | 3.07* | 3.56 | 6 | 4 | ⅝ |
| 3½ | 8½ | 15/16 | 4 13/16 | 4.00 | 2 13/16 | 3.55* | 4.06 | 7 | 8 | ⅝ |
| 4 | 9 | 15/16 | 5 5/16 | 4.50 | 3 | 4.03* | 4.56 | 7½ | 8 | ⅝ |
| 5 | 10 | 15/16 | 6 7/16 | 5.56 | 3½ | 5.05* | 5.66 | 8½ | 8 | ¾ |
| 6 | 11 | 1 | 7 9/16 | 6.63 | 3½ | 6.07* | 6.72 | 9½ | 8 | ¾ |
| 8 | 13½ | 1⅛ | 9 11/16 | 8.63 | 4 | 7.98* | 8.72 | 11¾ | 8 | ¾ |
| 10 | 16 | 1 3/16 | 12 | 10.75 | 4 | 10.02* | 10.88 | 14¼ | 12 | ⅞ |
| 12 | 19 | 1¼ | 14 3/16 | 12.75 | 4½ | ---------- | 12.88 | 17 | 12 | ⅞ |
| 14 O.D. | 21 | 1⅜ | 15¾ | 14.00 | 5 | To Be | 14.19 | 18¾ | 12 | 1 |
| 16 O.D. | 23½ | 1 7/16 | 18 | 16.00 | 5 | Specified | 16.19 | 21¼ | 16 | 1 |
| 18 O.D. | 25 | 1 9/16 | 19⅞ | 18.00 | 5½ | by | 18.19 | 22¾ | 16 | 1⅛ |
| 20 O.D. | 27½ | 1 11/16 | 22 | 20.00 | 5 11/16 | Purchaser | 20.19 | 25 | 20 | 1⅛ |
| 24 O.D. | 32 | 1⅞ | 26⅛ | 24.00 | 6 | | 24.19 | 29½ | 20 | 1¼ |

All dimensions given in inches.

[a]A raised face of 1/16 in. is included in *thickness of flange minimum* and in *length through hub.*

[b]The outside surface of the welding end of the hub shall be straight or tapered at not more than 6 deg.

[c]Dimensions *H* and *J* correspond to the outside and inside diameters of pipe as given in *A.S.A.* B36.10-1939, Schedule 40.

*These diameters are identical with the diameters of what was formerly designated as *Standard Weight Pipe* of the corresponding sizes.

Standard B16e-1939, American Standard for Steel Pipe Flanges and Flanged Fittings. The latter also contains dimensions for steel welding neck flanges for pressures up to 2500 psi, and slip-on welding flanges for 150 and 300 psi. Table 9 gives these dimensions for welding-neck and slip-on welding flanges suitable for 150 psi gage pressure.

Socket-welding fittings also are commercially available. These fittings have a machined recess for inserting the pipe which is attached by a fillet weld between the pipe wall and socket end. Use of socket-welding fittings generally is restricted to nominal pipe sizes 3 in. and smaller in