

INCH-POUND

MIL-PRF-20042E
16 September 1999
SUPERSEDING
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PERFORMANCE SPECIFICATION

FLANGES, PIPE, BRONZE (SILVER BRAZING)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers 50, 100, 150, 250, and 400 pound silver brazing bronze pipe flanges for use with water, oil, gas, or steam service not to exceed 425 degrees Fahrenheit (°F).

1.2 Classification. The flanges will be of the following types, classes, sizes, and ratings as specified (see 6.2).

1.2.1 Types. Flanges are of the following types:

Type PR - With groove for preinserted rings of silver brazing alloy.

Type EF - Without preinserted rings (end or face feed type).

1.2.2 Classes, sizes, and ratings. Flanges are of the classes, sizes, and ratings as specified in table I.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, SEA 03Q, Naval Sea Systems Command, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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TABLE I. Classes, sizes, and ratings.

Classes	NPS (inches)	Ratings	Applicable tables
Plain:			
50 pounds	14 to 40, inclusive	50 lb/in ² at 150°F	VI, X, XII
150 pounds	1/4 to 12, inclusive	150 lb/in ² at 150°F	VII, XI, XIII
		100 lb/in ² at 425°F	XIII
250 pounds	1/4 to 12, inclusive	250 lb/in ² at 150°F	VIII, XI
		150 lb/in ² at 450°F	XIV
400 pounds	1/4 to 10, inclusive	400 lb/in ² at 150°F	IX, XI
		200 lb/in ² at 425°F	XV
Brazing rings:			
50 pounds	14 to 40, inclusive	- - - -	XVI
100, 150, 250, and 400 pounds	1/4 to 12, inclusive	- - - -	XVII

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

QQ-B-654 - Brazing Alloys, Silver.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay). (DoD adopted)

(Application for copies should be addressed to the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.)

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM B61 - Standard Specification for Steam or Valve Bronze Castings. (DoD adopted)
- ASTM B271 - Standard Specification for Copper-Base Alloy Centrifugal Castings.
- ASTM B505 - Standard Specification for Copper-Base Alloy Continuous Castings.
- ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
- ASTM E172 - Standard Practice for Describing and Specifying the Excitation Source in Emission Spectrochemical Analysis.
- ASTM E1282 - Standard Guide for Specifying the Chemical Compositions and Selecting Sampling Practices and Quantitative Analysis Methods for Metals and Alloys.

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

- MSS SP-9 - Spot Facing for Bronze, Iron and Steel Flanges.

(Application for copies should be addressed to the Manufacturers Standardization Society, 127 Park Street, NE, Vienna, VA 22180-4602.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Chemical composition. Unless otherwise specified (see 6.2), the chemical composition of flanges shall be as specified in ASTM B61, or alloys C92200 or C90300 in accordance with ASTM B271, B505, or B584.

3.2 Recycled/recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recycled/recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recycled/recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3 Type PR, with groove for preinserted rings of silver brazing alloy.

3.3.1 Type PR flanges are grooved for preinsert rings of silver brazing alloy. The insert rings shall not be installed in the flange groove by the contractor. These flanges may be supplied without the silver brazing rings, in which case they shall be ordered separately, or with the rings separately packaged and furnished with the parent component for installation in the groove prior to brazing (see 6.2). The preinserted silver brazing rings shall be of a design to fill the groove shown on figure 1, the minimum internal

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diameter of which shall be not less than the bore of the hub shown as diameter "S" on figure 2. Unless otherwise specified (see 6.2), the silver brazing alloy used shall conform to BCuP-5 of QQ-B-654. Machining details shall be as specified in tables XVI and XVII. Dimensions noted on figures 1 and 2 shall be as specified in tables VI through XV.

3.4 Type EF, without preinserted rings (end or face feed type). Type EF flanges shall be chamfered at the outer end of socket a distance of 0.031 inch and at an angle of about 45 degrees with the axis at the socket.

3.5 Machining.

3.5.1 Flange finish. The machined surface finish of gasket mating surfaces on the flanges shall be in accordance with ASME B46.1 and as follows:

- (a) For flanges of a nominal size of 12 inches or less, a finish with a circular lay (concentric) of 500 to 1000 or (spiral) 125 to 250 roughness average (R_a) produced by machining 30 to 80 serrations of uniform depth per inch of flange face width.
- (b) For flanges over a nominal size of 12 inches, the requirements shall be the same except that 21 to 80 serrations per inch of flange face width may be used.

Unless otherwise specified (see 6.2), flanges shall have the bore of the hub and the waterway (diameters "S" and "T" as shown on figure 2) machined with a finish of 125 or better. Flanges need not be finished on the rim, provided they are cast smooth and true. The remaining external surfaces shall not be finished except for bolt hole spot facing.

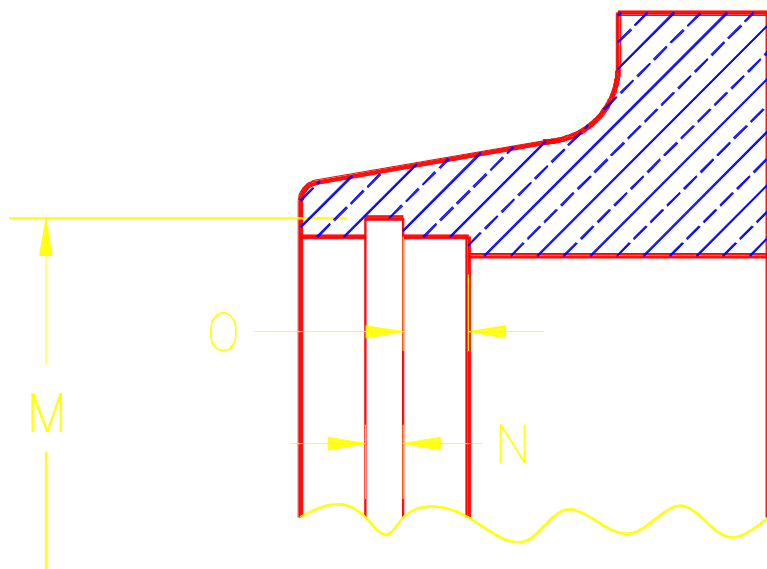
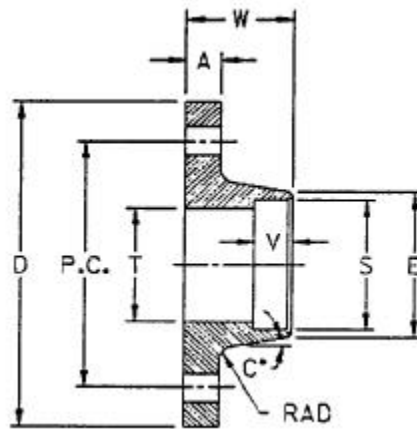


FIGURE 1. Detail dimensions of groove for preinserted ring of silver brazing alloy.

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FIGURE 2. Detail dimensions of plain flanges.

3.5.2 Flange drilling. Unless otherwise specified (see 6.2), flanges shall be drilled. Flanges shall be spot faced in accordance with MSS SP-9. The number and size of holes shall conform to tables XII through XV according to the classification of the flanges furnished.

3.6 Dimensions.

3.6.1 Socket. In measuring the depth of the socket in all the applicable tables specified herein, the chamfer shall be included.

3.6.2 Flange. Flange dimensions shall be as specified in the applicable figures and tables.

3.6.3 Tolerances. Tolerances shall be plus or minus 0.010 inch for decimal dimensions, unless otherwise specified herein or as shown in table II.

TABLE II. Tolerances.

NPS	D	O	S	W
	Inch	Inch	Inch	Inch
1-1/4 and under	+ 0.125 - 0.000	+ 0.000 - .031	+ 0.003 - .000	± 0.063
1-1/2 to 2	+ .125 - .000	+ .000 - .031	+ .005 - .000	± .063
2-1/2 to 12	+ .188 - .000	+ .000 - .047	+ .007 - .000	± .063
14 and over	+ .250 - .000	+ .000 - .047	+ .010 - .000	± .063

3.7 Marking. The size, pressure rating ("50", "100", "150", "250", or "400"), and "WOG" shall be legibly and permanently marked on the rim or back face of all flanges for identification.

3.8 Workmanship. Flanges shall be sound, smoothly cored, true to form, uniform in texture, and free of adhering sand, hard spots, cold shuts, porosity, or any other defects which may affect serviceability. They shall be thoroughly cleaned, inside and outside, and all fins and roughness that are

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not well rounded shall be blended.

4. VERIFICATION

4.1 Conformance inspection. Conformance inspection shall consist of the examination and tests as specified in 4.2 and 4.3.

4.1.1 Lot. Flanges of the same type, class, size, and rating presented at one time shall be considered a lot for purposes of sampling and inspection.

4.1.2 Sampling for visual and dimensional examination. As a minimum, the contractor shall randomly select a sample quantity of completed flanges as specified in table III and examine them as specified in 4.2 (see 6.3.1).

TABLE III. Sampling for visual and dimensional examination.

Sample size		
Lot size	Major defects	Minor defects
2 to 8	All	3
9 to 25	8	3
26 to 50	8	5
51 to 90	8	6
91 to 150	12	7
151 to 280	19	10
281 to 500	21	11
501 to 1,200	27	15
1,201 to 3,200	35	18
3,201 to 10,000	38	22

4.1.3 Sampling for hydrostatic pressure leakage test. As a minimum, the contractor shall randomly select a sample quantity of completed flanges as specified in table IV and test them as specified in 4.3.1 (see 6.3.2).

TABLE IV. Sampling for hydrostatic pressure leakage test.

Lot size	Sample size
2 to 8	All
9 to 151	13
151 to 280	20
281 to 500	29
501 to 1,200	34
1,201 to 3,200	50
3,201 to 10,000	60

4.1.4 Sampling for chemical analysis. Samples for chemical analysis shall be taken from one or more flanges selected from each melt from which the lot offered was cast, for the analysis specified in 4.3.3.

4.2 Examination. Each of the sample flanges selected as specified in 4.1.2 shall be examined to verify compliance with all the requirements of this specification not involving tests. Examination shall be conducted for defects listed in table V.

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TABLE V. Classification of defects.

Categories	Defects
Critical	None defined.
Major:	
101	Type, class, size and rating not as specified.
102	Material not as specified.
103	Flanges not sound, smoothly corded, true to form, uniform in texture, not free from cold shuts and porosity.
104	Flanges surface (internal and external) not thoroughly cleaned, fins and roughness not removed.
105	Brazing ring (if specified) missing or not as specified.
106	Socket not smooth.
107	Socket dimensions not as specified.
108	Flange dimensions not within tolerance specified.
Minor:	
201	Ends (other than preinserted ring type) not chamfered as specified.
202	Marking not cast, or stamped incorrect, or illegible.

4.3 Test methods.

4.3.1 Hydrostatic pressure leakage test. Each sample flange selected as specified in 4.1.3 shall be subjected to a hydrostatic pressure 1-1/2 times the rated pressure for 1 minute. Under the hydrostatic pressure, the fitting shall not leak water or sweat at any part of the surface.

4.3.2 Air pressure leakage test. Each flange shall be tested under water or with soapsuds at 100 pounds per square inch (lb/in²) (nominal) air pressure (85 lb/in² minimum) for 5 to 10 seconds. No leakage is allowed.

4.3.3 Chemical analysis. Each sample flange selected as specified in 4.1.4 for chemical analysis shall be tested in accordance with ASTM E172 or ASTM E1282 to determine conformance to 3.1.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. The installation of these flanges is intended to be accomplished by silver brazing without exceeding a temperature of 1500°F. The fittings are intended for use with the following or their equivalent commercial pipe standards:

<u>Material</u>	<u>Specification</u>
Copper tube	MIL-T-24107
Copper-nickel alloy tube	MIL-T-16420
Brass tube	MIL-T-20168
Nickel-copper alloy tube	MIL-T-1368

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of the specification.
- (b) Type, class, size, and rating required (see 1.2).
- (c) Issue of the DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- (d) Chemical composition if other than as specified (see 3.1).
- (e) When brazing rings are to be furnished with the flanges (see 3.3.1).
- (f) If silver brazing rings are other than as specified (see 3.3.1).
- (g) If flange finish is other than as specified (see 3.5.1).
- (h) When flanges are to be undrilled (see 3.5.2).
- (i) Packaging requirements (see 5.1).
- (j) Bore diameters when 400 lb/in² flanges are ordered (see table IX).

6.3 Lot acceptance and rejection criteria.

6.3.1 Visual and dimensional examination. If one or more defects are found in any sample, the entire lot represented by the sample should be rejected. If a lot is rejected, the contractor has the option of screening 100 percent of the lot for the defective characteristic(s) or providing a new lot which should be examined as specified in 4.2.

6.3.2 Hydrostatic pressure leakage test. If one or more defects are found in the sample, the entire lot represented by the sample should be rejected. If the lot is rejected, the contractor has the option of screening 100 percent of the lot for the defective characteristic(s) or providing a new lot which should be tested as specified in 4.3.1.

6.4 Subject term (key word) listing.

Brazing rings
Gas service
Oil service
Pipe standards
Steam service
Water service

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6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

TABLE VI. Plain flanges, 50-pound. 2/

NPS	A (min)	D <u>1/</u>	E (min)	S <u>1/</u> (min)	T <u>1/</u>	V (min)	W <u>1/</u>	Radius
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inch
14	0.750	19.125	14.813	14.188	14	1.188	1.937	0.500
16	.750	21.188	16.938	16.212	16	1.188	1.937	.500
18	.875	23.250	19.000	18.238	18	1.188	2.063	.500
20	.875	25.813	21.063	20.262	20	1.188	2.063	.500
22	.875	27.875	23.250	22.292	22	1.313	2.188	.563
24	1.000	30.000	25.313	24.316	24	1.313	2.313	.563
26	1.000	32.562	27.375	26.342	26	1.313	2.313	.563
28	1.000	34.688	29.500	28.366	28	1.375	2.375	.625
30	1.125	36.813	31.625	30.392	30	1.438	2.563	.625
32	1.125	39.000	33.750	32.420	32	1.500	2.625	.625
34	1.125	41.000	35.750	34.446	34	1.625	2.750	.688
36	1.250	43.875	37.875	36.470	36	1.688	2.875	.688
38	1.250	46.125	40.000	38.496	38	1.750	3.000	.688
40	1.250	48.125	42.000	40.520	40	1.813	3.000	.750

1/ For tolerance see 3.6.3.

2/ See figure 2.

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TABLE VII. Plain flanges, 150-pound, standard sizes. 4/

NPS	O.D.	A (min)	C (min)	D <u>2/</u>	E (min)	S <u>2/3/</u>	T <u>2/3/</u>	V (min)	W <u>2/</u>	Radius	P
	Inches	Inch	Degree	Inches	Inches	Inches	Inches	Inches	Inches	Inch	Inch
<u>1/</u> 1/4	0.540	0.375	---	3.250	0.813	0.540	0.40	0.266	0.875	0.250	0.008
3/8	.675	.375	---	3.375	1.000	.675	.54	.313	.938	.250	.008
1/2	.840	.375	---	3.563	1.163	.840	.71	.375	1.000	.250	.008
3/4	1.050	.438	---	3.813	1.344	1.050	.92	.406	1.063	.250	.008
1	1.315	.438	---	4.250	1.625	1.315	1.18	.438	1.125	.250	.016
1-1/4	1.660	.438	---	4.250	2.000	1.660	1.53	.500	1.250	.313	.016
1-1/2	1.900	.438	---	5.063	2.250	1.900	1.77	.625	1.375	.313	.016
2	2.375	.438	---	5.563	2.750	2.375	2.24	.656	1.375	.313	.016
2-1/2	2.875	.500	---	6.125	3.250	2.875	2.71	.625	1.375	.313	.031
3	3.500	.500	---	6.625	3.875	3.500	3.31	.625	1.375	.313	.031
3-1/2	4.000	.500	---	7.188	4.388	4.000	3.81	.688	1.438	.313	.031
4	4.500	.500	---	7.688	4.938	4.500	4.28	.688	1.438	.375	.031
4-1/2	5.000	.500	---	8.188	5.438	5.000	4.76	.688	1.500	.375	.031
5	5.563	.563	2	9.063	6.000	5.563	5.32	.688	1.563	.375	.047
5-1/2	6.125	.563	2	9.563	6.500	6.125	5.88	.750	1.688	.438	.047
6	6.625	.563	2	10.125	7.063	6.625	6.36	.750	1.688	.438	.047
7	7.625	.563	2	11.313	8.063	7.625	7.36	.813	1.813	.438	.047
8	8.625	.625	2	12.375	9.125	8.625	8.33	.938	2.000	.438	.063
9	9.625	.688	2	13.938	10.188	9.625	9.25	1.000	2.188	.500	.063
10	10.750	.688	2	15.000	11.313	10.750	10.38	1.063	2.250	.500	.063
12	12.750	.750	2	17.625	13.438	12.750	12.25	1.250	2.500	.500	.063

1/ For flanged gauge connections with 0.250 inch O.D. or 0.500 inch O.D. tube, "S" becomes 0.250 + 0.003 or 0.500 + 0.003 respectively "T" becomes 0.12 or 0.38 respectively.
- .000

2/ For tolerance see 3.6.3.

3/ The eccentricity of bores "S" and "T" shall be not greater than that shown in column P where measured.

4/ See figure 2.

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TABLE VIII. Plain flanges, 250-pound, standard sizes. 3/

NPS	O.D.	A (min)	C (min)	D <u>1/</u>	E (min)	S <u>2/1/</u>	T <u>2/1/</u>	V (min)	W <u>1/</u>	Radius	P
	Inches	Inches	Degree	Inches	Inches	Inches	Inches	Inches	Inches	Inch	Inch
1/4	0.540	0.688	---	3.250	0.813	0.540	0.398	0.266	1.188	0.250	0.008
3/8	.675	.688	---	3.375	1.000	.675	.532	.313	1.250	.250	.008
1/2	.840	.688	---	3.563	1.156	.840	.697	.375	1.313	.250	.008
3/4	1.050	.688	---	3.813	1.344	1.050	.907	.406	1.313	.250	.008
1	1.315	.750	---	4.250	1.625	1.315	1.171	.438	1.438	.250	.016
1-1/4	1.660	.813	---	4.500	2.000	1.660	1.502	.500	1.625	.313	.016
1-1/2	1.900	.813	---	5.063	2.250	1.900	1.742	.625	1.750	.313	.016
2	2.375	.813	---	5.563	2.750	2.375	2.186	.656	1.750	.313	.016
2-1/2	2.875	.938	---	6.125	3.250	2.875	2.686	.625	1.813	.313	.031
3	3.500	.938	---	6.625	3.875	3.500	3.286	.625	1.813	.313	.031
3-1/2	4.000	1.000	---	7.188	4.375	4.000	3.786	.688	1.938	.375	.031
4	4.500	1.000	---	7.688	4.938	4.500	4.252	.688	1.938	.375	.031
5	5.563	1.063	2	9.063	6.000	5.563	5.278	.688	2.063	.375	.047
6	6.625	1.188	2	10.125	7.063	6.625	6.321	.750	2.313	.438	.047
8	8.625	1.313	2	12.375	9.125	8.625	8.286	.938	2.688	.438	.063
10	10.750	1.438	2	15.000	11.313	10.750	10.325	1.063	3.000	.500	.063
12	12.750	1.500	2	17.625	13.438	12.750	12.322	1.250	3.250	.500	.063

1/ For tolerance see 3.6.3.2/ The eccentricity of bores "S" and "T" shall be not greater than that shown in column P where measured.3/ See figure 2.

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TABLE IX. Plain flanges, 400-pound, standard sizes. 5/

NPS	O.D.	A (min)	C (min)	D <u>3/</u>	E (min)	S <u>3/4/</u>	T <u>3/4/</u>	V (min)	W <u>3/</u>	Radius	P
	Inches	Inches	Degree	Inches	Inches	Inches	Inches	Inches	Inches	Inch	Inch
<u>1/</u> 1/4	0.540	0.688	---	3.750	0.875	0.540	0.41	0.266	1.188	0.250	0.008
3/8	.675	.688	---	3.875	1.063	.675	.54	.313	1.250	.250	.008
1/2	.840	.688	---	4.000	1.250	.840	.71	.375	1.313	.250	.008
3/4	1.050	.688	---	4.313	1.438	1.050	.92	.406	1.313	.250	.008
1	1.315	.750	---	5.063	1.750	1.315	1.18	.438	1.438	.250	.016
1-1/4	1.660	.813	---	5.375	2.125	1.660	1.53	.500	1.625	.313	.016
1-1/2	1.900	.813	---	5.938	2.375	1.900	1.77	.625	1.750	.313	.016
2	2.375	.813	---	6.500	2.875	2.375	2.24	.656	1.750	.313	.016
2-1/2	2.875	.938	---	7.563	3.375	2.875	<u>2/</u>	1.000	2.313	.500	.031
3	3.500	.938	---	8.125	4.000	3.500	<u>2/</u>	1.000	2.375	.500	.031
3-1/2	4.000	1.000	---	8.688	4.500	4.000	<u>2/</u>	1.000	2.438	.500	.031
4	4.500	1.000	---	9.250	5.000	4.500	<u>2/</u>	1.125	2.625	.563	.031
4-1/2	5.000	1.000	---	6.688	5.625	5.000	<u>2/</u>	1.125	2.625	.563	.031
5	5.563	1.063	2	10.375	6.188	5.563	<u>2/</u>	1.250	2.813	.563	.047
5-1/2	6.125	1.125	2	11.375	6.750	6.125	<u>2/</u>	1.250	2.938	.625	.047
6	6.625	1.188	2	11.938	7.313	6.625	<u>2/</u>	1.375	3.125	.625	.047
7	7.625	1.250	2	13.125	8.375	7.625	<u>2/</u>	1.375	3.250	.688	.047
8	8.625	1.313	2	14.750	9.375	8.625	<u>2/</u>	1.500	3.500	.688	.063
9	9.625	1.375	2	15.875	10.500	9.625	<u>2/</u>	1.625	3.750	.750	.063
10	10.750	1.438	2	17.000	11.625	10.750	<u>2/</u>	1.750	4.000	.750	.063

1/ For flanged gauge connections with 0.250 inch O.D. or 0.500 inch O.D. tube, "S" becomes 0.250 + 0.003 or 0.500 + 0.003 respectively and "T" becomes 0.12 and 0.38 respectively.
- .000

2/ Bore to suit inside diameter of tube (see 6.2).

3/ For tolerance see 3.6.3.

4/ The eccentricity of bores "S" and "T" shall be not greater than that shown in column P where measured.

5/ See figure 2.

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TABLE X. Machining details for type PR, 50-pound flanges,
standard sizes. 2/

NPS	O <u>1/</u>	N		M	
		Minimum	Maximum	Minimum	Maximum
	Inch	Inch	Inch	Inches	Inches
14	0.395	0.398	0.408	14.366	14.386
16	.395	.398	.408	16.390	16.410
18	.395	.398	.408	18.416	18.436
20	.395	.398	.408	20.440	20.460
22	.457	.398	.408	22.506	22.526
24	.457	.398	.408	24.530	24.550
26	.457	.398	.408	26.556	26.576
28	.488	.398	.408	28.580	28.600
30	.520	.398	.408	30.606	30.626
32	.551	.398	.408	32.634	32.654
34	.613	.398	.408	34.660	34.680
36	.645	.398	.408	36.684	36.704
38	.676	.398	.408	38.710	38.730
40	.707	.398	.408	40.734	40.754

1/ For tolerance see 3.6.32/ See figure 1.

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TABLE XI. Machining details for type PR, 100-, 150-, 250- and 400-
pound flanges, standard size. 4/

NPS	O.D.	O <u>1/</u>	N		M	
			Minimum	Minimum	Minimum	Minimum
	Inches	Inch	Inch	Inch	Inches	Inches
1/4	0.540	0.100	0.068	0.078	0.614	0.639
3/8	.675	.117	.083	.093	.764	.784
1/2	.840	.149	.083	.093	.929	.949
3/4	1.050	.154	.099	.109	1.159	1.179
1	1.315	.154	.130	.140	1.424	1.444
1-1/4	1.660	.185	.130	.140	1.769	1.789
1-1/2	1.900	.217	.192	.202	2.011	2.031
2	2.375	.232	.192	.202	2.486	2.506
2-1/2	2.875	.217	.192	.202	2.988	3.008
3	3.500	.185	.255	.265	3.613	3.633
3-1/2	4.000	.217	.255	.265	4.113	4.133
4	4.500	.217	.255	.265	4.673	4.693
<u>2/</u> 4-1/2	5.000	.217	.255	.265	5.173	5.193
5	5.563	.217	.255	.265	5.736	5.756
<u>2/</u> 5-1/2	6.125	.248	.255	.265	6.298	6.318
6	6.625	.248	.255	.265	6.798	6.818
<u>2/</u> 7	7.625	.247	.320	.330	7.798	7.818
8	8.625	.270	.398	.408	8.798	8.818
<u>2/</u> 9	9.625	.301	.398	.408	9.798	9.818
10	10.750	.333	.398	.408	10.923	10.943
<u>2/3/</u> 11	11.750	.364	.398	.408	11.963	11.983
<u>3/</u> 12	12.750	.426	.398	.408	12.963	12.983

1/ For tolerance see 3.6.3.2/ Not for 250-pound flange.3/ Not for 400-pound flange.4/ See figure 1.

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TABLE XII. Drilling dimensions, 50-pound flanges. 1/

NPS	Flange joint			
	Number of holes	Diameter of holes	Pitch circle P.C.	Pitch cord
		Inches	Inches	Inches
14	19	0.938	17.375	2.86
16	20	.938	19.438	3.04
18	22	.938	21.500	3.06
20	24	1.063	23.813	3.11
22	26	1.063	25.875	3.12
24	28	1.063	28.000	3.13
26	30	1.188	30.313	3.17
28	32	1.188	32.438	3.18
30	35	1.188	34.563	3.10
32	36	1.188	36.750	3.20
34	36	1.188	38.750	3.38
36	36	1.313	41.375	3.61
38	36	1.313	43.625	3.80
40	36	1.313	45.625	3.98

1/ See figure 2.

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TABLE XIII. Drilling dimensions, 150-pound flanges, standard sizes. 1/

NPS	O.D.	Flange joint			
		Number of holes	Diameter of holes	Pitch circle P.C.	Pitch cord
	Inches		Inch	Inches	Inches
1/4	0.540	3	0.563	2.13	1.84
3/8	.675	3	.563	2.25	1.95
1/2	.840	3	.563	2.44	2.11
3/4	1.050	4	.563	2.69	1.90
1	1.315	4	.563	3.13	2.21
1-1/4	1.660	4	.563	3.38	2.39
1-1/2	1.900	6	.563	3.94	1.97
2	2.375	6	.563	4.44	2.22
2-1/2	2.875	6	.563	5.00	2.50
3	3.500	8	.563	5.50	2.10
3-1/2	4.000	8	.563	6.06	2.32
4	4.500	8	.563	5.56	2.51
4-1/2	5.000	10	.563	7.06	2.18
5	5.563	10	.688	7.81	2.41
5-1/2	6.125	10	.688	8.31	2.57
6	6.625	12	.688	8.88	2.30
7	7.625	12	.688	10.00	2.59
8	8.625	14	.688	11.06	2.46
9	9.625	14	.813	12.38	2.75
10	10.750	15	.813	13.44	2.79
11	11.750	16	.813	15.00	2.93
12	12.750	18	.813	16.00	2.79

1/ See figure 2.

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TABLE XIV. Drilling dimensions, 250-pound flanges, standard sizes. 1/

NPS	O.D.	Flange joint		
		Number of holes	Diameter of holes	Pitch circle P.C.
	Inches		Inch	Inches
1/4	0.540	3	0.563	2.13
3/8	.675	3	.563	2.25
1/2	.840	3	.563	2.44
3/4	1.050	4	.563	2.69
1	1.315	4	.563	3.13
1-1/4	1.660	4	.563	3.38
1-1/2	1.900	6	.563	3.94
2	2.375	6	.688	4.44
2-1/2	2.875	6	.688	5.00
3	3.500	8	.688	5.50
3-1/2	4.000	8	.688	6.06
4	4.500	8	.688	6.56
5	5.563	10	.688	7.81
6	6.625	12	.688	8.88
8	8.625	14	.688	11.06
10	10.750	15	.813	13.44
12	12.750	18	.813	16.06

1/ See figure 2.

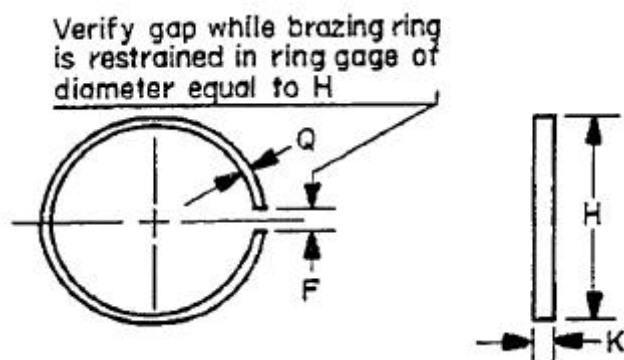
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TABLE XV. Drilling dimensions, 400-pound flanges, standard sizes. 1/

NPS	O.D.	Flange joint			
		Number of holes	Diameter of holes	Pitch circle P.C.	Pitch cord
	Inches		Inches	Inches	Inches
1/4	0.540	3	0.563	2.63	2.27
3/8	.675	4	.563	2.75	1.94
1/2	.840	4	.563	2.88	2.03
3/4	1.050	4	.563	2.19	2.25
1	1.315	5	.688	3.75	2.20
1-1/4	1.660	5	.688	4.06	2.39
1-1/2	1.900	6	.688	4.63	2.31
2	2.375	7	.688	5.19	2.25
2-1/2	2.875	8	.813	6.00	2.30
3	3.500	8	.813	6.56	2.51
3-1/2	4.000	9	.813	7.13	2.44
4	4.500	9	.813	7.69	2.63
4-1/2	5.000	10	.813	8.25	2.55
5	5.563	11	.813	8.81	2.48
5-1/2	6.125	11	.938	9.63	2.71
6	6.625	12	.938	10.19	2.64
7	7.625	12	.938	11.38	2.94
8	8.625	13	1.063	12.75	3.05
9	9.625	14	1.063	13.88	3.09
10	10.750	15	1.063	15.00	3.12

1/ See figure 2.

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TABLE XVI. Dimensions of silver brazing ring for 50-pound flanges.

Nominal pipe size	Q ± 0.003	K ± 0.003	H	F	
				Minimum	Maximum
	Inch	Inch	Inches	Inch	Inch
14	0.096	0.391	14.386	0.073	0.266
16	0.096	0.391	16.410	0.073	0.266
18	0.096	0.391	18.436	0.073	0.266
20	0.096	0.391	20.460	0.073	0.266
22	0.115	0.391	22.526	0.073	0.302
24	0.115	0.391	24.550	0.073	0.302
26	0.115	0.391	26.578	0.073	0.302
28	0.115	0.391	28.600	0.073	0.302
30	0.115	0.391	30.626	0.073	0.302
32	0.115	0.391	32.654	0.073	0.302
34	0.115	0.391	34.680	0.073	0.302
36	0.115	0.391	36.704	0.073	0.302
38	0.115	0.391	38.730	0.073	0.302
40	0.115	0.391	40.754	0.073	0.302

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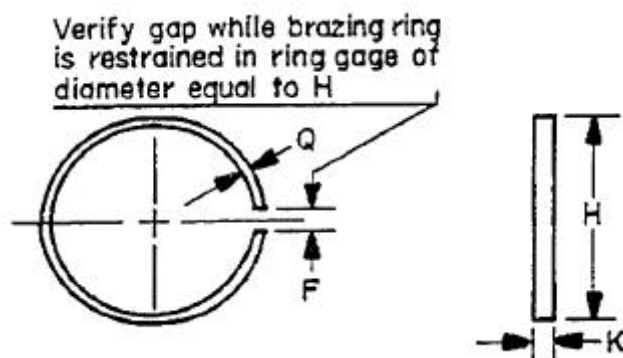


TABLE XVII. Dimensions of silver-brazing ring for 100-, 150-, 250-, and 400-pound flanges.

Nominal pipe size	Q ± 0.003	K ± 0.003	H	F	
				Minimum	Maximum
	Inch	Inch	Inches	Inch	Inch
1/4	0.035	0.063	0.639	0.073	0.130
3/8	.040	.078	.784	.073	.130
1/2	.040	.078	.949	.073	.130
3/4	.050	.094	1.179	.073	.130
1	.050	.125	1.444	.073	.135
1-1/4	.050	.125	1.789	.073	.135
1-1/2	.050	.188	2.031	.073	.135
2	.050	.188	2.506	.073	.135
2-1/2	.050	.188	3.008	.073	.135
3	.050	.250	3.633	.073	.167
3-1/2	.050	.250	4.133	.073	.167
4	.080	.250	4.693	.073	.229
5	.080	.250	5.756	.073	.229
6	.080	.250	6.818	.073	.261
7	.080	.391	7.818	.073	.261
8	.080	.391	8.818	.073	.261
9	.080	.391	9.818	.073	.261
10	.080	.391	10.943	.073	.261
12	.096	.391	12.983	.073	.261

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