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REFRIGERATION
FLARE TYPE FITTINGS

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Standardization of Refrigeration Flare Type Fittings

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FOREWORD

For some years prior to 1949, the need for an American Standard covering tube fittings had been expressed by several groups in the piping field, it being of primary concern to the instrument piping and refrigeration industries. Consequently, Sectional Committee B16 of the American Standards Association was asked to make a study of this subject and undertake development of standards where deemed appropriate.

Due to the broadness of the scope, coverage on the entire field of tube fittings was considered impractical and it was decided to limit the Sectional Committee activities to tube fittings for the refrigeration industry. As a result, Subcommittee 11 was organized to accomplish this task and held an initial meeting on October 2, 1951.

In the interim, research had indicated that the Society of Automotive Engineers had published standards on automotive flare tube fittings as early as 1912, and that as the refrigeration industry had developed it had made use of these fittings. However, it soon became apparent that these fittings were not entirely satisfactory for refrigerant service due to the porosity of castings, which were then prevalent, permitting refrigerants to escape and frost problems with nuts. To overcome these shortcomings the SAE developed another standard for flare fittings designated "Refrigeration and Marine Type" which was adopted in 1936 and intended specifically for refrigeration and marine applications.

In recognition of the background of experience of SAE in the tube fitting field, representatives of the Society were invited to sit in at the first meeting of Subcommittee 11. At this meeting it was agreed that the existing SAE Standard for refrigeration and marine tube fittings should be revised and expanded to satisfy the growing needs of the refrigeration industry. It was further agreed the revised SAE Standard would be submitted to the American Standards Association for approval and promulgation as an American Standard under the existing standards method with SAE as proprietary sponsor. To accomplish the development of the complete standard, it was decided to make the personnel of Subcommittee 11 members of the SAE Tube, Pipe, Hose and Lubrication Fittings Committee.

This augmented SAE Committee held frequent meetings throughout 1952, 1953, and 1954 which culminated in a revised standard acceptable to all interests on April 12, 1954. This new document together with the necessary exhibits reflecting its acceptance by all national groups substantially concerned was presented by SAE to the American Standards Association for approval and designation as an American Standard under the existing standards method. This was granted on August 26, 1954.

In 1958, as a result of interest expressed by the Air Conditioning and Refrigeration Institute in lengthening the threaded portion on the 1/4 and 5/16 flare ends and eliminating the undercut back of the thread on flare sizes 3/8 and smaller, the SAE group was reactivated as the Refrigeration Fittings Subcommittee to review and revise the standard. The resulting revision was duly processed through the American Standards Association and designated an American Standard on April 2, 1962.

In 1963, the SAE Refrigeration Fittings Subcommittee initiated an extensive investigation of the existing standard aimed at eliminating excessive material from the fittings consistent with current refrigeration industry requirements. This resulted in reduction of hexagon sizes on nearly all fittings and numerous minor dimensional adjustments in leg and overall lengths. In addition, the threaded portion of the 1/4 and 5/16 flare ends were changed back to the former dimensions. Also, working in conjunction with the SAE Automotive Tube Fittings Subcommittee dimensions of the refrigeration and automotive flare fittings were consolidated on all corresponding sizes. This revision was adopted by SAE in 1968 and was submitted in a new format to the American National Standards Institute (the reconstituted American Standards Association) for adoption as a ANS Standard under the existing standards procedures. This was granted on June 16, 1969.

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REFRIGERATION TUBE FITTINGS — SAE J513c

SAE Standard

Report of Parts and Fittings Division approved January 1936 and last revised by Tube, Pipe, Hose, and Lubrication Fittings Committee June 1967. Editorial change May 1968.

NOTICE: It should be noted that, for most sizes, the hexagon across flat widths applicable to the fittings depicted in Figs. 1-9, 20, 21, 23, 25-28, and 34, appearing in this revision of the standard have been reduced and will affect wrench interchangeability. It is recognized that until present stocks are depleted and new tooling is developed, fittings conforming with previous across flat dimensions will be available. Therefore, it is recommended that until such time as the transition has been accomplished, the manufacturers and users agree on the hexagon dimensions of fittings to be supplied in these categories.

INTRODUCTORY NOTES

Scope—This standard covers complete general and dimensional specifications for refrigeration flare type tube fittings intended for general use with flared annealed copper tubing in refrigeration applications. Also included is an appendix covering the coding system for identification of fittings.

The inclusion of dimensional data in this standard is not intended to imply that all of the fittings described are stock production items. Consumers are requested to consult with manufacturers concerning availability.

Pressure Ratings and Service Limitations—Fittings covered by this standard are satisfactory for operating pressures up to 500 psi gage and are suitable for use in systems conducting most fluorinated hydrocarbon refrigerants. Fitting manufacturers should be consulted for recommendations.

Fitting Identification Code—The coding system for identification of refrigeration flare type fittings is given in Appendix 1.

Dimensions—All dimensions in this standard are given in inches unless otherwise stated.

Options—Options, where specified, shall be at the discretion of the manufacturer unless otherwise agreed upon by the manufacturer and purchaser.

Assembly Considerations—Use of a compatible lubricant or sealant is desirable in assembling Dryseal pipe threads on refrigeration tube fittings to minimize galling and effect a pressure-tight seal.

GENERAL SPECIFICATIONS

Size Designations—Fitting sizes throughout the dimensional tables are designated by the corresponding outside diameter of the tubing for flared type or solder type tube ends and by the corresponding standard nominal pipe size for pipe thread ends.

Dimensions and Tolerances—Tabulated dimensions shall apply to the finished parts, plated or otherwise processed, as specified by the purchasers. Unless otherwise specified, the maximum and minimum across flat dimensions shall be within the commercial tolerance of bar or extruded stock from which the fittings are produced. The minimum across corners dimensions of hexagons shall be 1.092 times the nominal width across flats, but shall not result in a size flat width less than 0.43 times the nominal width across flats.

Unless otherwise specified, tolerance on hole diameters designated drill in the dimensional tables shall be as tabulated below:

Drill Size Range, in.	Tolerance	
	Plus	Minus
0.0135 (No. 80) through 0.185 (4.70 mm)	0.003	0.002
0.1875 (3/16) through 0.248 (6.30 mm)	0.004	0.002
0.250 (E) through 0.750 (3/4)	0.006	0.003
0.7579 (19.25 mm) through 1.000	0.007	0.004

Tolerance on all dimensions not otherwise limited shall be ± 0.010 in. Fitting seats shall be concentric with the straight thread pitch diameters within 0.010 in. full indicator reading (FIR). Angular tolerance on axis of ends on elbows, tees and crosses shall be ± 2.50 deg for sizes up to and including $\frac{3}{8}$, and ± 1.50 deg for sizes larger than $\frac{3}{8}$.

Where so illustrated and not otherwise specified, hexagon corners shall be chamfered 30 ± 5 deg, to a diameter equal to the nominal width across flats, with a tolerance of -0.016 in.; or where design permits, corners may be chamfered to the diameter of the abutting surface provided the length of chamfer does not exceed that produced by the 30 deg chamfer previously described.

Passages—Where passages in straight fittings are machined from opposite ends, the offset at the meeting point shall not exceed 0.015 in. The cross sectional area at the junction of passages in angle fittings shall not be less than that of the smallest passage. Where the passage is specified as a maximum or as tap drill diameter or less, the mini-

mum shall be no less than the minimum diameter of the smallest passage in the fitting.

Wall Thickness—Unless otherwise designated, the wall thickness at any point on fittings shall not be less than the thickness established by the specified dimensions, tolerances, and eccentricities for inner and outer surfaces.

Contour—Details of contour shall be optional with the manufacturer, providing the tabulated dimensions are maintained and serviceability of the fittings is not impaired. Wrench flats on elbows and tees shall be optional. Where extruded or forged shapes are reduced to conserve material, the wall thickness, unless otherwise specified, shall not be less than the respective minimum values tabulated below:

Nominal Tube OD	Wall Thickness, Min		Nominal Tube OD	Wall Thickness, Min	
	Extruded Shapes ^a	Forged Shapes		Extruded Shapes ^a	Forged Shapes
3/16	0.04	0.060	1/2	0.06	0.090
1/4	0.04	0.075	5/8	0.08	0.100
5/16	0.05	0.075	3/4	0.08	0.100
3/8	0.05	0.085			

^a Applies to reduction in one plane of shape only.

Straight Threads—Unified Standard Class 2A external and Class 2B internal threads with minor diameters, where specified, modified to Class 3B limits, shall apply to plain finish (unplated) fittings of all types. For externally threaded parts with additive finish, the maximum diameters of Class 2A may be exceeded by the amount of the allowance, that is, the basic diameters (Class 2A maximum diameters plus the allowance) apply to an externally threaded part after plating. For internally threaded parts with additive finish, the Class 2B diameters and modified minor diameters apply after plating. The pitch diameter tolerance shall be the same as the corresponding diameter-pitch combination and class of the Unified coarse and fine thread series. See ANS B1.1, Unified Screw Threads.

Where external threads are produced by roll threading and the body is not undercut, the unthreaded portion of body adjacent to the shoulder may be reduced to the minimum pitch diameter.

External threads shall be chamfered from the diameter of abutting surface to produce a length of chamfered or partial thread equivalent to $\frac{3}{4}$ to $1\frac{1}{4}$ times the pitch (rounded to a three-place decimal).

Internal threads shall be countersunk 90 deg included angle to the diameters specified in the dimensional tables.

Pipe Threads—Taper pipe threads, unless there is specific authorization to the contrary, shall conform to the Dryseal American Standard Taper Pipe Thread (NPTF). See ANS B2.2, Dryseal Pipe Threads.

The length of full form external thread shall not be shorter than L_2 plus one pitch (thread), except that where thread is cut through into a relieved body or undercut on the fitting, the minimum full thread length may be reduced by one pitch (thread).

Where external pipe threads are produced by roll threading, the diameter of the unthreaded portion of shank adjacent to shoulder may be reduced to the E_2 basic pitch diameter.

The tube fitting dimensions tabulated herein are based on length of the Dryseal American Standard Taper Pipe Thread (NPTF), it being the consensus of manufacturers and users that trouble-free assembly cannot be assured unless a full length thread is used. However, the tap drill depths and overall lengths specified in the tables for fittings with internal taper pipe threads are not consistent with the tap drill depths and overall thread lengths of the Dryseal American Standard Taper Pipe Threads (NPTF) given in ANS B2.2. The full length Dryseal American Standard Taper Pipe Taps specified in ANS B2.2, cannot be used, as the tap drill depths and overall lengths of the fittings have been reduced to the minimum required by bottoming taps to produce standard full thread length. The deviations described above are peculiar to these tube fittings and as special tooling is required, caution should be exercised in specifying such deviations for any other products.

Straight pipe threads, where specified, shall conform to American Standard Straight Pipe Threads for Mechanical Joints (NPSM) in ANS B2.1, Pipe Threads.

External pipe threads shall be chamfered from the diameters tabulated below to produce the specified length of chamfered or partial thread. Internal pipe threads shall be countersunk 90 deg included angle to the diameters tabulated below:

Nominal Pipe Thread Size	External Thread				Internal Thread	
	Chamfer Diameter ^a		Length of Chamfered or Partial Thread		Countersink Diameter ^a	
	Max	Min	Min	Max	Min	Max
1/8	0.32	0.30	0.037	0.055	0.42	0.44
1/4	0.42	0.40	0.056	0.084	0.55	0.57
3/8	0.55	0.53	0.056	0.084	0.69	0.71
1/2	0.68	0.66	0.071	0.107	0.85	0.87
3/4	0.89	0.87	0.071	0.107	1.06	1.08

^aTabulated diameters conform with American National Standard, ANS B2.2.

Material and Manufacture—Fittings shall be made from ASTM B16, SAE CA360 (half-hard), CA345, or CA350 brass bar or extruded shapes or ASTM B124 - Alloy 2, SAE CA377 brass forgings in accordance with the manufacturer's practices. Nuts may be made from steel when so specified by the purchaser. Seal bonnets and flare gaskets shall be made from copper conforming to ASTM B152 or SAE CA102, CA110, or CA122. As specified by purchaser, fusible metal alloys shall be supplied for temperature ranges 158-165, 203-219, or 275-290 F.

Finish—As specified by purchaser, steel nuts shall be furnished plain, cadmium or zinc plated to a thickness of 0.0002 in. minimum followed by a chromate treatment, or with a phosphate coating (oil finished). Plated or coated nuts must meet the requirements of 32 or 16 hr salt spray test, respectively, in accordance with ASTM B 117.

Workmanship—Workmanship shall conform to the best commercial practice to produce high quality fittings. Fittings shall be free from all hanging burrs, loose scale, and slivers which might become dislodged in usage and all other defects which might affect their serviceability. All sealing surfaces must be smooth except that annular tool marks up to 100 mu in. maximum shall be permissible.

NOTE: UNSPECIFIED DETAIL WITH RESPECT TO DIMENSIONS, TOLERANCES, CONTOURS, MATERIAL, WORKMANSHIP, ETC., MUST CONFORM TO GENERAL SPECIFICATIONS FOR REFRIGERATION TUBE FITTINGS. THE DIMENSIONAL DESIGNATIONS IN FIGS. 1, 6 AND 11 AND THE FIRST FIGURE IN EACH GROUP SHALL APPLY TO CORRESPONDING FEATURES OF OTHER FIGURES ON THIS PAGE UNLESS SHOWN OTHERWISE. THE ILLUSTRATIONS ON THIS PAGE APPLY TO TABLE 1.

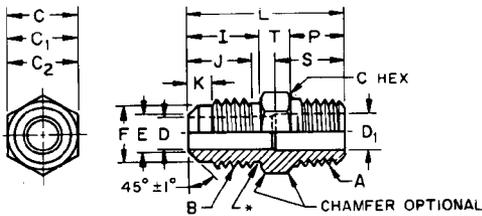


FIG. 1-CONNECTOR (HALF UNION)

*UNDERCUT TO G DIA OPTIONAL ON FLARE SIZES 1/2 AND LARGER UNLESS OTHERWISE SPECIFIED BY PURCHASER

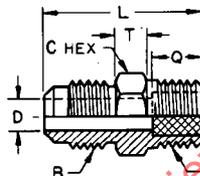


FIG. 2-FUSIBLE CONNECTOR (HALF UNION)

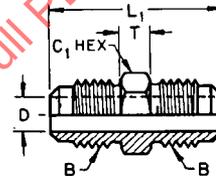


FIG. 3-UNION

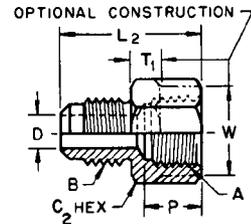


FIG. 4-INTERNAL PIPE THREAD CONNECTOR (HALF UNION)

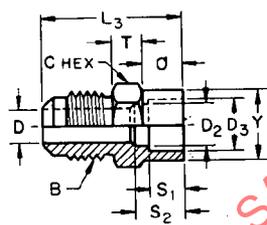


FIG. 5-SOLDER CONNECTOR (HALF UNION)

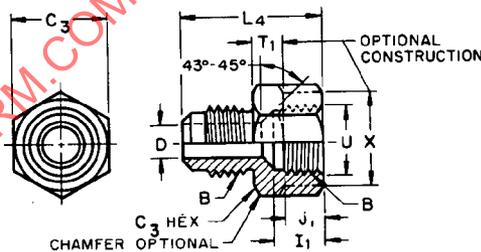


FIG. 6-INTERNAL FLARE TO EXTERNAL FLARE ADAPTER

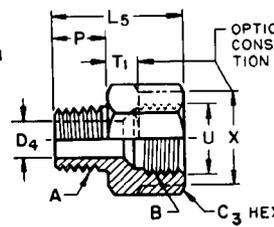


FIG. 7-INTERNAL FLARE TO EXTERNAL PIPE ADAPTER

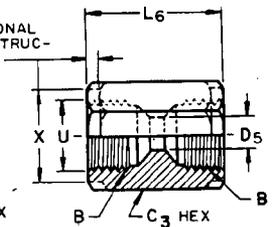


FIG. 8-INTERNAL FLARE UNION

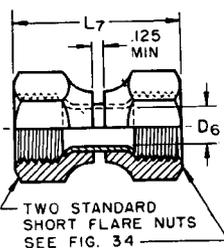


FIG. 9-INTERNAL FLARE SWIVEL UNION

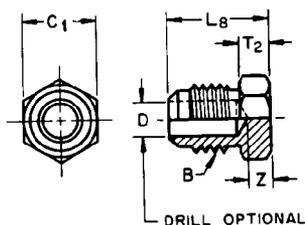


FIG. 10-PLUG

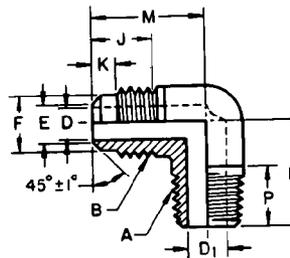


FIG. 11-90 DEG ELBOW

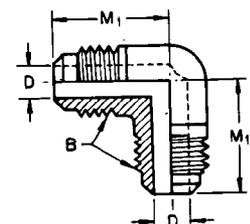


FIG. 12-90 DEG ELBOW UNION

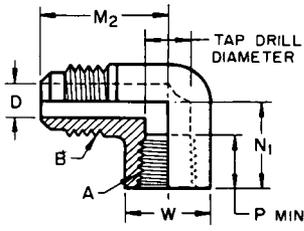


FIG. 13-90 DEG INTERNAL PIPE THREAD ELBOW

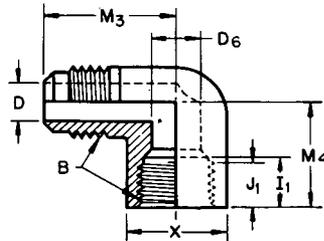


FIG. 14-INTERNAL FLARE TO EXTERNAL FLARE 90 DEG ELBOW

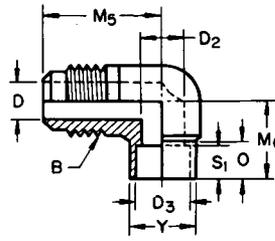


FIG. 15-90 DEG SOLDER ELBOW

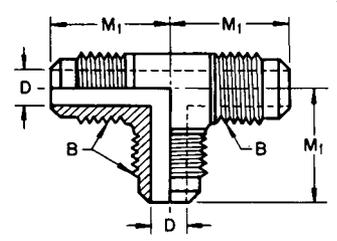


FIG. 16-THREE WAY TEE

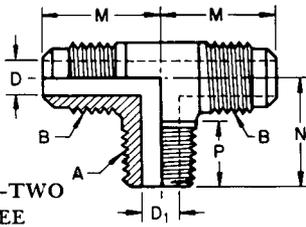


FIG. 17-TWO WAY TEE

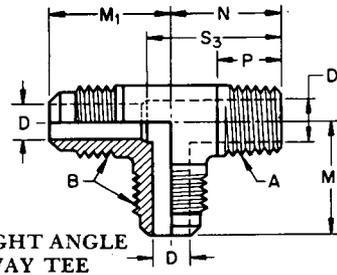


FIG. 18-RIGHT ANGLE TWO WAY TEE

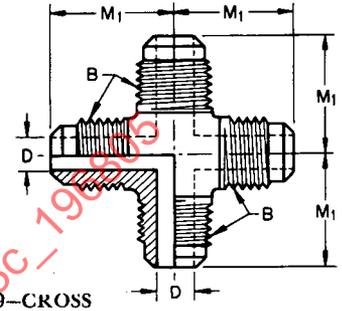


FIG. 19-CROSS

TABLE 1-DIMENSIONS OF CONNECTORS, UNIONS, ADAPTORS, ELBOWS, TEES, AND CROSSES (FIGS. 1-19)^a

Nominal Tube OD	A Dryseal Taper Thread NPTF ^b	Nominal Size	B, Straight Thread						C	C ₁	C ₂	C ₃	D _e Dia Drill	D ₁ ^e Dia Drill	D ₂ Dia Drill
			External		Internal										
			Pitch Dia		Pitch Dia		Minor Dia								
			Max	Min	Min	Max	Min	Max							
3/16	1/8	3/8-24	0.3468	0.3430	0.3479	0.3528	0.3300	0.3372	7/16	3/8	9/16	1/2	0.125	0.219	0.156
1/4	1/8	7/16-20	0.4037	0.3995	0.4050	0.4104	0.3830	0.3916	7/16	7/16	9/16	5/8	0.188	0.219	0.188
5/16	1/8	1/2-20	0.4662	0.4619	0.4675	0.4731	0.4460	0.4537	1/2	1/2	9/16	11/16	0.219	0.219	0.250
3/8	1/4	5/8-18	0.5875	0.5828	0.5889	0.5949	0.5650	0.5730	5/8	5/8	11/16	13/16	0.281	0.312	0.312
1/2	3/8	3/4-16	0.7079	0.7029	0.7094	0.7159	0.6820	0.6908	3/4	3/4	13/16	15/16	0.406	0.406	0.438
5/8	1/2	7/8-14	0.8270	0.8216	0.8286	0.8356	0.7980	0.8068	7/8	7/8	1	1-1/16	0.500	0.562	0.547
3/4	1/2	1-1/16-14	1.0145	1.0092	1.0161	1.0230	0.9850	0.9940	1-1/16	1-1/16	1-1/16	1-5/16	0.625	0.562	0.688

Nominal Tube OD	D ₃ ^b Dia ±0.0010	D ₄ Dia Drill	D ₅ Dia Drill	D ₆ Tube ID	E Dia	F Dia	G ^c Dia +0.000 -0.010	I	I ₁	J ^c Full Thread	J ₁ Full Thread	K	L ±0.03	L ₁ ±0.03	L ₂ ±0.03
										Min	Min				
3/16	0.1915	0.188	0.188	0.117	0.156	0.297	—	0.44	0.28	0.38	0.22	0.12	1.00	1.06	0.97
1/4	0.2540	0.219	0.250	0.180	0.219	0.344	—	0.50	0.34	0.41	0.27	0.16	1.06	1.19	1.03
5/16	0.3165	0.219	0.312	0.242	0.250	0.406	—	0.56	0.38	0.47	0.30	0.19	1.16	1.34	1.06
3/8	0.3790	0.344	0.375	0.305	0.312	0.531	—	0.62	0.44	0.54	0.34	0.22	1.44	1.50	1.31
1/2	0.5040	0.406	0.500	0.430	0.438	0.641	0.659	0.75	0.53	0.66	0.44	0.25	1.62	1.81	1.50
5/8	0.6290	0.562	0.625	0.555	0.531	0.750	0.770	0.88	0.66	0.76	0.55	0.28	2.00	2.12	1.81
3/4	0.7540	0.562	0.750	0.680	0.719	0.938	0.958	1.00	0.78	0.90	0.67	0.28	2.19	2.44	1.91

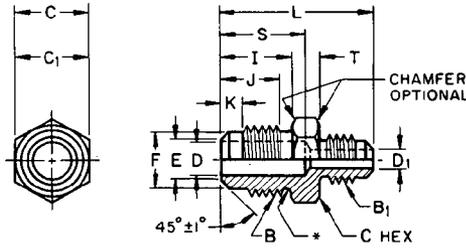
Nominal Tube OD	L ₃ ±0.03	L ₄ ±0.03	L ₅ ±0.03	L ₆ ±0.03	L ₇	L ₈ ±0.03	M ±0.03	M ₁ ±0.03	M ₂ ±0.03	M ₃ ±0.03	M ₄ ±0.03	M ₅ ±0.03	M ₆ ±0.03	N ±0.03	N ₁ ±0.03
					Min										
3/16	0.94	0.94	0.81	0.88	1.31	0.59	0.75	0.75	0.81	0.81	—	—	0.72	0.59	0.75
1/4	1.00	1.06	0.91	1.00	1.31	0.69	0.81	0.88	0.88	0.94	—	—	0.81	0.62	0.78
5/16	1.09	1.12	0.94	1.06	1.38	0.78	0.91	0.91	0.94	0.94	—	—	0.91	0.66	0.78
3/8	1.19	1.31	1.28	1.25	1.50	0.88	1.00	1.06	1.09	1.16	1.16	0.97	1.03	0.72	1.06
1/2	1.44	1.56	1.38	1.44	1.75	1.06	1.22	1.22	1.28	1.34	1.34	1.12	1.22	0.84	1.12
5/8	1.75	1.81	1.66	1.69	2.00	1.19	1.41	1.41	1.50	1.50	—	—	1.41	1.03	1.38
3/4	2.06	2.06	1.88	2.00	2.38	1.31	1.62	1.66	1.62	1.62	—	—	1.62	1.25	1.50

Nominal Tube OD	O	F	Q ^d	S ^e	S ₁	S ₂ ^e	S ₃ ^e	T ^f	T ₁	T ₂ ^f	U Dia		W ^g Dia +0.00 -0.02	X ^g Dia +0.00 -0.02	Y Dia	Z
				Max		Max	Min	Ref	Min	Ref	Min	Max	Min	Min		
3/16	0.31	0.38	—	0.48	0.31	0.41	0.85	0.18	0.21	0.15	0.39	0.41	0.56	0.50	0.28	0.06
1/4	0.31	0.38	—	0.48	0.31	—	0.92	0.18	0.24	0.18	0.45	0.47	0.56	0.62	0.34	0.05
5/16	0.31	0.38	—	—	0.31	0.42	—	0.21	0.24	0.21	0.51	0.53	0.56	0.69	0.40	0.06
3/8	0.31	0.56	0.69	0.69	0.31	0.44	1.24	0.24	0.30	0.24	0.64	0.67	0.69	0.81	0.48	0.06
1/2	0.38	0.56	—	—	0.38	0.54	—	0.30	0.37	0.30	0.77	0.80	0.81	0.94	0.60	0.08
5/8	0.50	0.75	0.94	0.94	0.50	0.69	1.67	0.37	0.43	0.30	0.90	0.93	1.00	1.06	0.74	0.10
3/4	0.62	0.75	—	1.22	0.62	0.84	2.02	0.43	0.49	0.30	1.08	1.11	1.06	1.31	0.86	0.10

^a For reducing sizes of Unions, Internal Flare to External Flare Adaptors and 90 Deg Elbow Unions, see Table 2; for reducing sizes of Solder Connectors and 90 Deg Solder Elbows, see Table 3; for reducing sizes of Connectors, Internal Pipe Thread Connectors, Internal Flare to External Pipe Adaptors, 90 Deg Elbow, and Internal Pipe Thread 90 Deg Elbow, and Internal Pipe Thread 90 Deg Elbow, see Table 4; for reducing sizes of Tees, see Tables 5 and 6.
^b Dryseal American Standard Taper Pipe Thread.
^c Where thread relief undercut J is used, last thread shall be chamfered 1/2 to 1 pitch long from G diameter and dimension J may be reduced by an amount equal to 1/2 pitch.

^d Available with three types of fusible alloys as specified in general specifications.
^e At manufacturer's option through passages in fittings shown in Figs. 1, 5, and 18 may conform with the smaller diameter specified or be counterbored to the larger diameter from the appropriate end for depths S₂, S₃ or S₃, respectively.
^f Minimum design thickness, not subject to inspection.
^g Basic dimensions shown shall apply as minimum for bosses. The -0.02 in. tolerance shall apply only to chamfer diameters on full hexagon versions of fittings shown in Figs. 4, 6-8, h ID of solder cup shall not be out of round by more than 0.003 in.

REFRIGERATION FLARE TYPE FITTINGS



*UNDERCUT TO G DIA OPTIONAL ON FLARE SIZES 1/2 AND LARGER UNLESS OTHERWISE SPECIFIED BY PURCHASER (SEE FOOTNOTE C)

FIG. 20—REDUCING UNION

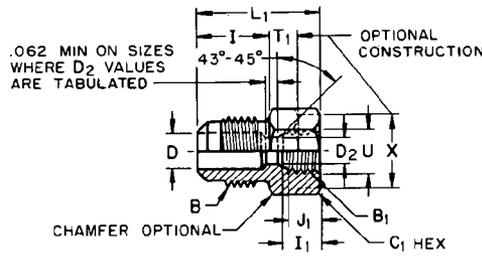


FIG. 21—INTERNAL FLARE TO EXTERNAL FLARE REDUCING ADAPTER

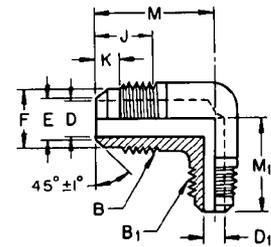


FIG. 22—90 DEG REDUCING ELBOW UNION

NOTE: UNSPECIFIED DETAIL WITH RESPECT TO DIMENSIONS, TOLERANCES, CONTOUR, MATERIAL, WORKMANSHIP, ETC., MUST CONFORM TO GENERAL SPECIFICATIONS FOR REFRIGERATION TUBE FITTINGS. THE ILLUSTRATIONS ON THIS PAGE APPLY TO TABLE 2.

TABLE 2 — DIMENSIONS OF REDUCING UNIONS, REDUCING ADAPTORS, AND REDUCING ELBOW UNIONS (FIGS. 20-22)^a

B ₀ Nominal Flare Size	B ₁ ^c Nominal Flare Size	C		D _d Dia Drill	D _{1d} Dia Drill	D ₂ Dia Drill	L ±0.03	L ₁ ±0.03	M ±0.03	M ₁ ±0.03	S _d		T ₀ Ref	T ₁ Min	X _t Dia +0.00 -0.02
		Nominal	Nominal								Max	Ref			
3/16	1/4	7/16	5/8	0.125	0.188	—	1.12	1.03	0.75	0.88	0.60	0.18	0.24	0.62	
3/16	5/16	1/2	11/16	0.125	0.219	—	1.22	1.06	0.78	0.91	0.67	0.21	0.24	0.69	
3/16	3/8	5/8	13/16	0.125	0.281	—	1.31	1.19	0.84	1.06	0.75	0.24	0.30	0.81	
3/16	1/2	3/4	15/16	0.125	0.406	—	1.50	1.34	0.91	1.22	0.91	0.30	0.37	0.94	
3/16	5/8	7/8	1-1/16	0.125	0.500	—	1.69	1.53	0.97	1.41	1.07	0.37	0.43	1.06	
3/16	3/4	1-1/16	1-5/16	0.125	0.625	—	1.88	1.75	1.06	1.66	1.22	0.43	0.49	1.31	
1/4 ^b	3/16	7/16	1/2	0.188	0.125	—	1.12	0.97	0.88	0.75	0.60	0.18	0.21	0.50	
1/4	5/16	1/2	11/16	0.188	0.219	—	1.28	1.12	0.84	0.91	0.67	0.21	0.24	0.69	
1/4	3/8	5/8	13/16	0.188	0.281	—	1.38	1.22	0.91	1.06	0.75	0.24	0.30	0.81	
1/4	1/2	3/4	15/16	0.188	0.406	—	1.56	1.38	0.97	1.22	0.91	0.30	0.37	0.94	
1/4	5/8	7/8	1-1/16	0.188	0.500	—	1.75	1.56	1.03	1.41	1.07	0.37	0.43	1.06	
1/4	3/4	1-1/16	1-5/16	0.188	0.625	—	1.94	1.69	1.12	1.66	1.22	0.43	0.49	1.31	
5/16 ^b	3/16	1/2	1/2	0.219	0.125	0.188	1.22	1.00	0.91	0.78	0.67	0.21	0.21	0.50	
5/16 ^b	1/4	1/2	5/8	0.219	0.188	—	1.28	1.09	0.91	0.84	0.67	0.21	0.24	0.62	
5/16	3/8	5/8	13/16	0.219	0.281	—	1.44	1.25	0.97	1.06	0.75	0.24	0.30	0.81	
5/16	1/2	3/4	15/16	0.219	0.406	—	1.62	1.41	1.03	1.22	0.91	0.30	0.37	0.94	
5/16	5/8	7/8	1-1/16	0.219	0.500	—	1.81	1.59	1.09	1.41	1.07	0.37	0.43	1.06	
5/16	3/4	1-1/16	1-5/16	0.219	0.625	—	2.00	1.81	1.19	1.66	1.22	0.43	0.49	1.31	
3/8 ^b	3/16	5/8	5/8	0.281	0.125	0.188	1.31	1.03	1.06	0.84	0.75	0.24	0.24	0.62	
3/8 ^b	1/4	5/8	5/8	0.281	0.188	0.250	1.38	1.12	1.06	0.91	0.75	0.24	0.24	0.62	
3/8 ^b	5/16	5/8	11/16	0.281	0.219	—	1.44	1.19	1.06	0.97	0.75	0.24	0.24	0.69	
3/8	1/2	3/4	15/16	0.281	0.406	—	1.69	1.44	1.09	1.22	0.91	0.30	0.37	0.94	
3/8	5/8	7/8	1-1/16	0.281	0.500	—	1.88	1.62	1.16	1.41	1.07	0.37	0.43	1.06	
3/8	3/4	1-1/16	1-5/16	0.281	0.625	—	2.06	1.84	1.25	1.66	1.22	0.43	0.49	1.31	
1/2 ^b	3/16	3/4	3/4	0.406	0.125	0.188	1.50	1.16	1.22	0.91	0.91	0.30	0.30	0.75	
1/2 ^b	1/4	3/4	3/4	0.406	0.188	0.250	1.56	1.25	1.22	0.97	0.91	0.30	0.30	0.75	
1/2 ^b	5/16	3/4	3/4	0.406	0.219	0.312	1.62	1.28	1.22	1.03	0.91	0.30	0.30	0.75	
1/2 ^b	3/8	3/4	13/16	0.406	0.281	0.375	1.69	1.41	1.22	1.09	0.91	0.30	0.30	0.81	
1/2	5/8	7/8	1-1/16	0.406	0.500	—	2.00	1.69	1.28	1.41	1.07	0.37	0.43	1.06	
1/2	3/4	1-1/16	1-5/16	0.406	0.625	—	2.19	1.91	1.38	1.66	1.22	0.43	0.49	1.31	
5/8 ^b	3/16	7/8	7/8	0.500	0.125	0.188	1.69	1.25	1.41	0.97	1.07	0.37	0.37	0.88	
5/8 ^b	1/4	7/8	7/8	0.500	0.188	0.250	1.75	1.31	1.41	1.03	1.07	0.37	0.37	0.88	
5/8 ^b	5/16	7/8	7/8	0.500	0.219	0.312	1.81	1.38	1.41	1.09	1.07	0.37	0.37	0.88	
5/8 ^b	3/8	7/8	7/8	0.500	0.281	0.375	1.88	1.47	1.41	1.16	1.07	0.37	0.37	0.88	
5/8 ^b	1/2	7/8	15/16	0.500	0.406	—	2.00	1.62	1.41	1.28	1.07	0.37	0.37	0.94	
5/8 ^b	3/4	1-1/16	1-5/16	0.500	0.625	—	2.31	1.97	1.50	1.66	1.22	0.43	0.49	1.31	
3/4 ^b	3/16	1-1/16	1-1/16	0.625	0.125	0.188	1.88	1.44	1.66	1.06	1.22	0.43	0.43	1.06	
3/4 ^b	1/4	1-1/16	1-1/16	0.625	0.188	0.250	1.94	1.44	1.66	1.12	1.22	0.43	0.43	1.06	
3/4 ^b	5/16	1-1/16	1-1/16	0.625	0.219	0.312	2.00	1.44	1.66	1.19	1.22	0.43	0.43	1.06	
3/4 ^b	3/8	1-1/16	1-1/16	0.625	0.281	0.375	2.06	1.53	1.66	1.25	1.22	0.43	0.43	1.06	
3/4 ^b	1/2	1-1/16	1-1/16	0.625	0.406	0.500	2.19	1.69	1.66	1.38	1.22	0.43	0.43	1.06	
3/4 ^b	5/8	1-1/16	1-1/16	0.625	0.500	—	2.31	1.88	1.66	1.50	1.22	0.43	0.43	1.06	

^a For flare dimensions shown on Figs. 20-22 but not covered in Table 2, see corresponding dimensions for the specified flare size (Tube OD) in Table 1.

^b In these sizes the reducing unions and reducing elbows are the reverses of sizes already specified in table.

^c Where thread relief undercut is used last thread shall be chamfered 1/2 to 1 pitch long from G diameter and dimension J may be reduced by an amount equal to 1/2 pitch.

^d At manufacturer's option through passages in fittings shown in Fig. 20 may conform with the smaller diameter specified or be counterbored to the larger diameter from the appropriate end for depth S.

^e Minimum design thickness, not subject to inspection.

^f Basic dimensions shown shall apply as minimum for bosses. The -0.02 in. tolerance shall apply only to chamfer diameter on full hexagon version of fittings in Fig. 21.

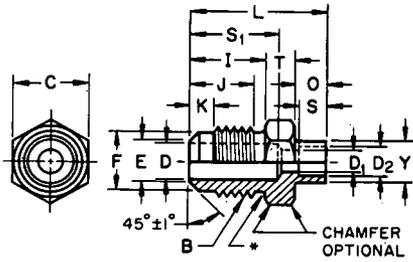


FIG. 23—FLARE TO SOLDER REDUCING CONNECTOR (HALF UNION)

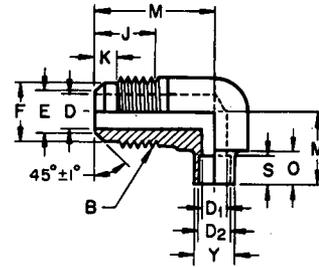


FIG. 24—FLARE TO SOLDER 90 DEG REDUCING ELBOW

*UNDERCUT TO G DIA OPTIONAL ON FLARE SIZES 1/2 AND LARGER UNLESS OTHERWISE SPECIFIED BY PURCHASER (SEE FOOTNOTE b)

NOTE: UNSPECIFIED DETAIL WITH RESPECT TO DIMENSIONS, TOLERANCES, CONTOUR, MATERIAL, WORKMANSHIP, ETC., MUST CONFORM TO GENERAL SPECIFICATIONS FOR REFRIGERATION TUBE FITTINGS. THE ILLUSTRATIONS ON THIS PAGE APPLY TO TABLE 3.

TABLE 3—DIMENSIONS OF REDUCING SOLDER CONNECTORS AND REDUCING SOLDER ELBOWS (FIGS. 23 AND 24)^a

B Nominal Flare Size	Solder Tube OD	C Nominal	D ^c Dia Drill	D ^c Dia Drill	D ₂ ^c Dia ±0.0010	L ±0.03	M ±0.03	M ₁ ±0.03	O	S	S ₁ ^c	T ^d	Y Dia
											Max	Ref	Min
3/16	1/8	3/8	0.125	0.094	0.1290	0.91	0.72	0.59	0.31	0.31	0.52	0.15	0.22
3/16	1/4	7/16	0.125	0.188	0.2540	0.94	0.72	0.59	0.31	0.31	0.41	0.18	0.34
3/16	5/16	7/16	0.125	0.250	0.3165	0.94	0.75	0.62	0.31	0.31	0.41	0.18	0.40
3/16	3/8	1/2	0.125	0.312	0.3790	0.94	0.78	0.66	0.31	0.31	0.41	0.18	0.48
3/16	1/2	5/8	0.125	0.438	0.5040	1.03	0.84	0.78	0.38	0.38	0.49	0.21	0.60
3/16	5/8	3/4	0.125	0.547	0.6290	1.19	0.91	0.97	0.50	0.50	0.63	0.24	0.74
3/16	3/4	7/8	0.125	0.688	0.7540	1.38	0.97	1.16	0.62	0.62	0.78	0.30	0.86
3/16	7/8	1	0.125	0.781	0.8790	1.56	1.06	1.38	0.75	0.75	0.94	0.37	0.98
1/4	1/8	7/16	0.188	0.094	0.1290	1.00	0.81	0.62	0.31	0.31	0.60	0.18	0.22
1/4	3/16	7/16	0.188	0.156	0.1915	1.00	0.81	0.62	0.31	0.31	0.60	0.18	0.28
1/4	5/16	7/16	0.188	0.250	0.3165	1.00	0.81	0.62	0.31	0.31	0.41	0.18	0.40
1/4	3/8	1/2	0.188	0.312	0.3790	1.00	0.84	0.66	0.31	0.31	0.41	0.18	0.48
1/4	1/2	5/8	0.188	0.438	0.5040	1.09	0.91	0.78	0.38	0.38	0.49	0.21	0.60
1/4	5/8	3/4	0.188	0.547	0.6290	1.25	0.97	0.97	0.50	0.50	0.63	0.24	0.74
1/4	3/4	7/8	0.188	0.688	0.7540	1.44	1.03	1.16	0.62	0.62	0.78	0.30	0.86
1/4	7/8	1	0.188	0.781	0.8790	1.62	1.12	1.38	0.75	0.75	0.94	0.37	0.98
5/16	1/8	1/2	0.219	0.094	0.1290	1.09	0.91	0.66	0.31	0.31	0.67	0.21	0.22
5/16	3/16	1/2	0.219	0.156	0.1915	1.09	0.91	0.66	0.31	0.31	0.67	0.21	0.28
5/16	1/4	1/2	0.219	0.188	0.2540	1.09	0.91	0.66	0.31	0.31	0.67	0.21	0.34
5/16	3/8	1/2	0.219	0.312	0.3790	1.09	0.91	0.66	0.31	0.31	0.42	0.21	0.48
5/16	1/2	5/8	0.219	0.438	0.5040	1.16	0.97	0.78	0.38	0.38	0.49	0.21	0.60
5/16	5/8	3/4	0.219	0.547	0.6290	1.31	1.03	0.97	0.50	0.50	0.63	0.24	0.74
5/16	3/4	7/8	0.219	0.688	0.7540	1.50	1.09	1.16	0.62	0.62	0.78	0.30	0.86
5/16	7/8	1	0.219	0.781	0.8790	1.69	1.19	1.38	0.75	0.75	0.94	0.37	0.98
3/8	1/8	5/8	0.281	0.094	0.1290	1.19	1.03	0.72	0.31	0.31	0.75	0.24	0.22
3/8	3/16	5/8	0.281	0.156	0.1915	1.19	1.03	0.72	0.31	0.31	0.75	0.24	0.28
3/8	1/4	5/8	0.281	0.188	0.2540	1.19	1.03	0.72	0.31	0.31	0.75	0.24	0.34
3/8	5/16	5/8	0.281	0.250	0.3165	1.19	1.03	0.72	0.31	0.31	0.75	0.24	0.40
3/8	1/2	5/8	0.281	0.438	0.5040	1.25	1.03	0.78	0.38	0.38	0.51	0.24	0.60
3/8	5/8	3/4	0.281	0.547	0.6290	1.38	1.09	0.97	0.50	0.50	0.63	0.24	0.74
3/8	3/4	7/8	0.281	0.688	0.7540	1.56	1.16	1.16	0.62	0.62	0.78	0.30	0.86
3/8	7/8	1	0.281	0.781	0.8790	1.75	1.25	1.38	0.75	0.75	0.94	0.37	0.98
1/2	1/8	3/4	0.406	0.094	0.1290	1.38	1.22	0.78	0.31	0.31	0.91	0.30	0.22
1/2	3/16	3/4	0.406	0.156	0.1915	1.38	1.22	0.78	0.31	0.31	0.91	0.30	0.28
1/2	1/4	3/4	0.406	0.188	0.2540	1.38	1.22	0.78	0.31	0.31	0.91	0.30	0.34
1/2	5/16	3/4	0.406	0.250	0.3165	1.38	1.22	0.78	0.31	0.31	0.91	0.30	0.40
1/2	3/8	3/4	0.406	0.312	0.3790	1.38	1.22	0.78	0.31	0.31	0.91	0.30	0.48
1/2	5/8	3/4	0.406	0.547	0.6290	1.56	1.22	0.97	0.50	0.50	0.66	0.30	0.74
1/2	3/4	7/8	0.406	0.688	0.7540	1.69	1.28	1.16	0.62	0.62	0.78	0.30	0.86
1/2	7/8	1	0.406	0.781	0.8790	1.88	1.38	1.38	0.75	0.75	0.94	0.37	0.98
5/8	1/8	7/8	0.500	0.094	0.1290	1.56	1.41	0.84	0.31	0.31	1.07	0.37	0.22
5/8	3/16	7/8	0.500	0.156	0.1915	1.56	1.41	0.84	0.31	0.31	1.07	0.37	0.28
5/8	1/4	7/8	0.500	0.188	0.2540	1.56	1.41	0.84	0.31	0.31	1.07	0.37	0.34
5/8	5/16	7/8	0.500	0.250	0.3165	1.56	1.41	0.84	0.31	0.31	1.07	0.37	0.40
5/8	3/8	7/8	0.500	0.312	0.3790	1.56	1.41	0.84	0.31	0.31	1.07	0.37	0.48
5/8	1/2	7/8	0.500	0.438	0.5040	1.62	1.41	0.91	0.38	0.38	1.07	0.37	0.60
5/8	3/4	7/8	0.500	0.688	0.7540	1.88	1.41	1.16	0.62	0.62	0.81	0.37	0.86
5/8	7/8	1	0.500	0.781	0.8790	2.00	1.50	1.38	0.75	0.75	0.94	0.37	0.98
3/4	1/8	1-1/16	0.625	0.094	0.1290	1.75	1.62	0.94	0.31	0.31	1.22	0.43	0.22
3/4	3/16	1-1/16	0.625	0.156	0.1915	1.75	1.62	0.94	0.31	0.31	1.22	0.43	0.28
3/4	1/4	1-1/16	0.625	0.188	0.2540	1.75	1.62	0.94	0.31	0.31	1.22	0.43	0.34
3/4	5/16	1-1/16	0.625	0.250	0.3165	1.75	1.62	0.94	0.31	0.31	1.22	0.43	0.40
3/4	3/8	1-1/16	0.625	0.312	0.3790	1.75	1.62	0.94	0.31	0.31	1.22	0.43	0.48
3/4	1/2	1-1/16	0.625	0.438	0.5040	1.81	1.62	1.00	0.38	0.38	1.22	0.43	0.60
3/4	5/8	1-1/16	0.625	0.547	0.6290	1.94	1.62	1.12	0.50	0.50	1.22	0.43	0.74
3/4	7/8	1-1/16	0.625	0.781	0.8790	2.19	1.62	1.38	0.75	0.75	0.97	0.43	0.98

^a For flare dimensions shown on Figs. 23 and 24 but not covered in Table 3, see corresponding dimensions for the specified flare size (Tube OD) in Table 1.

^b Where thread relief undercut is used, last thread shall be chamfered 1/2 to 1 pitch long from G diameter and dimension J may be reduced by an amount equal to 1/2 pitch.

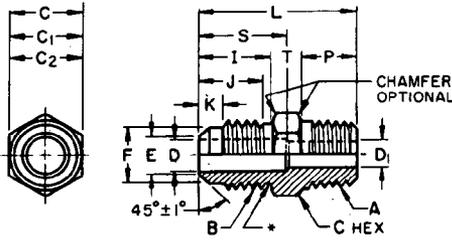
^c At manufacturer's option through passages in fittings shown in Fig. 23 may conform with

the smaller diameter specified or be counterbored to the larger diameter from appropriate end for depth S.

^d Minimum design thickness, not subject to inspection.

^e ID of solder cup shall not be out of round by more than 0.003 in.

REFRIGERATION FLARE TYPE FITTINGS



*UNDERCUT TO G DIA OPTIONAL ON FLARE SIZES 1/2 AND LARGER UNLESS OTHERWISE SPECIFIED BY PURCHASER (SEE FOOTNOTE c)
 FIG. 25—REDUCING CONNECTOR (HALF UNION)

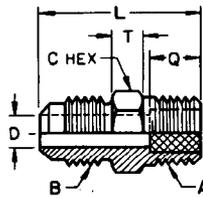


FIG. 26—FUSIBLE REDUCING CONNECTOR (HALF UNION)

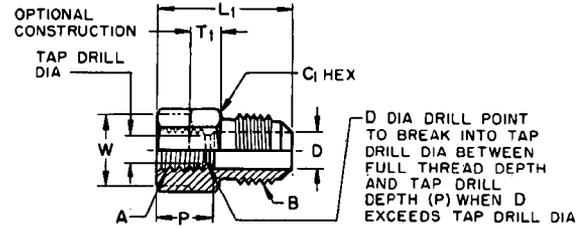


FIG. 27—INTERNAL THREAD REDUCING CONNECTOR (HALF UNION)

FIG. 28—INTERNAL FLARE TO EXTERNAL PIPE REDUCING ADAPTER

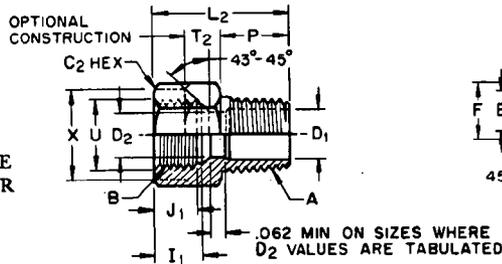


FIG. 29—90 DEG REDUCING ELBOW

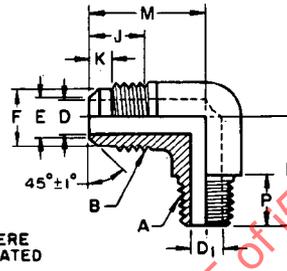
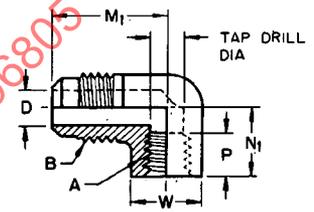


FIG. 30—90 DEG INTERNAL PIPE THREAD REDUCING ELBOW



NOTE: UNSPECIFIED DETAIL WITH RESPECT TO DIMENSIONS, TOLERANCES, CONTOURS, MATERIAL, WORKMANSHIP, ETC., MUST CONFORM TO GENERAL SPECIFICATIONS FOR REFRIGERATION TUBE FITTINGS. THE DIMENSIONAL DESIGNATIONS IN FIGS. 1 AND 29 SHALL APPLY TO CORRESPONDING FEATURES OF OTHER FIGURES ON THIS PAGE UNLESS SHOWN OTHERWISE. THE ILLUSTRATIONS ON THIS PAGE APPLY TO TABLE 4.

TABLE 4—DIMENSIONS OF REDUCING CONNECTORS, REDUCING ADAPTORS, AND REDUCING ELBOWS (FIGS. 25-30)^a

B Nom Flare Size	A Taper Thread NPTF ^b	C		D ^d Dia Drill	D ₁ ^d Dia Drill	D ₂ Dia Drill	L ±0.03	L ₁ ±0.03	L ₂ ±0.03	M ±0.03	M ₁ ±0.03	N ±0.03	N ₁ ±0.03	P	Q ^e	S ^d Max	T ^f Ref	T ₁ Min	T ₂ Min	W _R ±0.00 -0.02	X _R ±0.00 -0.02	
		Nom	Nom																			
3/16	1/4	9/16	11/16	9/16	0.125	0.312	0.188	1.19	1.19	0.94	0.81	0.91	0.97	0.62	0.56	—	0.66	0.18	0.24	0.21	0.69	0.56
3/16	3/8	11/16	13/16	11/16	0.125	0.406	0.188	1.25	1.22	0.84	0.88	0.97	1.00	0.62	0.56	—	0.69	0.24	0.30	0.24	0.81	0.69
3/16	1/2	7/8	1	7/8	0.125	0.562	0.188	1.50	1.44	1.06	0.97	1.06	1.28	0.81	0.75	—	0.91	0.30	0.37	0.30	1.00	0.88
3/16	3/4	1-1/16	1-1/4	1-1/16	0.125	0.750	0.188	1.62	1.50	1.19	1.06	1.22	1.38	0.81	0.75	—	0.97	0.43	0.49	0.43	1.25	1.06
1/4	1/4	9/16	11/16	5/8	0.188	0.312	0.250	1.25	1.25	1.03	0.91	0.97	0.94	0.66	0.56	0.66	0.66	0.18	0.24	0.24	0.69	0.62
1/4	3/8	11/16	13/16	11/16	0.188	0.406	0.250	1.31	1.28	0.94	0.94	1.03	1.03	0.66	0.56	0.69	0.69	0.24	0.30	0.24	0.81	0.69
1/4	1/2	7/8	1	7/8	0.188	0.562	0.250	1.56	1.50	1.06	1.03	1.12	1.28	0.84	0.75	—	0.91	0.30	0.37	0.30	1.00	0.88
1/4	3/4	1-1/16	1-1/4	1-1/16	0.188	0.750	0.250	1.69	1.56	1.19	1.12	1.28	1.38	0.84	0.75	—	0.97	0.43	0.49	0.43	1.25	1.06
5/16	1/4	9/16	11/16	11/16	0.219	0.312	0.312	1.34	1.28	1.09	0.97	1.03	0.94	0.66	0.56	—	0.67	0.21	0.24	0.24	0.69	0.69
5/16	3/8	11/16	13/16	11/16	0.219	0.406	0.312	1.38	1.31	1.00	1.00	1.09	1.03	0.66	0.56	—	0.69	0.24	0.30	0.24	0.81	0.69
5/16	1/2	7/8	1	7/8	0.219	0.562	0.312	1.62	1.53	1.12	1.09	1.19	1.28	0.84	0.75	—	0.91	0.30	0.37	0.30	1.00	0.88
5/16	3/4	1-1/16	1-1/4	1-1/16	0.219	0.750	0.312	1.75	1.59	1.19	1.19	1.34	1.38	0.84	0.75	—	0.97	0.43	0.49	0.43	1.25	1.06
3/8	1/8	5/8	5/8	13/16	0.281	0.219	—	1.25	1.12	1.09	1.03	1.06	0.91	0.50	0.38	—	0.75	0.24	0.24	0.30	0.62	0.81
3/8	3/8	11/16	13/16	13/16	0.281	0.406	0.375	1.44	1.38	1.12	1.06	1.16	1.09	0.69	0.56	0.69	0.69	0.24	0.30	0.30	0.81	0.81
3/8	1/2	7/8	1	7/8	0.281	0.562	0.375	1.69	1.62	1.25	1.16	1.25	1.28	0.88	0.75	—	0.91	0.30	0.37	0.30	1.00	0.88
3/8	3/4	1-1/16	1-1/4	1-1/16	0.281	0.750	0.375	1.81	1.66	1.19	1.25	1.41	1.38	0.88	0.75	—	0.97	0.43	0.49	0.43	1.25	1.06
1/2	1/8	3/4	3/4	15/16	0.406	0.219	—	1.44	1.19	1.25	1.22	1.22	1.00	0.56	0.38	—	0.91	0.30	0.30	0.37	0.75	0.94
1/2	1/4	3/4	3/4	15/16	0.406	0.312	—	1.62	1.41	1.34	1.22	1.22	1.19	0.75	0.56	—	0.91	0.30	0.30	0.37	0.75	0.94
1/2	1/2	7/8	1	15/16	0.406	0.562	0.500	1.81	1.75	1.47	1.28	1.38	1.38	0.94	0.75	—	0.91	0.30	0.37	0.37	1.00	0.94
1/2	3/4	1-1/16	1-1/4	1-1/16	0.406	0.750	0.500	1.94	1.81	1.38	1.38	1.53	1.38	0.94	0.75	—	0.97	0.43	0.49	0.43	1.25	1.06
5/8	1/8	7/8	7/8	1-1/16	0.500	0.219	—	1.62	1.28	1.41	1.41	1.41	1.06	0.62	0.38	—	1.07	0.37	0.37	0.43	0.88	1.06
5/8	1/4	7/8	7/8	1-1/16	0.500	0.312	—	1.81	1.50	1.53	1.41	1.41	1.25	0.81	0.56	—	1.07	0.37	0.37	0.43	0.88	1.06
5/8	3/8	7/8	7/8	1-1/16	0.500	0.406	—	1.81	1.59	1.56	1.41	1.41	1.25	0.81	0.56	—	1.07	0.37	0.37	0.43	0.88	1.06
5/8	3/4	1-1/16	1-1/4	1-1/16	0.500	0.750	0.625	2.06	1.91	1.66	1.44	1.66	1.50	1.00	0.75	—	0.97	0.43	0.49	0.43	1.25	1.06
3/4	1/8	1-1/16	1-1/16	1-5/16	0.625	0.219	—	1.81	1.38	1.62	1.62	1.59	1.22	0.69	0.38	—	1.22	0.43	0.43	0.49	1.06	1.31
3/4	1/4	1-1/16	1-1/16	1-5/16	0.625	0.312	—	2.00	1.56	1.75	1.62	1.59	1.41	0.88	0.56	—	1.22	0.43	0.43	0.49	1.06	1.31
3/4	3/8	1-1/16	1-1/16	1-5/16	0.625	0.406	—	2.00	1.66	1.78	1.62	1.59	1.41	0.88	0.56	—	1.22	0.43	0.43	0.49	1.06	1.31
3/4	3/4	1-1/16	1-1/4	1-5/16	0.625	0.750	—	2.19	1.97	1.78	1.59	1.78	1.62	1.06	0.75	—	0.97	0.43	0.49	0.49	1.25	1.31

^a For flare dimensions shown on Figs. 25-30 but not given in Table 4, see corresponding dimensions for the specified flare size (Tube OD) in Table 1.

^b Dryseal American Standard Taper Pipe Thread.

^c Where thread relief undercut is used, last thread shall be chamfered 1/2 to 1 pitch long from G diameter, and dimension J may be reduced by an amount equal to 1/2 pitch.

^d At manufacturer's option, through passages in fittings shown in Fig. 25 may conform with

the smaller diameter specified or be counterbored to the larger diameter from the appropriate end for depth S.

^e Available with three types of fusible alloys as specified in General Specifications.

^f Minimum design thickness, not subject to inspection.

^g Basic dimensions shown shall apply as minimum for bosses. The -0.02 in. tolerance shall apply only to chamfer diameters on full hexagon versions of fittings shown in Figs. 27 and 28.

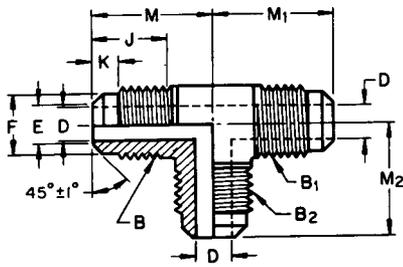


FIG. 31—THREE WAY REDUCING TEE

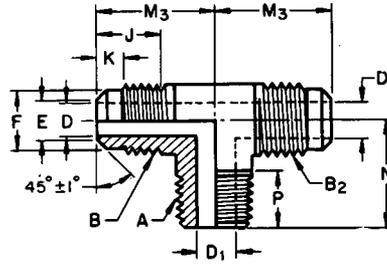


FIG. 32—TWO WAY REDUCING TEE

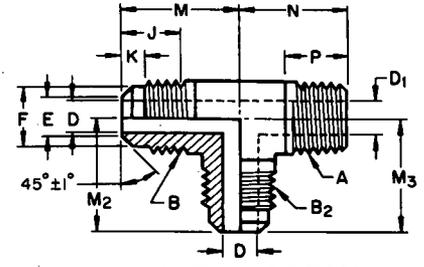


FIG. 33—RIGHT ANGLE TWO WAY REDUCING TEE

NOTES: UNSPECIFIED DETAIL WITH RESPECT TO DIMENSIONS, TOLERANCES, CONTOUR, MATERIAL, WORKMANSHIP, ETC., MUST CONFORM TO GENERAL SPECIFICATIONS FOR REFRIGERATION TUBE FITTINGS. THE ILLUSTRATIONS ON THIS PAGE APPLY TO TABLES 5-8.

TABLE 5—END TO CENTER DIMENSIONS OF FLARE TO FLARE ENDS ON REDUCING TEES^a

B and B ₁ Nominal Flare Sizes of Run	End to Center ±0.03	B ₂ , Nominal Flare Sizes of Branch						
		3/16	1/4	5/16	3/8	1/2	5/8	3/4
3/16	M or M ₁	0.75	0.75	0.78	0.84	0.91	0.97	1.06
	M ₂	0.75	0.88	0.91	1.06	1.22	1.41	1.66
1/4	M or M ₁	0.88	0.88	0.84	0.91	0.97	1.03	1.12
	M ₂	0.75	0.88	0.91	1.06	1.22	1.41	1.66
5/16	M or M ₁	0.91	0.91	0.91	0.97	1.03	1.09	1.19
	M ₂	0.78	0.84	0.91	1.06	1.22	1.41	1.66
3/8	M or M ₁	1.06	1.06	1.06	1.06	1.09	1.16	1.25
	M ₂	0.84	0.91	0.97	1.06	1.22	1.41	1.66
1/2	M or M ₁	1.22	1.22	1.22	1.22	1.22	1.28	1.38
	M ₂	0.91	0.97	1.03	1.09	1.22	1.41	1.66
5/8	M or M ₁	1.41	1.41	1.41	1.41	1.41	1.41	1.50
	M ₂	0.97	1.03	1.09	1.16	1.28	1.41	1.66
3/4	M or M ₁	1.66	1.66	1.66	1.66	1.66	1.66	1.66
	M ₂	1.06	1.12	1.19	1.25	1.38	1.50	1.66

^a For flare and pipe thread dimensions shown on Figs. 31-33, see corresponding dimensions for specified flare size (Tube OD) and specified pipe thread size in Table 1. For passage diameters, see Tables 7 and 8.

TABLE 6—END TO CENTER DIMENSIONS OF FLARE TO PIPE ENDS ON REDUCING TEES^a

B, B ₁ , or B ₂ Nominal Flare Sizes	End to Center ±0.03	A, Dryseal Taper Thread, NPTF ^b				
		1/8	1/4	3/8	1/2	3/4
3/16	M ₃	0.75	0.81	0.88	0.97	1.06
	N	0.75	0.97	1.00	1.28	1.38
1/4	M ₃	0.81	0.91	0.94	1.03	1.12
	N	0.78	0.94	1.03	1.28	1.38
5/16	M ₃	0.91	0.97	1.00	1.09	1.19
	N	0.78	0.94	1.03	1.28	1.38
3/8	M ₃	1.03	1.00	1.06	1.16	1.25
	N	0.91	1.06	1.09	1.28	1.38
1/2	M ₃	1.22	1.22	1.22	1.28	1.38
	N	1.00	1.19	1.12	1.38	1.38
5/8	M ₃	1.41	1.41	1.41	1.41	1.44
	N	1.06	1.25	1.25	1.38	1.50
3/4	M ₃	1.62	1.62	1.62	1.62	1.59
	N	1.22	1.41	1.41	1.50	1.62

^a For flare and pipe thread dimensions shown on Figs. 31-33, see corresponding dimensions for specified flare size (Tube OD) and specified pipe thread size in Table 1. For passage diameters, see Tables 7 and 8.

^b Dryseal American Standard Taper Pipe Thread.

TABLE 7—PASSAGE DIAMETERS THROUGH FLARE ENDS

Nominal Flare Size	D ^a Dia Drill
3/16	0.125
1/4	0.188
5/16	0.219
3/8	0.281
1/2	0.406
5/8	0.500
3/4	0.625

^a At manufacturer's option, through passages in tees shown in Figs. 31-33 having varying diameters at opposite ends may conform to the smaller diameters specified or be counterbored to the larger diameter from the appropriate end for a minimum depth equivalent to the maximum end to center length of that end, plus 1/2 the maximum passage through branch, plus 0.01 in.

TABLE 8—PASSAGE DIAMETERS THROUGH PIPE THREAD ENDS

Nominal Pipe Size	D ^a Dia Drill
1/8	0.219
1/4	0.312
3/8	0.406
1/2	0.562
3/4	0.750

^a At manufacturer's option, through passages in tees shown in Figs. 31-33 having varying diameters at opposite ends may conform to the smaller diameters specified or be counterbored to the larger diameter from the appropriate end for a minimum depth equivalent to the maximum end to center length of that end, plus 1/2 the maximum passage through branch, plus 0.01 in.

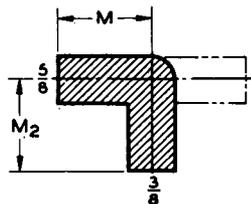
TO DETERMINE CORRECT END TO CENTER LENGTHS ON TEES, EACH 90 DEG MUST BE FIGURED SEPARATELY AS AN ELBOW AND THE LARGER OF THE TWO BRANCH LENGTHS SHALL APPLY. SEE EXAMPLES BELOW.

EXAMPLE: Find lengths for 3/8 x 1/2 x 3/8 Three Way Tee.

- From Table 5 obtain values for each 90 deg separately.
- Use larger of two M₂ dimensions as found.

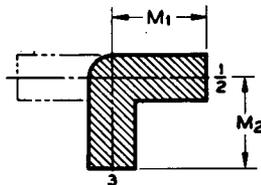
FROM TABLE 5

B Nominal Flare Size	End to Center	B ₂
		3/8
5/8	M M ₂	1.41
		1.16



FROM TABLE 5

B ₁ Nominal Flare Size	End to Center	B ₂
		3/8
1/2	M ₁ M ₂	1.22
		1.09



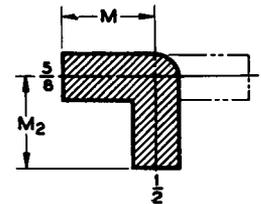
Result: M = 1.41; M₁ = 1.22; M₂ = 1.16.

EXAMPLE: Find lengths for 3/8 x 3/8 x 1/2 Right Angle Two Way Tee

- From Tables 5 and 6 obtain values for each 90 deg separately.
- Use the larger dimension M₂ or M₃ as found.

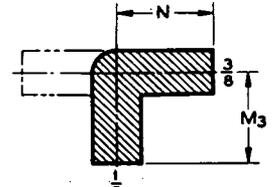
FROM TABLE 5

B Nominal Flare Size	Center End to Center	B ₂
		1/2
5/8	M M ₂	1.41
		1.28



FROM TABLE 6

B ₂ Nominal Flare Size	End to Center	A
		3/8
1/2	M ₃ N	1.22
		1.12



Result: M = 1.41; N = 1.12; M₂ = 1.28.

REFRIGERATION FLARE TYPE FITTINGS

NOTE: UNSPECIFIED DETAIL WITH RESPECT TO DIMENSIONS, TOLERANCES, CONTOUR, MATERIAL, WORKMANSHIP, ETC., MUST CONFORM TO GENERAL SPECIFICATIONS FOR REFRIGERATION TUBE FITTINGS.

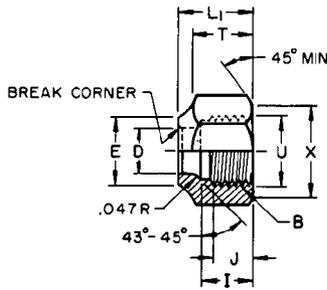


FIG. 34A - SHORT NUTS

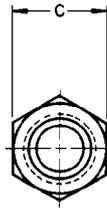


FIG. 34—FLARE NUTS AND REDUCING FLARE NUTS

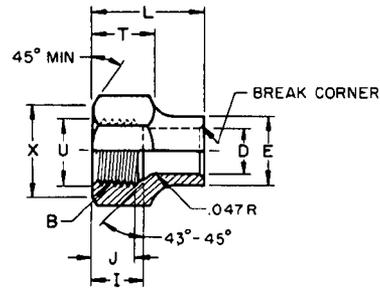


FIG. 34B - LONG NUTS

TABLE 9—DIMENSIONS FOR STANDARD SIZES OF SHORT AND LONG FLARE NUTS (FIGS. 34A AND 34B)

Nominal Tube OD	B, Straight Thread						C	D Dia +0.005 -0.000	E Dia	I	J Full Thread	L ±0.03	L1 +0.09 -0.00	T ±0.03	U Dia		X +0.00 -0.03							
	Nominal Size	Pitch Dia		Minor Dia		Nom									Min	Min		Min	Min	Min	Min	Max	Min	Max
		Min	Max	Min	Max																			
3/16 1/4	3/8 —24	0.3479	0.3528	0.3300	0.3372	1/2	0.192	0.41	0.28	0.22	0.88	0.53	0.38	0.39	0.41	0.50								
	7/16—20	0.4050	0.4104	0.3830	0.3916	5/8	0.255	0.47	0.34	0.27	0.94	0.59	0.44	0.45	0.47	0.62								
5/16 3/8 1/2	1/2 —20	0.4675	0.4731	0.4460	0.4537	11/16	0.317	0.47	0.38	0.30	0.94	0.62	0.44	0.51	0.53	0.69								
	5/8 —18	0.5889	0.5949	0.5650	0.5730	13/16	0.380	0.59	0.44	0.34	1.06	0.69	0.50	0.64	0.67	0.81								
	3/4 —16	0.7094	0.7159	0.6820	0.6908	15/16	0.505	0.75	0.53	0.44	1.19	0.81	0.56	0.77	0.80	0.94								
5/8 3/4	7/8 —14	0.8286	0.8356	0.7980	0.8068	1-1/16	0.630	0.94	0.66	0.55	1.44	0.94	0.75	0.90	0.93	1.06								
	1-1/16—14	1.0161	1.0230	0.9850	0.9940	1-5/16	0.755	1.12	0.78	0.67	1.75	1.12	1.00	1.08	1.11	1.31								

TABLE 10—DIMENSIONS FOR REDUCING SIZES OF SHORT AND LONG FLARE NUTS (FIGS. 34A AND 34B)

Nominal Flare Size	Nominal Tube OD	B, Straight Thread						C	D Dia +0.005 -0.000	E Dia	I	J Full Thread	L ±0.03	L1 +0.09 -0.00	T ±0.03	U Dia		X +0.00 -0.03							
		Nominal Size	Pitch Dia		Minor Dia		Nom									Min	Min		Min	Min	Min	Min	Max	Min	Max
			Min	Max	Min	Max																			
1/4	3/16	7/16—20	0.4050	0.4104	0.3830	0.3916	5/8	0.192	0.41	0.34	0.27	0.94	0.59	0.44	0.45	0.47	0.62								
5/16 5/16	3/16 1/4	1/2 —20	0.4675	0.4731	0.4460	0.4537	11/16	0.192	0.41	0.38	0.30	0.94	—	0.44	0.51	0.53	0.69								
		1/2 —20	0.4675	0.4731	0.4460	0.4537	11/16	0.255	0.47	0.38	0.30	0.94	0.62	0.44	0.51	0.53	0.69								
3/8 3/8	1/4 5/16	5/8 —18	0.5889	0.5949	0.5650	0.5730	13/16	0.255	0.47	0.44	0.34	1.06	0.69	0.50	0.64	0.67	0.81								
		5/8 —18	0.5889	0.5949	0.5650	0.5730	13/16	0.317	0.47	0.44	0.34	1.06	0.69	0.50	0.64	0.67	0.81								
1/2	3/8	3/4 —16	0.7094	0.7159	0.6820	0.6908	15/16	0.380	0.59	0.53	0.44	1.19	0.81	0.56	0.77	0.80	0.94								
5/8 5/8	3/8 1/2	7/8 —14	0.8286	0.8356	0.7980	0.8068	1-1/16	0.380	0.59	0.66	0.55	1.44	—	0.75	0.90	0.93	1.06								
		7/8 —14	0.8286	0.8356	0.7980	0.8068	1-1/16	0.505	0.75	0.66	0.55	1.44	0.94	0.75	0.90	0.93	1.06								
3/4 3/4	1/2 5/8	1-1/16—14	1.0161	1.0230	0.9850	0.9940	1-5/16	0.505	0.75	0.78	0.67	1.75	1.12	1.00	1.08	1.11	1.31								
		1-1/16—14	1.0161	1.0230	0.9850	0.9940	1-5/16	0.630	0.94	0.78	0.67	1.75	1.12	1.00	1.08	1.11	1.31								

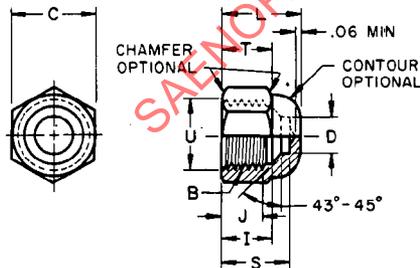


FIG. 35—FLARE CAP

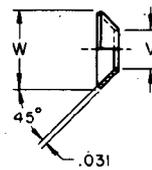


FIG. 36—FLARE GASKET

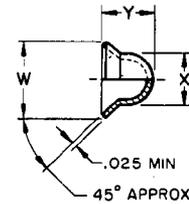


FIG. 37—FLARE SEAL BONNET

TABLE 11—DIMENSIONS OF FLARE CAP, FLARE GASKET, AND FLARE SEAL BONNET (FIGS. 35-37)

Nominal Tube OD	B, Straight Thread						C	D Dia	I	J Full Thread	L	S	T	U Dia		V Dia ±0.03	W Dia	X Dia ±0.02	Y							
	Nominal Size	Pitch Dia		Minor Dia		Nom								Min	Max					Min	Min	Max	Min	Max	Max	Min
		Min	Max	Min	Max																					
3/16 1/4	3/8 —24	0.3479	0.3528	0.3300	0.3372	1/2	0.12	0.28	0.22	0.47	0.34	0.27	0.39	0.41	0.12	0.31	0.16	0.16								
	7/16—20	0.4050	0.4104	0.3830	0.3916	9/16	0.19	0.34	0.27	0.53	0.41	0.40	0.45	0.47	0.19	0.36	0.22	0.22								
5/16 3/8 1/2	1/2 —20	0.4675	0.4731	0.4460	0.4537	5/8	0.22	0.38	0.30	0.62	0.50	0.40	0.51	0.53	0.22	0.42	0.28	0.28								
	5/8 —18	0.5889	0.5949	0.5650	0.5730	3/4	0.28	0.44	0.34	0.69	0.56	0.46	0.64	0.67	0.28	0.55	0.36	0.34								
	3/4 —16	0.7094	0.7159	0.6820	0.6908	7/8	0.41	0.53	0.44	0.84	0.72	0.52	0.77	0.80	0.41	0.66	0.47	0.41								
5/8 3/4	7/8 —14	0.8286	0.8356	0.7980	0.8068	1-1/16	0.50	0.66	0.55	0.97	0.84	0.62	0.90	0.93	0.50	0.77	0.61	0.44								
	1-1/16—14	1.0161	1.0230	0.9850	0.9940	1-5/16	0.62	0.78	0.67	1.09	0.97	0.74	1.08	1.11	0.62	0.95	0.72	0.56								