

MEMBER:
apfa
 INCORPORATED
 AMERICAN PIPE
 FITTINGS ASSOC.



FLOWLINE

**STAINLESS STEEL
 NICKEL, NICKEL ALLOY
 ALUMINUM ALLOY**

**BUTT WELD FITTINGS
 AND FLANGES**

FLOWLINE DIVISION

Markovitz Enterprises, Inc.

World's Largest Manufacturer of Corrosion-Resistant Fittings

HEADQUARTERS/PLANT:
 P.O. BOX 7027 • NEW CASTLE, PA 16107
 Tel: 412/658-3711 • FAX: 412/658-6117

ATLANTA:
 588 SIGMAN ROAD • ATLANTA, GA 30208
 Tel: 770/929-0606 • FAX: 770/929-1233

HOUSTON:
 5935A SOUTH LOOP EAST • HOUSTON, TX 77033
 Tel: 713/643-9400 • FAX: 713/643-9477

WATCHUNG, NJ 0706010 Shawnee Drive.....Tel. 908/561-4900 Fax 908/561-4950
 ARLINGTON HEIGHTS, IL 60006P.O. Box 398Tel. 847/392-5100 Fax 847/392-8304
 TEMECULA, CA 9259141741 Gilwood Ct.....Tel. 909/699-1580 Fax 909/699-7821
 THE WOODLANDS, TX 77387P.O. Box 9059Tel. 713/367-0325 Fax 713/364-0220

PRICE \$10.00

CATALOG 96

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FLOWLINE®
BUTT WELDING FITTINGS



**MADE IN
ACCORDANCE
WITH
ASME
STANDARDS**



**STAINLESS STEEL
TYPES 304, 304L, 304H,
316, 316L, 316H
MONEL 400*
NICKEL 200
ALUMINUM
TYPES 3003-F, 6061-T6**



**SIZES ½”
THROUGH 24”**



**SCHEDULES
5S, 10S, 40S, 80S,
160, XX Strong Wall**



*Flowline NiCu400 fittings are normally produced from material manufactured by the Huntington Alloy Products Division of Inco Alloys International, Inc. Inco is a registered trademark of Inco Alloys International, Inc.



LONG
RADIUS

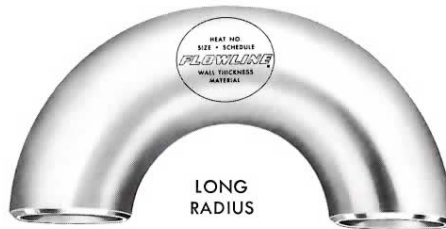
90° ELBOWS

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REDUCING 90° ELBOWS

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LONG
RADIUS

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STUB ENDS—ASME LONG LENGTH

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FLOWLINE®

New Castle, Pennsylvania

World's Largest Manufacturer
of Corrosion-Resistant Fittings

THE ONE

BEST WAY

to fabricate

process piping systems.

and

THE QUALITY STANDARD

of the industry

.. is **BUTT-WELDING**

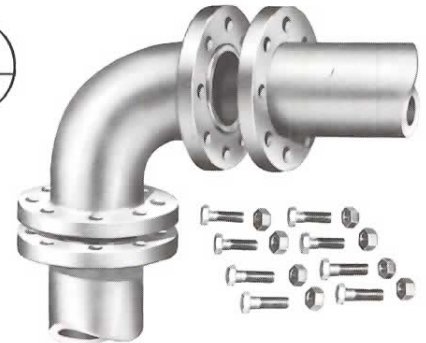
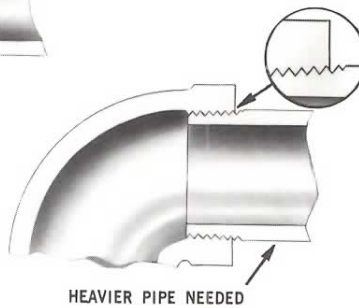
.. is ***FLOWLINE***®

BUTT-WELDING PROVIDES

- **LOWER MATERIAL COST**

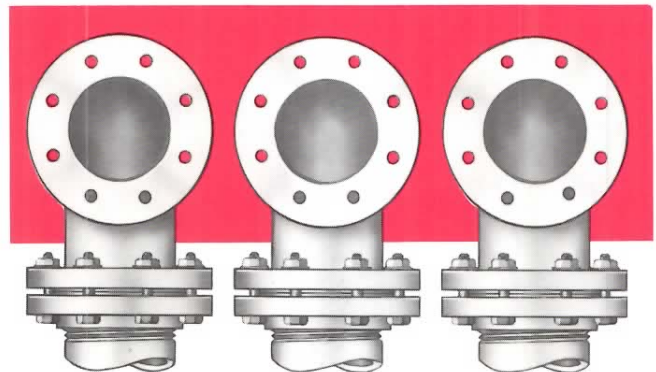
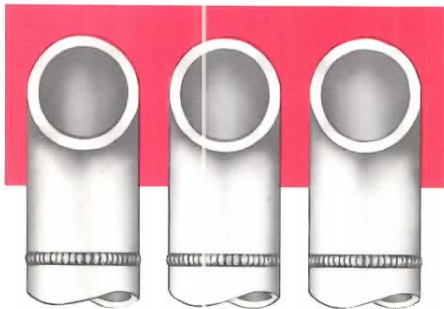


A butt welding assembly uses less material — a welded joint doesn't require extra wall for threading, or extra material for flanging.



- **DESIGN**

Welded construction permits the greatest freedom in designing a layout. The system uses less space; it is more compact; has greater strength. Can be installed close to wall, ceiling or floor.



- **WEIGHT**



47½ lbs.

A welded elbow connection weighs approximately one-fourth as much as a flanged connection—an extremely important consideration when multiplied by the number of connections in a piping system. The excess weight serves no useful purpose and places additional strain on the piping system.

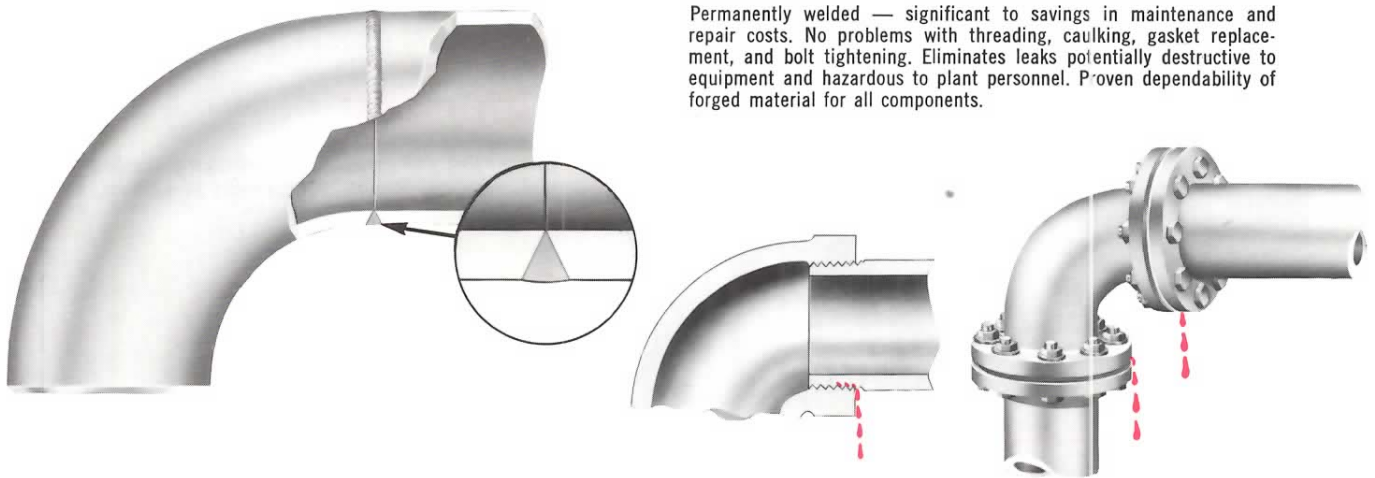


190 lbs.

ADVANTAGES IN...

● MAINTENANCE AND PLANT SAFETY

Permanently welded — significant to savings in maintenance and repair costs. No problems with threading, caulking, gasket replacement, and bolt tightening. Eliminates leaks potentially destructive to equipment and hazardous to plant personnel. Proven dependability of forged material for all components.



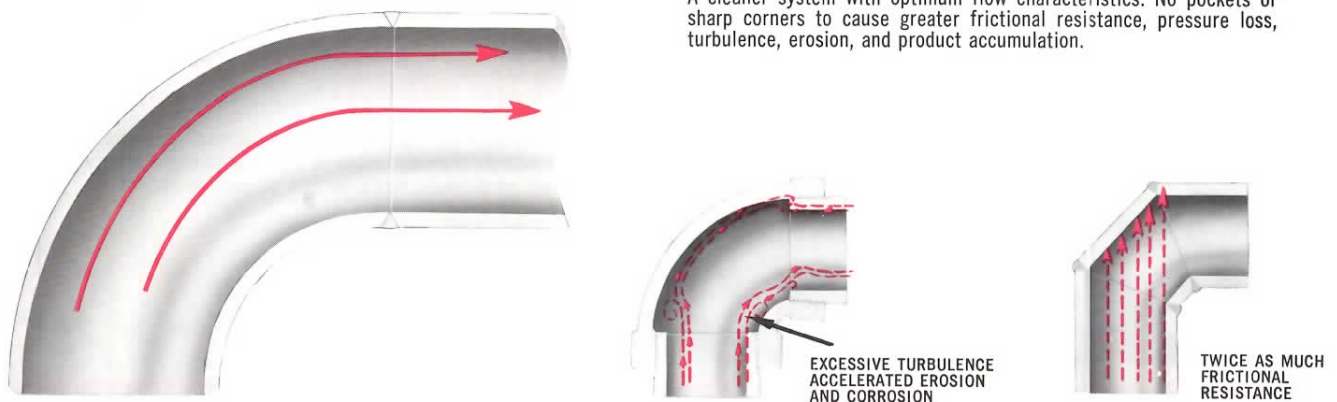
● INSULATION

Piping joints can be insulated as easily as the pipe and fittings. There are no protrusions to complicate work. Finished system is streamlined and economical. Leakproof—insulation lasts longer.



● CLEAN ... SMOOTH ... FULL FLOW

A cleaner system with optimum flow characteristics. No pockets or sharp corners to cause greater frictional resistance, pressure loss, turbulence, erosion, and product accumulation.

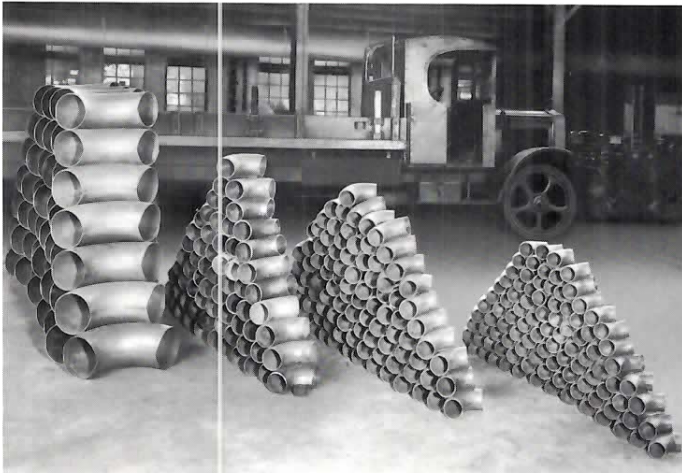


FLOWLINE® FITTINGS are



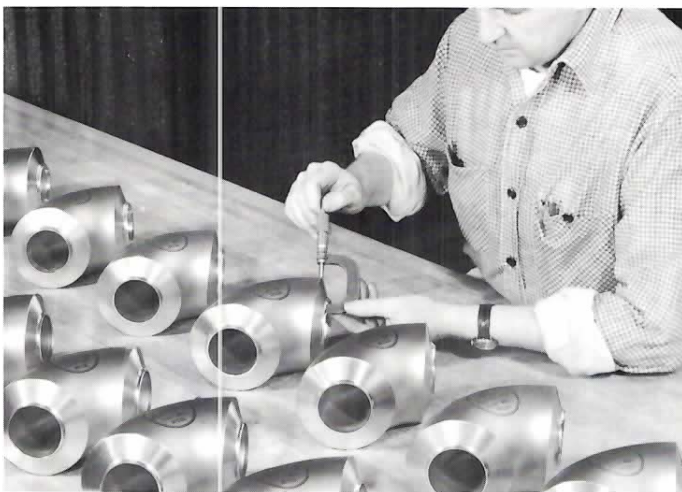
SINGLE PURPOSE

Concentrated professional effort continually creating more and better products through advancements in methods, equipment and availability.



PROVEN IN SERVICE

These **FLOWLINE** fittings were produced the year Lindbergh flew the Atlantic. Since then, many millions of **FLOWLINE** fittings have proven themselves in service throughout the world.



THE MOST EXPERIENCED HANDS IN THE BUSINESS

FLOWLINE has had continuous experience in the application of corrosion resistant alloys to piping problems, beginning with the use of stainless steels for this purpose in 1927.

a SPECIALTY... **NOT** a SIDELINE

(That's Why They Are First)

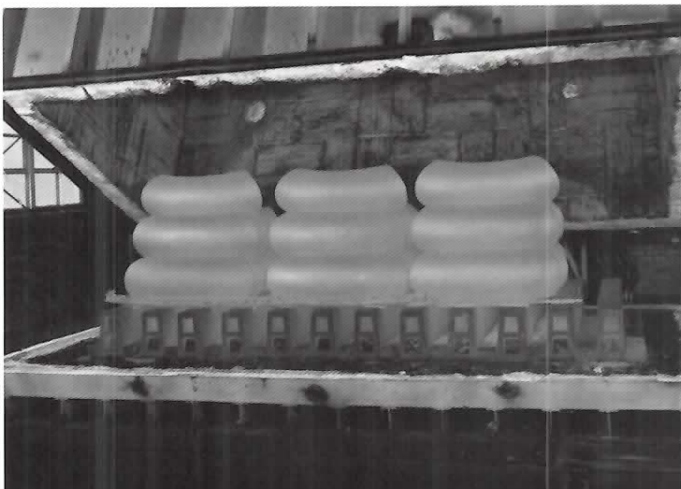
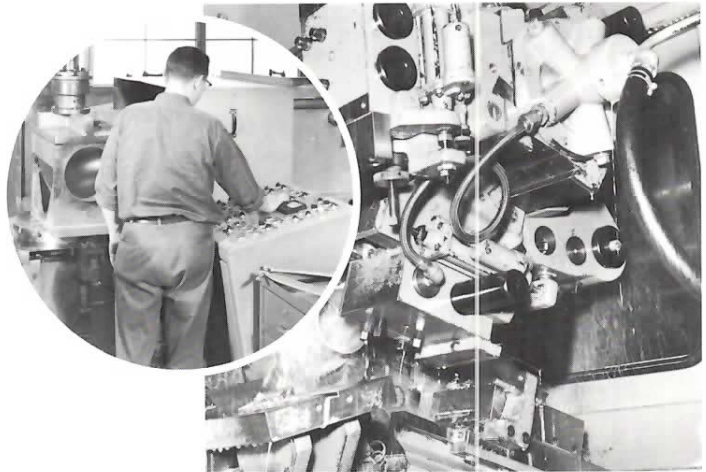


DEPENDABILITY

It's virtually impossible for a **FLOWLINE** fitting to fail final inspection. Starting with raw material analysis, every fitting is subjected to scientifically controlled and recorded manufacturing steps, proud craftsmen, the uniform performance of modern equipment, and intermediate inspections at every stage of production. It must meet the highest standards at each checkpoint to continue on to completion.

EQUIPMENT

Our specialization allows us to custom-design modern equipment to our **single** purpose, avoiding a possible compromise on machine performance and product quality!



METHODS

There is one best way to produce corrosion-resistant welding fittings. You can't kill two birds with one stone. Our methods are designed to produce corrosion-resistant welding fittings—nothing else.

Assuring plus values in corrosion-resistant . .

CERTIFIED MATERIAL TEST REPORT
FLOWLINE DIVISION

P.O. BOX 7027, NEW CASTLE, PA 16107-7027
(412) 658-3711

TO: JOHN DOE SUPPLY COMPANY BIG CITY, MO 63166	OUR ORDER NO. 3-2066-00 CUST. ORDER NO. 01-93859 MARKING LN1 01-93859 MARKING LN2 DATE 1/24/90 Q.A. APPROVED BY M. ALLEN
---	---

THIS NUMBER MARKED ON FITTINGS

** = ALL STAINLESS STEEL MAT'L SOLUTION ANNEALED AT 1950 DEGREES F FOR 1 HR/INCH OF THICKNESS (25 MINUTES MINIMUM) AND WATER QUENCHED WITHIN 3 MINUTES TO LESS THAN 500 DEGREES F.

+ = PRODUCT NO. 74853 DESCRIPTION: 4 40S 316L 90° LR ELBOW	CR 16.73 NI 11.14 MO 2.06	TENSILE PSI 90,700 Yield PSI 39,500 ELONG. % 58.00 RED. OF AREA 73.60
--	---------------------------------	--

ITEM SPEC. A403 HEAT TREAT ** BASE MAT'L PIPE ORIG. HEAT NO. 95649	C.020 MN 1.72 P .025 S .015 SI .42
---	--



◀ PERMANENT IDENTIFICATION

Every **FLOWLINE** fitting is marked by electrochemical etching using chloride-free electrolyte. Marking, in accordance with MSS SP-25, shows:

- HEAT NUMBER
- PIPE SIZE AND SCHEDULE
- TRADEMARK
- WALL THICKNESS
- TYPE OF MATERIAL

... **FLOWLINE**® welding fittings



◀ RADIOGRAPHY

Large size fittings fabricated by welding are exposed to X-rays. Photographic film record is examined to determine quality of weld, particularly sub-surface.

FLOWLINE

Testing Techniques For Special Orders

- ACCELERATED CORROSION TESTS
- BURST TESTING
- CHARPY IMPACT
- DUCTILITY
- DYE PENETRANT
- FATIGUE
- HARDNESS
- HYDROSTATIC
- MACRO ETCH
- MAGNETIC PERMEABILITY
- METALLOGRAPHY
- RADIOGRAPHIC X-RAY
- STRESS ANALYSIS
- STRESS RUPTURE
- TENSILE
- ULTRA-SONIC INSPECTION
- X-RAY



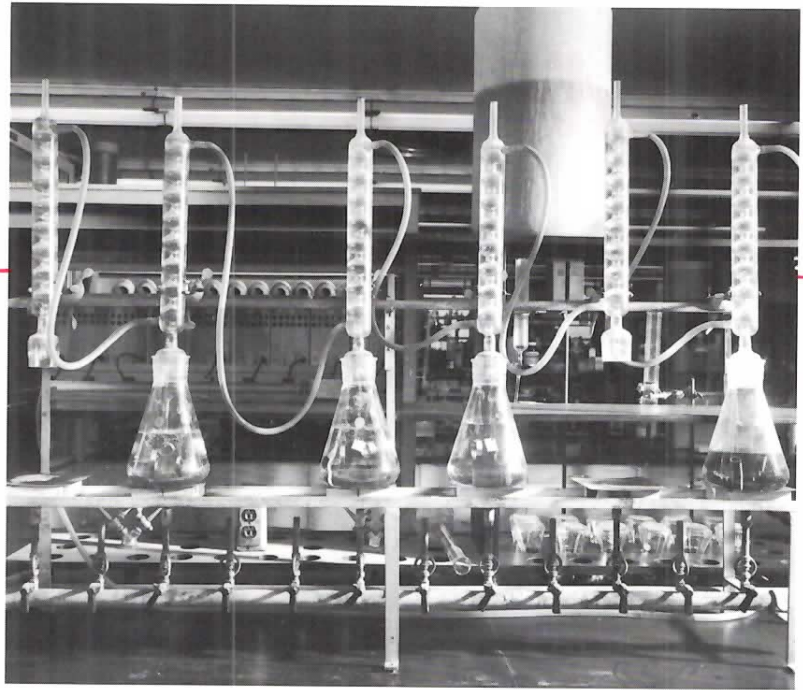
◀ DYE PENETRANT EXAMINATION

Involves spraying fittings with red colored penetrating solution which is cleaned off after it has dried. White developer is then sprayed over the fittings. Red stains appear on the white developer if the dye has been retained by surface defects.

Assuring plus values etc.

HUEY TEST ▶

The Huey test involves boiling specimens for five 48-hour periods in 65% nitric acid solution, then evaluating them to determine corrosion resistance (ASTM A 262 Practice C).



▲ ULTRASONIC INSPECTION

ASME and special orders require non-destructive testing often on both received materials and finished product. High frequency sound waves are transmitted through the piece under test and monitored on the Reflectoscope to detect even minute flaws in the materials.

▼ OXALIC ACID ETCH TEST

A sample of stainless steel, 1 centimeter square, is prepared by metallurgical procedure, electrolytically etched in 10% aqueous oxalic acid solution for 90 seconds, then examined under microscope and compared with photographic standards. This is a quick-screen test used for the same indication of the Huey test — as an alternate — or to determine whether Huey test should be conducted (ASTM A 262 Practice A).





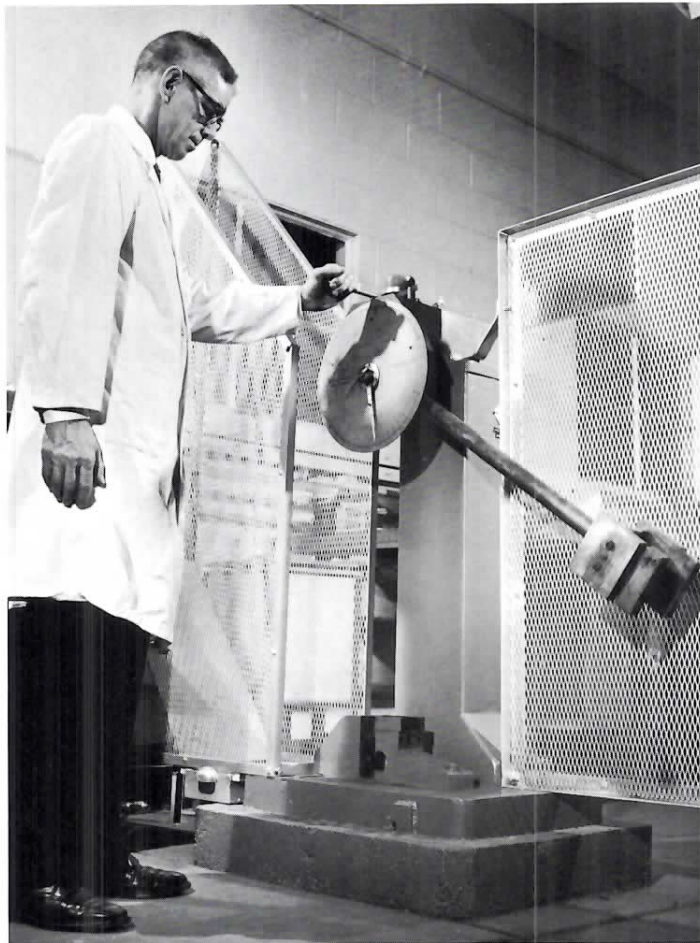
▲ ROCKWELL HARDNESS TESTING

An automatic method of measuring the resistance to indentation. From hardness data, estimates of machineability and fabricating characteristics can be obtained.



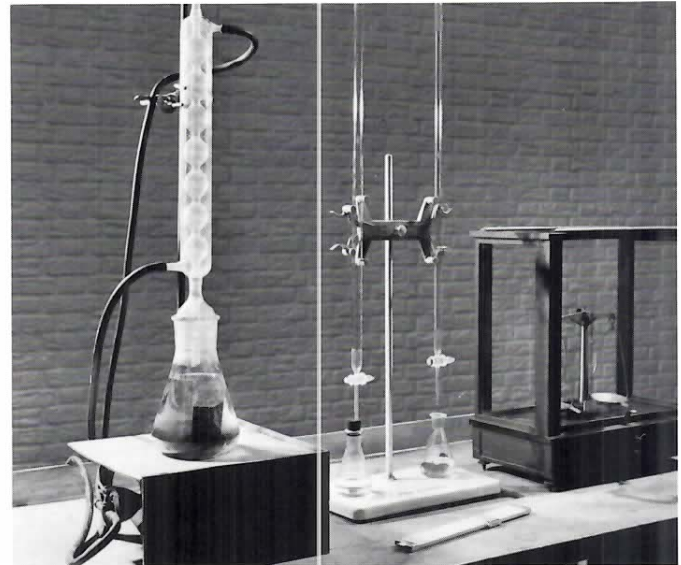
▲ TENSILE TEST

Evaluation of materials prior to forming assures performance of finished fittings for piping systems in their normal applications.



◀ CHARPY IMPACT TEST

This test is particularly useful in obtaining data on the mechanical behavior of certain types of metals, under conditions favorable to brittle failure (such as low temperature applications) for which tension tests are not significant.



▲ STRAUSS TEST

This test involves boiling a specimen in an acidified copper sulfate solution for a period of 48 to 72 hours. The specimen is then bent and examined for freedom from intergranular attack or disintegration (ASTM A 262 Practice E).

FLOWLINE®

Professionally-trained service specialists — experienced in *FLOWLINE'S* action-oriented system — giving individualized attention to your requirements. **Plus** — unequalled backup stocks, modern handling facilities and protective packaging combine to provide unmatched performance.



. . means SERVICE



FLOWLINE'S 30,000 square foot high rise storage warehouse facility, located at the New Castle, Pa. complex. Completed in 1971 to house the largest corrosion resistant welding fitting inventory in the world.



THE **FLOWLINE** ELBOW and its plus values

1

"FULL WALL THICKNESS THROUGHOUT"

FLOWLINE'S exclusive patented process assures full wall thickness. Remember . . . a piping system is no stronger than its weakest point. All **FLOWLINE** elbows are designed to operate at the maximum allowable pressure-temperature ratings.



2

"COLD FORMED"

Puts the fitting in the optimum metallurgical condition for corrosion resistance.

3

"MSS SP-25 IDENTIFICATION"

Electrochemical etched . . . uniform and permanent—complete **FLOWLINE** identification is assured . . . even years after a fitting is in service!

4

"CLEAN, PASSIVATED FINISH"

Ready for welding. Fittings are packaged to stay dust-free, grease-free and dry!

5

"STAINLESS AND INCO ALLOYS FULLY ANNEALED"

6**“PRECISION ENGINEERED CONSTRUCTION”**

Seamless or with one longitudinal weld through 14" size. Size 16" and larger are produced with two longitudinal welds.*

*100% inert gas shielded welding process performed by qualified welders to Section IX of the ASME Boiler & Pressure Vessel Code.

7**“MACHINE -TOOL-CUT BEVELS”
1/2" THROUGH 24"**

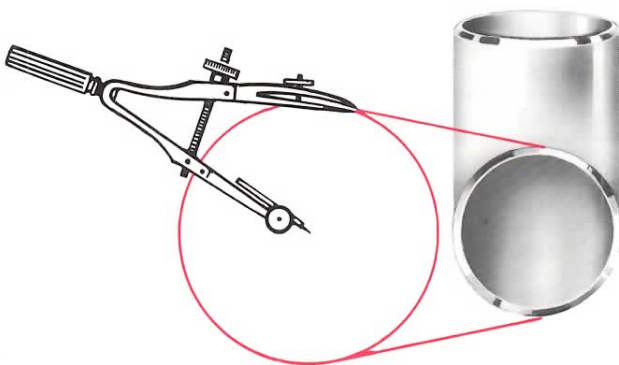
That **FLOWLINE** extra care which means precise squaring, accurate bevel angle and uniform land thickness . . . pays off in easier alignment and uniform, sound welds.

8**“FULL I.D. AT ALL CROSS SECTIONS”**

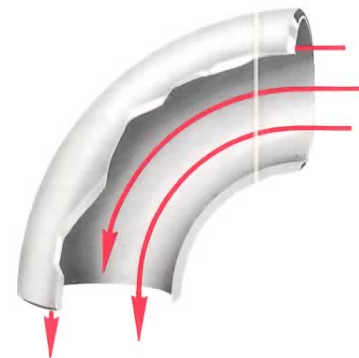
Patented die-forming assures full I.D. and true circularity at all cross sections . . . allows calculated flow . . . true alignment when cut to odd angles.

9**“SQUARED ENDS”
“PRECISE DIMENSIONS”**

Closest possible to nominal . . . not just within tolerances . . . that's what engineers and fabricators say they need. Multiple variations within tolerances can pyramid throughout the piping system. With **FLOWLINE** fittings, you'll never have to cut-and-piece—make all those extra welds to compensate for deviations!

10**“CONCENTRICITY OF ENDS”**

Eliminates time-consuming and costly pipe clamping to achieve alignment. With **FLOWLINE**, you get fast, accurate fit-up. You can't buy truer concentricity!

11**“SMOOTH INTERIOR SURFACES”**

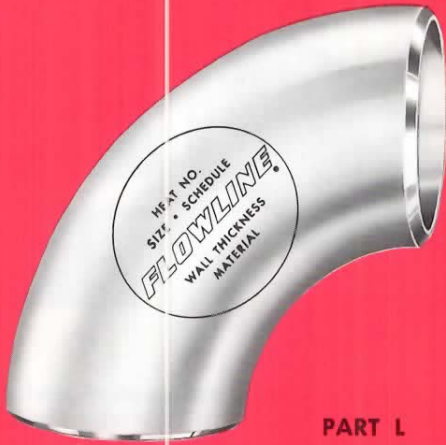
Assure optimum free flow with interior walls free of die marks, ridges and waves . . . possibility of corrosion, erosion and product accumulation minimized!

The **FLOWLINE** ELBOW costs no more than an ordinary fitting! 15

FLOWLINE®

90° ELBOWS

LONG RADIUS



PART L

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶			• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO FACE (A)	PART L-5			PART L-1			PART L-4		
			SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
			Inside Diameter	Wall Thickness (T)	Approx. Wt. in Pounds ‡	Inside Diameter	Wall Thickness (T)	Approx. Wt. in Pounds ‡	Inside Diameter	Wall Thickness (T)	Approx. Wt. in Pounds ‡
½	.840	1 ½	.710	.065	.12	.674	.083	.14	.622	.109	.18
¾	1.050	1 ½ ⁽¹⁾	.920	.065	.13	.884	.083	.15	.824	.113	.19
1	1.315	1 ½	1.185	.065	.19	1.097	.109	.30	1.049	.133	.35
1 ¼	1.660	1 ⅞	1.530	.065	.31	1.442	.109	.50	1.380	.140	.56
1 ½	1.900	2 ¼	1.770	.065	.38	1.682	.109	.69	1.610	.145	.88
2	2.375	3	2.245	.065	.64	2.157	.109	1.13	2.067	.154	1.56
2 ½	2.875	3 ¾	2.709	.083	1.50	2.635	.120	1.88	2.469	.203	3.00
3	3.500	4 ½	3.334	.083	2.00	3.260	.120	2.69	3.068	.216	4.81
3 ½	4.000	5 ¼	3.834	.083	2.62	3.760	.120	3.75	3.548	.226	6.25
4	4.500	6	4.334	.083	3.31	4.260	.120	4.75	4.026	.237	9.19
5	5.563	7 ½	5.345	.109	6.50	5.295	.134	8.00	5.047	.258	15.13
6	6.625	9	6.407	.109	10.00	6.357	.134	12.00	6.065	.280	24.00
8	8.625	12	8.407	.109	17.30	8.329	.148	23.50	7.981	.322	47.50
10	10.750	15	10.482	.134	32.00	10.420	.165	43.00	10.020	.365	85.00
12	12.750	18	12.438	.156	51.00	12.390	.180	60.00	12.000	.375	131.00
14	14.000	21	13.688	.156	68.00	13.624	.188	80.00	13.250	.375	155.00
16	16.000	24	15.670	.165	100.00	15.624	.188	105.00	15.250	.375	202.00
18	18.000	27	17.670	.165	125.00	17.624	.188	132.00	17.250	.375	269.00
20	20.000	30	19.624	.188	165.00	19.564	.218	220.00	19.250	.375	330.00
24	24.000	36	23.564	.218	280.00	23.500	.250	310.00	23.250	.375	464.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

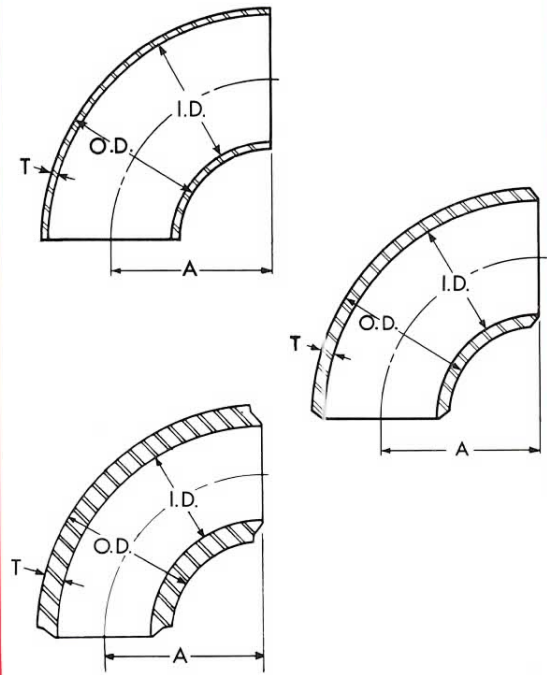
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

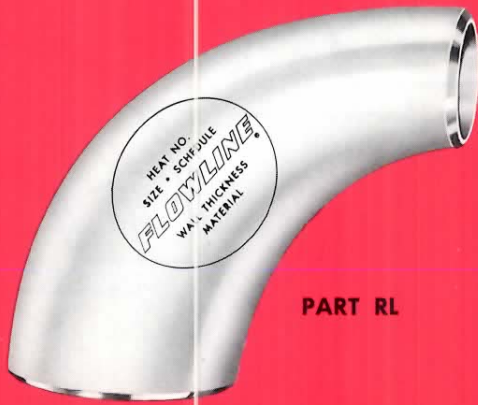
- STAINLESS STEELS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO FACE (A)	PART L-8			PART L-16			PART L-XX		
			SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
			Inside Diameter	Wall Thickness (T)	Approx. Wt. in Pounds ‡	Inside Diameter	Wall Thickness (T)	Approx. Wt. in Pounds ‡	Inside Diameter	Wall Thickness (T)	Approx. Wt. in Pounds ‡
1/2	.840	1 1/2	.546	.147	.23	.464	.188	.29	.252	.294	.46
3/4	1.050	1 1/2 ⁽¹⁾	.742	.154	.25	.612	.219	.35	.434	.308	.50
1	1.315	1 1/2	.957	.179	.48	.815	.250	.67	.599	.358	.96
1 1/4	1.660	1 7/8	1.278	.191	.88	1.160	.250	1.15	.896	.382	1.76
1 1/2	1.900	2 1/4	1.500	.200	1.13	1.338	.281	1.59	1.100	.400	2.26
2	2.375	3	1.939	.218	2.00	1.689	.343	3.14	1.503	.436	4.00
2 1/2	2.875	3 3/4	2.323	.276	4.00	2.125	.375	5.44	1.771	.552	8.00
3	3.500	4 1/2	2.900	.300	6.56	2.624	.438	9.58	2.300	.600	13.12
3 1/2	4.000	5 1/4	3.364	.318	8.80	—	—	—	2.728	.636	17.60
4	4.500	6	3.826	.337	13.63	3.438	.531	21.53	3.152	.674	27.26
5	5.563	7 1/2	4.813	.375	21.13	4.313	.625	35.29	4.063	.750	42.26
6	6.625	9	5.761	.432	36.00	5.187	.719	59.76	4.897	.864	72.00
8	8.625	12	7.625	.500	73.00	6.813	.906	132.00	6.875	.875	127.00
10	10.750	15	9.750	.500	114.00	8.500	1.125	256.00	—	—	—
12	12.750	18	11.750	.500	175.00	10.126	1.312	458.00	—	—	—
14	14.000	21	13.000	.500	206.00	11.188	1.406	—	—	—	—
16	16.000	24	15.000	.500	269.00	12.812	1.594	—	—	—	—
18	18.000	27	17.000	.500	350.00	14.438	1.781	—	—	—	—
20	20.000	30	19.000	.500	439.00	16.062	1.969	—	—	—	—
24	24.000	36	23.000	.500	617.00	19.312	2.344	—	—	—	—

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.
Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

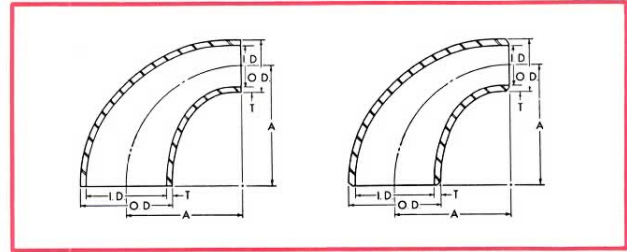
90° REDUCING ELBOWS

LONG RADIUS



PART RL

SCHEDULES 5S, 10S, 40S, 80S



BUTT WELDING FITTINGS

STAINLESS STEELS: TYPES 304, 304L, 304H, 316, 316L, 316H

NICKEL ALLOYS: ALLOY 400, ALLOY 200

ALUMINUM ALLOYS: TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶

NOM. PIPE SIZE	Outside Diam. (O.D.) Large End—LE Small End—SE	Center to Face (in)	• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS					
			PART RL-5			PART RL-1			PART RL-4			PART RL-8		
			SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.			SCHEDULE 80S Extra Heavy I.P.S.		
			Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick. (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick. (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick. (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick. (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡
2 x 1	LE 2.375 SE 1.315	3	LE 2.245 SE 1.185	LE .065 SE .065	.57	LE 2.157 SE 1.097	LE .109 SE .109	1.01	LE 2.067 SE 1.049	LE .154 SE .133	1.40	LE 1.939 SE .957	LE .218 SE .179	1.85
2 x 1½	LE 2.375 SE 1.660	3	LE 2.245 SE 1.530	LE .065 SE .065	.61	LE 2.157 SE 1.442	LE .109 SE .109	1.08	LE 2.067 SE 1.380	LE .154 SE .140	1.50	LE 1.939 SE 1.278	LE .218 SE .191	1.97
2 x 1½	LE 2.375 SE 1.900	3	LE 2.245 SE 1.770	LE .065 SE .065	.62	LE 2.157 SE 1.682	LE .109 SE .109	1.10	LE 2.067 SE 1.610	LE .154 SE .145	1.54	LE 1.939 SE 1.500	LE .218 SE .200	1.98
2½ x 1½	LE 2.875 SE 1.660	3¾	LE 2.709 SE 1.530	LE .083 SE .065	1.34	LE 2.635 SE 1.442	LE .120 SE .109	1.64	LE 2.469 SE 1.380	LE .203 SE .140	2.55	LE 2.323 SE 1.278	LE .276 SE .191	3.34
2½ x 1½	LE 2.875 SE 1.900	3¾	LE 2.709 SE 1.770	LE .083 SE .065	1.43	LE 2.635 SE 1.682	LE .120 SE .109	1.75	LE 2.469 SE 1.610	LE .203 SE .145	2.72	LE 2.323 SE 1.500	LE .276 SE .200	3.57
2½ x 2	LE 2.875 SE 2.375	3¾	LE 2.709 SE 2.245	LE .083 SE .065	1.48	LE 2.635 SE 2.157	LE .120 SE .109	1.86	LE 2.469 SE 2.067	LE .203 SE .154	2.90	LE 2.323 SE 1.939	LE .276 SE .218	3.80
3 x 1½	LE 3.500 SE 1.900	4½	LE 3.334 SE 1.770	LE .083 SE .065	1.72	LE 3.260 SE 1.682	LE .120 SE .109	2.32	LE 3.068 SE 1.610	LE .216 SE .145	4.04	LE 2.900 SE 1.500	LE .300 SE .200	5.46
3 x 2	LE 3.500 SE 2.375	4½	LE 3.334 SE 2.245	LE .083 SE .065	1.84	LE 3.260 SE 2.157	LE .120 SE .109	2.48	LE 3.068 SE 2.067	LE .216 SE .154	4.32	LE 2.900 SE 1.939	LE .300 SE .218	5.83
3 x 2½	LE 3.500 SE 2.875	4½	LE 3.334 SE 2.709	LE .083 SE .083	1.96	LE 3.260 SE 2.635	LE .120 SE .120	2.64	LE 3.068 SE 2.469	LE .216 SE .203	4.60	LE 2.900 SE 2.323	LE .300 SE .276	6.20
3½ x 2	LE 4.000 SE 2.375	5¼	LE 3.834 SE 2.245	LE .083 SE .065	2.27	LE 3.760 SE 2.157	LE .120 SE .109	3.26	LE 3.548 SE 2.067	LE .226 SE .154	5.37	LE 3.364 SE 1.939	LE .318 SE .218	7.66
3½ x 2½	LE 4.000 SE 2.875	5¼	LE 3.834 SE 2.709	LE .083 SE .083	2.43	LE 3.760 SE 2.635	LE .120 SE .120	3.48	LE 3.548 SE 2.469	LE .226 SE .203	5.73	LE 3.364 SE 2.323	LE .318 SE .276	8.18
3½ x 3	LE 4.000 SE 3.500	5¼	LE 3.834 SE 3.334	LE .083 SE .083	2.58	LE 3.760 SE 3.260	LE .120 SE .120	3.70	LE 3.548 SE 3.068	LE .226 SE .216	6.10	LE 3.364 SE 2.900	LE .318 SE .300	8.70

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111. Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

90° REDUCING ELBOWS

REGULAR PRODUCTION ▶			• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS					
			PART RL-5			PART RL-1			PART RL-4			PART RL-8		
NOM. PIPE SIZE	Outside Diam. (O.D.) Large End—LE Small End—SE	Center to Face (A)	SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.			SCHEDULE 80S Extra Heavy I.P.S.		
			Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thick (T) Large End—LE Small End—SE	Approx. Wt. in Pounds‡
4 x 2	LE 4.500 SE 2.375	6	LE 4.334 SE 2.245	LE .083 SE .065	2.66	LE 4.260 SE 2.157	LE .120 SE .109	3.81	LE 4.026 SE 2.067	LE .237 SE .154	7.30	LE 3.826 SE 1.939	LE .337 SE .218	10.82
4 x 2½	LE 4.500 SE 2.875	6	LE 4.334 SE 2.709	LE .083 SE .083	2.86	LE 4.260 SE 2.635	LE .120 SE .120	4.09	LE 4.026 SE 2.469	LE .237 SE .203	7.83	LE 3.826 SE 2.323	LE .337 SE .276	11.62
4 x 3	LE 4.500 SE 3.500	6	LE 4.334 SE 3.334	LE .083 SE .083	3.05	LE 4.260 SE 3.260	LE .120 SE .120	4.37	LE 4.026 SE 3.068	LE .237 SE .216	8.37	LE 3.826 SE 2.900	LE .337 SE .300	12.41
4 x 3½	LE 4.500 SE 4.000	6	LE 4.334 SE 3.834	LE .083 SE .083	3.25	LE 4.260 SE 3.760	LE .120 SE .120	4.65	LE 4.026 SE 3.548	LE .237 SE .226	8.90	LE 3.826 SE 3.364	LE .337 SE .318	13.20
5 x 2½	LE 5.563 SE 2.875	7½	LE 5.345 SE 2.709	LE .109 SE .083	5.25	LE 5.295 SE 2.635	LE .134 SE .120	6.44	LE 5.047 SE 2.469	LE .258 SE .203	12.09	LE 4.813 SE 2.323	LE .375 SE .276	16.97
5 x 3	LE 5.563 SE 3.500	7½	LE 5.345 SE 3.334	LE .109 SE .083	5.63	LE 5.295 SE 3.260	LE .134 SE .120	6.91	LE 5.047 SE 3.068	LE .258 SE .216	12.98	LE 4.813 SE 2.900	LE .375 SE .300	18.22
5 x 3½	LE 5.563 SE 4.000	7½	LE 5.345 SE 3.834	LE .109 SE .083	6.02	LE 5.295 SE 3.760	LE .134 SE .120	7.38	LE 5.047 SE 3.548	LE .258 SE .226	13.86	LE 4.813 SE 3.364	LE .375 SE .318	19.46
5 x 4	LE 5.563 SE 4.500	7½	LE 5.345 SE 4.334	LE .109 SE .083	6.40	LE 5.295 SE 4.260	LE .134 SE .120	7.85	LE 5.047 SE 4.026	LE .258 SE .237	14.75	LE 4.813 SE 3.826	LE .375 SE .337	20.70
6 x 3	LE 6.625 SE 3.500	9	LE 6.407 SE 3.334	LE .109 SE .083	8.08	LE 6.357 SE 3.260	LE .134 SE .120	9.68	LE 6.065 SE 3.068	LE .280 SE .216	19.35	LE 5.761 SE 2.900	LE .432 SE .300	28.04
6 x 3½	LE 6.625 SE 4.000	9	LE 6.407 SE 3.834	LE .109 SE .083	8.67	LE 6.357 SE 3.760	LE .134 SE .120	10.38	LE 6.065 SE 3.548	LE .280 SE .226	20.78	LE 5.761 SE 3.364	LE .432 SE .318	30.10
6 x 4	LE 6.625 SE 4.500	9	LE 6.407 SE 4.334	LE .109 SE .083	9.26	LE 6.357 SE 4.260	LE .134 SE .120	11.09	LE 6.065 SE 4.026	LE .280 SE .237	22.18	LE 5.761 SE 3.826	LE .432 SE .337	32.15
6 x 5	LE 6.625 SE 5.563	9	LE 6.407 SE 5.345	LE .109 SE .109	9.85	LE 6.357 SE 5.295	LE .134 SE .134	11.80	LE 6.065 SE 5.047	LE .280 SE .258	23.60	LE 5.761 SE 4.813	LE .432 SE .375	34.20
8 x 4	LE 8.625 SE 4.500	12	LE 8.407 SE 4.334	LE .109 SE .083	14.87	LE 8.329 SE 4.260	LE .148 SE .120	20.24	LE 7.981 SE 4.026	LE .322 SE .237	40.48	LE 7.625 SE 3.826	LE .500 SE .337	61.00
8 x 5	LE 8.625 SE 5.563	12	LE 8.407 SE 5.345	LE .109 SE .109	15.89	LE 8.329 SE 5.295	LE .148 SE .134	21.62	LE 7.981 SE 5.047	LE .322 SE .258	43.24	LE 7.625 SE 4.813	LE .500 SE .375	65.80
8 x 6	LE 8.625 SE 6.625	12	LE 8.407 SE 6.407	LE .109 SE .109	16.90	LE 8.329 SE 6.357	LE .148 SE .134	23.00	LE 7.981 SE 6.065	LE .322 SE .280	46.00	LE 7.625 SE 5.761	LE .500 SE .432	70.00
10 x 5	LE 10.750 SE 5.563	15	LE 10.482 SE 5.345	LE .134 SE .109	26.84	LE 10.420 SE 5.295	LE .165 SE .134	36.00	LE 10.020 SE 5.047	LE .365 SE .258	73.00	LE 9.750 SE 4.813	LE .500 SE .375	97.00
10 x 6	LE 10.750 SE 6.625	15	LE 10.482 SE 6.407	LE .134 SE .109	28.67	LE 10.420 SE 6.357	LE .165 SE .134	38.54	LE 10.020 SE 6.065	LE .365 SE .280	78.00	LE 9.750 SE 5.761	LE .500 SE .432	103.00
10 x 8	LE 10.750 SE 8.625	15	LE 10.482 SE 8.407	LE .134 SE .109	30.50	LE 10.420 SE 8.329	LE .165 SE .148	41.00	LE 10.020 SE 7.981	LE .365 SE .322	83.00	LE 9.750 SE 7.625	LE .500 SE .500	110.00
12 x 6	LE 12.750 SE 6.625	18	LE 12.438 SE 6.407	LE .156 SE .109	42.70	LE 12.390 SE 6.357	LE .180 SE .134	49.00	LE 12.000 SE 6.065	LE .375 SE .280	98.00	LE 11.750 SE 5.761	LE .500 SE .432	139.00
12 x 8	LE 12.750 SE 8.625	18	LE 12.438 SE 8.407	LE .156 SE .109	45.59	LE 12.390 SE 8.329	LE .180 SE .148	52.00	LE 12.000 SE 7.981	LE .375 SE .322	105.00	LE 11.750 SE 7.625	LE .500 SE .500	149.00
12 x 10	LE 12.750 SE 10.750	18	LE 12.438 SE 10.482	LE .156 SE .134	48.50	LE 12.390 SE 10.420	LE .180 SE .165	56.00	LE 12.000 SE 10.020	LE .375 SE .365	112.00	LE 11.750 SE 9.750	LE .500 SE .500	158.00

Ends are accurately machine tool cut and finished as shown on page 61.
All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

All reductions are shown for design reference purposes. **FLOWLINE** has tooling and normally inventories most popular reductions. Other sizes can be produced on special order.

FLOWLINE® 90° ELBOWS

SHORT RADIUS

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6



PART H

REGULAR PRODUCTION ▶

NOM. PIPE SIZE	OUTSIDE DIAMETER (O. D.)	CENTER TO FACE (D)	• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
			PART H-5			PART H-1			PART H-4		
			SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
			Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
1	1.315	1	1.185	.065	.17	1.097	.109	.23	1.049	.133	.26
1¼	1.660	1¼	1.530	.065	.31	1.442	.109	.38	1.380	.140	.45
1½	1.900	1½	1.770	.065	.43	1.682	.109	.49	1.610	.145	.63
2	2.375	2	2.245	.065	.63	2.157	.109	.81	2.067	.154	1.13
2½	2.875	2½	2.709	.083	1.25	2.635	.120	1.36	2.469	.203	2.25
3	3.500	3	3.334	.083	1.75	3.260	.120	2.17	3.068	.216	3.31
3½	4.000	3½	3.834	.083	2.35	3.760	.120	3.05	3.548	.226	4.54
4	4.500	4	4.334	.083	3.12	4.260	.120	3.79	4.026	.237	6.88
5	5.563	5	5.345	.109	4.94	5.295	.134	6.12	5.047	.258	11.63
6	6.625	6	6.407	.109	7.75	6.357	.134	9.15	6.065	.280	17.50
8	8.625	8	8.407	.109	15.44	8.329	.148	17.63	7.981	.322	37.60
10	10.750	10	10.482	.134	27.40	10.420	.165	35.00	10.020	.365	63.00
12	12.750	12	12.438	.156	35.00	12.390	.180	40.00	12.000	.375	80.00
14	14.000	14	13.688	.156	44.00	13.624	.188	52.00	13.250	.375	101.00
16	16.000	16	15.670	.165	65.00	15.624	.188	68.00	15.250	.375	131.00
18	18.000	18	17.670	.165	81.00	17.624	.188	86.00	17.250	.375	175.00
20	20.000	20	19.624	.188	107.00	19.564	.218	143.00	19.250	.375	215.00
24	24.000	24	23.564	.218	182.00	23.500	.250	202.00	23.250	.375	302.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.
The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

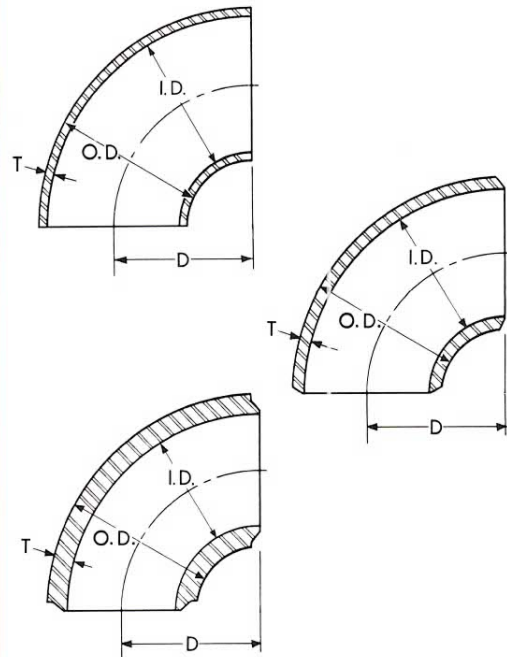
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

- STAINLESS STEELS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O. D.)	CENTER TO FACE (D)	PART H-8			PART H-16			PART H-XX		
			SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
			Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
1	1.315	1	.957	.179	.38	.815	.250	.53	.599	.358	.76
1¼	1.660	1¼	1.278	.191	.63	1.160	.250	.82	.895	.382	1.26
1½	1.900	1½	1.500	.200	.88	1.338	.281	1.23	1.100	.400	1.76
2	2.375	2	1.939	.218	1.55	1.689	.343	2.43	1.503	.436	3.10
2½	2.875	2½	2.323	.276	2.88	2.125	.375	3.88	1.771	.552	5.76
3	3.500	3	2.900	.300	4.20	2.624	.438	6.09	2.300	.600	8.40
3½	4.000	3½	3.364	.318	5.35	---	---	---	2.728	.636	10.70
4	4.500	4	3.826	.337	9.06	3.438	.531	14.22	3.152	.674	18.12
5	5.563	5	4.813	.375	16.10	4.313	.625	26.72	4.063	.750	32.20
6	6.625	6	5.761	.432	26.00	5.187	.719	43.16	4.897	.864	52.00
8	8.625	8	7.625	.500	54.80	6.813	.906	99.18	6.875	.875	109.00
10	10.750	10	9.750	.500	99.80	8.500	1.125	224.00	---	---	---
12	12.750	12	11.750	.500	125.00	10.126	1.312	327.00	---	---	---
14	14.000	14	13.000	.500	135.00	11.188	1.406	---	---	---	---
16	16.000	16	15.000	.500	175.00	12.812	1.594	---	---	---	---
18	18.000	18	17.000	.500	228.00	14.438	1.781	---	---	---	---
20	20.000	20	19.000	.500	285.00	16.062	1.969	---	---	---	---
24	24.000	24	23.000	.500	401.00	19.312	2.344	---	---	---	---

Ends are accurately machine tool cut and finished as shown on page 61. Made in accordance with ASME B16.9 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

FLOWLINE® 45° ELBOWS LONG RADIUS

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6



PART J

REGULAR PRODUCTION ▶

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO FACE (B)	• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
			PART J-5			PART J-1			PART J-4		
			SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
			Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
½	.840	⅝	.710	.065	.06	.674	.083	.07	.622	.109	.09
¾	1.050	⅞ ⁽¹⁾	.920	.065	.06	.884	.083	.07	.824	.113	.09
1	1.315	⅞	1.185	.065	.12	1.097	.109	.19	1.049	.133	.25
1¼	1.660	1	1.530	.065	.19	1.442	.109	.25	1.380	.140	.38
1½	1.900	1⅛	1.770	.065	.25	1.682	.109	.38	1.610	.145	.50
2	2.375	1⅜	2.245	.065	.31	2.157	.109	.56	2.067	.154	.88
2½	2.875	1¾	2.709	.083	.75	2.635	.120	1.06	2.469	.203	1.69
3	3.500	2	3.334	.083	1.06	3.260	.120	1.38	3.068	.216	2.38
3½	4.000	2¼	3.834	.083	1.16	3.760	.120	1.66	3.548	.226	3.13
4	4.500	2½	4.334	.083	1.66	4.260	.120	2.38	4.026	.237	4.60
5	5.563	3⅛	5.345	.109	3.25	5.295	.134	4.00	5.047	.258	7.57
6	6.625	3¾	6.407	.109	5.00	6.357	.134	6.00	6.065	.280	12.00
8	8.625	5	8.407	.109	8.65	8.329	.148	11.75	7.981	.322	23.75
10	10.750	6¼	10.482	.134	16.00	10.420	.165	21.50	10.020	.365	42.50
12	12.750	7½	12.438	.156	25.50	12.390	.180	30.00	12.000	.375	65.50
14	14.000	8¾	13.688	.156	34.00	13.624	.188	40.00	13.250	.375	77.50
16	16.000	10	15.670	.165	50.00	15.624	.188	52.50	15.250	.375	101.00
18	18.000	11¼	17.670	.165	62.50	17.624	.188	66.00	17.250	.375	131.00
20	20.000	12½	19.624	.188	82.50	19.564	.218	110.00	19.250	.375	165.00
24	24.000	15	23.564	.218	140.00	23.500	.250	155.00	23.250	.375	232.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111. The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

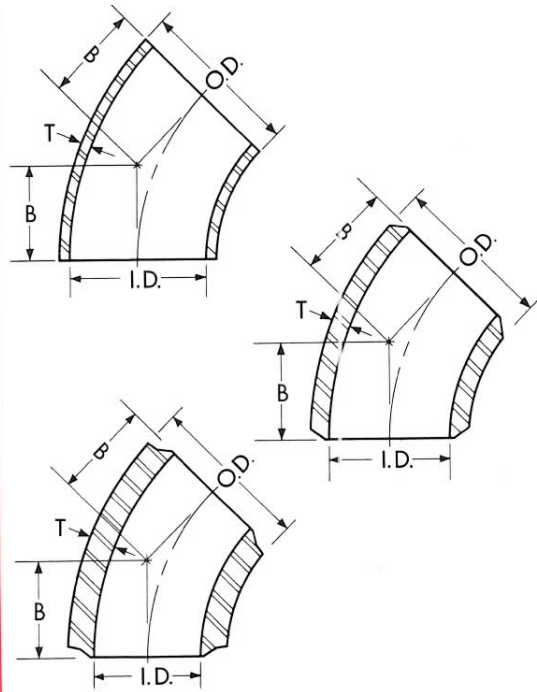
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ▶			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS			• STAINLESS STEELS					
			PART J-8			PART J-16			PART J-XX		
NOM. PIPE SIZE	OUTSIDE DIAMETER (O. D.)	CENTER TO FACE (B)	SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
			Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
½	.840	⅝	.546	.147	.12	.464	.188	.16	.252	.294	.24
¾	1.050	⅞ ⁽¹⁾	.742	.154	.12	.612	.219	.16	.434	.308	.24
1	1.315	⅞	.957	.179	.31	.815	.250	.43	.599	.358	.62
1¼	1.660	1	1.278	.191	.50	1.160	.250	.85	.895	.382	1.00
1½	1.900	1⅛	1.500	.200	.63	1.338	.281	.88	1.100	.400	1.26
2	2.375	1⅜	1.939	.218	1.13	1.689	.343	1.77	1.503	.436	2.26
2½	2.875	1¾	2.323	.276	2.19	2.125	.375	2.95	1.771	.552	4.38
3	3.500	2	2.900	.300	3.31	2.624	.438	4.80	2.300	.600	6.62
3½	4.000	2¼	3.364	.318	4.40	—	—	—	2.728	.636	8.80
4	4.500	2½	3.826	.337	6.82	3.438	.531	10.87	3.152	.674	13.64
5	5.563	3⅛	4.813	.375	10.56	4.313	.625	17.52	4.063	.750	21.12
6	6.625	3¾	5.761	.432	18.00	5.187	.719	20.88	4.897	.864	36.00
8	8.625	5	7.625	.500	36.50	6.813	.906	64.24	6.875	.875	63.87
10	10.750	6¼	9.750	.500	57.00	8.500	1.125	127.00	—	—	—
12	12.750	7½	11.750	.500	87.50	10.126	1.312	229.00	—	—	—
14	14.000	8¾	13.000	.500	103.00	11.188	1.406	—	—	—	—
16	16.000	10	15.000	.500	134.00	12.812	1.594	—	—	—	—
18	18.000	11¼	17.000	.500	175.00	14.438	1.781	—	—	—	—
20	20.000	12½	19.000	.500	219.00	16.062	1.969	—	—	—	—
24	24.000	15	23.000	.500	308.00	19.312	2.344	—	—	—	—

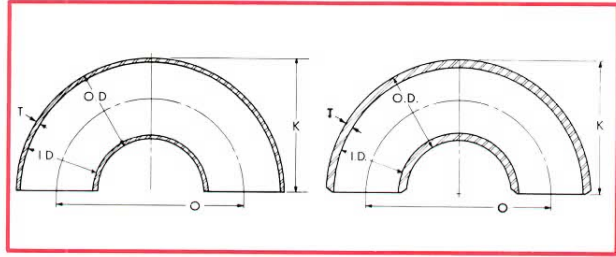
All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61. Ends are accurately machine tool cut and finished as shown on page 61. Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

(1) "B" dimension of ¾" may be furnished at manufacturer's option. The longer center to face dimension of the ¾" size Elbows permit a manufacturer to change over to a more uniform dimensional series, if he desires, while depleting existing stocks, retooling and replenishing with new stock.

FLOWLINE® 180° RETURNS LONG RADIUS



SCHEDULES 5S, 10S, 40S, 80S



BUTT WELDING FITTINGS

STAINLESS STEELS: TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS: ALLOY 400, ALLOY 200

ALUMINUM ALLOYS: TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶

• STAINLESS STEELS

• STAINLESS STEELS
• INCO ALLOYS

• STAINLESS STEELS
• INCO ALLOYS • ALUMINUM ALLOYS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO CENTER (O)	BACK TO FACE (K)	PART U-5		PART U-1		PART U-4		PART U-8	
				SCHEDULE 5S Featherweight		SCHEDULE 10S Light I.P.S.		SCHEDULE 40S Standard I.P.S.		SCHEDULE 80S Extra Heavy I.P.S.	
				Inside Diameter (I.D.)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Approx. Wt. in Pounds‡
½	.840	3	1⅞	ID .710 T .065	.21	ID .674 T .083	.26	ID .622 T .109	.34	ID .546 T .147	.43
¾	1.050	3 ⁽¹⁾	2 ⁽¹⁾	ID .920 T .065	.30	ID .884 T .083	.41	ID .824 T .113	.50	ID .742 T .154	.69
1	1.315	3	2¾	ID 1.185 T .065	.53	ID 1.097 T .109	.75	ID 1.049 T .133	.76	ID .957 T .179	1.38
1¼	1.660	3¾	2¾	ID 1.530 T .065	1.00	ID 1.442 T .109	1.26	ID 1.380 T .140	1.66	ID 1.278 T .191	2.50
1½	1.900	4½	3¼	ID 1.770 T .065	1.28	ID 1.682 T .109	1.75	ID 1.610 T .145	2.33	ID 1.500 T .200	3.00
2	2.375	6	4¾	ID 2.245 T .065	2.10	ID 2.157 T .109	3.13	ID 2.067 T .154	4.38	ID 1.939 T .218	6.21
2½	2.875	7½	5¾	ID 2.709 T .083	3.58	ID 2.635 T .120	5.88	ID 2.469 T .203	7.75	ID 2.323 T .276	9.70
3	3.500	9	6¼	ID 3.334 T .083	5.20	ID 3.260 T .120	9.81	ID 3.068 T .216	12.83	ID 2.900 T .300	17.18
3½	4.000	10½	7¼	ID 3.834 T .083	6.55	ID 3.760 T .120	10.50	ID 3.548 T .226	15.60	ID 3.364 T .318	22.00
4	4.500	12	8¼	ID 4.334 T .083	12.00	ID 4.260 T .120	13.60	ID 4.026 T .237	24.50	ID 3.826 T .337	34.30
5	5.563	15	10⅝	ID 5.345 T .109	13.00	ID 5.295 T .134	16.00	ID 5.047 T .258	31.00	ID 4.813 T .375	43.00
6	6.625	18	12¾	ID 6.407 T .109	20.00	ID 6.357 T .134	24.00	ID 6.065 T .280	48.00	ID 5.761 T .432	72.00
8	8.625	24	16¾	ID 8.407 T .109	35.00	ID 8.329 T .148	47.00	ID 7.981 T .322	95.00	ID 7.625 T .500	146.00
10	10.750	30	20¾	ID 10.482 T .134	64.00	ID 10.420 T .165	86.00	ID 10.020 T .365	170.00	ID 9.750 T .500	228.00
12	12.750	36	24¾	ID 12.438 T .156	102.00	ID 12.390 T .180	120.00	ID 12.000 T .375	262.00	ID 11.750 T .500	350.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

Ends are accurately machine tool cut and finished as shown on page 61.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

3½" and sizes over 4" of Return Bends are generally produced by butt welding 90° Elbows.

(1) The ¾" Nominal Pipe Size "O" and "K" dimensions of 2.25" and 1.69" may be furnished at manufacturer's option.

THE **FLOWLINE**® CAP and its plus values

1 "COLD FORMED"

Puts the fitting in the optimum metallurgical condition for corrosion resistance.

2 "MSS SP-25 IDENTIFICATION"

Electro chemical etched . . . uniform and permanent — complete **FLOWLINE** identification is assured . . . even years after a fitting is in service!

3 "CLEAN, PASSIVATED FINISH"

Ready for welding. Fittings are packaged to stay dust-free, grease-free and dry!

4 "STRAIGHT TANGENT"

Simple to fit up . . . easy to weld. Puts weld outside area of greatest stress . . . assures optimum life.



5 "STAINLESS AND INCO ALLOYS FULLY ANNEALED"

6 "SEAMLESS"

7 "CONCENTRICITY OF END"

Eliminates time-consuming, costly pipe clamping to achieve alignment. With **FLOWLINE**, you get fast, accurate alignment. You can't buy truer concentricity!

8 "ELLIPSOIDAL SHAPE"

Minor axis equal to half major axis.

9 "MACHINE-TOOL-CUT BEVEL"

That **FLOWLINE** extra care which means precise squaring, accurate bevel angle and uniform land thickness . . . pays off in easier alignment and uniform, sound welding.

The **FLOWLINE** CAP costs no more than an ordinary fitting!

FLOWLINE® CAPS



PART C

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	LENGTH (L) TANGENT LENGTH (S)	• STAINLESS STEELS PART C-5			• STAINLESS STEELS • INCO ALLOYS PART C-1			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS PART C-4		
			SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
			Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
1/2	.840	E 1 S 1.74	.710	.065	.08	.674	.083	.09	.622	.109	.10
3/4	1.050	E 1 S 1.68	.920	.065	.11	.884	.083	.12	.824	.113	.13
1	1.315	E 1 1/2 S 1.10	1.185	.065	.18	1.097	.109	.19	1.049	.133	.28
1 1/4	1.660	E 1 1/2 S 1.02	1.530	.065	.20	1.442	.109	.28	1.380	.140	.38
1 1/2	1.900	E 1 1/2 S 1.95	1.770	.065	.22	1.682	.109	.31	1.610	.145	.50
2	2.375	E 1 1/2 S 1.83	2.245	.065	.36	2.157	.109	.38	2.067	.154	.60
2 1/2	2.875	E 1 1/2 S 1.68	2.709	.083	.50	2.635	.120	.56	2.469	.203	1.00
3	3.500	E 2 S 1.02	3.334	.083	.86	3.260	.120	.88	3.068	.216	1.56
3 1/2	4.000	E 2 1/2 S 1.40	3.834	.083	1.20	3.760	.120	1.25	3.548	.226	2.25
4	4.500	E 2 1/2 S 1.26	4.334	.083	1.25	4.260	.120	1.44	4.026	.237	2.69
5	5.563	E 3 S 1.48	5.345	.109	2.00	5.295	.134	2.25	5.047	.258	4.06
6	6.625	E 3 1/2 S 1.70	6.407	.109	2.75	6.357	.134	3.00	6.065	.280	7.12
8	8.625	E 4 S 1.68	8.407	.109	4.50	8.329	.148	5.50	7.981	.322	12.50
10	10.750	E 5 S 2.13	10.482	.134	9.50	10.420	.165	10.80	10.020	.365	20.30
12	12.750	E 6 S 2.63	12.438	.156	14.00	12.390	.180	14.40	12.000	.375	28.80
14	14.000	E 6 1/2 S 2.31	13.688	.156	17.00	13.624	.188	18.00	13.250	.375	35.70
16	16.000	E 7 S 2.31	15.670	.165	30.00	15.624	.188	32.00	15.250	.375	48.50
18	18.000	E 8 S 3.31	17.670	.165	38.00	17.624	.188	39.60	17.250	.375	59.40
20	20.000	E 9 S 3.31	19.624	.188	55.00	19.564	.218	60.00	19.250	.375	75.00
24	24.000	E 10 1/2 S 4.31	23.564	.218	75.00	23.500	.250	76.00	23.250	.375	98.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

Some small sizes may be fabricated from bar stock.

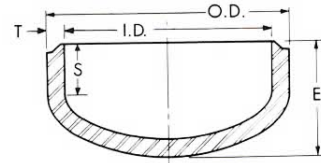
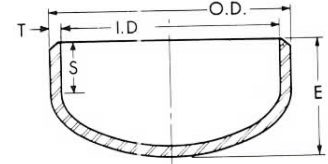
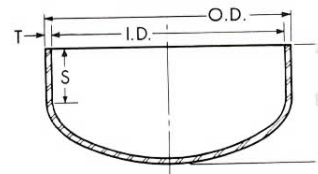
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

- STAINLESS STEELS

PART C-8

PART C-16

PART C-XX

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	LENGTH (E) TANGENT LENGTH (S)	LENGTH (E1) TANGENT LENGTH (S)	SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
				Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
1/2	.840	E 1 S .72	E1 1 S .64	.546	.147	.11	.464	.188	.14	.252	.294	.22
3/4	1.050	E 1 S .66	E1 1 S .58	.742	.154	.14	.612	.219	.20	.434	.308	.28
1	1.315	E 1 1/2 S 1.08	E1 1 1/2 S .99	.957	.179	.29	.815	.250	.40	.599	.358	.58
1 1/4	1.660	E 1 1/2 S .99	E1 1 1/2 S .89	1.278	.191	.39	1.160	.250	.50	.896	.382	.78
1 1/2	1.900	E 1 1/2 S .93	E1 1 1/2 S .83	1.500	.200	.54	1.338	.281	.75	1.100	.400	1.08
2	2.375	E 1 1/2 S .80	E1 1 3/4 S .95	1.939	.218	.75	1.689	.343	1.17	1.503	.436	1.50
2 1/2	2.875	E 1 1/2 S .64	E1 2 S 1.01	2.323	.276	1.12	2.125	.375	1.48	1.771	.552	2.24
3	3.500	E 2 S .98	E1 2 1/2 S 1.32	2.900	.300	1.87	2.624	.438	2.71	2.300	.600	3.74
3 1/2	4.000	E 2 1/2 S 1.34	E1 3 S 1.70	3.364	.318	2.50	—	—	—	2.728	.636	5.00
4	4.500	E 2 1/2 S 1.21	E1 3 S 1.60	3.826	.337	3.54	3.438	.531	5.55	3.152	.674	7.08
5	5.563	E 3 S 1.42	E1 3 1/2 S 1.73	4.813	.375	5.63	4.313	.625	9.34	4.063	.750	11.26
6	6.625	E 3 1/2 S 1.63	E1 4 S 1.91	5.761	.432	10.00	5.187	.719	16.00	4.897	.864	20.00
8	8.625	E 4 S 1.59	E1 5 S 2.41	7.625	.500	16.38	6.813	.906	29.64	6.875	.875	22.76
10	10.750	E 5 S 2.06	E1 6 S 2.75	9.750	.500	27.30	8.500	1.125	61.42	—	—	—
12	12.750	E 6 S 2.56	E1 7 S 3.16	11.750	.500	36.60	10.126	1.312	95.00	—	—	—
14	14.000	E 6 1/2 S 2.75	—	13.000	.500	48.00	11.188	1.406	—	—	—	—
16	16.000	E 7 S 2.75	—	15.000	.500	65.00	12.812	1.594	—	—	—	—
18	18.000	E 8 S 3.25	—	17.000	.500	79.20	14.438	1.781	—	—	—	—
20	20.000	E 9 S 3.75	—	19.000	.500	88.00	16.062	1.969	—	—	—	—
24	24.000	E 10 1/2 S 4.25	—	23.000	.500	135.00	19.312	2.344	—	—	—	—

Ends are accurately machine tool cut and finished as shown on page 61.
All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

Caps are formed to an ellipsoidal shape in which the minor axis is equal to half the major axis. Tangent length "S" is approximate.
*Length (E) applies to Schedules 5S, 10S, 40S, and 80S Caps. Length (E1) applies to wall thickness greater than Schedule 80S.

Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

THE *FLOWLINE* TEE

and its plus values

1 "REINFORCED CROTCH"

Extra thickness at the crotch... the point of the greatest stress. Remember... a piping system is no stronger than its weakest point.

2 "COLD FORMED"

Puts the fitting in the optimum metallurgical condition for corrosion resistance.

3 "LONG CROTCH RADIUS"

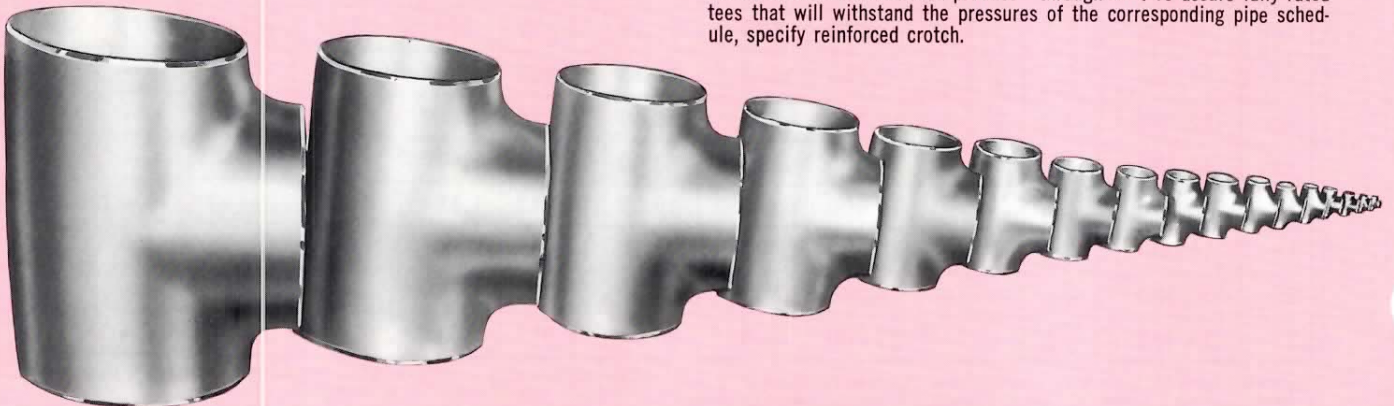
Contributes to optimum flow characteristics. ALL *FLOWLINE* tees from 1½" through 24" are scientifically shaped with long crotch radii.



4 "STAINLESS AND INCO ALLOYS FULLY ANNEALED"

5 "CONSISTENCY IN DESIGN – IN ALL SIZES"

Only *FLOWLINE* produces tees with no welds in the throat area and reinforced crotch as a standard product "through 12". To assure fully rated tees that will withstand the pressures of the corresponding pipe schedule, specify reinforced crotch.



6**"SEAMLESS OR NO WELDS
IN CRITICAL AREAS"**

Even where seamless raw material is either not generally available or economically impractical, **FLOWLINE'S** exclusive process necessitates only one weld*—positioned safely away from the critical crotch area.

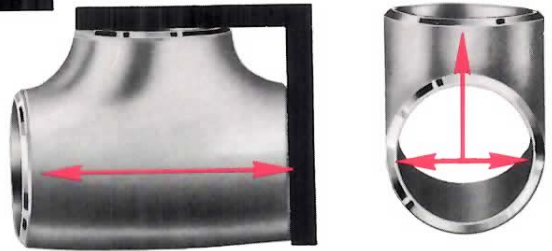
*100% inert gas shielded welding process performed by qualified welders to Section IX of the ASME Boiler & Pressure Vessel Code.

7**"MACHINE-TOOL-CUT BEVELS"
1/2" THROUGH 24"**

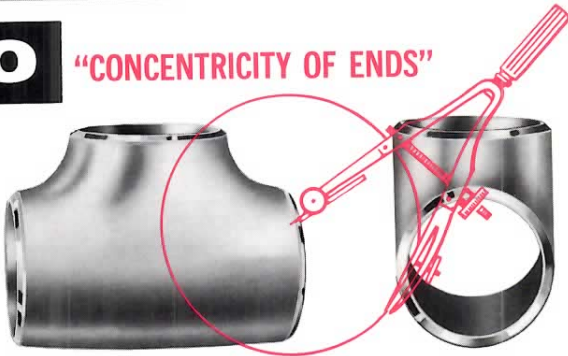
That **FLOWLINE** extra care which means precise squaring, accurate bevel angle and uniform land thickness . . . pays off in easier alignment and uniform, sound welds.

8**"UNIFORM WALLS AT ENDS"**

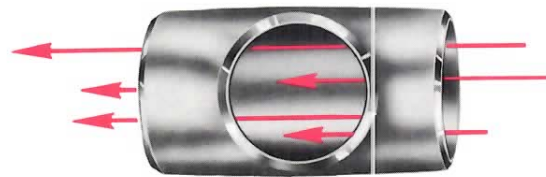
Provide optimum conditions for welding . . . alignment and tacking go faster . . . weld penetration is uniform—fast . . . total weld time is minimized!

9**"SQUARED ENDS" "PRECISE DIMENSIONS"**

Closest possible to nominal . . . not just within tolerances . . . that's what engineers and fabricators want. Multiple variations within tolerances can pyramid throughout the piping system. With **FLOWLINE** fittings, you'll never have to cut and piece—make all those extra welds to compensate for deviations!

10**"CONCENTRICITY OF ENDS"**

Eliminates time-consuming, costly pipe clamping to achieve alignment. With **FLOWLINE** you get fast, accurate alignment. You can't buy truer concentricity!

11**"SMOOTH INTERIOR SURFACES"**

Assure optimum free flow with interior walls free of die marks, ridges and waves . . . possibility of corrosion, erosion and product accumulation minimized!

12**"CLEAN, PASSIVATED FINISH"**

Ready for welding. Fittings are packaged to stay dust-free, greasefree and dry.

13**"FULL WALL THICKNESS THROUGHOUT"**

The **FLOWLINE** process and design eliminate thin walls prevalent in economy fittings. Remember . . . a piping system is no stronger than its weakest point.

The **FLOWLINE** TFF costs no more than an ordinary fitting!

FLOWLINE® STRAIGHT TEES



PART T

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO END (C)	• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
			PART T-5			PART T-1			PART T-4		
			SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
			Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
½	.840	1	.710	.065	.19	.674	.083	.21	.622	.109	.23
¾	1.050	1 ⅛	.920	.065	.22	.884	.083	.28	.824	.113	.38
1	1.315	1 ½	1.185	.065	.40	1.097	.109	.63	1.049	.133	.65
1 ¼	1.660	1 ¾	1.530	.065	.75	1.442	.109	1.10	1.380	.140	1.31
1 ½	1.900	2 ¼	1.770	.065	.95	1.682	.109	1.50	1.610	.145	1.90
2	2.375	2 ½	2.245	.065	1.20	2.157	.109	1.87	2.067	.154	2.83
2 ½	2.875	3	2.709	.083	2.15	2.635	.120	3.10	2.469	.203	4.85
3	3.500	3 ⅞	3.334	.083	3.40	3.260	.120	3.90	3.068	.216	7.30
3 ½	4.000	3 ¾	3.834	.083	5.50	3.760	.120	5.88	3.548	.226	9.00
4	4.500	4 ⅞	4.334	.083	7.20	4.260	.120	7.63	4.026	.237	11.63
5	5.563	4 ¾	5.345	.109	13.00	5.295	.134	13.45	5.047	.258	20.75
6	6.625	5 ⅞	6.407	.109	17.20	6.357	.134	17.80	6.065	.280	24.25
8	8.625	7	8.407	.109	31.00	8.329	.148	34.50	7.981	.322	46.10
10	10.750	8 ½	10.482	.134	55.00	10.420	.165	59.00	10.020	.365	78.00
12	12.750	10	12.438	.156	83.00	12.390	.180	87.00	12.000	.375	137.00
14	14.000	11	13.688	.156	89.00	13.624	.188	107.00	13.250	.375	175.00
16	16.000	12	15.670	.165	115.00	15.624	.188	130.00	15.250	.375	220.00
18	18.000	13 ½	17.670	.165	149.00	17.624	.188	169.00	17.250	.375	286.00
20	20.000	15	19.624	.188	171.00	19.564	.218	228.00	19.250	.375	358.00
24	24.000	17	23.564	.218	298.00	23.500	.250	343.00	23.250	.375	498.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

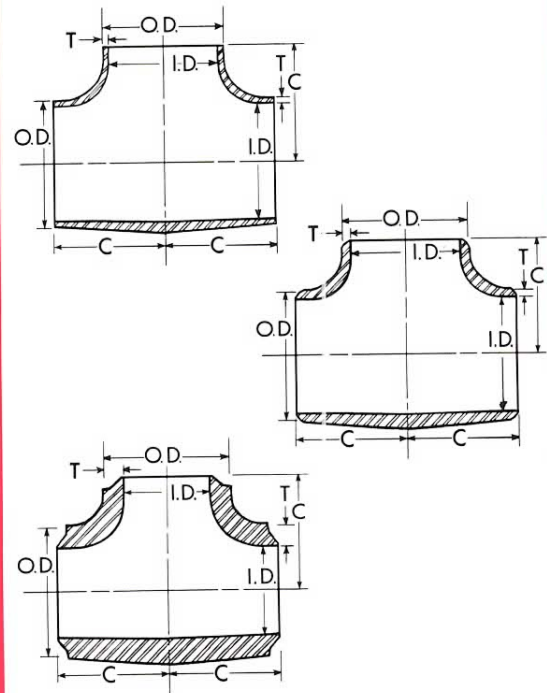
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying .33.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

- STAINLESS STEELS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	CENTER TO END (C)	PART T-8			PART T-16			PART T-XX		
			SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
			Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I.D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
½	.840	1	.546	.147	.30	.464	.188	.38	.252	.294	.60
¾	1.050	1½	.742	.154	.45	.612	.219	.64	.434	.308	.90
1	1.315	1½	.957	.179	.85	.815	.250	1.19	.599	.358	1.70
1¼	1.660	1¾	1.278	.191	1.50	1.160	.250	1.97	.896	.382	3.00
1½	1.900	2¼	1.500	.200	2.25	1.338	.281	3.15	1.100	.400	4.50
2	2.375	2½	1.939	.218	3.50	1.689	.343	5.50	1.503	.436	7.00
2½	2.875	3	2.323	.276	6.90	2.125	.375	9.38	1.771	.552	13.80
3	3.500	3¾	2.900	.300	9.80	2.624	.438	14.31	2.300	.600	19.60
3½	4.000	3¾	3.364	.318	12.00	—	—	—	2.728	.636	24.00
4	4.500	4½	3.826	.337	17.00	3.438	.531	26.86	3.152	.674	34.00
5	5.563	4¾	4.813	.375	25.00	4.313	.625	41.75	4.063	.750	50.00
6	6.625	5¾	5.761	.432	30.00	5.187	.719	49.80	4.897	.864	60.00
8	8.625	7	7.625	.500	62.00	6.813	.906	112.00	6.875	.875	108.00
10	10.750	8½	9.750	.500	110.00	8.500	1.125	247.00	—	—	—
12	12.750	10	11.750	.500	185.00	10.126	1.312	484.00	—	—	—
14	14.000	11	13.000	.500	210.00	11.188	1.406	590.00	—	—	—
16	16.000	12	15.000	.500	265.00	12.812	1.594	812.00	—	—	—
18	18.000	13½	17.000	.500	344.00	14.438	1.781	1097.00	—	—	—
20	20.000	15	19.000	.500	430.00	16.062	1.969	1690.00	—	—	—
24	24.000	17	23.000	.500	600.00	19.312	2.344	2950.00	—	—	—

Ends are accurately machine tool cut and finished as shown on page 61. Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 51.

FLOWLINE® REDUCING OUTLET TEES



PART K

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶

REGULAR PRODUCTION ▶						• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		PART K-5 SCHEDULE 5S Featherweight			PART K-1 SCHEDULE 10S Light I.P.S.			PART K-4 SCHEDULE 40S Standard I.P.S.		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
½	¼	.840	.540	1	1	R .710 O .410	T .065 t .065	.16	R .674 O .410	T .083 t .065	.18	R .622 O .364	T .109 t .088	.20
½	⅜	.840	.675	1	1	R .710 O .545	T .065 t .065	.17	R .674 O .545	T .083 t .065	.19	R .622 O .493	T .109 t .091	.21
¾	⅜	1.050	.675	1½	1½	R .920 O .545	T .065 t .065	.19	R .884 O .545	T .083 t .065	.24	R .824 O .493	T .113 t .091	.32
¾	½	1.050	.840	1½	1½	R .920 O .710	T .065 t .065	.20	R .884 O .674	T .083 t .083	.25	R .824 O .622	T .113 t .109	.34
1	⅜	1.315	.675	1½	1½	R 1.185 O .545	T .065 t .065	.34	R 1.097 O .545	T .109 t .065	.54	R 1.049 O .493	T .133 t .091	.56
1	½	1.315	.840	1½	1½	R 1.185 O .710	T .065 t .065	.35	R 1.097 O .674	T .109 t .083	.55	R 1.049 O .622	T .133 t .109	.57
1	¾	1.315	1.050	1½	1½	R 1.185 O .920	T .065 t .065	.36	R 1.097 O .884	T .109 t .083	.56	R 1.049 O .824	T .133 t .113	.59
1¼	½	1.660	.840	1¾	1¾	R 1.530 O .710	T .065 t .065	.64	R 1.442 O .674	T .109 t .083	.95	R 1.380 O .622	T .140 t .109	1.12
1¼	¾	1.660	1.050	1¾	1¾	R 1.530 O .920	T .065 t .065	.66	R 1.442 O .884	T .109 t .083	.97	R 1.380 O .824	T .140 t .113	1.15
1¼	1	1.660	1.315	1¾	1¾	R 1.530 O 1.185	T .065 t .065	.68	R 1.442 O 1.097	T .109 t .109	.99	R 1.380 O 1.049	T .140 t .133	1.17
1½	½	1.900	.840	2¼	2¼	R 1.770 O .710	T .065 t .065	.81	R 1.682 O .674	T .109 t .083	1.27	R 1.610 O .622	T .145 t .109	1.61
1½	¾	1.900	1.050	2¼	2¼	R 1.770 O .920	T .065 t .065	.82	R 1.682 O .884	T .109 t .083	1.29	R 1.610 O .824	T .145 t .113	1.63
1½	1	1.900	1.315	2¼	2¼	R 1.770 O 1.185	T .065 t .065	.83	R 1.682 O 1.097	T .109 t .109	1.32	R 1.610 O 1.049	T .145 t .133	1.67
1½	1¼	1.900	1.660	2¼	2¼	R 1.770 O 1.530	T .065 t .065	.85	R 1.682 O 1.442	T .109 t .109	1.35	R 1.610 O 1.380	T .145 t .140	1.71
2	¾	2.375	1.050	2½	1¾	R 2.245 O .920	T .065 t .065	1.02	R 2.157 O .884	T .109 t .083	1.59	R 2.067 O .824	T .154 t .113	2.40
2	1	2.375	1.315	2½	2	R 2.245 O 1.185	T .065 t .065	1.03	R 2.157 O 1.097	T .109 t .109	1.60	R 2.067 O 1.049	T .154 t .133	2.43
2	1¼	2.375	1.660	2½	2¼	R 2.245 O 1.530	T .065 t .065	1.05	R 2.157 O 1.442	T .109 t .109	1.64	R 2.067 O 1.380	T .154 t .140	2.49
2	1½	2.375	1.900	2½	2¾	R 2.245 O 1.770	T .065 t .065	1.08	R 2.157 O 1.682	T .109 t .109	1.68	R 2.067 O 1.610	T .154 t .145	2.54

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111. The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

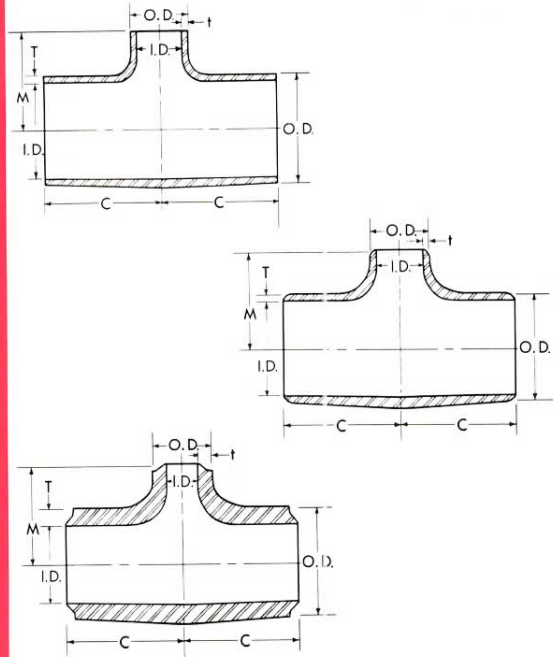
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BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ▶

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		PART K-8 SCHEDULE 80S Extra Heavy I.P.S.			PART K-16 SCHEDULE 160			PART K-XX XX STRONG WALL		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
½	¼	.840	.540	1	1	R .546 O .302	T .147 t .119	.25	—	—	—	—	—	—
½	⅜	.840	.675	1	1	R .546 O .423	T .147 t .126	.27	—	—	—	—	—	—
¾	⅜	1.050	.675	1 ⅛	1 ⅛	R .742 O .423	T .154 t .126	.38	R .612 O .301	T .219 t .187	.55	—	—	—
¾	½	1.050	.840	1 ⅛	1 ⅛	R .742 O .546	T .154 t .147	.40	R .612 O .466	T .219 t .187	.57	R .434 O .252	T .308 t .294	.81
1	⅜	1.315	.675	1 ½	1 ½	R .957 O .423	T .179 t .126	.73	R .815 O .301	T .250 t .187	1.02	—	—	—
1	½	1.315	.840	1 ½	1 ½	R .957 O .546	T .179 t .147	.75	R .815 O .466	T .250 t .187	1.04	R .599 O .252	T .358 t .294	1.49
1	¾	1.315	1.050	1 ½	1 ½	R .957 O .742	T .179 t .154	.76	R .815 O .614	T .250 t .218	1.07	R .599 O .434	T .358 t .308	1.53
1 ¼	½	1.660	.840	1 ⅞	1 ⅞	R 1.278 O .546	T .191 t .147	1.29	R 1.160 O .466	T .250 t .187	1.69	R .896 O .252	T .382 t .294	2.58
1 ¼	¾	1.660	1.050	1 ⅞	1 ⅞	R 1.278 O .742	T .191 t .154	1.32	R 1.160 O .614	T .250 t .218	1.73	R .896 O .434	T .382 t .308	2.64
1 ¼	1	1.660	1.315	1 ⅞	1 ⅞	R 1.278 O .957	T .191 t .179	1.35	R 1.160 O .815	T .250 t .250	1.77	R .896 O .599	T .382 t .358	2.70
1 ½	½	1.900	.840	2 ¼	2 ¼	R 1.500 O .546	T .200 t .147	1.91	R 1.338 O .466	T .281 t .187	2.67	R 1.100 O .252	T .400 t .294	3.82
1 ½	¾	1.900	1.050	2 ¼	2 ¼	R 1.500 O .742	T .200 t .154	1.93	R 1.338 O .614	T .281 t .218	2.71	R 1.100 O .434	T .400 t .308	3.87
1 ½	1	1.900	1.315	2 ¼	2 ¼	R 1.500 O .957	T .200 t .179	1.98	R 1.338 O .815	T .281 t .250	2.77	R 1.100 O .599	T .400 t .358	3.96
1 ½	1 ¼	1.900	1.660	2 ¼	2 ¼	R 1.500 O 1.278	T .200 t .191	2.02	R 1.338 O 1.160	T .281 t .250	2.83	R 1.100 O .896	T .400 t .382	4.05
2	¾	2.375	1.050	2 ½	1 ¾	R 1.939 O .742	T .218 t .154	2.97	R 1.689 O .614	T .343 t .218	4.67	R 1.503 O .434	T .436 t .308	5.95
2	1	2.375	1.315	2 ½	2	R 1.939 O .957	T .218 t .179	3.01	R 1.689 O .815	T .343 t .250	4.73	R 1.503 O .599	T .436 t .358	6.02
2	1 ¼	2.375	1.660	2 ½	2 ¼	R 1.939 O 1.278	T .218 t .191	3.08	R 1.689 O 1.160	T .343 t .250	4.84	R 1.503 O .896	T .436 t .382	6.16
2	1 ½	2.375	1.900	2 ½	2 ¾	R 1.939 O 1.500	T .218 t .200	3.15	R 1.689 O 1.338	T .343 t .281	4.95	R 1.503 O 1.100	T .436 t .400	6.30

Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

(continued on next page)

REGULAR PRODUCTION ▶

• STAINLESS STEELS

• STAINLESS STEELS
• INCO ALLOYS• STAINLESS STEELS
• INCO ALLOYS
• ALUMINUM ALLOYS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		PART K-5 SCHEDULE 5S Featherweight			PART K-1 SCHEDULE 10S Light I.P.S.			PART K-4 SCHEDULE 40S Standard I.P.S.		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
2½	1	2.875	1.315	3	2¼	R 2.709 O 1.185	T .083 t .065	1.83	R 2.635 O 1.097	T .120 t .109	2.63	R 2.469 O 1.049	T .203 t .133	4.12
2½	1¼	2.875	1.660	3	2½	R 2.709 O 1.530	T .083 t .065	1.85	R 2.635 O 1.442	T .120 t .109	2.66	R 2.469 O 1.380	T .203 t .140	4.17
2½	1½	2.875	1.900	3	2⅝	R 2.709 O 1.770	T .083 t .065	1.89	R 2.635 O 1.682	T .120 t .109	2.73	R 2.469 O 1.610	T .203 t .145	4.27
2½	2	2.875	2.375	3	2¾	R 2.709 O 2.245	T .083 t .065	1.93	R 2.635 O 2.157	T .120 t .109	2.79	R 2.469 O 2.067	T .203 t .154	4.36
3	1	3.500	1.315	3⅝	2⅝	R 3.334 O 1.185	T .083 t .065	2.85	R 3.260 O 1.097	T .120 t .109	3.27	R 3.068 O 1.049	T .216 t .133	6.13
3	1¼	3.500	1.660	3⅝	2¾	R 3.334 O 1.530	T .083 t .065	2.89	R 3.260 O 1.442	T .120 t .109	3.31	R 3.068 O 1.380	T .216 t .140	6.20
3	1½	3.500	1.900	3⅝	2⅞	R 3.334 O 1.770	T .083 t .065	2.93	R 3.260 O 1.682	T .120 t .109	3.35	R 3.068 O 1.610	T .216 t .145	6.28
3	2	3.500	2.375	3⅝	3	R 3.334 O 2.245	T .083 t .065	2.99	R 3.260 O 2.157	T .120 t .109	3.43	R 3.068 O 2.067	T .216 t .154	6.42
3	2½	3.500	2.875	3⅝	3¼	R 3.334 O 2.709	T .083 t .083	3.06	R 3.260 O 2.635	T .120 t .120	3.51	R 3.068 O 2.469	T .216 t .203	6.57
3½	1½	4.000	1.900	3¾	3⅝	R 3.834 O 1.770	T .083 t .065	4.67	R 3.760 O 1.682	T .120 t .109	4.99	R 3.548 O 1.610	T .226 t .145	7.65
3½	2	4.000	2.375	3¾	3¼	R 3.834 O 2.245	T .083 t .065	4.73	R 3.760 O 2.157	T .120 t .109	5.05	R 3.548 O 2.067	T .226 t .154	7.74
3½	2½	4.000	2.875	3¾	3½	R 3.834 O 2.709	T .083 t .083	4.84	R 3.760 O 2.635	T .120 t .120	5.17	R 3.548 O 2.469	T .226 t .203	8.97
3½	3	4.000	3.500	3¾	3⅝	R 3.834 O 3.334	T .083 t .083	4.95	R 3.760 O 3.260	T .120 t .120	5.29	R 3.548 O 3.068	T .226 t .216	9.10
4	1½	4.500	1.900	4⅞	3⅝	R 4.334 O 1.770	T .083 t .065	6.05	R 4.260 O 1.682	T .120 t .109	6.40	R 4.026 O 1.610	T .237 t .145	9.76
4	2	4.500	2.375	4⅞	3½	R 4.334 O 2.245	T .083 t .065	6.12	R 4.260 O 2.157	T .120 t .109	6.48	R 4.026 O 2.067	T .237 t .154	9.88
4	2½	4.500	2.875	4⅞	3¾	R 4.334 O 2.709	T .083 t .083	6.19	R 4.260 O 2.635	T .120 t .120	6.56	R 4.026 O 2.469	T .237 t .203	10.00
4	3	4.500	3.500	4⅞	3⅞	R 4.334 O 3.334	T .083 t .083	6.33	R 4.260 O 3.260	T .120 t .120	6.71	R 4.026 O 3.068	T .237 t .216	10.23
4	3½	4.500	4.000	4⅞	4	R 4.334 O 3.834	T .083 t .083	6.48	R 4.260 O 3.760	T .120 t .120	6.86	R 4.026 O 3.548	T .237 t .226	10.40
5	2	5.563	2.375	4⅞	4⅞	R 5.345 O 2.245	T .109 t .065	10.92	R 5.295 O 2.157	T .134 t .109	11.29	R 5.047 O 2.067	T .258 t .154	17.43
5	2½	5.563	2.875	4⅞	4¼	R 5.345 O 2.709	T .109 t .083	11.05	R 5.295 O 2.635	T .134 t .120	11.43	R 5.047 O 2.469	T .258 t .203	17.63
5	3	5.563	3.500	4⅞	4⅝	R 5.345 O 3.334	T .109 t .083	11.18	R 5.295 O 3.260	T .134 t .120	11.56	R 5.047 O 3.068	T .258 t .216	17.84
5	3½	5.563	4.000	4⅞	4½	R 5.345 O 3.834	T .109 t .083	11.44	R 5.295 O 3.760	T .134 t .120	11.83	R 5.047 O 3.548	T .258 t .226	18.26
5	4	5.563	4.500	4⅞	4⅝	R 5.345 O 4.334	T .109 t .083	11.70	R 5.295 O 4.260	T .134 t .120	12.10	R 5.047 O 4.026	T .258 t .237	18.67
6	2½	6.625	2.875	5⅝	4¾	R 6.407 O 2.709	T .109 t .083	14.48	R 6.357 O 2.635	T .134 t .120	14.95	R 6.065 O 2.469	T .280 t .203	20.37
6	3	6.625	3.500	5⅝	4⅞	R 6.407 O 3.334	T .109 t .083	14.62	R 6.357 O 3.260	T .134 t .120	15.13	R 6.065 O 3.068	T .280 t .216	26.32
6	3½	6.625	4.000	5⅝	5	R 6.407 O 3.834	T .109 t .083	14.79	R 6.357 O 3.760	T .134 t .120	15.31	R 6.065 O 3.548	T .280 t .226	20.85
6	4	6.625	4.500	5⅝	5⅞	R 6.407 O 4.334	T .109 t .083	15.13	R 6.357 O 4.260	T .134 t .120	15.66	R 6.065 O 4.026	T .280 t .237	21.34
6	5	6.625	5.563	5⅝	5⅝	R 6.407 O 5.345	T .109 t .109	15.48	R 6.357 O 5.295	T .134 t .134	16.02	R 6.065 O 5.047	T .280 t .253	21.82
8	3	8.625	3.500	7	6	R 8.407 O 3.334	T .109 t .083	26.04	R 8.329 O 3.260	T .148 t .120	29.00	R 7.981 O 3.068	T .322 t .216	38.72
8	3½	8.625	4.000	7	6	R 8.407 O 3.834	T .109 t .083	26.35	R 8.329 O 3.760	T .148 t .120	29.32	R 7.981 O 3.548	T .322 t .226	39.18
8	4	8.625	4.500	7	6⅞	R 8.407 O 4.334	T .109 t .083	26.66	R 8.329 O 4.260	T .148 t .120	29.67	R 7.981 O 4.026	T .322 t .237	39.64
8	5	8.625	5.563	7	6⅝	R 8.407 O 5.345	T .109 t .109	27.28	R 8.329 O 5.295	T .148 t .134	30.36	R 7.981 O 5.047	T .322 t .258	40.56
8	6	8.625	6.625	7	6⅝	R 8.407 O 6.407	T .109 t .109	27.90	R 8.329 O 6.357	T .148 t .134	31.05	R 7.981 O 6.065	T .322 t .280	41.49

(See footnotes on pages 32-33)

(continued on next page)

REDUCING OUTLET TEES

REGULAR PRODUCTION ▶

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

REGULAR PRODUCTION ▶						• STAINLESS STEELS			• STAINLESS STEELS					
						PART K-8			PART K-16			PART K-XX		
NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
2½	1	2.875	1.315	3	2¼	R 2.323 O .957	T .276 t .179	5.86	R 2.125 O .815	T .375 t .250	7.97	R 1.771 O .599	T .552 t .358	11.73
2½	1¼	2.875	1.660	3	2½	R 2.323 O 1.278	T .276 t .191	5.93	R 2.125 O 1.160	T .375 t .250	8.06	R 1.771 O .896	T .552 t .382	11.87
2½	1½	2.875	1.900	3	2⅝	R 2.323 O 1.500	T .276 t .200	6.07	R 2.125 O 1.338	T .375 t .281	8.25	R 1.771 O 1.100	T .552 t .400	12.14
2½	2	2.875	2.375	3	2¾	R 2.323 O 1.939	T .276 t .218	6.21	R 2.125 O 1.689	T .375 t .343	8.44	R 1.771 O 1.503	T .552 t .436	12.42
3	1	3.500	1.315	3¾	2⅝	R 2.900 O .957	T .300 t .179	8.23	R 2.624 O .815	T .438 t .250	12.02	R 2.300 O .599	T .600 t .358	16.46
3	1¼	3.500	1.660	3¾	2¾	R 2.900 O 1.278	T .300 t .191	8.33	R 2.624 O 1.160	T .438 t .250	12.16	R 2.300 O .896	T .600 t .382	16.66
3	1½	3.500	1.900	3¾	2⅞	R 2.900 O 1.500	T .300 t .200	8.43	R 2.624 O 1.338	T .438 t .281	12.30	R 2.300 O 1.100	T .600 t .400	16.85
3	2	3.500	2.375	3¾	3	R 2.900 O 1.939	T .300 t .218	8.62	R 2.624 O 1.689	T .438 t .343	12.59	R 2.300 O 1.503	T .600 t .436	17.24
3	2½	3.500	2.875	3¾	3¼	R 2.900 O 2.323	T .300 t .276	8.82	R 2.624 O 2.125	T .438 t .375	12.88	R 2.300 O 1.771	T .600 t .552	17.64
3½	1½	4.000	1.900	3¾	3⅝	R 3.364 O 1.500	T .318 t .200	10.20	— —	— —	— —	R 2.728 O 1.100	T .636 t .400	20.40
3½	2	4.000	2.375	3¾	3¼	R 3.364 O 1.939	T .318 t .218	10.32	— —	— —	— —	R 2.728 O 1.503	T .636 t .436	20.64
3½	2½	4.000	2.875	3¾	3½	R 3.364 O 2.323	T .318 t .276	10.56	— —	— —	— —	R 2.728 O 1.771	T .636 t .552	21.12
3½	3	4.000	3.500	3¾	3⅝	R 3.364 O 2.900	T .318 t .300	10.80	— —	— —	— —	R 2.728 O 2.300	T .636 t .600	21.60
4	1½	4.500	1.900	4⅞	3¾	R 3.826 O 1.500	T .337 t .200	14.28	R 3.438 O 1.338	T .531 t .281	22.56	R 3.152 O 1.100	T .674 t .400	28.56
4	2	4.500	2.375	4⅞	3½	R 3.826 O 1.939	T .337 t .218	14.45	R 3.438 O 1.689	T .531 t .343	22.83	R 3.152 O 1.503	T .674 t .436	28.90
4	2½	4.500	2.875	4⅞	3¾	R 3.826 O 2.323	T .337 t .276	14.62	R 3.438 O 2.125	T .531 t .375	23.10	R 3.152 O 1.771	T .674 t .552	29.24
4	3	4.500	3.500	4⅞	3⅞	R 3.826 O 2.900	T .337 t .300	14.96	R 3.438 O 2.624	T .531 t .438	23.63	R 3.152 O 2.300	T .674 t .600	29.92
4	3½	4.500	4.000	4⅞	4	R 3.826 O 3.364	T .337 t .318	15.30	— —	— —	— —	R 3.152 O 2.728	T .674 t .636	30.60
5	2	5.563	2.375	4⅞	4⅞	R 4.813 O 1.939	T .375 t .218	21.00	R 4.313 O 1.689	T .625 t .343	35.07	R 4.063 O 1.503	T .750 t .436	42.00
5	2½	5.563	2.875	4⅞	4¼	R 4.813 O 2.323	T .375 t .276	21.25	R 4.313 O 2.125	T .625 t .375	35.48	R 4.063 O 1.771	T .750 t .552	42.50
5	3	5.563	3.500	4⅞	4⅞	R 4.813 O 2.900	T .375 t .300	21.50	R 4.313 O 2.624	T .625 t .438	35.90	R 4.063 O 2.300	T .750 t .600	43.00
5	3½	5.563	4.000	4⅞	4½	R 4.813 O 3.364	T .375 t .318	22.00	— —	— —	— —	R 4.063 O 2.728	T .750 t .636	44.00
5	4	5.563	4.500	4⅞	4⅝	R 4.813 O 3.826	T .375 t .337	22.50	R 4.313 O 3.438	T .625 t .531	37.57	R 4.063 O 3.152	T .750 t .674	45.00
6	2½	6.625	2.875	5⅝	4¾	R 5.761 O 2.323	T .432 t .276	25.20	R 5.187 O 2.125	T .719 t .375	41.83	R 4.897 O 1.771	T .864 t .552	50.40
6	3	6.625	3.500	5⅝	4⅞	R 5.761 O 2.900	T .432 t .300	25.50	R 5.187 O 2.624	T .719 t .438	42.33	R 4.897 O 2.300	T .864 t .600	51.00
6	3½	6.625	4.000	5⅝	5	R 5.761 O 3.364	T .432 t .318	25.80	— —	— —	— —	R 4.897 O 2.728	T .864 t .636	51.60
6	4	6.625	4.500	5⅝	5⅞	R 5.761 O 3.826	T .432 t .337	26.40	R 5.187 O 3.438	T .719 t .531	43.82	R 4.897 O 3.152	T .864 t .674	52.80
6	5	6.625	5.563	5⅝	5¾	R 5.761 O 4.813	T .432 t .375	27.00	R 5.187 O 4.313	T .719 t .625	44.82	R 4.897 O 4.063	T .864 t .750	54.00
8	3	8.625	3.500	7	6	R 7.625 O 2.900	T .500 t .300	52.08	R 6.813 O 2.624	T .906 t .438	94.00	R 6.875 O 2.300	T .875 t .600	90.70
8	3½	8.625	4.000	7	6	R 7.625 O 3.364	T .500 t .318	52.70	— —	— —	— —	R 6.875 O 2.728	T .875 t .636	91.80
8	4	8.625	4.500	7	6⅞	R 7.625 O 3.826	T .500 t .337	53.32	R 6.813 O 3.438	T .906 t .531	96.30	R 6.875 O 3.152	T .875 t .674	92.90
8	5	8.625	5.563	7	6⅝	R 7.625 O 4.813	T .500 t .375	54.56	R 6.813 O 4.313	T .906 t .625	98.50	R 6.875 O 4.063	T .875 t .750	95.00
8	6	8.625	6.625	7	6⅝	R 7.625 O 5.761	T .500 t .432	55.80	R 6.813 O 5.187	T .906 t .719	101.00	R 6.875 O 4.897	T .875 t .864	97.20

(See footnotes on pages 32-33)

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REDUCING OUTLET TEES

REGULAR PRODUCTION ►

• STAINLESS STEELS

• STAINLESS STEELS
• INCO ALLOYS

• STAINLESS STEELS
• INCO ALLOYS
• ALUMINUM ALLOYS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		PART K-5 SCHEDULE 5S Featherweight			PART K-1 SCHEDULE 10S Light I.P.S.			PART K-4 SCHEDULE 40S Standard I.P.S.		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
10	4	10.750	4.500	8½	7¼	R 10.482 O 4.334	T .134 t .083	46.75	R 10.420 O 4.260	T .165 t .120	50.15	R 10.020 O 4.026	T .365 t .237	66.30
10	5	10.750	5.563	8½	7½	R 10.482 O 5.345	T .134 t .109	47.30	R 10.420 O 5.295	T .165 t .134	50.74	R 10.020 O 5.047	T .365 t .258	67.08
10	6	10.750	6.625	8½	7¾	R 10.482 O 6.407	T .134 t .109	48.40	R 10.420 O 6.357	T .165 t .134	51.92	R 10.020 O 6.065	T .365 t .280	68.64
10	8	10.750	8.625	8½	8	R 10.482 O 8.407	T .134 t .109	49.50	R 10.420 O 8.329	T .165 t .148	53.10	R 10.020 O 7.981	T .365 t .322	70.20
12	5	12.750	5.563	10	8½	R 12.438 O 5.345	T .156 t .109	70.55	R 12.390 O 5.295	T .180 t .134	73.95	R 12.000 O 5.047	T .375 t .258	116.00
12	6	12.750	6.625	10	8¾	R 12.438 O 6.407	T .156 t .109	71.38	R 12.390 O 6.357	T .180 t .134	74.82	R 12.000 O 6.065	T .375 t .280	118.00
12	8	12.750	8.625	10	9	R 12.438 O 8.407	T .156 t .109	73.04	R 12.390 O 8.329	T .180 t .148	76.56	R 12.000 O 7.981	T .375 t .322	120.00
12	10	12.750	10.750	10	9½	R 12.438 O 10.482	T .156 t .134	74.70	R 12.390 O 10.420	T .180 t .165	78.30	R 12.000 O 10.020	T .375 t .365	123.00
14	6	14.000	6.625	11	9¾	R 13.688 O 6.407	T .156 t .109	75.65	R 13.624 O 6.357	T .188 t .134	90.95	R 13.250 O 6.065	T .375 t .280	148.00
14	8	14.000	8.625	11	9¾	R 13.688 O 8.407	T .156 t .109	76.54	R 13.624 O 8.329	T .188 t .148	92.02	R 13.250 O 7.981	T .375 t .322	150.00
14	10	14.000	10.750	11	10½	R 13.688 O 10.482	T .156 t .134	78.32	R 13.624 O 10.420	T .188 t .165	94.16	R 13.250 O 10.020	T .375 t .365	154.00
14	12	14.000	12.750	11	10¾	R 13.688 O 12.438	T .156 t .156	80.10	R 13.624 O 12.390	T .188 t .180	96.30	R 13.250 O 12.000	T .375 t .375	157.00
16	6	16.000	6.625	12	10¾	R 15.670 O 6.407	T .165 t .109	96.60	R 15.624 O 6.357	T .188 t .134	109.00	R 15.250 O 6.065	T .375 t .280	184.00
16	8	16.000	8.625	12	10¾	R 15.670 O 8.407	T .165 t .109	97.75	R 15.624 O 8.329	T .188 t .148	110.00	R 15.250 O 7.981	T .375 t .322	187.00
16	10	16.000	10.750	12	11½	R 15.670 O 10.482	T .165 t .134	98.90	R 15.624 O 10.420	T .188 t .165	112.00	R 15.250 O 10.020	T .375 t .365	189.00
16	12	16.000	12.750	12	11¾	R 15.670 O 12.438	T .165 t .156	101.00	R 15.624 O 12.390	T .188 t .180	114.00	R 15.250 O 12.000	T .375 t .375	193.00
16	14	16.000	14.000	12	12	R 15.670 O 13.688	T .165 t .156	103.00	R 15.624 O 13.624	T .188 t .188	117.00	R 15.250 O 13.250	T .375 t .375	198.00
18	8	18.000	8.625	13½	11¾	R 17.670 O 8.407	T .165 t .109	125.00	R 17.624 O 8.329	T .188 t .148	142.00	R 17.250 O 7.981	T .375 t .322	240.00
18	10	18.000	10.750	13½	12½	R 17.670 O 10.482	T .165 t .134	126.00	R 17.624 O 10.420	T .188 t .165	143.00	R 17.250 O 10.020	T .375 t .365	243.00
18	12	18.000	12.750	13½	12¾	R 17.670 O 12.438	T .165 t .156	128.00	R 17.624 O 12.390	T .188 t .180	145.00	R 17.250 O 12.000	T .375 t .375	246.00
18	14	18.000	14.000	13½	13	R 17.670 O 13.688	T .165 t .156	131.00	R 17.624 O 13.624	T .188 t .188	148.00	R 17.250 O 13.250	T .375 t .375	251.00
18	16	18.000	16.000	13½	13	R 17.670 O 15.670	T .165 t .165	134.00	R 17.624 O 15.624	T .188 t .188	152.00	R 17.250 O 15.250	T .375 t .375	257.00
20	8	20.000	8.625	15	12¾	R 19.624 O 8.407	T .188 t .109	141.00	R 19.564 O 8.329	T .218 t .148	189.00	R 19.250 O 7.981	T .375 t .322	297.00
20	10	20.000	10.750	15	13½	R 19.624 O 10.482	T .188 t .134	143.00	R 19.564 O 10.420	T .218 t .165	191.00	R 19.250 O 10.020	T .375 t .365	300.00
20	12	20.000	12.750	15	13¾	R 19.624 O 12.438	T .188 t .156	145.00	R 19.564 O 12.390	T .218 t .180	193.00	R 19.250 O 12.000	T .375 t .375	304.00
20	14	20.000	14.000	15	14	R 19.624 O 13.688	T .188 t .156	147.00	R 19.564 O 13.624	T .218 t .188	196.00	R 19.250 O 13.250	T .375 t .375	308.00
20	16	20.000	16.000	15	14	R 19.624 O 15.670	T .188 t .165	150.00	R 19.564 O 15.624	T .218 t .188	200.00	R 19.250 O 15.250	T .375 t .375	315.00
20	18	20.000	18.000	15	14½	R 19.624 O 17.670	T .188 t .165	154.00	R 19.564 O 17.624	T .218 t .188	205.00	R 19.250 O 17.250	T .375 t .375	322.00
24	10	24.000	10.750	17	15½	R 23.564 O 10.482	T .218 t .134	247.00	R 23.500 O 10.420	T .250 t .165	284.00	R 23.250 O 10.020	T .375 t .365	413.00
24	12	24.000	12.750	17	15¾	R 23.564 O 12.438	T .218 t .156	250.00	R 23.500 O 12.390	T .250 t .180	288.00	R 23.250 O 12.000	T .375 t .375	418.00
24	14	24.000	14.000	17	16	R 23.564 O 13.688	T .218 t .156	253.00	R 23.500 O 13.624	T .250 t .188	291.00	R 23.250 O 13.250	T .375 t .375	423.00
24	16	24.000	16.000	17	16	R 23.564 O 15.670	T .218 t .165	256.00	R 23.500 O 15.624	T .250 t .188	295.00	R 23.250 O 15.250	T .375 t .375	428.00
24	18	24.000	18.000	17	16½	R 23.564 O 17.670	T .218 t .165	262.00	R 23.500 O 17.624	T .250 t .188	302.00	R 23.250 O 17.250	T .375 t .375	438.00
24	20	24.000	20.000	17	17	R 23.564 O 19.624	T .218 t .188	268.00	R 23.500 O 19.564	T .250 t .218	308.00	R 23.250 O 19.250	T .375 t .375	448.00

(See footnotes on pages 32-33)

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REDUCING OUTLET TEES

REGULAR PRODUCTION ▶

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
10	4	10.750	4.500	8½	7¼	R 9.750 O 3.826	T .500 t .337	93.50	R 8.500 O 3.438	T 1.125 t .531	210.00	---	---	---
10	5	10.750	5.563	8½	7½	R 9.750 O 4.813	T .500 t .375	94.60	R 8.500 O 4.313	T 1.125 t .625	212.00	---	---	---
10	6	10.750	6.625	8½	7⅝	R 9.750 O 5.761	T .500 t .432	96.80	R 8.500 O 5.187	T 1.125 t .719	217.00	---	---	---
10	8	10.750	8.625	8½	8	R 9.750 O 7.625	T .500 t .500	99.00	R 8.500 O 6.813	T 1.125 t .906	222.00	---	---	---
12	5	12.750	5.563	10	8½	R 11.750 O 4.813	T .500 t .375	157.00	R 10.126 O 4.313	T 1.312 t .625	411.00	---	---	---
12	6	12.750	6.625	10	8⅝	R 11.750 O 5.761	T .500 t .432	159.00	R 10.126 O 5.187	T 1.312 t .719	416.00	---	---	---
12	8	12.750	8.625	10	9	R 11.750 O 7.625	T .500 t .500	163.00	R 10.126 O 6.813	T 1.312 t .906	426.00	---	---	---
12	10	12.750	10.750	10	9½	R 11.750 O 9.750	T .500 t .500	166.00	R 10.126 O 8.500	T 1.312 t 1.125	435.00	---	---	---
14	6	14.000	6.625	11	9¾	R 13.000 O 5.761	T .500 t .432	178.00	R 11.188 O 5.187	T 1.406 t .719	---	---	---	---
14	8	14.000	8.625	11	9¾	R 13.000 O 7.625	T .500 t .500	180.00	R 11.188 O 6.813	T 1.406 t .906	---	---	---	---
14	10	14.000	10.750	11	10⅛	R 13.000 O 9.750	T .500 t .500	185.00	R 11.188 O 8.500	T 1.406 t 1.125	---	---	---	---
14	12	14.000	12.750	11	10⅝	R 13.000 O 11.750	T .500 t .500	189.00	R 11.188 O 10.126	T 1.406 t 1.312	---	---	---	---
16	6	16.000	6.625	12	10¾	R 15.000 O 5.761	T .500 t .432	222.00	R 12.812 O 5.187	T 1.594 t .719	---	---	---	---
16	8	16.000	8.625	12	10¾	R 15.000 O 7.625	T .500 t .500	225.00	R 12.812 O 6.813	T 1.594 t .906	---	---	---	---
16	10	16.000	10.750	12	11⅛	R 15.000 O 9.750	T .500 t .500	228.00	R 12.812 O 8.500	T 1.594 t 1.125	---	---	---	---
16	12	16.000	12.750	12	11⅝	R 15.000 O 11.750	T .500 t .500	233.00	R 12.812 O 10.126	T 1.594 t 1.312	---	---	---	---
16	14	16.000	14.000	12	12	R 15.000 O 13.000	T .500 t .500	238.00	R 12.812 O 11.188	T 1.594 t 1.406	---	---	---	---
18	8	18.000	8.625	13½	11¾	R 17.000 O 7.625	T .500 t .500	289.00	R 14.438 O 6.813	T 1.781 t .906	---	---	---	---
18	10	18.000	10.750	13½	12⅛	R 17.000 O 9.750	T .500 t .500	292.00	R 14.438 O 8.500	T 1.781 t 1.125	---	---	---	---
18	12	18.000	12.750	13½	12⅝	R 17.000 O 11.750	T .500 t .500	296.00	R 14.438 O 10.126	T 1.781 t 1.312	---	---	---	---
18	14	18.000	14.000	13½	13	R 17.000 O 13.000	T .500 t .500	303.00	R 14.438 O 11.188	T 1.781 t 1.406	---	---	---	---
18	16	18.000	16.000	13½	13	R 17.000 O 15.000	T .500 t .500	309.00	R 14.438 O 12.812	T 1.781 t 1.594	---	---	---	---
20	8	20.000	8.625	15	12¾	R 19.000 O 7.625	T .500 t .500	357.00	R 16.062 O 6.813	T 1.969 t .906	---	---	---	---
20	10	20.000	10.750	15	13⅛	R 19.000 O 9.750	T .500 t .500	361.00	R 16.062 O 8.500	T 1.969 t 1.125	---	---	---	---
20	12	20.000	12.750	15	13⅝	R 19.000 O 11.750	T .500 t .500	365.00	R 16.062 O 10.126	T 1.969 t 1.312	---	---	---	---
20	14	20.000	14.000	15	14	R 19.000 O 13.000	T .500 t .500	370.00	R 16.062 O 11.188	T 1.969 t 1.406	---	---	---	---
20	16	20.000	16.000	15	14	R 19.000 O 15.000	T .500 t .500	378.00	R 16.062 O 12.812	T 1.969 t 1.594	---	---	---	---
20	18	20.000	18.000	15	14½	R 19.000 O 17.000	T .500 t .500	387.00	R 16.062 O 14.438	T 1.969 t 1.781	---	---	---	---
24	10	24.000	10.750	17	15⅛	R 23.000 O 9.750	T .500 t .500	498.00	R 19.312 O 8.500	T 2.344 t 1.125	---	---	---	---
24	12	24.000	12.750	17	15⅝	R 23.000 O 11.750	T .500 t .500	504.00	R 19.312 O 10.126	T 2.344 t 1.312	---	---	---	---
24	14	24.000	14.000	17	16	R 23.000 O 13.000	T .500 t .500	510.00	R 19.312 O 11.188	T 2.344 t 1.406	---	---	---	---
24	16	24.000	16.000	17	16	R 23.000 O 15.000	T .500 t .500	516.00	R 19.312 O 12.812	T 2.344 t 1.594	---	---	---	---
24	18	24.000	18.000	17	16½	R 23.000 O 17.000	T .500 t .500	528.00	R 19.312 O 14.438	T 2.344 t 1.781	---	---	---	---
24	20	24.000	20.000	17	17	R 23.000 O 19.000	T .500 t .500	540.00	R 19.312 O 16.062	T 2.344 t 1.969	---	---	---	---

(See footnotes on pages 32-33)

FLOWLINE®

Type A and Type B

1

"STAINLESS AND INCO ALLOYS FULLY ANNEALED"

2

"CLEAN, PASSIVATED FINISH"

Ready for welding. Fittings are packaged to stay dust-free, grease-free and dry.

3

**"MACHINE-TOOL-CUT BEVELS"
1/2" THROUGH 24"**

That **FLOWLINE** extra care which means precise squaring, accurate bevel angle and uniform land thickness . . . pays off in easier alignment and uniform, sound welds.

4

"PRECISE DIMENSIONS"

Closest possible to nominal . . . not just within tolerances . . . that's what engineers and fabricators want. Multiple variations within tolerances can pyramid throughout the piping system. With **FLOWLINE** fittings, you'll never have to cut and piece—make all those extra welds to compensate for deviations!

5

"CONCENTRICITY OF ENDS"

Eliminates time-consuming, costly pipe clamping to achieve alignment. With **FLOWLINE** you get fast, accurate alignment. You can't buy truer concentricity!

6

"SMOOTH INTERIOR SURFACES"

Assure optimum free flow with interior walls free of die marks, ridges and waves . . . possibility of corrosion, erosion and product accumulation minimized!

7

"LAP MACHINED WITH SERRATED FACE IN ACCORDANCE WITH ASME B16.5"

Allows optimum gasket sealing efficiency.



MSS STANDARD--
SHORT LENGTH

8

"MSS SP-25 IDENTIFICATION"

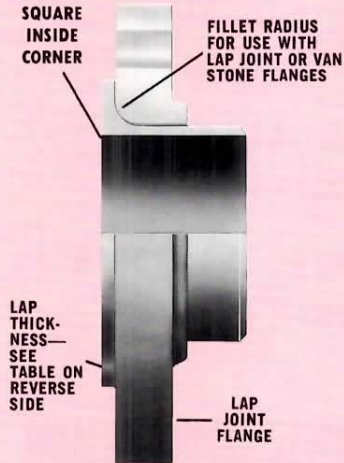
Electro chemical etched . . . uniform and permanent—complete **FLOWLINE** identification is assured . . . even years after a fitting is in service!



ANSI STANDARD--
LONG LENGTH

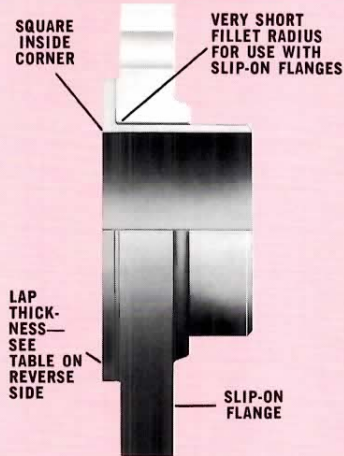
THE A-B-C'S OF BUTT-WELD STUB ENDS

TYPE "A"



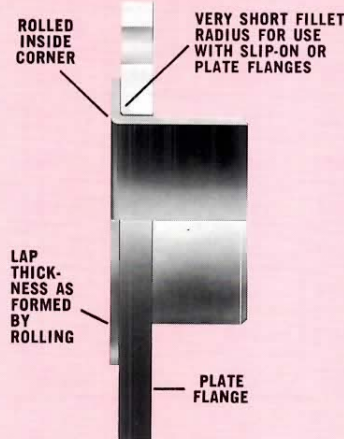
LENGTH ASME B16.9	SCHEDULE (1)	LAP FACE	FILLET RADIUS in accordance with	MARKED in accordance with MSS SP -25	AVAILABLE MATERIAL (1)				SIZES (Inches)
					STAINLESS STEEL 304, 304L, 316, 316L	ALLOY 400	ALLOY 200	ALUMINUM 3003-F, 6061-T6	
SHORT	5S (3)	<i>Machined with phonographic serrations in accordance with ASME B16.5</i>	ASME B16.9	X	X	—	—	—	½-24
	10S (3)		ASME B16.9	X	X	X	X	—	½-24
	40S		ASME B16.9	X	X	X	X	—	½-24
LONG	40S		ASME B16.9	X	X	X	X	X	½-24
	80S		ASME B16.9	X	X	X	X	X	½-24
	160		ASME B16.9	X	X	X	X	—	½-12
	XX S.		ASME B16.9	X	X	X	X	—	½-8

TYPE "B"



LENGTH ASME B16.9	SCHEDULE (1)	LAP FACE	FILLET RADIUS in accordance with	MARKED in accordance with MSS SP -25	AVAILABLE MATERIAL (1)				SIZES (Inches)
					STAINLESS STEEL 304, 304L, 316, 316L	ALLOY 400	ALLOY 200	ALUMINUM 3003-F, 6061-T6	
SHORT	5S (3)	<i>Machined with phonographic serrations in accordance with ASME B16.5</i>	MSS SP-43	X	X	—	—	—	½-24
	10S (3)		MSS SP-43	X	X	—	—	—	½-24
	40S		MSS SP-43	X	X	—	—	—	½-24

TYPE "C"



LENGTH	SCHEDULE (1)	LAP FACE	FILLET RADIUS in accordance with	MARKED in accordance with MSS SP -25	AVAILABLE MATERIAL (1)				SIZES (Inches)
					STAINLESS STEEL 304L, 316L	ALLOY 400	ALLOY 200	ALUMINUM 3003-F, 6061-T6	
SHORT	5S	<i>Formed to plane surface</i>	Not covered by any standard	X	X	—	—	—	½-24
	10S		Not covered by any standard	X	X	—	—	—	½-24

(1) Certain other wall thicknesses and materials available on special order.

(2) Concentric serrations can also be provided. Phonographic or concentric serrated stub end lap faces are equally acceptable for providing flanged connections which meet piping industry pressure rating requirements. Other special facings can be provided.

STUB ENDS

ASME B16.9 SHORT AND LONG PATTERN

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6



REGULAR PRODUCTION ▶

• STAINLESS STEELS

• STAINLESS STEELS
• INCO ALLOYS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	DIAMETER (G)	LENGTH J		RADIUS		PART S-5				PART S-1			
			Short	Long	A	B	SCHEDULE 5S Featherweight				SCHEDULE 10S Light I.P.S.			
							Inside Diameter (I.D.)	Wall Thickness (T)	Lap Thickness (l)	Approx. Wt. in Pounds‡ Short	Inside Diameter (I.D.)	Wall Thickness (T)	Lap Thickness (l)	Approx. Wt. in Pounds‡ Short
1/2	.840	1 3/8	2	3	1/8	1/32	.710	.065	.065	.14	.674	.083	.083	.16
3/4	1.050	1 1/2	2	3	1/8	1/32	.920	.065	.065	.18	.884	.083	.083	.21
1	1.315	2	2	4	1/8	1/32	1.185	.065	.065	.25	1.097	.109	.109	.35
1 1/4	1.660	2 1/2	2	4	3/16	1/32	1.530	.065	.065	.39	1.442	.109	.109	.49
1 1/2	1.900	2 7/8	2	4	1/4	1/32	1.770	.065	.065	.41	1.682	.109	.109	.56
2	2.375	3 5/8	2 1/2	6	5/16	1/32	2.245	.065	.065	.71	2.157	.109	.109	.94
2 1/2	2.875	4 1/8	2 1/2	6	5/16	1/32	2.709	.083	.083	.95	2.635	.120	.120	1.25
3	3.500	5	2 1/2	6	3/8	1/32	3.334	.083	.083	1.23	3.260	.120	.120	1.60
3 1/2	4.000	5 1/2	3	6	3/8	1/32	3.834	.083	.083	1.63	3.760	.120	.120	1.90
4	4.500	6 3/8	3	6	7/16	1/32	4.334	.083	.083	1.90	4.260	.120	.120	2.40
5	5.563	7 5/8	3	8	7/16	1/16	5.345	.109	.109	2.80	5.295	.134	.134	3.25
6	6.625	8 1/2	3 1/2	8	1/2	1/16	6.407	.109	.109	3.88	6.357	.134	.134	4.75
8	8.625	10 5/8	4	8	1/2	1/16	8.407	.109	.109	5.90	8.329	.148	.148	7.10
10	10.750	12 3/4	5	10	1/2	1/16	10.482	.134	.134	8.90	10.420	.165	.165	11.30
12	12.750	15	6	10	1/2	1/16	12.438	.156	.156	15.30	12.390	.180	.180	18.00
14	14.000	16 1/4	6	12	1/2	1/16	13.688	.156	.156	19.00	13.624	.188	.188	24.00
16	16.000	18 1/2	6	12	1/2	1/16	15.670	.165	.165	25.00	15.624	.188	.188	28.00
18	18.000	21	6	12	1/2	1/16	17.670	.165	.165	34.00	17.624	.188	.188	38.00
20	20.000	23	6	12	1/2	1/16	19.624	.188	.188	43.00	19.564	.218	.218	48.00
24	24.000	27 1/4	6	12	1/2	1/16	23.564	.218	.218	57.00	23.500	.250	.250	60.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 16C and XX Strong.

Aluminum is generally available in long pattern only.

BUTT WELDING FITTINGS

SCHEDULES
5S, 10S, 40S

*See pages 42 and 43 for
Schedules 80S, 160, XX Strong Wall*
STAINLESS STEELS

**TYPES 304, 304L, 304H,
316, 316L, 316H**

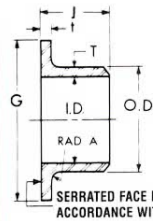
NICKEL ALLOYS
ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

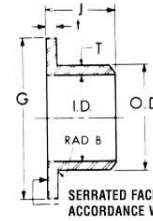
TYPES 3003-F, 6061-T6

**MADE IN ACCORDANCE
WITH ASME B16.9**

Stub Ends are supplied in Type A or Type B.
Type A is more readily available.



TYPE A



TYPE B

Schedules 5S and 10S Stub Ends are usually
supplied in Short Lengths; Long Lengths are
available on special order.

Schedule 40S Stub Ends are supplied in either
Short or Long Lengths.

REGULAR PRODUCTION ►

• STAINLESS STEELS
• INCO ALLOYS

PART S-4

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	DIAMETER (G)	LENGTH J		RADIUS		SCHEDULE 40S Standard I.P.S.			
			Short	Long	A	B	Inside Diameter (I.D.)	Wall Thickness (T)	Lap Thickness (l)	Approx. Wt. in Pounds± Short
1/2	.840	1 3/8	2	3	1/8	1/32	.622	.109	.109	.19
3/4	1.050	1 11/16	2	3	1/8	1/32	.824	.113	.113	.26
1	1.315	2	2	4	1/8	1/32	1.049	.133	.133	.38
1 1/4	1.660	2 1/2	2	4	3/16	1/32	1.380	.140	.140	.55
1 1/2	1.900	2 7/8	2	4	1/4	1/32	1.610	.145	.145	.69
2	2.375	3 5/8	2 1/2	6	5/16	1/32	2.067	.154	.154	1.35
2 1/2	2.875	4 1/8	2 1/2	6	5/16	1/32	2.469	.203	.203	1.77
3	3.500	5	2 1/2	6	3/8	1/32	3.068	.216	.216	2.50
3 1/2	4.000	5 1/2	3	6	3/8	1/32	3.548	.226	.226	3.58
4	4.500	6 3/16	3	6	7/16	1/32	4.026	.237	.237	4.13
5	5.563	7 5/16	3	8	7/16	1/16	5.047	.258	.258	6.15
6	6.625	8 1/2	3 1/2	8	1/2	1/16	6.065	.280	.280	7.88
8	8.625	10 5/8	4	8	1/2	1/16	7.981	.322	.322	13.38
10	10.750	12 3/4	5	10	1/2	1/16	10.020	.365	.365	22.20
12	12.750	15	6	10	1/2	1/16	12.000	.375	.375	31.50
14	14.000	16 1/4	6	12	1/2	1/16	13.250	.375	.375	37.80
16	16.000	18 1/2	6	12	1/2	1/16	15.250	.375	.375	45.00
18	18.000	21	6	12	1/2	1/16	17.250	.375	.375	60.00
20	20.000	23	6	12	1/2	1/16	19.250	.375	.375	66.00
24	24.000	27 1/4	6	12	1/2	1/16	23.250	.375	.375	85.00

±Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

Ends are accurately machine tool cut and finished as shown on page 61.

Made in accordance with ASME B16.9 where applicable.

All dimensions are in inches. See metric conversions on charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

The basic minimum lap thickness in all Schedules shall not be less than shown above.



FLOWLINE® STUB ENDS

ASME B16.9 SHORT AND LONG PATTERN

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	DIAMETER (S)	LENGTH		RADIUS A	PART S-4				PART S-8			
			Short	Long		SCHEDULE 40S Standard I.P.S.		SCHEDULE 80S Extra Heavy I.P.S.					
					Inside Diameter (I.D.)	Wall Thickness (T)	Lap Thickness (t)	Approx. Wt. in Pounds± Short	Inside Diameter (I.D.)	Wall Thickness (T)	Lap Thickness (t)	Approx. Wt. in Pounds± Long	
1/2	.840	1 3/8	2	3	1/8	.622	.109	.109	.26	.546	.147	.147	.34
3/4	1.050	1 11/16	2	3	1/8	.824	.113	.113	.36	.742	.154	.154	.47
1	1.315	2	2	4	1/8	1.049	.133	.133	.68	.957	.179	.179	.88
1 1/4	1.660	2 1/2	2	4	3/16	1.380	.140	.140	.97	1.278	.191	.191	1.26
1 1/2	1.900	2 7/8	2	4	1/4	1.610	.145	.145	1.20	1.500	.200	.200	1.49
2	2.375	3 5/8	2 1/2	6	5/16	2.067	.154	.154	2.25	1.939	.218	.218	3.05
2 1/2	2.875	4 1/8	2 1/2	6	5/16	2.469	.203	.203	3.40	2.323	.276	.276	4.40
3	3.500	5	2 1/2	6	3/8	3.068	.216	.216	4.65	2.900	.300	.300	6.50
3 1/2	4.000	5 1/2	3	6	3/8	3.548	.226	.226	5.89	3.364	.318	.318	7.75
4	4.500	6 3/16	3	6	7/16	4.026	.237	.237	6.83	3.826	.337	.337	9.65
5	5.563	7 5/16	3	8	7/16	5.047	.258	.258	11.88	4.813	.375	.375	16.33
6	6.625	8 1/2	3 1/2	8	1/2	6.065	.280	.280	15.18	5.761	.432	.432	22.63
8	8.625	10 5/8	4	8	1/2	7.981	.322	.322	23.81	7.625	.500	.500	34.12
10	10.750	12 3/4	5	10	1/2	10.020	.365	.365	39.50	9.750	.500	.500	54.00
12	12.750	15	6	10	1/2	12.000	.375	.375	48.50	11.750	.500	.500	64.50
14	14.000	16 1/4	6	12	1/2	13.250	.375	.375	63.00	13.000	.500	.500	84.00
16	16.000	18 1/2	6	12	1/2	15.250	.375	.375	73.50	15.000	.500	.500	98.00
18	18.000	21	6	12	1/2	17.250	.375	.375	99.00	17.000	.500	.500	136.00
20	20.000	23	6	12	1/2	19.250	.375	.375	108.00	19.000	.500	.500	157.00
24	24.000	27 1/4	6	12	1/2	23.250	.375	.375	139.00	23.000	.500	.500	178.00

"Long" length is standard for Schedules 80S, 160, and XX Strong Wall in accordance with ANSI B16.9.

Radius "A" is standard for Schedules 80S, 160, and XX Strong Wall in accordance with ANSI B16.9.

Other analysis and metals can be furnished where quantity justifies production.

See pages 62, 110 and 111.

The "L" grades are normally not available in Schedules 160 and XX Strong.

±Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

BUTT WELDING FITTINGS

SCHEDULES

80S, 160, XX Strong Wall

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

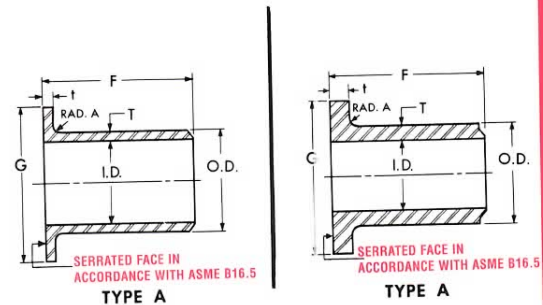
ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

MADE IN ACCORDANCE
WITH ASME STANDARDS

All schedules of Long (ANSI Length)
Stub Ends are usually supplied in Type A.



Schedules 80S, 160 and XX Strong Wall
Stub Ends are supplied in Long Lengths.
Short Lengths are available on special
order.

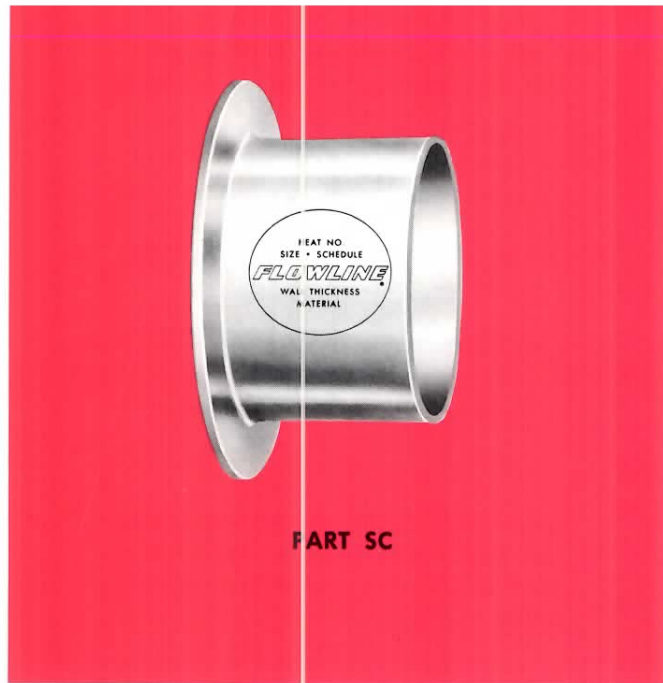
REGULAR PRODUCTION ►

• STAINLESS STEELS

NOM. PIPE SIZE	OUTSIDE DIAMETER (O.D.)	DIAMETER (G)	LENGTH F		RADIUS A	PART S-16				PART S-XX			
			Short	Long		SCHEDULE 160				XX STRONG WALL			
					Inside Diameter (I.D.)	Wall Thickness (T)	Lap Thickness (t)	Approx. Wt. in Pounds± Short	Inside Diameter (I.D.)	Wall Thickness (T)	Lap Thickness (t)	Approx. Wt. in Pounds± Long	
1/2	.840	1 3/8	2	3	1/8	.464	.188	.187	.43	.252	.294	.294	.68
3/4	1.050	1 11/16	2	3	1/8	.612	.219	.218	.66	.434	.308	.308	.94
1	1.315	2	2	4	1/8	.815	.250	.250	1.22	.599	.358	.358	1.76
1 1/4	1.660	2 1/2	2	4	3/16	1.160	.250	.250	1.64	.896	.382	.382	2.52
1 1/2	1.900	2 7/8	2	4	1/4	1.338	.281	.281	2.08	1.100	.400	.400	2.98
2	2.375	3 5/8	2 1/2	6	5/16	1.689	.343	.343	4.79	1.503	.436	.436	6.10
2 1/2	2.875	4 1/8	2 1/2	6	5/16	2.125	.375	.375	5.94	1.771	.552	.552	8.80
3	3.500	5	2 1/2	6	3/8	2.624	.438	.438	7.10	2.300	.600	.600	9.80
3 1/2	4.000	5 1/2	3	6	3/8	—	—	—	—	2.728	.636	.636	15.50
4	4.500	6 3/16	3	6	7/16	3.438	.531	.531	15.15	3.152	.674	.674	19.30
5	5.563	7 5/16	3	8	7/16	4.313	.625	.625	27.10	4.063	.750	.750	32.66
6	6.625	8 1/2	3 1/2	8	1/2	5.187	.719	.718	37.56	4.897	.864	.864	45.26
8	8.625	10 5/8	4	8	1/2	6.813	.906	.906	61.75	6.875	.875	.875	59.71
10	10.750	12 3/4	5	10	1/2	8.500	1.125	1.125	121.50	—	—	—	—
12	12.750	15	6	10	1/2	10.126	1.312	1.312	169.00	—	—	—	—

The basic minimum lap thickness in all Schedules shall not be less than shown above.
Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ANSI B16.9 and MSS SP-43 where applicable.

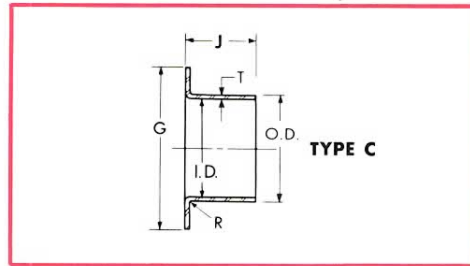
All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.



FLOWLINE®

AS FORMED

STUB ENDS



STAINLESS STEELS: TYPES 304L, 316L,

An ECONOMY Stub End for use where square inside corner is not required, and where pressure-temperature design considerations are not important.

					• STAINLESS STEELS					
					PART SC-5			PART SC-10		
					SCHEDULE 5S Featherweight			SCHEDULE 10S Light I. P. S.		
NOM. PIPE SIZE	OUTSIDE DIAMETER (O. D.)	DIAMETER (G)	LENGTH (J)	RADIUS (R)	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
½	.840	1⅜	2	⅓	.710	.065	.13	.674	.083	.14
¾	1.050	1⅞	2	⅓	.920	.065	.14	.884	.083	.18
1	1.315	2	2	⅓	1.185	.065	.19	1.097	.109	.31
1¼	1.660	2½	2	⅓	1.530	.065	.21	1.442	.109	.42
1½	1.900	2⅞	2	⅓	1.770	.065	.29	1.682	.109	.44
2	2.375	3⅝	2½	⅓	2.245	.065	.44	2.157	.109	.81
2½	2.875	4⅞	2½	⅓	2.709	.083	.75	2.635	.120	1.00
3	3.500	5	2½	⅓	3.334	.083	.94	3.260	.120	1.25
4	4.500	6⅝	3	⅓	4.334	.083	1.38	4.260	.120	1.88
5	5.563	7⅝	3	⅓	5.345	.109	2.06	5.295	.134	2.63
6	6.625	8½	3½	⅓	6.407	.109	2.75	6.357	.134	3.56
8	8.625	10⅝	4	⅓	8.407	.109	3.88	8.329	.148	6.19
10	10.750	12¾	5	⅓	10.482	.134	7.48	10.420	.165	9.46
12	12.750	15	6	⅓	12.438	.156	15.00	12.390	.180	16.07
14	14.000	16¼	6	⅓	13.688	.156	19.20	13.624	.188	23.10
16	16.000	18½	6	⅓	15.670	.165	23.90	15.624	.188	27.20
18	18.000	21	6	⅓	17.670	.165	28.50	17.624	.188	32.40
20	20.000	23	6	⅓	19.624	.188	36.30	19.564	.218	47.70
24	24.000	27¼	6	⅓	23.564	.218	56.00	23.500	.250	58.27

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.
The Type "C" Stub End is made from tubing, and with the lap rolled over. The lap face is not machined; it is formed to a plane surface which is suitable for applications where an economy-type Stub End is desired.

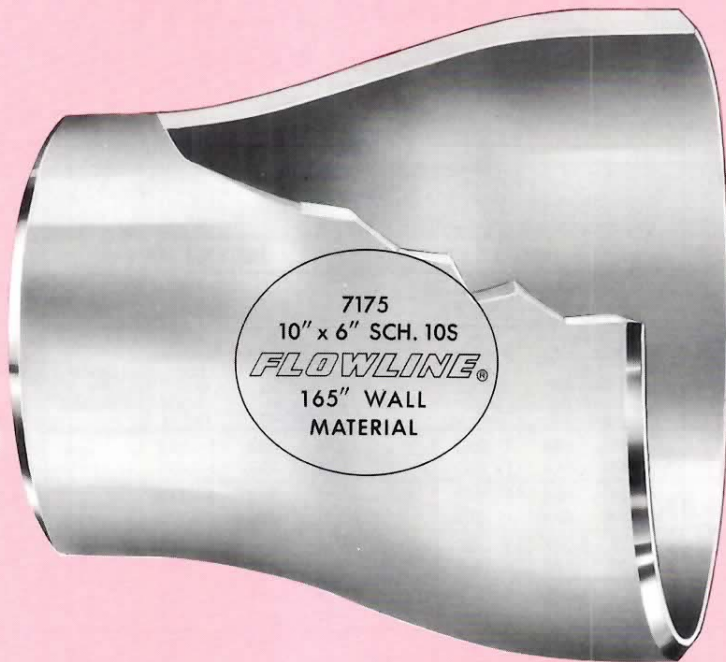
Type "C" Stub Ends are available in short length only, in Schedules 5S and 10S. Permanently marked, in accordance with MSS SP-25. By electro-chemical etch—to show product number, size and schedule, trademark, wall thickness and type of material.

THE **FLOWLINE** REDUCER and its plus values

1

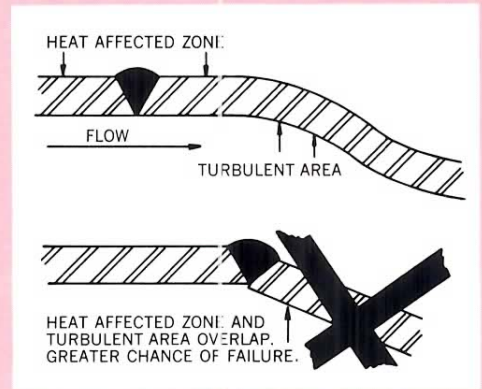
"CONSISTENCY IN DESIGN"

All **FLOWLINE** reducers below 16" are produced and stocked "bell" shaped. Above 14", popular sizes are supplied "belled." Few manufacturers, if any, can make this claim of consistency throughout the size range. Avoid buying the problems created by conical shaped reducers.



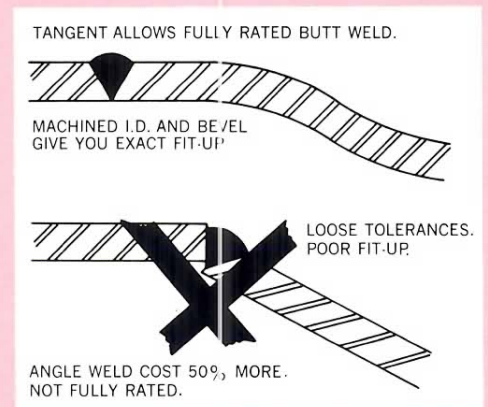
2

"CRITICAL HEAT AFFECTED AREA AND TURBULENT ZONE DON'T OVERLAP"



3

"BETTER ALIGNMENT, FABRICATION SAVINGS, AND FULLY RATED"



4

"COLD FORMED"

5

"MSS SP-25 IDENTIFICATION"

6

"CLEAN, PASSIVATED FINISH"

7

"ENGINEERED BELL SHAPED CONSTRUCTION"

8

"MACHINE-TOOL-CUT BEVELS"

9

"STAINLESS AND INCO ALLOYS FULLY ANNEALED"

10

"PRECISE DIMENSIONS"

11

"CONCENTRICITY OF ENDS"

12

"SMOOTH INTERIOR SURFACES"

The **FLOWLINE** REDUCER Costs No More Than An Ordinary Fitting!



FLOWLINE® REDUCERS

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶

REGULAR PRODUCTION ▶				• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
				PARTS Q-5 AND R-5			PARTS Q-1 AND R-1			PARTS Q-4 AND R-4		
NOM. PIPE SIZE	OUTSIDE DIAMETER		LENGTH (H)	SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
	Large End (O.D.)	Small End (O.D.)		Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡
¾ x ¾	1.050	.675	1½	LE .920 SE .545	T .065 + .065	.15	LE .884 SE .545	T .083 + .065	.20	LE .824 SE .493	T .113 + .091	.27
¾ x ½	1.050	.840	1½	LE .920 SE .710	T .065 + .065	.17	LE .884 SE .674	T .083 + .083	.22	LE .824 SE .622	T .113 + .109	.31
1 x ¾	1.315	.675	2	LE 1.185 SE .545	T .065 + .065	.16	LE 1.097 SE .545	T .109 + .065	.21	LE 1.049 SE .493	T .133 + .091	.33
1 x ½	1.315	.840	2	LE 1.185 SE .710	T .065 + .065	.16	LE 1.097 SE .674	T .109 + .083	.27	LE 1.049 SE .622	T .133 + .109	.34
1 x ¾	1.315	1.050	2	LE 1.185 SE .920	T .065 + .065	.17	LE 1.097 SE .884	T .109 + .083	.29	LE 1.049 SE .824	T .133 + .113	.36
1¼ x ½	1.660	.840	2	LE 1.530 SE .710	T .065 + .065	.21	LE 1.442 SE .674	T .109 + .083	.35	LE 1.380 SE .622	T .140 + .109	.46
1¼ x ¾	1.660	1.050	2	LE 1.530 SE .920	T .065 + .065	.22	LE 1.442 SE .884	T .109 + .083	.39	LE 1.380 SE .824	T .140 + .113	.49
1¼ x 1	1.660	1.315	2	LE 1.530 SE 1.185	T .065 + .065	.22	LE 1.442 SE 1.097	T .109 + .109	.39	LE 1.380 SE 1.049	T .140 + .133	.49
1½ x ½	1.900	.840	2½	LE 1.770 SE .710	T .065 + .065	.23	LE 1.682 SE .674	T .109 + .083	.37	LE 1.610 SE .622	T .145 + .109	.50
1½ x ¾	1.900	1.050	2½	LE 1.770 SE .920	T .065 + .065	.24	LE 1.682 SE .884	T .109 + .083	.39	LE 1.610 SE .824	T .145 + .113	.52
1½ x 1	1.900	1.315	2½	LE 1.770 SE 1.185	T .065 + .065	.25	LE 1.682 SE 1.097	T .109 + .109	.43	LE 1.610 SE 1.049	T .145 + .133	.58
1½ x 1¼	1.900	1.660	2½	LE 1.770 SE 1.530	T .065 + .065	.27	LE 1.682 SE 1.442	T .109 + .109	.46	LE 1.610 SE 1.380	T .145 + .140	.62
2 x ¾	2.375	1.050	3	LE 2.245 SE .920	T .065 + .065	.33	LE 2.157 SE .884	T .109 + .083	.56	LE 2.067 SE .824	T .154 + .113	.80
2 x 1	2.375	1.315	3	LE 2.245 SE 1.185	T .065 + .065	.37	LE 2.157 SE 1.097	T .109 + .109	.62	LE 2.067 SE 1.049	T .154 + .133	.89
2 x 1¼	2.375	1.660	3	LE 2.245 SE 1.530	T .065 + .065	.40	LE 2.157 SE 1.442	T .109 + .109	.67	LE 2.067 SE 1.380	T .154 + .140	.96
2 x 1½	2.375	1.900	3	LE 2.245 SE 1.770	T .065 + .065	.41	LE 2.157 SE 1.682	T .109 + .109	.69	LE 2.067 SE 1.610	T .154 + .145	.99
2½ x 1	2.875	1.315	3½	LE 2.709 SE 1.185	T .083 + .065	.56	LE 2.635 SE 1.097	T .120 + .109	.83	LE 2.469 SE 1.049	T .203 + .133	1.42

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.
The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

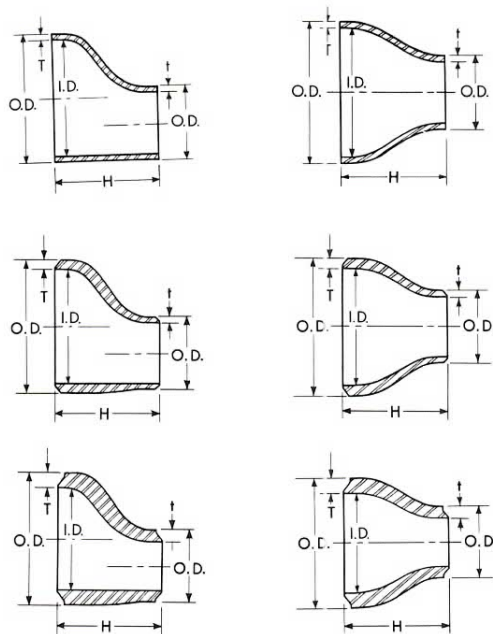
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

NOM. PIPE SIZE	OUTSIDE DIAMETER		LENGTH (H)	SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
	Large End (O.D.)	Small End (O.D.)		Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡
¾ x ⅝	1.050	.675	1 ½	LE .742 SE .423	T .154 t .126	.37	---	---	---	---	---	---
¾ x ½	1.050	.840	1 ½	LE .742 SE .546	T .154 t .147	.40	LE .612 SE .466	T .219 t .187	.55	LE .434 SE .252	T .308 t .294	.80
1 x ⅝	1.315	.675	2	LE .957 SE .423	T .179 t .126	.42	---	---	---	---	---	---
1 x ½	1.315	.840	2	LE .957 SE .546	T .179 t .147	.44	LE .815 SE .466	T .250 t .187	.57	LE .599 SE .252	T .358 t .294	.88
1 x ¾	1.315	1.050	2	LE .957 SE .742	T .179 t .154	.49	LE .815 SE .612	T .250 t .219	.61	LE .599 SE .434	T .358 t .308	.98
1 ¼ x ½	1.660	.840	2	LE 1.278 SE .546	T .191 t .147	.52	LE 1.160 SE .466	T .250 t .187	.67	LE .896 SE .252	T .382 t .294	1.04
1 ¼ x ¾	1.660	1.050	2	LE 1.278 SE .742	T .191 t .154	.56	LE 1.160 SE .612	T .250 t .219	.73	LE .896 SE .434	T .382 t .308	1.12
1 ¼ x 1	1.660	1.315	2	LE 1.278 SE .957	T .191 t .179	.59	LE 1.160 SE .815	T .250 t .250	.82	LE .896 SE .599	T .382 t .358	1.18
1 ½ x ½	1.900	.840	2 ½	LE 1.500 SE .546	T .200 t .147	.68	LE 1.338 SE .466	T .281 t .187	.95	LE 1.100 SE .252	T .400 t .294	1.36
1 ½ x ¾	1.900	1.050	2 ½	LE 1.500 SE .742	T .200 t .154	.71	LE 1.338 SE .612	T .281 t .219	.99	LE 1.100 SE .434	T .400 t .308	1.42
1 ½ x 1	1.900	1.315	2 ½	LE 1.500 SE .957	T .200 t .179	.74	LE 1.338 SE .815	T .281 t .250	1.03	LE 1.100 SE .599	T .400 t .358	1.48
1 ½ x 1 ¼	1.900	1.660	2 ½	LE 1.500 SE 1.278	T .200 t .191	.80	LE 1.338 SE 1.160	T .281 t .250	1.12	LE 1.100 SE .896	T .400 t .382	1.60
2 x ¾	2.375	1.050	3	LE 1.939 SE .742	T .218 t .154	1.11	LE 1.689 SE .612	T .343 t .219	1.74	LE 1.503 SE .434	T .436 t .308	2.22
2 x 1	2.375	1.315	3	LE 1.939 SE .957	T .218 t .179	1.18	LE 1.689 SE .815	T .343 t .250	1.85	LE 1.503 SE .599	T .436 t .358	2.36
2 x 1 ¼	2.375	1.660	3	LE 1.939 SE 1.278	T .218 t .191	1.27	LE 1.689 SE 1.160	T .343 t .250	1.99	LE 1.503 SE .896	T .436 t .382	2.54
2 x 1 ½	2.375	1.900	3	LE 1.939 SE 1.500	T .218 t .200	1.30	LE 1.689 SE 1.338	T .343 t .281	2.04	LE 1.503 SE 1.100	T .436 t .400	2.60
2 ½ x 1	2.875	1.315	3 ½	LE 2.323 SE .957	T .276 t .179	1.92	LE 2.125 SE .815	T .375 t .250	2.59	LE 1.771 SE .599	T .552 t .358	3.84

Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

(continued on next page)

REDUCERS . . . ECCENTRIC, PART Q – CONCENTRIC, PART R

REGULAR PRODUCTION ▶

REGULAR PRODUCTION ▶				• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
				PARTS Q-5 AND R-5			PARTS Q-1 AND R-1			PARTS Q-4 AND R-4		
NOM. PIPE SIZE	OUTSIDE DIAMETER		LENGTH (H)	SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
	Large End (O.D.)	Small End (O.D.)		Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡
2½ x 1¼	2.875	1.660	3½	LE 2.709 SE 1.530	T .083 + .065	.64	LE 2.635 SE 1.442	T .120 + .109	.95	LE 2.469 SE 1.380	T .203 + .140	1.61
2½ x 1½	2.875	1.900	3½	LE 2.709 SE 1.770	T .083 + .065	.67	LE 2.635 SE 1.682	T .120 + .109	.98	LE 2.469 SE 1.610	T .203 + .145	1.67
2½ x 2	2.875	2.375	3½	LE 2.709 SE 2.245	T .083 + .065	.70	LE 2.635 SE 2.157	T .120 + .109	1.03	LE 2.469 SE 2.067	T .203 + .154	1.76
3 x 1	3.500	1.315	3½	LE 3.334 SE 1.185	T .083 + .065	.70	LE 3.260 SE 1.097	T .120 + .109	1.03	LE 3.068 SE 1.049	T .216 + .133	1.81
3 x 1¼	3.500	1.660	3½	LE 3.334 SE 1.530	T .083 + .065	.70	LE 3.260 SE 1.442	T .120 + .109	1.03	LE 3.068 SE 1.380	T .216 + .140	1.86
3 x 1½	3.500	1.900	3½	LE 3.334 SE 1.770	T .083 + .065	.78	LE 3.260 SE 1.682	T .120 + .109	1.13	LE 3.068 SE 1.610	T .216 + .145	2.07
3 x 2	3.500	2.375	3½	LE 3.334 SE 2.245	T .083 + .065	.83	LE 3.260 SE 2.157	T .120 + .109	1.21	LE 3.068 SE 2.067	T .216 + .154	2.20
3 x 2½	3.500	2.875	3½	LE 3.334 SE 2.709	T .083 + .083	.90	LE 3.260 SE 2.635	T .120 + .120	1.30	LE 3.068 SE 2.469	T .216 + .203	2.38
3½ x 1¼	4.000	1.660	4	LE 3.834 SE 1.530	T .083 + .065	.93	LE 3.760 SE 1.442	T .120 + .109	1.37	LE 3.548 SE 1.380	T .226 + .140	2.60
3½ x 1½	4.000	1.900	4	LE 3.834 SE 1.770	T .083 + .065	.99	LE 3.760 SE 1.682	T .120 + .109	1.46	LE 3.548 SE 1.610	T .226 + .145	2.76
3½ x 2	4.000	2.375	4	LE 3.834 SE 2.245	T .083 + .065	1.06	LE 3.760 SE 2.157	T .120 + .109	1.57	LE 3.548 SE 2.067	T .226 + .154	2.97
3½ x 2½	4.000	2.875	4	LE 3.834 SE 2.709	T .083 + .083	1.17	LE 3.760 SE 2.635	T .120 + .120	1.72	LE 3.548 SE 2.469	T .226 + .203	3.25
3½ x 3	4.000	3.500	4	LE 3.834 SE 3.334	T .083 + .083	1.20	LE 3.760 SE 3.260	T .120 + .120	1.77	LE 3.548 SE 3.068	T .226 + .216	3.35
4 x 1½	4.500	1.900	4	LE 4.334 SE 1.770	T .083 + .065	1.05	LE 4.260 SE 1.682	T .120 + .109	1.50	LE 4.026 SE 1.610	T .237 + .145	3.00
4 x 2	4.500	2.375	4	LE 4.334 SE 2.245	T .083 + .065	1.21	LE 4.260 SE 2.157	T .120 + .109	1.73	LE 4.026 SE 2.067	T .237 + .154	3.47
4 x 2½	4.500	2.875	4	LE 4.334 SE 2.709	T .083 + .083	1.28	LE 4.260 SE 2.635	T .120 + .120	1.83	LE 4.026 SE 2.469	T .237 + .203	3.66
4 x 3	4.500	3.500	4	LE 4.334 SE 3.334	T .083 + .083	1.34	LE 4.260 SE 3.260	T .120 + .120	1.92	LE 4.026 SE 3.068	T .237 + .216	3.84
4 x 3½	4.500	4.000	4	LE 4.334 SE 3.834	T .083 + .083	1.38	LE 4.260 SE 3.760	T .120 + .120	1.98	LE 4.026 SE 3.548	T .237 + .226	3.97
5 x 2	5.563	2.375	5	LE 5.345 SE 2.245	T .109 + .065	2.33	LE 5.295 SE 2.157	T .134 + .109	2.83	LE 5.047 SE 2.067	T .258 + .154	5.55
5 x 2½	5.563	2.875	5	LE 5.345 SE 2.709	T .109 + .083	2.55	LE 5.295 SE 2.635	T .134 + .120	3.09	LE 5.047 SE 2.469	T .258 + .203	6.07
5 x 3	5.563	3.500	5	LE 5.345 SE 3.334	T .109 + .083	2.64	LE 5.295 SE 3.260	T .134 + .120	3.20	LE 5.047 SE 3.068	T .258 + .216	6.29
5 x 3½	5.563	4.000	5	LE 5.345 SE 3.834	T .109 + .083	2.71	LE 5.295 SE 3.760	T .134 + .120	3.28	LE 5.047 SE 3.548	T .258 + .226	6.45
5 x 4	5.563	4.500	5	LE 5.345 SE 4.334	T .109 + .083	2.76	LE 5.295 SE 4.260	T .134 + .120	3.29	LE 5.047 SE 4.026	T .258 + .237	6.57
6 x 2½	6.625	2.875	5½	LE 6.407 SE 2.709	T .109 + .083	3.18	LE 6.357 SE 2.635	T .134 + .120	3.35	LE 6.065 SE 2.469	T .280 + .203	8.37
6 x 3	6.625	3.500	5½	LE 6.407 SE 3.334	T .109 + .083	3.33	LE 6.357 SE 3.260	T .134 + .120	4.01	LE 6.065 SE 3.068	T .280 + .216	8.77
6 x 3½	6.625	4.000	5½	LE 6.407 SE 3.834	T .109 + .083	3.39	LE 6.357 SE 3.760	T .134 + .120	4.20	LE 6.065 SE 3.548	T .280 + .226	8.93
6 x 4	6.625	4.500	5½	LE 6.407 SE 4.334	T .109 + .083	3.41	LE 6.357 SE 4.260	T .134 + .120	4.31	LE 6.065 SE 4.026	T .280 + .237	8.99
6 x 5	6.625	5.563	5½	LE 6.407 SE 5.345	T .109 + .109	3.60	LE 6.357 SE 5.295	T .134 + .134	4.45	LE 6.065 SE 5.047	T .280 + .258	9.48
8 x 3½	8.625	4.000	6	LE 8.407 SE 3.834	T .109 + .083	4.65	LE 8.329 SE 3.760	T .148 + .120	6.48	LE 7.981 SE 3.548	T .322 + .226	14.10
8 x 4	8.625	4.500	6	LE 8.407 SE 4.334	T .109 + .083	4.76	LE 8.329 SE 4.260	T .148 + .120	6.64	LE 7.981 SE 4.026	T .322 + .237	14.44

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.
The "H" grades are generally not available in Schedules 5S. The "L" grades are

normally not available in Schedules 160 and XX Strong.
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are

REDUCERS . . . ECCENTRIC, PART Q – CONCENTRIC, PART R

REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

NOM. PIPE SIZE	OUTSIDE DIAMETER		LENGTH (H)	SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
	Large End (O.D.)	Small End (O.D.)		Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡
2½ x 1¼	2.875	1.660	3½	LE 2.323 SE 1.278	T .276 t .191	1.98	LE 2.125 SE 1.160	T .375 t .250	2.67	LE 1.771 SE .896	T .552 t .382	3.96
2½ x 1½	2.875	1.900	3½	LE 2.323 SE 1.500	T .276 t .200	2.07	LE 2.125 SE 1.338	T .375 t .281	2.79	LE 1.771 SE 1.100	T .552 t .400	4.14
2½ x 2	2.875	2.375	3½	LE 2.323 SE 1.939	T .276 t .218	2.26	LE 2.125 SE 1.689	T .375 t .343	3.05	LE 1.771 SE 1.503	T .552 t .436	4.52
3 x 1	3.500	1.315	3½	LE 2.900 SE .957	T .300 t .179	2.39	LE 2.624 SE .815	T .438 t .250	3.32	LE 2.300 SE .599	T .600 t .358	4.76
3 x 1¼	3.500	1.660	3½	LE 2.900 SE 1.278	T .300 t .191	2.51	LE 2.624 SE 1.160	T .438 t .250	3.63	LE 2.300 SE .896	T .600 t .382	5.02
3 x 1½	3.500	1.900	3½	LE 2.900 SE 1.500	T .300 t .200	2.66	LE 2.624 SE 1.338	T .438 t .281	3.85	LE 2.300 SE 1.100	T .600 t .400	5.32
3 x 2	3.500	2.375	3½	LE 2.900 SE 1.939	T .300 t .218	2.85	LE 2.624 SE 1.689	T .438 t .343	4.13	LE 2.300 SE 1.503	T .600 t .436	5.70
3 x 2½	3.500	2.875	3½	LE 2.900 SE 2.323	T .300 t .276	3.28	LE 2.624 SE 2.125	T .438 t .375	4.75	LE 2.300 SE 1.771	T .600 t .552	6.56
3½ x 1¼	4.000	1.660	4	LE 3.364 SE 1.278	T .318 t .191	3.53	— —	— —	— —	LE 2.728 SE .896	T .636 t .382	7.06
3½ x 1½	4.000	1.900	4	LE 3.364 SE 1.500	T .318 t .200	3.69	— —	— —	— —	LE 2.728 SE 1.100	T .636 t .400	7.38
3½ x 2	4.000	2.375	4	LE 3.364 SE 1.939	T .318 t .218	3.87	— —	— —	— —	LE 2.728 SE 1.503	T .636 t .436	7.74
3½ x 2½	4.000	2.875	4	LE 3.364 SE 2.323	T .318 t .276	4.21	— —	— —	— —	LE 2.728 SE 1.771	T .636 t .552	8.42
3½ x 3	4.000	3.500	4	LE 3.364 SE 2.900	T .318 t .300	4.46	— —	— —	— —	LE 2.728 SE 2.300	T .636 t .600	8.92
4 x 1½	4.500	1.900	4	LE 3.826 SE 1.500	T .337 t .200	4.18	LE 3.438 SE 1.338	T .531 t .281	6.56	LE 3.152 SE 1.100	T .674 t .400	8.36
4 x 2	4.500	2.375	4	LE 3.826 SE 1.939	T .337 t .218	4.31	LE 3.438 SE 1.689	T .531 t .343	6.76	LE 3.152 SE 1.503	T .674 t .436	8.62
4 x 2½	4.500	2.875	4	LE 3.826 SE 2.323	T .337 t .276	4.83	LE 3.438 SE 2.125	T .531 t .375	7.58	LE 3.152 SE 1.771	T .674 t .552	9.66
4 x 3	4.500	3.500	4	LE 3.826 SE 2.900	T .337 t .300	5.14	LE 3.438 SE 2.624	T .531 t .438	8.07	LE 3.152 SE 2.300	T .674 t .600	10.28
4 x 3½	4.500	4.000	4	LE 3.826 SE 3.364	T .337 t .318	5.33	— —	— —	— —	LE 3.152 SE 2.728	T .674 t .636	10.66
5 x 2	5.563	2.375	5	LE 4.813 SE 1.939	T .375 t .218	7.25	LE 4.313 SE 1.689	T .625 t .343	12.03	LE 4.063 SE 1.503	T .750 t .436	14.50
5 x 2½	5.563	2.875	5	LE 4.813 SE 2.323	T .375 t .276	7.93	LE 4.313 SE 2.125	T .625 t .375	13.16	LE 4.063 SE 1.771	T .750 t .552	15.86
5 x 3	5.563	3.500	5	LE 4.813 SE 2.900	T .375 t .300	8.55	LE 4.313 SE 2.624	T .625 t .438	14.19	LE 4.063 SE 2.300	T .750 t .600	17.10
5 x 3½	5.563	4.000	5	LE 4.813 SE 3.364	T .375 t .318	8.80	— —	— —	— —	LE 4.063 SE 2.728	T .750 t .636	17.60
5 x 4	5.563	4.500	5	LE 4.813 SE 3.826	T .375 t .337	9.11	LE 4.313 SE 3.438	T .625 t .531	15.12	LE 4.063 SE 3.152	T .750 t .674	18.22
6 x 2½	6.625	2.875	5½	LE 5.761 SE 2.323	T .432 t .276	10.88	LE 5.187 SE 2.125	T .719 t .375	18.06	LE 4.897 SE 1.771	T .864 t .552	21.76
6 x 3	6.625	3.500	5½	LE 5.761 SE 2.900	T .432 t .300	12.15	LE 5.187 SE 2.624	T .719 t .438	20.17	LE 4.897 SE 2.300	T .864 t .600	24.30
6 x 3½	6.625	4.000	5½	LE 5.761 SE 3.364	T .432 t .318	12.67	— —	— —	— —	LE 4.897 SE 2.728	T .864 t .636	25.34
6 x 4	6.625	4.500	5½	LE 5.761 SE 3.826	T .432 t .337	13.14	LE 5.187 SE 3.438	T .719 t .531	21.81	LE 4.897 SE 3.152	T .864 t .674	26.28
6 x 5	6.625	5.563	5½	LE 5.761 SE 4.813	T .432 t .375	13.79	LE 5.187 SE 4.313	T .719 t .625	22.89	LE 4.897 SE 4.063	T .864 t .750	27.58
8 x 3½	8.625	4.000	6	LE 7.625 SE 3.364	T .500 t .318	17.61	— —	— —	— —	LE 6.875 SE 2.728	T .875 t .636	30.81
8 x 4	8.625	4.500	6	LE 7.625 SE 3.826	T .500 t .337	20.36	LE 6.813 SE 3.438	T .906 t .531	36.85	LE 6.875 SE 3.152	T .875 t .674	35.63

obtained by multiplying by .33.
Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

(continued on next page)

REDUCERS . . . ECCENTRIC, PART Q – CONCENTRIC, PART R

REGULAR PRODUCTION ▶				• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
				PARTS Q-5 AND R-5			PARTS Q-1 AND R-1			PARTS Q-4 AND R-4		
NOM. PIPE SIZE	OUTSIDE DIAMETER		LENGTH (H)	SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
	Large End (O.D.)	Small End (O.D.)		Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡
8 x 5	8.625	5.563	6	LE 8.407 SE 5.345	T .109 † .109	4.87	LE 8.329 SE 5.295	T .148 † .134	6.79	LE 7.981 SE 5.047	T .322 † .258	14.78
8 x 6	8.625	6.625	6	LE 8.407 SE 6.407	T .109 † .109	5.05	LE 8.329 SE 6.357	T .148 † .134	7.04	LE 7.981 SE 6.065	T .322 † .280	15.31
10 x 4	10.750	4.500	7	LE 10.482 SE 4.334	T .134 † .083	8.34	LE 10.420 SE 4.260	T .165 † .120	10.43	LE 10.020 SE 4.026	T .365 † .237	23.19
10 x 5	10.750	5.563	7	LE 10.482 SE 5.345	T .134 † .109	8.62	LE 10.420 SE 5.295	T .165 † .134	10.78	LE 10.020 SE 5.047	T .365 † .258	23.96
10 x 6	10.750	6.625	7	LE 10.482 SE 6.407	T .134 † .109	8.82	LE 10.420 SE 6.357	T .165 † .134	11.03	LE 10.020 SE 6.065	T .365 † .280	24.52
10 x 8	10.750	8.625	7	LE 10.482 SE 8.407	T .134 † .109	9.17	LE 10.420 SE 8.329	T .165 † .148	11.46	LE 10.020 SE 7.981	T .365 † .322	25.48
12 x 5	12.750	5.563	8	LE 12.438 SE 5.345	T .156 † .109	13.72	LE 12.390 SE 5.295	T .180 † .134	16.07	LE 12.000 SE 5.047	T .375 † .258	33.48
12 x 6	12.750	6.625	8	LE 12.438 SE 6.407	T .156 † .109	14.01	LE 12.390 SE 6.357	T .180 † .134	16.38	LE 12.000 SE 6.065	T .375 † .280	34.13
12 x 8	12.750	8.625	8	LE 12.438 SE 8.407	T .156 † .109	14.45	LE 12.390 SE 8.329	T .180 † .148	16.91	LE 12.000 SE 7.981	T .375 † .322	35.24
12 x 10	12.750	10.750	8	LE 12.438 SE 10.482	T .156 † .134	15.03	LE 12.390 SE 10.420	T .180 † .165	17.60	LE 12.000 SE 10.020	T .375 † .365	36.67
14 x 6	14.000	6.625	13	LE 13.688 SE 6.407	T .156 † .109	23.78	LE 13.624 SE 6.357	T .188 † .134	29.00	LE 13.250 SE 6.065	T .375 † .280	58.00
14 x 8	14.000	8.625	13	LE 13.688 SE 8.407	T .156 † .109	25.10	LE 13.624 SE 8.329	T .188 † .148	30.61	LE 13.250 SE 7.981	T .375 † .322	61.22
14 x 10	14.000	10.750	13	LE 13.688 SE 10.482	T .156 † .134	26.05	LE 13.624 SE 10.420	T .188 † .165	31.77	LE 13.250 SE 10.020	T .375 † .365	63.55
14 x 12	14.000	12.750	13	LE 13.688 SE 12.438	T .156 † .156	27.64	LE 13.624 SE 12.390	T .188 † .180	33.71	LE 13.250 SE 12.000	T .375 † .375	67.42
16 x 8	16.000	8.625	14	LE 15.670 SE 8.407	T .165 † .109	32.39	LE 15.624 SE 8.329	T .188 † .148	36.81	LE 15.250 SE 7.981	T .375 † .322	73.62
16 x 10	16.000	10.750	14	LE 15.670 SE 10.482	T .165 † .134	34.37	LE 15.624 SE 10.420	T .188 † .165	39.06	LE 15.250 SE 10.020	T .375 † .365	78.12
16 x 12	16.000	12.750	14	LE 15.670 SE 12.438	T .165 † .156	35.60	LE 15.624 SE 12.390	T .188 † .180	40.45	LE 15.250 SE 12.000	T .375 † .375	80.91
16 x 14	16.000	14.000	14	LE 15.670 SE 13.688	T .165 † .156	36.48	LE 15.624 SE 13.624	T .188 † .188	41.46	LE 15.250 SE 13.250	T .375 † .375	82.92
18 x 10	18.000	10.750	15	LE 17.670 SE 10.482	T .165 † .134	40.78	LE 17.624 SE 10.420	T .188 † .165	46.34	LE 17.250 SE 10.020	T .375 † .365	92.69
18 x 12	18.000	12.750	15	LE 17.670 SE 12.438	T .165 † .156	41.66	LE 17.624 SE 12.390	T .188 † .180	47.35	LE 17.250 SE 12.000	T .375 † .375	94.70
18 x 14	18.000	14.000	15	LE 17.670 SE 13.688	T .165 † .156	42.48	LE 17.624 SE 13.624	T .188 † .188	48.28	LE 17.250 SE 13.250	T .375 † .375	96.56
18 x 16	18.000	16.000	15	LE 17.670 SE 15.670	T .165 † .165	43.64	LE 17.624 SE 15.624	T .188 † .188	49.60	LE 17.250 SE 15.250	T .375 † .375	99.20
20 x 12	20.000	12.750	20	LE 19.624 SE 12.438	T .188 † .156	71.50	LE 19.564 SE 12.390	T .218 † .180	71.50	LE 19.250 SE 12.000	T .375 † .375	143.00
20 x 14	20.000	14.000	20	LE 19.624 SE 13.688	T .188 † .156	72.50	LE 19.564 SE 13.624	T .218 † .188	84.10	LE 19.250 SE 13.250	T .375 † .375	145.00
20 x 16	20.000	16.000	20	LE 19.624 SE 15.670	T .188 † .165	73.00	LE 19.564 SE 15.624	T .218 † .188	84.68	LE 19.250 SE 15.250	T .375 † .375	146.00
20 x 18	20.000	18.000	20	LE 19.624 SE 17.670	T .188 † .165	75.50	LE 19.564 SE 17.624	T .218 † .188	87.58	LE 19.250 SE 17.250	T .375 † .375	151.00
24 x 16	24.000	16.000	20	LE 23.564 SE 15.670	T .218 † .165	98.02	LE 23.500 SE 15.624	T .250 † .188	98.02	LE 23.250 SE 15.250	T .375 † .375	169.00
24 x 18	24.000	18.000	20	LE 23.564 SE 17.670	T .218 † .165	100.00	LE 23.500 SE 17.624	T .250 † .188	100.00	LE 23.250 SE 17.250	T .375 † .375	173.00
24 x 20	24.000	20.000	20	LE 23.564 SE 19.624	T .218 † .188	103.00	LE 23.500 SE 19.564	T .250 † .218	103.00	LE 23.250 SE 19.250	T .375 † .375	179.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

The "H" grades are generally not available in Schedules 5S. The "L" grades are

normally not available in Schedules 160 and XX Strong.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are

REDUCERS . . . ECCENTRIC, PART Q – CONCENTRIC, PART R

REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

- STAINLESS STEELS

PARTS Q-8 AND R-8

PARTS Q-16 AND R-16

PARTS Q-XX AND R-XX

NOM. PIPE SIZE	OUTSIDE DIAMETER		LENGTH (H)	SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
	Large End (O.D.)	Small End (O.D.)		Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Large End—LE Small End—SE	Wall Thickness Large End—T Small End—t	Approx. Wt. in Pounds‡
8 x 5	8.625	5.563	6	LE 7.625 SE 4.813	T .500 t .375	21.32	LE 6.813 SE 4.313	T .906 t .625	38.50	LE 6.875 SE 4.063	T .875 t .750	37.31
8 x 6	8.625	6.625	6	LE 7.625 SE 5.761	T .500 t .432	22.32	LE 6.813 SE 5.187	T .906 t .719	40.30	LE 6.875 SE 4.897	T .875 t .864	39.06
10 x 4	10.750	4.500	7	LE 9.750 SE 3.826	T .500 t .337	27.68	LE 8.500 SE 3.438	T 1.125 t .531	62.30	—	—	—
10 x 5	10.750	5.563	7	LE 9.750 SE 4.813	T .500 t .375	31.40	LE 8.500 SE 4.313	T 1.125 t .625	70.60	—	—	—
10 x 6	10.750	6.625	7	LE 9.750 SE 5.761	T .500 t .432	32.61	LE 8.500 SE 5.187	T 1.125 t .719	73.30	—	—	—
10 x 8	10.750	8.625	7	LE 9.750 SE 7.625	T .500 t .500	34.34	LE 8.500 SE 6.813	T 1.125 t .906	77.10	—	—	—
12 x 5	12.750	5.563	8	LE 11.750 SE 4.813	T .500 t .375	42.78	LE 10.126 SE 4.313	T 1.312 t .625	112.00	—	—	—
12 x 6	12.750	6.625	8	LE 11.750 SE 5.761	T .500 t .432	44.42	LE 10.126 SE 5.187	T 1.312 t .719	116.00	—	—	—
12 x 8	12.750	8.625	8	LE 11.750 SE 7.625	T .500 t .500	46.06	LE 10.126 SE 6.813	T 1.312 t .906	120.00	—	—	—
12 x 10	12.750	10.750	8	LE 11.750 SE 9.750	T .500 t .500	47.70	LE 10.126 SE 8.500	T 1.312 t 1.125	124.00	—	—	—
14 x 6	14.000	6.625	13	LE 13.000 SE 5.761	T .500 t .432	77.81	LE 11.188 SE 5.187	T 1.406 t .719	—	—	—	—
14 x 8	14.000	8.625	13	LE 13.000 SE 7.625	T .500 t .500	81.22	LE 11.188 SE 6.813	T 1.406 t .906	—	—	—	—
14 x 10	14.000	10.750	13	LE 13.000 SE 9.750	T .500 t .500	85.40	LE 11.188 SE 8.500	T 1.406 t 1.125	—	—	—	—
14 x 12	14.000	12.750	13	LE 13.000 SE 11.750	T .500 t .500	88.97	LE 11.188 SE 10.126	T 1.406 t 1.312	—	—	—	—
16 x 8	16.000	8.625	14	LE 15.000 SE 7.625	T .500 t .500	97.49	LE 12.812 SE 6.813	T 1.594 t .906	—	—	—	—
16 x 10	16.000	10.750	14	LE 15.000 SE 9.750	T .500 t .500	102.00	LE 12.812 SE 8.500	T 1.594 t 1.125	—	—	—	—
16 x 12	16.000	12.750	14	LE 15.000 SE 11.750	T .500 t .500	105.00	LE 12.812 SE 10.126	T 1.594 t 1.312	—	—	—	—
16 x 14	16.000	14.000	14	LE 15.000 SE 13.000	T .500 t .500	108.00	LE 12.812 SE 11.188	T 1.594 t 1.406	—	—	—	—
18 x 10	18.000	10.750	15	LE 17.000 SE 9.750	T .500 t .500	120.00	LE 14.438 SE 8.500	T 1.781 t 1.125	—	—	—	—
18 x 12	18.000	12.750	15	LE 17.000 SE 11.750	T .500 t .500	126.00	LE 14.438 SE 10.126	T 1.781 t 1.312	—	—	—	—
18 x 14	18.000	14.000	15	LE 17.000 SE 13.000	T .500 t .500	127.00	LE 14.438 SE 11.188	T 1.781 t 1.406	—	—	—	—
18 x 16	18.000	16.000	15	LE 17.000 SE 15.000	T .500 t .500	130.00	LE 14.438 SE 12.812	T 1.781 t 1.594	—	—	—	—
20 x 12	20.000	12.750	20	LE 19.000 SE 11.750	T .500 t .500	189.00	LE 16.062 SE 10.126	T 1.969 t 1.312	—	—	—	—
20 x 14	20.000	14.000	20	LE 19.000 SE 13.000	T .500 t .500	192.00	LE 16.062 SE 11.188	T 1.969 t 1.406	—	—	—	—
20 x 16	20.000	16.000	20	LE 19.000 SE 15.000	T .500 t .500	195.00	LE 16.062 SE 12.812	T 1.969 t 1.594	—	—	—	—
20 x 18	20.000	18.000	20	LE 19.000 SE 17.000	T .500 t .500	198.00	LE 16.062 SE 14.438	T 1.969 t 1.781	—	—	—	—
24 x 16	24.000	16.000	20	LE 23.000 SE 15.000	T .500 t .500	226.00	LE 19.312 SE 12.812	T 2.344 t 1.594	—	—	—	—
24 x 18	24.000	18.000	20	LE 23.000 SE 17.000	T .500 t .500	230.00	LE 19.312 SE 14.438	T 2.344 t 1.781	—	—	—	—
24 x 20	24.000	20.000	20	LE 23.000 SE 19.000	T .500 t .500	234.00	LE 19.312 SE 16.062	T 2.344 t 1.969	—	—	—	—

obtained by multiplying by .33.
Ends are accurately machine tool cut and finished as shown on page 61.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

FLOWLINE® STRAIGHT CROSSES



PART X

STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ▶

NOM. PIPE SIZE	OUTSIDE DIAMETER (O. D.)	CENTER TO END (C)	• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
			PART X-5			PART X-1			PART X-4		
			SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
			Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
1	1.315	1½	1.185	.065	.50	1.097	.109	.72	1.049	.133	.65
1¼	1.660	1¾	1.530	.065	.93	1.442	.109	1.26	1.380	.140	1.32
1½	1.900	2¼	1.770	.065	1.18	1.682	.109	1.72	1.610	.145	1.91
2	2.375	2½	2.245	.065	1.49	2.157	.109	2.15	2.067	.154	2.86
2½	2.875	3	2.709	.083	2.66	2.635	.120	3.56	2.469	.203	4.90
3	3.500	3¾	3.334	.083	4.21	3.260	.120	4.48	3.068	.216	7.37
3½	4.000	3¾	3.834	.083	6.82	3.760	.120	6.76	3.548	.226	9.09
4	4.500	4¾	4.334	.083	8.92	4.260	.120	8.77	4.026	.237	11.74
5	5.563	4¾	5.345	.109	16.12	5.295	.134	15.46	5.047	.258	20.95
6	6.625	5¾	6.407	.109	21.32	6.357	.134	20.47	6.065	.280	24.49
8	8.625	7	8.407	.109	38.44	8.329	.148	39.67	7.981	.322	46.56
10	10.750	3½	10.482	.134	68.20	10.420	.165	67.85	10.020	.365	78.78
12	12.750	10	12.438	.156	102.00	12.390	.180	100.00	12.000	.375	138.00
14	14.000	11	13.688	.156	110.00	13.624	.188	123.00	13.250	.375	176.00
16	16.000	12	15.670	.165	142.00	15.624	.188	149.00	15.250	.375	222.00
18	18.000	13½	17.670	.165	185.00	17.624	.188	194.00	17.250	.375	289.00
20	20.000	15	19.624	.188	212.00	19.564	.218	262.00	19.250	.375	361.00
24	24.000	17	23.564	.218	369.00	23.500	.250	394.00	23.250	.375	503.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111. The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

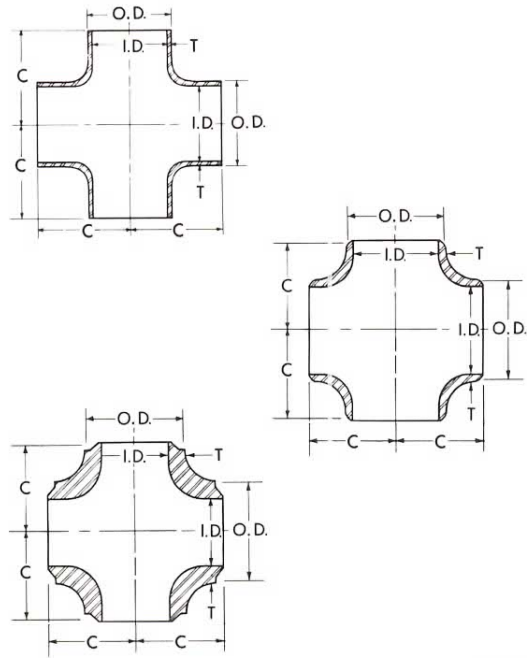
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33. Inco is a registered trademark of the International Nickel Company.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

- STAINLESS STEELS

PART X-8

PART X-16

PART X-XX

SCHEDULE 80S
Extra Heavy I.P.S.

SCHEDULE 160

XX STRONG WALL

NOM. PIPE SIZE	OUTSIDE DIAMETER (O. D.)	CENTER TO END (C)	PART X-8			PART X-16			PART X-XX		
			Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡	Inside Diameter (I. D.)	Wall Thickness (T)	Approx. Wt. in Pounds‡
1	1.315	1½	.957	.179	.86	.815	.250	1.19	.599	.358	1.72
1¼	1.660	1¾	1.278	.191	1.51	1.160	.250	1.96	.896	.382	3.02
1½	1.900	2¼	1.500	.200	2.27	1.338	.281	3.17	1.100	.400	4.54
2	2.375	2½	1.939	.218	3.53	1.689	.343	3.91	1.503	.436	7.06
2½	2.875	3	2.323	.276	6.97	2.125	.375	9.40	1.771	.552	13.90
3	3.500	3¾	2.900	.300	9.90	2.624	.438	11.33	2.300	.600	19.80
3½	4.000	3¾	3.364	.318	12.12	—	—	—	2.728	.636	24.24
4	4.500	4¼	3.826	.337	17.17	3.438	.531	26.95	3.152	.674	34.34
5	5.563	4¾	4.813	.375	25.25	4.313	.625	41.91	4.063	.750	50.50
6	6.625	5¾	5.761	.432	30.30	5.187	.719	50.29	4.897	.864	60.60
8	8.625	7	7.625	.500	62.62	6.813	.906	113.00	6.875	.875	109.00
10	10.750	8½	9.750	.500	111.00	8.500	1.125	249.00	—	—	—
12	12.750	10	11.750	.500	187.00	10.126	1.312	489.00	—	—	—
14	14.000	11	13.000	.500	212.00	11.188	1.406	—	—	—	—
16	16.000	12	15.000	.500	267.00	12.812	1.594	—	—	—	—
18	18.000	13½	17.000	.500	347.00	14.438	1.781	—	—	—	—
20	20.000	15	19.000	.500	434.00	16.062	1.969	—	—	—	—
24	24.000	17	23.000	.500	606.00	19.312	2.344	—	—	—	—

Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

REDUCING OUTLET CROSSES



STAINLESS STEELS

TYPES 304, 304L, 304H,
316, 316L, 316H

NICKEL ALLOYS

ALLOY 400, ALLOY 200

ALUMINUM ALLOYS

TYPES 3003-F, 6061-T6

REGULAR PRODUCTION ►

REGULAR PRODUCTION ►						• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
						PART Z-5			PART Z-1			PART Z-4		
NOM. PIPE SIZE		OUTSIDE DIAMETER (O.D.)		CENTER TO END		SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
1	¾	1.315	1.050	1½	1½	R 1.185 O .920	T .065 t .065	.44	R 1.097 O .884	T .109 t .083	.64	R 1.049 O .824	T .133 t .113	.59
1¼	¾	1.660	1.050	1¾	1¾	R 1.530 O .920	T .065 t .065	.81	R 1.442 O .884	T .109 t .083	1.11	R 1.380 O .824	T .140 t .113	1.61
1¼	1	1.660	1.315	1¾	1¾	R 1.530 O 1.185	T .065 t .065	.84	R 1.442 O 1.097	T .109 t .109	1.14	R 1.380 O 1.049	T .140 t .133	1.18
1½	¾	1.900	1.050	2¼	2¼	R 1.770 O .920	T .065 t .065	1.01	R 1.682 O .884	T .109 t .083	1.48	R 1.610 O .824	T .145 t .113	1.64
1½	1	1.900	1.315	2¼	2¼	R 1.770 O 1.185	T .065 t .065	1.03	R 1.682 O 1.097	T .109 t .109	1.52	R 1.610 O 1.049	T .145 t .133	1.68
1½	1¼	1.900	1.660	2¼	2¼	R 1.770 O 1.530	T .065 t .065	1.05	R 1.682 O 1.442	T .109 t .109	1.55	R 1.610 O 1.380	T .145 t .140	1.72
2	¾	2.375	1.050	2½	1¾	R 2.245 O .920	T .065 t .065	1.26	R 2.157 O .884	T .109 t .083	1.83	R 2.067 O .824	T .154 t .113	2.42
2	1	2.375	1.315	2½	2	R 2.245 O 1.185	T .065 t .065	1.27	R 2.157 O 1.097	T .109 t .109	1.84	R 2.067 O 1.049	T .154 t .133	2.45
2	1¼	2.375	1.660	2½	2¼	R 2.245 O 1.530	T .065 t .065	1.30	R 2.157 O 1.442	T .109 t .109	1.88	R 2.067 O 1.380	T .154 t .140	2.51
2	1½	2.375	1.900	2½	2¾	R 2.245 O 1.770	T .065 t .065	1.34	R 2.157 O 1.682	T .109 t .109	1.93	R 2.067 O 1.610	T .154 t .145	2.56
2½	1	2.875	1.315	3	2¼	R 2.709 O 1.185	T .083 t .065	2.27	R 2.635 O 1.097	T .120 t .109	3.02	R 2.469 O 1.049	T .203 t .133	4.16
2½	1¼	2.875	1.660	3	2½	R 2.709 O 1.530	T .083 t .065	2.29	R 2.635 O 1.442	T .120 t .109	3.06	R 2.469 O 1.380	T .203 t .140	4.21
2½	1½	2.875	1.900	3	2½	R 2.709 O 1.770	T .083 t .065	2.34	R 2.635 O 1.682	T .120 t .109	3.14	R 2.469 O 1.610	T .203 t .145	4.31
2½	2	2.875	2.375	3	2¾	R 2.709 O 2.245	T .083 t .065	2.39	R 2.635 O 2.157	T .120 t .109	3.21	R 2.469 O 2.067	T .203 t .154	4.40
3	1	3.500	1.315	3¾	2½	R 3.334 O 1.185	T .083 t .065	3.53	R 3.260 O 1.097	T .120 t .109	3.76	R 3.068 O 1.049	T .216 t .133	6.19
3	1¼	3.500	1.660	3¾	2¾	R 3.334 O 1.530	T .083 t .065	3.58	R 3.260 O 1.442	T .120 t .109	3.80	R 3.068 O 1.380	T .216 t .140	6.26
3	1½	3.500	1.900	3¾	2¾	R 3.334 O 1.770	T .083 t .065	3.63	R 3.260 O 1.682	T .120 t .109	3.85	R 3.068 O 1.610	T .216 t .145	6.34

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111. The "H" grades are generally not available in Schedules 5S. The "L" grades are normally not available in Schedules 160 and XX Strong.

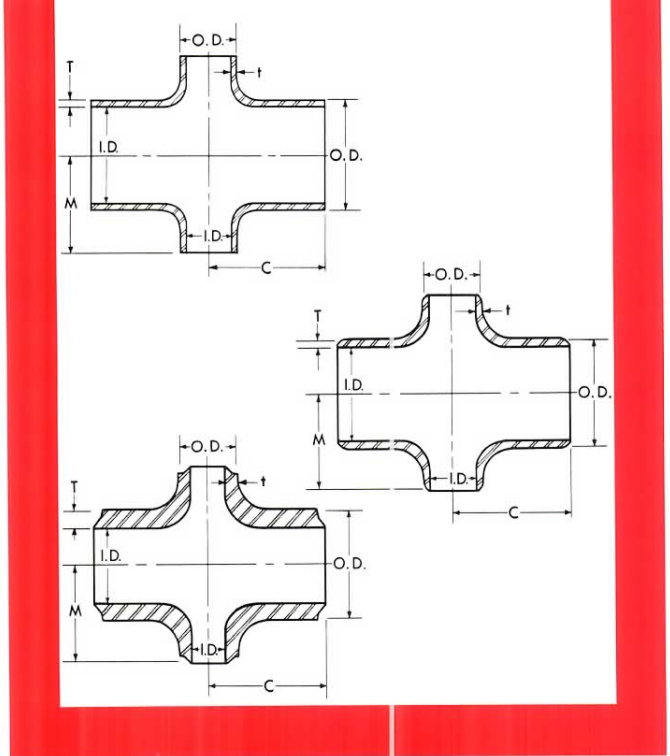
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

BUTT WELDING FITTINGS

SCHEDULES

5S, 10S, 40S, 80S, 160, XX Strong Wall

MADE IN ACCORDANCE
WITH ASME & MSS STANDARDS



REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
1	¾	1.315	1.050	1½	1½	R .957 O .742	T .179 t .154	.76	R .815 O .612	T .250 t .219	1.05	R .599 O .434	T .358 t .308	1.52
1¼	¾	1.660	1.050	1⅞	1⅞	R 1.278 O .742	T .191 t .154	1.33	R 1.160 O .612	T .250 t .219	1.74	R .896 O .434	T .382 t .308	2.62
1¼	1	1.660	1.315	1⅞	1⅞	R 1.278 O .957	T .191 t .179	1.36	R 1.160 O .815	T .250 t .250	1.78	R .896 O .599	T .382 t .358	2.72
1½	¾	1.900	1.050	2¼	2¼	R 1.500 O .742	T .200 t .154	1.94	R 1.338 O .612	T .281 t .219	2.71	R 1.100 O .434	T .400 t .308	3.88
1½	1	1.900	1.315	2¼	2¼	R 1.500 O .957	T .200 t .179	2.00	R 1.338 O .815	T .281 t .250	2.80	R 1.100 O .599	T .400 t .358	4.00
1½	1¼	1.900	1.660	2¼	2¼	R 1.500 O 1.278	T .200 t .191	2.04	R 1.338 O 1.160	T .281 t .250	2.85	R 1.100 O .896	T .400 t .382	4.08
2	¾	2.375	1.050	2½	1¾	R 1.939 O .742	T .218 t .154	3.00	R 1.689 O .612	T .343 t .219	4.71	R 1.503 O .434	T .436 t .308	6.00
2	1	2.375	1.315	2½	2	R 1.939 O .957	T .218 t .179	3.04	R 1.689 O .815	T .343 t .250	4.77	R 1.503 O .599	T .436 t .358	6.08
2	1¼	2.375	1.660	2½	2¼	R 1.939 O 1.278	T .218 t .191	3.11	R 1.689 O 1.160	T .343 t .250	4.88	R 1.503 O .896	T .436 t .382	6.22
2	1½	2.375	1.900	2½	2⅝	R 1.939 O 1.500	T .218 t .200	3.18	R 1.689 O 1.338	T .343 t .281	4.99	R 1.503 O 1.100	T .436 t .400	6.36
2½	1	2.875	1.315	3	2¼	R 2.323 O .957	T .276 t .179	5.91	R 2.125 O .815	T .375 t .250	7.97	R 1.771 O .599	T .552 t .358	11.82
2½	1¼	2.875	1.660	3	2½	R 2.323 O 1.278	T .276 t .191	5.99	R 2.125 O 1.160	T .375 t .250	8.08	R 1.771 O .896	T .552 t .382	11.98
2½	1½	2.875	1.900	3	2⅝	R 2.323 O 1.500	T .276 t .200	6.13	R 2.125 O 1.338	T .375 t .281	8.27	R 1.771 O 1.100	T .552 t .400	12.26
2½	2	2.875	2.375	3	2¾	R 2.323 O 1.939	T .276 t .218	6.27	R 2.125 O 1.689	T .375 t .343	8.46	R 1.771 O 1.503	T .552 t .436	12.54
3	1	3.500	1.315	3⅝	2⅝	R 2.900 O .957	T .300 t .179	8.31	R 2.624 O .815	T .438 t .250	10.22	R 2.300 O .599	T .600 t .358	16.62
3	1¼	3.500	1.660	3⅝	2¾	R 2.900 O 1.278	T .300 t .191	8.41	R 2.624 O 1.160	T .438 t .250	10.34	R 2.300 O .896	T .600 t .382	16.82
3	1½	3.500	1.900	3⅝	2⅞	R 2.900 O 1.500	T .300 t .200	8.51	R 2.624 O 1.338	T .438 t .281	10.46	R 2.300 O 1.100	T .600 t .400	17.02

Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

(continued on next page)

REDUCING OUTLET CROSSES

REGULAR PRODUCTION ►

REGULAR PRODUCTION ►						• STAINLESS STEELS			• STAINLESS STEELS • INCO ALLOYS			• STAINLESS STEELS • INCO ALLOYS • ALUMINUM ALLOYS		
						PART Z-5			PART Z-1			PART Z-4		
NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
3	2	3.500	2.375	3 ³ / ₈	3	R 3.334 O 2.245	T .083 t .065	3.70	R 3.260 O 2.157	T .120 t .109	3.94	R 3.068 O 2.067	T .216 t .154	6.48
3	2½	3.500	2.875	3 ³ / ₈	3¼	R 3.334 O 2.709	T .083 t .083	3.79	R 3.260 O 2.635	T .120 t .120	4.03	R 3.068 O 2.469	T .216 t .203	6.63
3½	1½	4.000	1.900	3¾	3⅝	R 3.834 O 1.770	T .083 t .065	5.79	R 3.760 O 1.682	T .120 t .109	5.74	R 3.548 O 1.610	T .226 t .145	7.72
3½	2	4.000	2.375	3¾	3¼	R 3.834 O 2.245	T .083 t .065	5.86	R 3.760 O 2.157	T .120 t .109	5.80	R 3.548 O 2.067	T .226 t .154	7.81
3½	2½	4.000	2.875	3¾	3½	R 3.834 O 2.709	T .083 t .083	6.00	R 3.760 O 2.635	T .120 t .120	5.94	R 3.548 O 2.469	T .226 t .203	9.05
3½	3	4.000	3.500	3¾	3 ⁵ / ₈	R 3.834 O 3.334	T .083 t .083	6.14	R 3.760 O 3.260	T .120 t .120	6.08	R 3.548 O 3.068	T .226 t .216	9.19
4	1½	4.500	1.900	4⅛	3 ³ / ₈	R 4.334 O 1.770	T .083 t .065	7.50	R 4.260 O 1.682	T .120 t .109	7.36	R 4.026 O 1.610	T .237 t .145	9.85
4	2	4.500	2.375	4⅛	3½	R 4.334 O 2.245	T .083 t .065	7.59	R 4.260 O 2.157	T .120 t .109	7.45	R 4.026 O 2.067	T .237 t .154	9.97
4	2½	4.500	2.875	4⅛	3¾	R 4.334 O 2.709	T .083 t .083	7.67	R 4.260 O 2.635	T .120 t .120	7.54	R 4.026 O 2.469	T .237 t .203	10.10
4	3	4.500	3.500	4⅛	3 ⁷ / ₈	R 4.334 O 3.334	T .083 t .083	7.85	R 4.260 O 3.260	T .120 t .120	7.71	R 4.026 O 3.068	T .237 t .216	10.33
4	3½	4.500	4.000	4⅛	4	R 4.334 O 3.834	T .083 t .083	8.03	R 4.260 O 3.760	T .120 t .120	7.89	R 4.026 O 3.548	T .237 t .226	10.50
5	2	5.563	2.375	4 ⁷ / ₈	4⅛	R 5.345 O 2.245	T .109 t .065	13.54	R 5.295 O 2.157	T .134 t .109	12.98	R 5.047 O 2.067	T .258 t .154	17.60
5	2½	5.563	2.875	4 ⁷ / ₈	4¼	R 5.345 O 2.709	T .109 t .083	13.70	R 5.295 O 2.635	T .134 t .120	13.14	R 5.047 O 2.469	T .258 t .203	17.80
5	3	5.563	3.500	4 ⁷ / ₈	4 ³ / ₈	R 5.345 O 3.334	T .109 t .083	13.86	R 5.295 O 3.260	T .134 t .120	13.29	R 5.047 O 3.068	T .258 t .216	18.01
5	3½	5.563	4.000	4 ⁷ / ₈	4½	R 5.345 O 3.834	T .109 t .083	14.18	R 5.295 O 3.760	T .134 t .120	13.60	R 5.047 O 3.548	T .258 t .226	18.44
5	4	5.563	4.500	4 ⁷ / ₈	4 ⁵ / ₈	R 5.345 O 4.334	T .109 t .083	14.50	R 5.295 O 4.260	T .134 t .120	13.91	R 5.047 O 4.026	T .258 t .237	18.80
6	2½	6.625	2.875	5 ⁵ / ₈	4¾	R 6.407 O 2.709	T .109 t .083	17.95	R 6.357 O 2.635	T .134 t .120	17.19	R 6.065 O 2.469	T .280 t .203	20.57
6	3	6.625	3.500	5 ⁵ / ₈	4 ⁷ / ₈	R 6.407 O 3.334	T .109 t .083	18.13	R 6.357 O 3.260	T .134 t .120	17.39	R 6.065 O 3.068	T .280 t .216	26.58
6	3½	6.625	4.000	5 ⁵ / ₈	5	R 6.407 O 3.834	T .109 t .083	18.34	R 6.357 O 3.760	T .134 t .120	17.60	R 6.065 O 3.548	T .280 t .226	21.05
6	4	6.625	4.500	5 ⁵ / ₈	5⅝	R 6.407 O 4.334	T .109 t .083	18.76	R 6.357 O 4.260	T .134 t .120	18.01	R 6.065 O 4.026	T .280 t .237	21.55
6	5	6.625	5.563	5 ⁵ / ₈	5 ³ / ₈	R 6.407 O 5.345	T .109 t .109	19.19	R 6.357 O 5.295	T .134 t .134	18.42	R 6.065 O 5.047	T .280 t .258	22.03
8	3	8.625	3.500	7	6	R 8.407 O 3.334	T .109 t .083	32.28	R 8.329 O 3.260	T .148 t .120	33.35	R 7.981 O 3.068	T .322 t .216	39.10
8	3½	8.625	4.000	7	6	R 8.407 O 3.834	T .109 t .083	32.67	R 8.329 O 3.760	T .148 t .120	33.72	R 7.981 O 3.548	T .322 t .226	39.57
8	4	8.625	4.500	7	6⅝	R 8.407 O 4.334	T .109 t .083	33.06	R 8.329 O 4.260	T .148 t .120	34.12	R 7.981 O 4.026	T .322 t .237	40.03
8	5	8.625	5.563	7	6 ³ / ₈	R 8.407 O 5.345	T .109 t .109	33.82	R 8.329 O 5.295	T .148 t .134	34.91	R 7.981 O 5.047	T .322 t .258	40.96
8	6	8.625	6.625	7	6 ⁵ / ₈	R 8.407 O 6.407	T .109 t .109	34.59	R 8.329 O 6.357	T .148 t .134	35.70	R 7.981 O 6.065	T .322 t .280	41.90
10	4	10.750	4.500	8½	7¼	R 10.482 O 4.334	T .134 t .083	57.97	R 10.420 O 4.260	T .165 t .120	57.67	R 10.020 O 4.026	T .365 t .237	56.86
10	5	10.750	5.563	8½	7½	R 10.482 O 5.345	T .134 t .109	58.65	R 10.420 O 5.295	T .165 t .134	58.35	R 10.020 O 5.047	T .365 t .258	67.75
10	6	10.750	6.625	8½	7 ⁵ / ₈	R 10.482 O 6.407	T .134 t .109	60.01	R 10.420 O 6.357	T .165 t .134	59.71	R 10.020 O 6.065	T .365 t .280	69.32
10	8	10.750	8.625	8½	8	R 10.482 O 8.407	T .134 t .109	61.38	R 10.420 O 8.329	T .165 t .148	61.06	R 10.020 O 7.981	T .365 t .322	70.90

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

The "H" grades are generally not available in Schedules 5S. The "L" grades are

normally not available in Schedules 160 and XX Strong.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are

REDUCING OUTLET CROSSES

REGULAR PRODUCTION ►

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
3	2	3.500	2.375	3 ³ / ₈	3	R 2.900 O 1.939	T .300 t .218	8.70	R 2.624 O 1.689	T .438 t .343	10.70	R 2.300 O 1.503	T .600 t .436	17.40
3	2½	3.500	2.875	3 ³ / ₈	3¼	R 2.900 O 2.323	T .300 t .276	8.90	R 2.624 O 2.125	T .438 t .375	10.94	R 2.300 O 1.771	T .600 t .552	17.80
3½	1½	4.000	1.900	3¾	3½	R 3.364 O 1.500	T .318 t .200	10.30	— —	— —	— —	R 2.728 O 1.100	T .636 t .400	20.60
3½	2	4.000	2.375	3¾	3¼	R 3.364 O 1.939	T .318 t .218	10.42	— —	— —	— —	R 2.728 O 1.503	T .636 t .436	20.84
3½	2½	4.000	2.875	3¾	3½	R 3.364 O 2.323	T .318 t .276	10.66	— —	— —	— —	R 2.728 O 1.771	T .636 t .552	21.32
3½	3	4.000	3.500	3¾	3 ⁵ / ₈	R 3.364 O 2.900	T .318 t .300	10.90	— —	— —	— —	R 2.728 O 2.300	T .636 t .600	21.80
4	1½	4.500	1.900	4½	3 ³ / ₈	R 3.826 O 1.500	T .337 t .200	14.42	R 3.438 O 1.338	T .531 t .281	22.63	R 3.152 O 1.100	T .674 t .400	28.84
4	2	4.500	2.375	4½	3½	R 3.826 O 1.939	T .337 t .218	14.59	R 3.438 O 1.689	T .531 t .343	22.90	R 3.152 O 1.503	T .674 t .436	29.18
4	2½	4.500	2.875	4½	3¾	R 3.826 O 2.323	T .337 t .276	14.76	R 3.438 O 2.125	T .531 t .375	23.17	R 3.152 O 1.771	T .674 t .552	29.52
4	3	4.500	3.500	4½	3 ⁷ / ₈	R 3.826 O 2.900	T .337 t .300	15.10	R 3.438 O 2.624	T .531 t .438	23.70	R 3.152 O 2.300	T .674 t .600	30.20
4	3½	4.500	4.000	4½	4	R 3.826 O 3.364	T .337 t .318	15.45	— —	— —	— —	R 3.152 O 2.728	T .674 t .636	30.90
5	2	5.563	2.375	4 ⁷ / ₈	4½	R 4.813 O 1.939	T .375 t .218	21.21	R 4.313 O 1.689	T .625 t .343	35.20	R 4.063 O 1.503	T .750 t .436	42.42
5	2½	5.563	2.875	4 ⁷ / ₈	4¾	R 4.813 O 2.323	T .375 t .276	21.46	R 4.313 O 2.125	T .625 t .375	35.62	R 4.063 O 1.771	T .750 t .552	42.92
5	3	5.563	3.500	4 ⁷ / ₈	4 ³ / ₈	R 4.813 O 2.900	T .375 t .300	21.71	R 4.313 O 2.624	T .625 t .438	36.03	R 4.063 O 2.300	T .750 t .600	43.42
5	3½	5.563	4.000	4 ⁷ / ₈	4½	R 4.813 O 3.364	T .375 t .318	22.22	— —	— —	— —	R 4.063 O 2.728	T .750 t .636	44.44
5	4	5.563	4.500	4 ⁷ / ₈	4 ⁵ / ₈	R 4.813 O 3.826	T .375 t .337	22.72	R 4.313 O 3.438	T .625 t .531	37.71	R 4.063 O 3.152	T .750 t .674	45.44
6	2½	6.625	2.875	5 ⁵ / ₈	4¾	R 5.761 O 2.323	T .432 t .276	25.45	R 5.187 O 2.125	T .719 t .375	42.24	R 4.897 O 1.771	T .864 t .552	50.90
6	3	6.625	3.500	5 ⁵ / ₈	4 ⁷ / ₈	R 5.761 O 2.900	T .432 t .300	25.75	R 5.187 O 2.624	T .719 t .438	42.74	R 4.897 O 2.300	T .864 t .600	51.50
6	3½	6.625	4.000	5 ⁵ / ₈	5	R 5.761 O 3.364	T .432 t .318	26.05	— —	— —	— —	R 4.897 O 2.728	T .864 t .636	52.10
6	4	6.625	4.500	5 ⁵ / ₈	5½	R 5.761 O 3.826	T .432 t .337	26.66	R 5.187 O 3.438	T .719 t .531	44.25	R 4.897 O 3.152	T .864 t .674	53.32
6	5	6.625	5.563	5 ⁵ / ₈	5 ³ / ₈	R 5.761 O 4.813	T .432 t .375	27.27	R 5.187 O 4.313	T .719 t .625	45.26	R 4.897 O 4.063	T .864 t .750	54.54
8	3	8.625	3.500	7	6	R 7.625 O 2.900	T .500 t .300	52.60	R 6.813 O 2.624	T .906 t .438	95.20	R 6.875 O 2.300	T .875 t .600	92.05
8	3½	8.625	4.000	7	6	R 7.625 O 3.364	T .500 t .318	53.22	— —	— —	— —	R 6.875 O 2.728	T .875 t .636	94.18
8	4	8.625	4.500	7	6½	R 7.625 O 3.826	T .500 t .337	53.85	R 6.813 O 3.438	T .906 t .531	97.46	R 6.875 O 3.152	T .875 t .674	94.23
8	5	8.625	5.563	7	6 ³ / ₈	R 7.625 O 4.813	T .500 t .375	55.10	R 6.813 O 4.313	T .906 t .625	99.73	R 6.875 O 4.063	T .875 t .750	96.42
8	6	8.625	6.625	7	6 ⁵ / ₈	R 7.625 O 5.761	T .500 t .432	56.36	R 6.813 O 5.187	T .906 t .719	102.00	R 6.875 O 4.897	T .875 t .864	98.63
10	4	10.750	4.500	8½	7¼	R 9.750 O 3.826	T .500 t .337	94.43	R 8.500 O 3.438	T 1.125 t .531	212.00	— —	— —	— —
10	5	10.750	5.563	8½	7½	R 9.750 O 4.813	T .500 t .375	95.55	R 8.500 O 4.313	T 1.125 t .625	214.00	— —	— —	— —
10	6	10.750	6.625	8½	7 ⁵ / ₈	R 9.750 O 5.761	T .500 t .432	97.76	R 8.500 O 5.187	T 1.125 t .719	219.00	— —	— —	— —
10	8	10.750	8.625	8½	8	R 9.750 O 7.625	T .500 t .500	100.00	R 8.500 O 6.813	T 1.125 t .906	225.00	— —	— —	— —

obtained by multiplying by .33.
Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

(continued on next page)

REDUCING OUTLET CROSSES

REGULAR PRODUCTION ▶

• STAINLESS STEELS

• STAINLESS STEELS
• INCO ALLOYS

• STAINLESS STEELS
• INCO ALLOYS
• ALUMINUM ALLOYS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		SCHEDULE 5S Featherweight			SCHEDULE 10S Light I.P.S.			SCHEDULE 40S Standard I.P.S.		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
12	5	12.750	5.563	10	8½	R 12.438 O 5.345	T .156 t .109	87.50	R 12.390 O 5.295	T .180 t .134	85.04	R 12.000 O 5.047	T .375 t .258	117.00
12	6	12.750	6.625	10	8¾	R 12.438 O 6.407	T .156 t .109	88.50	R 12.390 O 6.357	T .180 t .134	86.04	R 12.000 O 6.065	T .375 t .280	119.00
12	8	12.750	8.625	10	9	R 12.438 O 8.407	T .156 t .109	90.50	R 12.390 O 8.329	T .180 t .148	88.04	R 12.000 O 7.981	T .375 t .322	121.00
12	10	12.750	10.750	10	9½	R 12.438 O 10.482	T .156 t .134	92.60	R 12.390 O 10.420	T .180 t .165	90.04	R 12.000 O 10.020	T .375 t .365	124.00
14	6	14.000	6.625	11	9¾	R 13.688 O 6.407	T .156 t .109	93.80	R 13.624 O 6.357	T .188 t .134	104.00	R 13.250 O 6.065	T .375 t .280	149.00
14	8	14.000	8.625	11	9¾	R 13.688 O 8.407	T .156 t .109	94.90	R 13.624 O 8.329	T .188 t .148	106.00	R 13.250 O 7.981	T .375 t .322	151.00
14	10	14.000	10.750	11	10½	R 13.688 O 10.482	T .156 t .134	97.10	R 13.624 O 10.420	T .188 t .165	108.00	R 13.250 O 10.020	T .375 t .365	155.00
14	12	14.000	12.750	11	10¾	R 13.688 O 12.438	T .156 t .156	99.32	R 13.624 O 12.390	T .188 t .180	110.00	R 13.250 O 12.000	T .375 t .375	158.00
16	6	16.000	6.625	12	10¾	R 15.670 O 6.407	T .165 t .109	119.00	R 15.624 O 6.357	T .188 t .134	125.00	R 15.250 O 6.065	T .375 t .280	185.00
16	8	16.000	8.625	12	10¾	R 15.670 O 8.407	T .165 t .109	121.00	R 15.624 O 8.329	T .188 t .148	126.00	R 15.250 O 7.981	T .375 t .322	188.00
16	10	16.000	10.750	12	11½	R 15.670 O 10.482	T .165 t .134	122.00	R 15.624 O 10.420	T .188 t .165	129.00	R 15.250 O 10.020	T .375 t .365	190.00
16	12	16.000	12.750	12	11¾	R 15.670 O 12.438	T .165 t .156	125.00	R 15.624 O 12.390	T .188 t .180	131.00	R 15.250 O 12.000	T .375 t .375	194.00
16	14	16.000	14.000	12	12	R 15.670 O 13.688	T .165 t .156	127.00	R 15.624 O 13.624	T .188 t .188	134.00	R 15.250 O 13.250	T .375 t .375	200.00
18	8	18.000	8.625	13½	11¾	R 17.670 O 8.407	T .165 t .109	155.00	R 17.624 O 8.329	T .188 t .148	163.00	R 17.250 O 7.981	T .375 t .322	242.00
18	10	18.000	10.750	13½	12½	R 17.670 O 10.482	T .165 t .134	156.00	R 17.624 O 10.420	T .188 t .165	164.00	R 17.250 O 10.020	T .375 t .365	245.00
18	12	18.000	12.750	13½	12¾	R 17.670 O 12.438	T .165 t .156	158.00	R 17.624 O 12.390	T .188 t .180	166.00	R 17.250 O 12.000	T .375 t .375	248.00
18	14	18.000	14.000	13½	13	R 17.670 O 13.688	T .165 t .156	162.00	R 17.624 O 13.624	T .188 t .188	170.00	R 17.250 O 13.250	T .375 t .375	253.00
18	16	18.000	16.000	13½	13	R 17.670 O 15.670	T .165 t .165	166.00	R 17.624 O 15.624	T .188 t .188	175.00	R 17.250 O 15.250	T .375 t .375	259.00
20	8	20.000	8.625	15	12¾	R 19.624 O 8.407	T .188 t .109	175.00	R 19.564 O 8.329	T .218 t .148	217.00	R 19.250 O 7.981	T .375 t .322	300.00
20	10	20.000	10.750	15	13½	R 19.624 O 10.482	T .188 t .134	177.00	R 19.564 O 10.420	T .218 t .165	219.00	R 19.250 O 10.020	T .375 t .365	303.00
20	12	20.000	12.750	15	13¾	R 19.624 O 12.438	T .188 t .156	179.00	R 19.564 O 12.390	T .218 t .180	222.00	R 19.250 O 12.000	T .375 t .375	307.00
20	14	20.000	14.000	15	14	R 19.624 O 13.688	T .188 t .156	182.00	R 19.564 O 13.624	T .218 t .188	225.00	R 19.250 O 13.250	T .375 t .375	311.00
20	16	20.000	16.000	15	14	R 19.624 O 15.670	T .188 t .165	186.00	R 19.564 O 15.624	T .218 t .188	230.00	R 19.250 O 15.250	T .375 t .375	318.00
20	18	20.000	18.000	15	14½	R 19.624 O 17.670	T .188 t .165	191.00	R 19.564 O 17.624	T .218 t .188	235.00	R 19.250 O 17.250	T .375 t .375	325.00
24	10	24.000	10.750	17	15½	R 23.564 O 10.482	T .218 t .134	306.00	R 23.500 O 10.420	T .250 t .165	326.00	R 23.250 O 10.020	T .375 t .365	417.00
24	12	24.000	12.750	17	15¾	R 23.564 O 12.438	T .218 t .156	310.00	R 23.500 O 12.390	T .250 t .180	331.00	R 23.250 O 12.000	T .375 t .375	422.00
24	14	24.000	14.000	17	16	R 23.564 O 13.688	T .218 t .156	313.00	R 23.500 O 13.624	T .250 t .188	334.00	R 23.250 O 13.250	T .375 t .375	427.00
24	16	24.000	16.000	17	16	R 23.564 O 15.670	T .218 t .165	317.00	R 23.500 O 15.624	T .250 t .188	339.00	R 23.250 O 15.250	T .375 t .375	432.00
24	18	24.000	18.000	17	16½	R 23.564 O 17.670	T .218 t .165	325.00	R 23.500 O 17.624	T .250 t .188	347.00	R 23.250 O 17.250	T .375 t .375	442.00
24	20	24.000	20.000	17	17	R 23.564 O 19.624	T .218 t .188	332.00	R 23.500 O 19.564	T .250 t .218	354.00	R 23.250 O 19.250	T .375 t .375	449.00

Other analysis and metals can be furnished where quantity justifies production. See pages 62, 110 and 111.

The "H" grades are generally not available in Schedules 5S. The "L" grades are

normally not available in Schedules 160 and XX Strong.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are

REDUCING OUTLET CROSSES

REGULAR PRODUCTION ▶

- STAINLESS STEELS
- INCO ALLOYS
- ALUMINUM ALLOYS

• STAINLESS STEELS

NOM. PIPE SIZE		OUTSIDE DIAMETER (O. D.)		CENTER TO END		SCHEDULE 80S Extra Heavy I.P.S.			SCHEDULE 160			XX STRONG WALL		
Run	Outlet	Run (O.D.)	Outlet (O.D.)	Run (C)	Outlet (M)	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡	Inside Diam. (I.D.) Run—R Outlet—O	Wall Thickness Run—T Outlet—t	Approx. Wt. in Pounds‡
12	5	12.750	5.563	10	8½	R 11.750 O 4.813	T .500 t .375	158.00	R 10.126 O 4.313	T 1.312 t .625	413.00	—	—	—
12	6	12.750	6.625	10	8⅝	R 11.750 O 5.761	T .500 t .432	160.00	R 10.126 O 5.187	T 1.312 t .719	419.00	—	—	—
12	8	12.750	8.625	10	9	R 11.750 O 7.625	T .500 t .500	164.00	R 10.126 O 6.813	T 1.312 t .906	429.00	—	—	—
12	10	12.750	10.750	10	9½	R 11.750 O 9.750	T .500 t .500	167.00	R 10.126 O 8.500	T 1.312 t 1.125	437.00	—	—	—
14	6	14.000	6.625	11	9¾	R 13.000 O 5.761	T .500 t .432	179.00	R 11.188 O 5.187	T 1.406 t .719	—	—	—	—
14	8	14.000	8.625	11	9¾	R 13.000 O 7.625	T .500 t .500	182.00	R 11.188 O 6.813	T 1.406 t .906	—	—	—	—
14	10	14.000	10.750	11	10⅛	R 13.000 O 9.750	T .500 t .500	187.00	R 11.188 O 8.500	T 1.406 t 1.125	—	—	—	—
14	12	14.000	12.750	11	10⅝	R 13.000 O 11.750	T .500 t .500	190.00	R 11.188 O 10.126	T 1.406 t 1.312	—	—	—	—
16	6	16.000	6.625	12	10¾	R 15.000 O 5.761	T .500 t .432	224.00	R 12.812 O 5.187	T 1.594 t .719	—	—	—	—
16	8	16.000	8.625	12	10¾	R 15.000 O 7.625	T .500 t .500	227.00	R 12.812 O 6.813	T 1.594 t .906	—	—	—	—
16	10	16.000	10.750	12	11⅛	R 15.000 O 9.750	T .500 t .500	230.00	R 12.812 O 8.500	T 1.594 t 1.125	—	—	—	—
16	12	16.000	12.750	12	11⅝	R 15.000 O 11.750	T .500 t .500	235.00	R 12.812 O 10.126	T 1.594 t 1.312	—	—	—	—
16	14	16.000	14.000	12	12	R 15.000 O 13.000	T .500 t .500	240.00	R 12.812 O 11.188	T 1.594 t 1.406	—	—	—	—
18	8	18.000	8.625	13½	11¾	R 17.000 O 7.625	T .500 t .500	292.00	R 14.438 O 6.813	T 1.781 t .906	—	—	—	—
18	10	18.000	10.750	13½	12⅛	R 17.000 O 9.750	T .500 t .500	294.00	R 14.438 O 8.500	T 1.781 t 1.125	—	—	—	—
18	12	18.000	12.750	13½	12⅝	R 17.000 O 11.750	T .500 t .500	299.00	R 14.438 O 10.126	T 1.781 t 1.312	—	—	—	—
18	14	18.000	14.000	13½	13	R 17.000 O 13.000	T .500 t .500	306.00	R 14.438 O 11.188	T 1.781 t 1.406	—	—	—	—
18	16	18.000	16.000	13½	13	R 17.000 O 15.000	T .500 t .500	312.00	R 14.438 O 12.812	T 1.781 t 1.594	—	—	—	—
20	8	20.000	8.625	15	12¾	R 19.000 O 7.625	T .500 t .500	360.00	R 16.062 O 6.813	T 1.969 t .906	—	—	—	—
20	10	20.000	10.750	15	13⅛	R 19.000 O 9.750	T .500 t .500	364.00	R 16.062 O 8.500	T 1.969 t 1.125	—	—	—	—
20	12	20.000	12.750	15	13⅝	R 19.000 O 11.750	T .500 t .500	368.00	R 16.062 O 10.126	T 1.969 t 1.312	—	—	—	—
20	14	20.000	14.000	15	14	R 19.000 O 13.000	T .500 t .500	373.00	R 16.062 O 11.188	T 1.969 t 1.406	—	—	—	—
20	16	20.000	16.000	15	14	R 19.000 O 15.000	T .500 t .500	381.00	R 16.062 O 12.812	T 1.969 t 1.594	—	—	—	—
20	18	20.000	18.000	15	14½	R 19.000 O 17.000	T .500 t .500	390.00	R 16.062 O 14.438	T 1.969 t 1.781	—	—	—	—
24	10	24.000	10.750	17	15⅛	R 23.000 O 9.750	T .500 t .500	503.00	R 19.312 O 8.500	T 2.344 t 1.125	—	—	—	—
24	12	24.000	12.750	17	15⅝	R 23.000 O 11.750	T .500 t .500	509.00	R 19.312 O 10.126	T 2.344 t 1.312	—	—	—	—
24	14	24.000	14.000	17	16	R 23.000 O 13.000	T .500 t .500	515.00	R 19.312 O 11.188	T 2.344 t 1.406	—	—	—	—
24	16	24.000	16.000	17	16	R 23.000 O 15.000	T .500 t .500	521.00	R 19.312 O 12.812	T 2.344 t 1.594	—	—	—	—
24	18	24.000	18.000	17	16½	R 23.000 O 17.000	T .500 t .500	533.00	R 19.312 O 14.438	T 2.344 t 1.781	—	—	—	—
24	20	24.000	20.000	17	17	R 23.000 O 19.000	T .500 t .500	554.00	R 19.312 O 16.062	T 2.344 t 1.969	—	—	—	—

obtained by multiplying .33.
Ends are accurately machine tool cut and finished as shown on page 61.
Made in accordance with ASME B16.9 and MSS SP-43 where applicable.

All dimensions are in inches. See metric conversion charts on pages 112 through 123, and dimensional tolerances on pages 60 and 61.

DIMENSIONAL TOLERANCES OF CORROSION-RESISTANT WELDING FITTINGS LISTED IN THIS BULLETIN

The tolerances given below have been approved by the American Society of Mechanical Engineers (ASME) and The Manufacturers Standardization Society (MSS), and are in accordance with ASME Specification B16.9 and MSS SP-43, where applicable. The limits as given are maximum allowances, but do to our methods of manufacture and inspection the **FLOWLINE** fittings listed in this bulletin are normally much closer to nominal dimensions than to permitted extremes.

▶ **WALL THICKNESS**
Schedules 5S, 10S, 40S, 80S, 160,
and XX Strong Wall

The wall thickness of Schedule 5S, 10S, 40S, 80S, 160, and XX Strong Wall fittings shall not at any point be less than 87½% of nominal thickness.

▶ **OUTSIDE DIAMETER**
Schedules 5S, 10S, 40S, 80S, 160, and
XX Strong Wall

The outside diameter of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall fittings at beginning of chamfer shall not vary from nominal more than:

For sizes up to and including		
2½"	+ 1/16"	— 1/32"
For sizes 3" through 4"	+ 1/16"	— 1/16"
For sizes 5" through 8"	+ 3/32"	— 1/16"
For sizes 10" through 18"	+ 5/32"	— 1/8"
For sizes 20" and 24"	+ 1/4"	— 3/16"

▶ **INSIDE DIAMETER**
Schedules 5S, 10S, 40S, 80S, 160, and
XX Strong Wall

The inside diameter of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall fittings at welding ends shall not vary from nominal more than:

For sizes up to and including		
2½"	+ 1/32"	— 1/32"
For sizes 3" through 8"	+ 1/16"	— 1/16"
For sizes 10" through 18"	+ 1/8"	— 1/8"
For sizes 20" and 24"	+ 3/16"	— 3/16"

▶ **ANGLE ANGULARITY**
Schedules 5S, 10S, 40S, 80S, 160,
and XX Strong Wall

The off angle tolerance for Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall fittings is:

For sizes up to and including 4"	1/32"
For sizes 5" through 8"	1/16"
For sizes 10" through 16"	3/32"
For sizes 18" through 24"	1/8"

PLANE ANGULARITY
Schedules 5S, 10S, 40S, 80S, 160,
and XX Strong Wall

The off plane tolerance for Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall fittings is:

For sizes up to and including 4"	1/16"
For sizes 5" through 8"	1/8"
For sizes 10" and 12"	3/16"
For sizes 14" through 18"	1/4"
For sizes 20" and 24"	3/8"

▶ **CENTER-TO-END OF 90° ELBOWS,**
45° ELBOWS AND TEES
Schedule 5S, 10S, 40S, 80S, 160,
and XX Strong Wall

This dimension of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall fittings shall not vary from manufacturer's published figures more than:

For sizes up to and including 8"	+ 1/16"	— 1/16"
For sizes 10" through 24"	+ 3/32"	— 3/32"

▶ **CENTER-TO-CENTER OF 180° RETURNS,**
Schedule 5S, 10S, 40S, 80S, 160,
and XX Strong Wall

The center-to-center tolerance of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall 180° Returns is:

For sizes up to and including 8"	+ 1/4"	— 1/4"
For sizes 10" through 24"	+ 3/8"	— 3/8"

▶ **BACK-TO-FACE OF 180° RETURNS**
Schedule 5S, 10S, 40S, 80S, 160,
and XX Strong Wall

The back-to-face tolerance of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall 180° Returns is:

For all sizes	+ 1/4"	— 1/4"
-------------------------	--------	--------

▶ **ALIGNMENT OF ENDS OF 180° RETURNS**
Schedule 5S, 10S, 40S, 80S, 160,
and XX Strong Wall

The alignment of ends of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall 180° Returns (variation between back-to-face dimensions) shall not vary more than:

For sizes up to and including 8"	+ 1/32"	— 1/32"
For sizes 10" through 24"	+ 1/16"	— 1/16"

▶ **END-TO-END OF REDUCERS, AND LAP JOINT STUB ENDS** ①
Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall

This dimension of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall fittings shall not vary from manufacturer's published figures by more than:

For sizes up to and including 8" +1/16" -1/16"
 For sizes 10" through 24" +3/32" -3/32"

▶ **OUTSIDE DIAMETER OF LAP ON LAP JOINT STUB ENDS** ①
Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall

The outside diameter of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall Lap Joint Stub Ends, for all sizes, shall not vary from manufacturer's published figures more than:

For sizes up to and including 8" +0 -1/32"
 For sizes 10" through 24" +0 -1/16"

▶ **OUTSIDE DIAMETER OF LAP ON TYPE C LAP JOINT STUB ENDS**
Schedules 5S and 10S.

The outside diameter of Schedules 5S and 10S Lap Joint Stub Ends shall not vary more than +0 -3/32".

▶ **LAP THICKNESS OF LAP JOINT STUB ENDS** ①
Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall

The lap thickness of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall Lap Joint Stub Ends, shall not vary from nominal more than:

1/2"-12" NPS +1/16" -0
 14"-24" NPS +1/8" -0

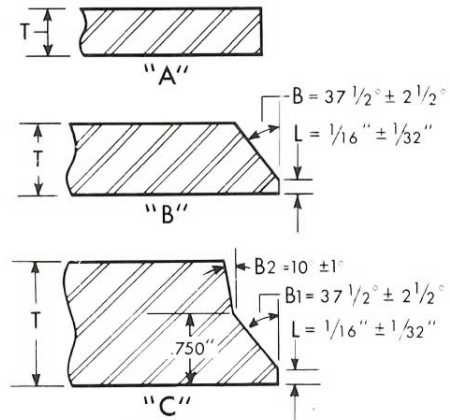
▶ **WELDING CAPS**
Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall

The overall length of Schedules 5S, 10S, 40S, 80S, 160, and XX Strong Wall Welding Caps is subject to the following tolerances:

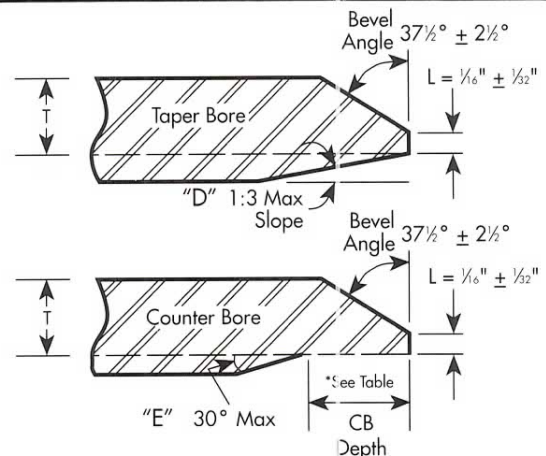
For sizes 4" and smaller +1/8" -1/8"
 For sizes 5" through 24" +1/4" -1/4"

① Type A and B Stub Ends.

DETAIL OF WELDING ENDS



Nominal Pipe Wall Thickness	End Preparation Conforming to ANSI B16.25
Less than .125"	Cut square as in illustration "A" or slightly chamfer.
.125" through .875"	Beveled 37 1/2° with 1/16" land as in illustration "B".
More than .875"	Compound bevel as in illustration "C".



*Stainless Steel and Inco Products	
1/2" through 2-1/2"	-1/8" min. CB Depth
3" through 24"	-1/4" min. CB Depth
*Aluminum	
1/2" through 2-1/2"	-1/8" min. CB Depth
3" through 4"	-1/4" min. CB Depth
5"	-5/16" min. CB Depth
6" and 8"	-3/8" min. CB Depth
10" through 24"	-1/2" min. CB Depth

Specially produced . . .

SPECIAL FITTINGS

Special fittings and components, made of corrosion-resistant metals, can be manufactured on special order. Items illustrated or sketched on this page are representative of such special-purpose products.

SPECIAL ALLOYS

All standard and special **FLOWLINE** welding fittings can be furnished on special order where quantity justifies production, in any of the alloys listed below:

STAINLESS STEELS:

Type 309	Type 321
Type 310	Type 347
Type 317	Type 348

NICKEL ALLOYS:

Alloy 200-201	Alloy 625
Alloy 400	Alloy 800
Alloy 600	Alloy 825

ALUMINUM ALLOYS:

1060	5086
1100	6063
5083	
Aluminum—Copper	
Aluminum—Manganese	

COPPER NICKEL ALLOYS:

70-30	90-10
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TITANIUM

ALLOY 20CB (3)

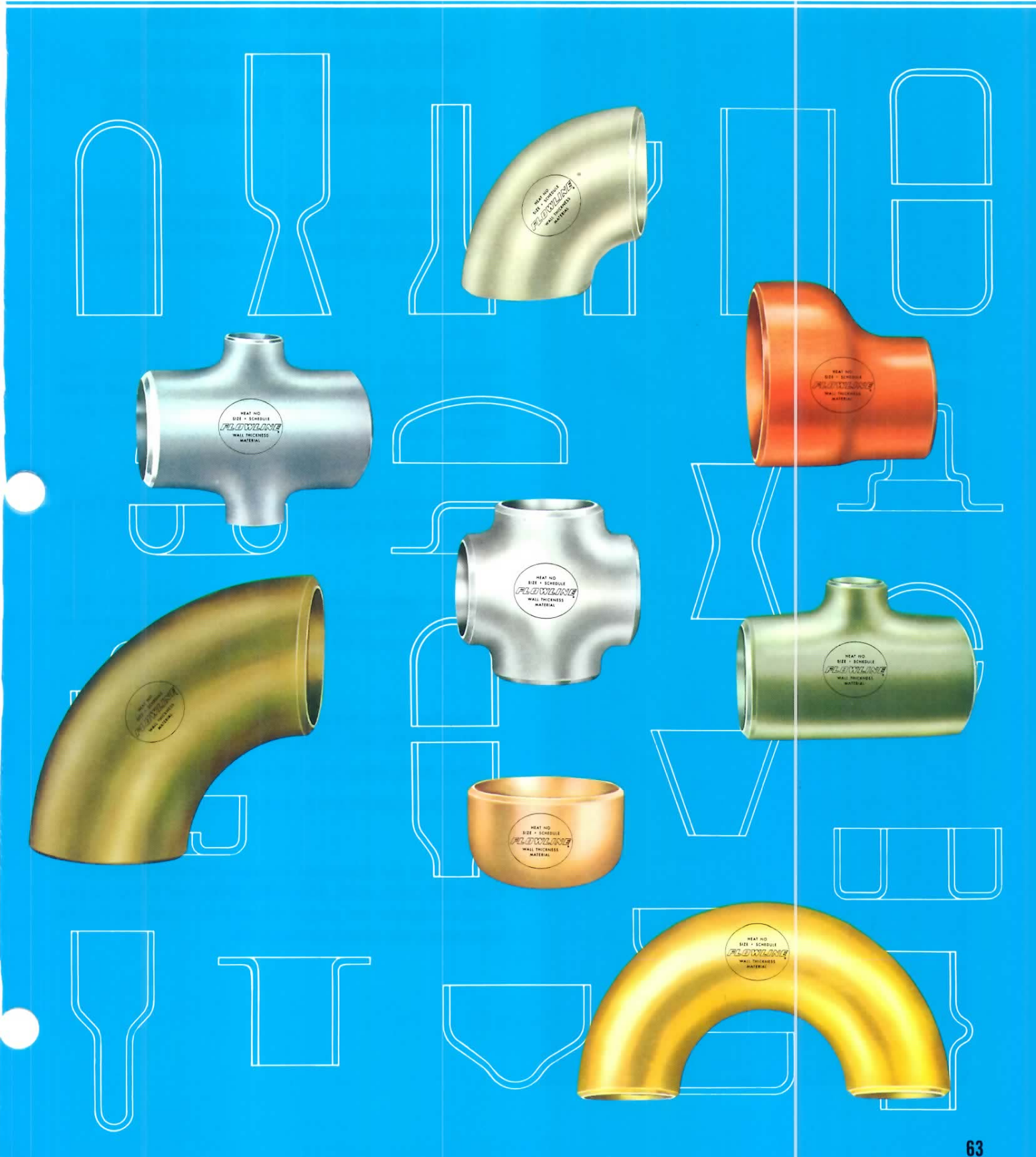
SUPER AUSTENITIC 6-MOLY STAINLESS

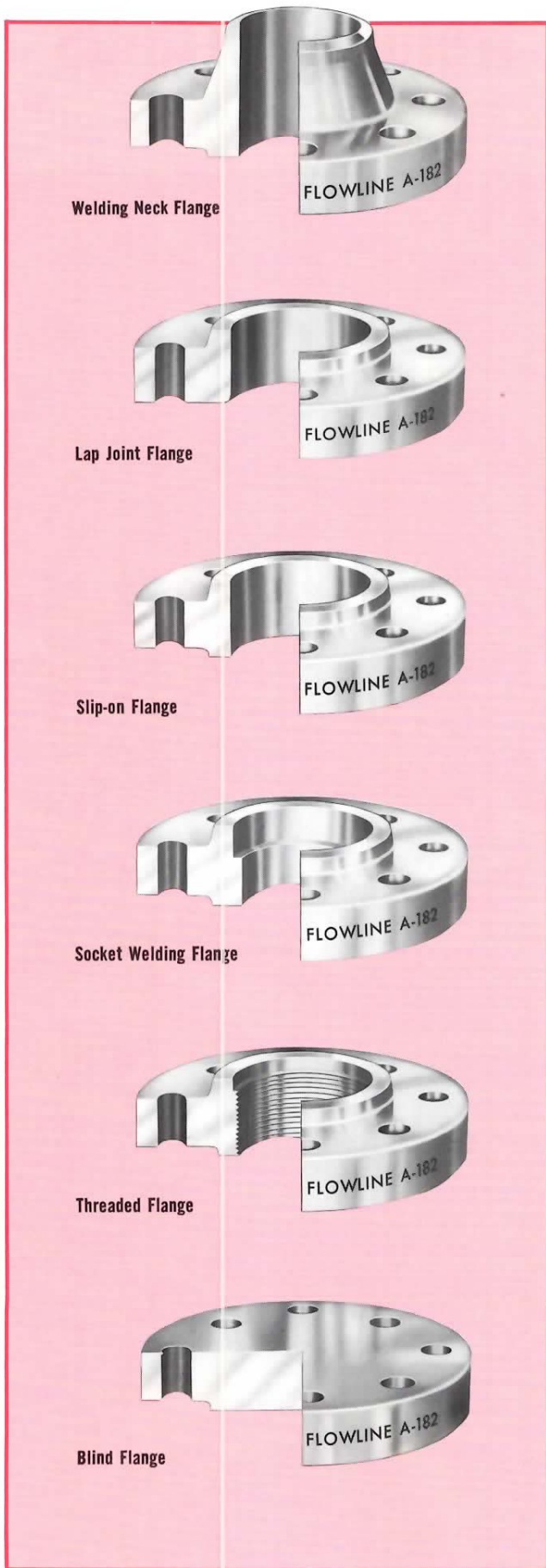
DUPLEX STAINLESS

ALLOY C276



FLOWLINE welding fittings





DESIGN DATA CORROSION-RESISTANT FORGED FLANGES

THIS FLANGE DATA IS INCLUDED FOR REFERENCE PURPOSES ONLY. FLOWLINE DOES NOT PRODUCE ALL SIZES AND ALLOYS SHOWN.

Dimensions for Class 150, 300, 400, 600, 900, 1500 and 2500 flanges, in conformance with forged ANSI steel flange standards and templates for drilling steel flanges, are given on pages 66 through 79.

Dimensional tolerances, in accordance with ANSI B16.5, are tabulated on page 65.

Pressure-temperature ratings of Class 150, 300, 400, 600, 900, 1500 and 2500 forged flanges are given on pages 81 through 83 for the following materials:

Stainless Steel Types 304, 304H, 304L, 310, 316, 316H, 316L, 321, 347, and 348.

Alloy 200, Alloy 201, Alloy 400, and Alloy 600.

Aluminum 3003-H112, and 6061-T6.

Dimensions for American Standard Flange Facings, for Class 150, 300, 400, 600, 900, 1500 and 2500 forged flanges appear on pages 84 and 85, and applicable tolerances are given on page 65.

DIMENSIONAL TOLERANCES

for *FLOWLINE* CORROSION-RESISTANT FORGED FLANGES

The tolerances given below are those established by the American National Standard Institute and are part of ANSI-B16.5 except where noted otherwise. This standard covers steel pipe flanges and flanged valves and fittings. By reference, flanges produced from other materials such as Aluminum and Nickel alloys comply with these

tolerances.

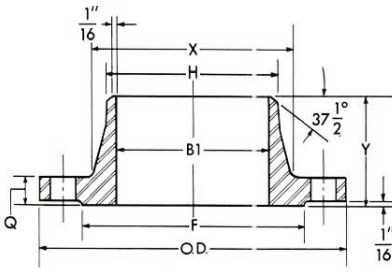
The limits shown are maximum. *FLOWLINE* manufacturing techniques and tight inspection procedures will normally assure closer dimensional accuracy than the tolerances listed below.

Tolerance for:	WELDING NECK FLANGES	
Outside* Diameter	When O.D. is 24" or less	±.06"
	When O.D. is over 24"	±.12"
Inside Diameter	Sizes 10" and smaller	±.03"
	Sizes 12" thru 18"	±.06"
	Sizes 20" and larger	+.12" - .06"
Outside Diameter of Hub at Welding End	Sizes 5" and smaller	+.09" - .03"
	Sizes 6" and larger	+.16" - .03"
Diameter of Hub at Base*	Diameter of 24" or less	±.06"
	Diameter of over 24"	±.12"
Overall Length of Hub	Sizes 10" and smaller	±.06"
	Sizes 12" and larger	±.12"
Flange Thickness	Sizes 18" and smaller	+.12" - 0"
	Sizes 20" and larger	+.19" - 0"
Drilling	Bolt circle diameter	±.06"
	Center to center of adjacent bolt holes.	±.03"
	Eccentricity between bolt circle diameter and machined facing diameters.	Sizes 2½" and smaller	±.03"
Sizes 3" and larger		±.06"
Thickness of Hub	Regardless of tolerances permitted for inside diameter and outside diameter of hub at welding end, the thickness of the hub shall never be less than 87½% of the nominal thickness of pipe to which flange is to be attached.	

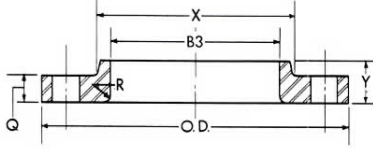
Tolerance for:	THREADED, SLIP-ON, BLIND, LAP JOINT AND SOCKET WELD FLANGES	
Outside* Diameter	When O.D. is 24" or less	±.06"
	When O.D. is over 24"	±.12"
Inside Diameter	Slip-On, Lap Joint and Socket Weld	Sizes 10" and smaller +.03" - 0"
		Sizes 12" and larger +.06" - 0"
Outside* Diameter of Hub	Sizes 12" and smaller	+.09" - .06"
	Sizes 14" and larger	±.12"
Overall Length of Hub	Sizes 10" and smaller	±.06"
	Sizes 12" and larger	±.12"
Flange Thickness	Sizes 18" and smaller	+.12" - 0"
	Sizes 20" and larger	+.19" - 0"
Diameter of Counterbore	Threaded and Socket Weld	Sizes 10" and smaller +.03" - 0"
		Sizes 12" and larger +.06" - 0"
Drilling	Bolt circle diameter	±.06"
	Center to center of adjacent bolt holes.	±.03"
	Eccentricity between bolt circle diameter and machined facing diameters.	Sizes 2½" and smaller	±.03"
Sizes 3" and larger		±.06"

Tolerance for:	RAISED FACE	TONGUE AND GROOVE	MALE AND FEMALE	RING JOINT
Center to Contact Surfaces	Sizes 10" and Smaller ±.03" Sizes 12" and Larger ±.06"	Sizes 10" and Smaller ±.03" Sizes 12" and Larger ±.06"	Sizes 10" and Smaller ±.03" Sizes 12" and Larger ±.06"	.....
Center to End	.....	.....	.....	Sizes 10" and Smaller ±.03" Sizes 12" and Larger ±.06"
Contact Surface to Contact Surface	Sizes 10" and Smaller ±.06" Sizes 12" and Larger ±.12"	Sizes 10" and Smaller ±.06" Sizes 12" and Larger ±.12"	Sizes 10" and Smaller ±.06" Sizes 12" and Larger ±.12"	.....
End to End	.....	.....	.....	Sizes 10" and Smaller ±.06" Sizes 12" and Larger ±.12"
Inside Diameter	.....	All Sizes ±.02"	All Sizes ±.02"	See Table on Page 85 for ring-joint groove tolerances
Outside Diameter	⅜" Raised Face ±.03" ¼" Raised Face ±.02"	All Sizes ±.02"	All Sizes ±.02"	See Table on Page 85 for ring-joint groove tolerances

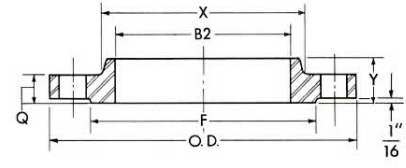
*Tolerance for these dimensions not included in ANSI B16.5.



WELDING NECK



LAP JOINT



SLIP-ON

CLASS 150 CORROSION RESISTANT

NOM. PIPE SIZE	FLANGE DIAMETER (O.D.)	FLANGE THICKNESS (Q) MIN. (1)	HUB DIA. AT BASE (X)	RAISED FACE DIA. (F)	HUB DIA. AT WELDING POINT (H)	BORE DIAMETER (B)			COUNTER BORE OF THREADED FLANGE (C)	DEPTH OF SOCKET (D)	LENGTH THROUGH HUB (Y)		
						(B1) WELDING NECK AND SOCKET WELD (2)	(B2) SLIP-ON AND SOCKET WELD MIN.	(B3) LAP JOINT MIN.			WELDING NECK	SLIP-ON SOCKET WELD AND THREADED	LAP JOINT
1/2	3.50	0.44	1.19	1.38	0.84	0.62	0.88	0.90	NO COUNTER BORE REQUIRED ON 150# THREADED FLANGES	0.38	1.88	0.62	0.62
3/4	3.88	0.50	1.50	1.69	1.05	0.82	1.09	1.11		0.44	2.06	0.62	0.62
1	4.25	0.56	1.94	2.00	1.32	1.05	1.36	1.38		0.50	2.19	0.69	0.69
1 1/4	4.62	0.62	2.31	2.50	1.66	1.38	1.70	1.72		0.56	2.25	0.81	0.81
1 1/2	5.00	0.69	2.56	2.88	1.90	1.61	1.95	1.97		0.62	2.44	0.88	0.88
2	6.00	0.75	3.06	3.62	2.38	2.07	2.44	2.46		0.69	2.50	1.00	1.00
2 1/2	7.00	0.88	3.56	4.12	2.88	2.47	2.94	2.97		0.75	2.75	1.12	1.12
3	7.50	0.94	4.25	5.00	3.50	3.07	3.57	3.60		0.81	2.75	1.19	1.19
3 1/2	8.50	0.94	4.81	5.50	4.00	3.55	4.07	4.10		0.88	2.81	1.25	1.25
4	9.00	0.94	5.31	6.19	4.50	4.03	4.57	4.60		0.94	3.00	1.31	1.31
5	10.00	0.94	6.44	7.31	5.56	5.05	5.66	5.69		0.94	3.50	1.44	1.44
6	11.00	1.00	7.56	8.50	6.63	6.07	6.72	6.75		1.06	3.50	1.56	1.56
8	13.50	1.12	9.69	10.62	8.63	7.98	8.72	8.75		1.25	4.00	1.75	1.75
10	16.00	1.19	12.00	12.75	10.75	10.02	10.88	10.92		1.31	4.00	1.94	1.94
12	19.00	1.25	14.38	15.00	12.75	12.00	12.88	12.92		1.56	4.50	2.19	2.19
14	21.00	1.38	15.75	16.25	14.00	13.25	14.14	14.18		1.63	5.00	2.25	3.12
16	23.50	1.44	18.00	18.50	16.00	15.25	16.16	16.19		1.75	5.00	2.50	3.44
18	25.00	1.56	19.88	21.00	18.00	17.25	18.18	18.20		1.94	5.50	2.69	3.81
20	27.50	1.69	22.00	23.00	20.00	19.25	20.20	20.25		2.12	5.69	2.88	4.06
24	32.00	1.88	26.12	27.25	24.00	23.25	24.25	24.25		2.50	6.00	3.25	4.38

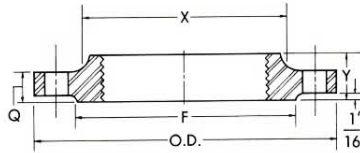
Dimensions are in inches and conform to ANSI B16.5. For dimensional tolerances, see page 65.

(1) Flange Thickness (Q) includes 1/16" raised face.

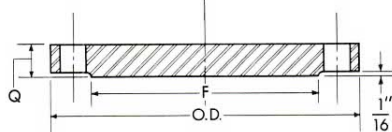
(2) Bore Diameter (B) of welding neck flanges corresponds to matching dimension of Standard Wall/Schedule 40S pipe. Flanges can be bored to match Extra Strong/Schedule 80S pipe.

(3) Every flange is marked to show the **FLOWLINE** trademark, type of metal, pressure rating, and pipe size in accordance with ANSI B16.5.

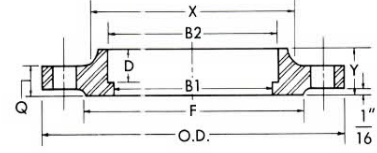
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THREADED



BLIND



SOCKET WELD

FORGED FLANGES ANSI B16.5

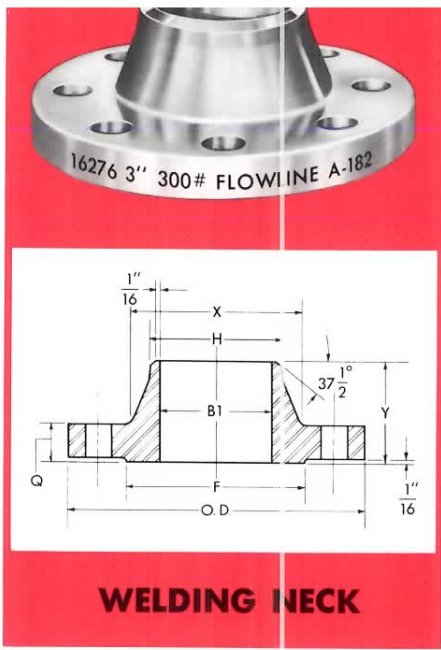
STAINLESS STEEL
INCO® ALLOY
ALUMINUM

NOM. PIPE SIZE	MIN. THREAD LENGTH	RADIUS (R) LAP JOINT	DRILLING			BOLTING			
			DIAMETER OF BOLT CIRCLE	NO. OF HOLES	DIA. OF HOLES	DIA. OF BOLTS	MACHINE BOLT LENGTH	STUD BOLT LENGTH	
							Raised Face .06"	Raised Face .06"	Ring Joint
1/2	0.62	0.12	2.38	4	0.62	1/2	2.00	2.50	—
3/4	0.62	0.12	2.75	4	0.62	1/2	2.25	2.50	—
1	0.69	0.12	3.12	4	0.62	1/2	2.25	2.75	3.25
1 1/4	0.81	0.19	3.50	4	0.62	1/2	2.50	2.75	3.25
1 1/2	0.88	0.25	3.88	4	0.62	1/2	2.50	3.00	3.50
2	1.00	0.31	4.75	4	0.75	5/8	2.75	3.25	3.75
2 1/2	1.12	0.31	5.50	4	0.75	5/8	3.00	3.50	4.00
3	1.19	0.38	6.00	4	0.75	5/8	3.25	3.75	4.25
3 1/2	1.25	0.38	7.00	8	0.75	5/8	3.25	3.75	4.25
4	1.31	0.44	7.50	8	0.75	5/8	3.25	3.75	4.25
5	1.44	0.50	8.50	8	0.88	3/4	3.25	4.00	4.50
6	1.56	0.50	9.50	8	0.88	3/4	3.50	4.00	4.50
8	1.75	0.50	11.75	8	0.88	3/4	3.75	4.25	4.75
10	1.94	0.50	14.25	12	1.00	7/8	4.00	4.75	5.25
12	2.19	0.50	17.00	12	1.00	7/8	4.25	4.75	5.25
14	2.25	0.50	18.75	12	1.12	1	4.50	5.25	5.75
16	2.50	0.50	21.25	16	1.12	1	4.75	5.50	6.00
18	2.69	0.50	22.75	16	1.25	1 1/8	5.00	6.00	6.50
20	2.88	0.50	25.00	20	1.25	1 1/8	5.50	6.25	6.75
24	3.25	0.50	29.50	20	1.38	1 1/4	6.00	7.00	7.50

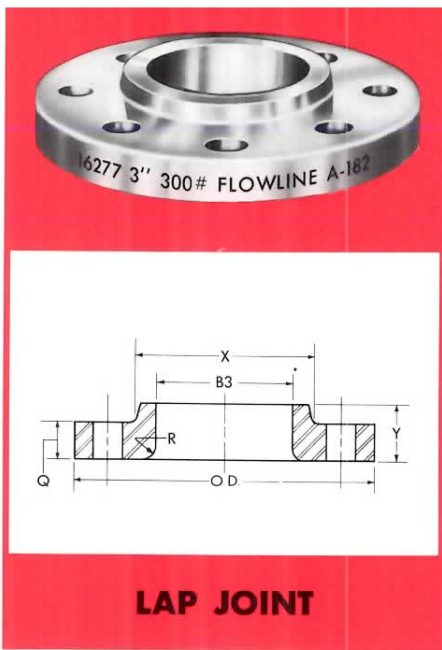
NOM. PIPE SIZE	APPROXIMATE WEIGHT EACH — POUNDS‡			
	WELDING NECK	SLIP-ON, SOCKET WELD AND THREADED	LAP JOINT	BLIND
1/2	1 1/4	1	1	1 1/4
3/4	2	1 1/2	1 1/2	1 1/2
1	2 1/2	2	2	2
1 1/4	3	3	3	3
1 1/2	4 1/4	3	3 1/2	4
2	6	5 1/4	5	6 1/2
2 1/2	10	8	7	9 1/2
3	12	9	9 1/4	12 1/2
3 1/2	12	11	11	13
4	16 1/2	12 1/2	12 1/2	17
5	19	15	15	20
6	25	19	19	26 1/2
8	39	30	30	45
10	52	43	43	70
12	80	64	64	110
14	110	90	105	140
16	140	98	140	180
18	150	130	160	220
20	180	165	195	285
24	260	220	275	430

(4) Length Through Hub (Y) does include 1/16" raised face.
 (5) Length of stud bolt does not include the height of the points.
 (6) For flange facing details see pages 84 through 87.

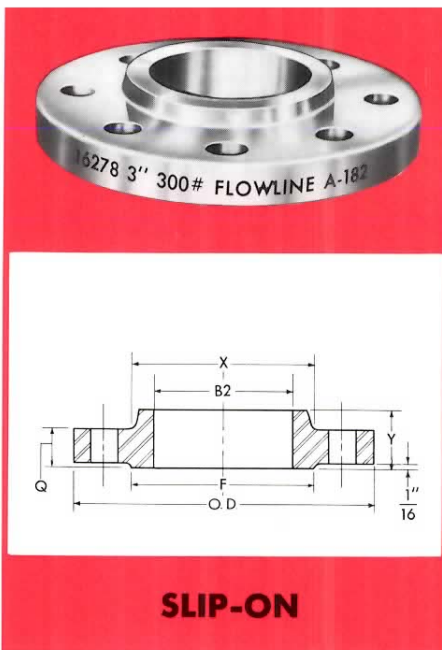
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel Alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.



WELDING NECK



LAP JOINT



SLIP-ON

CLASS 300 CORROSION RESISTANT

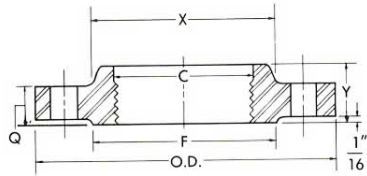
NOM. PIPE SIZE	FLANGE DIAMETER (O.D.)	FLANGE THICKNESS (Q) MIN. (1)	HUB DIA. AT BASE (X)	RAISED FACE DIA. (F)	HUB DIA. AT WELDING POINT (H)	BORE DIAMETER (B)			COUNTER BORE OF THREADED FLANGE (C) MIN.	DEPTH OF SOCKET (D)	LENGTH THROUGH HUB (Y)		
						(B1) WELDING NECK AND SOCKET WELD (2)	(B2) SLIP-ON AND SOCKET WELD MIN.	(B3) LAP JOINT MIN.			WELDING NECK	SLIP-ON, SOCKET WELD AND THREADED	LAP JOINT
1/2	3.75	0.56	1.50	1.38	0.84	0.62	0.88	0.90	0.93	0.38	2.06	0.88	0.88
3/4	4.62	0.62	1.88	1.69	1.05	0.82	1.09	1.11	1.14	0.44	2.25	1.00	1.00
1	4.88	0.69	2.12	2.00	1.32	1.05	1.36	1.38	1.41	0.50	2.44	1.06	1.06
1 1/4	5.25	0.75	2.50	2.50	1.66	1.38	1.70	1.72	1.75	0.56	2.56	1.06	1.06
1 1/2	6.12	0.81	2.75	2.88	1.90	1.61	1.95	1.97	1.99	0.62	2.69	1.19	1.19
2	6.50	0.88	3.31	3.62	2.38	2.07	2.44	2.46	2.50	0.69	2.75	1.31	1.31
2 1/2	7.50	1.00	3.94	4.12	2.88	2.47	2.94	2.97	3.00	0.75	3.00	1.50	1.50
3	8.25	1.12	4.62	5.00	3.50	3.07	3.57	3.60	3.63	0.81	3.12	1.69	1.69
3 1/2	9.00	1.19	5.25	5.50	4.00	3.55	4.07	4.10	4.13	—	3.19	1.75	1.75
4	10.00	1.25	5.75	6.19	4.50	4.03	4.57	4.60	4.63	—	3.38	1.88	1.88
5	11.00	1.38	7.00	7.31	5.56	5.05	5.66	5.69	5.69	—	3.88	2.00	2.00
6	12.50	1.44	8.12	8.50	6.63	6.07	6.72	6.75	6.75	—	3.88	2.06	2.06
8	15.00	1.62	10.25	10.62	8.63	7.98	8.72	8.75	8.75	—	4.38	2.44	2.44
10	17.50	1.88	12.62	12.75	10.75	10.02	10.88	10.92	10.88	—	4.62	2.62	3.75
12	20.50	2.00	14.75	15.00	12.75	12.00	12.88	12.92	12.94	—	5.12	2.88	4.00
14	23.00	2.12	16.75	16.25	14.00	13.25	14.14	14.18	14.19	—	5.62	3.00	4.38
16	25.50	2.25	19.00	18.50	16.00	15.25	16.16	16.19	16.19	—	5.75	3.25	4.75
18	28.00	2.38	21.00	21.00	18.00	17.25	18.18	18.20	18.19	—	6.25	3.50	5.12
20	30.50	2.50	23.12	23.00	20.00	19.25	20.20	20.25	20.19	—	6.38	3.75	5.50
24	36.00	2.75	27.62	27.25	24.00	23.25	24.25	24.25	24.19	—	6.62	4.19	6.00

Dimensions are in inches and conform to ANSI B16.5. For dimensional tolerances, see page 65.

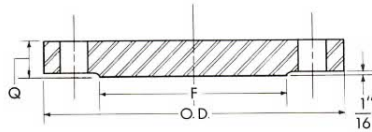
- (1) Flange Thickness (Q) includes 1/16" raised face.
- (2) Bore Diameter (B) of welding neck flanges corresponds to matching dimension of Standard Wall/Schedule 40S pipe. Flanges can be bored to match Extra Strong/Schedule 80S pipe.

(3) Every flange is marked to show the **FLOWLINE** trademark, type of metal, pressure rating, and pipe size in accordance with ANSI B16.5.

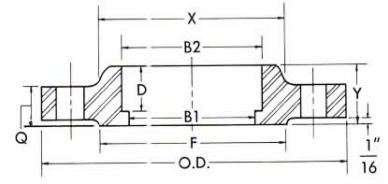
(continued on next page)



THREADED



BLIND



SOCKET WELD

FORGED FLANGES ANSI B16.5

STAINLESS STEEL
INCO® ALLOY
ALUMINUM

NOM. PIPE SIZE	MIN. THREAD LENGTH	RADIUS (R) LAP JOINT	DRILLING			BOLTING			
			DIAMETER OF BOLT CIRCLE	NO. OF HOLES	DIA. OF HOLES	DIA. OF BOLTS	STUD BOLT LENGTH		
							MACHINE BOLT LENGTH	Raised Face .06"	Ring Joint
1/2	0.62	0.12	2.62	4	0.62	1/2	2.25	2.75	3.00
3/4	0.62	0.12	3.25	4	0.75	5/8	2.50	3.00	3.50
1	0.69	0.12	3.50	4	0.75	5/8	2.75	3.25	3.75
1 1/4	0.81	0.19	3.88	4	0.75	5/8	2.75	3.25	3.75
1 1/2	0.88	0.25	4.50	4	0.88	3/4	3.00	3.75	4.25
2	1.12	0.31	5.00	8	0.75	5/8	3.00	3.50	4.25
2 1/2	1.25	0.31	5.88	8	0.88	3/4	3.50	4.00	4.75
3	1.25	0.38	6.62	8	0.88	3/4	3.75	4.25	5.00
3 1/2	1.44	0.38	7.25	8	0.88	3/4	3.75	4.50	5.25
4	1.44	0.44	7.88	8	0.88	3/4	4.00	4.50	5.25
5	1.69	0.44	9.25	8	0.88	3/4	4.25	4.75	5.50
6	1.81	0.50	10.62	12	0.88	3/4	4.25	5.00	5.75
8	2.00	0.50	13.00	12	1.00	7/8	4.75	5.50	6.25
10	2.19	0.50	15.25	16	1.12	1	5.50	6.25	7.00
12	2.38	0.50	17.75	16	1.25	1 1/8	6.00	6.75	7.50
14	2.50	0.50	20.25	20	1.25	1 1/8	6.25	7.00	7.75
16	2.69	0.50	22.50	20	1.38	1 1/4	6.50	7.50	8.25
18	2.75	0.50	24.75	24	1.38	1 1/4	6.75	7.75	8.50
20	2.88	0.50	27.00	24	1.38	1 1/4	7.25	8.25	9.00
24	3.25	0.50	32.00	24	1.62	1 1/2	8.00	9.25	10.25

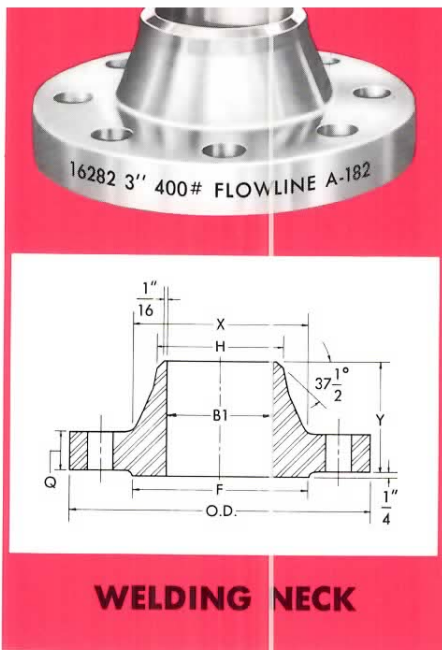
NOM. PIPE SIZE	APPROXIMATE WEIGHT EACH—POUNDS±			
	WELDING NECK	SLIP-ON, SOCKET WELD AND THREADED	LAP JOINT	BLIND
1/2	2	2	2	2
3/4	3	3	3	3
1	4	3	3	3
1 1/4	5	4	4	4
1 1/2	7	6	6	6
2	9	7	7	8
2 1/2	12	10	10	12
3	15	13	13	16
3 1/2	18	17	17	21
4	25	22	22	27
5	32	28	28	35
6	42	39	39	50
8	67	58	58	81
10	91	81	91	125
12	140	115	140	185
14	180	165	190	250
16	250	190	250	295
18	320	250	295	395
20	400	315	370	505
24	580	475	550	790

(4) Length Through Hub (Y) includes 1/16" raised face.

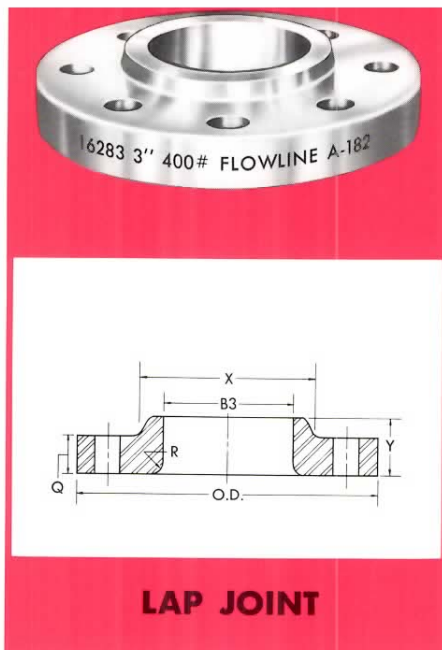
(5) Length of stud bolt does not include the height of the points.

(6) For flange tacing details see pages 84 through 87.

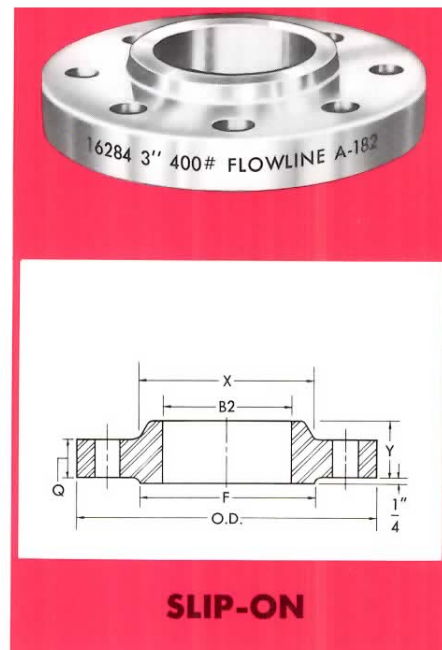
±Weights shown are for Stainless Steel. Approximate Nickel and Nickel Alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.



WELDING NECK



LAP JOINT



SLIP-ON

CLASS 400 CORROSION RESISTANT

NOM. PIPE SIZE	FLANGE DIAMETER (O.D.)	FLANGE THICKNESS (Q) MIN. (1)	HUB DIA. AT BASE (X)	RAISED FACE DIA. (F)	HUB DIA. AT WELDING POINT (H)	BORE DIAMETER (B)			COUNTER BORE OF THREADED FLANGE (C) MIN.	LENGTH THROUGH HUB (Y)		
						(B1) WELDING NECK (2)	(B2) SLIP-ON MIN.	(B3) LAP JOINT MIN.		WELDING NECK	SLIP-ON AND THREADED	LAP JOINT
1/2	3.75	0.56	1.50	1.38	0.84		0.88	0.90	0.93	2.06	0.88	0.88
3/4	4.62	0.62	1.88	1.69	1.05		1.09	1.11	1.14	2.25	1.00	1.00
1	4.88	0.67	2.12	2.00	1.32		1.36	1.38	1.41	2.44	1.06	1.06
1 1/4	5.25	0.81	2.50	2.50	1.66		1.70	1.72	1.75	2.62	1.12	1.12
1 1/2	6.12	0.88	2.75	2.88	1.90		1.95	1.97	1.99	2.75	1.25	1.25
2	6.50	1.00	3.31	3.62	2.38		2.44	2.46	2.50	2.88	1.44	1.44
2 1/2	7.50	1.12	3.94	4.12	2.88		2.94	2.97	3.00	3.12	1.62	1.62
3	8.25	1.25	4.62	5.00	3.50		3.57	3.60	3.63	3.25	1.81	1.81
3 1/2	9.00	1.33	5.25	5.50	4.00		4.07	4.10	4.13	3.38	1.94	1.94
4	10.00	1.33	5.75	6.19	4.50		4.57	4.60	4.63	3.50	2.00	2.00
5	11.00	1.50	7.00	7.31	5.56		5.66	5.69	5.69	4.00	2.12	2.12
6	12.50	1.62	8.12	8.50	6.63		6.72	6.75	6.75	4.06	2.25	2.25
8	15.00	1.83	10.25	10.62	8.63		8.72	8.75	8.75	4.62	2.69	2.69
10	17.50	2.12	12.62	12.75	10.75		10.88	10.92	10.88	4.88	2.88	4.00
12	20.50	2.25	14.75	15.00	12.75		12.88	12.92	12.94	5.38	3.12	4.25
14	23.00	2.33	16.75	16.25	14.00		14.14	14.18	14.19	5.88	3.31	4.62
16	25.50	2.50	19.00	18.50	16.00		16.16	16.19	16.19	6.00	3.69	5.00
18	28.00	2.62	21.00	21.00	18.00		18.18	18.20	18.19	6.50	3.88	5.38
20	30.50	2.75	23.12	23.00	20.00		20.20	20.25	20.19	6.62	4.00	5.75
24	36.00	3.00	27.62	27.25	24.00		24.25	24.25	24.19	6.88	4.50	6.25

TO BE SPECIFIED BY PURCHASER

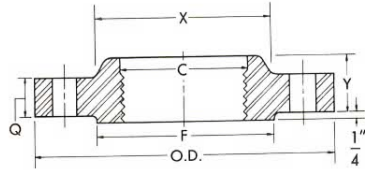
Dimensions are in inches and conform to ANSI B16.5. For dimensional tolerances, see page 65.

(1) Flange Thickness (Q) does not include 1/4" raised face.

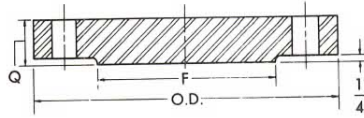
(2) Bore Diameter of welding neck flanges can be provided to match purchaser's requirements.

(3) Every flange is marked to show the **FLOWLINE** trademark, type of metal, pressure rating, and pipe size in accordance with ANSI B16.5.

(continued on next page)



THREADED



BLIND

**SOCKET WELD
IS NOT PRODUCED
IN CLASS 400**

SOCKET WELD

FORGED FLANGES ANSI B16.5

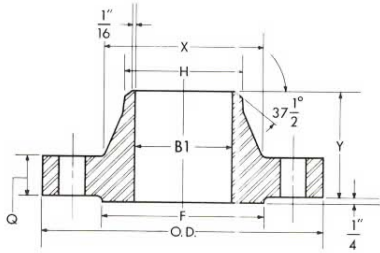
STAINLESS STEEL
INCO® ALLOY
ALUMINUM

NOM. PIPE SIZE	MIN. THREAD LENGTH	RADIUS (R) LAP JOINT	DRILLING			BOLTING			
			DIAMETER OF BOLT CIRCLE	NO. OF HOLES	DIA. OF HOLES	STUD BOLT LENGTH			
						DIA. OF BOLTS	.25" Raised Face	Male & Female Tongue & Groove	Ring Joint
1/2	0.62	0.12	2.62	4	0.62	1/2	3.25	3.00	3.00
3/4	0.62	0.12	3.25	4	0.75	5/8	3.50	3.25	3.50
1	0.69	0.12	3.50	4	0.75	5/8	3.75	3.50	3.75
1 1/4	0.81	0.19	3.88	4	0.75	5/8	4.00	3.75	4.00
1 1/2	0.88	0.25	4.50	4	0.88	3/4	4.25	4.00	4.25
2	1.12	0.31	5.00	8	0.75	5/8	4.25	4.00	4.50
2 1/2	1.25	0.31	5.88	8	0.88	3/4	4.75	4.50	5.00
3	1.38	0.38	6.62	8	0.88	3/4	5.00	4.75	5.25
3 1/2	1.56	0.38	7.25	8	1.00	7/8	5.50	5.25	5.75
4	1.44	0.44	7.88	8	1.00	7/8	5.50	5.25	5.75
5	1.69	0.44	9.25	8	1.00	7/8	5.75	5.50	6.00
6	1.81	0.50	10.62	12	1.00	7/8	6.00	5.75	6.25
8	2.00	0.50	13.00	12	1.12	1	6.75	6.50	7.00
10	2.19	0.50	15.25	16	1.25	1 1/8	7.50	7.25	7.75
12	2.38	0.50	17.75	16	1.38	1 1/4	8.00	7.75	8.25
14	2.50	0.50	20.25	20	1.38	1 1/4	8.25	8.00	8.50
16	2.69	0.50	22.50	20	1.50	1 3/8	8.75	8.50	9.00
18	2.75	0.50	24.75	24	1.50	1 3/8	9.00	8.75	9.25
20	2.88	0.50	27.00	24	1.62	1 1/2	9.75	9.50	10.00
24	3.25	0.50	32.00	24	1.88	1 3/4	10.75	10.50	11.25

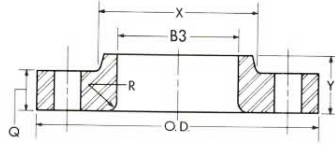
NOM. PIPE SIZE	APPROXIMATE WEIGHT EACH—POUNDS‡			
	WELDING NECK	SLIP-ON AND THREADED	LAP JOINT	BLIND
1/2	2	2	2	2
3/4	4	3	3	3
1	4	4	4	4
1 1/4	6	5	5	5
1 1/2	8	7	7	8
2	12	9	9	10
2 1/2	18	13	12	15
3	23	16	15	20
3 1/2	26	21	20	29
4	35	26	25	33
5	43	31	29	44
6	57	44	42	61
8	89	67	64	100
10	125	91	110	155
12	175	130	150	225
14	230	180	205	290
16	295	235	260	370
18	350	285	315	455
20	425	345	385	585
24	620	510	570	890

(4) Length Through Hub (Y) does not include 1/4" raised face.
 (5) Length of stud bolt does not include the height of the points.
 (6) For flange facing details see pages 84 through 87.

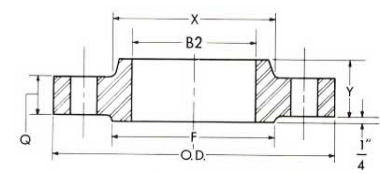
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel Alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.



WELDING NECK



LAP JOINT



SLIP-ON

CLASS 600 CORROSION RESISTANT

NOM. PIPE SIZE	FLANGE DIAMETER (O.D.)	FLANGE THICKNESS (Q) MIN. (1)	HUB DIA. AT BASE (X)	RAISED FACE DIA. (F)	HUB DIA. AT WELDING POINT (H)	BORE DIAMETER (B)			COUNTER BORE OF THREADED FLANGE (C) MIN.	DEPTH OF SOCKET (D)	LENGTH THROUGH HUB (Y)		
						(B1) WELDING NECK AND SOCKET WELD (2)	(B2) SLIP-ON AND SOCKET WELD MIN.	(B3) LAP JOINT MIN.			WELDING NECK	SLIP-ON, SOCKET WELD AND THREADED	LAP JOINT
1/2	3.75	0.56	1.50	1.38	0.84	0.88	0.90	0.93	0.38	2.06	0.88	0.88	
3/4	4.62	0.62	1.88	1.69	1.05	1.09	1.11	1.14	0.44	2.25	1.00	1.00	
1	4.88	0.69	2.12	2.00	1.32	1.36	1.38	1.41	0.50	2.44	1.06	1.06	
1 1/4	5.25	0.81	2.50	2.50	1.66	1.70	1.72	1.75	0.56	2.62	1.12	1.12	
1 1/2	6.12	0.88	2.75	2.88	1.90	1.95	1.97	1.99	0.62	2.75	1.25	1.25	
2	6.50	1.00	3.31	3.62	2.38	2.44	2.46	2.50	0.69	2.88	1.44	1.44	
2 1/2	7.50	1.12	3.94	4.12	2.88	2.94	2.97	3.00	0.75	3.12	1.62	1.62	
3	8.25	1.25	4.62	5.00	3.50	3.57	3.60	3.63	0.81	3.25	1.81	1.81	
3 1/2	9.00	1.38	5.25	5.50	4.00	4.07	4.10	4.13	—	3.38	1.94	1.94	
4	10.75	1.50	6.00	6.19	4.50	4.57	4.60	4.63	—	4.00	2.12	2.12	
5	13.00	1.75	7.44	7.31	5.56	5.66	5.69	5.69	—	4.50	2.38	2.38	
6	14.00	1.88	8.75	8.50	6.63	6.72	6.75	6.75	—	4.62	2.62	2.62	
8	16.50	2.19	10.75	10.62	8.63	8.72	8.75	8.75	—	5.25	3.00	3.00	
10	20.00	2.50	13.50	12.75	10.75	10.88	10.92	10.88	—	6.00	3.38	4.38	
12	22.00	2.62	15.75	15.00	12.75	12.88	12.92	12.94	—	6.12	3.62	4.62	
14	23.75	2.75	17.00	16.25	14.00	14.14	14.18	14.19	—	6.50	3.69	5.00	
16	27.00	3.00	19.50	18.50	16.00	16.16	16.19	16.19	—	7.00	4.19	5.50	
18	29.25	3.25	21.50	21.00	18.00	18.18	18.20	18.19	—	7.25	4.62	6.00	
20	32.00	3.50	24.00	23.00	20.00	20.20	20.25	20.19	—	7.50	5.00	6.50	
24	37.00	4.00	28.25	27.25	24.00	24.25	24.25	24.19	—	8.00	5.50	7.25	

TO BE SPECIFIED BY PURCHASER

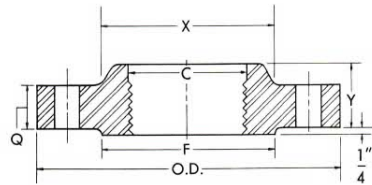
Dimensions are in inches and conform to ANSI B16.5. For dimensional tolerances, see page 65.

(1) Flange Thickness (Q) does not include 1/4" raised face.

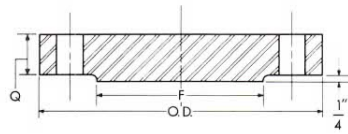
(2) Bore Diameter of welding neck flanges can be provided to match purchaser's requirements.

(3) Every flange is marked to show the **FLOWLINE** trademark, type of metal, pressure rating, and pipe size in accordance with ANSI B16.5.

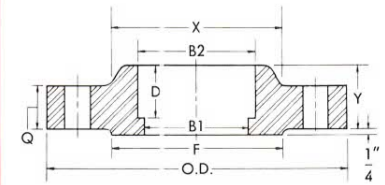
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THREADED



BLIND



SOCKET WELD

FORGED FLANGES ANSI B16.5

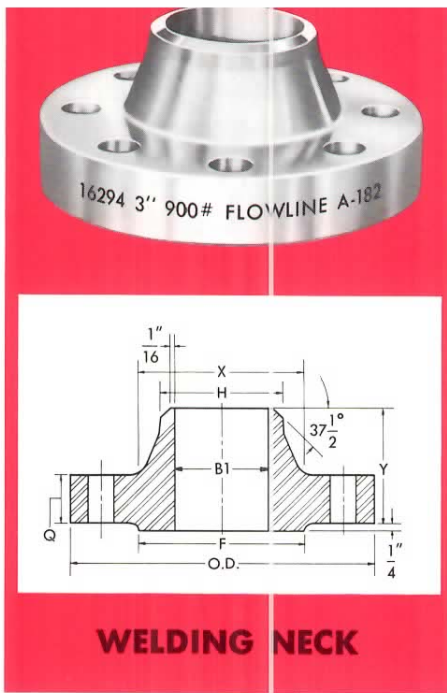
STAINLESS STEEL
INCO® ALLOY
ALUMINUM

NOM. PIPE SIZE	MIN. THREAD LENGTH	RADIUS (R) LAP JOINT	DRILLING			BOLTING			
			DIAMETER OF BOLT CIRCLE	NO. OF HOLES	DIA. OF HOLES	STUD BOLT LENGTH			
						DIA. OF BOLTS	.25" Raised Face	Male & Female Tongue & Groove	Ring Joint
1/2	0.62	0.12	2.62	4	0.62	1/2	3.25	3.00	3.00
3/4	0.62	0.12	3.25	4	0.75	5/8	3.50	3.25	3.50
1	0.69	0.12	3.50	4	0.75	5/8	3.75	3.50	3.75
1 1/4	0.81	0.19	3.88	4	0.75	5/8	4.00	3.75	4.00
1 1/2	0.88	0.25	4.50	4	0.88	3/4	4.25	4.00	4.25
2	1.12	0.31	5.00	8	0.75	5/8	4.25	4.00	4.50
2 1/2	1.25	0.31	5.88	8	0.88	3/4	4.75	4.50	5.00
3	1.38	0.38	6.62	8	0.88	3/4	5.00	4.75	5.25
3 1/2	1.56	0.38	7.25	8	1.00	7/8	5.50	5.25	5.75
4	1.62	0.44	8.50	8	1.00	7/8	5.75	5.50	6.00
5	1.88	0.44	10.50	8	1.12	1	6.50	6.25	6.75
6	2.00	0.50	11.50	12	1.12	1	6.75	6.50	7.00
8	2.25	0.50	13.75	12	1.25	1 1/8	7.75	7.50	7.75
10	2.56	0.50	17.00	16	1.38	1 1/4	8.50	8.25	8.75
12	2.75	0.50	19.25	20	1.38	1 1/4	8.75	8.50	9.00
14	2.88	0.50	20.75	20	1.50	1 3/8	9.25	9.00	9.50
16	3.06	0.50	23.75	20	1.62	1 1/2	10.00	9.75	10.25
18	3.12	0.50	25.75	20	1.75	1 5/8	10.75	10.50	11.00
20	3.25	0.50	28.50	24	1.75	1 5/8	11.50	11.25	11.75
24	3.62	0.50	33.00	24	2.00	1 7/8	13.00	12.75	13.25

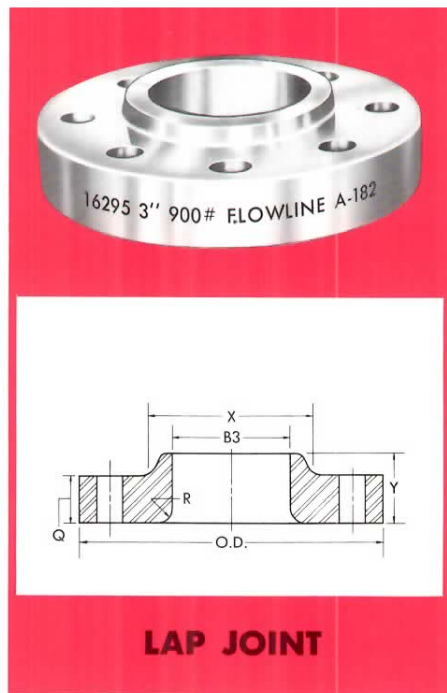
NOM. PIPE SIZE	APPROXIMATE WEIGHT EACH—POUNDS‡			
	WELDING NECK	SLIP-ON, SOCKET WELD AND THREADED	LAP JOINT	BLIND
1/2	2	2	2	2
3/4	4	3	3	3
1	4	4	4	4
1 1/4	6	5	5	5
1 1/2	8	7	7	8
2	12	9	9	10
2 1/2	18	13	12	15
3	23	16	15	20
3 1/2	26	21	20	29
4	42	37	36	41
5	68	63	61	68
6	81	80	78	86
8	120	115	110	140
10	190	170	170	230
12	225	200	200	295
14	280	230	250	355
16	390	330	365	495
18	475	400	435	630
20	590	510	570	810
24	830	730	810	1250

(4) Length Through Hub (Y) does not include 1/4" raised face.
 (5) Length of stud bolt does not include the height of the points.
 (6) For flange facing details see pages 84 through 87.

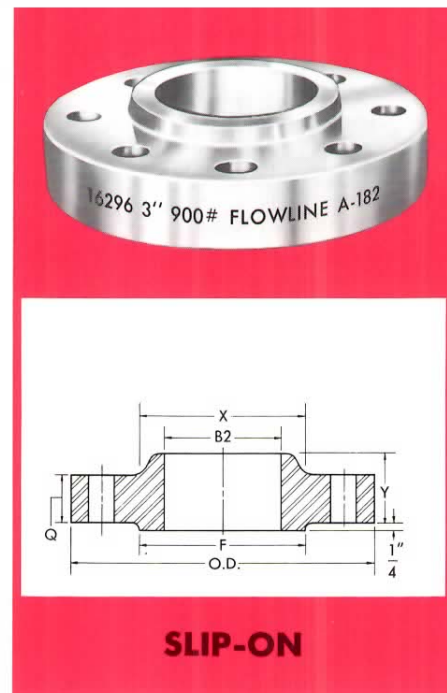
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel Alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.



WELDING NECK



LAP JOINT



SLIP-ON

CLASS 900 CORROSION RESISTANT

NOM. PIPE SIZE	FLANGE DIAMETER (O.D.)	FLANGE THICKNESS (Q) MILL. (1)	HUB DIA. AT BASE (X)	RAISED FACE DIA. (F)	HUB DIA. AT WELDING POINT (H)	BORE DIAMETER (B)			COUNTER BORE OF THREADED FLANGE (C) MIN.	LENGTH THROUGH HUB (Y)		
						(B1) WELDING NECK (2)	(B2) SLIP-ON MIN.	(B3) LAP JOINT MIN.		WELDING NECK	SLIP-ON AND THREADED	LAP JOINT
1/2	4.75	0.88	1.50	1.38	0.84		0.88	0.90	0.93	2.38	1.25	1.25
3/4	5.12	1.00	1.75	1.69	1.05		1.09	1.11	1.14	2.75	1.38	1.38
1	5.88	1.12	2.06	2.00	1.32		1.36	1.38	1.41	2.88	1.62	1.62
1 1/4	6.25	1.12	2.50	2.50	1.66		1.70	1.72	1.75	2.88	1.62	1.62
1 1/2	7.00	1.25	2.75	2.88	1.90		1.95	1.97	1.99	3.25	1.75	1.75
2	8.50	1.50	4.12	3.62	2.38		2.44	2.46	2.50	4.00	2.25	2.25
2 1/2	9.62	1.62	4.88	4.12	2.88		2.94	2.97	3.00	4.12	2.50	2.50
3	9.50	1.50	5.00	5.00	3.50		3.57	3.60	3.63	4.00	2.12	2.12
4	11.50	1.75	6.25	6.19	4.50		4.57	4.60	4.63	4.50	2.75	2.75
5	13.75	2.00	7.50	7.31	5.56		5.66	5.69	5.69	5.00	3.12	3.12
6	15.00	2.19	9.25	8.50	6.63		6.72	6.75	6.75	5.50	3.38	3.38
8	18.50	2.50	11.75	10.62	8.63		8.72	8.75	8.75	6.38	4.00	4.50
10	21.50	2.75	14.50	12.75	10.75		10.88	10.92	10.88	7.25	4.25	5.00
12	24.00	3.12	16.50	15.00	12.75		12.88	12.92	12.94	7.88	4.62	5.62
14	25.25	3.38	17.75	16.25	14.00		14.14	14.18	14.19	8.38	5.12	6.12
16	27.75	3.50	20.00	18.50	16.00		16.16	16.19	16.19	8.50	5.25	6.50
18	31.00	4.00	22.25	21.00	18.00		18.18	18.20	18.19	9.00	6.00	7.50
20	33.75	4.25	24.50	23.00	20.00		20.20	20.25	20.19	9.75	6.25	8.25
24	41.00	5.50	29.50	27.25	24.00		24.25	24.25	24.19	11.50	8.00	10.50

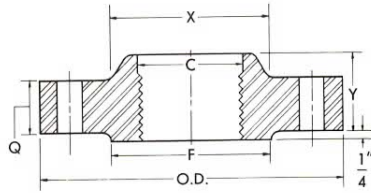
TO BE SPECIFIED BY PURCHASER

Dimensions are in inches and conform to ANSI B16.5. For dimensional tolerances, see page 65. (3) Every flange is marked to show the **FLOWLINE** trademark, type of metal, pressure rating, and pipe size in accordance with ANSI B16.5.

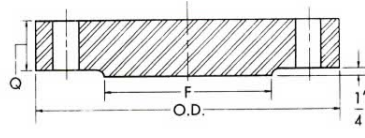
(1) Flange Thickness (Q) does not include 1/4" raised face.

(2) Bore Diameter of welding neck flanges can be provided to match purchaser's requirements.

(continued on next page)



THREADED



BLIND

**SOCKET WELD
IS NOT PRODUCED
IN CLASS 900**

SOCKET WELD

FORGED FLANGES ANSI B16.5

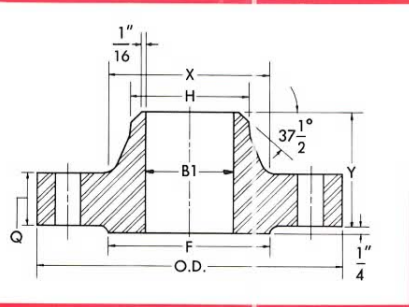
**STAINLESS STEEL
INCO® ALLOY
ALUMINUM**

NOM. PIPE SIZE	MIN. THREAD LENGTH	RADIUS (R) LAP JOINT	DRILLING			BOLTING			
			DIAMETER OF BOLT CIRCLE	NO. OF HOLES	DIA. OF HOLES	DIA. OF BOLTS	STUD BOLT LENGTH		
							.25" Raised Face	Male & Female Tongue & Groove	Ring Joint
1/2	0.88	0.12	3.25	4	0.88	3/4	4.25	4.00	4.25
3/4	1.00	0.12	3.50	4	0.88	3/4	4.50	4.25	4.50
1	1.12	0.12	4.00	4	1.00	7/8	5.00	4.75	5.00
1 1/4	1.19	0.19	4.38	4	1.00	7/8	5.00	4.75	5.00
1 1/2	1.25	0.25	4.88	4	1.12	1	5.50	5.25	5.50
2	1.50	0.31	6.50	8	1.00	7/8	5.75	5.50	5.75
2 1/2	1.88	0.31	7.50	8	1.12	1	6.25	6.00	6.25
3	1.62	0.38	7.50	8	1.00	7/8	5.75	5.50	6.00
4	1.88	0.44	9.25	8	1.25	1 1/8	6.75	6.50	7.00
5	2.12	0.44	11.00	8	1.38	1 1/4	7.50	7.25	7.75
6	2.25	0.50	12.50	12	1.25	1 1/8	7.75	7.50	7.75
8	2.50	0.50	15.50	12	1.50	1 3/8	8.75	8.50	9.00
10	2.81	0.50	18.50	16	1.50	1 3/8	9.25	9.00	9.50
12	3.00	0.50	21.00	20	1.50	1 3/8	10.00	9.75	10.25
14	3.25	0.50	22.00	20	1.62	1 1/2	10.75	10.50	11.25
16	3.38	0.50	24.25	20	1.75	1 5/8	11.25	11.00	11.75
18	3.50	0.50	27.00	20	2.00	1 7/8	12.75	12.50	13.50
20	3.62	0.50	29.50	20	2.12	2	13.50	13.50	14.25
24	4.00	0.50	35.50	20	2.62	2 1/2	17.25	17.00	17.75

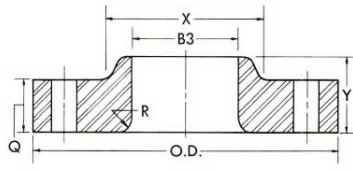
NOM. PIPE SIZE	APPROXIMATE WEIGHT EACH—POUNDS‡			
	WELDING NECK	SLIP-ON AND THREADED	LAP JOINT	BLIND
1/2	5	4	4	4
3/4	6	5	5	6
1	9	8	8	8
1 1/4	10	9	9	9
1 1/2	13	12	12	13
2	25	25	25	25
2 1/2	31	26	25	35
3	36	36	35	29
4	51	53	51	54
5	86	83	81	87
6	110	110	105	115
8	175	170	190	200
10	260	245	275	290
12	325	325	370	415
14	400	400	415	520
16	495	425	465	600
18	680	600	650	850
20	830	730	810	1075
24	1500	1400	1550	2025

(4) Length Through Hub (Y) does not include 1/4" raised face.
 (5) Length of stud bolt does not include the height of the points.
 (6) For flange facing details see pages 84 and 87.

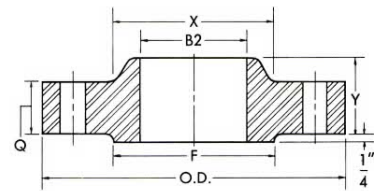
‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel Alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.



WELDING NECK



LAP JOINT



SLIP-ON

CLASS 1500 CORROSION RESISTANT

NOM. PIPE SIZE	FLANGE DIAMETER (O.D.)	FLANGE THICKNESS (Q) MIN. (1)	HUB DIA. AT BASE (X)	RAISED FACE DIA. (F)	HUB DIA. AT WELDING POINT (H)	BORE DIAMETER (B)			COUNTER BORE OF THREADED FLANGE (C)	DEPTH OF SOCKET (D)	LENGTH THROUGH HUB (Y)		
						(B1) WELDING NECK AND SOCKET WELD (2)	(B2) SLIP-ON AND SOCKET WELD MIN.	(B3) LAP JOINT MIN.			WELDING NECK	SLIP-ON, SOCKET WELD AND THREADED	LAP JOINT
1/2	4.75	0.88	1.50	1.38	0.84	0.88	0.90	0.93	0.38	2.38	1.25	1.25	
3/4	5.12	1.00	1.75	1.69	1.05	1.09	1.11	1.14	0.44	2.75	1.38	1.38	
1	5.88	1.12	2.06	2.00	1.32	1.36	1.38	1.41	0.50	2.88	1.62	1.62	
1 1/4	6.25	1.12	2.50	2.50	1.66	1.70	1.72	1.75	0.56	2.88	1.62	1.62	
1 1/2	7.00	1.25	2.75	2.88	1.90	1.95	1.97	1.99	0.62	3.25	1.75	1.75	
2	8.50	1.50	4.12	3.62	2.38	2.44	2.46	2.50	0.69	4.00	2.25	2.25	
2 1/2	9.62	1.62	4.88	4.12	2.88	2.94	2.97	3.00	0.75	4.12	2.50	2.50	
3	10.50	1.88	5.25	5.00	3.50	—	3.60	3.63	—	4.62	2.88	2.88	
4	12.25	2.12	6.38	6.19	4.50	—	4.60	4.63	—	4.88	3.56	3.56	
5	14.75	2.88	7.75	7.31	5.56	—	5.69	5.69	—	6.12	4.12	4.12	
6	15.50	3.25	9.00	8.50	6.63	—	6.75	6.75	—	6.75	4.69	4.69	
8	19.00	3.62	11.50	10.62	8.63	—	8.75	8.75	—	8.38	5.62	5.62	
10	23.00	4.25	14.50	12.75	10.75	—	10.92	10.88	—	10.00	6.25	7.00	
12	26.50	4.88	17.75	15.00	12.75	—	12.92	12.94	—	11.12	7.12	8.62	
14	29.50	5.25	19.50	16.25	14.00	—	14.18	14.19	—	11.75	—	9.50	
16	32.50	5.75	21.75	18.50	16.00	—	16.19	16.19	—	12.25	—	10.25	
18	36.00	6.38	23.50	21.00	18.00	—	18.20	18.19	—	12.88	—	10.88	
20	38.75	7.00	25.25	23.00	20.00	—	20.25	20.19	—	14.00	—	11.50	
24	46.00	8.00	30.00	27.25	24.00	—	24.25	24.19	—	16.00	—	13.00	

TO BE SPECIFIED BY PURCHASER

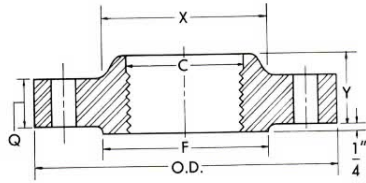
Dimensions are in inches and conform to ANSI B16.5. For dimensional tolerances, see page 65.

(1) Flange Thickness (Q) does not include 1/4" raised face.

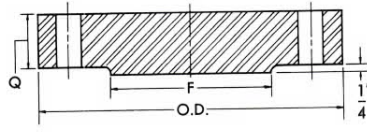
(2) Bore Diameter of welding neck flanges can be provided to match purchaser's requirements.

(3) Every flange is marked to show the **FLOWLINE** trademark, type of metal, pressure rating, and pipe size in accordance with ANSI B16.5.

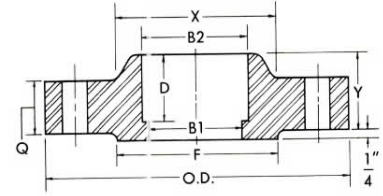
(continued on next page)



THREADED



BLIND



SOCKET WELD

FORGED FLANGES ANSI B16.5

STAINLESS STEEL
INCO® ALLOY
ALUMINUM

NOM. PIPE SIZE	MIN. THREAD LENGTH	RADIUS (R) LAP JOINT	DRILLING			BOLTING			
			DIAMETER OF BOLT CIRCLE	NO. OF HOLES	DIA. OF HOLES	STUD BOLT LENGTH			
						DIA. OF BOLTS	.25" Raised Face	Male & Female Tongue & Groove	Ring Joint
1/2	0.88	0.12	3.25	4	0.88	3/4	4.25	4.00	4.25
3/4	1.00	0.12	3.50	4	0.88	3/4	4.50	4.25	4.50
1	1.12	0.12	4.00	4	1.00	7/8	5.00	4.75	5.00
1 1/4	1.19	0.19	4.38	4	1.00	7/8	5.00	4.75	5.00
1 1/2	1.25	0.25	4.88	4	1.12	1	5.50	5.25	5.50
2	1.50	0.31	6.50	8	1.00	7/8	5.75	5.50	5.75
2 1/2	1.88	0.31	7.50	8	1.12	1	6.25	6.00	6.25
3	2.00	0.38	8.00	8	1.25	1 1/8	7.00	6.75	7.00
4	2.25	0.44	9.50	8	1.38	1 1/4	7.75	7.50	7.75
5	2.50	0.44	11.50	8	1.62	1 1/2	9.75	9.50	9.75
6	2.75	0.50	12.50	12	1.50	1 3/8	10.25	10.00	10.50
8	3.00	0.50	15.50	12	1.75	1 5/8	11.50	11.25	12.00
10	3.31	0.50	19.00	12	2.00	1 7/8	13.25	13.00	13.75
12	3.62	0.50	22.50	16	2.12	2	14.75	14.50	15.50
14	—	0.50	25.00	16	2.38	2 1/4	16.00	15.75	17.00
16	—	0.50	27.75	16	2.62	2 1/2	17.50	17.25	18.50
18	—	0.50	30.50	16	2.88	2 3/4	19.50	19.00	20.50
20	—	0.50	32.75	16	3.12	3	21.50	21.00	22.50
24	—	0.50	39.00	16	3.62	3 1/2	24.50	24.00	25.75

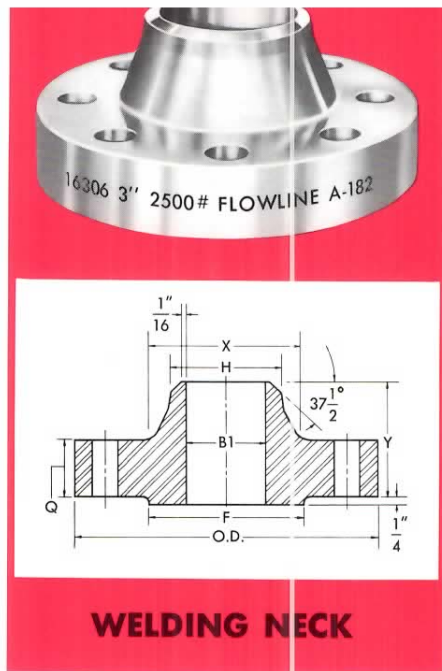
NOM. PIPE SIZE	APPROXIMATE WEIGHT EACH—POUNDS‡			
	WELDING NECK	SLIP-ON, SOCKET WELD AND THREADED	LAP JOINT	BLIND
1/2	5	4	4	4
3/4	6	5	5	6
1	9	8	8	8
1 1/4	10	9	9	9
1 1/2	13	12	12	13
2	25	25	25	25
2 1/2	36	36	35	35
3	48	48	47	48
4	73	73	75	73
5	130	130	140	140
6	165	165	170	160
8	275	260	285	300
10	455	435	485	510
12	690	580	630	690
14	940	—	890	975
16	1250	—	1150	1300
18	1625	—	1475	1750
20	2050	—	1775	2225
24	3325	—	2825	3625

(4) Length Through Hub (Y) does not include 1/4" raised face.

(5) Length of stud bolt does not include the height of the points.

(6) For flange facing details see pages 84 and 87.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel Alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.



WELDING NECK



LAP JOINT

**SLIP-ON
IS NOT PRODUCED
IN CLASS 2500**

SLIP-ON

CLASS 2500 CORROSION RESISTANT

NOM. PIPE SIZE	FLANGE DIAMETER (O.D.)	FLANGE THICKNESS (Q) MIN. (1)	HUB DIA. AT BASE (X)	RAISED FACE DIA. (F)	HUB DIA. AT WELDING POINT (H)	BORE DIAMETER (B)			COUNTER BORE OF THREADED FLANGE (C)	LENGTH THROUGH HUB (Y)		
						(B1) WELDING NECK (2)	(B2) SLIP-ON MIN.	(B3) LAP JOINT MIN.		WELDING NECK	SLIP-ON AND THREADED	LAP JOINT
1/2	5.25	1.19	1.69	1.38	0.84	TO BE SPECIFIED BY PURCHASER	0.88	0.90	0.93	2.88	1.56	1.56
3/4	5.50	1.25	2.00	1.69	1.05		1.09	1.11	1.14	3.12	1.69	1.69
1	6.25	1.38	2.25	2.00	1.32		1.36	1.38	1.41	3.50	1.88	1.88
1 1/4	7.25	1.50	2.88	2.50	1.66		1.70	1.72	1.75	3.75	2.06	2.06
1 1/2	8.00	1.75	3.12	2.88	1.90		1.95	1.97	1.99	4.38	2.38	2.38
2	9.25	2.00	3.75	3.62	2.38		2.44	2.46	2.50	5.00	2.75	2.75
2 1/2	10.50	2.25	4.50	4.12	2.88		2.94	2.97	3.00	5.62	3.12	3.12
3	12.00	2.62	5.25	5.00	3.50		3.57	3.60	3.63	6.62	3.62	3.62
4	14.00	3.00	6.50	6.19	4.50		4.57	4.60	4.63	7.50	4.25	4.25
5	16.50	3.62	8.00	7.31	5.56		5.66	5.69	5.69	9.00	5.12	5.12
6	19.00	4.25	9.25	8.50	6.63		6.72	6.75	6.75	10.75	6.00	6.00
8	21.75	5.00	12.00	10.62	8.63		8.72	8.75	8.75	12.50	7.00	7.00
10	26.50	6.50	14.75	12.75	10.75		10.88	10.92	10.88	16.50	9.00	9.00
12	30.00	7.25	17.38	15.00	12.75		12.88	12.92	12.94	18.25	10.00	10.00

Class 2500 Slip-On Flanges are not included in ANSI B16.5

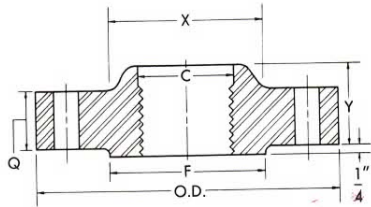
Dimensions are in inches and conform to ANSI B16.5. For dimensional tolerances, see page 65.

(1) Flange Thickness (Q) does not include 1/4" raised face.

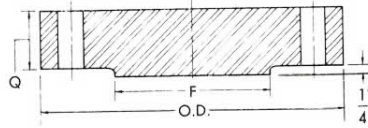
(2) Bore Diameter of welding neck flanges can be provided to match purchaser's requirements.

(3) Every flange is marked to show the **FLOWLINE** trademark, type of metal, pressure rating, and pipe size in accordance with ANSI B16.5.

(continued on next page)



THREADED



BLIND

**SOCKET WELD
IS NOT PRODUCED
IN CLASS 2500**

SOCKET WELD

FORGED FLANGES ANSI B16.5

**STAINLESS STEEL
INCO® ALLOY
ALUMINUM**

NOM. PIPE SIZE	MIN. THREAD LENGTH	RADIUS (R) LAP JOINT	DRILLING			BOLTING			
			DIAMETER OF BOLT CIRCLE	NO. OF HOLES	DIA. OF HOLES	DIA. OF BOLTS	STUD BOLT LENGTH		
							.25" Raised Face	Male & Female Tongue & Groove	Ring Joint
1/2	1.12	0.12	3.50	4	0.88	3/4	5.25	5.00	5.25
3/4	1.25	0.12	3.75	4	0.88	3/4	5.25	5.00	5.25
1	1.38	0.12	4.25	4	1.00	7/8	5.75	5.50	5.75
1 1/4	1.50	0.19	5.12	4	1.12	1	6.25	6.00	6.50
1 1/2	1.75	0.25	5.75	4	1.25	1 1/8	7.00	6.75	7.25
2	2.00	0.31	6.75	8	1.12	1	7.25	7.00	7.50
2 1/2	2.25	0.31	7.75	8	1.25	1 1/8	8.00	7.75	8.25
3	2.50	0.38	9.00	8	1.38	1 1/4	9.00	8.75	9.25
4	2.75	0.44	10.75	8	1.62	1 1/2	10.25	10.00	10.75
5	3.00	0.44	12.75	8	1.88	1 3/4	12.00	11.75	12.75
6	3.25	0.50	14.50	8	2.12	2	13.75	13.50	14.50
8	3.75	0.50	17.25	12	2.12	2	15.25	15.00	16.00
10	4.25	0.50	21.25	12	2.62	2 1/2	19.50	19.25	20.50
12	4.75	0.50	24.38	12	2.88	2 3/4	21.50	21.25	22.50

NOM. PIPE SIZE	APPROXIMATE WEIGHT EACH — POUNDS‡			
	WELDING NECK	SLIP-ON AND THREADED	LAP JOINT	BLIND
1/2	7	7	7	7
3/4	8	8	8	8
1	12	11	11	11
1 1/4	17	16	16	17
1 1/2	25	22	22	23
2	42	38	37	39
2 1/2	52	55	53	56
3	94	83	80	86
4	145	125	120	135
5	245	210	205	225
6	380	325	315	345
8	580	485	470	530
10	1075	930	900	1025
12	1525	1100	1100	1300

(4) Length Through Hub (Y) does not include 1/4" raised face.
 (5) Length of stud bolt does not include the height of the points.
 (6) For flange facing details see pages 84 and 87.

‡Weights shown are for Stainless Steel. Approximate Nickel and Nickel Alloy weights are obtained by multiplying by 1.12. Approximate Aluminum weights are obtained by multiplying by .33.

PRESSURE-TEMPERATURE RATINGS OF CORROSION-RESISTANT FORGED FLANGES

The data on this page and pages 81 to 83 are for Class 150, 300, 400, 600, 900, 1500 and 2500 forged pipe flanges in conformance with ANSI B16.5 for ferrous and non-ferrous materials. Aluminum flanges are based on Code Case 141 for ANSI/ASME B31-3 Piping.

Pressure temperature ratings are listed for the following corrosion resistant metals:

General Classification	Applicable Specification
Stainless Steels Types 304 and 304H, 304L, 310, 316 and 316H, 316L, 321, 347 and 348	ASTM A-182
Nickel 200 (annealed)	ASTM B-160
Nickel 201 (low carbon—annealed)	ASTM B-160
Monel 400 (nickel, copper—annealed)	ASTM B-164
Inconel 600 (nickel, chromium, iron—annealed)	ASTM B-166
Aluminum Alloy—3003—H112	ASTM B-247
Aluminum Alloy—6061-T6	ASTM B-247

The temperature shown for a corresponding pressure rating is the temperature of the pressure containing shell of the component. The ratings are the maximum allowable non-shock pressures at the temperature shown and the allowable pressure may be interpolated between the temperatures.

Application of this data depends on the use of proper gaskets and bolting. A product used under the jurisdiction of the ASME Boiler and Pressure Vessel Code, the ANSI code for pressure piping or governmental regulations, is subject to any limitation of that code or regulation. This includes any maximum temperature limitation for a material or rule governing the use of a material at low temperature.

CLASS 150 PRESSURE-TEMPERATURE RATINGS

SERVICE TEMPERATURE DEGREES F.	STAINLESS STEEL							INCO ALLOYS				ALUMINUM (2)	
	(1) 304	304L	(1) 310	(1) 316	316L	(1) 321	(1) 347 and 348	Alloy 200	Alloy 201	Alloy 400	Alloy 600	3003 H112	6061 T6
	Working Pressure — Pounds Per Square Inch Gage (PSIG)												
—20 to 100	275	230	260	275	230	275	275	140	90	230	275	40	275
200	235	195	230	240	195	235	245	140	85	200	260	35	265
300	205	175	220	215	175	210	225	140	85	190	230	—	—
400	180	160	200	195	160	190	200	140	85	185	200	—	—
500	170	145	170	170	145	170	170	140	85	170	170	—	—
600	140	140	140	140	140	140	140	140	85	140	140	—	—
650	125	125	125	125	125	125	125	—	85	125	125	—	—
700	110	110	110	110	110	110	110	—	85	110	110	—	—
750	95	95	95	95	95	95	95	—	80	95	95	—	—
800	80	80	80	80	80	80	80	—	80	80	80	—	—
850	65	—	65	65	65	65	65	—	65	65	65	—	—
900	50	—	50	50	—	50	50	—	50	50	50	—	—
950	35	—	35	35	—	35	35	—	35	—	35	—	—
1000	20	—	20	20	—	20	20	—	20	—	20	—	—
HYDROSTATIC SHELL TEST PRESSURE	425	350	400	425	350	425	425	225	150	350	425	—	—

1. At temperatures over 1000°F. (540°C.), only use when carbon is 0.04 percent or higher.
2. The ratings are based on ANSI/ASME B31.3 Code Case #141.

(continued on next page)

CLASS 300 PRESSURE-TEMPERATURE RATINGS

SERVICE TEMPERATURE DEGREES F.	STAINLESS STEEL							INCO ALLOYS				ALUMINUM (2)	
	(1) 304	304L	(1) 310	(1) 316	316L	(1) 321	(1) 347 and 348	Alloy 200	Alloy 201	Alloy 400	Alloy 600	3003 H112	6061 T6
	Working Pressure — Pounds Per Square Inch Gage (PSIG)												
—20 to 100	720	600	670	720	600	720	720	360	240	600	720	105	720
200	600	505	605	620	505	610	635	360	230	530	670	95	700
300	530	455	570	560	455	545	590	360	225	495	640	—	—
400	470	415	535	515	415	495	555	360	215	480	615	—	—
500	435	380	505	480	380	460	520	360	215	475	595	—	—
600	415	360	480	450	360	435	490	360	215	475	575	—	—
650	410	350	465	445	350	430	480	—	215	475	565	—	—
700	405	345	455	430	345	420	470	—	215	475	555	—	—
750	400	335	445	425	335	415	460	—	210	470	530	—	—
800	395	330	435	415	330	415	455	—	205	460	510	—	—
850	390	—	425	405	320	410	445	—	205	340	485	—	—
900	385	—	415	395	—	405	430	—	140	245	450	—	—
950	375	—	385	385	—	385	385	—	115	—	325	—	—
1000	325	—	350	365	—	355	365	—	95	—	215	—	—
1050	310	—	335	360	—	345	360	—	75	—	140	—	—
1100	260	—	290	325	—	300	325	—	60	—	95	—	—
1150	195	—	245	275	—	235	275	—	45	—	70	—	—
1200	155	—	205	205	—	180	170	—	35	—	60	—	—
1250	110	—	160	180	—	140	125	—	—	—	—	—	—
1300	85	—	120	140	—	105	95	—	—	—	—	—	—
1350	60	—	80	105	—	80	70	—	—	—	—	—	—
1400	50	—	55	75	—	60	50	—	—	—	—	—	—
1450	35	—	40	60	—	50	40	—	—	—	—	—	—
1500	25	—	25	40	—	40	35	—	—	—	—	—	—
HYDROSTATIC SHELL TEST PRESSURE	1100	900	1025	1100	900	1100	1100	550	375	900	1100	175	1100

CLASS 400 PRESSURE-TEMPERATURE RATINGS

SERVICE TEMPERATURE DEGREES F.	STAINLESS STEEL							INCO ALLOYS				ALUMINUM (2)	
	(1) 304	304L	(1) 310	(1) 316	316L	(1) 321	(1) 347 and 348	Alloy 200	Alloy 201	Alloy 400	Alloy 600	3003 H112	6061 T6
	Working Pressure — Pounds Per Square Inch Gage (PSIG)												
—20 to 100	960	800	895	960	800	960	960	480	320	800	960	135	960
200	800	675	805	825	675	815	850	480	305	705	895	130	930
300	705	605	760	745	605	725	785	480	300	660	850	—	—
400	630	550	710	685	550	660	740	480	290	635	820	—	—
500	585	510	670	635	510	610	690	480	290	635	790	—	—
600	555	480	635	600	480	585	655	480	290	635	765	—	—
650	545	470	620	590	470	570	640	—	290	635	750	—	—
700	540	460	610	575	460	560	625	—	290	635	740	—	—
750	530	450	595	565	450	555	615	—	280	625	710	—	—
800	525	440	580	555	440	550	610	—	270	610	675	—	—
850	520	—	565	540	430	545	590	—	270	455	650	—	—
900	510	—	555	525	—	540	575	—	185	430	600	—	—
950	500	—	515	515	—	515	515	—	150	—	495	—	—
1000	430	—	465	485	—	475	485	—	125	—	290	—	—
1050	410	—	445	480	—	460	480	—	100	—	185	—	—
1100	345	—	390	430	—	400	430	—	80	—	125	—	—
1150	260	—	330	365	—	315	365	—	60	—	90	—	—
1200	205	—	275	275	—	240	230	—	50	—	80	—	—
1250	145	—	215	245	—	185	165	—	—	—	—	—	—
1300	110	—	160	185	—	140	125	—	—	—	—	—	—
1350	85	—	105	140	—	110	90	—	—	—	—	—	—
1400	65	—	75	100	—	80	70	—	—	—	—	—	—
1450	45	—	50	80	—	65	55	—	—	—	—	—	—
1500	30	—	30	65	—	50	45	—	—	—	—	—	—
HYDROSTATIC SHELL TEST PRESSURE	1450	1200	1350	1450	1200	1450	1450	725	500	1200	1450	225	1450

1. At temperatures over 1000F. (540C), only use when carbon is 0.04 percent or higher.

2. The ratings are based on ANSI/ASME B31.3 Code Case #141.

(continued on next page)

CLASS 600 PRESSURE-TEMPERATURE RATINGS

SERVICE TEMPERATURE DEGREES F.	STAINLESS STEEL							INCO ALLOYS				ALUMINUM (2)	
	(1) 304	304L	(1) 310	(1) 316	316L	(1) 321	(1) 347 and 348	Alloy 200	Alloy 201	Alloy 400	Alloy 600	3003 H112	6061 T6
	Working Pressure — Pounds Per Square Inch Gage (PSIG)												
-20 to 100	1440	1200	1345	1440	1200	1440	1440	720	480	1200	1440	205	1440
200	1200	1015	1210	1240	1015	1220	1270	720	455	1055	1345	195	1400
300	1055	910	1140	1120	910	1090	1175	720	445	990	1275	—	—
400	940	825	1065	1030	825	990	1110	720	430	955	1230	—	—
500	875	765	1010	955	765	915	1035	720	430	950	1185	—	—
600	830	720	955	905	720	875	985	720	430	950	1145	—	—
650	815	700	930	890	700	855	960	—	430	950	1130	—	—
700	805	685	910	865	685	840	935	—	430	950	1115	—	—
750	795	670	895	845	670	830	920	—	420	935	1065	—	—
800	790	660	870	830	660	825	910	—	410	915	1015	—	—
850	780	—	850	810	645	815	890	—	410	680	975	—	—
900	770	—	830	790	—	810	865	—	380	495	900	—	—
950	750	—	775	775	—	775	775	—	230	—	655	—	—
1000	645	—	700	725	—	715	725	—	185	—	430	—	—
1050	620	—	665	720	—	695	720	—	150	—	280	—	—
1100	515	—	585	645	—	605	645	—	125	—	185	—	—
1150	390	—	495	550	—	475	550	—	95	—	135	—	—
1200	310	—	410	410	—	365	345	—	75	—	125	—	—
1250	220	—	325	365	—	280	245	—	—	—	—	—	—
1300	165	—	240	275	—	210	185	—	—	—	—	—	—
1350	125	—	160	205	—	165	135	—	—	—	—	—	—
1400	90	—	110	150	—	125	105	—	—	—	—	—	—
1450	70	—	75	115	—	95	80	—	—	—	—	—	—
1500	50	—	55	85	—	75	70	—	—	—	—	—	—
HYDROSTATIC SHELL TEST PRESSURE	2175	1800	2025	2175	1800	2175	2175	1100	725	1800	2175	325	2175

CLASS 900 PRESSURE-TEMPERATURE RATINGS

SERVICE TEMPERATURE DEGREES F.	STAINLESS STEEL							INCO ALLOYS			
	(1) 304	304L	(1) 310	(1) 316	316L	(1) 321	(1) 347 and 348	Alloy 200	Alloy 201	Alloy 400	Alloy 600
	Working Pressure — Pounds Per Square Inch Gage (PSIG)										
-20 to 100	2160	1800	2015	2160	1800	2160	2160	1080	720	1800	2160
200	1800	1520	1815	1860	1520	1830	1910	1080	685	1585	2015
300	1585	1360	1705	1680	1360	1635	1765	1080	670	1485	1915
400	1410	1240	1600	1540	1240	1485	1665	1080	650	1435	1845
500	1310	1145	1510	1435	1145	1375	1555	1080	650	1435	1780
600	1245	1080	1435	1355	1080	1310	1475	1080	650	1435	1720
650	1225	1050	1395	1330	1050	1280	1440	—	650	1435	1690
700	1210	1030	1370	1295	1030	1260	1405	—	650	1435	1670
750	1195	1010	1340	1270	1010	1245	1385	—	635	1405	1595
800	1180	985	1305	1245	985	1240	1370	—	610	1375	1520
850	1165	—	1275	1215	965	1225	1330	—	610	1020	1460
900	1150	—	1245	1180	—	1215	1295	—	415	740	1350
950	1125	—	1160	1160	—	1160	1160	—	345	—	980
1000	965	—	1050	1090	—	1070	1090	—	280	—	650
1050	925	—	1000	1080	—	1040	1080	—	220	—	415
1100	770	—	875	965	—	905	965	—	185	—	280
1150	585	—	740	825	—	710	825	—	140	—	205
1200	465	—	620	620	—	545	515	—	110	—	185
1250	330	—	485	545	—	420	370	—	—	—	—
1300	245	—	360	410	—	320	280	—	—	—	—
1350	185	—	235	310	—	245	205	—	—	—	—
1400	145	—	165	225	—	185	155	—	—	—	—
1450	105	—	115	175	—	145	125	—	—	—	—
1500	70	—	70	125	—	115	105	—	—	—	—
HYDROSTATIC SHELL TEST PRESSURE	3250	2700	3025	3250	2700	3250	3250	1625	1100	2700	3250

1. At temperatures over 1000°F (540C), only use when carbon is 0.04 percent or higher.
 2. The ratings are based on ANSI/ASME B31.3 Code Case #141.

(continued on next page)

CLASS 1500 PRESSURE-TEMPERATURE RATINGS

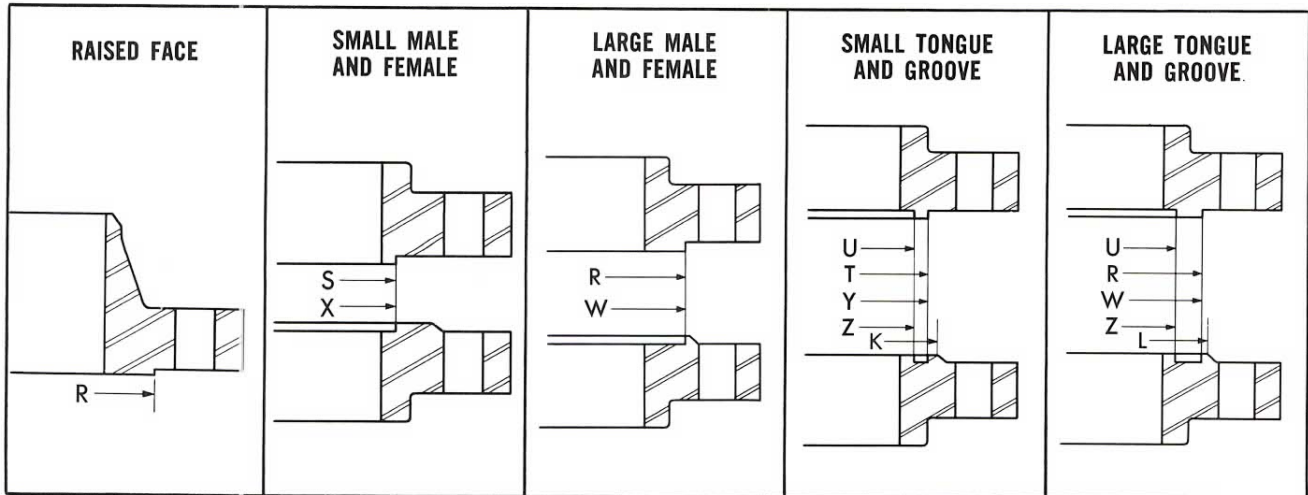
SERVICE TEMPERATURE DEGREES F.	STAINLESS STEEL							NCO ALLOYS			
	(1) 304	304L	(1) 310	(1) 316	316L	(1) 321	(1) 347 and 348	Alloy 200	Alloy 201	Alloy 400	Alloy 600
	Working Pressure — Pounds Per Square Inch Gage (PSIG)										
—20 to 100	3600	3000	3360	3600	3000	3600	3600	1800	1200	3000	3600
200	3000	2530	3025	3095	2530	3050	3180	1800	1140	2640	3360
300	2640	2270	2845	2795	2270	2725	2940	1800	1115	2470	3190
400	2350	2065	2665	2570	2065	2470	2770	1800	1080	2390	3070
500	2185	1910	2520	2390	1910	2290	2590	1800	1080	2375	2965
600	2075	1800	2390	2255	1800	2185	2460	1800	1080	2375	2870
650	2040	1750	2330	2220	1750	2135	2400	—	1080	2375	2820
700	2015	1715	2280	2160	1715	2100	2340	—	1080	2375	2785
750	1990	1680	2230	2110	1680	2075	2305	—	1055	2340	2660
800	1970	1645	2170	2075	1645	2065	2280	—	1020	2290	2540
850	1945	—	2125	2030	1610	2040	2220	—	1020	1695	2435
900	1920	—	2075	1970	—	2030	2160	—	695	1235	2245
950	1870	—	1930	1930	—	1930	1930	—	570	—	1635
1000	1610	—	1750	1820	—	1785	1820	—	465	—	1080
1050	1545	—	1665	1800	—	1730	1800	—	370	—	695
1100	1285	—	1460	1610	—	1510	1610	—	310	—	465
1150	980	—	1235	1370	—	1185	1370	—	230	—	340
1200	770	—	1030	1030	—	910	855	—	185	—	310
1250	550	—	805	910	—	705	615	—	—	—	—
1300	410	—	600	685	—	530	465	—	—	—	—
1350	310	—	395	515	—	410	345	—	—	—	—
1400	240	—	275	380	—	310	255	—	—	—	—
1450	170	—	190	290	—	240	205	—	—	—	—
1500	120	—	120	205	—	190	170	—	—	—	—
HYDROSTATIC SHELL TEST PRESSURE	5400	4500	5050	5400	4500	5400	5400	2700	1300	4500	5400

CLASS 2500 PRESSURE-TEMPERATURE RATINGS

SERVICE TEMPERATURE DEGREES F.	STAINLESS STEEL							INCO ALLOYS			
	(1) 304	304L	(1) 310	(1) 316	316L	(1) 321	(1) 347 and 348	Alloy 200	Alloy 201	Alloy 400	Alloy 600
	Working Pressure — Pounds Per Square Inch Gage (PSIG)										
—20 to 100	6000	5000	5600	6000	5000	6000	6000	3000	2000	5000	6000
200	5000	4220	5040	5160	4220	5080	5300	3000	1900	4400	5600
300	4400	3780	4740	4660	3780	4540	4900	3000	1860	4120	5320
400	3920	3440	4440	4280	3440	4120	4620	3000	1800	3980	5120
500	3640	3180	4200	3980	3180	3820	4320	3000	1800	3960	4940
600	3460	3000	3980	3760	3000	3640	4100	3000	1800	3960	4780
650	3400	2920	3880	3700	2920	3560	4000	—	1800	3960	4700
700	3360	2860	3800	3600	2860	3500	3900	—	1800	3960	4640
750	3320	2800	3720	3520	2800	3460	3840	—	1760	3900	4430
800	3280	2740	3620	3460	2740	3440	3800	—	1700	3820	4230
850	3240	—	3540	3380	2680	3400	3700	—	1700	2830	4060
900	3200	—	3460	3280	—	3380	3600	—	1155	2055	3745
950	3120	—	3220	3220	—	3220	3220	—	950	—	2725
1000	2685	—	2915	3030	—	2970	3030	—	770	—	1800
1050	2570	—	2770	3000	—	2885	3000	—	615	—	1155
1100	2145	—	2430	2685	—	2515	2685	—	515	—	770
1150	1630	—	2060	2285	—	1970	2285	—	385	—	565
1200	1285	—	1715	1715	—	1515	1430	—	310	—	515
1250	915	—	1345	1515	—	1170	1030	—	—	—	—
1300	685	—	1000	1145	—	885	770	—	—	—	—
1350	515	—	660	860	—	685	570	—	—	—	—
1400	400	—	460	630	—	515	430	—	—	—	—
1450	285	—	315	485	—	400	345	—	—	—	—
1500	200	—	200	345	—	315	285	—	—	—	—
HYDROSTATIC SHELL TEST PRESSURE	9000	7500	8400	9000	7500	9000	9000	4500	3000	7500	9000

1. At temperatures over 1000F (540C), only use when carbon is 0.04 percent or higher.

AMERICAN STANDARD FLANGE FACINGS



DIMENSIONS OF FLANGE FACINGS OTHER THAN RING-JOINT

Class 150, 300, 400, 600, 900, 1500 and 2500 ANSI Steel Flange Standards

NOMINAL PIPE SIZE	Outside Diameter			Inside Diameter of Large and Small Tongue (U)	Outside Diameter			Inside Diameter of Large and Small Groove (Z)	Minimum Diameter of Raised Portion (2)	
	Raised Face, Large Male, and Large Tongue (R)	Small Male (1)	Small Tongue (T)		Large Female and Large Groove (W)	Small Female (1)	Small Groove (Y)		Small Tongue and Groove (K)	Large Tongue and Groove (L)
1/2	1.38	0.72	1.38	1.00	1.44	0.78	1.44	0.94	1.75	1.81
3/4	1.69	0.94	1.69	1.31	1.75	1.00	1.75	1.25	2.06	2.12
1	2.00	1.19	1.88	1.50	2.06	1.25	1.94	1.44	2.25	2.44
1 1/4	2.50	1.50	2.25	1.88	2.56	1.56	2.31	1.81	2.62	2.94
1 1/2	2.88	1.75	2.50	2.12	2.94	1.81	2.56	2.06	2.88	3.31
2	3.62	2.25	3.25	2.88	3.69	2.31	3.31	2.81	3.62	4.06
2 1/2	4.12	2.69	3.75	3.38	4.19	2.75	3.81	3.31	4.12	4.56
3	5.00	3.31	4.62	4.25	5.06	3.38	4.69	4.19	5.00	5.44
3 1/2	5.50	3.81	5.12	4.75	5.56	3.88	5.19	4.69	5.50	5.94
4	6.19	4.31	5.69	5.19	6.25	4.38	5.75	5.12	6.19	6.62
5	7.31	5.38	6.81	6.31	7.38	5.44	6.88	6.25	7.31	7.75
6	8.50	6.38	8.00	7.50	8.56	6.44	8.06	7.44	8.50	8.94
8	10.62	8.38	10.00	9.38	10.69	8.44	10.06	9.31	10.62	11.06
10	12.75	10.50	12.00	11.25	12.81	10.56	12.06	11.19	12.75	13.19
12	15.00	12.50	14.25	13.50	15.06	12.56	14.31	13.44	15.00	15.44
14	16.25	13.75	15.50	14.75	16.31	13.81	15.56	14.69	16.25	16.69
16	18.50	15.75	17.62	16.75	18.56	15.81	17.69	16.69	18.50	18.94
18	21.00	17.75	20.12	19.25	21.06	17.81	20.19	19.19	21.00	21.44
20	23.00	19.75	22.00	21.00	23.06	19.81	22.06	20.94	23.00	23.44
24	27.25	23.75	26.25	25.25	27.31	23.81	26.31	25.19	27.25	27.69

For facing tolerances, see pages 85, 86, 87.

All dimensions are in inches and conform to ANSI B16.5.

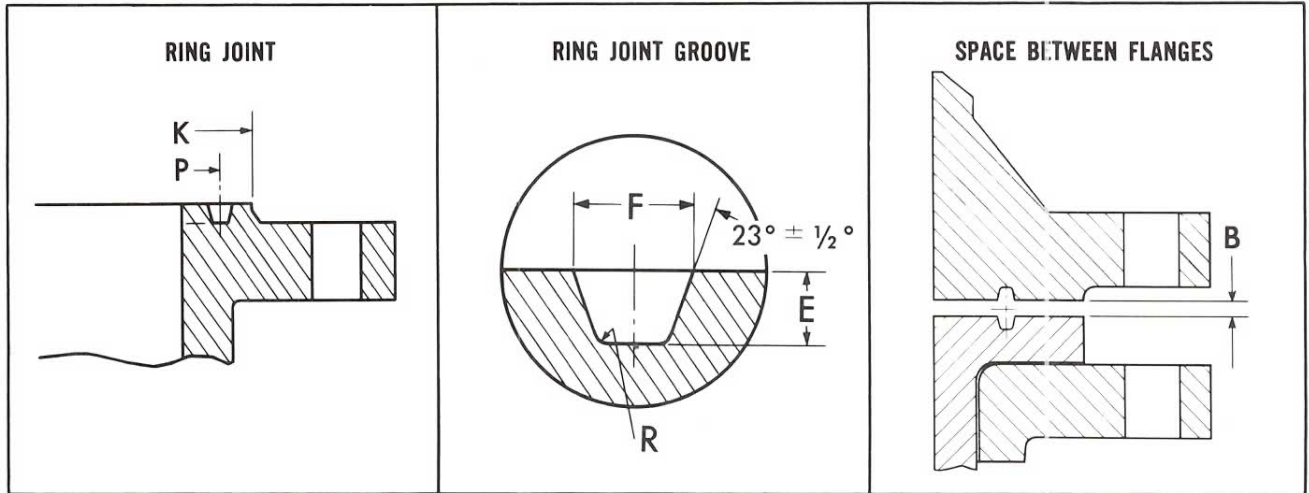
- (1) For small male and female joints care should be taken in applying these dimensions to insure that the inside diameter of fitting on pipe is small enough to permit sufficient bearing surface to prevent crushing of gasket.
- (2) Raised portion or full face may be furnished by flange manufacturer unless otherwise ordered.

Depth of groove or female is 0.19"; thickness of lap remaining after machining groove (or tongue) shall not be less than wall thickness of pipe used.

Height of large and small male and tongue is 0.25" or no less than wall thickness of pipe used, whichever is greater.

(continued on next page)

AMERICAN STANDARD FLANGE FACINGS



DIMENSIONS OF RING-JOINT FLANGE FACINGS

Class 150, 300 and 400 ANSI Steel Flange Standards

NOMINAL PIPE SIZE	CLASS 150 PRIMARY PRESSURE RATING						CLASS 300 AND 400 PRIMARY PRESSURE RATING						
	Groove Number	Groove Dimensions‡			Diameter of Raised Portion (K)	Approx. Distance Between Flanges (B) (2)	Groove Number	Groove Dimensions‡			Diameter of Raised Portion (K)	Approx. Distance Between Flanges (B) (2)	
		Pitch Diameter $\pm .005$ (P)	Depth $+0.016$ -0 (E) (1)	Width $\pm .008$ (F)				Pitch Diameter $\pm .005$ (P)	Depth $+0.016$ -0 (E) (1)	Width $\pm .008$ (F)		300 lb.	400 lb.
1/2	—	—	—	—	—	—	11	1.344	0.219	0.281	2.00	0.12	0.12
3/4	—	—	—	—	—	—	13	1.688	0.250	0.344	2.50	0.16	0.16
1	15	1.875	0.250	0.344	2.50	0.16	16	2.000	0.250	0.344	2.75	0.16	0.16
1 1/4	17	2.250	0.250	0.344	2.88	0.16	18	2.375	0.250	0.344	3.12	0.16	0.16
1 1/2	19	2.562	0.250	0.344	3.25	0.16	20	2.688	0.250	0.344	3.56	0.16	0.16
2	22	3.250	0.250	0.344	4.00	0.16	23	3.250	0.312	0.469	4.25	0.22	0.19
2 1/2	25	4.000	0.250	0.344	4.75	0.16	26	4.000	0.312	0.469	5.00	0.22	0.19
3	29	4.500	0.250	0.344	5.25	0.16	31	4.875	0.312	0.469	5.75	0.22	0.19
3 1/2	33	5.188	0.250	0.344	6.06	0.16	34	5.188	0.312	0.469	6.25	0.22	0.19
4	36	5.875	0.250	0.344	6.75	0.16	37	5.875	0.312	0.469	6.88	0.22	0.22
5	40	6.750	0.250	0.344	7.62	0.16	41	7.125	0.312	0.469	8.25	0.22	0.22
6	43	7.625	0.250	0.344	8.62	0.16	45	8.312	0.312	0.469	9.50	0.22	0.22
8	48	9.750	0.250	0.344	10.75	0.16	49	10.625	0.312	0.469	11.88	0.22	0.22
10	52	12.000	0.250	0.344	13.00	0.16	53	12.750	0.312	0.469	14.00	0.22	0.22
12	56	15.000	0.250	0.344	16.00	0.16	57	15.000	0.312	0.469	16.25	0.22	0.22
14	59	15.625	0.250	0.344	16.75	0.12	61	16.500	0.312	0.469	18.00	0.22	0.22
16	64	17.875	0.250	0.344	19.00	0.12	65	18.500	0.312	0.469	20.00	0.22	0.22
18	68	20.375	0.250	0.344	21.50	0.12	69	21.000	0.312	0.469	22.62	0.22	0.22
20	72	22.000	0.250	0.344	23.50	0.12	73	23.000	0.375	0.531	25.00	0.22	0.22
24	76	26.500	0.250	0.344	28.00	0.12	77	27.250	0.438	0.656	29.50	0.25	0.25

All dimensions are in inches and conform to ANSI B16.5.

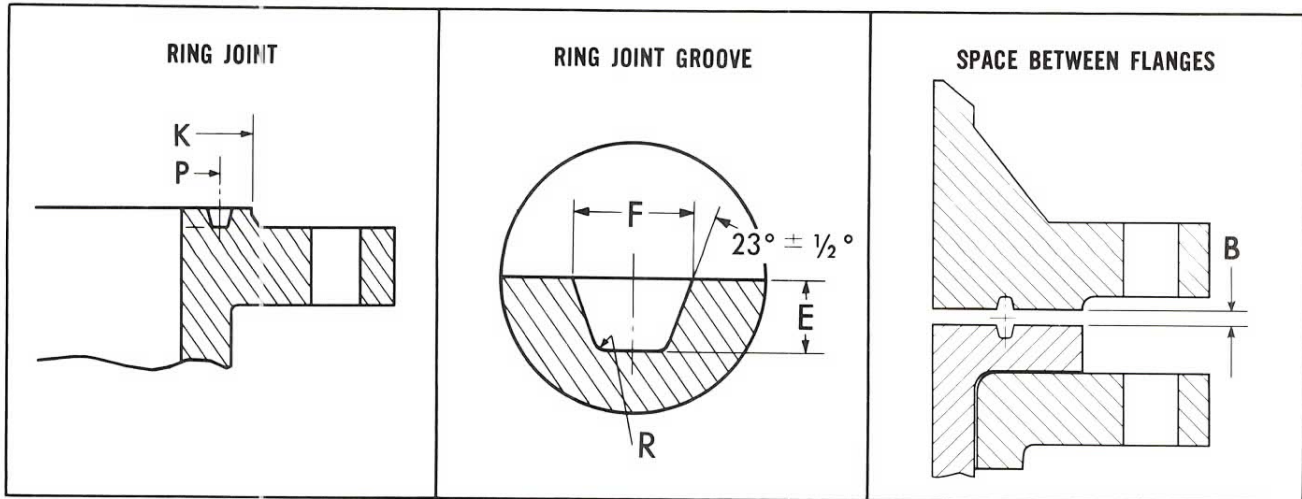
- (1) Height of Raised Portion (K) is equal to dimensions of Groove (E) but is not subject to the tolerance for (E).
 (2) Approximate space between two ring joint flanges when ring gasket is compressed.

(R) Radius at bottom of Groove is 0.03" max. for all facings listed in above table except for the 20" and 24" Class 300 and 400 flange facings for which this radius is 0.06" max.

‡ Tolerances for groove dimensions, in conformance with ANSI B16.5, are stated in column titles.

(continued on next page)

AMERICAN STANDARD FLANGE FACINGS



DIMENSIONS OF RING-JOINT FLANGE FACINGS
Class 600 and 900 ANSI Steel Flange Standards

NOMINAL PIPE SIZE	CLASS 600 PRIMARY PRESSURE RATING							CLASS 900 PRIMARY PRESSURE RATING						
	Groove Number	Groove Dimensions‡			Diameter of Raised Portion (K)	Approx. Distance Between Flanges (B) (2)	Radius at Bottom of Groove Max.	Groove Number	Groove Dimensions‡			Diameter of Raised Portion (K)	Approx. Distance Between Flanges (B) (2)	Radius at Bottom of Groove Max.
		Pitch Diameter $\pm .005$ (P)	Depth $+0.016 - 0$ (E) (1)	Width $\pm .008$ (F)					Pitch Diameter $\pm .005$ (P)	Depth $+0.016 - 0$ (E) (1)	Width $\pm .008$ (F)			
1/2	11	1.344	0.219	0.281	2.00	0.12	0.03	12	1.562	0.250	0.344	2.38	0.16	0.03
3/4	13	1.688	0.250	0.344	2.50	0.16	0.03	14	1.750	0.250	0.344	2.62	0.16	0.03
1	16	2.000	0.250	0.344	2.75	0.16	0.03	16	2.000	0.250	0.344	2.81	0.16	0.03
1 1/4	18	2.375	0.250	0.344	3.12	0.16	0.03	18	2.375	0.250	0.344	3.19	0.16	0.03
1 1/2	20	2.688	0.250	0.344	3.56	0.16	0.03	20	2.688	0.250	0.344	3.62	0.16	0.03
2	23	3.250	0.312	0.469	4.25	0.19	0.03	24	3.750	0.312	0.469	4.88	0.12	0.03
2 1/2	26	4.000	0.312	0.469	5.00	0.19	0.03	27	4.250	0.312	0.469	5.38	0.12	0.03
3	31	4.875	0.312	0.469	5.75	0.19	0.03	31	4.875	0.312	0.469	6.12	0.16	0.03
3 1/2	34	5.188	0.312	0.469	6.25	0.19	0.03	—	—	—	—	—	—	—
4	37	5.875	0.312	0.469	6.88	0.19	0.03	37	5.875	0.312	0.469	7.12	0.16	0.03
5	41	7.125	0.312	0.469	8.25	0.19	0.03	41	7.125	0.312	0.469	8.50	0.16	0.03
6	45	8.312	0.312	0.469	9.50	0.19	0.03	45	8.312	0.312	0.469	9.50	0.16	0.03
8	49	10.625	0.312	0.469	11.88	0.19	0.03	49	10.625	0.312	0.469	12.12	0.16	0.03
10	53	12.750	0.312	0.469	14.00	0.19	0.03	53	12.750	0.312	0.469	14.25	0.16	0.03
12	57	15.000	0.312	0.469	16.25	0.19	0.03	57	15.000	0.312	0.469	16.50	0.16	0.03
14	61	16.500	0.312	0.469	18.00	0.19	0.03	62	16.500	0.438	0.656	18.38	0.16	0.06
16	65	18.500	0.312	0.469	20.00	0.19	0.03	66	18.500	0.438	0.656	20.62	0.16	0.06
18	69	21.000	0.312	0.469	22.62	0.19	0.03	70	21.000	0.500	0.781	23.38	0.19	0.06
20	73	23.000	0.375	0.531	25.00	0.19	0.06	74	23.000	0.500	0.781	25.50	0.19	0.06
24	77	27.250	0.438	0.656	29.50	0.22	0.06	78	27.250	0.625	1.062	30.38	0.22	0.09

All dimensions are in inches and conform to ANSI B16.5.

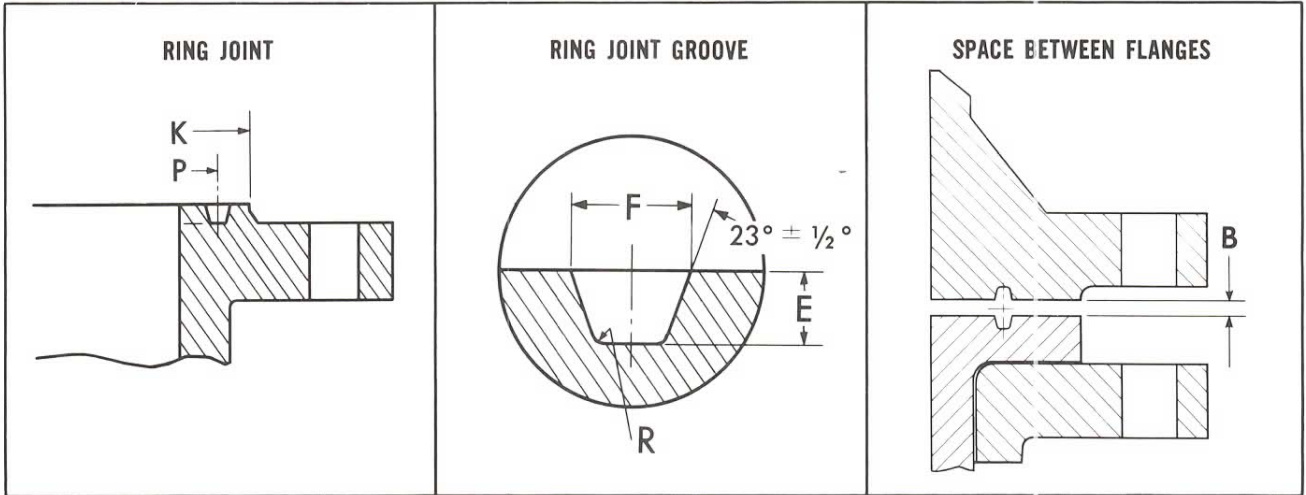
(2) Approximate space between two ring joint flanges when ring gasket is compressed.

(1) Height of Raised Portion (K) is equal to dimensions of Groove (E) but is not subject to the tolerance for (E).

‡ Tolerances for groove dimensions, in conformance with ANSI B16.5, are stated in column titles.

(continued on next page)

AMERICAN STANDARD FLANGE FACINGS



DIMENSIONS OF RING-JOINT FLANGE FACINGS

Class 1500 and 2500 ANSI Steel Flange Standards

NOMINAL PIPE SIZE	CLASS 1500 PRIMARY PRESSURE RATING							CLASS 2500 PRIMARY PRESSURE RATING						
	Groove Number	Groove Dimensions‡			Diameter of Raised Portion (K)	Approx. Distance Between Flanges (B) (2)	Radius at Bottom of Groove Max.	Groove Number	Groove Dimensions‡			Diameter of Raised Portion (K)	Approx. Distance Between Flanges (B) (2)	Radius at Bottom of Groove Max.
		Pitch Diameter ±.005 (P)	Depth +0.016 -0 (E) (1)	Width ±.008 (F)					Pitch Diameter ±.005 (P)	Depth +0.016 -0 (E) (1)	Width ±.008 (F)			
1/2	12	1.562	0.250	0.344	2.38	0.16	0.03	13	1.688	0.250	0.344	2.56	0.16	0.03
3/4	14	1.750	0.250	0.344	2.62	0.16	0.03	16	2.000	0.250	0.344	2.88	0.16	0.03
1	16	2.000	0.250	0.344	2.81	0.16	0.03	18	2.375	0.250	0.344	3.25	0.16	0.03
1 1/4	18	2.375	0.250	0.344	3.19	0.16	0.03	21	2.844	0.312	0.469	4.00	0.12	0.03
1 1/2	20	2.688	0.250	0.344	3.62	0.16	0.03	23	3.250	0.312	0.469	4.50	0.12	0.03
2	24	3.750	0.312	0.469	4.88	0.12	0.03	26	4.000	0.312	0.469	5.25	0.12	0.03
2 1/2	27	4.250	0.312	0.469	5.38	0.12	0.03	28	4.375	0.375	0.531	5.88	0.12	0.06
3	35	5.375	0.312	0.469	6.62	0.12	0.03	32	5.000	0.375	0.531	6.62	0.12	0.06
3 1/2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	39	6.375	0.312	0.469	7.62	0.12	0.03	38	6.188	0.438	0.656	8.00	0.16	0.06
5	44	7.625	0.312	0.469	9.00	0.12	0.03	42	7.500	0.500	0.781	9.50	0.16	0.06
6	46	8.312	0.375	0.531	9.75	0.12	0.06	47	9.000	0.500	0.781	11.00	0.16	0.06
8	50	10.625	0.438	0.656	12.50	0.16	0.06	51	11.000	0.562	0.906	13.38	0.19	0.06
10	54	12.750	0.438	0.656	14.62	0.16	0.06	55	13.500	0.688	1.188	16.75	0.25	0.09
12	58	15.000	0.562	0.906	17.25	0.19	0.06	60	16.000	0.688	1.312	19.50	0.31	0.09
14	63	16.500	0.625	1.062	19.25	0.22	0.09	—	—	—	—	—	—	—
16	67	18.500	0.688	1.188	21.50	0.31	0.09	—	—	—	—	—	—	—
18	71	21.000	0.688	1.188	24.12	0.31	0.09	—	—	—	—	—	—	—
20	75	23.000	0.688	1.312	26.50	0.38	0.09	—	—	—	—	—	—	—
24	79	27.250	0.812	1.438	31.25	0.44	0.09	—	—	—	—	—	—	—

All dimensions are in inches and conform to ANSI B16.5.

(2) Approximate space between two ring joint flanges when ring gasket is compressed.

(1) Height of Raised Portion (K) is equal to dimensions of Groove (E) but is not subject to the tolerance for (E).

‡ Tolerances for groove dimensions, in conformance with ANSI B16.5, are stated in column titles.

PIPING DESIGN

INTRODUCTION

The basic factors controlling the designing of a corrosion-resistant piping system are established by ANSI, ASME, and MSS codes. The general service for which the piping is intended determines code specifications which are applicable. These specifications represent *minimum* requirements in respect to dimensional standards, materials, etc. Beyond these minimum requirements there are areas which provide opportunities to design for maximum utility and economy. Among these areas are:

Determining Pipe Size: The optimum pipe size is the minimum size which will convey a given amount of process material from one point to another, in design time and pressure. The use of over-size pipe increases original and operating costs. Use of under-size pipe increases the power cost of moving the process material.

Calculating Wall Thickness: The optimum pipe wall thickness is the minimum thickness of the selected metal which will handle design pressure/temperature factors as well as stresses and thermal and mechanical shocks encountered in service. Butt-weld piping—which is the nearest approach to a system without joints—permits this objective to be reached. The butt-welded system can be designed to pressure/temperature requirements rather than to the mechanical limitations inherent in threaded and socket-weld construction. It also permits the use of Schedules 5S and 10S pipe and fittings which are too light to be threaded.

Choosing Metal: The optimum metal is that having suitable chemical and physical properties to provide maximum service life under a given combination of pressure, temperature, and corrosion conditions. In selecting the metal, consideration can be given to possible future adaptation of the system for handling process materials requiring higher corrosion resistance than what is needed in the original design.

Design Properties of Pipe . . . pages 89-95

This table provides data on all pipe sizes and thicknesses which are in general use for corrosion-resistant service. The information is useful in determining bending stresses from line expansion or load, pipe column sizes required to handle the design axial load, flow rate, pressure drop, insulation or coating requirements, etc. Definitions of symbols used in the tables appear as footnotes on pages 90 through 95.

Pressure/stress ratios appearing in the last four columns of the table provide a simplified method for determining approximate allowable working pressures that may be obtained by precise calculation according to code formula. Corrosion allowance (as well as allowance for threading) is zero in these ratios. The Y coefficients which reflect the effect of creep, are 0.4 for temperatures through 1,050°F., 0.5 for 1,100°F., and 0.7 for 1,150°F. and above.

For any given pipe size and wall thickness the allowable working pressure is found simply by multiplying the pressure/stress ratio by the specified metal's allowable stress value. Example: Multiplying .0896 (p/s ratio for 1" Schedule 5S pipe) by 11,450 (allowable stress value at 600°F. for Stainless Steel Type 316L) gives 1025—the allowable working pressure, p.s.i., in this instance.

Pipe Dimensions . . . pages 96-97

A complete tabulation of outside diameters, wall thicknesses, and inside diameters of 1/8" through 24" pipe, in all thicknesses generally used for corrosion service, appears on pages 96-97. This dimensional data is in conformance with ANSI specifications.

Allowable Working Pressures . . . pages 98-109

For convenience, the allowable working pressures for Stainless Steel Types 304L, 304, 316L, 316, Monel Alloy 400 and Nickel 200, and Aluminum 3003-0 and 6061-T6—in wall thicknesses generally used in corrosion service—are tabulated on pages 99-109. The allowable working pressure of any other piping material can be obtained by applying the pressure/stress ratio as described under "Design" Properties of Pipe."

Chemical and Physical Properties of Stainless, Inco and Aluminum Alloy Fittings . . . pages 110-111

Includes analyses, tensile strengths, yield points, and % elongations of the most commonly-used corrosion-resistant piping materials.

Metric Dimensions of Fittings and Flanges . . . pages 112-117

Conversion Factors and Tables . . . pages 118-123

Tabulations of conversions of Fahrenheit to Centigrade, fractions of inches to millimeters, decimals of inches to millimeters, millimeters to inches, pounds to kilograms, pounds per square inch to kilograms per square centimeter, and general conversion factors.

DESIGN PROPERTIES OF PIPE

Pipe Sched. or Weight	Wall Thick. Inches T	Inside Dia. Inches I.D.	Fifth Power of I.D. In. ⁵ I.D. ⁵	Surface Area Outside Sq. ft. Per ft. A _o	Surface Area Inside Sq. ft. Per ft. A _i	Cross-Sectional		Flow GPM Q	Weight of Pipe Lb. per ft. W	Weight of Water Lb. per ft. W _w	Radius of Gyration Inches R _g	Moment of Inertia In. ⁴ I	Section Modulus In. ³ Z	PRESSURE/STRESS RATIOS			
						Area of Metal Sq. in. A	Flow Area Sq. in. A _f							(Corrosion Allowance—Zero) Y COEFFICIENT			
														0.0	0.4	0.5	0.7

1/8" NOMINAL PIPE SIZE (O.D. = .405")

10S	.049	.307	.00273	.106	.080	.055	.074	2.313	.186	.032	.1271	.0009	.0043	.2117	.2313	.2368	.2486
40 ST 40S	.068	.269	.00141	.106	.070	.072	.057	1.775	.245	.025	.1215	.0011	.0052	.2938	.3330	.3444	.3699
80 XS 80S	.095	.215	.00046	.106	.056	.092	.036	1.138	.314	.016	.1146	.0012	.0060	.4105	.4911	.5165	.5760

1/4" NOMINAL PIPE SIZE (O.D. = .540")

10S	.065	.410	.01159	.141	.107	.097	.132	4.125	.330	.057	.1694	.0028	.0103	.2106	.2300	.2354	.2471
40 ST 40S	.088	.364	.00639	.141	.095	.125	.104	3.253	.425	.045	.1628	.0033	.0123	.2852	.3219	.3326	.3563
80 XS 80S	.119	.302	.00251	.141	.079	.157	.072	2.238	.535	.031	.1547	.0038	.0140	.3856	.4560	.4778	.5283

3/8" NOMINAL PIPE SIZE (O.D. = .675")

10S	.065	.545	.04808	.177	.143	.124	.233	7.290	.423	.101	.2169	.0059	.0174	.1685	.1807	.1840	.1911
40 ST 40S	.091	.493	.02912	.177	.129	.167	.191	5.969	.568	.083	.2090	.0073	.0216	.2359	.2605	.2675	.2826
80 XS 80S	.126	.423	.01354	.177	.111	.217	.140	4.391	.739	.061	.1991	.0086	.0255	.3267	.3758	.3904	.4235

1/2" NOMINAL PIPE SIZE (O.D. = .840")

5S	.065	.710	.18042	.220	.186	.158	.396	12.384	.537	.172	.275	.0120	.0285	.1083	.1431	.1456	.1500
10S	.083	.674	.13909	.220	.176	.197	.357	11.150	.671	.154	.269	.0143	.0341	.1729	.1858	.1893	.1967
40 ST 40S	.109	.622	.09310	.220	.163	.250	.304	9.500	.851	.132	.261	.0171	.0407	.2271	.2498	.2562	.2700
80 XS 80S	.147	.546	.04852	.220	.143	.320	.234	7.313	1.088	.101	.250	.0201	.0478	.3063	.3490	.3616	.3898
160	.188	.464	.02198	.220	.122	.384	.171	5.331	1.304	.074	.240	.0221	.0527	.3896	.4615	.4838	.5357
XX	.294	.252	.00102	.220	.066	.504	.050	1.559	1.715	.022	.219	.0243	.0577	.6125	.8113	.8829	1.0722

3/4" NOMINAL PIPE SIZE (O.D. = 1.050")

5S	.065	.920	.6591	.275	.241	.201	.666	20.736	.683	.288	.349	.0245	.0467	.1083	.1132	.1145	.1172
10S	.083	.884	.5398	.275	.231	.252	.614	19.180	.857	.266	.343	.0297	.0566	.1383	.1464	.1486	.1532
40 ST 40S	.113	.824	.3799	.275	.216	.333	.533	16.656	1.131	.231	.334	.0370	.0706	.1883	.2037	.2079	.2169
80 XS 80S	.154	.742	.2249	.275	.194	.434	.432	13.530	1.474	.187	.321	.0448	.0853	.2567	.2860	.2945	.3129
160	.219	.612	.0873	.275	.161	.570	.296	9.253	1.937	.128	.304	.0527	.1004	.3633	.4251	.4440	.4873
XX	.308	.434	.0154	.275	.114	.718	.148	4.622	2.441	.064	.284	.0579	.1104	.5133	.6460	.6906	.8012

(continued on next page)

DESIGN PROPERTIES OF PIPE

Pipe Sched. or Weight	Wall Thick.	Inside Dia.	Fifth Power of I.D.	Surface Area Outside	Surface Area Inside	Cross-Sectional		Flow GPM	Weight of Pipe	Weight of Water	Radius of Gyration	Moment of Inertia	Section Modulus	PRESSURE/STRESS RATIOS					
						Sq. ft. Per ft. A_o	Sq. ft. Per ft. A_i							Sq. in. A	Sq. in. A_f	(Corrosion Allowance—Zero)			
																Y COEFFICIENT			
Inches T	Inches I.D.	In. ⁵ I.D. ⁵	Sq. ft. Per ft. A_o	Sq. ft. Per ft. A_i	Sq. in. A	Sq. in. A_f	Q	Lb. per ft. W	Lb. per ft. W_w	Inches R_g	In. ⁴ I	In. ³ Z	0.0	0.4	0.5	0.7			

1" NOMINAL PIPE SIZE (O.D. = 1.315")

5S	.065	1.185	2.337	.344	.310	.255	1.101	34.42	.867	.478	.443	.0500	.0760	.0865	.0896	.0904	.0921
10S	.109	1.097	1.589	.344	.287	.413	.945	29.53	1.404	.409	.428	.0757	.1151	.1451	.1504	.1564	.1615
40 ST 40S	.133	1.049	1.270	.344	.275	.494	.864	27.00	1.679	.374	.420	.0874	.1329	.1770	.1905	.1942	.2020
80 XS 80S	.179	.957	.803	.344	.250	.639	.719	22.47	2.172	.311	.407	.1056	.1606	.2382	.2633	.2704	.2859
160	.250	.815	.360	.344	.213	8.36	.522	16.30	2.844	.226	.387	.1252	.1903	.3327	.3838	.3991	.4337
XX	.358	.599	.077	.344	.157	1.076	.282	8.81	3.659	.122	.361	.1405	.2137	.4764	.5886	.6254	.7148

1 1/4" NOMINAL PIPE SIZE (O.D. = 1.660")

5S	.065	1.530	8.384	.434	.401	.322	1.839	57.31	1.108	.796	.564	.1037	.1253	.0685	.0705	.0710	.0720
10S	.109	1.442	6.235	.434	.378	.531	1.633	51.03	1.805	.707	.550	.1605	.1934	.1149	.1204	.1219	.1250
40 ST 40S	.140	1.380	5.005	.434	.361	.668	1.496	46.72	2.273	.648	.540	.1948	.2346	.1476	.1568	.1594	.1646
80 XS 80S	.191	1.278	3.409	.434	.334	.881	1.283	40.09	2.997	.555	.524	.2418	.291	.2014	.2190	.2239	.2344
160	.250	1.160	2.100	.434	.304	1.107	1.057	33.03	3.765	.458	.506	.284	.342	.2636	.2946	.3036	.3232
XX	.382	.896	.577	.434	.234	1.534	.630	19.70	5.215	.273	.472	.341	.411	.4027	.4800	.5042	.5608

1 1/2" NOMINAL PIPE SIZE (O.D. = 1.900")

5S	.065	1.770	17.37	.497	.463	.372	2.460	76.75	1.275	1.066	.649	.158	.166	.0599	.0613	.0617	.0625
10S	.109	1.682	13.46	.497	.440	.613	2.222	69.41	2.085	.962	.634	.247	.260	.1004	.1046	.1057	.1080
40 ST 40S	.145	1.610	10.82	.497	.421	.799	2.036	63.62	2.718	.882	.623	.310	.326	.1336	.1411	.1431	.1473
80 XS 80S	.200	1.500	7.59	.497	.393	1.068	1.767	55.22	3.632	.765	.605	.391	.412	.1842	.1987	.2029	.2115
160	.281	1.337	4.27	.497	.350	1.431	1.404	43.91	4.866	.608	.581	.483	.508	.2588	.2887	.2973	.3161
XX	.400	1.100	1.61	.497	.288	1.885	.950	29.69	6.409	.411	.549	.568	.598	.3684	.4321	.4516	.4965

2" NOMINAL PIPE SIZE (O.D. = 2.375")

5S	.065	2.245	57.03	.622	.588	.424	3.960	123.41	1.605	1.714	.817	.315	.265	.0479	.0488	.0491	.0496
10S	.109	2.157	46.69	.622	.565	.776	3.654	114.19	2.638	1.582	.802	.499	.420	.0803	.0830	.0837	.0851
40 ST 40S	.154	2.057	37.73	.622	.541	1.074	3.356	104.84	3.653	1.453	.787	.666	.561	.1135	.1189	.1203	.1233
80 XS 80S	.218	1.939	27.41	.622	.508	1.477	2.953	92.28	5.022	1.278	.766	.868	.731	.1606	.1717	.1747	.1801
160	.343	1.639	13.74	.622	.442	2.190	2.240	70.00	7.445	.970	.728	1.163	.979	.2527	.2811	.2893	.3071
XX	.436	1.503	7.67	.622	.393	2.656	1.774	55.44	9.030	.768	.703	1.312	1.104	.3213	.3684	.3827	.4145

O.D. = outside diameter in inches

T = nominal wall thickness in inches

I.D. = inside diameter in inches

$A_o = \frac{O.D. \cdot \pi}{12}$ = outside pipe surface, sq. ft. per ft. length

$A_i = \frac{I.D. \cdot \pi}{12}$ = inside pipe surface, sq. ft. per ft. length

$A = \frac{(O.D.^2 - I.D.^2) \cdot \pi}{4}$ = cross-sectional metal area, sq. in.

$A_f = \frac{I.D.^2 \cdot \pi}{4}$ = cross-sectional flow area, sq. in.

Q = flow in U. S. gallons per minute at mean velocity of 10 ft. per second

W = 3.4 A = weight of pipe, lbs. per ft. length

$W_w = 0.433 A_f$ = weight of water filling, lb. per ft. length

DESIGN PROPERTIES OF PIPE

Pipe Sched. or Weight	Wall Thick. Inches T	Inside Dia. Inches I.D.	Fifth Power of I.D. In. ⁵ I.D. ⁵	Surface Area Outside Sq. ft. Per ft. A _o	Surface Area Inside Sq. ft. Per ft. A _i	Cross-Sectional		Flow GPM Q	Weight of Pipe Lb. per ft. W	Weight of Water Lb. per ft. W _w	Radius of Gyration Inches R _g	Moment of Inertia In. ⁴ I	Section Modulus In. ³ Z	PRESSURE/STRESS RATIOS			
						(Corrosion Allowance—Zero) Y COEFFICIENT											
						0.0	0.4							0.5	0.7		

2 1/2" NOMINAL PIPE SIZE (O.D. = 2.875")

5S	.083	2.709	145.9	.753	.709	.726	5.75	179.71	2.475	2.496	.988	.711	.495	.0505	.0516	.0518	.0524
10S	.120	2.635	127.0	.753	.690	1.039	5.45	170.41	3.531	2.361	.975	.988	.687	.0730	.0752	.0758	.0770
40 ST 40S	.203	2.469	91.8	.753	.646	1.704	4.79	149.63	5.794	2.073	.947	1.530	1.064	.1236	.1300	.1317	.1353
80 XS 80S	.276	2.323	67.6	.753	.608	2.254	4.24	132.44	7.662	1.835	.924	1.925	1.339	.1680	.1801	.1834	.1904
160	.375	2.125	43.3	.753	.556	2.945	3.55	110.84	10.01	1.54	.894	2.353	1.637	.2283	.2512	.2577	.2717
XX	.552	1.771	17.4	.753	.464	4.028	2.46	77.00	13.70	1.07	.844	2.872	1.998	.3360	.3882	.4038	.4393

3" NOMINAL PIPE SIZE (O.D. = 3.500")

5S	.083	3.334	411.9	.916	.873	.906	8.74	272.16	3.03	3.78	1.208	1.300	.743	.0415	.0422	.0424	.0427
10S	.120	3.260	368.2	.916	.853	1.274	8.35	260.81	4.33	3.61	1.196	1.822	1.041	.0600	.0615	.0619	.0626
40 ST 40S	.216	3.068	271.8	.916	.803	2.228	7.39	231.03	7.58	3.20	1.164	3.02	1.724	.1080	.1129	.1142	.1168
80 XS 80S	.300	2.900	205	.916	.759	3.016	6.60	206.41	10.25	2.86	1.136	3.90	2.226	.1500	.1569	.1622	.1676
160	.438	2.624	124	.916	.687	4.213	5.41	168.97	14.33	2.34	1.094	5.04	2.879	.2190	.2400	.2459	.2587

3 1/2" NOMINAL PIPE SIZE (O.D. = 4.000")

5S	.083	3.834	828	1.047	1.047	1.020	11.55	360.00	3.47	5.00	1.385	1.96	.979	.0363	.0368	.0370	.0373
10S	.120	3.760	752	1.047	.984	1.463	11.10	346.88	4.97	4.81	1.372	2.76	1.378	.0525	.0536	.0539	.0545
40 ST 40S	.226	3.548	562	1.047	.929	2.680	9.89	309.06	9.11	4.28	1.337	4.79	2.394	.0989	.1029	.1040	.1062
80 XS 80S	.318	3.364	431	1.047	.881	3.678	8.89	277.81	12.51	3.85	1.307	6.28	3.141	.1391	.1473	.1495	.1541
XX	.636	2.728	151	1.047	.714	6.721	5.84	181.74	22.85	2.53	1.210	9.85	4.925	.2783	.3131	.3232	.3456

4" NOMINAL PIPE SIZE (O.D. = 4.500")

5S	.083	4.334	1529	1.178	1.135	1.139	14.72	460.01	3.91	6.39	1.562	2.81	1.248	.0323	.0327	.0328	.0330
10S	.120	4.260	1403	1.178	1.115	1.651	14.25	445.31	5.61	6.17	1.549	3.96	1.762	.0467	.0476	.0478	.0482
40 ST 40S	.237	4.026	1058	1.178	1.054	3.17	12.73	397.81	10.79	5.51	1.510	7.23	3.22	.0922	.0957	.0966	.0985
80 XS 80S	.337	3.826	820	1.178	1.002	4.41	11.50	359.38	14.99	4.98	1.477	9.61	4.27	.1311	.1383	.1402	.1433
120	.438	3.624	625	1.178	.949	5.59	10.31	322.50	19.00	4.47	1.444	11.66	5.18	.1703	.1828	.1862	.1934
160	.531	3.438	480	1.178	.900	6.62	9.28	290.00	22.51	4.02	1.416	13.27	5.90	.2065	.2251	.2303	.2414
XX	.671	3.152	311	1.178	.825	8.10	7.80	243.75	27.54	3.38	1.374	15.29	6.79	.2621	.2928	.3016	.3210

$$R_g = \sqrt{\frac{I}{A}} = \sqrt{\frac{O.D.^2 + I.D.^2}{4}} = \text{radius of gyration in inches}$$

$$I = AR_g^2 = 0.0491 (O.D.^4 - I.D.^4) = \text{moment of inertia, inches fourth}$$

$$Z = \frac{2I}{O.D.} = 0.0982 \frac{O.D.^4 - I.D.^4}{O.D.} = \text{section modulus, inches cube}$$

ST designates standard weight steel pipe; dimensions are in conformance with ANSI B36.10.

XS designates extra strong steel pipe; dimensions are in conformance with ANSI B16.10.

XX designates double extra strong steel pipe; dimensions are in conformance with ANSI B16.10.

Numbers 10, 20, 30, 40, 60, 80, 100, 120, 140 and 160 designate schedule numbers; dimensions are in conformance with ANSI B16.10.

Dimensions for Schedules 5S, 10S, 40S, and 80S are in conformance with ANSI B36.19.

(A) Proposed wall thickness for Schedules 5S and 10S.

(1) Thickness agrees with that for Standard Weight Pipe (ANSI B36.10); not included in Schedule 40S.

(2) Thickness agrees with that for Extra Strong Pipe (ANSI B36.10); not included in Schedule 80S.

DESIGN PROPERTIES OF PIPE

Pipe Sched. or Weight	Wall Thick. Inches T	Inside Dia. Inches I.D.	Fifth Power of I.D. In. ⁵ I.D. ⁵	Surface Area Outside Sq. ft. Per ft. A _o	Surface Area Inside Sq. ft. Per ft. A _i	Cross-Sectional		Flow GPM Q	Weight of Pipe Lb. per ft. W	Weight of Water Lb. per ft. W _w	Radius of Gyration Inches R _g	Moment of Inertia In. ⁴ I	Section Modulus In. ³ Z	PRESSURE/STRESS RATIOS			
						Area of Metal Sq. in. A	Flow Area Sq. in. A _f							(Corrosion Allowance—Zero) Y COEFFICIENT			
														0.0	0.4	0.5	0.7

5" NOMINAL PIPE SIZE (O.D. = 5.563")

5S	.109	5.345	4363	1.456	1.399	1.80	22.4	699.12	6.38	9.71	1.928	6.97	2.51	.0343	.0348	.0349	.0351
10S	.134	5.295	4162	1.456	1.386	2.29	22.02	688.13	7.77	9.53	1.920	8.43	3.03	.0422	.0429	.0431	.0396
40 ST 40S	.258	5.047	3275	1.456	1.321	4.30	20.01	625.31	14.62	8.66	1.878	15.17	5.45	.0812	.0839	.0846	.0860
80 XS 80S	.375	4.813	2583	1.456	1.260	6.11	18.19	568.44	20.78	7.88	1.839	20.68	7.43	.1180	.1238	.1254	.1286
120	.500	4.563	1978	1.456	1.194	7.95	16.35	510.94	27.04	7.06	1.799	25.74	9.25	.1573	.1678	.1707	.1768
160	.625	4.313	1492	1.456	1.129	9.70	14.61	456.56	32.97	6.33	1.760	30.03	10.80	.1966	.2134	.2180	.2280
XX	.750	4.063	1107	1.456	1.064	11.34	12.97	405.31	38.55	5.61	1.722	33.64	12.10	.2359	.2605	.2675	.2826

6" NOMINAL PIPE SIZE (O.D. = 6.625")

5S	.109	6.407	10.80	1.734	1.677	2.28	32.3	1005.12	7.58	13.96	2.304	11.84	3.58	.0288	.0291	.0292	.0294
10S	.134	6.357	10.38	1.734	1.664	2.73	31.7	992.19	9.29	13.74	2.295	14.40	4.35	.0354	.0359	.0360	.0363
40 ST 40S	.280	6.065	8.21	1.734	1.588	5.58	28.9	905.94	18.98	12.51	2.246	28.1	8.50	.0740	.0762	.0768	.0780
80 XS 80S	.432	5.761	6.35	1.734	1.508	8.40	26.1	814.69	28.58	11.29	2.195	40.5	12.23	.1141	.1196	.1210	.1240
120	.562	5.501	5.04	1.734	1.440	10.70	23.8	742.81	36.40	10.29	2.153	49.6	14.98	.1485	.1578	.1604	.1657
160	.719	5.187	3.76	1.734	1.358	13.32	21.1	660.94	45.30	9.16	2.104	59.0	17.81	.1897	.2052	.2095	.2187
XX	.864	4.897	2.82	1.734	1.282	15.64	18.8	588.44	53.17	8.16	2.060	66.3	20.03	.2282	.2512	.2576	.2716

8" NOMINAL PIPE SIZE (O.D. = 8.625")

5S	.109	8.407	42.0	2.258	2.201	2.90	55.7	1730.9	9.91	24.04	3.01	26.4	6.13	.0221	.0223	.0224	.0225
10S	.148	8.329	40.1	2.258	2.180	3.94	54.5	1703.1	13.40	23.59	3.00	35.4	8.21	.0300	.0304	.0305	.0307
20	.250	8.125	35.4	2.258	2.127	6.58	51.8	1618.8	22.37	22.45	2.96	57.7	13.39	.0507	.0518	.0520	.0526
30	.227	8.071	34.2	2.258	2.113	7.26	51.2	1600.0	24.70	22.15	2.95	63.4	14.69	.0562	.0575	.0578	.0585
40 ST 40S	.322	7.981	32.4	2.258	2.089	8.40	50.0	1562.5	28.56	21.68	2.94	72.5	16.81	.0653	.0671	.0675	.0685
60	.406	7.813	29.1	2.258	2.045	10.48	47.9	1496.9	35.6	20.8	2.91	88.8	20.58	.0824	.0852	.0859	.0874
80 XS 80S	.500	7.625	25.8	2.258	1.996	12.76	45.7	1425.0	43.4	19.8	2.88	105.7	24.52	.1014	.1057	.1069	.1092
100	.594	7.437	22.8	2.258	1.948	14.96	43.5	1359.4	50.9	18.8	2.85	121.4	28.14	.1203	.1264	.1280	.1314
120	.719	7.137	19.2	2.258	1.882	17.84	40.6	1268.8	60.6	17.6	2.81	140.6	32.60	.1457	.1547	.1571	.1622
140	.812	7.001	16.8	2.258	1.833	19.93	38.5	1203.1	67.8	16.7	2.78	153.7	35.63	.1648	.1764	.1795	.1862
XX	.875	6.875	15.4	2.258	1.800	21.30	37.1	1159.4	72.4	16.1	2.76	162.0	37.57	.1775	.1911	.1948	.2027
160	.906	6.813	14.7	2.258	1.784	21.97	36.5	1137.5	74.7	15.8	2.75	165.9	38.48	.1838	.1984	.2024	.2110

O.D. = outside diameter in inches

T = nominal wall thickness in inches

I.D. = inside diameter in inches

A_o = $\frac{O.D. \cdot \pi}{12}$ = outside pipe surface, sq. ft. per ft. length

A_i = $\frac{I.D. \cdot \pi}{12}$ = inside pipe surface, sq. ft. per ft. length

A = $\frac{(O.D.^2 - I.D.^2)\pi}{4}$ = cross-sectional metal area, sq. in.

A_f = $\frac{I.D.^2 \cdot \pi}{4}$ = cross-sectional flow area, sq. in.

Q = flow in U. S. gallons per minute at mean velocity of 10 ft. per second

W = 3.4 A = weight of pipe, lbs. per ft. length

W_w = 0.433 A_f = weight of water filling, lb. per ft. length

DESIGN PROPERTIES OF PIPE

Pipe Sched. or Weight	Wall Thick. Inches T	Inside Dia. Inches I.D.	Fifth Power of I.D. In. ⁵ I.D. ⁵	Surface Area Outside Sq. ft. Per ft. A _o	Surface Area Inside Sq. ft. Per ft. A _i	Cross-Sectional		Flow GPM Q	Weight of Pipe Lb. per ft. W	Weight of Water Lb. per ft. W _w	Radius of Gyration Inches R _g	Moment of Inertia In. ⁴ I	Section Modulus In. ³ Z	PRESSURE/STRESS RATIOS			
						Area of Metal Sq. in. A	Flow Area Sq. in. A _f							(Corrosion Allowance—Zero) Y COEFFICIENT			
														0.0	0.4	0.5	0.7

10" NOMINAL PIPE SIZE (O.D. = 10.750")

5S	.134	10.482	127	2.81	2.74	4.45	86.3	2692.8	15.2	37.4	3.75	63.0	11.72	.0218	.0220	.0221	.0222
10S	.165	10.420	123	2.81	2.73	5.49	85.3	2665.6	18.7	36.9	3.74	76.9	14.30	.0269	.0272	.0272	.0274
20	.250	10.250	113	2.81	2.68	8.25	82.5	2581.3	28.0	35.7	3.71	113.7	21.16	.0407	.0414	.0415	.0419
30	.307	10.136	107	2.81	2.65	10.07	80.7	2521.9	34.2	34.9	3.69	137.5	25.6	.0500	.0510	.0513	.0518
40 ST 40S	.365	10.020	101	2.81	2.62	11.91	78.9	2465.6	40.5	34.1	3.67	160.8	29.9	.0594	.0609	.0612	.0620
60 XS 80S	.500	9.750	88.1	2.81	2.55	16.10	74.7	2334.4	54.7	32.3	3.63	212.0	39.4	.0814	.0841	.0848	.0863
80	.594	9.562	80.0	2.81	2.50	18.92	71.8	2243.7	64.3	31.1	3.60	244.8	45.5	.0965	.1004	.1014	.1035
100	.719	9.312	70.1	2.81	2.44	22.63	68.1	2128.1	76.9	29.5	3.56	286.2	53.2	.1169	.1226	.1241	.1273
120	.844	9.062	61.2	2.81	2.37	26.24	64.5	2015.6	89.2	27.9	3.52	324.3	60.3	.1372	.1452	.1473	.1518
140	1.000	8.750	51.3	2.81	2.29	30.63	60.1	1878.1	104.1	26.0	3.47	367.9	68.4	.1628	.1741	.1772	.1837
160	1.125	8.500	44.4	2.81	2.23	34.02	56.7	1771.8	115.7	24.6	3.43	399.4	74.3	.1831	.1976	.2016	.2101

12" NOMINAL PIPE SIZE (O.D. = 12.750")

5S	.156	12.420	296	3.34	3.25	6.52	121.2	3780.0	22.2	52.5	4.45	129.2	20.3	.0214	.0229	.0229	.0230
10S	.180	12.390	292	3.34	3.24	7.11	120.6	3768.7	24.2	52.2	4.44	140.5	22.0	.0247	.0250	.0250	.0251
20	.250	12.250	276	3.34	3.21	9.82	117.9	3687.5	33.4	51.0	4.42	191.9	30.1	.0343	.0348	.0349	.0352
30	.330	12.090	258	3.34	3.17	12.88	114.8	3587.5	43.8	49.7	4.39	248.5	39.0	.0453	.0461	.0463	.0468
40 ST 40S	.375	12.000	249	3.34	3.14	14.58	113.1	3534.4	49.6	49.0	4.38	279	43.8	.0515	.0526	.0528	.0534
40	.406	11.938	242	3.34	3.13	15.74	111.9	3496.9	53.5	48.5	4.37	300	47.1	.0557	.0570	.0573	.0580
60 XS 80S	.500	11.750	224	3.34	3.08	19.24	108.4	3387.5	65.4	47.0	4.33	362	56.7	.0686	.0706	.0711	.0721
80	.562	11.626	212	3.34	3.04	21.52	106.2	3318.8	73.2	46.0	4.31	401	62.8	.0771	.0796	.0802	.0815
100	.688	11.374	191	3.34	2.98	26.04	101.6	3175.0	88.5	44.0	4.27	475	74.5	.0943	.0980	.0990	.1010
120	.844	11.062	166	3.34	2.90	31.53	96.1	3003.1	107.2	41.6	4.22	562	88.1	.1157	.1213	.1228	.1259
140	1.000	10.750	144	3.34	2.81	36.91	90.8	2837.5	125.5	39.3	4.17	642	100.7	.1373	.1452	.1474	.1518
160	1.125	10.500	128	3.34	2.75	41.09	86.6	2706.3	139.7	37.5	4.13	701	109.9	.1544	.1646	.1673	.1713
160	1.312	10.126	106	3.34	2.65	47.14	80.5	2515.6	160.3	34.9	4.07	781	122.6	.1801	.1941	.1979	.2061

14" NOMINAL PIPE SIZE (O.D. = 14.000")

5S	.156(A)	13.688	481	3.67	3.58	6.78	147.2	4580.1	23.1	63.7	4.90	163	23.2	.0195	.0196	.0197	.0198
10S	.188(A)	13.624	469	3.67	3.57	8.16	145.8	4537.3	27.7	63.1	4.88	195	27.8	.0235	.0237	.0238	.0239
10	.250	13.500	448	3.67	3.53	10.80	143.1	4468.8	36.7	62.0	4.86	255	36.5	.0312	.0316	.0317	.0319
20	.312	13.375	428	3.67	3.50	13.44	140.5	4390.6	45.7	60.8	4.84	315	45.0	.0390	.0396	.0398	.0401
30 ST 40S	.375(1)	13.250	408	3.67	3.47	16.05	137.9	4309.4	54.6	59.7	4.82	373	53.3	.0469	.0478	.0480	.0485
40	.438	13.124	389	3.67	3.44	18.66	135.3	4228.1	63.4	58.6	4.80	429	61.4	.0548	.0560	.0563	.0569

$$R_g = \sqrt{\frac{I}{A}} = \sqrt{\frac{0.0491(O.D.^4 - I.D.^4)}{4}} = \text{radius of gyration in inches}$$

$$I = AR_g^2 = 0.0491(O.D.^4 - I.D.^4) = \text{moment of inertia, inches fourth}$$

XX designates double extra strong steel pipe; dimensions are in conformance with ANSI B16.10.

Numbers 10, 20, 30, 40, 60, 80, 100, 120, 140 and 160 designate schedule numbers; dimensions are in conformance with ANSI B16.10.

DESIGN PROPERTIES OF PIPE

Pipe Sched. or Weight	Wall Thick. Inches T	Inside Dia. Inches I.D.	Fifth Power of I.D. In. ⁵ I.D. ⁵	Surface Area Outside Sq. ft. Per ft. A _o	Surface Area Inside Sq. ft. Per ft. A _i	Cross-Sectional		Flow GPM Q	Weight of Pipe Lb. per ft. W	Weight of Water Lb. per ft. W _w	Radius of Gyration Inches R _g	Moment of Inertia In. ⁴ I	Section Modulus In. ³ Z	PRESSURE/STRESS RATIOS			
						Area of Metal Sq. in. A	Flow Area Sq. in. A _f							(Corrosion Allowance—Zero) Y COEFFICIENT			
														0.0	0.4	0.5	0.7

14" NOMINAL PIPE SIZE (cont'd) (O.D. = 14.000")

XS 80S	.500 ⁽²⁾	13.000	371	3.67	3.40	21.21	132.7	4146.9	72.1	57.5	4.78	484	69.1	.0625	.0641	.0645	.0654
60	.594	12.812	345	3.67	3.35	24.98	129.0	4031.3	84.9	55.8	4.74	562	80.3	.0741	.0764	.0770	.0782
80	.750	12.500	305	3.67	3.27	31.22	122.7	3834.4	106.1	53.1	4.69	687	98.2	.0937	.0974	.0984	.1003
100	.938	12.124	262	3.67	3.17	38.47	115.5	3603.0	130.8	50.0	4.63	825	117.9	.1171	.1229	.1244	.1276
120	1.094	11.812	230	3.67	3.09	44.32	109.6	3425.0	150.7	47.5	4.58	930	132.8	.1366	.1445	.1466	.1511
140	1.250	11.500	201	3.67	3.01	50.07	103.9	3246.9	170.2	45.0	4.53	1027	146.8	.1562	.1667	.1695	.1754
160	1.406	11.188	175	3.67	2.93	55.63	98.3	3071.9	189.1	42.6	4.48	1117	159.6	.1758	.1890	.1927	.2004

16" NOMINAL PIPE SIZE (O.D. = 16.000")

5S	.165 ^(A)	15.670	945	4.19	4.10	8.21	192.9	6003.1	27.9	83.5	5.60	257	32.2	.0185	.0186	.0187	.0187
10S	.188 ^(A)	15.624	931	4.19	4.09	9.34	191.7	5965.7	31.8	83.0	5.59	292	36.5	.0206	.0207	.0208	.0209
10	.250	15.500	895	4.19	4.06	12.37	188.7	5906.3	42.1	81.7	5.57	384	48.0	.0273	.0276	.0277	.0279
20	.312	15.375	859	4.19	4.02	15.40	185.7	5800.0	52.4	80.4	5.55	474	59.3	.0341	.0346	.0347	.0350
30 ST 40S	.375 ⁽¹⁾	15.250	825	4.19	3.99	18.41	182.7	5706.3	62.6	79.1	5.53	562	70.3	.0410	.0417	.0419	.0422
40 XS 80S	.500 ⁽²⁾	15.000	759	4.19	3.93	24.35	176.7	5521.9	82.8	76.5	5.48	732	91.5	.0547	.0559	.0562	.0569
60	.656	14.688	684	4.19	3.85	31.62	169.4	5293.8	107.5	73.4	5.43	933	116.6	.0718	.0739	.0744	.0755
80	.844	14.312	601	4.19	3.75	40.14	160.9	5028.1	136.5	69.7	5.37	1157	144.6	.0922	.0957	.0967	.0986
100	1.031	13.938	526	4.19	3.65	48.48	152.6	4768.8	164.8	66.1	5.29	1365	170.6	.1128	.1181	.1195	.1224
120	1.219	13.562	459	4.19	3.55	56.56	144.5	4515.6	192.3	62.6	5.23	1556	194.5	.1332	.1407	.1427	.1469
140	1.438	13.124	389	4.19	3.44	65.79	135.3	4228.1	245.1	58.6	5.17	1761	220.1	.1573	.1678	.1707	.1767
160	1.594	12.812	345	4.19	3.35	72.10	129.0	4031.3	245.1	55.8	5.12	1894	236.7	.1742	.1873	.1909	.1984

18" NOMINAL PIPE SIZE (O.D. = 18.000")

5S	.165 ^(A)	17.670	1723	4.71	4.63	9.24	245.2	7630.6	31.4	106.2	6.31	368	40.9	.0160	.0161	.0162	.0162
10S	.188 ^(A)	17.624	1700	4.71	4.61	10.52	243.9	7590.2	35.8	105.6	6.30	417	46.4	.0183	.0184	.0184	.0185
10	.250	17.500	1641	4.71	4.58	13.94	240.5	7531.3	47.4	104.1	6.28	549	61.0	.0243	.0245	.0246	.0247
20	.312	17.375	1584	4.71	4.55	17.36	237.1	7409.4	59.0	102.7	6.25	679	75.5	.0303	.0307	.0308	.0310
30 ST 40S	.375 ⁽¹⁾	17.250	1527	4.71	4.52	20.76	233.7	7303.1	70.6	101.2	6.23	807	89.6	.0365	.0370	.0371	.0374
40 XS 80S	.500 ⁽²⁾	17.000	1420	4.71	4.45	27.49	227.0	7093.8	93.5	98.3	6.19	1053	117.0	.0486	.0496	.0498	.0503
60	.562	16.876	1369	4.71	4.42	30.79	223.7	7000.0	104.7	96.9	6.17	1171	130.2	.0546	.0559	.0562	.0568
80	.750	16.500	1223	4.71	4.32	40.64	213.8	6681.3	138.2	92.6	6.10	1515	168.3	.0729	.0751	.0757	.0768
100	.938	16.124	1090	4.71	4.22	50.23	204.2	6381.3	170.8	88.4	6.04	1834	203.8	.0911	.0945	.0954	.0973
120	1.156	15.688	950	4.71	4.11	61.17	193.3	6040.6	208.0	83.7	5.97	2180	242.2	.1124	.1171	.1191	.1220

O.D. = outside diameter in inches

T = nominal wall thickness in inches

I.D. = inside diameter in inches

A_o = $\frac{O.D. \cdot \pi}{12}$ = outside pipe surface, sq. ft. per ft. length

A_i = $\frac{I.D. \cdot \pi}{12}$ = inside pipe surface, sq. ft. per ft. length

A = $\frac{(O.D.^2 - I.D.^2)\pi}{4}$ = cross-sectional metal area, sq. in.

A_f = $\frac{I.D.^2 \cdot \pi}{4}$ = cross-sectional flow area, sq. in.

Q = flow in U. S. gallons per minute at mean velocity of 10 ft. per second

W = 3.4 A = weight of pipe, lbs. per ft. length

W_w = 0.433 A_f = weight of water filling, lb. per ft. length

... COMMONLY USED FOR CORROSION SERVICE

Nominal Pipe Size		Outside Diameter		SCHEDULE 80S AND EXTRA STRONG (B)		SCHEDULE 80 (B)		SCHEDULE 100		SCHEDULE 120	
in.	mm	in.	mm	Wall Thickness		Wall Thickness		Wall Thickness		Wall Thickness	
				in.	mm	in.	mm	in.	mm	in.	mm
1/8	3.2	.405	10.3	.095	2.41	.095	2.41	—	—	—	—
1/4	6.4	.540	13.7	.119	3.02	.119	3.02	—	—	—	—
3/8	9.5	.675	17.1	.126	3.20	.126	3.20	—	—	—	—
1/2	12.7	.840	21.3 ^a	.147	3.73	.147	3.73	—	—	—	—
3/4	19.1	1.050	26.7 ^a	.154	3.91	.154	3.91	—	—	—	—
1	25.4	1.315	33.4 ^a	.179	4.55	.179	4.55	—	—	—	—
1 1/4	31.8	1.660	42.2 ^a	.191	4.85	.191	4.85	—	—	—	—
1 1/2	38.1	1.900	48.3 ^a	.200	5.08 ^a	.200	5.08 ^a	—	—	—	—
2	50.8	2.375	60.3 ^a	.218	5.54	.218	5.54	—	—	—	—
2 1/2	63.5	2.875	73.0 ^a	.276	7.01	.276	7.01	—	—	—	—
3	76.2	3.500	88.9 ^a	.300	7.62 ^a	.300	7.62 ^a	—	—	—	—
3 1/2	88.9	4.000	101.6 ^a	.318	8.08	.318	8.08 ^a	—	—	—	—
4	101.6	4.500	114.3 ^a	.337	8.56	.337	8.56	—	—	.438	11.13
5	127.0	5.563	141.3 ^a	.375	9.53 ^a	.375	9.53 ^a	—	—	.500	12.70
6	152.4	6.625	168.3 ^a	.432	10.97	.432	10.97	—	—	.562	14.28
8	203.2	8.625	219.1 ^a	.500	12.70 ^a	.500	12.70	.594	15.09	.719	18.26
10	254.0	10.750	273.1 ^a	.500	12.70 ^a	.594	15.09	.719	18.26	.844	21.44
12	304.8	12.750	328.9 ^a	.500	12.70 ^a	.688	17.48	.844	21.44	1.000	25.40
14	355.6	14.000	355.6 ^a	.500(2)	12.70 ^a	.750	19.05 ^a	.938	23.83	1.094	27.79
16	406.4	16.000	406.4 ^a	.500(2)	12.70 ^a	.844	21.44	1.031	26.19	1.219	30.96
18	457.2	18.000	457.2 ^a	.500(2)	12.70 ^a	.938	23.83	1.156	29.36	1.375	34.93 ^a
20	508.0	20.000	508.0 ^a	.500(3)	12.70 ^a	1.031	26.19	1.281	32.54	1.500	38.10
24	609.6	24.000	609.6 ^a	.500(3)	12.70 ^a	1.219	30.96	1.531	38.89	1.812	46.03

Nominal Pipe Size		Outside Diameter		SCHEDULE 140		SCHEDULE 160		DOUBLE XX STRONG	
in.	mm	in.	mm	Wall Thickness		Wall Thickness		Wall Thickness	
				in.	mm	in.	mm	in.	mm
1/8	3.2	.405	10.3	—	—	—	—	—	—
1/4	6.4	.540	13.7	—	—	—	—	—	—
3/8	9.5	.675	17.1	—	—	—	—	—	—
1/2	12.7	.840	21.3 ^a	—	—	.188	4.78	.294	7.47
3/4	19.1	1.050	26.7 ^a	—	—	.219	5.56	.308	7.82
1	25.4	1.315	33.4 ^a	—	—	.250	6.35 ^a	.358	9.09
1 1/4	31.8	1.660	42.2 ^a	—	—	.250	6.35 ^a	.382	9.70
1 1/2	38.1	1.900	48.3 ^a	—	—	.281	7.14	.400	10.16 ^a
2	50.8	2.375	60.3 ^a	—	—	.344	8.74	.436	11.07
2 1/2	63.5	2.875	73.0 ^a	—	—	.375	9.53 ^a	.552	14.02
3	76.2	3.500	88.9 ^a	—	—	.438	11.13	.600	15.24 ^a
3 1/2	88.9	4.000	101.6 ^a	—	—	—	—	.636(3)	18.15
4	101.6	4.500	114.3 ^a	—	—	.531	13.49	.674	17.12
5	127.0	5.563	141.3 ^a	—	—	.625	15.88 ^a	.750	19.05 ^a
6	152.4	6.625	168.3 ^a	—	—	.719	18.26	.864	21.95
8	203.2	8.625	219.1 ^a	.812	20.63	.906	23.01	.875	22.23 ^a
10	254.0	10.750	273.1 ^a	1.000	25.40 ^a	1.125	28.58 ^a	1.000	25.40 ^a
12	304.8	12.750	328.9 ^a	1.125	28.58 ^a	1.312	33.33	1.000	25.40 ^a
14	355.6	14.000	355.6 ^a	1.250	31.75 ^a	1.406	35.71	—	—
16	406.4	16.000	406.4 ^a	1.438	36.53	1.594	40.49	—	—
18	457.2	18.000	457.2 ^a	1.562	39.68	1.781	45.24	—	—
20	508.0	20.000	508.0 ^a	1.750	44.45 ^a	1.969	50.01	—	—
24	609.6	24.000	609.6 ^a	2.062	52.38	2.344	59.54	—	—

^a Exact figure

Dimensions are shown both in inches and millimeters.

Dimensions for Standard Weight, Extra Strong, Double Extra Strong, Schedules 10, 20, 30, 40, 60, 80, 100, 120, 140 and 160 conform with ANSI B36.10.

Dimensions for Schedules 5S, 10S, 40S, and 80S conform with ANSI B36.19.

(A) Wall thicknesses for Schedules 40, 40S, and Standard Weight are identical through 10".

(B) Wall Thicknesses for Schedules 80, 80S, and Extra Strong are identical through 8".

(1) Thickness agrees with that for Standard Weight Pipe ANSI B36.10; not included in Schedule 40S.

(2) Thickness agrees with that for Extra Strong Pipe ANSI B36.10; not included in Schedule 80S.

(3) Thickness not listed in any standard.

The red tint areas are schedules covered in this bulletin.

ALLOWABLE WORKING PRESSURES

For the convenience of piping engineers, pages 99 through 109 show the allowable pressure rating at temperature of various piping materials including Stainless Steel Type 304L, 304, 316L, 316 and Monel, Nickel and Aluminum Alloys 3003 and 6061 in sizes ½" through 24" in popular wall schedules.

Stress values shown at various temperatures are as given in Appendix A of ANSI B31.3—Code for Pressure Piping for Petroleum Refinery Piping.

The allowable pressure ratings have been calculated from the basic formula given in ANSI B31.3 as follows:

$$P = \frac{2SE T}{D}$$

- Where: T = design thickness of the pipe (12½ % less than the nominal wall thickness of any given pipe size)
 P = internal design pressure, PSIG
 D = outside diameter of pipe, inches
 S = allowable stress for materials at service temperature, PSI
 E = 1.0 for seamless pipe and 0.8 for welded pipe.

The computations shown are a preliminary guide for determining the proper wall thickness and are not to be considered a substitute for various Codes for Pressure Piping.

The user should refer to the applicable Code for Pressure Piping covering the design and material limitations and rules. The particular Code should be reviewed before final design thickness is determined. Depending upon the general service for which the piping system is intended, one of the following may be applicable:

- ASME—Section I—Power Boilers
- ASME—Section III—Nuclear Power Plant Components
- ASME—Section VIII—Pressure Vessels
- ANSI B31.1—Power Piping
- ANSI B31.3—Petroleum Refinery Piping
- ANSI B31.5—Refrigeration Piping

The user is cautioned that the stress values shown in the various Codes do vary. For example, the stress values used in our calculations are not the same as noted in ANSI B31.1. Limitations on maximum temperature for materials may also vary with each Code.

It should be noted that all calculations are based on a specific piping material. Other materials may be used in the manufacture of **FLOWLINE** butt weld fittings. **FLOWLINE** fittings are so manufactured that their pressure rating will equal or exceed those of equivalent straight pipe for the same size, wall thickness and material.

Type 304L—Schedules 5S and 10S.....	page 99	Type 316—Schedules 40S and 80S.....	page 106
Type 304L—Schedules 40S and 80S.....	page 100	Alloy 400 and Alloy 200—	
Type 304—Schedules 10S.....	page 101	Schedules 10S and 40S	page 107
Type 304—Schedules 40S and 80S.....	page 102	Aluminum 3003-O—	
Type 316L—Schedules 5S and 10S.....	page 103	Schedules 40S and 80S	page 108
Type 316L—Schedules 40S and 80S.....	page 104	Aluminum 6061-T6—	
Type 316—Schedules 10S.....	page 105	Schedules 40S and 80S	page 109

(continued on next page)

DESIGN PROPERTIES OF PIPE

Pipe Sched. or Weight	Wall Thick. Inches T	Inside Dia. Inches I.D.	Fifth Power of I.D. In. ⁵ I.D. ⁵	Surface Area Outside Sq. ft. Per ft. A _o	Surface Area Inside Sq. ft. Per ft. A _i	Cross-Sectional		Flow GPM Q	Weight of Pipe Lb. per ft. W	Weight of Water Lb. per ft. W _w	Radius of Gyration Inches R _g	Moment of Inertia In. ⁴ I	Section Modulus In. ³ Z	PRESSURE/STRESS RATIOS			
						Area of Metal Sq. in. A	Flow Area Sq. in. A _f							(Corrosion Allowance—Zero) Y COEFFICIENT			
														0.0	0.4	0.5	0.7

18" NOMINAL PIPE SIZE (cont'd) (O.D. = 18.000")

120	1.375	15.250	825	4.71	3.99	71.81	182.7	5709.4	244.2	79.1	5.90	2498	277.6	.1337	.1412	.1433	.1475
140	1.562	14.876	728	4.71	3.89	80.66	173.8	5431.3	274.3	75.3	5.84	2750	305.5	.1519	.1617	.1643	.1699
160	1.781	14.438	627	4.71	3.78	90.75	163.7	5115.6	308.5	70.9	5.77	3020	335.6	.1732	.1860	.1896	.1970

20" NOMINAL PIPE SIZE (O.D. = 20.000")

10	5S	.188(A)	19.624	2.91	5.24	5.14	11.70	302.5	9413.8	39.8	131.0	7.00	574	57.4	.0165	.0166	.0166	.0166
	10S	.218(A)	19.564	2.87	5.24	5.12	13.55	300.6	9354.6	46.1	130.2	6.99	663	66.3	.0191	.0192	.0193	.0193
20	ST	.250	19.500	2.82	5.24	5.11	15.51	298.6	9343.8	52.7	129.3	6.98	757	75.7	.0219	.0221	.0221	.0222
	40S	.375(1)	19.250	2.64	5.24	5.04	23.12	291.0	9096.9	78.6	126.0	6.94	1114	111.4	.0328	.0332	.0334	.0336
30	XS	.500(2)	19.000	2.48	5.24	4.97	30.6	283.5	8859.4	104.1	122.8	6.90	1457	145.7	.0437	.0445	.0447	.0451
	80S	.594	18.812	2.36	5.24	4.93	36.2	278.0	8687.5	122.9	120.4	6.86	1704	170.4	.0519	.0530	.0533	.0538
40	60	.812	18.376	2.10	5.24	4.81	48.9	265.2	8287.5	166.4	114.8	6.79	2257	225.7	.0711	.0731	.0737	.0748
	80	1.031	17.938	1.86	5.24	4.70	61.4	252.7	7896.9	208.9	109.4	6.72	2772	277.2	.0902	.0936	.0945	.0963
100	120	1.281	17.438	1.61	5.24	4.57	75.3	238.8	7462.5	256.1	103.4	6.63	3316	331.6	.1121	.1173	.1187	.1216
	140	1.500	17.000	1.42	5.24	4.45	87.2	227.0	7093.8	296.4	98.3	6.56	3755	375.5	.1312	.1385	.1405	.1445
140	160	1.750	16.500	1.22	5.24	4.32	100.3	213.8	6681.3	341.1	92.6	6.48	4217	421.7	.1531	.1631	.1658	.1715
	160	1.969	16.062	1.07	5.24	4.21	111.5	202.7	6334.4	379.1	87.8	6.41	4585	458.6	.1722	.1849	.1884	.1958

24" NOMINAL PIPE SIZE (O.D. = 24.000")

10	5S	.218(A)	23.564	7.26	6.28	6.17	16.3	436	13568.3	55.4	188.8	8.41	1152	96.0	.0159	.0160	.0160	.0161
	10S	.250(A)	23.500	7.17	6.28	6.15	18.7	434	13593.8	63.4	187.8	8.40	1316	109.6	.0182	.0184	.0184	.0185
20	ST	.375(1)	23.250	6.79	6.28	6.09	27.8	425	13268.8	94.6	183.8	8.35	1943	161.9	.0273	.0276	.0277	.0279
	40S	.500(2)	23.000	6.44	6.28	6.02	36.9	415	13000.0	125.5	179.9	8.31	2550	212.5	.0365	.0370	.0371	.0374
30	XS	.562	22.876	6.26	6.28	5.99	41.4	411	12843.8	140.7	178.0	8.29	2840	237.0	.0410	.0417	.0418	.0422
	80S	.688	22.624	5.93	6.28	5.92	50.3	402	12565.6	171.1	174.1	8.25	3420	285	.0501	.0511	.0514	.0519
40	60	.969	22.062	5.23	6.28	5.78	70.0	382	11946.9	238.1	165.6	8.15	4653	388	.0706	.0726	.0732	.0743
	80	1.219	21.562	4.66	6.28	5.65	87.2	365	11412.5	296.4	158.1	8.07	5670	473	.0888	.0921	.0929	.0947
100	120	1.531	20.938	4.02	6.28	5.48	108.1	344	10759.4	367.4	149.1	7.96	6852	571	.1116	.1169	.1182	.1211
	140	1.812	20.376	3.51	6.28	5.33	126.3	326	10190.6	429.4	141.2	7.87	7824	652	.1321	.1395	.1415	.1456
140	160	2.062	19.876	3.10	6.28	5.20	142.1	310	9696.9	483.2	134.3	7.79	8630	719	.1504	.1599	.1626	.1680
	160	2.344	19.312	2.69	6.28	5.06	159.4	293	9156.3	542.0	126.9	7.70	9455	788	.1708	.1834	.1868	.1940

$$R_g = \sqrt{\frac{I}{A}} = \sqrt{\frac{O.D.^2 + I.D.^2}{4}} = \text{radius of gyration in inches}$$

$$I = AR_g^2 = 0.0491 (O.D.^4 - I.D.^4) = \text{moment of inertia, inches fourth}$$

$$Z = \frac{2I}{O.D.} = 0.0982 \frac{O.D.^4 - I.D.^4}{O.D.} = \text{section modulus, inches cube}$$

ST designates standard weight steel pipe; dimensions are in conformance with ANSI B36.10.

XS designates extra strong steel pipe; dimensions are in conformance with ANSI B16.10.

XX designates double extra strong steel pipe; dimensions are in conformance with ANSI B16.10.

Numbers 10, 20, 30, 40, 60, 80, 100, 120, 140 and 160 designate schedule numbers; dimensions are in conformance with ANSI B16.10.

Dimensions for Schedules 5S, 10S, 40S, and 80S are in conformance with ANSI B36.19.

(A) Proposed wall thickness for Schedules 5S and 10S.

(1) Thickness agrees with that for Standard Weight Pipe (ANSI B36.10); not included in Schedule 40S.

(2) Thickness agrees with that for Extra Strong Pipe (ANSI B36.10); not included in Schedule 80S.

DIMENSIONS FOR SEAMLESS AND WELDED PIPE . . .

Nominal Pipe Size		Outside Diameter		SCHEDULE 5S		SCHEDULE 10S		SCHEDULE 10		SCHEDULE 20	
in.	mm	in.	mm	Wall Thickness		Wall Thickness		Wall Thickness		Wall Thickness	
				in.	mm	in.	mm	in.	mm	in.	mm
1/8	3.2	.405	10.3	—	—	.049	1.25	—	—	—	—
1/4	6.4	.540	13.7	—	—	.065	1.65	—	—	—	—
3/8	9.5	.675	17.1	—	—	.065	1.65	—	—	—	—
1/2	12.7	.840	21.3 ^a	.065	1.65	.083	2.11	—	—	—	—
3/4	19.1	1.050	26.7 ^a	.065	1.65	.083	2.11	—	—	—	—
1	25.4	1.315	33.4 ^a	.065	1.65	.109	2.77	—	—	—	—
1 1/4	31.8	1.660	42.2 ^a	.065	1.65	.109	2.77	—	—	—	—
1 1/2	38.1	1.900	48.3 ^a	.065	1.65	.109	2.77	—	—	—	—
2	50.8	2.375	60.3 ^a	.065	1.65	.109	2.77	—	—	—	—
2 1/2	63.5	2.875	73.0 ^a	.083	2.11	.120	3.02	—	—	—	—
3	76.2	3.500	88.9 ^a	.083	2.11	.120	3.02	—	—	—	—
3 1/2	88.9	4.000	101.6 ^a	.083	2.11	.120	3.02	—	—	—	—
4	101.6	4.500	114.3 ^a	.083	2.11	.120	3.02	—	—	—	—
5	127.0	5.563	141.3 ^a	.109	2.77	.134	3.38	—	—	—	—
6	152.4	5.625	168.3 ^a	.109	2.77	.134	3.38	—	—	—	—
8	203.2	8.625	219.1 ^a	.109	2.77	.148	3.73	—	—	.250	6.35 ^a
10	254.0	10.750	273.1 ^a	.134	3.38	.165	4.19	—	—	.250	6.35 ^a
12	304.8	12.750	328.9 ^a	.156	3.97	.180	4.55	—	—	.250	6.35 ^a
14	355.6	14.000	355.6 ^a	.156	3.97	.188	4.78	.250	6.35 ^a	.312	7.93
16	406.4	15.000	406.4 ^a	.165	4.19	.188	4.78	.250	6.35 ^a	.312	7.93
18	457.2	18.000	457.2 ^a	.165	4.19	.188	4.78	.250	6.35 ^a	.312	7.93
20	508.0	20.000	508.0 ^a	.188	4.78	.218	5.54	.250	6.35 ^a	.375	9.53 ^a
24	609.6	24.000	609.6 ^a	.218	5.54	.250	6.35 ^a	.250	6.35 ^a	.375	9.53 ^a

Nominal Pipe Size		Outside Diameter		SCHEDULE 30		SCHEDULE 40S AND STANDARD WT. (A)		SCHEDULE 40 (A)		SCHEDULE 60	
in.	mm	in.	mm	Wall Thickness		Wall Thickness		Wall Thickness		Wall Thickness	
				in.	mm	in.	mm	in.	mm	in.	mm
1/8	3.2	.405	10.3	—	—	.068	1.73	.068	1.73	—	—
1/4	6.4	.540	13.7	—	—	.088	2.24	.088	2.24	—	—
3/8	9.5	.675	17.1	—	—	.091	2.31	.091	2.31	—	—
1/2	12.7	.840	21.3 ^a	—	—	.109	2.77	.109	2.77	—	—
3/4	19.1	1.050	26.7 ^a	—	—	.113	2.87	.113	2.87	—	—
1	25.4	1.315	33.4 ^a	—	—	.133	3.38	.133	3.38	—	—
1 1/4	31.8	1.660	42.2 ^a	—	—	.140	3.56 ^a	.140	3.56 ^a	—	—
1 1/2	38.1	1.900	48.3 ^a	—	—	.145	3.68 ^a	.145	3.68 ^a	—	—
2	50.8	2.375	60.3 ^a	—	—	.154	3.91	.154	3.91	—	—
2 1/2	63.5	2.875	73.0 ^a	—	—	.203	5.16	.203	5.16	—	—
3	76.2	3.500	88.9 ^a	—	—	.216	5.49	.216	5.49	—	—
3 1/2	88.9	4.000	101.6 ^a	—	—	.226	5.74	.226	5.74	—	—
4	101.6	4.500	114.3 ^a	—	—	.237	6.02	.237	6.02	—	—
5	127.0	5.563	141.3 ^a	—	—	.258	6.55	.258	6.55	—	—
6	152.4	5.625	168.3 ^a	—	—	.280	7.11 ^a	.280	7.11 ^a	—	—
8	203.2	8.625	219.1 ^a	.277	7.04	.322	8.18	.322	8.18	.406	10.31
10	254.0	10.750	273.1 ^a	.307	7.80	.365	9.27 ^a	.365	9.27 ^a	.500	12.70 ^a
12	304.8	12.750	328.9 ^a	.330	8.38 ^a	.375	9.53 ^a	.406	10.31	.562	14.28
14	355.6	14.000	355.6 ^a	.375	9.53 ^a	.375(1)	9.53 ^a	.438	11.13	.594	15.09
16	406.4	15.000	406.4 ^a	.375	9.53 ^a	.375(1)	9.53 ^a	.500	12.70 ^a	.656	16.66
18	457.2	18.000	457.2 ^a	.438	11.13	.375(1)	9.53 ^a	.562	14.26	.750	19.05 ^a
20	508.0	20.000	508.0 ^a	.500	12.70 ^a	.375(1)	9.53 ^a	.594	15.09	.812	20.63
24	609.6	24.000	609.6 ^a	.562	14.28	.375(1)	9.53 ^a	.688	17.48	.969	24.61

^a Exact figure
Dimensions are shown both in inches and millimeters.
Dimensions for Standard Weight, Extra Strong, Double Extra Strong, Schedules 10, 20, 30, 40, 60, 80, 100, 120, 140 and 160 conform with ANSI B36.10.
Dimensions for Schedules 5S, 10S, 40S, and 80S conform with ANSI B36.19.
(A) Wall thicknesses for Schedules 40, 40S, and Standard Weight are identical through 10".

(B) Wall Thicknesses for Schedules 80, 80S, and Extra Strong are identical through 8".

- (1) Thickness agrees with that for Standard Weight Pipe ANSI B36.10; not included in Schedule 40S.
- (2) Thickness agrees with that for Extra Strong Pipe ANSI B36.10; not included in Schedule 80S.
- (3) Thickness not listed in any standard.

The red tint areas are schedules covered in this bulletin.

**ALLOWABLE WORKING PRESSURES
FOR A-312 WELDED PIPE**

**TYPE 304L
Schedules 5S, 10S**

TEMPERATURE °F.			-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	
MAX. STRESS			16700	15800	14800	14000	13700	13500	13300	13000	12800	11900	9900	7800	6300	5100	4000	3200	2600	2100	1700	1100	1000	900	
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																						
½	5S	.065	1809	1712	1603	1517	1484	1463	1441	1408	1387	1289	1073	845	683	553	433	347	282	226	184	119	108	98	
	10S	.083	2310	2186	2047	1937	1895	1868	1840	1798	1771	1646	1370	1079	872	706	553	443	363	291	235	152	138	125	
¾	5S	.065	1447	1389	1283	1213	1187	1170	1153	1127	1109	1031	858	676	546	442	347	277	225	182	147	95	87	78	
	10S	.083	1848	1749	1636	1549	1516	1494	1472	1439	1417	1317	1096	863	697	564	443	354	283	232	188	122	111	100	
1	5S	.065	1156	1093	1024	969	948	934	920	900	886	823	835	540	436	353	277	221	181	145	118	76	69	62	
	10S	.109	1938	1834	1717	1625	1590	1567	1543	1509	1485	1381	1149	905	731	592	464	371	302	244	197	128	116	104	
1¼	5S	.065	915	888	811	767	751	740	729	713	702	652	543	426	345	280	219	175	143	115	93	60	55	49	
	10S	.109	1535	1452	1361	1287	1259	1241	1223	1195	1177	1094	910	717	579	469	368	294	233	193	156	101	92	83	
1½	5S	.065	800	757	709	671	656	647	637	623	613	570	474	374	302	244	192	153	125	101	81	53	48	43	
	10S	.109	1341	1269	1189	1124	1100	1064	1068	1044	1028	956	795	626	506	410	321	257	203	169	137	88	80	72	
2	5S	.065	640	605	587	538	525	517	510	498	490	456	379	299	241	195	153	123	103	80	65	42	38	34	
	10S	.109	1073	1015	951	900	880	867	855	835	822	765	636	501	405	328	257	206	167	135	109	71	64	58	
2½	5S	.083	675	639	598	566	554	546	538	525	517	481	400	315	255	206	162	129	105	85	69	44	40	36	
	10S	.120	976	923	865	818	801	789	777	760	748	695	579	456	388	298	234	187	152	123	99	64	58	53	
3	5S	.083	554	525	491	465	455	448	442	432	425	395	329	259	209	169	133	106	85	70	56	37	33	30	
	10S	.120	802	758	710	672	658	648	638	624	614	571	475	374	302	245	192	154	125	101	82	53	48	43	
3½	5S	.083	485	459	430	407	398	392	386	378	372	346	288	227	183	148	116	93	75	61	49	32	29	26	
	10S	.120	701	664	622	588	575	567	559	546	538	500	416	328	265	214	168	134	103	88	71	46	42	38	
4	5S	.083	431	408	382	362	354	349	343	336	331	307	256	201	163	132	103	83	67	54	44	28	26	23	
	10S	.120	623	590	553	523	511	504	497	485	478	444	370	291	235	190	149	119	97	78	63	41	37	34	
5	5S	.109	458	433	406	384	376	370	365	357	351	326	272	214	173	140	110	88	71	58	47	30	27	25	
	10S	.134	583	533	499	472	462	455	449	438	432	401	334	263	212	172	135	108	83	71	57	37	34	30	
6	5S	.109	385	364	341	322	316	311	306	299	295	274	228	180	145	117	92	74	60	48	39	25	23	21	
	10S	.134	473	447	419	396	388	382	377	368	362	337	260	221	178	144	113	91	74	59	48	31	28	25	
8	5S	.109	295	280	262	248	242	239	235	230	226	211	175	138	111	90	71	57	46	37	30	19	18	16	
	10S	.148	401	380	356	336	329	324	320	312	307	286	238	187	151	123	96	77	62	50	41	26	24	22	
10	5S	.134	291	278	258	244	239	236	232	227	223	208	173	138	110	89	70	58	45	37	30	19	17	16	
	10S	.165	359	340	318	301	294	290	286	279	275	256	213	168	135	110	86	69	56	45	37	24	21	19	
12	5S	.156	286	271	254	240	235	231	228	223	219	204	170	134	108	87	69	55	45	36	29	19	17	15	
	10S	.180	330	312	293	277	271	267	263	257	253	235	196	154	125	101	79	63	51	42	34	22	20	18	
14	5S	.156	261	246	231	218	214	211	207	203	200	186	154	122	98	80	62	50	41	33	27	17	16	14	
	10S	.188	314	297	276	263	258	254	250	244	241	224	186	147	118	96	75	60	49	39	32	21	19	17	
16	5S	.165	241	228	214	202	198	195	192	188	185	172	143	113	91	74	58	46	38	30	25	16	14	13	
	10S	.188	275	260	243	230	225	222	219	214	211	196	163	128	104	84	66	53	43	35	28	18	16	15	
18	5S	.165	214	203	190	180	176	173	171	167	164	153	127	100	81	65	51	41	33	27	22	14	13	12	
	10S	.188	244	231	216	205	200	197	194	190	187	174	145	114	92	75	58	47	38	31	25	16	15	13	
20	5S	.188	220	208	195	184	180	178	175	171	168	157	130	103	83	67	53	42	34	28	22	14	13	12	
	10S	.218	255	241	226	214	209	206	203	198	195	182	151	119	96	78	61	49	40	32	26	17	15	14	
24	5S	.218	212	201	188	178	174	172	169	165	163	151	126	99	80	65	51	41	33	27	22	14	13	11	
	10S	.250	244	230	216	204	200	197	194	190	187	174	144	114	92	74	58	47	38	31	25	16	15	13	

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.
Allowable Working Pressures shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 98 for calculation details.
All dimensions are in inches.

TYPE 304L

Schedules 40S, 80S

ALLOWABLE WORKING PRESSURES FOR A-312 WELDED PIPE

TEMPERATURE °F.			-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	
MAX. STRESS			16700	15800	14800	14000	13700	13500	13300	13000	12800	11900	9900	7800	6300	5100	4000	3200	2600	2100	1700	1100	1000	900	
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																						
			1/2	40S 80S	.109 .147	3034 4092	2870 387	2689 3626	2543 3430	2489 3357	2453 3308	2416 3259	2362 3185	2325 3136	2162 2916	1799 2426	1417 1911	1145 1544	927 1250	727 980	581 784	472 637	382 515	309 417	200 270	182 245	164 221
3/4	40S 80S	.113 .154	2516 3429	238 3244	2230 3039	2109 2875	2064 2813	2034 2772	2004 2731	1959 2669	1929 2628	1793 2443	1492 2033	1175 1602	949 1294	768 1047	603 821	482 657	392 534	316 431	256 349	166 226	151 205	136 185	
1	40S 80S	.133 .179	2365 3183	2237 301	2096 2820	1962 2668	1940 2611	1912 2573	1863 2535	1841 2477	1812 2439	1685 2268	1402 1887	1104 1486	892 1201	722 972	566 762	453 610	368 495	297 400	241 324	156 210	142 191	127 172	
1 1/4	40S 80S	.140 .191	1972 2690	1866 2545	1747 2384	1653 2255	1618 2207	1594 2175	1570 2142	1535 2094	1511 2062	1405 1917	1169 1595	921 1256	744 1015	602 822	472 644	376 515	307 419	248 338	201 274	130 177	118 161	106 145	
1 1/2	40S 80S	.145 .200	1784 2461	1688 2328	1561 2181	1496 2063	1464 2019	1442 1989	1421 1960	1389 1916	1368 1886	1271 1754	1058 1459	833 1149	673 928	545 752	427 589	342 472	278 383	224 309	182 251	118 162	107 147	96 133	
2	40S 80S	.154 .218	1516 2146	1434 2030	1344 1902	1271 1799	1244 1761	1226 1735	1207 1709	1180 1671	1162 1645	1080 1529	899 1272	708 1002	572 810	463 655	363 514	290 411	236 334	191 270	154 218	100 141	91 129	82 116	
2 1/2	40S 80S	.203 .276	1651 2244	1562 2124	1463 1989	1384 1882	1354 1841	1335 1814	1315 1788	1285 1747	1265 1720	1176 1599	979 1331	771 1048	623 847	504 685	395 538	316 430	257 349	208 282	168 228	109 148	99 134	89 121	
3	40S 80S	.216 .300	1443 2004	1365 1895	1279 1776	1210 1680	1184 1644	1166 1620	1149 1596	1123 1560	1106 1536	1028 1428	855 1188	674 938	544 756	441 612	348 480	276 384	225 312	181 252	147 204	95 132	86 120	78 108	
3 1/2	40S 80S	.226 .318	1321 1859	1250 1750	1171 1647	1107 1558	1084 1525	1068 1503	1052 1460	1028 1447	1012 1425	941 1324	783 1102	617 868	498 701	403 568	316 445	253 356	206 289	166 234	134 169	87 122	79 111	71 100	
4	40S 80S	.237 .337	1231 1751	1165 1657	1091 1552	1032 1468	1010 1436	995 1415	981 1394	959 1363	944 1342	877 1248	730 1038	575 818	465 661	376 535	295 419	236 336	192 273	155 220	125 178	81 115	74 105	66 94	
5	40S 80S	.258 .375	1084 1576	1025 1491	961 1397	909 1321	890 1293	877 1274	864 1255	844 1227	831 1208	773 1123	643 934	506 738	409 595	331 481	260 377	208 302	169 245	136 198	110 160	71 104	65 94	58 85	
6	40S 80S	.280 .432	988 1525	935 1442	876 1351	828 1278	811 1251	799 1232	787 1214	769 1187	757 1169	704 1086	586 904	462 712	373 575	302 466	237 365	189 292	154 237	124 192	101 155	65 100	59 91	53 82	
8	40S 80S	.322 .500	873 1355	825 1262	774 1201	732 1136	716 1112	706 1096	695 1079	679 1055	669 1039	622 966	517 803	408 633	329 511	267 414	209 325	167 260	136 211	110 170	89 138	57 89	52 81	47 73	
10	40S 80S	.385 .500	794 1087	751 1029	704 984	665 912	651 892	642 879	632 866	618 847	608 833	586 775	471 645	371 508	299 410	242 332	190 260	152 208	124 169	100 137	81 111	52 72	48 65	43 59	
12	40S 80S	.375 .500	688 917	651 867	609 813	576 769	564 752	556 741	548 730	535 714	527 703	490 653	408 544	321 428	259 346	210 280	165 220	132 176	107 143	86 115	70 93	45 60	41 55	37 49	
14	40S 80S	.375 .500	626 835	593 790	555 740	525 700	514 685	506 675	499 665	488 650	480 640	446 595	371 495	293 390	236 315	191 255	150 200	120 160	98 130	79 105	64 85	41 55	38 50	34 45	
16	40S 80S	.375 .500	548 731	513 691	486 648	459 613	450 599	443 591	438 582	427 569	420 560	390 521	325 433	256 341	207 276	167 223	131 175	105 140	85 114	69 92	56 74	36 48	33 44	30 39	
18	40S 80S	.375 .500	487 649	461 614	432 576	408 544	400 533	394 525	388 517	379 506	373 498	347 463	289 385	228 303	184 245	149 198	117 156	93 124	76 101	61 82	50 66	32 43	29 39	26 35	
20	40S 80S	.375 .500	438 585	415 553	389 518	368 490	360 480	354 473	349 466	341 455	336 448	312 417	260 347	205 273	165 221	134 179	105 140	84 112	68 91	55 74	45 60	29 39	26 35	24 32	
24	40S 80S	.375 .500	365 487	345 461	324 432	306 408	300 400	295 394	291 388	284 379	280 373	260 347	217 289	171 228	138 184	112 149	88 117	70 93	57 76	46 61	37 50	24 32	22 29	20 26	

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.
Allowable Working Pressures Shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 96 for calculation details.
All dimensions are in inches.

(continued on next page)

**ALLOWABLE WORKING PRESSURES
FOR A-312 WELDED PIPE**

**TYPE 304
Schedule 10S**

TEMPERATURE °F.			-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500		
MAX. STRESS			20000	18700	17500	16400	16200	16000	15600	15200	14900	14600	14400	13800	12200	9700	7700	6000	4700	3700	2900	2300	1800	1400		
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																							
½	10S	.083	2767	2587	2421	2269	2241	2213	2158	2103	2061	2020	1992	1909	1688	1342	1065	830	650	512	401	318	249	194		
¾	10S	.083	2213	2069	1937	1815	1793	1771	1726	1682	1649	1616	1594	1527	1350	1073	852	664	520	409	321	255	199	155		
1	10S	.109	2321	2170	2031	1903	1880	1857	1810	1764	1729	1694	1671	1601	1416	1126	894	696	545	429	337	267	209	162		
1¼	10S	.109	1839	1719	1609	1508	1489	1471	1434	1397	1370	1342	1324	1269	1122	892	708	552	432	340	267	211	165	129		
1½	10S	.109	1606	1502	1406	1317	1301	1285	1253	1221	1197	1173	1157	1108	980	779	618	482	377	297	233	185	145	112		
2	10S	.109	1265	1202	1124	1054	1041	1028	1002	977	957	938	925	887	784	623	495	386	302	238	166	148	116	90		
2½	10S	.120	1169	1093	1023	958	947	935	912	888	871	853	841	806	713	567	450	351	275	216	169	134	105	82		
3	10S	.120	960	898	840	787	778	768	749	730	715	701	691	662	586	466	370	288	226	178	139	110	86	67		
3½	10S	.120	840	785	735	689	680	672	655	638	626	613	605	580	512	407	323	252	197	155	122	97	76	59		
4	10S	.120	747	698	653	612	605	597	582	567	556	545	538	515	455	362	287	224	175	138	106	86	67	52		
5	10S	.134	674	631	590	553	548	540	526	513	502	492	486	465	411	327	260	202	158	125	98	78	61	47		
6	10S	.134	566	530	496	464	459	453	442	430	422	413	406	391	345	275	218	170	133	105	82	65	51	40		
8	10S	.148	480	449	420	394	389	384	375	365	358	351	346	332	293	233	185	144	113	89	70	55	43	34		
10	10S	.165	430	402	376	352	348	344	335	327	320	314	309	297	262	208	165	129	101	80	62	49	39	30		
12	10S	.180	395	370	346	324	320	316	308	300	294	289	285	273	241	192	152	119	93	73	57	45	36	28		
14	10S	.188	376	352	329	308	305	301	293	288	280	274	271	259	229	182	145	113	88	70	55	43	34	26		
16	10S	.188	329	308	268	270	266	263	257	250	245	240	237	227	201	160	127	99	77	61	48	38	30	23		
18	10S	.188	292	273	256	240	237	234	228	222	218	213	211	202	178	142	113	88	69	54	42	34	26	20		
20	10S	.218	305	285	267	250	247	244	238	232	227	223	220	211	186	148	118	92	72	56	44	35	27	21		
24	10S	.250	292	273	255	239	236	233	228	222	217	213	210	201	178	141	112	88	69	54	42	34	26	20		

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.

The Stress Values at all temperatures above 1000F apply only when the carbon is 0.04% or higher.

Allowable Working Pressures shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 98 for calculation details.
All dimensions are in inches.

(continued on next page)

TYPE 304

Schedules 40S, 80S

ALLOWABLE WORKING PRESSURES FOR A-312 WELDED PIPE

TEMPERATURE °F.			-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	
MAX. STRESS			20000	18700	17500	16400	16200	16000	15600	15200	14900	14600	14400	13800	12200	9700	7700	6000	4700	3700	2900	2300	1800	1400	
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																						
			1/2	40S 80S	.109 .147	3633 4900	3397 4582	3179 4288	2979 4018	2943 3969	2907 3920	2834 3822	2761 3724	2707 3651	2652 3577	2618 3528	2507 3381	2216 2989	1762 2377	1399 1887	1090 1470	854 1152	672 907	527 711	418 564
3/4	40S 80S	.113 .154	3013 4107	2617 3840	2637 3593	2471 3387	2441 3326	2411 3285	2350 3203	2290 3121	2245 3059	2200 2998	2170 2957	2079 2834	1838 2505	1461 1992	1160 1581	904 1232	708 965	557 760	437 595	347 472	271 370	211 287	
1	40S 80S	.133 .179	2832 3811	2648 3584	2478 3335	2322 3125	2294 3087	2266 3049	2209 2973	2152 2897	2110 2839	2067 2782	2039 2744	1954 2630	1727 2325	1373 1849	1090 1467	850 1143	666 898	524 705	411 553	326 438	255 343	198 267	
1 1/4	40S 80S	.140 .191	2361 3222	2208 3012	2066 2819	1936 2642	1913 2610	1889 2577	1842 2513	1795 2448	1759 2400	1724 2352	1700 2320	1629 2223	1440 1965	1145 1563	909 1240	708 967	555 757	437 596	342 467	272 370	213 290	165 226	
1 1/2	40S 80S	.145 .200	2137 2947	1996 2758	1870 2579	1752 2417	1731 2387	1709 2358	1667 2299	1624 2240	1592 2196	1560 2152	1539 2122	1474 2034	1303 1798	1036 1429	823 1135	641 884	502 693	395 545	310 427	246 339	192 265	150 206	
2	40S 80S	.154 .218	1816 2570	1693 2403	1589 2249	1489 2107	1471 2082	1452 2058	1416 2005	1380 1953	1353 1915	1325 1876	1307 1850	1253 1773	1108 1588	881 1247	699 989	545 771	427 604	336 475	263 373	209 296	163 231	127 180	
2 1/2	40S 80S	.203 .276	1977 2888	1849 2513	1730 2352	1621 2204	1601 2177	1582 2150	1542 2097	1503 2043	1473 2003	1443 1962	1423 1935	1384 1855	1206 1640	959 1304	761 1035	593 806	465 632	368 497	287 390	227 309	178 242	138 188	
3	40S 80S	.216 .300	1728 2400	1616 2244	1512 2100	1417 1988	1400 1944	1362 1920	1348 1872	1313 1824	1287 1788	1261 1752	1244 1728	1192 1658	1054 1464	838 1164	665 924	518 720	406 564	320 444	251 348	199 276	158 218	121 168	
3 1/2	40S 80S	.226 .318	1562 2226	1479 2081	1364 1948	1297 1825	1261 1803	1266 1781	1234 1738	1202 1692	1179 1658	1155 1625	1139 1603	1092 1538	965 1358	767 1080	609 857	475 666	372 523	293 412	229 323	182 256	142 200	111 156	
4	40S 80S	.237 .337	1475 2097	1379 1961	1290 1835	1209 1719	1194 1698	1180 1678	1150 1636	1121 1594	1099 1562	1077 1531	1062 1510	1018 1447	900 1279	715 1017	588 807	442 629	347 493	273 388	214 304	170 241	133 169	103 147	
5	40S 80S	.258 .375	1299 1667	1214 1765	1136 1652	1065 1548	1052 1529	1039 1510	1013 1472	987 1434	967 1406	948 1378	935 1359	896 1302	792 1151	630 915	500 727	390 566	305 444	240 349	188 274	149 217	117 170	91 132	
6	40S 80S	.280 .432	1183 1628	1106 1707	1035 1596	970 1497	959 1479	947 1461	923 1424	899 1368	882 1360	884 1333	852 1315	817 1260	722 1114	574 886	456 703	355 546	278 429	219 338	172 265	136 210	107 164	83 128	
8	40S 80S	.322 .500	1045 1623	977 1518	915 1420	857 1331	847 1315	836 1299	815 1266	794 1234	779 1209	763 1185	753 1169	721 1120	638 990	507 787	402 625	314 487	246 381	193 300	152 235	120 187	94 146	73 114	
10	40S 80S	.385 .500	951 1302	889 1218	832 1140	780 1068	770 1055	761 1042	742 1016	723 990	708 970	694 951	685 938	658 899	580 794	461 632	386 501	285 391	223 306	176 241	138 189	109 150	86 117	67 91	
12	40S 80S	.375 .500	824 1098	770 1027	721 961	675 900	667 869	659 876	642 856	626 835	614 818	601 802	593 791	568 758	502 670	399 533	317 423	247 329	194 258	152 203	119 159	95 126	74 99	58 77	
14	40S 80S	.375 .500	750 1000	701 935	656 875	615 820	608 810	600 800	585 780	570 760	559 745	548 730	540 720	518 690	458 610	364 485	289 385	225 300	178 235	139 185	109 145	86 115	68 90	53 70	
16	40S 80S	.375 .500	656 875	614 818	574 766	538 718	532 709	525 700	512 683	499 665	489 652	479 639	473 630	453 604	400 534	318 424	253 337	197 263	154 206	121 162	95 127	75 101	59 79	46 61	
18	40S 80S	.375 .500	583 778	545 727	510 681	478 638	473 630	467 622	455 607	443 591	435 579	426 568	420 560	403 537	358 474	263 377	225 299	175 233	137 183	106 144	85 113	67 89	53 70	41 54	
20	40S 80S	.375 .500	525 700	491 655	459 613	431 574	425 587	420 560	410 548	399 532	391 522	383 511	378 504	362 483	320 427	255 340	202 270	158 210	123 165	97 130	76 -102	60 81	47 63	37 49	
24	40S 80S	.375 .500	438 583	409 545	383 510	359 478	354 473	350 467	341 455	333 443	328 435	319 426	315 420	302 403	267 358	212 283	168 225	131 175	103 137	81 108	63 85	50 67	39 53	31 41	

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.

The Stress Values at all temperatures above 1000F apply only when the carbon is 0.04% or higher.

Allowable Working Pressures shown for each size reflect the minus 12 1/2% manufacturers wall tolerance.

See Page 98 for calculation details.

All dimensions are in inches.

(continued on next page)

**ALLOWABLE WORKING PRESSURES
FOR A-312 WELDED PIPE**

**TYPE 316L
Schedules 5S, 10S**

TEMPERATURE °F.			-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	
MAX. STRESS			16700	15500	14400	13500	13200	12900	12600	12400	12100	11800	11500	11200	10800	10200	8800	6400	4700	3500	2500	1800	1300	1000	
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																						
			1/2	5S 10S	.065 .083	1809 2310	1679 2144	1560 1992	1463 1888	1430 1826	1398 1785	1365 1743	1343 1715	1311 1674	1278 1632	1246 1591	1213 1549	1170 1494	1105 1411	953 1217	693 885	509 650	379 484	271 346	195 249	141 180	108 138
3/4	5S 10S	.065 .083	1447 1848	1343 1715	1248 1594	1170 1494	1144 1461	1118 1428	1092 1394	1075 1372	1049 1339	1023 1306	997 1273	971 1239	936 1195	884 1129	763 974	555 708	407 520	303 387	217 277	158 199	113 144	87 111	
1	5S 10S	.065 .109	1156 1938	1073 1799	997 1671	934 1587	913 1532	893 1497	872 1462	858 1439	837 1404	817 1389	796 1335	775 1300	747 1253	706 1184	609 1021	443 743	325 545	242 406	173 290	125 209	90 151	69 116	
1 1/4	5S 10S	.065 .109	915 1535	850 1425	789 1324	740 1241	724 1213	707 1186	691 1158	680 1140	663 1112	647 1085	630 1057	614 1030	592 993	559 938	482 809	351 588	253 432	192 322	137 230	55 165	71 120	55 92	
1 1/2	5S 10S	.065 .109	800 1341	742 1245	690 1157	647 1084	632 1060	618 1038	603 1012	594 996	580 972	565 948	551 924	538 900	517 887	489 819	421 707	307 514	225 377	168 281	120 201	86 145	62 104	48 80	
2	5S 10S	.065 .109	640 1073	594 996	552 925	517 867	506 848	494 829	483 810	475 797	464 777	452 758	441 739	429 720	414 694	391 655	337 565	245 411	183 302	134 225	96 161	69 116	50 84	38 64	
2 1/2	5S 10S	.083 .120	675 976	626 906	582 841	546 789	534 771	521 754	509 736	501 725	489 707	477 690	465 672	453 654	437 631	412 596	356 514	259 374	190 275	141 205	101 146	73 105	53 76	40 58	
3	5S 10S	.083 .120	554 802	515 744	478 691	448 648	438 634	428 619	418 605	412 595	402 581	392 566	382 552	372 538	359 518	339 490	292 422	212 307	156 226	116 168	83 120	60 86	43 62	33 48	
3 1/2	5S 10S	.083 .120	485 701	450 651	418 605	392 567	383 554	375 542	366 529	360 521	352 506	343 496	334 483	325 470	314 454	296 428	256 370	186 269	137 197	102 147	73 105	52 76	38 55	29 42	
4	5S 10S	.083 .120	431 623	400 579	372 538	349 504	341 493	333 482	325 470	320 463	312 452	305 441	297 429	289 418	279 403	263 381	227 329	165 239	121 175	90 131	65 93	46 67	34 49	26 37	
5	5S 10S	.109 .134	458 563	425 523	395 486	370 455	362 445	354 435	346 425	340 418	332 408	324 398	315 388	307 378	296 364	280 344	241 297	176 216	129 158	96 118	69 84	49 61	36 44	27 34	
6	5S 10S	.109 .134	385 473	357 439	332 408	311 362	304 374	297 365	290 357	286 351	279 343	272 334	265 326	258 317	249 306	235 289	203 249	147 181	108 133	81 99	58 71	41 51	30 37	23 28	
8	5S 10S	.109 .146	295 401	274 372	255 346	239 324	234 317	228 310	223 303	219 298	214 291	209 283	203 276	198 269	191 259	180 245	158 211	113 154	83 113	62 84	44 60	32 43	23 31	18 24	
10	5S 10S	.134 .165	291 359	270 333	251 309	236 290	230 284	225 277	220 271	216 266	211 260	206 254	201 247	195 241	188 232	178 219	154 189	112 138	82 101	61 75	44 54	31 39	23 28	17 21	
12	5S 10S	.156 .180	286 330	266 308	247 285	231 267	226 261	221 255	216 249	212 245	207 239	202 233	197 227	192 221	185 213	175 202	151 174	110 126	81 93	60 69	43 49	31 36	22 26	17 20	
14	5S 10S	.156 .188	261 314	242 291	225 271	211 254	206 248	201 243	197 237	193 233	189 227	184 222	179 216	175 211	168 203	159 192	137 165	100 120	73 88	55 66	39 47	28 34	20 24	16 19	
16	5S 10S	.165 .188	241 275	224 255	208 237	195 222	191 217	186 212	182 207	179 204	175 199	170 194	168 189	162 184	156 178	147 168	127 145	92 105	68 77	51 58	36 41	26 30	19 21	14 16	
18	5S 10S	.165 .188	214 244	199 227	185 211	173 197	169 193	166 189	162 184	159 181	155 177	151 173	148 168	144 164	139 158	131 149	113 129	82 94	60 69	45 51	32 37	23 26	17 19	13 15	
20	5S 10S	.188 .218	220 255	204 237	190 220	178 206	174 201	170 197	166 192	163 189	159 185	155 180	151 175	147 171	142 165	134 156	116 134	84 96	62 72	46 53	33 38	24 27	17 20	13 15	
24	5S 10S	.218 .250	212 244	197 226	183 210	172 197	168 193	164 188	160 184	158 181	154 176	150 172	146 168	142 163	137 158	130 149	112 128	81 93	60 69	45 51	32 36	23 26	17 19	13 15	

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.
Allowable Working Pressures shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 96 for calculation details.
All dimensions are in inches.

TYPE 316L

Schedules 40S, 80S

ALLOWABLE WORKING PRESSURES FOR A-312 WELDED PIPE

TEMPERATURE °F.			-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500		
MAX. STRESS			16700	15500	14400	13500	13200	12900	12600	12400	12100	11800	11500	11200	10800	10200	8800	6400	4700	3500	2500	1800	1300	1000		
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																							
			1/2	40S 80S	.109 .147	3034 4092	2816 3796	2616 3528	2453 3306	2398 3234	2344 3161	2289 3067	2253 3038	2198 2965	2144 2891	2089 2816	2035 2744	1962 2646	1853 2499	1599 2158	1163 1568	854 1152	636 858	454 613	327 441	236 319	182 245
3/4	40S 80S	.113 .154	2516 3429	2334 3183	2170 2957	2034 2772	1989 2710	1944 2649	1898 2587	1888 2546	1823 2485	1778 2423	1733 2361	1687 2300	1627 2218	1537 2094	1326 1807	964 1314	706 965	527 719	377 513	271 370	196 267	151 205		
1	40S 80S	.133 .179	2365 3183	2194 2954	2039 2744	1912 2573	1869 2516	1827 2458	1784 2401	1756 2363	1713 2306	1671 2249	1628 2192	1586 2134	1529 2058	1444 1944	1246 1677	906 1220	666 896	496 667	354 476	255 343	184 248	142 191		
1 1/4	40S 80S	.140 .191	1972 2690	1830 2497	1700 2320	1594 2175	1559 2126	1523 2078	1488 2030	1464 1997	1429 1949	1393 1901	1358 1852	1322 1804	1275 1740	1204 1643	1039 1418	756 1031	555 757	413 564	295 403	213 290	153 209	118 161		
1 1/2	40S 80S	.145 .200	1784 2461	1656 2284	1539 2122	1442 1969	1410 1945	1378 1901	1346 1857	1325 1827	1293 1763	1261 1739	1229 1695	1197 1651	1154 1592	1090 1503	940 1297	684 943	502 693	374 516	267 368	192 265	139 192	107 147		
2	40S 80S	.154 .218	1516 2146	1407 1992	1307 1850	1226 1735	1198 1696	1171 1658	1144 1619	1126 1593	1098 1555	1071 1516	1044 1478	1017 1439	980 1388	926 1311	799 1131	581 822	427 604	318 450	227 321	163 231	118 167	91 129		
2 1/2	40S 80S	.203 .276	1651 2244	1532 2083	1423 1935	1335 1814	1305 1774	1275 1734	1246 1693	1226 1667	1196 1626	1166 1586	1137 1548	1107 1505	1068 1452	1008 1371	670 1183	633 860	465 632	346 470	247 336	178 242	129 175	99 134		
3	40S 80S	.216 .300	1443 2004	1339 1860	1244 1728	1166 1620	1140 1584	1115 1548	1069 1512	1071 1488	1045 1452	1020 1416	994 1380	968 1344	933 1296	881 1224	760 1056	553 766	406 564	302 420	216 300	156 216	112 156	86 120		
3 1/2	40S 80S	.226 .318	1321 1859	1226 1725	1139 1603	1068 1503	1044 1469	1020 1438	997 1402	961 1380	957 1347	933 1313	910 1280	886 1247	854 1202	807 1135	696 979	506 712	372 523	277 390	198 278	142 200	103 145	79 111		
4	40S 80S	.237 .337	1231 1751	1143 1625	1062 1510	995 1415	973 1384	951 1352	929 1321	914 1300	892 1269	870 1237	848 1206	826 1174	796 1132	752 1069	649 923	472 671	347 493	258 367	184 262	133 189	96 138	74 105		
5	40S 80S	.258 .375	1084 1576	1006 1463	935 1359	877 1274	857 1248	838 1217	818 1189	805 1170	786 1142	766 1114	747 1085	727 1057	701 1019	662 963	571 830	416 604	305 444	227 330	162 236	117 170	84 123	65 94		
6	40S 80S	.280 .432	988 1525	917 1415	852 1315	799 1232	781 1205	763 1178	746 1150	734 1132	716 1105	698 1077	680 1050	663 1022	639 986	604 931	521 803	379 584	278 429	207 320	148 228	107 164	77 119	59 91		
8	40S 80S	.322 .500	873 1355	810 1258	753 1169	706 1096	690 1071	674 1047	659 1023	648 1006	632 962	617 958	601 933	585 909	564 877	533 826	460 714	335 519	246 381	183 284	131 203	94 146	68 106	52 81		
10	40S 80S	.365 .500	794 1087	737 1009	685 938	642 879	627 860	613 840	599 820	589 807	575 788	561 768	547 749	532 729	513 703	485 664	418 573	304 417	223 306	166 228	119 163	86 117	62 85	48 65		
12	40S 80S	.375 .500	688 917	638 851	593 791	556 741	544 725	531 708	519 692	511 681	498 664	486 648	474 631	461 615	445 593	420 560	362 483	264 351	194 258	144 192	103 137	74 99	54 71	41 55		
14	40S 80S	.375 .500	626 835	581 775	540 720	506 675	495 660	484 645	473 630	465 620	454 605	443 590	431 575	420 560	405 540	383 510	330 440	240 320	176 235	131 175	94 125	68 90	49 65	38 50		
16	40S 80S	.375 .500	548 731	509 678	473 630	443 591	433 576	423 564	413 551	407 543	397 529	387 516	377 503	368 490	354 473	335 446	289 385	210 260	154 206	115 153	82 109	59 79	43 57	33 44		
18	40S 80S	.375 .500	487 649	452 603	420 560	394 525	385 513	376 502	388 490	362 482	353 471	344 459	335 447	327 436	315 420	298 397	257 342	187 249	137 183	102 136	73 97	53 70	38 51	29 39		
20	40S 80S	.375 .500	438 585	407 543	378 504	354 473	347 462	339 452	331 441	326 434	318 424	310 413	302 403	294 392	284 378	268 357	231 306	168 224	123 165	92 123	66 88	47 63	34 46	26 35		
24	40S 80S	.375 .500	365 487	339 452	315 420	295 394	289 385	282 376	276 368	271 362	265 353	258 348	252 335	245 327	236 315	223 298	193 257	140 187	103 137	77 102	55 73	39 53	28 38	22 29		

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.

Allowable Working Pressures shown for each size reflect the minus 12 1/2% manufacturers wall tolerance.

See Page 98 for calculation details.

All dimensions are in inches.

(continued on next page)

**ALLOWABLE WORKING PRESSURES
FOR A-312 WELDED PIPE**

**TYPE 316
Schedule 10S**

TEMPERATURE °F.			-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	
MAX. STRESS			20000	19300	17900	17000	16700	16300	16100	15900	15700	15500	15400	15300	14500	12400	9600	7400	5500	4100	3100	2300	1700	1300	
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																						
			½	10S	.083	2767	2670	2476	2352	2310	2255	2227	2200	2172	2144	2130	2117	2006	1715	1356	1024	751	587	429	318	235	180
¾	10S	.083	2213	2136	1981	1881	1848	1804	1782	1760	1737	1715	1704	1693	1605	1372	1085	819	609	454	343	255	188	144	
1	10S	.109	2321	2240	2077	1973	1938	1892	1888	1845	1822	1799	1787	1775	1683	1439	1137	859	638	476	360	267	197	151	
1¼	10S	.109	1839	1774	1646	1563	1535	1496	1480	1462	1443	1425	1416	1406	1333	1140	901	680	506	377	285	211	156	120	
1½	10S	.109	1608	1550	1438	1365	1341	1309	1293	1277	1261	1245	1237	1229	1165	996	787	594	442	329	249	185	137	104	
2	10S	.109	1285	1240	1150	1092	1073	1047	1034	1022	1009	996	969	983	932	797	630	475	353	263	199	148	109	84	
2½	10S	.120	1169	1128	1046	993	976	952	941	929	917	906	900	894	847	725	573	432	321	240	181	134	99	76	
3	10S	.120	960	926	859	816	802	782	773	763	754	744	739	734	696	595	470	355	264	197	149	110	82	62	
3½	10S	.120	840	811	752	714	701	685	676	668	659	651	647	643	609	521	412	311	231	172	130	97	71	55	
4	10S	.120	747	721	668	635	623	609	601	594	586	579	575	571	541	463	366	276	205	153	116	86	63	49	
5	10S	.134	674	651	604	573	563	550	543	538	529	523	519	516	489	418	330	250	185	138	105	78	57	44	
6	10S	.134	566	547	507	481	473	462	456	450	445	439	438	433	411	351	278	210	156	116	88	65	48	37	
8	10S	.148	480	464	430	408	401	392	387	382	377	372	370	368	348	298	235	178	132	96	74	55	41	31	
10	10S	.165	430	415	385	365	359	350	346	342	337	333	331	329	312	266	211	159	118	88	67	49	37	28	
12	10S	.180	395	381	354	336	330	322	318	314	310	306	304	302	287	245	194	148	109	81	61	45	34	26	
14	10S	.188	376	363	337	320	314	306	303	299	295	291	290	288	273	233	184	139	103	77	58	43	32	24	
16	10S	.188	329	317	294	260	275	268	265	262	258	255	253	252	239	204	161	122	90	67	51	38	28	21	
18	10S	.188	292	282	262	249	244	238	235	232	230	227	225	224	212	181	143	108	80	60	45	34	25	19	
20	10S	.218	305	295	273	259	255	249	246	243	240	237	235	233	221	189	150	113	84	63	47	35	26	20	
24	10S	.250	292	281	261	248	244	238	235	232	229	226	225	223	211	181	143	108	80	60	45	34	25	19	

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.

The Stress Values at all temperatures above 1000F apply only when the carbon is 0.04% or higher.

Allowable Working Pressures shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 98 for calculation details.

All dimensions are in inches.

(continued on next page)

TYPE 316

Schedules 40S, 80S

ALLOWABLE WORKING PRESSURES FOR A-312 WELDED PIPE

TEMPERATURE °F.		-425 to 300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	
MAX. STRESS		20000	19300	17900	17000	16700	16300	16100	15900	15700	15500	15400	15300	14500	12400	9800	7400	5500	4100	3100	2300	1700	1300	
NOM. PIPE SIZE	SCH. NO.	NOM. WALL.	ALLOWABLE WORKING PRESSURES PSIG																					
			1/2	40S 80S	.109 .147	3633 4900	3506 4729	3252 4386	3088 4165	3034 4092	2961 3994	2925 3945	2889 3896	2652 3847	2816 3798	2798 3773	2780 3749	2634 3553	2253 3038	1780 2401	1344 1813	999 1348	745 1005	563 760	418 564	309 417	238 319
3/4	40S 80S	.113 .154	3013 4107	2908 3963	2697 3675	2561 3491	2516 3429	2456 3347	2426 3308	2396 3265	2365 3224	2335 3183	2320 3162	2305 3142	2185 2977	1868 2546	1477 2012	1115 1519	829 1129	618 842	467 637	347 472	256 349	196 267
1	40S 80S	.133 .179	2832 3811	2733 3678	2535 3411	2407 3240	2365 3183	2308 3106	2280 3068	2251 3030	2223 2992	2195 2954	2161 2935	2166 2916	2053 2763	1756 2383	1368 1888	1048 1410	779 1048	581 781	439 591	326 438	241 324	184 248
1 1/4	40S 80S	.140 .191	2361 3222	2279 3109	2113 2883	2007 2738	1972 2690	1925 2628	1901 2593	1877 2561	1854 2529	1830 2497	1818 2481	1807 2465	1712 2336	1464 1997	1157 1579	874 1192	649 886	484 660	366 499	272 370	201 274	153 209
1 1/2	40S 80S	.145 .200	2137 2947	2062 2844	1912 2638	1816 2505	1784 2461	1742 2402	1720 2373	1699 2343	1677 2314	1656 2284	1645 2269	1635 2255	1549 2137	1325 1827	1047 1444	791 1091	588 811	438 604	331 457	246 339	182 251	139 192
2	40S 80S	.154 .218	1816 2570	1752 2480	1625 2300	1543 2185	1516 2146	1480 2095	1462 2069	1443 2043	1425 2018	1407 1992	1398 1979	1389 1966	1316 1863	1126 1593	890 1259	672 951	499 707	372 527	281 398	209 296	154 218	118 167
2 1/2	40S 80S	.203 .276	1977 2688	1908 2594	1769 2406	1680 2285	1651 2244	1611 2191	1592 2164	1572 2137	1552 2110	1532 2083	1522 2070	1512 2056	1433 1949	1226 1667	969 1317	732 995	544 739	405 551	306 417	227 309	168 228	129 175
3	40S 80S	.216 .300	1728 2400	1688 2316	1547 2148	1469 2040	1443 2004	1408 1956	1391 1932	1374 1908	1356 1884	1339 1860	1331 1848	1322 1836	1253 1740	1071 1488	847 1176	639 888	475 660	354 492	266 372	199 276	147 204	112 156
3 1/2	40S 80S	.226 .318	1582 2226	1527 2146	1416 1992	1345 1892	1321 1859	1289 1814	1274 1792	1258 1770	1242 1747	1226 1725	1218 1714	1210 1703	1147 1614	981 1360	775 1091	585 824	435 612	324 456	245 345	182 256	134 189	103 145
4	40S 80S	.237 .337	1475 2097	1423 2023	1320 1877	1253 1782	1231 1751	1202 1709	1187 1688	1172 1667	1158 1646	1143 1625	1135 1615	1128 1604	1069 1520	914 1300	723 1027	546 776	406 577	302 430	229 325	170 241	125 178	96 136
5	40S 80S	.258 .375	1299 1887	1253 1821	1162 1689	1104 1604	1084 1576	1058 1538	1045 1519	1032 1501	1019 1482	1006 1463	1000 1453	993 1444	941 1368	805 1170	636 925	480 698	357 519	266 387	201 293	149 217	110 160	84 123
6	40S 80S	.280 .432	1183 1826	1142 1762	1059 1634	1006 1552	988 1525	964 1488	953 1470	941 1452	929 1433	917 1415	911 1406	905 1397	858 1324	734 1132	580 895	438 676	325 502	243 374	183 283	138 210	101 155	77 119
8	40S 80S	.322 .500	1045 1623	1009 1566	936 1453	889 1380	873 1355	852 1323	841 1307	831 1290	821 1274	810 1258	805 1250	800 1242	758 1177	648 1006	512 795	387 601	287 446	214 333	162 252	120 187	89 138	68 106
10	40S 80S	.365 .500	951 1302	917 1257	851 1166	808 1107	794 1087	775 1061	765 1048	758 1035	746 1022	737 1009	732 1003	727 996	689 944	589 807	466 638	352 482	261 358	195 287	147 202	109 150	81 111	62 85
12	40S 80S	.375 .500	824 1098	795 1060	737 983	700 933	688 917	671 895	663 884	655 873	646 862	638 851	634 845	630 840	597 796	511 681	404 538	305 406	226 302	169 225	128 170	95 126	70 93	54 71
14	40S 80S	.375 .500	750 1000	724 965	671 895	638 850	626 835	611 815	604 805	596 795	589 785	581 775	578 770	574 765	544 725	465 620	366 490	278 370	206 275	154 205	116 155	86 115	64 85	49 65
16	40S 80S	.375 .500	656 875	633 844	587 783	558 744	548 731	535 713	528 704	522 696	515 687	509 678	505 674	502 669	476 634	407 543	322 429	243 324	180 241	135 179	102 136	75 101	56 74	43 57
18	40S 80S	.375 .500	583 778	563 751	522 696	496 661	487 649	475 634	470 626	464 618	458 611	452 603	449 599	446 595	423 584	362 482	286 381	216 288	160 214	120 159	90 121	67 89	50 68	38 51
20	40S 80S	.375 .500	525 700	507 676	470 627	446 595	438 585	428 571	423 564	417 557	412 550	407 543	404 539	402 536	381 508	326 434	257 343	194 259	144 193	108 144	81 109	60 81	45 60	34 46
24	40S 80S	.375 .500	438 583	422 563	392 522	372 496	365 487	357 475	352 470	348 464	343 458	339 452	337 449	335 446	317 423	271 362	214 286	162 216	120 160	90 120	68 90	50 67	37 50	28 38

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1993 for welded pipe to ASTM A-312 having a weld joint factor of .80.

The Stress Values at all temperatures above 1000F apply only when the carbon is 0.04% or higher.

Allowable Working Pressures shown for each size reflect the minus 12 1/2% manufacturers wall tolerance.

See Page 98 for calculation details.

All dimensions are in inches.

(continued on next page)

**ALLOWABLE WORKING PRESSURES
FOR SEAMLESS PIPE**

ALLOY 400, ALLOY 200
Schedule 10S, 40S

MATERIAL		ALLOY 400								ALLOY 200
TEMPERATURE F.		-325 to 100	200	300	400	500	600	700	800	-325 to 600
MAX. STRESS		18700	16400	15400	14800	14800	14800	14800	14200	10000
NOM. PIPE SIZE	SCH. NO.	ALLOWABLE WORKING PRESSURE PSIG								
½	10S	3234	2836	2883	2559	2559	2559	2559	2455	1729
	40S	4246	3724	3497	3381	3381	3381	3381	3225	2271
¾	10S	2587	2269	2130	2047	2047	2047	2047	1984	1383
	40S	3522	3089	2900	2787	2787	2787	2787	2674	1883
1	10S	2713	2379	2234	2147	2147	2147	2147	2060	1451
	40S	3310	2903	2726	2820	2820	2820	2820	2513	1770
1¼	10S	2149	1885	1770	1701	1701	1701	1701	1632	1149
	40S	2760	2420	2273	2184	2184	2184	2184	2096	1476
1½	10S	1877	1646	1546	1486	1486	1486	1486	1426	1004
	40S	2497	2190	2057	1977	1977	1977	1977	1896	1336
2	10S	1502	1317	1237	1189	1189	1189	1189	1140	803
	40S	2122	1861	1747	1679	1679	1679	1679	1611	1135
2½	10S	1366	1198	1125	1081	1081	1081	1081	1037	730
	40S	2311	2026	1903	1829	1829	1829	1829	1755	1236
3	10S	1122	964	924	888	888	888	888	852	600
	40S	2020	1771	1663	1598	1598	1598	1598	1534	1080
3½	10S	932	881	809	777	777	777	777	746	525
	40S	1849	1622	1523	1463	1463	1463	1463	1404	989
4	10S	873	765	719	691	691	691	691	663	467
	40S	1724	1512	1419	1364	1364	1364	1364	1309	922
MAX. STRESS		16700	14700	13700	13200	13200	13200	13200	12700	8000
5	10S	704	620	578	556	556	556	556	535	337
	40S	1355	1193	1112	1071	1071	1071	1071	1031	649
6	10S	591	520	485	467	467	467	467	450	283
	40S	1235	1087	1013	976	976	976	976	939	592
8	10S	501	441	411	396	396	396	396	381	240
	40S	1091	980	895	862	862	862	862	830	523
10	10S	449	395	368	355	355	355	355	341	215
	40S	992	873	814	784	784	784	784	755	475
12	10S	413	363	338	326	326	326	326	314	198
	40S	860	757	705	679	679	679	679	654	412
14	10S	392	345	322	310	310	310	310	298	188
	40S	783	669	642	619	619	619	619	595	375
16	10S	343	302	282	271	271	271	271	261	165
	40S	885	603	562	541	541	541	541	521	323
18	10S	305	269	250	241	241	241	241	232	146
	40S	609	536	499	481	481	481	481	463	292
20	10S	319	280	261	252	252	252	252	242	153
	40S	548	482	450	433	433	433	433	417	263
24	10S	304	288	250	241	241	241	241	232	148
	40S	457	402	375	361	361	361	361	347	219

The Allowable Stress Values used are for annealed material as shown in Appendix A of "ANSI B31.3-1993 and are based on seamless pipe to ASTM B-165 for "Monel 400" and ASTM B-161 for "Nickel 200".

Allowable Working Pressures shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 98 for calculation details.
All dimensions are in inches.

(continued on next page)

ALUMINUM 3003-O & H-112

Schedules 40S, 80S

ALLOWABLE WORKING PRESSURES FOR B-241 SEAMLESS PIPE

WALL	SCHEDULE 40S STANDARD WEIGHT							SCHEDULE 80S EXTRA HEAVY						
	TEMPERATURE F.	-452 to 100	150	200	250	300	350	400	-452 to 100	150	200	250	300	350	400
MAX. STRESS.	3300	3300	3300	3100	2400	1800	1400	3300	3300	3300	3100	2400	1800	1400
NOM. PIPE SIZE	ALLOWABLE WORKING PRESSURES PSIG							ALLOWABLE WORKING PRESSURES PSIG						
½	749	749	749	704	545	409	318	1011	1011	1011	949	735	551	429
¾	622	622	622	584	452	339	264	847	847	847	796	616	462	359
1	584	584	584	549	425	319	248	786	786	786	738	572	429	333
1¼	487	487	487	458	354	266	207	664	664	664	624	483	362	282
1½	441	441	441	414	321	240	187	603	603	603	571	442	332	258
2	374	374	374	352	272	204	159	530	530	530	498	386	289	225
2½	408	408	408	383	297	222	173	554	554	554	521	403	302	235
3	356	356	356	335	259	194	151	495	495	495	465	360	270	210
3½	326	326	326	307	237	178	138	459	459	459	431	334	250	195
4	304	304	304	286	221	166	129	432	432	432	406	315	236	183
5	268	268	268	252	195	146	114	389	389	389	366	283	212	165
6	244	244	244	229	176	133	104	377	377	377	354	274	205	160
8	216	216	216	203	157	118	91	335	335	335	314	243	183	142
10	196	196	196	184	143	107	83	269	269	269	252	195	147	114
12	170	170	170	160	124	93	72	226	226	226	213	165	124	96
14	155	155	155	145	113	84	66	206	206	206	194	150	113	88
16	135	135	135	127	96	74	57	180	180	180	170	131	96	77
18	120	120	120	113	88	66	51	160	160	160	151	117	88	68
20	108	108	108	102	79	59	46	144	144	144	136	105	79	61
24	90	90	90	85	66	49	38	120	120	120	113	88	66	51

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B-31.
 Allowable Working Pressures shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 98 for calculation details.
 All dimensions are in inches.

**ALLOWABLE WORKING PRESSURES
FOR B-241 SEAMLESS PIPE**

ALUMINUM 6061-T6
Schedules 40S, 80S

WALL	SCHEDULE 40S STANDARD WEIGHT							SCHEDULE 80S EXTRA HEAVY						
	TEMPERATURE F. -452 TO 100	150	200	250	300	350	400	-452 TO 100	150	200	250	300	350	400
MAX. STRESS.	12700	12700	12700	12100	10600	7900	5600	12700	12700	12700	12100	10600	7900	5600
NOM. PIPE SIZE	ALLOWABLE WORKING PRESSURES PSIG							ALLOWABLE WORKING PRESSURES PSIG						
1/2	2884	2884	2884	2748	2407	1794	1272	3889	3889	3889	3706	3246	2419	1715
3/4	2392	2392	2392	2279	1996	1488	1055	3260	3260	3260	3106	2721	2028	1437
1	2248	2248	2248	2142	1876	1398	991	3025	3025	3025	2882	2525	1882	1334
1 1/4	1874	1874	1874	1786	1564	1166	827	2557	2557	2557	2436	2134	1591	1128
1 1/2	1696	1696	1696	1616	1416	1055	748	2339	2339	2339	2229	1953	1455	1032
2	1441	1441	1441	1373	1203	896	635	2040	2040	2040	1944	1703	1269	900
2 1/2	1569	1569	1569	1495	1310	976	692	2134	2134	2134	2033	1781	1327	941
3	1372	1372	1372	1307	1145	853	605	1905	1905	1905	1815	1590	1185	840
3 1/2	1256	1256	1256	1196	1048	781	554	1767	1767	1767	1683	1475	1099	779
4	1171	1171	1171	1115	977	728	516	1664	1664	1664	1586	1389	1035	734
5	1031	1031	1031	982	860	641	455	1498	1498	1498	1427	1250	932	661
6	939	939	939	895	784	584	414	1449	1449	1449	1381	1210	901	639
8	830	830	830	791	693	516	366	1288	1288	1288	1282	1075	801	568
10	755	755	755	719	630	469	333	1034	1034	1034	985	863	634	456
12	654	654	654	623	546	407	288	872	872	872	830	727	542	384
14	595	595	595	567	497	370	263	794	794	794	756	663	494	350
16	521	521	521	496	435	324	230	695	695	695	662	580	432	306
18	463	463	463	441	386	288	204	617	617	617	588	515	384	272
20	417	417	417	397	348	259	184	556	556	556	529	464	346	245
24	347	347	347	331	290	216	153	463	463	463	441	386	288	204

The Allowable Stress Values used are as shown in Appendix "A" of ANSI B31.3-1990.
Allowable Working Pressures shown for each size reflect the minus 12½% manufacturers wall tolerance.

See Page 98 for calculation details.
All dimensions are in inches.

CHEMICAL AND PHYSICAL PROPERTIES OF STAINLESS, NICKEL, NICKEL ALLOY AND ALUMINUM ALLOY FITTINGS

Marking Symbol	Strength Min. P.S.I.	Tensile Min. P.S.I.	Elongation in 2" Min. %	ASTM	Carbon %	Manganese Max. %	Phosphorus Max. %	% Max.
WP 304	75,000	30,000	35	A-312	0.08 max.	2.00	0.040	....
WP 304H	75,000	30,000	35	A-312	0.04-0.10	2.00	0.040	....
WP 304L	70,000	25,000	35	A-312	0.035 max.	2.00	0.040	....
WP 309	75,000	30,000	35	A-312	0.15 max.	2.00	0.040	....
WP 310	75,000	30,000	35	A-312	0.15 max.	2.00	0.040	....
WP 316	75,000	30,000	35	A-312	0.08 max.	2.00	0.040	....
WP 316H	75,000	30,000	35	A-312	0.04-0.10	2.00	0.040	....
WP 316L	70,000	25,000	35	A-312	0.035 max.	2.00	0.040	....
WP 317	75,000	30,000	35	A-312	0.08 max.	2.00	0.040	....
WP 321	75,000	30,000	35	A-312	0.08 max.	2.00	0.040	0.60
WP 321H	75,000	30,000	35	A-312	0.04-0.10	2.00	0.040	0.60
WP 347	75,000	30,000	35	A-312	0.08 max.	2.00	0.040	....
WP 347H	75,000	30,000	35	A-312	0.04-0.10	2.00	0.040	....
WP 348	75,000	30,000	35	A-312	0.08 max.	2.00	0.040	....
WP 348H	75,000	30,000	35	A-312	0.04-0.10	2.00	0.040	....
WPN 200	55,000	15,000 ⁽¹⁾	40	B-161	0.15 max.	0.35	....	....
WPNL 201	50,000	12,000 ⁽²⁾	40	B-161	0.02 max.	0.35	....	....
WPNC 400	70,000	28,000 ⁽³⁾	35	B-165	0.30 max.	2.00	....	....
WPNCI 600	80,000	35,000 ⁽⁴⁾	30 ⁽⁵⁾	B-167	0.15 max.	1.0	....	....
WPNIC 800	75,000	30,000	30	B-407	0.10 max.	1.50	....	0.15-0.60
WP 1060 (H112) ⁽⁶⁾	8,500	2,500	(6)	B-221	.....	0.03	....	0.03
WP 1100 (H112) ⁽⁶⁾	11,000	3,000	(6)	B-221	.....	0.05	....	....
WP 3003 (H112) ⁽⁶⁾	14,000	.....	(6)	B-221	.....	1.0-1.5	....	....
WP 5083 (O) ⁽⁶⁾	39,000	16,000	14	B-221	.....	0.40-1.0	....	0.15
WP 5086 (O) ⁽⁶⁾	35,000	14,000	14	B-221	.....	0.20-0.7	....	0.15
WP 6061 (T6) ⁽⁶⁾	38,000	35,000	8	B-221	.....	0.15	....	0.15
WP 6063 (T4) ⁽⁶⁾	19,000	10,000	14	B-221	.....	0.10	....	0.10

The accompanying tables show pipe material specifications in effect when this bulletin was published. Since the specifications may be revised subsequent to issuance of this bulletin, it is advisable to check your material supplier for possible changes in the data.

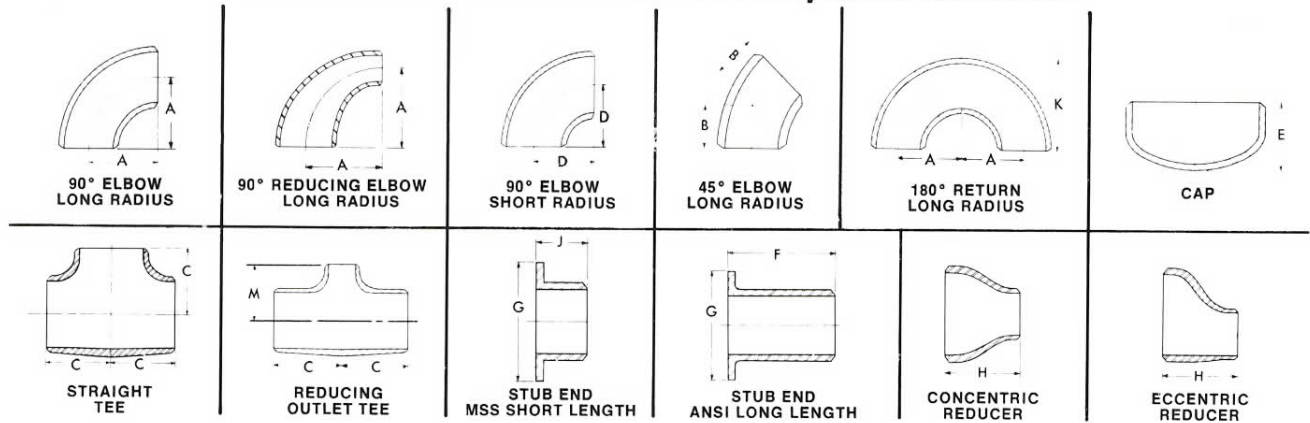
(1) Yield point 5" O.D. and under; yield point over 5" O.D. is 12,000.
(2) Yield point 5" O.D. and under; yield point over 5" O.D. is 10,000.

Marking Symbol	Sulphur Max. %	Silicon % Max.	Nickel %	Chromium %	Molybdenum %	Iron %	Aluminum %	Copper %	Magnesium %	Zinc % Max.	Other
WP 304	0.030	0.75	8.00-11.0	18.0-20.0	.....	Remainder	.....	.....	.....	...	.....
WP 304H	0.030	0.75	8.00-11.0	18.0-20.0	.....	Remainder	.....	.....	.....	...	.....
WP 304L	0.030	0.75	8.00-13.0	18.0-20.0	.....	Remainder	.....	.....	.....	...	.....
WP 309	0.030	0.75	12.0-15.0	22.0-24.0	.....	Remainder	.....	.....	.....	...	.....
WP 310	0.030	0.75	19.0-22.0	24.0-26.0	.....	Remainder	.....	.....	.....	...	.....
WP 316	0.030	0.75	11.0-14.0	16.0-18.0	2.0-3.0	Remainder	.....	.....	.....	...	.....
WP 316H	0.030	0.75	11.0-14.0	16.0-18.0	2.0-3.0	Remainder	.....	.....	.....	...	.....
WP 316L	0.030	0.75	10.0-15.0	16.0-18.0	2.0-3.0	Remainder	.....	.....	.....	...	.....
WP 317	0.030	0.75	11.0-14.0	18.0-20.0	3.0-4.0	Remainder	.....	.....	.....	...	.....
WP 321	0.030	0.75	9.00-13.0	17.0-20.0	.....	Remainder	.....	.....	.....	...	Titanium Min.—5 x C
WP 321H	0.030	0.75	9.00-13.0	17.0-20.0	.....	Remainder	.....	.....	.....	...	Titanium Min.—4 x C
WP 347	0.030	0.75	9.00-13.0	17.0-20.0	.....	Remainder	.....	.....	.....	...	Cb plus Ta: Min.—10 x C Max.—1.0%
WP 347H	0.030	0.75	9.00-13.0	17.0-20.0	.....	Remainder	.....	.....	.....	...	Cb plus Ta: Min.—8 x C Max.—1.0%
WP 348	0.030	0.75	9.00-13.0	17.0-20.0	.....	Remainder	.....	.....	.....	...	Cb plus Ta: Min.—10 x C Max.—1.0% Ta max: 0.10%
WP 348H	0.030	0.75	9.00-13.0	17.0-20.0	.....	Remainder	.....	.....	.....	...	Cb plus Ta: Min.—8 x C Max.—1.0% Ta max: 0.10%
WPN 200	0.01	0.35	99.0 min.	.....	.....	0.40 max.	.....	0.25 max.	.....	...	.....
WPNL 201	0.01	0.35	99.0 min.	.....	.....	0.40 max.	.....	0.25 max.	.....	...	.....
WPNC 400	0.024	0.50	63.0-70.0	.....	.....	2.50 max.	.....	Remainder	.....	...	.....
WPNCI 600	0.015	0.5	72.0 min.	14.0-17.0	.....	6.0-10.0	.....	0.50 max.	.....	...	.....
WPNIC 800	0.015	1.0	30.0-35.0	19.0-23.0	.....	Remainder	0.15-0.60	0.75 max.	.....	...	.....
WP 1060 (H112) ⁽⁸⁾	0.25	.....	.....	.....	0.35 max.	99.60 min.	0.05	0.03 max.	0.05	Each: 0.03
WP 1100 (H112) ⁽⁸⁾	1.0 ⁽⁷⁾	1.0 ⁽⁷⁾	99.00 min.	0.05-0.20	.....	0.10	Each: 0.05 Total: 0.15
WP 3003 (H112) ⁽⁸⁾	0.6	.....	.....	.....	0.7 max.	Remainder	0.05-0.20	.....	0.10	Each: 0.05 Total: 0.15
WP 5083 (0) ⁽⁸⁾	0.40	.....	0.05-0.25	.....	0.40 max.	Remainder	0.10 max.	4.0-4.9	0.25	Each: 0.05 Total: 0.15
WP 5086 (0) ⁽⁸⁾	0.40	.....	0.05-0.25	.....	0.50 max.	Remainder	0.10 max.	3.5-4.5	0.25	Each: 0.05 Total: 0.15
WP 6061 (T6) ⁽⁸⁾	0.40-0.8	.....	0.04-0.35	.....	0.7 max.	Remainder	0.15-0.40	0.8-1.2	0.25	Each: 0.05 Total: 0.15
WP 6063 (T4) ⁽⁸⁾	0.20-0.6	.....	0.10 max.	.....	0.35 max.	Remainder	0.10 max.	0.45-0.9	0.10	Each: 0.05 Total: 0.15

(3) Yield point 5" O.D. and under; yield point over 5" O.D. is 25,000.
(4) Yield point 5" O.D. and under; yield point over 5" O.D. is 30,000.
(5) Elongation for 5" O.D. and under; elongation over 5" O.D. is 35.

(6) Consult basic metal producer for data.
(7) Silicon plus iron does not exceed 1%.
(8) Aluminum tempers.

BUTT WELDING FITTINGS CONVERSION TABLE INCH/MILLIMETER



Nominal Pipe Size	Pipe Outside Diameter		A		B		D		K		E (2)		J		F		G	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1/2	.840	21	1.500	38	.625	16	—	—	1.875	48	1.000	25	2.000	51	3.000	76	1.375	35
3/4	1.050	27	1.125 ⁽¹⁾	29	.438 ⁽¹⁾	11	—	—	1.688 ⁽¹⁾	43	1.000	25	2.000	51	3.000	76	1.6875	43
1	1.315	33	1.500	38	.875	22	1.000	25	2.188	56	1.500	38	2.000	51	4.000	102	2.000	51
1 1/4	1.660	42	1.875	48	1.000	25	1.250	32	2.750	70	1.500	38	2.000	51	4.000	102	2.500	64
1 1/2	1.900	48	2.250	57	1.125	29	1.500	38	3.250	83	1.500	38	2.000	51	4.000	102	2.875	73
2	2.375	60	3.000	76	1.375	35	2.000	51	4.188	106	1.500	38	2.500	64	6.000	152	3.625	92
2 1/2	2.875	73	3.750	95	1.750	44	2.500	64	5.188	132	1.500	38	2.500	64	6.000	152	4.125	105
3	3.500	89	4.500	114	2.000	51	3.000	76	6.250	159	2.000	51	2.500	64	6.000	152	5.000	127
3 1/2	4.000	102	5.250	133	2.250	57	3.500	89	7.250	184	2.500	64	3.000	76	6.000	152	5.500	140
4	4.500	114	6.000	152	2.500	64	4.000	102	8.250	210	2.500	64	3.000	76	6.000	152	6.1875	157
5	5.563	141	7.500	190	3.125	79	5.000	127	10.313	262	3.000	76	3.000	76	8.000	203	7.3125	186
6	6.625	168	9.000	229	3.750	95	6.000	152	12.313	313	3.500	89	3.500	89	8.000	203	8.500	216
8	8.625	219	12.000	305	5.000	127	8.000	203	16.313	414	4.000	102	4.000	102	8.000	203	10.625	270
10	10.750	273	15.000	381	6.250	159	10.000	254	20.375	518	5.000	127	5.000	127	10.000	254	12.750	324
12	12.750	324	18.000	457	7.500	190	12.000	305	24.375	619	6.000	152	6.000	152	10.000	254	15.000	381
14	14.000	356	21.000	533	8.750	222	14.000	356	28.000	711	6.500	165	6.000	152	12.000	305	16.250	413
16	16.000	406	24.000	610	10.000	254	16.000	406	32.000	813	7.000	178	6.000	152	12.000	305	18.500	470
18	18.000	457	27.000	686	11.250	286	18.000	457	36.000	914	8.000	203	6.000	152	12.000	305	21.000	533
20	20.000	508	30.000	762	12.500	318	20.000	508	42.000	1016	9.000	229	6.000	152	12.000	305	23.000	584
24	24.000	610	36.000	914	15.000	381	24.000	610	48.000	1219	10.500	254	6.000	152	12.000	305	27.250	692

(1) For alternate dimensions on 3/4" sizes, see pages 16, 17, 22, 23 and 24.
 (2) Applies only to wall thicknesses of Schedule 80S or lighter.

(continued on next page)

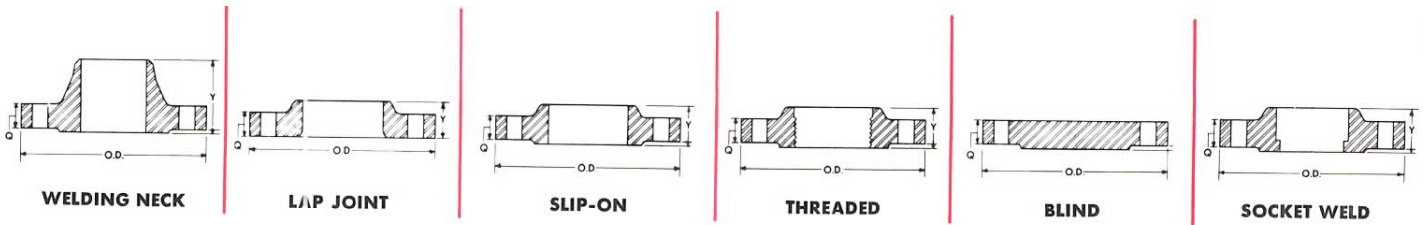
BUTT WELDING FITTINGS CONVERSION TABLE INCH/MILLIMETER

Nominal Pipe Size	C		M		H	
	in.	mm	in.	mm	in.	mm
3/4 x 3/4	1.125	29	—	—	—	—
3/4 x 1/2	1.125	29	1.125	29	1.500	38
1 x 1	1.500	38	—	—	—	—
1 x 3/4	1.500	38	1.500	38	2.000	51
1 x 1/2	1.500	38	1.500	38	2.000	51
1 1/4 x 1 1/4	1.875	48	—	—	—	—
1 1/4 x 1	1.875	48	1.875	48	2.000	51
1 1/4 x 3/4	1.875	48	1.875	48	2.000	51
1 1/4 x 1/2	1.875	48	1.875	48	2.000	51
1 1/2 x 1 1/2	2.250	57	—	—	—	—
1 1/2 x 1 1/4	2.250	57	2.250	57	2.500	64
1 1/2 x 1	2.250	57	2.250	57	2.500	64
1 1/2 x 3/4	2.250	57	2.250	57	2.500	64
1 1/2 x 1/2	2.250	57	2.250	57	2.500	64
2 x 2	2.500	64	—	—	—	—
2 x 1 1/2	2.500	64	2.375	60	3.000	76
2 x 1 1/4	2.500	64	2.250	57	3.000	76
2 x 1	2.500	64	2.000	51	3.000	76
2 x 3/4	2.500	64	1.750	44	3.000	76
2 1/2 x 2 1/2	3.000	76	—	—	—	—
2 1/2 x 2	3.000	76	2.750	70	3.500	89
2 1/2 x 1 1/2	3.000	76	2.625	67	3.500	89
2 1/2 x 1 1/4	3.000	76	2.500	64	3.500	89
2 1/2 x 1	3.000	76	2.250	57	3.500	89
3 x 3	3.375	86	—	—	—	—
3 x 2 1/2	3.375	86	3.250	83	3.500	89
3 x 2	3.375	86	3.000	76	3.500	89
3 x 1 1/2	3.375	86	2.875	73	3.500	89
3 x 1 1/4	3.375	86	2.750	70	3.500	89
3 1/2 x 3 1/2	3.750	95	—	—	—	—
3 1/2 x 3	3.750	95	3.625	92	4.000	102
3 1/2 x 2 1/2	3.750	95	3.500	89	4.000	102
3 1/2 x 2	3.750	95	3.250	83	4.000	102
3 1/2 x 1 1/2	3.750	95	3.125	79	4.000	102
4 x 4	4.125	105	—	—	—	—
4 x 3 1/2	4.125	105	4.000	102	4.000	102
4 x 3	4.125	105	3.875	98	4.000	102
4 x 2 1/2	4.125	105	3.750	95	4.000	102
4 x 2	4.125	105	3.500	89	4.000	102
4 x 1 1/2	4.125	105	3.375	86	4.000	102
5 x 5	4.875	124	—	—	—	—
5 x 4	4.875	124	4.625	117	5.000	127
5 x 3 1/2	4.875	124	4.500	114	5.000	127
5 x 3	4.875	124	4.375	111	5.000	127
5 x 2 1/2	4.875	124	4.250	108	5.000	127
5 x 2	4.875	124	4.125	105	5.000	127

Nominal Pipe Size	C		M		H	
	in.	mm	in.	mm	in.	mm
6 x 6	5.625	143	—	—	—	—
6 x 5	5.625	143	5.375	137	5.500	140
6 x 4	5.625	143	5.125	130	5.500	140
6 x 3 1/2	5.625	143	5.000	127	5.500	140
6 x 3	5.625	143	4.875	124	5.500	140
6 x 2 1/2	5.625	143	4.750	121	5.500	140
8 x 8	7.000	178	—	—	—	—
8 x 6	7.000	178	6.625	168	6.000	152
8 x 5	7.000	178	6.375	162	6.000	152
8 x 4	7.000	178	6.125	156	6.000	152
8 x 3 1/2	7.000	178	6.000	152	6.000	152
10 x 10	8.500	216	—	—	—	—
10 x 8	8.500	216	8.000	203	7.000	178
10 x 6	8.500	216	7.625	194	7.000	178
10 x 5	8.500	216	7.500	191	7.000	178
10 x 4	8.500	216	7.188	184	7.000	178
12 x 12	10.000	254	—	—	—	—
12 x 10	10.000	254	9.500	241	8.000	203
12 x 8	10.000	254	9.000	229	8.000	203
12 x 6	10.000	254	8.625	219	8.000	203
12 x 5	10.000	254	8.500	216	8.000	203
14 x 14	11.000	279	—	—	—	—
14 x 12	11.000	279	10.625	270	13.000	330
14 x 10	11.000	279	10.125	257	13.000	330
14 x 8	11.000	279	9.750	248	13.000	330
14 x 6	11.000	279	9.375	238	13.000	330
16 x 16	12.000	305	—	—	—	—
16 x 14	12.000	305	12.000	305	14.000	356
16 x 12	12.000	305	11.625	295	14.000	356
16 x 10	12.000	305	11.125	283	14.000	356
16 x 8	12.000	305	10.750	273	14.000	356
16 x 6	12.000	305	10.375	264	14.000	356
18 x 18	13.500	343	—	—	—	—
18 x 16	13.500	343	13.000	330	15.000	381
18 x 14	13.500	343	13.000	330	15.000	381
18 x 12	13.500	343	12.625	321	15.000	381
18 x 10	13.500	343	12.125	308	15.000	381
18 x 8	13.500	343	11.750	298	15.000	381
20 x 20	15.000	381	—	—	—	—
20 x 18	15.000	381	14.500	368	20.000	508
20 x 16	15.000	381	14.000	356	20.000	508
20 x 14	15.000	381	14.000	356	20.000	508
20 x 12	15.000	381	13.625	346	20.000	508
20 x 10	15.000	381	13.125	333	20.000	508
20 x 8	15.000	381	12.750	324	20.000	508
24 x 24	17.000	432	—	—	—	—
24 x 20	17.000	432	17.000	432	20.000	508
24 x 18	17.000	432	16.500	419	20.000	508
24 x 16	17.000	432	16.000	406	20.000	508
24 x 14	17.000	432	16.000	406	20.000	508
24 x 12	17.000	432	15.625	397	20.000	508

FLANGES

CONVERSION TABLE INCH / MILLIMETER



150 LB. FLANGES

Nominal Pipe Size	Outside Diameter		Q (2)		Y (2)						Bolt Circle		No. and Size of Hole	
					Welding Neck (1)		Slip-On, Threaded		Lap Joint					
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	No. in.	mm
1/2	3.50	88.9	0.44	11.1	1.88	47.6	0.62	15.9	0.62	15.9	2.38	60.3	4- 5/8	15.9
3/4	3.88	98.4	0.50	12.7	2.06	52.4	0.62	15.9	0.62	15.9	2.75	69.9	4- 5/8	15.9
1	4.25	108.0	0.56	14.3	2.19	55.6	0.69	17.5	0.69	17.5	3.12	79.4	4- 5/8	15.9
1 1/4	4.62	117.5	0.62	15.9	2.25	57.2	0.81	20.6	0.81	20.6	3.50	88.9	4- 5/8	15.9
1 1/2	5.00	127.0	0.69	17.5	2.44	61.9	0.88	22.2	0.88	22.2	3.88	98.4	4- 5/8	15.9
2	6.00	152.4	0.75	19.1	2.50	63.5	1.00	25.4	1.00	25.4	4.75	120.7	4- 3/4	19.1
2 1/2	7.00	177.8	0.88	22.2	2.75	69.9	1.12	28.6	1.12	28.6	5.50	139.7	4- 3/4	19.1
3	7.50	190.5	0.94	23.8	2.75	69.9	1.19	30.2	1.19	30.2	6.00	152.4	4- 3/4	19.1
3 1/2	8.50	215.9	0.94	23.8	2.81	71.4	1.25	31.8	1.25	31.8	7.00	177.8	8- 3/4	19.1
4	9.00	228.6	0.94	23.8	3.00	76.2	1.31	33.3	1.31	33.3	7.50	190.5	8- 3/4	19.1
5	10.00	254.0	0.94	23.8	3.50	88.9	1.44	36.5	1.44	36.5	8.50	215.9	8- 7/8	22.2
6	11.00	279.4	1.00	25.4	3.50	88.9	1.56	39.7	1.56	39.7	9.50	241.3	8- 7/8	22.2
8	13.50	342.9	1.12	28.6	4.00	101.6	1.75	44.5	1.75	44.5	11.75	298.5	8- 7/8	22.2
10	16.00	406.4	1.19	30.2	4.00	101.6	1.94	49.2	1.94	49.2	14.25	362.0	12-1	25.4
12	19.00	482.6	1.25	31.8	4.50	114.3	2.19	55.6	2.19	55.6	17.00	431.8	12-1	25.4
14	21.00	533.4	1.38	34.9	5.00	127.0	2.25	57.2	3.12	79.4	18.75	476.3	12-1 1/8	28.6
16	23.50	596.9	1.44	36.5	5.00	127.0	2.50	63.5	3.44	87.3	21.25	539.8	16-1 1/8	28.6
18	25.00	635.0	1.56	39.7	5.50	139.7	2.69	68.3	3.81	96.8	22.75	577.9	16-1 1/4	31.8
20	27.50	698.5	1.69	42.9	5.69	144.5	2.88	73.0	4.06	103.2	25.00	635.0	20-1 1/4	31.8
24	32.00	812.8	1.88	47.6	6.00	152.4	3.25	82.6	4.38	111.1	29.50	749.3	20-1 3/8	34.9

300 LB. FLANGES

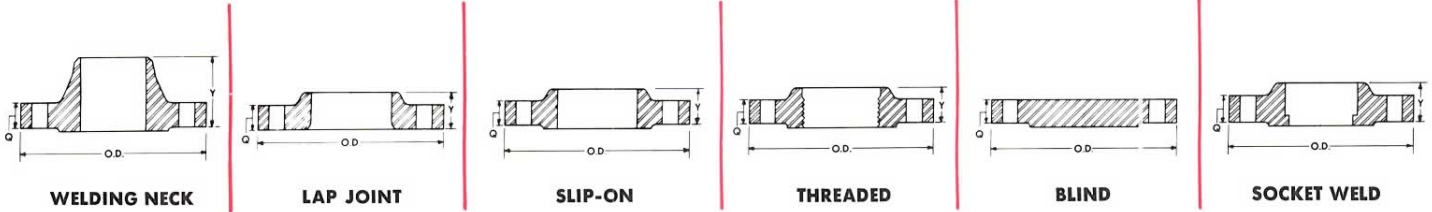
Nominal Pipe Size	Outside Diameter		Q (2)		Y (2)						Bolt Circle		No. and Size of Hole	
					Welding Neck (1)		Slip-On, Threaded		Lap Joint					
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	No. in.	mm
1/2	3.75	95.3	0.56	14.3	2.06	52.4	0.88	22.2	0.88	22.2	2.62	66.7	4- 5/8	15.9
3/4	4.62	117.5	0.62	15.9	2.25	57.2	1.00	25.4	1.00	25.4	3.25	82.6	4- 3/4	19.1
1	4.88	123.8	0.69	17.5	2.44	61.9	1.06	27.0	1.06	27.0	3.50	88.9	4- 3/4	19.1
1 1/4	5.25	133.4	0.75	19.1	2.56	65.1	1.06	27.0	1.06	27.0	3.88	98.4	4- 3/4	19.1
1 1/2	6.12	155.6	0.81	20.6	2.69	68.3	1.19	30.2	1.19	30.2	4.50	114.3	4- 7/8	22.2
2	6.50	165.1	0.88	22.2	2.75	69.9	1.31	33.3	1.31	33.4	5.00	127.0	8- 3/4	19.1
2 1/2	7.50	190.5	1.00	25.4	3.00	76.2	1.50	38.1	1.50	38.1	5.88	149.2	8- 7/8	22.2
3	8.25	209.6	1.12	28.6	3.12	79.4	1.69	42.9	1.69	42.9	6.62	168.3	8- 7/8	22.2
3 1/2	9.00	228.6	1.19	30.2	3.19	81.0	1.75	44.5	1.75	44.5	7.25	184.2	8- 7/8	22.2
4	10.00	254.0	1.25	31.8	3.38	85.7	1.88	47.6	1.88	47.6	7.88	200.0	8- 7/8	22.2
5	11.00	279.4	1.38	34.9	3.88	98.4	2.00	50.8	2.00	50.8	9.25	235.0	8- 7/8	22.2
6	12.50	317.5	1.44	36.5	3.88	98.4	2.06	52.4	2.06	52.4	10.62	269.9	12- 7/8	22.2
8	15.00	381.0	1.62	41.3	4.38	111.1	2.44	61.9	2.44	61.9	13.00	330.2	12-1	25.4
10	17.50	444.5	1.88	47.6	4.62	117.5	2.62	66.7	3.75	95.3	15.25	387.4	16-1 1/8	28.6
12	20.50	520.7	2.00	50.8	5.12	130.2	2.88	73.0	4.00	101.6	17.75	450.9	16-1 1/4	31.8
14	23.00	584.2	2.12	54.0	5.62	142.9	3.00	76.2	4.38	111.1	20.25	514.4	20-1 1/4	31.8
16	25.50	647.7	2.25	57.2	5.75	146.1	3.25	82.6	4.75	120.7	22.50	571.5	20-1 3/8	34.9
18	28.00	711.2	2.38	60.3	6.25	158.8	3.50	88.9	5.12	130.2	24.75	628.7	24-1 3/8	34.9
20	30.50	774.7	2.50	63.5	6.38	161.9	3.75	95.3	5.50	139.7	27.00	685.8	24-1 3/8	34.9
24	36.00	914.4	2.75	69.9	6.62	168.3	4.19	106.4	6.00	152.4	32.00	812.8	24-1 5/8	41.3

NOTES: (1) Always specify bore when ordering. See Page 117.
 (2) Includes 1/16" raised face in 150 lb. and 300 lb. standards.
 Does NOT include 1/4" raised face in 400 lb. and heavier standards.

(continued on next page)

FLANGES

CONVERSION TABLE INCH/MILLIMETER



400 LB. FLANGES

Nominal Pipe Size	Outside Diameter		Q(2)		Y(2)						Bolt Circle		No. and Size of Hole	
					Welding Neck (1)		Slip-On, Threaded		Lap Joint					
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	No. in.	mm
1/2	3.75	95.3	0.56	14.3	2.06	52.4	0.88	22.2	0.88	22.2	2.62	66.7	4- 5/8	15.9
3/4	4.62	117.5	0.62	15.9	2.25	57.2	1.00	25.4	1.00	25.4	3.25	82.6	4- 3/4	19.1
1	4.88	123.8	0.69	17.5	2.44	61.9	1.06	27.0	1.06	27.0	3.50	88.9	4- 3/4	19.1
1 1/4	5.25	133.4	0.81	20.6	2.62	66.7	1.12	28.6	1.12	28.6	3.88	98.4	4- 3/4	19.1
1 1/2	6.12	155.6	0.88	22.2	2.75	69.9	1.25	31.8	1.25	31.8	4.50	114.3	4- 7/8	22.2
2	6.50	165.1	1.00	25.4	2.88	73.0	1.44	36.5	1.44	36.5	5.00	127.0	8- 3/4	19.1
2 1/2	7.50	190.5	1.12	28.6	3.12	79.4	1.62	41.3	1.62	41.3	5.88	149.2	8- 7/8	22.2
3	8.25	209.6	1.25	31.8	3.25	82.6	1.81	46.0	1.81	46.0	6.62	168.3	8- 7/8	22.2
3 1/2	9.00	228.6	1.38	34.9	3.38	85.7	1.94	49.2	1.94	49.2	7.25	184.2	8-1	25.4
4	10.00	254.0	1.38	34.9	3.50	88.9	2.00	50.8	2.00	50.8	7.88	200.0	8-1	25.4
5	11.00	279.4	1.50	38.1	4.00	101.6	2.12	54.0	2.12	54.0	9.25	235.0	8-1	25.4
6	12.50	317.5	1.62	41.3	4.06	103.2	2.25	57.2	2.25	57.2	10.62	269.9	12-1	25.4
8	15.00	381.0	1.88	47.6	4.62	117.5	2.69	68.3	2.69	68.3	13.00	330.2	12-1 1/4	28.5
10	17.50	444.5	2.12	54.0	4.88	123.8	2.88	73.0	4.00	101.6	15.25	387.4	16-1 1/4	31.8
12	20.50	520.7	2.25	57.2	5.38	136.5	3.12	79.4	4.25	108.0	17.75	450.9	16-1 1/4	34.9
14	23.00	584.2	2.38	60.3	5.88	149.2	3.31	84.1	4.62	117.5	20.25	514.4	20-1 3/8	34.9
16	25.50	647.7	2.50	63.5	6.00	152.4	3.69	93.7	5.00	127.0	22.50	571.5	20-1 1/2	38.1
18	28.00	711.2	2.62	66.7	6.50	165.1	3.88	860.4	5.38	136.5	24.75	628.7	24-1 1/2	38.1
20	30.50	774.7	2.75	69.9	6.62	168.3	4.00	101.6	5.75	146.1	27.00	685.8	24-1 3/4	41.3
24	36.00	914.4	3.00	76.2	6.88	174.6	4.50	114.3	6.25	158.8	32.00	812.8	24-1 7/8	47.6

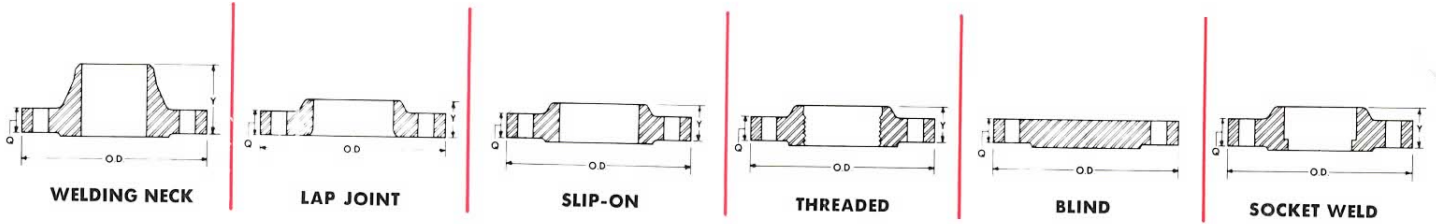
600 LB. FLANGES

Nominal Pipe Size	Outside Diameter		Q(2)		Y(2)						Bolt Circle		No. and Size of Hole	
					Welding Neck (1)		Slip-On, Threaded		Lap Joint					
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	No. in.	mm
1/2	3.75	95.3	0.56	14.3	2.06	52.4	0.88	22.2	0.88	22.2	2.62	66.7	4- 5/8	15.9
3/4	4.62	117.5	0.62	15.9	2.25	57.2	1.00	25.4	1.00	25.4	3.25	82.6	4- 3/4	19.1
1	4.88	123.8	0.69	17.5	2.44	61.9	1.06	27.0	1.06	27.0	3.50	88.9	4- 3/4	19.1
1 1/4	5.25	133.4	0.81	20.6	2.62	66.7	1.12	28.6	1.12	28.6	3.88	98.4	4- 3/4	19.1
1 1/2	6.12	155.6	0.88	22.2	2.75	69.9	1.25	31.8	1.25	31.8	4.50	114.3	4- 7/8	22.2
2	6.50	165.1	1.00	25.4	2.88	73.0	1.44	36.5	1.44	36.5	5.00	127.0	8- 3/4	19.1
2 1/2	7.50	190.5	1.12	28.6	3.12	79.4	1.62	41.3	1.62	41.3	5.88	149.2	8- 7/8	22.2
3	8.25	209.6	1.25	31.8	3.25	82.6	1.81	46.0	1.81	46.0	6.62	168.3	8- 7/8	22.2
3 1/2	9.00	228.6	1.38	34.9	3.38	85.7	1.94	49.2	1.94	49.2	7.25	184.2	8-1	25.4
4	10.75	273.1	1.50	38.1	4.00	101.6	2.12	54.0	2.12	54.0	8.50	215.9	8-1	25.4
5	13.00	330.2	1.75	44.5	4.50	114.3	2.38	60.3	2.38	60.3	10.50	266.7	8-1 1/8	28.6
6	14.00	355.6	1.88	47.6	4.62	117.5	2.62	66.7	2.62	66.7	11.50	292.1	12-1 1/8	28.6
8	16.50	419.1	2.19	55.6	5.25	133.4	3.00	76.2	3.00	76.2	13.75	349.3	12-1 1/4	31.8
10	20.00	508.0	2.50	63.5	6.00	152.4	3.38	85.9	4.38	111.1	17.00	431.8	16-1 3/4	34.9
12	22.00	558.8	2.62	66.7	6.12	155.6	3.62	92.1	4.62	117.5	19.25	489.0	20-1 3/8	34.9
14	23.75	603.3	2.75	69.9	6.50	165.1	3.69	93.7	5.00	127.0	20.75	527.1	20-1 1/2	38.1
16	27.00	685.8	3.00	76.2	7.00	177.8	4.19	106.4	5.50	139.7	23.75	603.3	20-1 3/4	41.3
18	29.25	743.0	3.25	82.6	7.25	184.2	4.62	117.5	6.00	152.4	25.75	654.1	20-1 3/4	44.5
20	32.00	812.8	3.50	88.9	7.50	190.5	5.00	127.0	6.50	165.1	28.50	723.9	24-1 3/4	44.5
24	37.00	939.8	4.00	101.6	8.00	203.2	5.50	139.7	7.25	184.2	33.00	838.2	24-2	50.8

NOTES: (1) Always specify bore when ordering. See page 117.
 (2) Includes 1/16" raised face in 150 lb. and 300 lb. standards.
 Does NOT include 1/4" raised face in 400 lb. and heavier standards.

FLANGES

CONVERSION TABLE INCH/MILLIMETER



900 LB. FLANGES

Nominal Pipe Size	Outside Diameter		Q (2)		Y (2)						Bolt Circle		No. and Size of Hole	
					Welding Neck (1)		Slip-On Threaded		Lap Joint					
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	No. in.	mm
1/2	4.75	120.7	0.88	22.2	2.38	60.3	1.25	31.8	1.25	31.8	3.25	82.6	4- 7/8	22.2
3/4	5.12	130.2	1.00	25.4	2.75	69.9	1.38	34.9	1.38	34.9	3.50	88.9	4- 7/8	22.2
1	5.88	149.2	1.12	28.6	2.88	73.0	1.62	41.3	1.62	41.3	4.00	101.6	4-1	25.4
1 1/4	6.25	158.8	1.12	28.6	2.88	73.0	1.62	41.3	1.62	41.3	4.38	111.1	4-1	25.4
1 1/2	7.00	177.8	1.25	31.8	3.25	82.6	1.75	44.5	1.75	44.5	4.88	123.8	4-1 1/8	28.6
2	8.50	215.9	1.50	38.1	4.00	101.6	2.25	57.2	2.25	57.2	6.50	165.1	8-1	25.4
2 1/2	9.62	244.5	1.62	41.3	4.12	104.8	2.50	63.5	2.50	63.5	7.50	190.5	8-1 1/8	28.6
3	9.50	241.3	1.50	38.1	4.00	101.6	2.12	54.0	2.12	54.0	7.50	190.5	8-1	25.4
3 1/2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	11.50	292.1	1.75	44.5	4.50	114.3	2.75	69.9	2.75	69.9	9.25	235.0	8-1 1/4	31.8
5	13.75	349.3	2.00	50.6	5.00	127.0	3.12	79.4	3.12	79.4	11.00	279.4	8-1 3/8	34.9
6	15.00	381.0	2.19	55.6	5.50	139.7	3.38	85.8	3.38	85.7	12.50	317.5	12-1 1/4	31.8
8	18.50	469.9	2.50	63.5	6.38	161.9	4.00	101.6	4.50	114.3	15.50	393.7	12-1 1/2	38.1
10	21.50	546.1	2.75	69.9	7.25	184.2	4.25	108.0	5.00	127.0	18.50	469.9	16-1 1/2	38.1
12	24.00	609.6	3.12	79.4	7.88	200.0	4.62	117.5	5.62	142.9	21.00	533.4	20-1 1/2	38.1
14	25.25	641.4	3.38	85.8	8.38	212.7	5.12	130.2	6.12	155.6	22.00	558.8	20-1 5/8	41.3
16	27.75	704.9	3.50	88.9	8.50	215.9	5.25	133.4	6.50	165.1	24.25	616.0	20-1 3/4	44.5
18	31.00	787.4	4.00	101.6	9.00	228.6	6.00	152.4	7.50	190.5	27.00	685.8	20-2	50.8
20	33.75	857.3	4.25	108.0	9.75	247.7	6.25	158.8	8.25	209.6	29.50	749.3	20-2 1/8	54.0
24	41.00	1041.4	5.50	139.7	11.50	292.1	8.00	203.2	10.50	266.7	35.50	901.7	20-2 5/8	66.7

1500 LB. FLANGES

Nominal Pipe Size	Outside Diameter		Q (2)		Y (2)						Bolt Circle		No. and Size of Hole	
					Welding Neck (1)		Slip-On Threaded		Lap Joint					
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	No. in.	mm
1/2	4.75	120.7	0.88	22.2	2.38	60.3	1.25	31.8	1.25	31.8	3.25	82.6	4- 7/8	22.2
3/4	5.12	130.2	1.00	25.4	2.75	69.9	1.38	34.9	1.38	34.9	3.50	88.9	4- 7/8	22.2
1	5.88	149.2	1.12	28.6	2.88	73.0	1.62	41.3	1.62	41.3	4.00	101.6	4-1	25.4
1 1/4	6.25	158.8	1.12	28.6	2.88	73.0	1.62	41.3	1.62	41.3	4.38	111.1	4-1	25.4
1 1/2	7.00	177.8	1.25	31.8	3.25	82.6	1.75	44.5	1.75	44.5	4.88	123.8	4-1 1/8	28.6
2	8.50	215.9	1.50	38.1	4.00	101.6	2.25	57.2	2.25	57.2	6.50	165.1	8-1	25.4
2 1/2	9.62	244.5	1.62	41.3	4.12	104.8	2.50	63.5	2.50	63.5	7.50	190.5	8-1 1/8	28.6
3	10.50	266.7	1.88	47.6	4.62	117.5	2.88	73.0	2.88	73.0	8.00	203.2	8-1 1/4	31.8
3 1/2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	12.25	311.2	2.12	54.0	4.88	123.8	3.56	90.5	3.56	90.5	9.50	241.3	8-1 3/8	34.9
5	14.75	374.7	2.88	73.0	6.12	155.6	4.12	104.8	4.12	104.8	11.50	292.1	8-1 5/8	41.3
6	15.50	393.7	3.25	82.6	6.75	171.5	4.69	119.1	4.69	119.1	12.50	317.5	12-1 1/2	38.1
8	19.00	482.6	3.62	92.1	8.38	212.7	5.62	142.9	5.62	142.9	15.50	393.7	12-1 3/4	44.5
10	23.00	584.2	4.25	108.0	10.00	254.0	6.25	158.8	7.00	177.8	19.00	482.6	12-2	50.8
12	26.50	673.1	4.88	123.8	11.12	282.6	7.12	181.0	8.62	219.1	22.50	571.5	16-2 1/8	54.0
14	29.50	749.3	5.25	133.4	11.75	298.5	—	—	—	9.50	241.3	635.0	16-2 3/8	60.3
16	32.50	825.5	5.75	146.1	12.25	311.2	—	—	—	10.25	260.4	675.0	16-2 5/8	66.7
18	36.00	914.4	6.38	161.9	12.88	327.0	—	—	—	10.88	276.2	774.0	16-2 7/8	73.0
20	38.75	984.3	7.00	177.8	14.00	355.6	—	—	—	11.50	292.1	831.9	16-3 1/8	79.4
24	46.00	1168.4	8.00	203.2	16.00	406.4	—	—	—	13.00	330.2	990.6	16-3 5/8	92.1

2500 LB. FLANGES

Nominal Pipe Size	Outside Diameter		Q (2)		Y (2)						Bolt Circle		No. and Size of Hole	
					Welding Neck (1)		Slip-On Threaded		Lap Joint					
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	No. in.	mm
1/2	5.25	33.4	1.19	30.2	2.88	73.0	1.56	39.7	1.56	39.7	3.50	88.9	4- 7/8	22.2
3/4	5.50	39.7	1.25	31.8	3.12	79.4	1.69	42.9	1.69	42.9	3.75	95.3	4- 7/8	22.2
1	6.25	58.8	1.38	34.9	3.50	88.9	1.88	47.6	1.88	47.6	4.25	108.0	4-1	25.4
1 1/4	7.25	84.2	1.50	38.1	3.75	95.2	2.06	52.4	2.06	52.4	5.12	130.2	4-1 1/8	28.6
1 1/2	8.00	103.2	1.75	44.5	4.38	111.1	2.38	60.3	2.38	60.3	5.75	146.1	4-1 1/4	31.8
2	9.25	135.0	2.00	50.8	5.00	127.0	2.75	69.9	2.75	69.9	6.75	171.5	8-1 1/8	28.6
2 1/2	10.50	166.7	2.25	57.2	5.62	142.9	3.12	79.4	3.12	80.4	7.75	196.9	8- 1/4	31.8
3	12.00	104.8	2.62	66.7	6.62	168.3	3.62	92.1	3.62	92.1	9.00	228.6	8-1 3/8	34.9
4	14.00	155.6	3.00	76.2	7.50	190.5	4.25	108.0	4.25	108.0	10.75	273.1	8-1 5/8	41.3
5	16.50	119.1	3.62	92.1	9.00	228.6	5.12	130.2	5.12	130.2	12.75	323.9	8-1 7/8	47.6
6	19.00	182.6	4.25	108.0	10.75	273.1	6.00	152.4	6.00	152.4	14.50	368.3	8-2 1/8	54.0
8	21.75	152.5	5.00	127.0	12.50	317.5	7.00	177.8	7.00	177.8	17.25	438.2	12-2 1/8	54.0
10	26.50	173.1	6.50	165.1	16.50	419.1	9.00	228.6	9.00	228.6	21.25	539.8	12-2 3/8	66.7
12	30.00	162.0	7.25	184.2	18.25	463.6	10.00	254.0	10.00	254.0	24.38	619.1	12-2 7/8	73.0

NOTES: (1) Always specify bore when ordering. See page 117.
 (2) Includes 1/16" raised face in 150 lb. and 300 lb. standards.
 Does NOT include 1/4" raised face in 400 lb. and heavier standards.

WELDING NECK FLANGE BORES CONVERSION TABLE INCH/MILLIMETER

Nominal Pipe Size	Outside Diameter		WELDING NECK FLANGE BORES											
			Schedule 10S		Schedule 20		Schedule 30		Schedule 40S and Standard Wt		Schedule 40		Schedule 60	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1/2	0.840	21.34	.674	17.12	—	—	—	—	.622	15.80	.622	15.80	—	—
3/4	1.050	26.67	.884	22.45	—	—	—	—	.824	20.93	.824	20.93	—	—
1	1.315	33.40	1.097	27.86	—	—	—	—	1.049	26.65	1.049	26.65	—	—
1 1/4	1.660	42.16	1.442	36.63	—	—	—	—	1.380	35.05	1.380	35.05	—	—
1 1/2	1.900	48.26	1.682	42.72	—	—	—	—	1.610	40.89	1.610	40.89	—	—
2	2.375	60.33	2.157	54.79	—	—	—	—	2.067	52.50	2.067	52.50	—	—
2 1/2	2.875	73.03	2.635	66.93	—	—	—	—	2.469	62.71	2.469	62.71	—	—
3	3.500	88.90	3.260	82.80	—	—	—	—	3.068	77.93	3.068	77.93	—	—
3 1/2	4.000	101.60	3.760	95.50	—	—	—	—	3.548	90.12	3.548	90.12	—	—
4	4.500	114.30	4.260	108.20	—	—	—	—	4.026	102.26	4.026	102.26	—	—
5	5.563	141.30	5.295	134.49	—	—	—	—	5.047	128.19	5.047	128.19	—	—
6	6.625	168.28	6.357	161.47	—	—	—	—	6.065	154.05	6.065	154.05	—	—
8	8.625	219.08	8.329	211.56	8.125	206.38	8.071	205.00	7.981	202.72	7.981	202.72	7.813	198.45
10	10.750	273.05	10.420	264.67	10.250	266.35	10.136	257.45	10.020	254.51	10.020	254.51	9.750	247.65
12	12.750	323.85	12.390	314.71	12.250	311.15	12.090	307.09	12.000	304.80	11.938	303.23	11.626	295.30
14	14.000	355.60	13.624	346.05	13.376	339.75	13.250	336.55	13.250	336.55	13.124	333.35	12.812	325.43
16	16.000	406.40	15.624	396.85	15.376	390.55	15.250	387.35	15.250	387.35	15.000	381.00	14.688	373.08
18	18.000	457.20	17.624	447.65	17.376	441.35	17.124	434.95	17.250	438.15	16.876	428.65	16.500	419.10
20	20.000	508.00	19.564	496.93	19.250	488.95	19.000	482.60	19.250	488.95	18.812	477.83	18.376	466.75
24	24.000	609.60	23.500	596.90	23.250	590.55	22.876	581.05	23.250	590.55	22.624	574.65	22.062	560.38

Nominal Pipe Size	Outside Diameter		WELDING NECK FLANGE BORES													
			Schedule 40S and Extra Strong		Schedule 80		Schedule 100		Schedule 120		Schedule 140		Schedule 160		Double X Strong	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1/2	0.840	21.34	.546	13.87	.546	13.87	—	—	—	—	—	—	.464	11.79	.252	6.40
3/4	1.050	26.67	.742	18.85	.742	18.85	—	—	—	—	—	—	.612	15.55	.434	11.02
1	1.315	33.40	.957	24.31	.957	24.31	—	—	—	—	—	—	.815	20.70	.599	15.22
1 1/4	1.660	42.16	1.278	32.46	1.278	32.46	—	—	—	—	—	—	1.160	29.46	.896	22.76
1 1/2	1.900	48.26	1.500	38.10	1.500	38.10	—	—	—	—	—	—	1.338	33.96	1.100	27.94
2	2.375	60.33	1.939	49.25	1.939	49.25	—	—	—	—	—	—	1.687	42.85	1.503	38.18
2 1/2	2.875	73.03	2.323	59.00	2.323	59.00	—	—	—	—	—	—	2.125	53.98	1.771	44.98
3	3.500	88.90	2.900	73.66	2.900	73.66	—	—	—	—	—	—	2.624	66.65	2.300	58.42
3 1/2	4.000	101.60	3.364	85.45	3.364	85.45	—	—	—	—	—	—	—	—	2.728	69.29
4	4.500	114.30	3.826	97.18	3.826	97.18	—	—	3.624	92.05	—	—	3.438	87.33	3.152	80.06
5	5.563	141.30	4.813	122.25	4.813	122.25	—	—	4.563	115.90	—	—	4.313	109.55	4.063	103.20
6	6.625	168.28	5.761	146.33	5.761	146.33	—	—	5.501	139.73	—	—	5.187	131.75	4.897	124.38
8	8.625	219.08	7.625	193.68	7.625	193.68	7.437	188.90	7.187	182.55	7.001	177.83	6.813	173.05	6.875	174.63
10	10.750	273.05	9.750	247.65	9.562	242.88	9.312	236.53	9.062	230.18	8.750	222.25	8.500	215.90	8.750	222.25
12	12.750	323.85	11.750	273.05	11.374	288.90	11.062	280.98	10.750	273.05	10.500	266.70	10.126	257.20	10.750	273.05
14	14.000	355.60	13.000	330.20	12.500	317.50	12.124	307.95	11.812	300.03	11.500	292.10	11.188	284.18	—	—
16	16.000	406.40	15.000	381.00	14.312	363.53	13.938	354.03	13.562	344.48	13.124	333.35	12.812	325.43	—	—
18	18.000	457.20	17.000	431.80	16.124	409.55	15.688	398.48	15.250	387.35	14.876	377.85	14.438	366.73	—	—
20	20.000	508.00	19.000	482.60	17.938	455.63	17.438	455.63	17.000	431.80	16.500	419.10	16.062	407.98	—	—
24	24.000	609.60	23.000	584.20	21.562	547.68	20.938	531.83	20.376	517.55	19.876	504.85	19.312	490.53	—	—

CONVERSION FACTORS

MEASURE	WEIGHT	PRESSURE
1 in. = 25.4 mm. 1 mm. = .03937 in. 1 mm. = .00328 ft. 1 ft. = 304.8 mm. 1 ft. = 30.48 cm. 1 sq. in. = 6.4516 sq. cm. 1 sq. cm. = 0.155 sq. in. 1 sq. cm. = .00108 sq. ft. 1 sq. ft. = 929.03 sq. cm. 1 cu. in. = 16.39 cu. cm. 1 cu. ft. = 1728 cu. in. 1 cu. ft. = 28,316.83 cu. cm. 1 cu. ft. = 7.4805 U.S. gals. 1 cu. ft. = 6.23 imp. gals. 1 cu. ft. = 28.375 liters 1 U.S. gal. = 0.1337 cu. ft. 1 imp. gal. = 277.27 cu. in. 1 imp. gal. = 0.16 cu. ft. 1 imp. gal. = 1.2 U.S. gals. 1 imp. gal. = 4.537 liters 1 liter = 61 cu. in. 1 liter = .0353 cu. ft. 1 liter = .22 imp. gal.	1 cu. in. of water = .0361 lb. (15° C.) 1 cu. ft. of water = 62.4 lbs. (15° C.) 1 U.S. gal. of water = 8.33 lbs. (15° C.) 1 imp. gal. of water = 10 lbs. (15° C.) 1 liter of water = 2.2 lbs. (15° C.) 1 kg. = 2.2 lbs. 1 cu. in. of water = .0735 cu. in. of mercury 1 cu. in. of mercury = 13.6 cu. in. of water 1 cu. in. of mercury = .491 lb.	1 in. of water = .0361 lb. per sq. in. 1 in. of water = .0735 in. of mercury 1 ft. of water = .4332 lb. per sq. in. 1 ft. of water = .8824 in. of mercury 1 in. of mercury = .4912 lb. per sq. in. 1 in. of mercury = 13.6 in. of water 1 in. of mercury = 1.133 ft. of water 1 cm. of mercury = .1934 lb. per sq. in. 1 atmosphere = 14.696 lbs. per sq. in. 1 atmosphere = 34 ft. of water 1 atmosphere = 760 mm. of mercury 1 lb. per sq. in. = 27.71 in. of water 1 lb. per sq. in. = 2.312 ft. of water 1 lb. per sq. in. = 2.04 in. of mercury 1 lb. per sq. in. = .06804 atmosphere 1 lb. per sq. in. = .0703 kg. per sq. cm. 1 lb. per sq. in. = 703.08 kg. per sq. m. 1 kg. per sq. cm. = 14.223 lbs. per sq. in. 1 kg. per sq. m. = .00142 lb. per sq. in.
	VELOCITY 1 ft. per sec. = .3048 m. per sec. 1 m. per sec. = 3.2808 ft. per sec.	TEMPERATURE $F = \frac{9}{5}C + 32$ $C = \frac{5}{9}(F - 32)$
	DENSITY 1 lb. per cu. in. = 27.68 gram. per cu. cm. 1 gr. per cu. cm. = .03613 lb. per cu. in. 1 lb. per cu. ft. = 16.0184 kg. per cu. m. 1 kg. per cu. m. = .06243 lb. per cu. ft.	

HEAT TRANSFER	THERMAL CONDUCTIVITY
1 B.t.u. per sq. ft. = .2712 gram. calorie per sq. cm. 1 gram. cal. per sq. cm. = 3.687 B.t.u. per sq. ft. 1 B.t.u. per hr. per sq. ft. per F° = 4.88 kg. cal. per hr. per sq. m. per C°. 1 kg. cal. per hr. per sq. m. per C° = .205 B.t.u. per hr. per sq. ft. per F°. 1 B.t.u. per hr. per sq. ft. per F° = .0001355 gram. cal. per sec. per sq. cm. per C°. 1 gram. cal. per sec. per sq. cm. per C° = 7380 B.t.u. per hr. per sq. ft. per F°.	1 B.t.u. per sq. ft. per in. = .6892 gram. calories per sq. cm. per cm. 1 gram. cal. per sq. cm. per cm. = 1.451 B.t.u. per sq. ft. per in. 1 B.t.u. per hr. per sq. ft. per F° per in. = .0003445 gram. cal. per sec. per sq. cm. per C° per cm. 1 gram. cal. per sec. per sq. cm. per C° per cm. = 2903 B.t.u. per hr. per sq. ft. per F° per in. 1 B.t.u. per hr. per sq. ft. per F° per ft. = .00413 gram. cal. per sec. per sq. cm. per C° per cm. 1 gram. cal. per sec. per sq. cm. per C° per cm. = 242.13 B.t.u. per hr. per sq. ft. per F° per ft.

FRACTIONS OF INCHES TO DECIMALS AND TO MILLIMETERS

Fraction	Decimal	Millimeter	Fraction	Decimal	Millimeter	Fraction	Decimal	Millimeter
$\frac{1}{64}$	.015625	0.39688	$\frac{11}{32}$	.34375	8.73127	$\frac{43}{64}$	.671875	17.06566
$\frac{1}{32}$	.03125	0.79375	$\frac{23}{64}$	.359375	9.12814	$\frac{11}{16}$	.6875	17.46253
$\frac{3}{64}$	.046875	1.19063	$\frac{3}{8}$	.375	9.52502	$\frac{45}{64}$	.703125	17.85941
$\frac{1}{16}$	.0625	1.58750	$\frac{25}{64}$	.390625	9.92189	$\frac{23}{32}$	.71875	18.25629
$\frac{5}{64}$	.078125	1.98438	$\frac{13}{32}$	.40625	10.31877	$\frac{47}{64}$	.734375	18.65316
$\frac{3}{32}$	.09375	2.38125	$\frac{27}{64}$	.421875	10.71565	$\frac{3}{4}$	.75	19.05004
$\frac{7}{64}$	.109375	2.77813	$\frac{1}{16}$	.4375	11.11252	$\frac{49}{64}$	.765625	19.44691
$\frac{1}{8}$	.125	3.17501	$\frac{29}{64}$	.453125	11.50940	$\frac{25}{32}$	.78125	19.84379
$\frac{9}{64}$	.140625	3.57188	$\frac{15}{32}$	.46875	11.90627	$\frac{51}{64}$	.796875	20.24066
$\frac{5}{32}$	.15625	3.96876	$\frac{31}{64}$	.484375	12.30315	$\frac{13}{16}$	.8125	20.63754
$\frac{11}{64}$	.171875	4.36563	$\frac{1}{2}$	.5	12.70002	$\frac{53}{64}$	.828125	21.03442
$\frac{3}{16}$	.1875	4.76251	$\frac{33}{64}$	.515625	13.09690	$\frac{27}{32}$	.84375	21.43129
$\frac{13}{64}$	.203125	5.15939	$\frac{17}{32}$	.53125	13.49378	$\frac{55}{64}$	.859375	21.82817
$\frac{7}{32}$	.21875	5.55626	$\frac{35}{64}$	.546875	13.89065	$\frac{7}{8}$	.875	22.22504
$\frac{15}{64}$	.234375	5.95314	$\frac{9}{16}$	.5625	14.28753	$\frac{57}{64}$	.890625	22.62192
$\frac{1}{4}$	.25	6.35001	$\frac{37}{64}$	.578125	14.68440	$\frac{29}{32}$	.90625	23.01880
$\frac{17}{64}$	.265625	6.74689	$\frac{19}{32}$	.59375	15.08128	$\frac{59}{64}$	.921875	23.41567
$\frac{9}{32}$	.28125	7.14376	$\frac{39}{64}$	.609375	15.47816	$\frac{15}{16}$	.9375	23.81255
$\frac{19}{64}$	.296875	7.54064	$\frac{5}{8}$	.625	15.87503	$\frac{61}{64}$	.953125	24.20942
$\frac{5}{16}$	.3125	7.93752	$\frac{41}{64}$	.640625	16.27191	$\frac{31}{32}$	.96875	24.60630
$\frac{21}{64}$	.328125	8.33439	$\frac{21}{32}$	.65625	16.66878	$\frac{63}{64}$	.984375	25.00317
						1	1.0	25.40005

TEMPERATURE CONVERSION

Locate given value in the middle column; if in degrees Centigrade, read equivalent Fahrenheit degrees in right hand column; if in degrees Fahrenheit, read equivalent Centigrade degrees in left-hand column.

°C	▽	°F	°C	▽	°F	°C	▽	°F	°C	▽	°F	°C	▽	°F
-273	-459.4		-17.2	1	33.8	16.1	61	141.8	149	300	572	482	900	1652
-268	-450		-16.7	2	35.6	16.7	62	143.6	154	310	590	488	910	1670
-262	-440		-16.1	3	37.4	17.2	63	145.4	160	320	608	493	920	1688
-257	-430		-15.6	4	39.2	17.8	64	147.2	166	330	626	499	930	1706
-251	-420		-15.0	5	41.0	18.3	65	149.0	171	340	644	504	940	1724
-246	-410		-14.4	6	42.8	18.9	66	150.8	177	350	662	510	950	1742
-240	-400		-13.9	7	44.6	19.4	67	152.6	182	360	680	516	960	1760
-234	-390		-13.3	8	46.4	20.0	68	154.4	188	370	698	521	970	1778
-229	-380		-12.8	9	48.2	20.6	69	156.2	193	380	716	527	980	1796
-223	-370		-12.2	10	50.0	21.1	70	158.0	199	390	734	532	990	1814
-218	-360		-11.7	11	51.8	21.7	71	159.8	204	400	752	538	1000	1832
-212	-350		-11.1	12	53.6	22.2	72	161.6	210	410	770	549	1020	1868
-207	-340		-10.6	13	55.4	22.8	73	163.4	216	420	788	560	1040	1904
-201	-330		-10.0	14	57.2	23.3	74	165.2	221	430	806	571	1060	1940
-196	-320		-9.4	15	59.0	23.9	75	167.0	227	440	824	582	1080	1976
-190	-310		-8.9	16	60.8	24.4	76	168.8	232	450	842	593	1100	2012
-184	-300		-8.3	17	62.6	25.0	77	170.6	238	460	860	604	1120	2048
-179	-290		-7.8	18	64.4	25.6	78	172.4	243	470	878	616	1140	2084
-173	-280		-7.2	19	66.2	26.1	79	174.2	249	480	896	627	1160	2120
-169	-273	-459.4	-6.7	20	68.0	26.7	80	176.0	254	490	914	638	1180	2156
-168	-270	-454	-6.1	21	69.8	27.2	81	177.8	260	500	932	649	1200	2192
-162	-260	-436	-5.6	22	71.6	27.8	82	179.6	266	510	950	660	1220	2228
-157	-250	-418	-5.0	23	73.4	28.3	83	181.4	271	520	968	671	1240	2264
-151	-240	-400	-4.4	24	75.2	28.9	84	183.2	277	530	986	682	1260	2300
-146	-230	-382	-3.9	25	77.0	29.4	85	185.0	282	540	1004	693	1280	2336
-140	-220	-364	-3.3	26	78.8	30.0	86	186.8	288	550	1022	704	1300	2372
-134	-210	-346	-2.8	27	80.6	30.6	87	188.6	293	560	1040	732	1350	2462
-129	-200	-328	-2.2	28	82.4	31.1	88	190.4	299	570	1058	760	1400	2552
-123	-190	-310	-1.7	29	84.2	31.7	89	192.2	304	580	1076	788	1450	2642
-118	-180	-292	-1.1	30	86.0	32.2	90	194.0	310	590	1094	816	1500	2732
-112	-170	-274	-0.6	31	87.8	32.8	91	195.8	316	600	1112	843	1550	2822
-107	-160	-256	0.0	32	89.6	33.3	92	197.6	321	610	1130	871	1600	2912
-101	-150	-238	0.6	33	91.4	33.9	93	199.4	327	620	1148	899	1650	3002
-96	-140	-220	1.1	34	93.2	34.4	94	201.2	332	630	1166	927	1700	3092
-90	-130	-202	1.7	35	95.0	35.0	95	203.0	338	640	1184	954	1750	3182
-84	-120	-184	2.2	36	96.8	35.6	96	204.8	343	650	1202	982	1800	3272
-79	-110	-166	2.8	37	98.6	36.1	97	206.6	349	660	1220	1010	1850	3362
-73	-100	-148	3.3	38	100.4	36.7	98	208.4	354	670	1238	1038	1900	3452
-68	-90	-130	3.9	39	102.2	37.2	99	210.2	360	680	1256	1066	1950	3542
-62	-80	-112	4.4	40	104.0	37.8	100	212.0	366	690	1274	1093	2000	3632
-57	-70	-94	5.0	41	105.8	43	110	230	371	700	1292	1121	2050	3722
-51	-60	-76	5.6	42	107.6	49	120	248	377	710	1310	1149	2100	3812
-46	-50	-58	6.1	43	109.4	54	130	266	382	720	1328	1177	2150	3902
-40	-40	-40	6.7	44	111.2	60	140	284	388	730	1346	1204	2200	3992
-34	-30	-22	7.2	45	113.0	66	150	302	393	740	1364	1232	2250	4082
-29	-20	-4	7.8	46	114.8	71	160	320	399	750	1382	1260	2300	4172
-23	-10	14	8.3	47	116.6	77	170	338	404	760	1400	1288	2350	4262
-17.8	0	32	8.9	48	118.4	82	180	356	410	770	1418	1316	2400	4352
			9.4	49	120.2	88	190	374	416	780	1436	1343	2450	4442
			10.0	50	122.0	93	200	392	421	790	1454	1371	2500	4532
			10.6	51	123.8	99	210	410	427	800	1472	1399	2550	4622
			11.1	52	125.6	100	212	413.6	432	810	1490	1427	2600	4712
			11.7	53	127.4	104	220	428	438	820	1508	1454	2650	4802
			12.2	54	129.2	110	230	446	443	830	1526	1482	2700	4892
			12.8	55	131.0	116	240	464	449	840	1544	1510	2750	4982
			13.3	56	132.8	121	250	482	454	850	1562	1538	2800	5072
			13.9	57	134.6	127	260	500	460	860	1580	1566	2850	5162
			14.4	58	136.4	132	270	518	466	870	1598	1593	2900	5252
			15.0	59	138.2	138	280	536	471	880	1616	1621	2950	5342
			15.6	60	140.0	143	290	554	477	890	1634	1649	3000	5432

(Albert Sauveur type of table. Values revised.)

INCHES TO MILLIMETERS

Inches	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
0	0.0	1.6	3.2	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8
1	25.4	27.0	28.6	30.2	31.8	33.3	34.9	36.5	38.1	39.7	41.3	42.9	44.5	46.0	47.6	49.2
2	50.8	52.4	54.0	55.6	57.2	58.7	60.3	61.9	63.5	65.1	66.7	68.3	69.9	71.4	73.0	74.6
3	76.2	77.8	79.4	81.0	82.6	84.1	85.7	87.3	88.9	90.5	92.1	93.7	95.3	96.8	98.4	100.0
4	101.6	103.2	104.8	106.4	108.0	109.5	111.1	112.7	114.3	115.9	117.5	119.1	120.7	122.2	123.8	125.4
5	127.0	128.6	130.2	131.8	133.4	134.9	136.5	138.1	139.7	141.3	142.9	144.5	146.1	147.6	149.2	150.8
6	152.4	154.0	155.6	157.2	158.8	160.3	161.9	163.5	165.1	166.7	168.3	169.9	171.5	173.0	174.6	176.2
7	177.8	179.4	181.0	182.6	184.2	185.7	187.3	188.9	190.5	192.1	193.7	195.3	196.9	198.4	200.0	201.6
8	203.2	204.8	206.4	208.0	209.6	211.1	212.7	214.3	215.9	217.5	219.1	220.7	222.3	223.8	225.4	227.0
9	228.6	230.2	231.8	233.4	235.0	236.5	238.1	239.7	241.3	242.9	244.5	246.1	247.7	249.2	250.8	252.4
10	254.0	255.6	257.2	258.8	260.4	261.9	263.5	265.1	266.7	268.3	269.9	271.5	273.1	274.6	276.2	277.8
11	279.4	281.0	282.6	284.2	285.8	287.3	288.9	290.5	292.1	293.7	295.3	296.9	298.5	300.0	301.6	303.2
12	304.8	306.4	308.0	309.6	311.2	312.7	314.3	315.9	317.5	319.1	320.7	322.3	323.9	325.4	327.0	328.6
13	330.2	331.8	333.4	335.0	336.6	338.1	339.7	341.3	342.9	344.5	346.1	347.7	349.3	350.8	352.4	354.0
14	355.6	357.2	358.8	360.4	362.0	363.5	365.1	366.7	368.3	369.9	371.5	373.1	374.7	376.2	377.8	379.4
15	381.0	382.6	384.2	385.8	387.4	388.9	390.5	392.1	393.7	395.3	396.9	398.5	400.1	401.6	403.2	404.8
16	406.4	408.0	409.6	411.2	412.8	414.3	415.9	417.5	419.1	420.7	422.3	423.9	425.5	427.0	428.6	430.2
17	431.8	433.4	435.0	436.6	438.2	439.7	441.3	442.9	444.5	446.1	447.7	449.3	450.9	452.4	454.0	455.6
18	457.2	458.8	460.4	462.0	463.6	465.1	466.7	468.3	469.9	471.5	473.1	474.7	476.3	477.8	479.4	481.0
19	482.6	484.2	485.8	487.4	489.0	490.5	492.1	493.7	495.3	496.9	498.5	500.1	501.7	503.2	504.8	506.4
20	508.0	509.6	511.2	512.8	514.4	515.9	517.5	519.1	520.7	522.3	523.9	525.5	527.1	528.6	530.2	531.8
21	533.4	535.0	536.6	538.2	539.8	541.3	542.9	544.5	546.1	547.7	549.3	550.9	552.5	554.0	555.6	557.2
22	558.8	560.4	562.0	563.6	565.2	566.7	568.3	569.9	571.5	573.1	574.7	576.3	577.9	579.4	581.0	582.6
23	584.2	585.8	587.4	589.0	590.6	592.1	593.7	595.3	596.9	598.5	600.1	601.7	603.3	604.8	606.4	608.0
24	609.6	611.2	612.8	614.4	616.0	617.5	619.1	620.7	622.3	623.9	625.5	627.1	628.7	630.2	631.8	633.4
25	635.0	636.6	638.2	639.8	641.4	642.9	644.5	646.1	647.7	649.3	650.9	652.5	654.1	655.6	657.2	658.8
26	660.4	662.0	663.6	665.2	666.8	668.3	669.9	671.5	673.1	674.7	676.3	677.9	679.5	681.0	682.6	684.2
27	685.8	687.4	689.0	690.6	692.2	693.7	695.3	696.9	698.5	700.1	701.7	703.3	704.9	706.4	708.0	709.6
28	711.2	712.8	714.4	716.0	717.6	719.1	720.7	722.3	723.9	725.5	727.1	728.7	730.3	731.8	733.4	735.0
29	736.6	738.2	739.8	714.4	743.0	744.5	746.1	747.7	749.3	750.9	752.5	754.1	755.7	757.2	758.8	760.4
30	762.0	763.6	765.2	766.8	768.4	769.9	771.5	773.1	774.7	776.3	777.9	779.5	781.1	782.6	784.2	785.8
31	787.4	789.0	790.6	792.2	793.8	795.3	796.9	798.5	800.1	801.7	803.3	804.9	806.5	808.0	809.6	811.2
32	812.8	814.4	816.0	817.6	819.2	820.7	822.3	823.9	825.5	827.1	828.7	830.3	831.9	833.4	835.0	836.6
33	838.2	839.8	841.4	843.0	844.6	846.1	847.7	849.3	850.9	852.5	854.1	855.7	857.3	858.8	860.4	862.0
34	863.6	865.2	866.8	868.4	870.0	871.5	873.1	874.7	876.3	877.9	879.5	881.1	882.7	884.2	885.8	887.4
35	889.0	890.6	892.2	893.8	895.4	896.9	898.5	900.1	901.7	903.3	904.9	906.5	908.1	909.6	911.2	912.8
36	914.4	916.0	917.6	919.2	920.8	922.3	923.9	925.5	927.1	928.7	930.3	931.9	933.5	935.0	936.6	938.2
37	939.8	941.4	943.0	944.6	946.2	947.7	949.3	950.9	952.5	954.1	955.7	957.3	958.9	960.4	962.0	963.6
38	965.2	966.8	968.4	970.0	971.6	973.1	974.7	976.3	977.9	979.5	981.1	982.7	984.3	985.8	987.4	989.0
39	990.6	992.2	993.8	995.4	997.0	998.5	1000.1	1001.7	1003.3	1004.9	1006.5	1008.1	1009.7	1011.2	1012.8	1014.4
40	1016.0	1017.6	1019.2	1020.8	1022.4	1023.9	1025.5	1027.1	1028.7	1030.3	1031.9	1033.5	1035.1	1036.6	1038.2	1039.8
41	1041.4	1043.0	1044.6	1046.2	1047.8	1049.3	1050.9	1052.5	1054.1	1055.7	1057.3	1058.9	1060.5	1062.0	1063.6	1065.2
42	1066.8	1068.4	1070.0	1071.6	1073.2	1074.7	1076.3	1077.9	1079.5	1081.1	1082.7	1084.3	1085.9	1087.4	1089.0	1090.6
43	1092.2	1093.8	1095.4	1097.0	1098.6	1100.1	1101.7	1103.3	1104.9	1106.5	1108.1	1109.7	1111.3	1112.8	1114.4	1116.0
44	1117.6	1119.2	1120.8	1122.4	1124.0	1125.5	1127.1	1128.7	1130.3	1131.9	1133.5	1135.1	1136.7	1138.2	1139.8	1141.4
45	1143.0	1144.6	1146.2	1147.8	1149.4	1150.9	1152.5	1154.1	1155.7	1157.3	1158.9	1160.5	1162.1	1163.6	1165.2	1166.8
46	1168.4	1170.0	1171.6	1173.2	1174.8	1176.3	1177.9	1179.5	1181.1	1182.7	1184.3	1185.9	1187.5	1189.0	1190.6	1192.2
47	1193.8	1195.4	1197.0	1198.6	1200.2	1201.7	1203.3	1204.9	1206.5	1208.1	1209.7	1211.3	1212.9	1214.4	1216.0	1217.6
48	1219.2	1220.8	1222.4	1224.0	1225.6	1227.1	1228.7	1230.3	1231.9	1233.5	1235.1	1236.7	1238.3	1239.8	1241.4	1243.0
49	1244.6	1246.2	1247.8	1249.4	1251.0	1252.5	1254.1	1255.7	1257.3	1258.9	1260.5	1262.1	1263.7	1265.2	1266.8	1268.4
50	1270.0	1271.6	1273.2	1274.8	1276.4	1277.9	1279.5	1281.1	1282.7	1284.3	1285.9	1287.5	1289.1	1290.6	1292.2	1293.8

DECIMALS OF INCH TO MILLIMETERS

Inches	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	Inches
0.00	0.00	0.25	0.51	0.76	1.02	1.27	1.52	1.78	2.03	2.29	0.00
.10	2.54	2.79	3.05	3.30	3.56	3.81	4.06	4.32	4.57	4.83	.10
.20	5.08	5.33	5.59	5.84	6.10	6.35	6.60	6.86	7.11	7.37	.20
.30	7.62	7.87	8.13	8.38	8.64	8.89	9.14	9.40	9.65	9.91	.30
.40	10.16	10.41	10.67	10.92	11.18	11.43	11.68	11.94	12.19	12.45	.40
.50	12.70	12.95	13.21	13.46	13.72	13.97	14.22	14.48	14.73	14.99	.50
.60	15.24	15.49	15.75	16.00	16.26	16.51	16.76	17.02	17.27	17.53	.60
.70	17.78	18.03	18.29	18.54	18.80	19.05	19.30	19.56	19.81	20.07	.70
.80	20.32	20.57	20.83	21.08	21.34	21.59	21.84	22.10	22.35	22.61	.80
.90	22.86	23.11	23.37	23.62	23.88	24.13	24.38	24.64	24.89	25.15	.90

MILLIMETERS TO INCHES

Millimeters	0	1	2	3	4	5	6	7	8	9	Millimeters
0	0.00	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354	0
10	0.39	0.43	0.47	0.51	0.55	0.59	0.63	0.67	0.71	0.75	10
20	0.79	0.83	0.87	0.91	0.94	0.98	1.02	1.06	1.10	1.14	20
30	1.18	1.22	1.26	1.30	1.34	1.38	1.42	1.46	1.50	1.54	30
40	1.57	1.61	1.65	1.69	1.73	1.77	1.81	1.85	1.89	1.93	40
50	1.97	2.01	2.05	2.09	2.13	2.17	2.20	2.24	2.28	2.32	50
60	2.36	2.40	2.44	2.48	2.52	2.56	2.60	2.64	2.68	2.72	60
70	2.76	2.80	2.83	2.87	2.91	2.95	2.99	3.03	3.07	3.11	70
80	3.15	3.19	3.23	3.27	3.31	3.35	3.39	3.43	3.46	3.50	80
90	3.54	3.58	3.62	3.66	3.70	3.74	3.78	3.82	3.86	3.90	90
100	3.94	3.98	4.02	4.06	4.09	4.13	4.17	4.21	4.25	4.29	100
110	4.33	4.37	4.41	4.45	4.49	4.53	4.57	4.61	4.65	4.69	110
120	4.72	4.76	4.80	4.84	4.88	4.92	4.96	5.00	5.04	5.08	120
130	5.12	5.16	5.20	5.24	5.28	5.31	5.35	5.39	5.43	5.47	130
140	5.51	5.55	5.59	5.63	5.67	5.71	5.75	5.79	5.83	5.87	140
150	5.91	5.94	5.98	6.02	6.06	6.10	6.14	6.18	6.22	6.26	150
160	6.30	6.34	6.38	6.42	6.46	6.50	6.54	6.57	6.61	6.65	160
170	6.69	6.73	6.77	6.81	6.85	6.89	6.93	6.97	7.01	7.05	170
180	7.09	7.13	7.17	7.20	7.24	7.28	7.32	7.36	7.40	7.44	180
190	7.48	7.52	7.56	7.60	7.64	7.68	7.72	7.76	7.80	7.83	190
200	7.87	7.91	7.95	7.99	8.03	8.07	8.11	8.15	8.19	8.23	200
210	8.27	8.31	8.35	8.39	8.43	8.46	8.50	8.54	8.58	8.62	210
220	8.66	8.70	8.74	8.78	8.82	8.86	8.90	8.94	8.98	9.02	220
230	9.06	9.09	9.13	9.17	9.21	9.25	9.29	9.33	9.37	9.41	230
240	9.45	9.49	9.53	9.57	9.61	9.65	9.69	9.72	9.76	9.80	240
250	9.84	9.88	9.92	9.96	10.00	10.04	10.08	10.12	10.16	10.20	250
260	10.24	10.28	10.31	10.35	10.39	10.43	10.47	10.51	10.55	10.59	260
270	10.63	10.67	10.71	10.75	10.79	10.83	10.87	10.91	10.94	10.98	270
280	11.02	11.06	11.10	11.14	11.18	11.22	11.26	11.30	11.34	11.38	280
290	11.42	11.46	11.50	11.54	11.57	11.61	11.65	11.69	11.73	11.77	290
300	11.81	11.85	11.89	11.93	11.97	12.01	12.05	12.09	12.13	12.17	300
310	12.20	12.24	12.28	12.32	12.36	12.40	12.44	12.48	12.52	12.56	310
320	12.60	12.64	12.68	12.72	12.76	12.80	12.83	12.87	12.91	12.95	320
330	12.99	13.03	13.07	13.11	13.15	13.19	13.23	13.27	13.31	13.35	330
340	13.39	13.43	13.46	13.50	13.54	13.58	13.62	13.66	13.70	13.74	340
350	13.78	13.82	13.86	13.90	13.94	13.98	14.02	14.06	14.09	14.13	350
360	14.17	14.21	14.25	14.29	14.33	14.37	14.41	14.45	14.49	14.53	360
370	14.57	14.61	14.65	14.69	14.72	14.76	14.80	14.84	14.88	14.92	370
380	14.96	15.00	15.04	15.08	15.12	15.16	15.20	15.24	15.28	15.31	380
390	15.35	15.39	15.43	15.47	15.51	15.55	15.59	15.63	15.67	15.71	390

(continued on next page)

MILLIMETERS TO INCHES

Millimeters	0	1	2	3	4	5	6	7	8	9	Millimeters
400	15.75	15.79	15.83	15.87	15.91	15.94	15.98	16.02	16.06	16.10	400
410	16.14	16.18	16.22	16.26	16.30	16.34	16.38	16.42	16.46	16.50	410
420	16.54	16.57	16.61	16.65	16.69	16.73	16.77	16.81	16.85	16.89	420
430	16.93	16.97	17.01	17.05	17.09	17.13	17.17	17.20	17.24	17.28	430
440	17.32	17.36	17.40	17.44	17.48	17.52	17.56	17.60	17.64	17.68	440
450	17.72	17.76	17.80	17.83	17.87	17.91	17.95	17.99	18.03	18.07	450
460	18.11	18.15	18.19	18.23	18.27	18.31	18.35	18.39	18.43	18.46	460
470	18.50	18.54	18.58	18.62	18.66	18.70	18.74	18.78	18.82	18.86	470
480	18.90	18.94	18.98	19.02	19.06	19.09	19.13	19.17	19.21	19.25	480
490	19.29	19.33	19.37	19.41	19.45	19.49	19.53	19.57	19.61	19.65	490
500	19.69	19.72	19.76	19.80	19.84	19.88	19.92	19.96	20.00	20.04	500
510	20.08	20.12	20.16	20.20	20.24	20.28	20.31	20.35	20.39	20.43	510
520	20.47	20.51	20.55	20.59	20.63	20.67	20.71	20.75	20.79	20.83	520
530	20.87	20.91	20.94	20.98	21.02	21.06	21.10	21.14	21.18	21.22	530
540	21.26	21.30	21.34	21.38	21.42	21.46	21.50	21.54	21.58	21.61	540
550	21.65	21.69	21.73	21.77	21.81	21.85	21.89	21.93	21.97	22.01	550
560	22.05	22.09	22.13	22.17	22.20	22.24	22.28	22.32	22.36	22.40	560
570	22.44	22.48	22.52	22.56	22.60	22.64	22.68	22.72	22.76	22.80	570
580	22.83	22.87	22.91	22.95	22.99	23.03	23.07	23.11	23.15	23.19	580
590	23.23	23.27	23.31	23.35	23.39	23.43	23.46	23.50	23.54	23.58	590
600	23.62	23.66	23.70	23.74	23.78	23.82	23.86	23.90	23.94	23.98	600
610	24.02	24.06	24.09	24.13	24.17	24.21	24.25	24.29	24.33	24.37	610
620	24.41	24.45	24.49	24.53	24.57	24.61	24.65	24.68	24.72	24.76	620
630	24.80	24.84	24.88	24.92	24.96	25.00	25.04	25.08	25.12	25.16	630
640	25.20	25.24	25.28	25.31	25.35	25.39	25.43	25.47	25.51	25.55	640
650	25.59	25.63	25.67	25.71	25.75	25.79	25.83	25.87	25.91	25.94	650
660	25.98	26.02	26.06	26.10	26.14	26.18	26.22	26.26	26.30	26.34	660
670	26.38	26.42	26.46	26.50	26.54	26.57	26.61	26.65	26.69	26.73	670
680	26.77	26.81	26.85	26.89	26.93	26.97	27.01	27.05	27.09	27.13	680
690	27.17	27.20	27.24	27.28	27.32	27.36	27.40	27.44	27.48	27.52	690
700	27.56	27.60	27.64	27.68	27.72	27.76	27.80	27.83	27.87	27.91	700
710	27.95	27.99	28.03	28.07	28.11	28.15	28.19	28.23	28.27	28.31	710
720	28.35	28.39	28.43	28.46	28.50	28.54	28.58	28.62	28.66	28.70	720
730	28.74	28.78	28.82	28.86	28.90	28.94	28.98	29.02	29.06	29.09	730
740	29.13	29.17	29.21	29.25	29.29	29.33	29.37	29.41	29.45	29.49	740
750	29.53	29.57	29.61	29.65	29.68	29.72	29.76	29.80	29.84	29.88	750
760	29.92	29.96	30.00	30.04	30.08	30.12	30.16	30.20	30.24	30.28	760
770	30.31	30.35	30.39	30.43	30.47	30.51	30.55	30.59	30.63	30.67	770
780	30.71	30.75	30.79	30.83	30.87	30.91	30.94	30.98	31.02	31.06	780
790	31.10	31.14	31.18	31.22	31.26	31.30	31.34	31.38	31.42	31.46	790
800	31.50	31.54	31.57	31.61	31.65	31.69	31.73	31.77	31.81	31.85	800
810	31.89	31.93	31.97	32.01	32.05	32.09	32.13	32.17	32.20	32.24	810
820	32.28	32.32	32.36	32.40	32.44	32.48	32.52	32.56	32.60	32.64	820
830	32.68	32.72	32.76	32.80	32.83	32.87	32.91	32.95	32.99	33.03	830
840	33.07	33.11	33.15	33.19	33.23	33.27	33.31	33.35	33.39	33.43	840
850	33.46	33.50	33.54	33.58	33.62	33.66	33.70	33.74	33.78	33.82	850
860	33.86	33.90	33.94	33.98	34.02	34.06	34.09	34.13	34.17	34.21	860
870	34.25	34.29	34.33	34.37	34.41	34.45	34.49	34.53	34.57	34.61	870
880	34.65	34.68	34.72	34.76	34.80	34.84	34.88	34.92	34.96	35.00	880
890	35.04	35.08	35.12	35.16	35.20	35.24	35.28	35.31	35.35	35.39	890
900	35.43	35.47	35.51	35.55	35.59	35.63	35.67	35.71	35.75	35.79	900
910	35.83	35.87	35.91	35.94	35.98	36.02	36.06	36.10	36.14	36.18	910
920	36.22	36.26	36.30	36.34	36.38	36.42	36.46	36.50	36.54	36.57	920
930	36.61	36.65	36.69	36.73	36.77	36.81	36.85	36.89	36.93	36.97	930
940	37.01	37.05	37.09	37.13	37.17	37.20	37.24	37.28	37.32	37.36	940
950	37.40	37.44	37.48	37.52	37.56	37.60	37.64	37.68	37.72	37.76	950
960	37.80	37.83	37.87	37.91	37.95	37.99	38.03	38.07	38.11	38.15	960
970	38.19	38.23	38.27	38.31	38.35	38.39	38.43	38.46	38.50	38.54	970
980	38.58	38.62	38.66	38.70	38.74	38.78	38.82	38.86	38.90	38.94	980
990	38.98	39.02	39.06	39.09	39.13	39.17	39.21	39.25	39.29	39.33	990
1000	39.37	39.41	39.45	39.49	39.53	39.57	39.61	39.65	39.68	39.72	1000

POUNDS TO KILOGRAMS

Pounds	0	1	2	3	4	5	6	7	8	9
0	0.00	0.45	0.91	1.36	1.81	2.27	2.72	3.18	3.63	4.08
10	4.54	4.99	5.44	5.90	6.35	6.80	7.26	7.71	8.16	8.62
20	9.07	9.53	9.98	10.43	10.89	11.34	11.79	12.25	12.70	13.15
30	13.61	14.06	14.52	14.97	15.42	15.88	16.33	16.78	17.24	17.69
40	18.14	18.60	19.05	19.50	19.96	20.41	20.87	21.32	21.77	22.23
50	22.68	23.13	23.59	24.04	24.49	24.95	25.40	25.86	26.31	26.76
60	27.22	27.67	28.12	28.58	29.03	29.48	29.94	30.39	30.84	31.30
70	31.75	32.21	32.66	33.11	33.57	34.02	34.47	34.93	35.38	35.83
80	36.29	36.74	37.20	37.65	38.10	38.56	39.01	39.46	39.92	40.37
90	40.82	41.28	41.73	42.18	42.64	43.09	43.55	44.00	44.45	44.91

KILOGRAMS TO POUNDS

Kilograms	0	1	2	3	4	5	6	7	8	9
0	0.00	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	52.91	55.12	57.32	59.52	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.77	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.43	114.64	116.84	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.09	143.30	145.50	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.75	171.96	174.16
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.00	196.21
90	198.41	200.62	202.82	205.03	207.23	209.44	211.64	213.85	216.05	218.26

PRESSURE CONVERSION

POUNDS PER SQUARE INCH TO KILOGRAMS PER SQUARE CENTIMETER

Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.	Lbs. per Sq. Inch	Kg. per Sq. Cm.
1	.07	31	2.18	61	4.29	91	6.40	205	14.41	410	28.83	710	49.92	1010	71.01
2	.14	32	2.25	62	4.36	92	6.47	210	14.76	420	29.53	720	50.62	1020	71.71
3	.21	33	2.32	63	4.43	93	6.54	215	15.12	430	30.23	730	51.32	1030	72.42
4	.28	34	2.39	64	4.50	94	6.61	220	15.47	440	30.93	740	52.03	1040	73.12
5	.35	35	2.46	65	4.57	95	6.68	225	15.82	450	31.64	750	52.73	1050	73.82
6	.42	36	2.53	66	4.64	96	6.75	230	16.17	460	32.34	760	53.43	1060	74.52
7	.49	37	2.60	67	4.71	97	6.82	235	16.52	470	33.04	770	54.14	1070	75.23
8	.56	38	2.67	68	4.78	98	6.89	240	16.87	480	33.75	780	54.84	1080	75.93
9	.63	39	2.74	69	4.85	99	6.96	245	17.23	490	34.45	790	55.54	1090	76.63
10	.70	40	2.81	70	4.92	100	7.03	250	17.58	500	35.15	800	56.25	1100	77.34
11	.77	41	2.88	71	4.99	105	7.38	255	17.93	510	35.86	810	56.95	1120	78.74
12	.84	42	2.95	72	5.06	110	7.73	260	18.28	520	36.56	820	57.65	1140	80.15
13	.91	43	3.02	73	5.13	115	8.09	265	18.63	530	37.26	830	58.35	1160	81.56
14	.98	44	3.09	74	5.20	120	8.44	270	18.98	540	37.97	840	59.06	1180	82.96
15	1.05	45	3.16	75	5.27	125	8.79	275	19.33	550	38.67	850	59.76	1200	84.37
16	1.12	46	3.23	76	5.34	130	9.14	280	19.69	560	39.37	860	60.46	1220	85.77
17	1.20	47	3.30	77	5.41	135	9.49	285	20.04	570	40.07	870	61.17	1240	87.18
18	1.27	48	3.37	78	5.48	140	9.84	290	20.39	580	40.78	880	61.87	1260	88.59
19	1.34	49	3.45	79	5.55	145	10.19	295	20.74	590	41.48	890	62.57	1280	89.99
20	1.41	50	3.52	80	5.62	150	10.55	300	21.09	600	42.18	900	63.28	1300	91.40
21	1.48	51	3.59	81	5.69	155	10.90	310	21.80	610	42.89	910	63.98	1320	92.80
22	1.55	52	3.66	82	5.77	160	11.25	320	22.50	620	43.59	920	64.68	1340	94.21
23	1.62	53	3.73	83	5.84	165	11.60	330	23.20	630	44.29	930	65.39	1360	95.62
24	1.69	54	3.80	84	5.91	170	11.95	340	23.90	640	45.00	940	66.09	1380	97.02
25	1.76	55	3.87	85	5.98	175	12.30	350	24.61	650	45.70	950	66.79	1400	98.43
26	1.83	56	3.94	86	6.05	180	12.66	360	25.31	660	46.40	960	67.49	1420	99.84
27	1.90	57	4.01	87	6.12	185	13.01	370	26.01	670	47.11	970	68.20	1440	101.24
28	1.97	58	4.08	88	6.19	190	13.36	380	26.72	680	47.81	980	68.90	1460	102.65
29	2.04	59	4.15	89	6.26	195	13.71	390	27.42	690	48.51	990	69.60	1480	104.05
30	2.11	60	4.22	90	6.33	200	14.06	400	28.12	700	49.21	1000	70.31	1500	105.46

A. S. T. M. PRODUCT CROSS INDEX

Metal	Type	Pipe	Tubing	Welding Fittings ¹	Flanges	Welding Rod
Stainless Austenitic Steel	Type 304 18 Cr-8 Ni	A312-TP304 A358-304 A376-TP304	A213-TP304 A249-TP304 A269-TP304 A271-TP304	A403-WP304	A182-F304	308
		312-TP304H 376-TP304H	A213-TP304H A249-TP304H A271-TP304H	A403-WP304H	A182-F304H	308
		A312-TP304L	A213-TP304L A249-TP304L A271-TP304L	A403-WP304L	A182-F304L	308-L
	Type 309 25 Cr-12 Ni	A312-TP309 A358-309	A249-TP309	A403-WP309	A314-309	309
	Type 310 25 Cr-20 Ni	A312-TP310 A358-310	A213-TP310 A249-TP310	A403-WP310	A182-F310	310
	Type 316 16 Cr-13 Ni with 2½ Mo	A312-TP316 A358-316 A376-TP316	A213-TP316 A249-TP316 A269-TP316	A403-WP316	A182-F316	316
		A312-TP316H A376-TP316H	A213-TP316H A249-TP316H	A403-WP316L	A182-F316H	316
		A312-TP316L	A213-TP316L A249-TP316L A269-TP316L	A403-WP316L	A182-F316L	316-L
	Type 317 16 Cr-13 Ni with 3½ Mo	A312-TP317	A249-TP317 A269-TP317	A403-WP317	A314-317	317
	Type 321 18 Cr-8 Ni with Ti	A312-TP321 A358-321 A376-TP321	A213-TP321 A249-TP321 A269-TP321 A271-TP321	A403-WP321	A182-F321	347
		A312-TP321H A376-TP321H	A213-TP321H A249-TP321H A271-TP321H	A403-WP321H	A182-F321H	347
	Type 347 18 Cr-8 Ni with Ta-C	A312-TP347 A358-347 A376-TP347	A213-TP347 A249-TP347 A269-TP347 A271-TP347	A403-WP347	A182-F347	347
		A312-TP347H A376-TP347H	A213-TP347H A249-TP347H A271-TP347H	A403-WP347H	A182-F347H	347
	Type 348 18 Cr-8 Ni with Cb	A312-TP348 A358-348 A376-TP348	A213-TP348 A249-TP348 A269-TP348 A271-TP348	A403-WP348	A182-F348	347
		A312-TP348H	A213-TP348H A249-TP348H A271-TP348H	A403-WP348H	A182-F348H	
Nickel and Nickel Base Alloys	Alloy—200	B161	B161	B366-WPN	(2)	Inco Alloy #61
	Alloy—201 (low carbon)	B161	B161	B366-WPNL	(2)	
	Alloy—400 Ni-Cu	B165	B165	B366-WPNC	(2)	Inco Alloy #60
	Alloy—600 Ni-Cr-Fe	B167	B167	B366-WPNCl	(2)	Inco Alloy #62
	Alloy B—(H ₂ stelloy) Ni-Mo	(2)	(2)	B366-WPHB	(2)	
	Alloy C—(H ₂ stelloy) Ni-Mo-Cr	(2)	(2)	B366-WPHC	(2)	
Aluminum	3003F	B241	B210 B221 B234	B361	(2)	1100 or 404
	5083-0	B241	B210 B221 B234	B361	(2)	5356
	6061-T6	B241	B210 B221 B234	B361	(2)	5356 or 404

1. When fittings are of welded construction, the fitting manufacturer shall supplement the grade symbol marking with the letter "W".

2. No ASTM specification has been written. However, materials having chemical and physical properties comparable to the other materials listed may be used.

ALUMINUM MILL PRODUCT SPECIFICATIONS INDEX

Alloy	Aluminum Products Commodity	Federal	Military	SAE	ASTM (ASME)	ANSI	
				AMS			
1060	Bar, Rod, Shapes, and Tube, Extruded			4000	B221	H38.5	
	Plate and Sheet				B209	H38.2	
	Tube, Drawn				{B210 B234 B483 B241 B345}	{H38.3 H38.6 H38.17 H38.7 H38.13}	
1100	Tube, Extruded				B221	H38.5	
	Bar, Rod, Shapes, and Tube, Extruded			4102	B211	H38.4	
	Bar, Rod, Wire and Shapes, Rolled or Drawn	QQ-A-225/1			B247	H38.8	
	Forgings			{4001 4003}	B209	H38.2	
	Plate and Sheet	QQ-A-250/1		4062	{B210 B483 B241 B491}	{H38.3 H38.17 H38.7 H38.18}	
3003	Tube, Drawn	WW-T-700/1			B313	H38.11	
	Tube, Extruded				B221	H38.5	
	Tube, Welded				B211	H38.4	
	Bar, Rod, Shapes, and Tube, Extruded	QQ-A-200/1			B247	H38.8	
	Bar, Rod, Wire and Shapes, Rolled or Drawn	QQ-A-225/2			{B241 B345}	{H38.7 H38.13}	
	Forgings		MIL-P-25995				
	Pipe, Extruded or Drawn				{4006 4008}	B209	H38.2
	Plate and Sheet	QQ-A-250/2			{4065 4067}	{B210 B234 B483 B241 B345 B491}	{H38.3 H38.6 H38.17 H38.7 H38.13 H38.18}
	Tube, Drawn	WW-T-700/2			B313	H38.11	
	Tube, Extruded				B221	H38.5	
5083	Tube, Welded				B211	H38.4	
	Bar, Rod, Shapes, and Tube, Extruded	QQ-A-200/4			B247	H38.8	
	Forgings	QQ-A-367					
5086	Plate and Sheet	QQ-A-250/6			{4056 4057 4058 4059}	B209	H38.2
	Tube, Drawn				B210	H38.3	
	Tube, Extruded				{B241 B345}	{H38.7 H38.13}	
	Bar, Rod, Shapes, and Tube, Extruded	QQ-A-200/5			B221	H38.5	
	Plate and Sheet	{QQ-A-250/7 QQ-A-00250/19}			B209	H38.2	
6061	Tube, Drawn	WW-T-700/5			B210	H38.3	
	Tube, Extruded				{B241 B345}	{H38.7 H38.13}	
	Tube, Welded				B313	H38.11	
	Bar, Rod, Shapes, and Tube, Extruded	QQ-A-200/8			{4150 4161 4172 4173 4115 4116 4117 4128 4129 4127 4146}	B221	H38.5
	Bar, Rod, Wire and Shapes, Rolled or Drawn	QQ-A-225/8				B211	H38.4
	Forgings [Ⓢ]	QQ-A-367	MIL-A-22771			B247	H38.8
	Pipe, Extruded or Drawn		MIL-P-25995			{B241 B345}	{H38.7 H38.13}
	Plate and Sheet	QQ-A-250/11			{4025 4026 4027 4043 4053 4079 4080 4082}	B209	H38.2
	Tube, Drawn	WW-T-700/6			{B210 B234 B483 B241 B345}	{H38.3 H38.6 H38.17 H38.7 H38.13}	
	Tube, Extruded						
6063	Tube, Extruded	QQ-A-00200/15			{4167 4168 4169}	B221	H38.5
	Bar, Rod, Shapes, and Tube, Extruded	QQ-A-200/9			4156	B221	H38.5
	Pipe, Extruded or Drawn		MIL-P-25995			{B241 B345}	{H38.7 H38.13}
	Tube, Drawn		MIL-T-46155			{B210 B483 B241 B345 B491}	{H38.3 H38.17 H38.7 H38.13 H38.18}
	Tube, Extruded						

SPECIFICATIONS and MATERIALS APPLICABLE TO STAINLESS BUTT WELDING FITTINGS

ASTM (American Society for Testing Materials) SPECIFICATIONS

These are basically materials specifications. ASTM A-403 (Factory Made Wrought Austenitic Steel Welding Fittings) lists the permissible raw materials from which fittings can be made. In addition, it controls the method of manufacture, quality assurance and marking.

The corresponding ASME Spec is SA-403. This is found in Section II Part A of the ASME Boiler and Pressure Vessel Code. This is similar, but more exacting than ASTM A-403 for items manufactured with filler metal added.

ANSI (American National Standards Institute) and MSS (Manufacturers Standardization Society) STANDARDS

Both ANSI B16.9 entitled "Wrought Steel Butt Welding Fittings" and MSS SP-43 entitled "Wrought Stainless Steel Butt Welding Fittings" cover 1/2" through 24" and govern dimension and tolerance. This difference is that ANSI B 16.9 covers all wall thicknesses and requires fittings to be fully rated to the pressure temperature ratings of the matching pipe.

MSS SP-43 covers only lightweight stainless steel fittings and allows lower pressure temperature ratings than B16.9. See below for details.

Other supplementary ANSI and MSS Standards

ANSI B16.25	Butt Welding End Preparations
ANSI B16.28	Butt Welding Short Radius Elbows and Returns 1" through 24"
MSS SP-25	Marking of Each Fitting

ASME (American Society of Mechanical Engineers) BOILERS AND PRESSURE VESSEL CODE

This governs the fabrication and materials requirements for pressure vessels, piping and components.

Section II — Materials

Part A — Ferrous Part B — Non Ferrous Part C — Welding Materials

Section III — Nuclear Power Plant Components

For the manufacture of fittings where filler metal is added, a Certificate of Authorization (NPT Stamp) is required.

Section V — Non Destructive Examination

Section VIII — Pressure Vessels

Section IX — Welding Qualifications

MSS SP-43 vs ANSI B16.9 for Schedules 5S and 10S Fittings

In response to the need of the process industries, SP-43 Specification was issued in 1950 by the Manufacturers Standardization Society. At that time, stainless steel piping was used for its resistance to corrosion and to eliminate product contamination. Pressure was seldom a factor.

Pressure ratings for 5S and 10S fittings are shown in MSS SP-43. They reflect the emphasis on corrosion resistance rather than pressure. These pressure ratings are less than the allowable pressure ratings that are applicable to the matching pipe.

Today there are many applications for schedules 5S and 10S piping at higher pressures than those permitted in SP-43. To cover this, SP-43 was revised to include a statement, "For fittings of same pressure rating of matching pipe, refer to ANSI-B16.9."

SP-43 and B16.9 are similar dimensionally in that the fixed position for the welding ends with reference to the centerline of the fitting and the overall dimensions are identical. OD tolerances of SP-43 fittings are tighter than those shown for B16.9 fittings.

ANSI B16.9 has the added provision that the pressure of the fitting shall at least equal the computed bursting pressure of seamless pipe of the same wall thickness and material.

In order to differentiate fittings made to these specifications, the prefix "CR" is shown before the alloy designated for SP-43 and the symbol "WP" is shown to indicate B16.9 fittings.

A user who wants to obtain 5S and 10S to B16.9 fittings must reference this Spec when ordering fittings to ASTM A-403. If B16.9 is not specified, the manufacturer may supply either SP-43 or B16.9 at his option.

Other suggestions to engineers and purchasing managers are on the following pages, and are offered as a guide to help you receive what you specify and order.

SUGGESTIONS for *the Engineer*

A few words added to your specifications will assure greater quality and fabrication savings. Your particular requirement will determine the degree of quality demanded. But, remember that each quality assurance mentioned here can be obtained from certain quality producers at no extra cost.

SPEC. SUGGESTION #1

"All fittings will be in accordance with ASTM A-403", and will be rated to corresponding pipe schedules.

Tees will have no welds in the throat area and the crotch will be reinforced with long radius design to eliminate sharp corners.

YOU'RE ASSURED OF THESE FEATURES

1

"SEAMLESS PROCESS"



Eliminates chances of sub-par welds . . . faulty construction design. Most **FLOWLINE** tees are seamless. Even where seamless pipe is not generally available, **FLOWLINE'S** exclusive process necessitates only one weld* . . . safely away from the side outlet—the point of greatest stress.

*100% inert gas shielded welding process performed by qualified welders to Section IX of the ASME Boiler & Pressure Vessel Code.

2

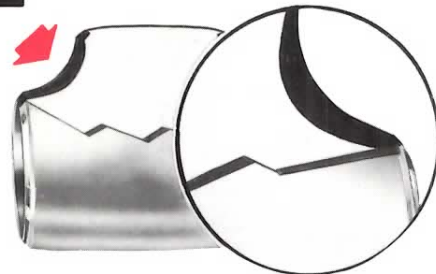
"LONG CROTCH RADIUS"



Contributes to optimum flow characteristics. ALL **FLOWLINE** tees from 1½" through 24" are scientifically shaped with long crotch radii.

3

"REINFORCED CROTCH"

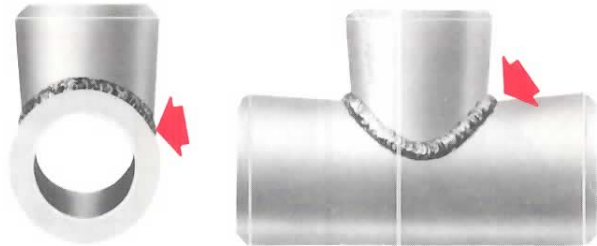


Extra thickness at the crotch . . . the point of greatest stress. Tee is stronger than corresponding pipe.

YOU ELIMINATED THESE FAULTS

1

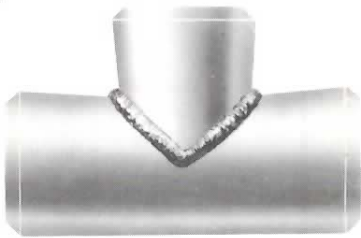
“CHOKED THROAT”



Generally distorts original shape. Results in impaired or unknown flow conditions. This **crude design** often allows porosity from filling gaps caused by uneven template cutting . . . induces formation of erosion pockets . . . areas of concentrated stress!

2

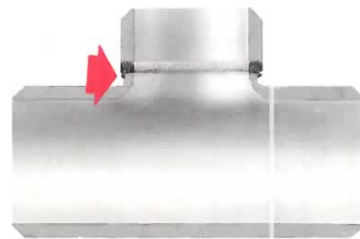
“POINT AND NOTCH”



Even under optimum welding techniques, this design results in a **pressure-strength factor of 65%**—compared with pipe of the same schedule. If a lower pressure rating is acceptable, **really save money—use lighter schedule pipe and fully pressure rated tees.**

3

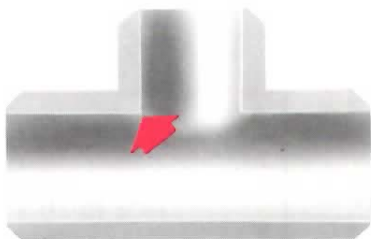
“THIN WALL AT CROTCH AREA”



Usually caused by pulling lip to weld on nipple . . . result—**built-in points of early system failure!** Remember . . . a process piping system is only as strong as its weakest point!

4

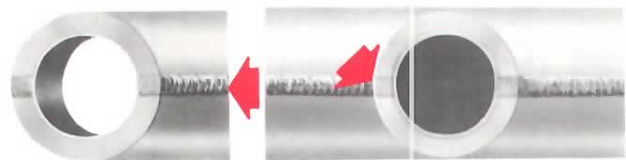
“SQUARE INSIDE CORNERS”



Restrict flow . . . cause pressure loss, excessive turbulence resulting in erosion and stress corrosion!

5

“WELD IN CROTCH AREA”



When weld is put in the crotch it is placed in the most highly stressed area of the tee.


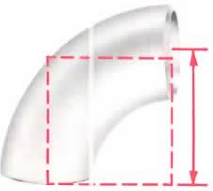


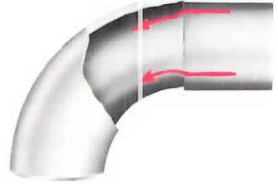
(Suggestions for the Engineer, cont'd.)

SPEC. SUGGESTION #2

"All fittings to be in accordance with ASTM A-403.

The following manufacturers are acceptable: **FLOWLINE**" (If desirable mention other known quality manufacturers).

Specifying Known Quality Manufacturers Assures Elimination of These Faults

FAULT	CORRECTION REQUIRED	CORRECTION COST as expressed in terms of original fitting cost
<p>1 END OUT OF SQUARE</p>  <p>Even within tolerances . . . multiple variations pyramid . . . make costly "Rube Goldberg" adjustments necessary!</p>	<p>End must be re-machined in your shop or sub-contracted. Also, cost of shop order or purchase order. Fittings and shop print must be marked with new dimension and handled as a special.</p>	<p>From 10% on large fittings to 50% on small fittings</p>
<p>2 CENTER-TO-FACE OUT OF TOLERANCE</p>  <p>If short: two additional welds and cuts for compensating section. If long: one additional cut to hold layout dimension.</p>	<p>Check fitting to see if it complies with dimensional standard. If not, fitting is then marked as a special. Check drawings and alter pipe cutting sheet in order to hold dimensions. Inspection and engineering time consumed—two hours.</p>	<p>From 7% on large fittings to 30% on small fittings</p>
<p>3 OUT-OF-ROUND</p>  <p>Requires correction prior to latching.</p>	<p>Time-consuming, difficult pipe clamping necessary to achieve roundness of matching pipe. Layout is cumbersome and welding more difficult.</p>	<p>From 10% on large fittings to 50% on small fittings</p>
<p>4 INADEQUATE STOCKS</p>  <p>Extended deliveries and broken promises delay on-stream date . . . increase fabrication costs . . . hurt customer's position when competitor's new product reaches the market first.</p>	<p>Increased administrative cost of expediting. Possible cancellation and re-purchase. New order usually subject to disadvantageous price level.</p>	<p>5% to 35% depending on value of fittings involved</p>
<p>5 I.D. BEYOND TOLERANCE</p>  <p>Disturbs flow . . . must be corrected before proper joint possible.</p>	<p>Requires taper boring or re-sizing ends. If re-sizing is necessary, it cannot be performed on the site and fitting must be returned to the supplier.</p>	<p>10% to 20% depending on fitting size</p>

SOME FAULTS THAT CANNOT BE CORRECTED

6 UNMARKED FITTINGS



Another manufacturing **short-cut!** Why buy fittings from a manufacturer who won't commit himself to trademark, alloy, heat number, size and schedule? Maybe he isn't sure himself?

7 DEFECTIVE INNER SURFACE



Die marks, scores and waves accelerate corrosion, stress, turbulence, erosion and product accumulation.

8 THIN WALL AT OUTSIDE RADIUS



Less than system's designed minimum . . . shorter life . . . possible plant shutdown . . . dangerous personnel hazard.

9 CHOKED BODY—FLAT BACK



Prevents design flow. Causes pressure loss . . . excessive turbulence resulting in erosion . . . shorter life.

SUGGESTIONS for

Materials Managers

Strict compliance by your suppliers in quoting to your specifications is becoming more important than ever. Product quality variance can be enormous within an industry.

Dependable suppliers will ask you to assure your Company in obtaining reliable bids and promised product, by—

1. Declaring their source(s) of supply, stressing that no exceptions to the declaration will be tolerated.
2. Communicating with the delivery point to assure that you have received what you bought.

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Basic Part Designator	Part Numbers for Fittings in Various Schedules							See Bulletin Page
	Fitting	Schedule 5S	Schedule 10S	Schedule 40S	Schedule 80S	Schedule 160	XX Strong Wall	
C	CAPS	C-5	C-1	C-4	C-8	C-16	C-XX	26-27
H	90° ELBOWS, Short Radius	H-5	H-1	H-4	H-8	H-16	H-XX	20-21
J	45° ELBOWS	J-5	J-1	J-4	J-8	J-16	J-XX	22-23
K	TEES, Reducing Outlet	K-5	K-1	K-4	K-8	K-16	K-XX	32-37
L	90° ELBOWS, Long Radius	L-5	L-1	L-4	L-8	L-16	L-XX	16-17
Q	REDUCERS, Eccentric	Q-5	Q-1	Q-4	Q-8	Q-16	Q-XX	46-51
R	REDUCERS, Concentric	R-5	R-1	R-4	R-8	R-16	R-XX	46-51
RL	90° REDUCING ELBOWS, Long Radius	RL-5	RL-1	RL-4	RL-8	--	--	18-19
S	STUB ENDS, Type A, MSS Short Length	S-5	S-1	S-4	--	--	--	40-41
S	STUB ENDS, Type B, ANSI Long Length	--	--	S-4	S-8	S-16	S-XX	42-43
SC	STUB ENDS, Type C	SC-5	SC-1	--	--	--	--	44
T	TEES, Straight	T-5	T-1	T-4	T-8	T-16	T-XX	30-31
U	180° RETURNS, Long Radius	U-5	U-1	U-4	U-8	--	--	24
X	CROSSES, Straight	X-5	X-1	X-4	X-8	X-16	X-XX	52-53
Z	CROSSES, Reducing Outlet	Z-5	Z-1	Z-4	Z-8	Z-16	Z-XX	54-59

GENERAL TERMS AND CONDITIONS

▶ ACCEPTANCE

All orders are subject to acceptance by **FLOWLINE DIVISION** at its home office at New Castle, Pennsylvania only.

▶ PRICES

See Price Sheet for prices. All prices and all terms and conditions of sale are subject to change without notice.

▶ TERMS

Terms are given on Price Sheet. All accounts are payable in United States funds, free of collection, exchange, or any other charges.

▶ TAXES

The amount of any sales, use, occupancy, or excise tax of any kind for which **FLOWLINE DIVISION** is legally liable, either initially or through failure of payment by purchaser, shall be added to the prices quoted and purchaser agrees to pay the same to **FLOWLINE DIVISION**, unless otherwise specifically arranged.

▶ PARTIAL SHIPMENTS

FLOWLINE DIVISION reserves the option, depending on conditions, and unless otherwise definitely agreed, to make partial shipments. Payment for partial shipments is due on the basis of dates of invoices covering them.

▶ RETURNS

Items purchased from **FLOWLINE DIVISION** may not be returned without our express written consent. A waiver by **FLOWLINE DIVISION** of this requirement in any instance shall not preclude **FLOWLINE DIVISION** from asserting this provision in any other instance.

▶ RESPONSIBILITY

FLOWLINE DIVISION is not responsible for delays, defaults, or damages due to any causes whatsoever, beyond **FLOWLINE DIVISION**'s control, including fires, floods, accidents, strikes, embargoes, and governmental action.

▶ SPECIAL FITTINGS

Orders for special fittings are accepted only with the agreement that the purchaser will pay for work performed, material used, and a reasonable profit in the event of cancellation.

▶ CANCELLATION

Cancellation of orders placed with and accepted by **FLOWLINE DIVISION** may be made only with the written consent of **FLOWLINE DIVISION**.

▶ CLAIMS

Claims for shortages, damaged products, or non-conformance of products must be made in writing within ten (10) days after receipt of items shipped, provided that **FLOWLINE DIVISION** is afforded the opportunity to investigate.

▶ WARRANTIES

ALL EXPRESS OR IMPLIED WARRANTIES OF **FLOWLINE DIVISION** (INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS) ARE HEREBY EXCLUDED EXCEPT AS FOLLOWS: **FLOWLINE DIVISION** warrants only that it will replace any items sold hereunder which fail to meet applicable ANSI and/or MSS standards or specific customer specifications within one year after the date of delivery of said items to the Buyer, provided (a) Buyer gives **FLOWLINE DIVISION** prompt written notice of any such failure, (b) the items have been installed and/or used as recommended by **FLOWLINE DIVISION** and in accordance with recognized engineering and piping practices, and (c) the items have not been subjected to corrosive or abrasive operating conditions deemed to be inappropriate or improper under recognized engineering and piping practices.

▶ SELLER'S LIABILITY

FLOWLINE DIVISION's liability in any cause of action arising from manufacturing defects or defective material in the items sold is limited solely to the replacement, free of charge, of such defective items or to the refunding to the Buyer of the purchase price of such defective items, whichever is of less cost to **FLOWLINE DIVISION**. **FLOWLINE DIVISION** shall not be responsible for the results of technical advice or services rendered in connection with the design, installation or use of any product. **FLOWLINE DIVISION** shall not be liable in any cause of action for any interruption of operations, loss of profits, or for special, incidental, contingent or consequential damages.

NOTE: For additional "Terms and Conditions", refer to Price Sheet.

