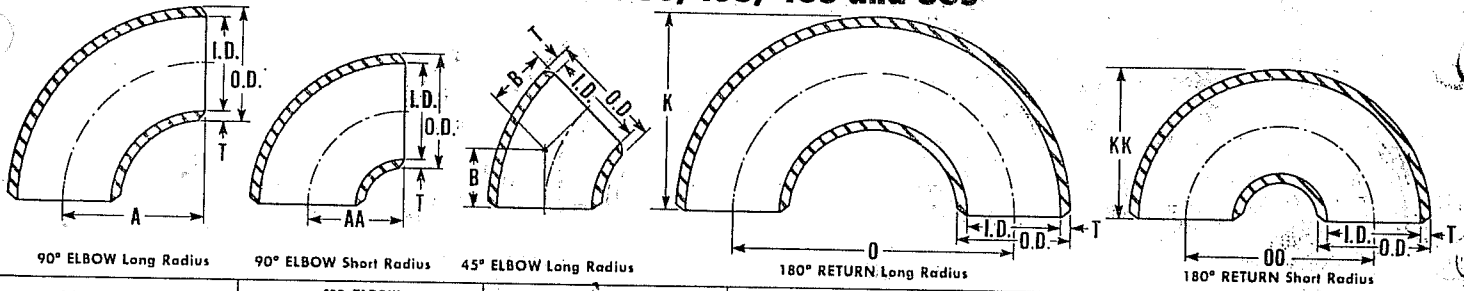


LADISH IPS BUTT WELDING FITTINGS

Schedules 5S, 10S, 40S and 80S



PART NUMBERS	90° ELBOW Long Radius	90° ELBOW Short Radius	45° ELBOW Long Radius	180° RETURN Long Radius	180° RETURN Short Radius
SCH. 5S	20005	21005	20105	20205	21205
SCH. 10S	20010	21010	20110	20210	21210
SCH. 40S	20000	21000	20100	20200	21200
SCH. 80S	20001	21001	20101	20201	21201

NOMINAL PIPE SIZE	OUTSIDE DIAMETER O.D.	SCHEDULE 5S		SCHEDULE 10S		SCHEDULE 40S		SCHEDULE 80S		90° ELBOW		45° ELBOW	
		WALL THICKNESS	INSIDE DIAMETER	WALL THICKNESS	INSIDE DIAMETER	WALL THICKNESS	INSIDE DIAMETER	WALL THICKNESS	INSIDE DIAMETER	LONG RADIUS	SHORT RADIUS*	LONG RADIUS	
		T	I.D.	T	I.D.	T	I.D.	T	I.D.	A	AA	B	
1/2	0.840	.065	.710	.083	.674	.109	.622	.147	.546	1 1/2	...	5/8	
3/4	1.050	.065	.920	.083	.884	.113	.824	.154	.742	1 3/8	...	7/16	
1	1.315	.065	1.185	.109	1.097	.133	1.049	.179	.957	1 1/2	1	7/8	
1 1/4	1.660	.065	1.530	.109	1.442	.140	1.380	.191	1.278	1 7/8	1 1/4	1	
1 1/2	1.900	.065	1.770	.109	1.682	.145	1.610	.200	1.500	2 1/4	1 1/2	1 1/8	
2	2.375	.065	2.245	.109	2.157	.154	2.067	.218	1.939	3	2	1 3/8	
2 1/2	2.875	.083	2.709	.120	2.635	.203	2.469	.276	2.323	3 3/4	2 1/2	1 3/4	
3	3.500	.083	3.334	.120	3.260	.216	3.068	.300	2.900	4 1/2	3	2	
3 1/2	4.000	.083	3.834	.120	3.760	.226	3.548	.318	3.364	5 1/4	3 1/2	2 1/4	
4	4.500	.083	4.334	.120	4.260	.237	4.026	.337	3.826	6	4	2 1/2	
5	5.563	.109	5.345	.134	5.295	.258	5.047	.375	4.813	7 1/2	5	3 1/8	
6	6.625	.109	6.407	.134	6.357	.280	6.065	.432	5.761	9	6	3 3/4	
8	8.625	.109	8.407	.148	8.329	.322	7.981	.500	7.625	12	8	5	
10	10.750	.134	10.482	.165	10.420	.365	10.020	.500	9.750	15	10	6 1/4	
12	12.750	.156	12.438	.180	12.390	.375	12.000	.500	11.750	18	12	7 1/2	
14	14.000	.156	13.688	.188	13.624	.375†	13.250	.500†	13.000	21	14	8 3/4	
16	16.000	.165	15.670	.188	15.624	.375†	15.250	.500†	15.000	24	16	10	
18	18.000	.165	17.670	.188	17.624	.375†	17.250	.500†	17.000	27	18	11 1/4	
20	20.000	.188	19.624	.218	19.564	.375†	19.250	.500†	19.000	30	20	12 1/2	
24	24.000	.218	23.564	.250	23.500	.375†	23.250	.500†	23.000	36	24	15	
30	30.000	.250	29.500	.312	29.376	.375†	29.250	.500†	29.000	45	30	18 1/2	
36	36.000	TO BE SPECIFIED					.375†	35.250	.500†	35.000	54	36	22 1/4

** Dimensions are in accordance with MSS SP-43 and where applicable to ASA B16.9. Short Radius Elbows are not included in either of these standards.

* Not available in Schedules 5S and 10S in sizes through 4".

† Sizes 14" through 36" are not covered by ASA B36.19-1957.

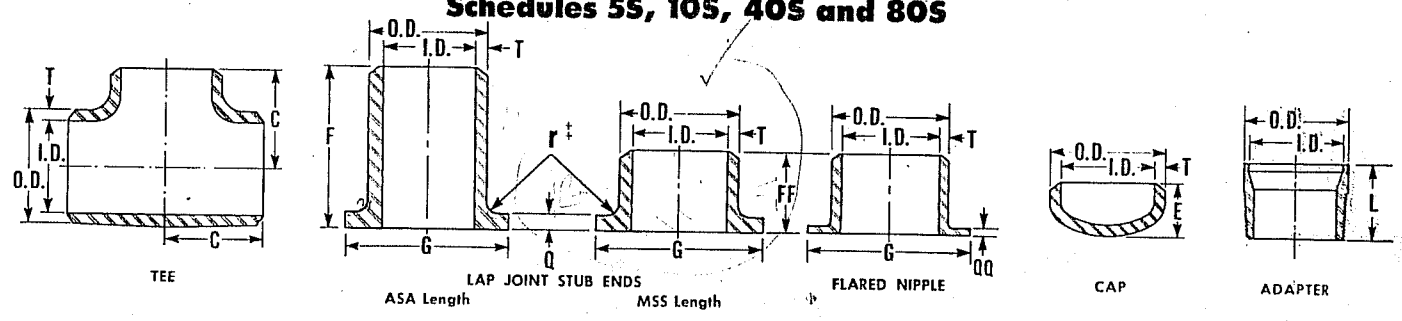
Wall thicknesses shown represent nominal or average wall dimensions as established

in ASA B36.19-1957. Wall thicknesses are subject to a minus 12 1/2% mill tolerance. Wall thickness for Schedules 5S and 10S in sizes 12" through 30" are tentative and subject to change.

† These wall thicknesses correspond respectively to Standard Weight and Extra Strong. OTHER SCHEDULES AND WALL THICKNESSES ARE AVAILABLE.

LADISH IPS BUTT WELDING FITTINGS

Schedules 5S, 10S, 40S and 80S



PART NUMBERS	TEE	LAP JOINT STUB END ASA LENGTH	LAP JOINT STUB END MSS LENGTH	FLARED NIPPLE	CAP	ADAPTER
SCH. 5S	24005	...	27405	27105	25505	25705
SCH. 10S	24010	...	27410	27110	25510	25710
SCH. 40S	24000	27200	27400	...	25500	...
SCH. 80S	24001	27201	...	...	25501	...

NOMINAL PIPE SIZE	180° RETURN				TEE C	F	FF	LAP JOINT STUB ENDS ASA LENGTH AND MSS LENGTH				FLARED NIPPLE QO	CAP E	ADAPTER+ L
	LONG RADIUS		SHORT RADIUS*					G	r†	Q*				
	K	O	KK	OO						SCH. 5S	SCH. 10S			
1/2	1 15/16	3	...	...	1	3	2	.084	.095	1 3/8	1/8	...	1	...
3/4	1 11/16	2 1/4	...	...	1 1/8	3	2	.086	.097	1 11/16	1/8	...	1	1 5/8
1	2 3/16	3	1 5/8	2	1 1/2	4	2	.093	.120	2	1/8	...	1 1/2	1 3/4
1 1/4	2 3/4	3 3/4	2 1/16	2 1/2	1 7/8	4	2	.095	.124	2 1/2	3/16	...	1 1/2	1 3/4
1 1/2	3 1/4	4 1/2	2 7/16	3	2 1/4	4	2	.097	.126	2 7/8	1/4	...	1 1/2	1 3/4
2	4 3/16	6	3 3/16	4	2 1/2	6	2 1/2	.100	.130	3 5/8	5/16	...	1 1/2	1 13/16
2 1/2	5 3/16	7 1/2	3 15/16	5	3	6	2 1/2	.130	.156	4 1/8	5/16	...	1 1/2	2 5/16
3	6 1/4	9	4 3/4	6	3 3/8	6	2 1/2	.134	.161	5	3/8	...	1 1/2	2 1/2
3 1/2	7 1/4	10 1/2	5 1/2	7	3 3/4	6	3	.137	.165	5 1/2	3/8	...	2 1/2	2 9/16
4	8 1/4	12	6 1/4	8	4 1/8	6	3	.140	.169	6 3/16	7/16	...	2 1/2	2 9/16
5	10 5/16	15	7 3/4	10	4 7/8	8	3	.168	.186	7 5/16	7/16	...	3	...
6	12 5/16	18	9 5/16	12	5 5/8	8	3 1/2	.175	.194	8 1/2	1/2	...	3 1/2	...
8	16 5/16	24	12 5/16	16	7	8	4	.187	.218	10 5/8	1/2	...	4	...
10	20 3/8	30	15 3/8	20	8 1/2	10	5	.221	.245	12 3/4	1/2	...	5	...
12	24 3/8	36	18 3/8	24	10	10	6	.249	.260	15	1/2	...	6	...
14	28	42	21	28	11	12	7	.375	.375	16 1/4	1/2	...	6 1/2	...
16	32	48	24	32	12	12	8	.375	.375	18 1/2	1/2	...	7	...
18	36	54	27	36	13 1/2	12	9	.375	.375	21	1/2	...	8	...
20	40	60	30	40	15	12	10	.375	.375	23	1/2	...	9	...
24	48	72	36	48	17	12	12	.375	.375	27 1/4	1/2	...	10 1/2	...
30	60	90	45	60	...	...	...	...	...	...	...	...	...	...
36	72	108	54	72	...	...	...	...	...	...	...	...	...	...

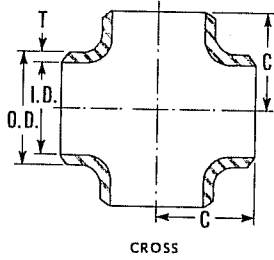
SLIGHTLY
LESS
THAN
NOMINAL
PIPE
WALL
THICKNESS

For O.D., I.D. and wall thickness T, see facing page.
 ** Dimensions are in accordance with MSS SP-43 and where applicable to ASA B16.9.
 * Not available in Schedules 5S and 10S in sizes through 4".
 LAP JOINT STUB ENDS—MSS length available in Schedules 5S, 10S and 40S; ASA length in Schedules 40S and 80S.
 * Lap thickness Q for Schedule 40S and 80S in sizes through 12" is equal to wall thickness T. In sizes 14" and larger, the lap thickness for Schedules 40S and 80S is .375" and .500" respectively.
 † Type B, Lap Joint Stub End (fillet radius "r" decreased to accommodate Slip-On Flange) available in Schedules 5S, 10S and 40S.

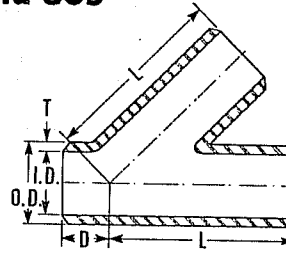
ASA and MSS length Lap Joint Stub Ends are furnished with a modified serrated face. Face of Flared Nipple is not serrated.
 FLARED NIPPLES are available in Schedules 5S and 10S.
 † Flared nipple has same FF and G dimensions as MSS length Lap Joint Stub End. Reducing Fittings—page 25.
 Caps have semi-ellipsoidal shape with minor axis at least one half of major axis.
 + WELDING ADAPTER (from Schedule 5S or 10S to NPT thread) available in Type 316 only. For Schedule 40S and 80S, use Standard Weight or Extra Strong Short Nipple threaded one end only.
 OTHER SCHEDULES AND WALL THICKNESSES ARE AVAILABLE.

LADISH IPS BUTT WELDING FITTINGS

Schedules 5S, 10S, 40S and 80S



CROSS



LATERAL

PART NUMBERS	CROSS	LATERAL
SCH. 5S	24205	24405
SCH. 10S	24210	24410
SCH. 40S	24200	24400
SCH. 80S	24201	24401

NOMINAL PIPE SIZE	OUTSIDE DIAMETER O.D.	SCHEDULE 5S		SCHEDULE 10S		SCHEDULE 40S		SCHEDULE 80S		CROSS C	LATERAL			
		WALL THICKNESS T	INSIDE DIAMETER I.D.	WALL THICKNESS T	INSIDE DIAMETER I.D.	WALL THICKNESS T	INSIDE DIAMETER I.D.	WALL THICKNESS T	INSIDE DIAMETER I.D.		SCHEDULES 5S, 10S, 40S		SCHEDULE 80S	
		T	I.D.	T	I.D.	T	I.D.	T	I.D.		D	L	D	L
3/4	1.050	.065	.920	.083	.884	.113	.824	.154	.742	1 1/8	1	5	...	...
1	1.315	.065	1.185	.109	1.097	.133	1.049	.179	.957	1 1/2	1 3/4	5 3/4	2	6 1/2
1 1/4	1.660	.065	1.530	.109	1.442	.140	1.380	.191	1.278	1 7/8	1 3/4	6 1/4	2 1/4	7 1/4
1 1/2	1.900	.065	1.770	.109	1.682	.145	1.610	.200	1.500	2 1/4	2	7	2 1/2	8 1/2
2	2.375	.065	2.245	.109	2.157	.154	2.067	.218	1.939	2 1/2	2 1/2	8	2 1/2	9
2 1/2	2.875	.083	2.709	.120	2.635	.203	2.469	.276	2.323	3	2 1/2	9 1/2	2 1/2	10 1/2
3	3.500	.083	3.334	.120	3.260	.216	3.068	.300	2.900	3 3/8	3	10	3	11
3 1/2	4.000	.083	3.834	.120	3.760	.226	3.548	.318	3.364	3 3/4	3	11 1/2	3	12 1/2
4	4.500	.083	4.334	.120	4.260	.237	4.026	.337	3.826	4 1/8	3	12	3	13 1/2
5	5.563	.109	5.345	.134	5.295	.258	5.047	.375	4.813	4 7/8	3 1/2	13 1/2	3 1/2	15
6	6.625	.109	6.407	.134	6.357	.280	6.065	.432	5.761	5 5/8	3 1/2	14 1/2	4	17 1/2
8	8.625	.109	8.407	.148	8.329	.322	7.981	.500	7.625	7	4 1/2	17 1/2	5	20 1/2
10	10.750	.134	10.482	.165	10.420	.365	10.020	.500	9.750	8 1/2	5	20 1/2	5 1/2	24
12	12.750	.156	12.438	.180	12.390	.375	12.000	.500	11.750	10	5 1/2	24 1/2	6	27 1/2
14	14.000	.156	13.688	.188	13.624	.375†	13.250	.500†	13.000	11	6	27	6 1/2	31
16	16.000	.165	15.670	.188	15.624	.375†	15.250	.500†	15.000	12	6 1/2	30	7 1/2	34 1/2
18	18.000	.165	17.670	.188	17.624	.375†	17.250	.500†	17.000	13 1/2	7	32	8	37 1/2
20	20.000	.188	19.624	.218	19.564	.375†	19.250	.500†	19.000	15	8	35	8 1/2	40 1/2
24	24.000	.218	23.564	.250	23.500	.375†	23.250	.500†	23.000	17	9	40 1/2	10	47 1/2

Sizes 14" through 24" are not covered by ASA B36.19-1957.

Wall thicknesses shown represent nominal or average wall dimensions as established in ASA B36.19-1957. Wall thicknesses are subject to a minus 12 1/2% mill tolerance.

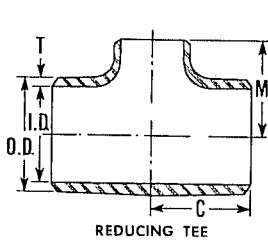
Wall thickness for Schedules 5S and 10S in sizes 12" through 24" are tentative and subject to change.

† These wall thicknesses correspond respectively to Standard Weight and Extra Strong. Center to face dimensions of the Cross correspond to that of the Tee in ASA B16.9. Reducing Laterals are available with the same center to end dimensions as Straight Laterals of the same size run.

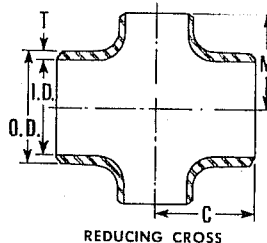
OTHER SCHEDULES AND WALL THICKNESSES ARE AVAILABLE.

LADISH IPS BUTT WELDING FITTINGS

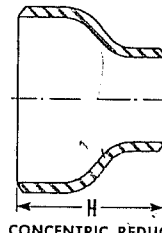
Schedules 5S, 10S, 40S and 80S



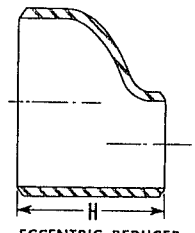
REDUCING TEE



REDUCING CROSS



CONCENTRIC REDUCER



ECCENTRIC REDUCER

PART NUMBERS	REDUCING TEE	REDUCING CROSS	CONCENTRIC REDUCER	ECCENTRIC REDUCER
SCH. 5S	24105	24305	25005	25105
SCH. 10S	24110	24310	25010	25110
SCH. 40S	24100	24300	25000	25100
SCH. 80S	24101	24301	25001	25101

NOMINAL PIPE SIZE	REDUCING TEE AND REDUCING CROSS		REDUCERS—CONCENTRIC ECCENTRIC
	C	M	H
3/4 x 1/2	1 1/8	1 1/8	2
1 x 1/2	1 1/2	1 1/2	2
	1 1/2	1 1/2	2
1 1/4 x 3/4	1 7/8	1 7/8	2
	1 7/8	1 7/8	2
	1 7/8	1 7/8	2
1 1/2 x 1	2 1/4	2 1/4	2 1/2
	2 1/4	2 1/4	2 1/2
	2 1/4	2 1/4	2 1/2
	2 1/4	2 1/4	2 1/2
2 x 1 1/4	2 1/2	1 3/4	3
	2 1/2	2	3
	2 1/2	2 1/4	3
	2 1/2	2 3/8	3
2 1/2 x 1 1/2	3	2 1/4	3 1/2
	3	2 1/2	3 1/2
	3	2 5/8	3 1/2
	3	2 3/4	3 1/2
3 x 2 1/2	3 3/8	2 3/4	3 1/2
	3 3/8	2 7/8	3 1/2
	3 3/8	3	3 1/2
	3 3/8	3 1/4	3 1/2
3 1/2 x 2	...	...	4
	3 3/4	3 1/8	4
	3 3/4	3 1/4	4
	3 3/4	3 1/2	4
4 x 3	3 3/4	3 5/8	4
	4 1/8	3 3/8	4
	4 1/8	3 1/2	4
	4 1/8	3 3/4	4
4 x 2 1/2	4 1/8	3 3/8	4
	4 1/8	3 1/2	4
	4 1/8	3 3/4	4
	4 1/8	3 7/8	4
5 x 4	4 1/8	4	4
	4 7/8	4 1/8	5
	4 7/8	4 1/4	5
	4 7/8	4 3/8	5
5 x 3 1/2	4 7/8	4 1/2	5
	4 7/8	4 5/8	5
	4 7/8	4 3/4	5
	4 7/8	4 7/8	5

NOMINAL PIPE SIZE	REDUCING TEE AND REDUCING CROSS		REDUCERS—CONCENTRIC ECCENTRIC
	C	M	H
6 x 4	5 5/8	4 3/4	5 1/2
	5 5/8	4 7/8	5 1/2
	5 5/8	5	5 1/2
	5 5/8	5 1/8	5 1/2
	5 5/8	5 3/8	5 1/2
8 x 6	7	6	6
	7	6 1/8	6
	7	6 3/8	6
8 x 4	7	6 5/8	6
	7	7 1/4	7
	7	7 1/2	7
10 x 8	8 1/2	7 5/8	7
	8 1/2	8	7
	8 1/2	8 1/2	7
	8 1/2	8	7
12 x 10	10	8 1/2	8
	10	8 5/8	8
	10	9	8
	10	9 1/2	8
14 x 12	11	9 3/4	13
	11	10 1/8	13
	11	10 5/8	13
16 x 14	12	10 3/4	14
	12	11 1/8	14
	12	11 5/8	14
	12	12	14
18 x 16	13 1/2	12 1/8	15
	13 1/2	12 5/8	15
	13 1/2	13	15
	13 1/2	13	15
20 x 18	15	13 1/8	20
	15	13 5/8	20
	15	14	20
	15	14	20
	15	14 1/2	20
24 x 20	17	15 5/8	20
	17	16	20
	17	16	20
	17	16 1/2	20
	17	17	20

** Dimensions are in accordance with MSS SP-43 and where applicable to ASA B16.9. Reducing Cross is not included in either of these standards. O.D., I.D. and wall thickness for each end of a reducer correspond to dimensions for pipe of the same size, see facing page. Sizes 14" through 24" are not covered by ASA B36.19-1957.

Reductions other than those listed are available on application. Reducers 8" and larger will be furnished conical or contour design at Ladish option. In 12" and smaller sizes, Reducers with reductions beyond those shown are available in conical shapes with increased lengths.

OTHER SCHEDULES AND WALL THICKNESSES ARE AVAILABLE.

WEIGHTS*—LADISH IPS BUTT WELDING FITTINGS

SCHEDULE NUMBER	NOMINAL PIPE SIZE	90° ELBOW		45° ELBOW	180° RETURN		TEE (24005)	LAP JOINT STUB END MSS LENGTH (27405)	FLARED NIPPLE (27105)	CAP (25505)	CROSS (24205)	LATERAL (24405)	ADAPTER (25705)	
		LONG RADIUS (20005)	SHORT RADIUS (21005)	LONG RADIUS (20105)	LONG RADIUS (20205)	SHORT RADIUS (21205)								
SCH. 5S	1/2	.10	...	.05	.20	...	.18	.14	.10	.02	.24	.35	...
	3/4	.12	...	.06	.25	...	.21	.18	.12	.02	.31	.56	.06
	1	.22	...	.14	.44	...	.35	.24	.16	.06	.47	.72	.14
	1 1/4	.29	...	.19	.59	...	.65	.34	.22	.08	.95	1.13	.17
	1 1/2	.44	...	.28	.89	...	.89	.44	.26	.14	1.19	1.30	.26
	2	.66	...	.35	1.31	...	1.07	.69	.41	.18	1.43	1.93	.40
	2 1/2	1.24	...	.69	2.48	...	2.07	.83	.64	.28	2.90	3.46	.46
	3	1.73	...	.89	3.45	...	2.69	1.34	.81	.50	3.66	4.50	.90
	3 1/2	2.35	...	1.17	4.63	...	3.38	1.70	1.08	.57	4.49	6.19	1.00	
	4	2.97	...	1.52	5.94	...	3.94	2.10	1.17	.76	5.11	6.57	1.30	
	5	6.01	4.24	3.09	12.2	8.49	9.76	3.09	2.04	1.32	13.0	15.3	...	
	6	8.94	6.09	4.47	17.8	12.1	13.8	4.30	2.79	1.57	19.5	16.7	...	
	8	15.4	6.63	8.10	30.9	13.2	18.4	6.48	4.12	2.06	24.3	25.3	...	
	10	29.2	20.3	14.6	57.6	40.6	30.0	10.7	7.59	3.79	37.3	47.5	...	
	12	51.2	33.6	25.5	102.	67.2	46.7	16.0	12.9	6.15	56.2	74.7	...	
	14	65.6	43.1	32.5	130.	86.3	49.4	22.9	15.5	7.60	59.1	94.4	...	
	16	89.8	59.7	44.9	179.	118.	66.8	31.2	21.0	10.1	78.5	127.	...	
	18	114.	75.7	57.2	228.	151.	83.2	36.5	27.3	12.7	98.5	157.	...	
20	160.	106.	80.3	320.	213.	112.	47.9	38.3	17.7	137.	228.	...		
24	260.	178.	130.	520.	355.	174.	72.2	62.6	28.6	219.	361.	...		
30	478.	319.	239.	956.	638.	...	...	...	...	...	...	...
36	DEPENDENT ON WALL THICKNESS SPECIFIED						

SCHEDULE NUMBER	NOMINAL PIPE SIZE	90° ELBOW		45° ELBOW	180° RETURN		TEE (24010)	LAP JOINT STUB END MSS LENGTH (27410)	FLARED NIPPLE (27110)	CAP (25510)	CROSS (24210)	LATERAL (24410)	ADAPTER (25710)	
		LONG RADIUS (20010)	SHORT RADIUS (21010)	LONG RADIUS (20110)	LONG RADIUS (20210)	SHORT RADIUS (21210)								
SCH. 10S	1/2	.13	...	.06	.26	...	.20	.17	.12	.03	.28	.45	...
	3/4	.16	...	.08	.33	...	.28	.21	.15	.03	.40	.71	.07
	1	.38	...	.25	.75	...	.60	.33	.27	.10	.80	1.16	.14
	1 1/4	.50	...	.33	1.00	...	1.10	.45	.36	.13	1.60	1.85	.19
	1 1/2	.75	...	.47	1.50	...	1.50	.57	.43	.23	2.00	2.14	.28
	2	1.10	...	.60	2.20	...	1.80	.91	.68	.30	2.40	3.17	.42
	2 1/2	1.80	...	1.00	3.60	...	3.00	1.05	.91	.40	4.20	4.94	.49	
	3	2.50	...	1.30	5.00	...	3.90	1.61	1.16	.72	5.30	6.44	.91	
	3 1/2	3.40	...	1.70	6.70	...	4.90	2.07	1.55	.83	6.50	8.87	1.06	
	4	4.30	...	2.20	8.60	...	5.70	2.52	1.79	1.16	7.40	10.0	1.33	
	5	7.40	5.19	3.80	15.0	10.3	12.0	3.44	2.50	1.61	16.0	18.4	...	
	6	11.0	7.45	5.50	22.0	14.9	17.0	4.79	3.42	1.93	24.0	20.5	...	
	8	21.0	14.3	11.0	42.0	28.6	25.0	7.62	5.57	2.78	33.0	41.1	...	
	10	36.0	24.9	18.0	71.0	49.8	37.0	12.1	9.32	4.66	46.0	70.0	...	
	12	57.0	38.1	29.0	120.	76.3	54.0	17.9	14.8	7.05	65.0	86.2	...	
	14	78.0	51.7	39.4	156.	103.	59.6	22.3	18.6	9.20	78.6	113.	...	
	16	102.	67.7	51.0	204.	135.	75.9	27.5	24.9	11.5	89.5	144.	...	
	18	129.	85.7	64.5	258.	171.	94.7	35.2	31.4	14.5	112.	179.	...	
20	185.	122.	92.5	370.	246.	130.	49.8	44.5	20.5	160.	265.	...		
24	306.	203.	153.	612.	406.	200.	77.4	71.9	32.9	251.	416.	...		
30	596.	388.	298.	1192.	778.	...	...	...	...	...	...	...
36	DEPENDENT ON WALL THICKNESS SPECIFIED						

*Approximate weight in pounds. For weights of reducing fittings, see page 28.
For dimensions, see pages 22-24.

WEIGHTS*—LADISH IPS BUTT WELDING FITTINGS

SCHEDULE NUMBER	NOMINAL PIPE SIZE	90° ELBOW		45° ELBOW	180° RETURN		TEE (24000)	LAP JOINT STUB ENDS		CAP (25500)	CROSS (24200)	LATERAL (24400)
		LONG RADIUS (20000)	SHORT RADIUS (21000)	LONG RADIUS (20100)	LONG RADIUS (20200)	SHORT RADIUS (21200)		ASA LENGTH (27200)	MSS LENGTH (27400)			
SCH. 40S	1/2	.18	...	.09	.35	...	.35	.30	.25	.12	...	...
	3/4	.19	...	.09	.40	...	.45	.40	.34	.16	.75	1.20
	1	.40	.25	.25	.75	.50	.75	.68	.43	.20	1.20	1.71
	1 1/4	.60	.40	.38	1.25	.80	1.30	.93	.60	.30	1.98	2.44
	1 1/2	.90	.56	.40	1.88	1.13	2.00	1.14	.75	.40	2.78	3.27
	2	1.60	1.00	.81	3.23	2.00	3.50	2.22	1.22	.60	4.70	5.04
	2 1/2	3.25	2.13	1.75	6.50	4.25	6.00	3.51	1.82	.90	7.35	9.23
	3	5.00	3.00	2.63	10.2	6.00	7.00	4.70	2.49	1.50	8.45	12.6
	3 1/2	6.75	4.50	3.50	13.0	9.00	9.00	5.65	3.36	2.00	11.2	17.2
	4	9.00	6.25	4.50	18.5	12.5	12.0	6.81	4.12	2.50	16.0	20.8
	5	15.5	9.60	7.50	30.0	19.0	21.0	11.8	5.69	4.50	27.8	31.4
	6	24.5	18.0	12.0	50.0	35.0	34.0	15.3	8.28	6.50	43.1	42.4
	8	50.0	34.0	23.0	95.0	68.0	55.0	23.1	13.6	12.0	67.5	76.4
	10	88.0	58.0	43.0	177.	115.	85.0	39.9	23.0	20.0	103.	124.
	12	125.	80.0	62.0	230.	155.	120.	49.2	32.7	30.0	145.	180.
	14	160.	105.	80.0	325.	210.	165.	63.8	37.6	36.0	198.	218.
	16	206.	132.	100.	412.	260.	195.	73.9	46.3	40.0	244.	275.
18	260.	167.	126.	510.	330.	249.	85.2	64.0	54.0	299.	326.	
20	320.	210.	160.	640.	410.	342.	94.7	74.2	75.0	414.	396.	
24	460.	298.	238.	890.	590.	528.	116.	116.	96.0	636.	544.	
30	734.	464.	367.	1465.	930.	...	...	...	...	...	...
36	1062.	671.	531.	2124.	1342.	...	...	...	...	...	...

SCHEDULE NUMBER	NOMINAL PIPE SIZE	90° ELBOW		45° ELBOW	180° RETURN		TEE (24001)	LAP JOINT STUB END ASA LENGTH (27201)	CAP (25501)	CROSS (24201)	LATERAL (24401)
		LONG RADIUS (20001)	SHORT RADIUS (21001)	LONG RADIUS (20101)	LONG RADIUS (20201)	SHORT RADIUS (21201)					
SCH. 80S	1/2	.25	...	.19	.65	...	.45	.38	.15	...	...
	3/4	.25	...	.19	.65	...	.60	.51	.20	...	...
	1	.50	.41	.31	1.00	.74	.88	.87	.30	1.45	2.52
	1 1/4	.90	.63	.50	1.75	1.10	1.60	1.24	.40	2.70	3.86
	1 1/2	1.15	.75	.69	2.39	1.50	2.25	1.51	.50	3.74	5.44
	2	2.20	1.50	1.19	4.40	3.00	4.00	3.10	.75	5.50	7.76
	2 1/2	4.00	2.80	2.13	8.00	5.60	7.00	4.64	1.00	8.37	13.5
	3	6.50	4.25	3.50	13.0	8.50	8.50	6.36	1.75	10.9	18.8
	3 1/2	8.35	6.00	4.50	16.7	12.0	12.0	7.71	2.50	15.3	25.6
	4	13.5	8.50	6.10	25.0	17.0	15.7	9.37	3.00	19.1	32.8
	5	22.0	14.0	10.7	44.0	28.0	26.0	16.7	5.50	33.2	49.8
	6	35.0	23.0	17.5	70.0	46.0	40.0	23.0	9.00	50.8	79.4
	8	71.0	47.5	35.0	142.	100.	75.0	34.9	16.0	92.5	140.
	10	107.	70.0	53.0	215.	140.	105.	53.6	25.0	138.	202.
	12	160.	104.	84.0	320.	218.	160.	64.7	36.0	224.	273.
	14	205.	140.	100.	400.	275.	240.	84.0	45.0	289.	340.
	16	276.	174.	135.	550.	340.	280.	97.4	54.0	338.	433.
18	340.	219.	167.	690.	430.	332.	112.	72.0	397.	526.	
20	420.	275.	206.	830.	550.	480.	126.	86.0	578.	628.	
24	600.	392.	300.	1200.	780.	610.	152.	130.	728.	882.	
30	975.	618.	488.	1950.	1235.	...	...	...	...	...
36	1412.	904.	706.	2824.	1808.	...	...	...	...	...

*Approximate weight in pounds. For weights of reducing fittings, see page 29.
For dimensions, see pages 22-24.

WEIGHTS*—LADISH IPS BUTT WELDING FITTINGS

SCHEDULE NUMBER	NOMINAL PIPE SIZE	REDUCING TEE (24105)	REDUCING CROSS (24305)	REDUCERS (25005) (25105)	
SCH. 5S	3/4 x 1/2	.25	.33	.10	
	1	x 1/2	.43	.51	.20
		x 3/4	.46	.55	.21
		x 1/2	.65	.76	.23
	1 1/4	x 3/4	.67	.77	.24
		x 1	.69	.78	.25
		x 1/2	.79	.94	.24
	1 1/2	x 3/4	.84	1.00	.26
		x 1	.86	1.03	.28
		x 1 1/4	.89	1.06	.32
	2	x 3/4	.93	1.12	.29
		x 1	1.00	1.20	.32
x 1 1/4		1.02	1.23	.36	
x 1 1/2		1.07	1.28	.38	
2 1/2	x 1	1.48	1.78	.51	
	x 1 1/4	1.55	1.86	.54	
	x 1 1/2	1.63	1.96	.57	
	x 2	1.78	2.13	.62	
3	x 1 1/4	2.47	2.98	.62	
	x 1 1/2	2.47	2.98	.66	
	x 2	2.57	3.10	.69	
	x 2 1/2	2.69	3.22	.76	
3 1/2	x 1 1/2	3.08	3.70	.94	
	x 2	3.19	3.83	1.04	

NOMINAL PIPE SIZE	REDUCING TEE (24105)	REDUCING CROSS (24305)	REDUCERS (25005) (25105)
3 1/2 x 2 1/2 x 3	3.26	3.42	1.09
	3.38	4.05	1.19
4	x 1 1/2	3.70	4.45
	x 2	3.75	4.51
	x 2 1/2	3.77	4.54
	x 3	3.88	4.66
5	x 3 1/2	3.94	4.72
	x 2	7.52	9.04
	x 2 1/2	7.70	9.25
	x 3	7.91	9.51
6	x 3 1/2	8.10	9.73
	x 4	8.29	9.94
	x 2 1/2	12.7	15.3
	x 3	12.9	15.6
8	x 3 1/2	13.1	15.8
	x 4	13.3	16.0
	x 5	13.8	16.5
	x 3 1/2	19.0	22.8
10	x 4	19.4	23.3
	x 5	19.9	23.9
	x 6	20.3	24.3
	x 4	24.8	29.8
10	x 5	25.5	30.6
	x 6	26.7	32.1
	x 8	27.2	32.6
	x 5	30.1	36.1
10	x 6	30.3	36.3
	x 8	37.0	44.4
	x 5	32.3	38.9
	x 6	36.3	43.6

NOMINAL PIPE SIZE	REDUCING TEE (24105)	REDUCING CROSS (24305)	REDUCERS (25005) (25105)
12	x 5	38.2	45.9
	x 6	39.6	47.6
	x 8	40.6	48.8
14	x 10	41.4	49.6
	x 8	45.2	53.1
	x 10	46.0	55.3
16	x 12	46.7	55.9
	x 8	58.8	69.6
	x 10	60.8	73.1
18	x 12	62.4	75.0
	x 14	63.5	76.2
	x 10	73.3	83.1
20	x 12	75.9	91.1
	x 14	77.9	93.5
	x 16	79.6	95.5
24	x 10	108.	130.
	x 12	109.	130.
	x 14	109.	131.
	x 16	110.	132.
24	x 18	111.	132.
	x 12	172.	206.
	x 14	172.	207.
	x 16	173.	209.
24	x 18	174.	210.
	x 20	176.	210.
	x 12	99.4	101.
	x 14	101.	104.
24	x 16	104.	106.
	x 18	106.	107.
	x 12	107.	107.
	x 14	107.	107.

SCHEDULE NUMBER	NOMINAL PIPE SIZE	REDUCING TEE (24110)	REDUCING CROSS (24310)	REDUCERS (25010) (25110)	
SCH. 10S	3/4 x 1/2	.28	.37	.16	
	1	x 1/2	.56	.67	.37
		x 3/4	.60	.72	.38
		x 1/2	1.06	1.27	.39
	1 1/4	x 3/4	1.10	1.32	.42
		x 1	1.15	1.38	.44
		x 1/2	1.33	1.59	.49
	1 1/2	x 3/4	1.41	1.69	.53
		x 1	1.45	1.74	.56
		x 1 1/4	1.50	1.80	.59
	2	x 3/4	1.37	1.65	.71
		x 1	1.67	2.00	.78
x 1 1/4		1.72	2.07	.82	
x 1 1/2		1.80	2.16	.85	
2 1/2	x 1	2.49	2.95	1.04	
	x 1 1/4	2.62	3.14	1.09	
	x 1 1/2	2.74	3.29	1.12	
	x 2	3.00	3.60	1.18	
3	x 1 1/4	3.61	4.33	1.33	
	x 1 1/2	3.65	4.38	1.39	
	x 2	3.75	4.50	1.45	
	x 2 1/2	3.90	4.68	1.53	
3 1/2	x 1 1/2	4.20	5.04	1.73	
	x 2	4.49	5.39	1.86	

NOMINAL PIPE SIZE	REDUCING TEE (24110)	REDUCING CROSS (24310)	REDUCERS (25010) (25110)
3 1/2 x 2 1/2 x 3	4.73	5.68	1.96
	4.90	5.88	2.12
4	x 1 1/2	5.38	6.46
	x 2	5.43	6.52
	x 2 1/2	5.45	6.56
	x 3	5.60	6.72
5	x 3 1/2	5.70	6.84
	x 2	10.8	12.9
	x 2 1/2	11.1	13.3
	x 3	11.4	13.6
6	x 3 1/2	11.7	14.0
	x 4	12.0	14.4
	x 2 1/2	15.7	18.9
	x 3	16.0	19.2
8	x 3 1/2	16.2	19.5
	x 4	16.5	19.8
	x 5	17.0	20.4
	x 3 1/2	23.4	28.2
10	x 4	23.9	28.7
	x 5	24.5	29.5
	x 6	25.0	30.0
	x 4	30.1	36.1
10	x 5	32.3	38.9
	x 6	36.3	43.6
	x 8	37.0	44.4
	x 5	30.1	36.1
10	x 6	30.3	36.3
	x 8	37.0	44.4
	x 5	32.3	38.9
	x 6	36.3	43.6

NOMINAL PIPE SIZE	REDUCING TEE (24110)	REDUCING CROSS (24310)	REDUCERS (25010) (25110)
12	x 5	49.8	59.9
	x 6	51.7	62.2
	x 8	53.0	63.7
14	x 10	54.0	64.8
	x 8	52.5	62.9
	x 10	53.5	64.2
16	x 12	54.3	65.1
	x 8	67.1	80.5
	x 10	69.3	82.7
18	x 12	71.2	85.0
	x 14	72.4	86.5
	x 10	83.5	99.3
20	x 12	86.5	103.
	x 14	88.7	106.
	x 16	90.2	108.
24	x 10	126.	143.
	x 12	126.	147.
	x 14	126.	151.
	x 16	127.	153.
24	x 18	128.	154.
	x 12	191.	229.
	x 14	192.	232.
	x 16	193.	235.
24	x 18	194.	238.
	x 20	195.	242.
	x 12	107.	107.
	x 14	121.	121.
24	x 16	125.	125.
	x 18	128.	128.
	x 20	132.	132.
	x 12	107.	107.

*Approximate weight in pounds.
For dimensions, see page 25.

WEIGHTS*—LADISH IPS BUTT WELDING FITTINGS

SCHEDULE NUMBER	NOMINAL PIPE SIZE	REDUCING TEE (24100)	REDUCING CROSS (24300)	REDUCERS (25000) (25100)	
SCH. 40S	3/4 x 1/2	.50	.63	.17	
	1	x 1/2	.88	1.06	.40
		x 3/4	.93	1.12	.40
	1 1/4	x 1/2	1.50	1.80	.40
		x 3/4	1.50	1.83	.40
	1 1/2	x 1	1.50	1.87	.50
		x 1/2	2.00	2.40	.50
		x 3/4	2.13	2.56	.54
	2	x 1	2.18	2.62	.62
		x 1 1/4	2.25	2.70	.70
		x 3/4	3.25	3.90	.70
	2 1/2	x 1	3.50	4.20	.76
x 1 1/4		3.60	4.32	.84	
x 1 1/2		3.75	4.50	.90	
x 2		5.00	6.00	1.25	
3	x 1 1/4	5.25	6.30	1.25	
	x 1 1/2	5.50	6.60	1.38	
	x 2	6.00	7.20	1.50	
	x 2 1/2	6.25	7.50	1.60	
3 1/2	x 1 1/4	6.25	7.58	1.70	
	x 1 1/2	6.50	7.80	1.80	
	x 2	6.75	8.10	2.00	
4	x 2 1/2	8.00	9.50	2.50	
	x 3	8.30	9.95	2.75	

NOMINAL PIPE SIZE	REDUCING TEE (24100)	REDUCING CROSS (24300)	REDUCERS (25000) (25100)	
3 1/2	x 2 1/2	8.50	10.2	2.88
	x 3	8.80	10.5	3.15
4	x 1 1/2	11.1	13.3	2.88
	x 2	11.2	13.5	3.00
	x 2 1/2	11.3	13.6	3.25
	x 3	11.6	13.9	3.38
5	x 3 1/2	11.8	14.1	3.50
	x 2	19.0	22.8	5.00
	x 2 1/2	19.5	23.4	5.25
	x 3	20.0	24.0	5.50
6	x 3 1/2	20.5	24.6	5.75
	x 4	21.0	25.2	6.00
	x 2 1/2	32.0	38.4	7.25
	x 3	32.5	39.0	8.00
8	x 3 1/2	33.0	39.6	8.25
	x 4	33.5	40.3	8.25
	x 5	34.5	41.5	8.50
10	x 3 1/2	50.7	60.8	11.0
	x 4	51.7	62.2	11.0
	x 5	53.0	63.6	12.0
12	x 6	54.0	64.9	13.2
	x 4	80.0	96.0	20.0
	x 5	81.0	97.2	21.0
	x 6	83.0	99.5	21.5
14	x 8	84.5	100.	22.0
	x 10			

NOMINAL PIPE SIZE	REDUCING TEE (24100)	REDUCING CROSS (24300)	REDUCERS (25000) (25100)	
12	x 5	110.	132.	30.0
	x 6	114.	133.	31.0
	x 8	117.	140.	32.0
14	x 10	119.	142.	34.0
	x 8	155.	186.	58.5
	x 10	158.	189.	59.2
16	x 12	160.	192.	60.0
	x 8	180.	216.	68.5
	x 10	186.	223.	69.5
18	x 12	191.	229.	70.0
	x 14	194.	233.	71.0
	x 10	222.	266.	82.0
20	x 12	230.	276.	83.0
	x 14	236.	283.	84.0
	x 16	241.	289.	85.0
24	x 10	332.	398.	117.
	x 12	334.	401.	120.
	x 14	336.	403.	122.
	x 16	338.	405.	124.
28	x 18	340.	408.	125.
	x 12	510.	612.	139.
	x 14	513.	616.	141.
	x 16	516.	619.	145.
30	x 18	519.	624.	148.
	x 20	522.	627.	150.

SCHEDULE NUMBER	NOMINAL PIPE SIZE	REDUCING TEE (24101)	REDUCING CROSS (24301)	REDUCERS (25001) (25101)	
SCH. 80S	3/4 x 1/2	.50	.72	.22	
	1	x 1/2	1.00	1.24	.45
		x 3/4	1.00	1.30	.45
	1 1/4	x 1/2	1.75	2.10	.50
		x 3/4	1.75	2.18	.50
	1 1/2	x 1	1.75	2.40	.50
		x 1/2	2.50	3.00	.65
		x 3/4	2.50	3.11	.70
	2	x 1	2.50	3.25	.75
		x 1 1/4	2.50	3.51	.78
		x 3/4	4.00	4.80	1.00
	2 1/2	x 1	4.10	4.92	1.10
x 1 1/4		4.13	4.96	1.15	
x 1 1/2		4.25	5.10	1.20	
x 2		7.00	8.40	1.75	
3	x 1 1/4	7.06	8.48	1.85	
	x 1 1/2	7.13	8.55	1.90	
	x 2	7.19	8.64	2.00	
4	x 2 1/2	7.60	9.12	2.40	
	x 3	7.68	9.25	2.50	
	x 2	8.00	9.60	2.60	
	x 2 1/2	8.25	9.90	2.75	
5	x 3 1/2	11.5	13.7	3.25	
	x 4	11.8	14.1	3.50	

NOMINAL PIPE SIZE	REDUCING TEE (24101)	REDUCING CROSS (24301)	REDUCERS (25001) (25101)	
3 1/2	x 2 1/2	12.2	14.6	3.50
	x 3	12.6	15.1	4.00
4	x 1 1/2	15.2	18.3	4.00
	x 2	15.5	18.6	4.25
	x 2 1/2	15.5	18.6	4.38
	x 3	15.6	18.7	4.50
5	x 3 1/2	15.6	18.8	4.75
	x 2	23.5	28.2	6.50
	x 2 1/2	24.0	28.8	7.00
	x 3	24.5	29.4	7.50
6	x 3 1/2	25.0	30.0	7.75
	x 4	25.5	30.6	8.25
	x 2 1/2	36.0	43.2	10.0
	x 3	37.0	44.4	10.5
8	x 3 1/2	38.2	45.9	11.0
	x 4	39.2	47.1	11.5
	x 5	40.0	48.1	12.0
10	x 3 1/2	70.5	84.6	16.5
	x 4	71.7	86.1	17.0
	x 5	73.0	87.6	18.0
12	x 6	74.0	88.8	18.7
	x 4	104.	124.	25.5
	x 5	106.	127.	28.0
	x 6	108.	129.	29.5
14	x 8	109.	130.	29.5

NOMINAL PIPE SIZE	REDUCING TEE (24101)	REDUCING CROSS (24301)	REDUCERS (25001) (25101)	
12	x 5	160.	192.	39.0
	x 6	165.	198.	40.0
	x 8	175.	210.	42.0
14	x 10	184.	221.	43.5
	x 8	225.	270.	78.5
	x 10	233.	279.	79.2
16	x 12	237.	284.	80.0
	x 8	260.	312.	88.5
	x 10	266.	319.	89.0
18	x 12	270.	324.	90.0
	x 14	275.	330.	91.0
	x 10	296.	355.	112.
20	x 12	307.	368.	113.
	x 14	315.	378.	114.
	x 16	321.	385.	115.
24	x 10	466.	559.	164.
	x 12	469.	564.	167.
	x 14	472.	567.	168.
	x 16	475.	571.	169.
28	x 18	477.	574.	170.
	x 12	592.	711.	179.
	x 14	595.	714.	185.
	x 16	598.	717.	190.
30	x 18	601.	722.	195.
	x 20	604.	725.	200.

*Approximate weight in pounds.
For dimensions, see page 25.

For Light Weight, Permanent Systems Utilizing O.D. Tubing

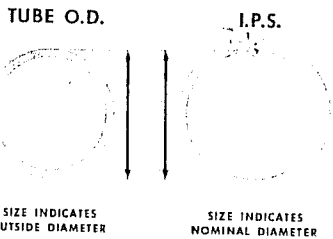
Ladish Tube O.D. fittings offer piping engineers an opportunity to take advantage of the intermediate flow capacity and dimensional characteristics offered by the O.D. tubing. These fittings are particularly applicable in the food, beverage and pharmaceutical fields where the primary purpose for the use of stainless steel is to assure freedom from product contamination.

Welded into a system, these fittings provide a permanent, low cost installation with smooth inner surfaces that facili-

tate cleaning and sterilization and assure streamlined flow with minimum of friction and pressure loss.

They are light in weight and have a high strength to weight relationship . . . providing an ample factor of safety in the piping of many corrosive media where temperature and pressure are not vital design factors.

Adapters are available, permitting efficient conversion from Tube O.D. to IPS dimensions.

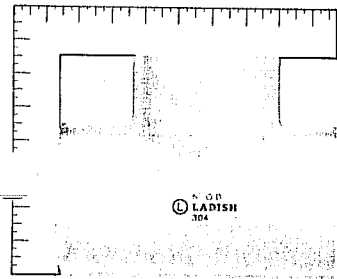
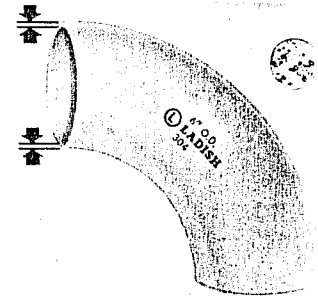


HOW TUBE O.D. DIFFERS FROM IPS

In Tube O.D. the size specified indicates its outside diameter . . . whereas in Iron Pipe Size (I.P.S.), the size has reference to a nominal diameter. See comparison charted below.

UNIFORMITY IN WALLS

Adequate strength, accurate alignment and smooth, free-flow interior surfaces are operating advantages of the uniformity in walls maintained in Ladish fittings.

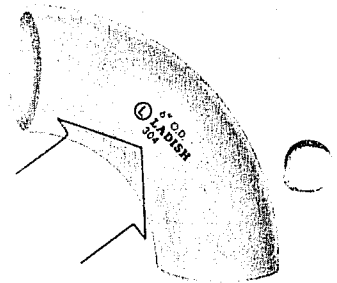


GEOMETRIC ACCURACY

Manufacturing methods and controls produce in Ladish Tube O.D. fittings accuracy both in dimensions and geometry that assures installation economies and accurate make-up.

PERMANENT IDENTIFICATION

Every Ladish Tube O.D. fitting carries a permanent marking giving complete data on size, weight and material specification from which it was produced.



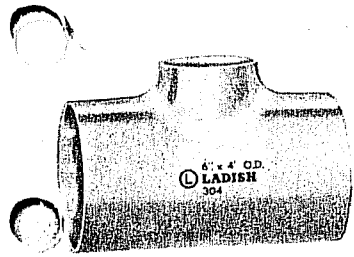
COMPARISON OF DIMENSIONS AND FLOW AREA OF O.D. TUBING AND IPS PIPE**

O.D. TUBING				IPS PIPE					
O.D. TUBING SIZE	OUTSIDE DIAMETER	INSIDE DIAMETER*	FLOW AREA SQ. IN.	IPS PIPE SIZE	OUTSIDE DIAMETER	SCHEDULE 5S		SCHEDULE 10S	
						INSIDE DIAMETER	FLOW AREA SQ. IN.	INSIDE DIAMETER	FLOW AREA SQ. IN.
1/2	...	...	...	1/2	.840	.710	.396	.674	.357
3/4	.750	.652	.334	3/4	1.050	.920	.665	.884	.614
1	1.000	.870	.595	1	1.315	1.185	1.10	1.097	.945
1 1/4	1.250	1.120	.985	1 1/4	1.660	1.530	1.84	1.442	1.63
1 1/2	1.500	1.370	1.47	1 1/2	1.900	1.770	2.46	1.682	2.22
2	2.000	1.870	2.75	2	2.375	2.245	3.96	2.157	3.65
2 1/2	2.500	2.370	4.41	2 1/2	2.875	2.709	5.76	2.635	5.45
3	3.000	2.834	6.31	3	3.500	3.334	8.73	3.260	8.35
3 1/2	...	...	...	3 1/2	4.000	3.834	11.55	3.760	11.10
4	4.000	3.834	11.55	4	4.500	4.334	14.75	4.260	14.25
5	5.000	4.782	17.96	5	5.563	5.345	22.44	5.295	22.02
6	6.000	5.782	26.26	6	6.625	6.407	32.24	6.357	31.75
8	8.000	7.782	47.56	8	8.625	8.407	55.5	8.329	54.5
10	10.000	9.732	74.4	10	10.750	10.482	86.3	10.420	85.3
12	12.000	11.732	108.	12	12.750	12.438	121.	12.390	120.
14	14.000	13.732	140.	14	14.000	13.688	147.	13.624	146.
16	16.000	15.732	194.	16	16.000	15.670	193.	15.624	192.
18	18.000	17.732	247.	18	18.000	17.670	245.	17.624	244.
20	20.000	19.732	306.	20	20.000	19.624	302.	19.564	300.
24	24.000	23.732	442.	24	24.000	23.564	436.	23.500	434.

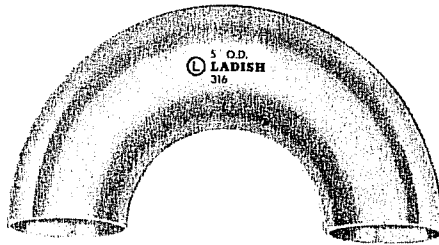
*Based on wall thickness listed on following pages.

**Indicates greater latitude in selecting line size with capacity closest to flow requirement.

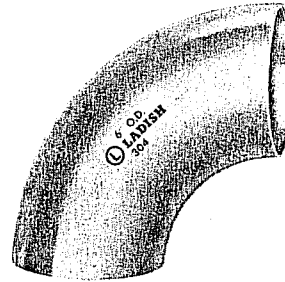
STAINLESS STEEL FITTINGS



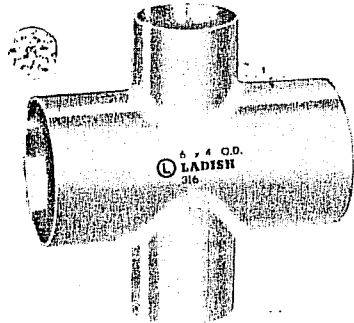
REDUCING
TEE



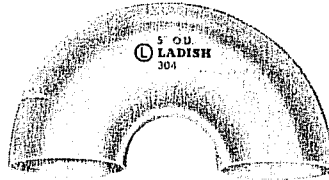
180° RETURN
LONG RADIUS



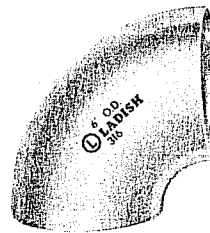
90° ELBOW
LONG RADIUS



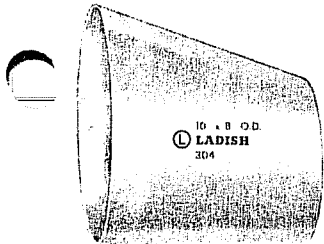
REDUCING
CROSS



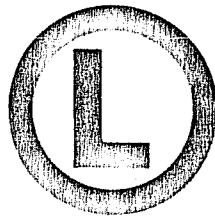
180° RETURN
SHORT RADIUS



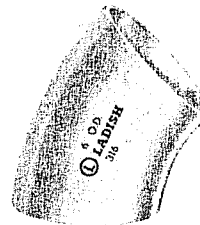
90° ELBOW
SHORT RADIUS



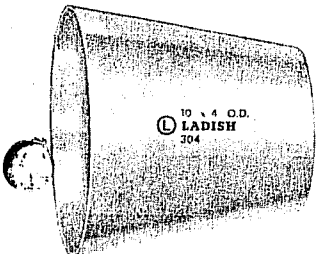
ECCENTRIC
REDUCER



TO MARK PROGRESS



45° ELBOW
LONG RADIUS



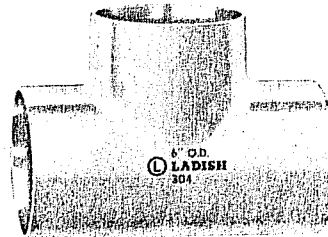
CONCENTRIC
REDUCER



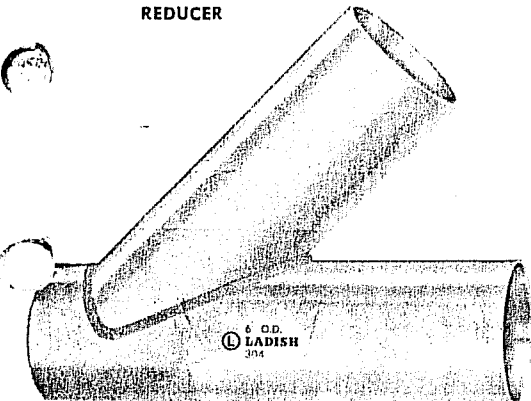
LAP JOINT
STUB END



FLARED
NIPPLE



TEE



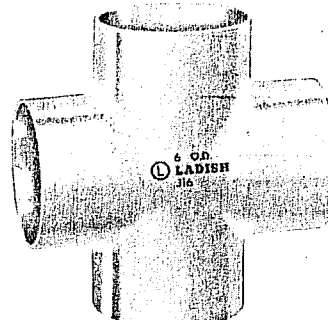
LATERAL



CAP



ADAPTER



CROSS

1 IPS
BUTT WELDING
FITTINGS

Pages 20-21

2 TUBE O.D.
BUTT WELDING
FITTINGS

Pages 30-31

3 ASA, MSS,
LIGHT TYPE
and CORROSION
WEIGHT
FLANGES

Pages 36-51

4 SCREWED and
SOCKET WELDING
FITTINGS

Pages 56-61

5 PART NUMBER
and PRODUCT
INDEX

Sections 1 through 4

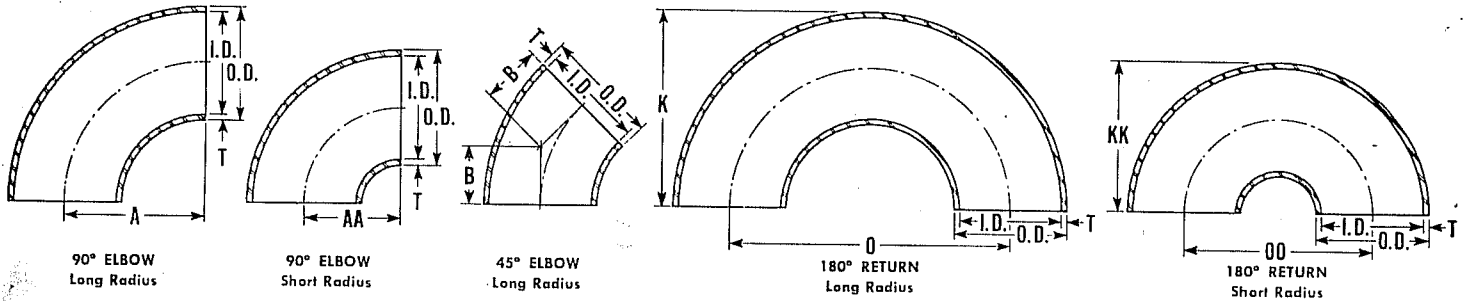
6 TECHNICAL
DATA

Page 71—

7 OTHER PRODUCTS
SUPPLEMENTAL
DATA

LADISH TUBE O.D. BUTT WELDING FITTINGS

For Use with O.D. Tubing

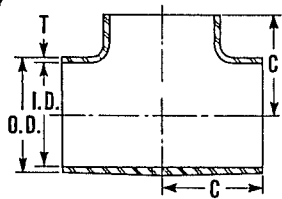


PART NUMBERS	90° ELBOW LONG RADIUS	90° ELBOW SHORT RADIUS	45° ELBOW LONG RADIUS	180° RETURN LONG RADIUS	180° RETURN SHORT RADIUS
	50000	51000	50100	50200	51200

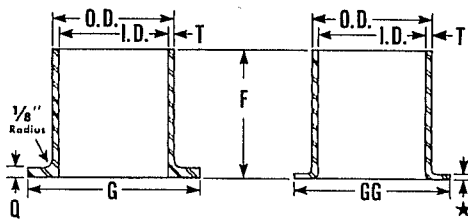
TUBE O.D. SIZE	OUTSIDE DIAMETER	INSIDE DIAMETER	WALL THICKNESS	GAUGE NUMBER	90° ELBOW		45° ELBOW	180° RETURN			
					LONG RADIUS	SHORT RADIUS	LONG RADIUS	LONG RADIUS		SHORT RADIUS	
					A	AA	B	K	O	KK	OO
3/4	.750	.652	.049	18	1 1/8	...	1 5/32	1 1/2	2 1/4	...	...
1	1.000	.870	.065	16	1 1/2	...	5/8	2	3	...	...
1 1/4	1.250	1.120	.065	16	1 7/8	...	2 5/32	2 1/2	3 3/4	...	...
1 1/2	1.500	1.370	.065	16	2 1/4	...	1 5/16	3	4 1/2	...	...
2	2.000	1.870	.065	16	3	...	1 1/4	4	6	...	...
2 1/2	2.500	2.370	.065	16	3 3/4	...	1 9/16	5	7 1/2	...	...
3	3.000	2.834	.083	14	4 1/2	...	1 7/8	6	9	...	...
4	4.000	3.834	.083	14	6	...	2 1/2	8	12	...	...
5	5.000	4.782	.109	12	7 1/2	5	3 1/8	10	15	7 1/2	10
6	6.000	5.782	.109	12	9	6	3 3/4	12	18	9	12
8	8.000	7.782	.109	12	12	8	5	16	24	12	16
10	10.000	9.732	.134	10	15	10	6 1/4	20	30	15	20
12	12.000	11.732	.134	10	18	12	7 1/2	24	36	18	24
14	14.000	13.732	.134	10	21	14	8 3/4	28	42	21	28
16	16.000	15.732	.134	10	24	16	10	32	48	24	32
18	18.000	17.732	.134	10	27	18	11 1/4	36	54	27	36
20	20.000	19.732	.134	10	30	20	12 1/2	40	60	30	40
24	24.000	23.732	.134	10	36	24	14 7/8	48	72	36	48

LADISH TUBE O.D. BUTT WELDING FITTINGS

For Use with O.D. Tubing

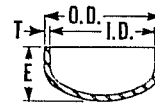


TEE

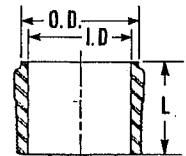


LAP JOINT
STUB END

FLARED
NIPPLE



CAP



ADAPTER

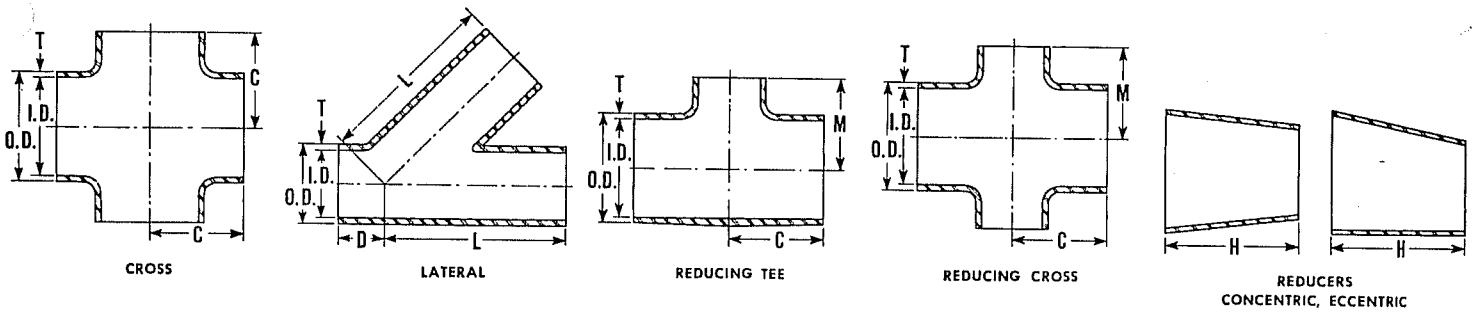
PART NUMBERS	TEE	LAP JOINT STUB END	FLARED NIPPLE	CAP	ADAPTER
	54000	57000	57100	55500	55800

TUBE O.D. SIZE	OUTSIDE DIAMETER	INSIDE DIAMETER	WALL THICKNESS	GAUGE NUMBER	TEE	LAP JOINT STUB END		FLARED NIPPLE		CAP	ADAPTER
	O.D.	I.D.	T		G	Q	G	F	GG	E	L
3/4	.750	.652	.049	18	1 7/8	.098	1 11/16	1 3/8	1 3/8	5/16	1 5/8
1	1.000	.870	.065	16	1 7/8	.130	2	1 5/8	1 3/4	3/8	1 3/4
1 1/4	1.250	1.120	.065	16	2 1/4	.130	2 1/2	1 1/2	2 1/8	1/2	1 3/4
1 1/2	1.500	1.370	.065	16	2 1/4	.130	2 7/8	1 3/4	2 1/2	9/16	1 3/4
2	2.000	1.870	.065	16	3	.130	3 5/8	1 1/2	3 1/4	3/4	1 13/16
2 1/2	2.500	2.370	.065	16	3	.130	4 1/8	2	3 3/4	1	2 5/16
3	3.000	2.834	.083	14	3 1/4	.166	5	2 1/4	4 3/8	1 1/4	2 1/2
4	4.000	3.834	.083	14	3 3/8	.166	6 3/16	2 5/8	5 5/8	1 1/2	2 9/16
5	5.000	4.782	.109	12	4 1/2	.218	7 5/16	3	6 11/16	1 3/4	...
6	6.000	5.782	.109	12	5	.218	8 1/2	3	7 3/4	2	...
8	8.000	7.782	.109	12	6	.240	10 5/8	3	9 3/4	2 1/2	...
10	10.000	9.732	.134	10	7 1/2	.268	12 3/4	3 1/2	11 3/4	3	...
12	12.000	11.732	.134	10	9	.268	15	3	14 1/8	3 1/2	...
14	14.000	13.732	.134	10	11	.268	16 1/4	3 1/2	16 1/4	4	...
16	16.000	15.732	.134	10	12	.268	18 1/2	3	18 1/2	4 3/8	...
18	18.000	17.732	.134	10	13 1/2	.268	21	3	...	4 7/8	...
20	20.000	19.732	.134	10	15	.268	23	3	...	5 3/8	...
24	24.000	23.732	.134	10	17	.268	27 1/4	5	...	6 1/4	...

*FLARED NIPPLE—Lap thickness is slightly less than wall thickness for that size.
*WELDING ADAPTER (from Tube O.D. to NPT thread) available in Type 316 only.

LADISH TUBE O.D. BUTT WELDING FITTINGS

For Use with O.D. Tubing



PART NUMBERS	CROSS	LATERAL	REDUCING TEE	REDUCING CROSS	CONCENTRIC REDUCER	ECCENTRIC REDUCER
		54200	54400	54100	54300	55000	55100

TUBE O.D. SIZE	CROSS	LATERAL	
	C	D	L
3/4	1 7/8	1	5
1	1 7/8	1	5
1 1/4	2 1/4	1 3/16	6 3/16
1 1/2	2 1/4	1 3/16	6 3/16
2	3	1 5/8	7 1/8
2 1/2	3	1 1/2	8 1/2
3	3 1/4	1 7/8	8 7/8
4	3 7/8	2 1/16	10 3/4
5	4 1/2	3 1/2	11 1/4
6	5	4	12 1/2
8	6	5 1/4	14 3/4
10	7 1/2	6 1/2	17 1/4
12	9	7 3/4	19 1/2
14	11	9	22 1/2
16	12	10	25
18	13 1/2	11	27 1/2
20	15	12	31 3/4
24	17	14	36

TUBE O.D. SIZE	REDUCING TEE AND CROSS		REDUCERS
	C	M	H
1 x 1/2	1 7/8	1 1/2	2
1 x 3/4	1 7/8	2	1
1 1/4 x 1/2	2 1/4	1 5/8	3
1 1/4 x 3/4	2 1/4	2 1/8	2
1 1/4 x 1	2 1/4	2	1
1 1/2 x 1/2	2 1/4	1 3/4	4
1 1/2 x 3/4	2 1/4	2 1/4	3
1 1/2 x 1	2 1/4	2 1/8	2
1 1/2 x 1 1/4	2 1/4	2 3/8	1
2 x 3/4	3	2 1/2	5
2 x 1	3	2 3/8	4
2 x 1 1/4	3	2 5/8	3
2 x 1 1/2	3	2 1/2	2
2 1/2 x 1	3	2 5/8	6
2 1/2 x 1 1/4	3	2 7/8	5
2 1/2 x 1 1/2	3	2 3/4	4
2 1/2 x 2	3	3 1/4	2
3 x 1 1/4	3 1/4	3 1/8	7
3 x 1 1/2	3 1/4	3	6
3 x 2	3 1/4	3 1/2	4
3 x 2 1/2	3 1/4	3 1/4	2
4 x 1 1/2	3 7/8	3 1/2	10
4 x 2	3 7/8	4	8
4 x 2 1/2	3 7/8	3 3/4	6
4 x 3	3 7/8	3 3/4	4
5 x 2	4 1/2	4 1/2	6
5 x 2 1/2	4 1/2	4 1/4	5
5 x 3	4 1/2	4 1/4	4
5 x 4	4 1/2	4 3/8	2
6 x 2 1/2	5	4 3/4	7
6 x 3	5	4 3/4	6
6 x 4	5	4 7/8	4
6 x 5	5	5	2
8 x 3	6	5 7/8	10
8 x 4	6	5 7/8	8

TUBE O.D. SIZE	REDUCING TEE AND CROSS			REDUCERS
	C	M	H	
8 x 5	6	6	6	
8 x 6	6	6	4	
10 x 4	7 1/2	6 7/8	12	
10 x 5	7 1/2	7	10	
10 x 6	7 1/2	7	8	
10 x 8	7 1/2	7	4	
12 x 5	9	8	14	
12 x 6	9	8	12	
12 x 8	9	8	8	
12 x 10	9	8 1/2	4	
14 x 6	11	9 1/4	16	
14 x 8	11	9 3/4	12	
14 x 10	11	10 1/8	8	
14 x 12	11	10 5/8	4	
16 x 6	12	10 1/4	20	
16 x 8	12	10 5/8	16	
16 x 10	12	11 1/8	12	
16 x 12	12	11 5/8	8	
16 x 14	12	12	4	
18 x 8	13 1/2	11 3/4	20	
18 x 10	13 1/2	12 1/8	16	
18 x 12	13 1/2	12 5/8	12	
18 x 14	13 1/2	13	8	
18 x 16	13 1/2	13	4	
20 x 8	15	12 3/4	24	
20 x 10	15	13 1/8	20	
20 x 12	15	13 3/8	16	
20 x 14	15	14	12	
20 x 16	15	14	8	
20 x 18	15	14 1/2	4	
24 x 10	17	15 1/8	28	
24 x 12	17	15 5/8	24	
24 x 14	17	16	20	
24 x 16	17	16	16	
24 x 18	17	16 1/2	12	
24 x 20	17	17	8	

For O.D., I.D., wall thickness T and gauge number, see page 32.

WEIGHTS*—LADISH TUBE O.D. BUTT WELDING FITTINGS

TUBE O.D. SIZE	90° ELBOW		45° ELBOW	180° RETURN		TEE (54000)	CROSS (54200)	LAP JOINT STUB END (57000)	FLARED NIPPLE (57100)	LATERAL (54400)	CAP (55500)	ADAPTER (55800)
	LONG RADIUS (50000)	SHORT RADIUS (51000)	LONG RADIUS (50100)	LONG RADIUS (50200)	SHORT RADIUS (51200)							
3/4	.08	...	.04	.13	...	.14	.16	.06	.12	.25	.03	.07
1	.13	...	.08	.26	...	.28	.33	.12	.18	.54	.05	.14
1 1/4	.22	...	.08	.36	...	.38	.45	.15	.24	.74	.07	.19
1 1/2	.29	...	.15	.58	...	.46	.60	.21	.32	1.58	.09	.28
2	.52	...	.26	1.06	...	.98	1.90	.28	.48	1.66	.12	.42
2 1/2	.87	...	.44	1.76	...	1.32	1.38	.40	.76	2.56	.29	.49
3	1.53	...	.77	3.08	...	1.76	2.11	.70	1.08	3.90	.33	.91
4	2.85	...	1.43	5.66	...	2.89	3.40	1.04	1.58	6.52	.56	1.33
5	5.91	3.82	2.96	11.82	7.64	5.47	6.41	2.00	3.05	11.76	1.00	...
6	8.53	5.51	4.26	17.06	11.02	7.16	8.26	2.45	5.45	15.25	1.80	...
8	17.00	10.82	8.50	34.00	21.64	13.22	15.68	3.85	6.40	27.70	3.00	...
10	20.25	18.90	10.13	40.50	37.80	22.40	25.41	5.80	7.95	46.50	5.80	...
12	29.10	27.30	14.55	58.20	54.60	32.70	37.44	6.60	9.15	62.73	8.10	...
14	38.00	37.20	19.00	76.00	74.40	44.00	30.10	8.35	10.05	84.30	10.80	...
16	51.90	48.70	25.95	103.80	97.40	57.54	65.50	9.40	10.95	106.00	13.50	...
18	65.50	61.65	32.75	131.00	123.30	72.70	83.00	...	13.40	132.50	17.00	...
20	82.00	76.20	41.00	164.00	152.40	91.00	104.00	...	15.60	165.00	20.80	...
24	118.00	109.80	59.00	236.00	219.60	131.00	150.00	...	23.05	238.00	29.00	...

TUBE O.D. SIZE	REDUCING TEE (54100)	REDUCING CROSS (54300)	REDUCERS (55000) (55100)	
1	x 1/2	.24	.27	.08
	x 3/4	.25	.29	.05
1 1/4	x 1/2	.34	.36	.12
	x 3/4	.36	.42	.11
	x 1	.39	.49	.06
1 1/2	x 1/2	.38	.44	.21
	x 3/4	.40	.51	.18
	x 1	.41	.52	.13
	x 1 1/4	.43	.53	.08
2	x 3/4	.80	1.02	.48
	x 1	.86	1.05	.33
	x 1 1/4	.90	1.07	.40
	x 1 1/2	.94	1.09	.27
	x 2	1.07	1.33	.26
2 1/2	x 1	.93	.99	.66
	x 1 1/4	.96	1.02	.44
	x 1 1/2	.98	1.10	.44
	x 2	1.07	1.33	.26
3	x 1 1/4	1.48	1.62	1.03
	x 1 1/2	1.53	1.65	.93
	x 2	1.55	1.84	.60
	x 2 1/2	1.84	1.92	.38
4	x 1 1/2	2.40	2.43	1.89
	x 2	2.48	2.55	1.66

TUBE O.D. SIZE	REDUCING TEE (54100)	REDUCING CROSS (54300)	REDUCERS (55000) (55100)	
4	x 2 1/2	2.40	2.51	1.35
	x 3	2.73	2.68	.97
5	x 2	4.55	4.65	2.02
	x 2 1/2	4.32	4.47	1.80
	x 3	4.44	4.93	1.53
	x 4	4.71	5.14	.86
6	x 2 1/2	5.75	5.90	2.85
	x 3	6.10	6.30	2.60
	x 4	5.80	6.25	1.92
8	x 5	5.85	6.15	1.06
	x 3	10.40	11.00	6.70
	x 4	10.90	11.20	5.19
10	x 5	11.00	11.65	3.92
	x 6	10.55	10.75	3.03
	x 4	19.20	15.00	10.33
12	x 5	18.60	18.80	13.32
	x 6	18.50	18.50	9.85
	x 8	18.20	18.00	4.43
	x 5	26.80	26.95	14.64
14	x 6	26.75	25.95	13.28
	x 8	26.40	26.20	8.86
	x 10	28.60	30.70	5.41
14	x 6	38.70	39.50	19.68
	x 8	38.30	38.70	16.24

TUBE O.D. SIZE	REDUCING TEE (54100)	REDUCING CROSS (54300)	REDUCERS (55000) (55100)	
14	x 10	38.65	39.40	11.81
	x 12	38.95	40.00	6.40
16	x 6	47.45	47.60	27.06
	x 8	47.55	47.80	23.62
	x 10	47.90	48.60	19.19
	x 12	46.40	45.50	13.78
	x 14	51.15	55.00	7.38
18	x 8	60.20	60.60	31.98
	x 10	60.55	61.35	27.55
	x 12	59.00	58.05	22.14
	x 14	61.65	63.50	15.75
	x 16	59.65	59.80	8.37
20	x 8	74.20	74.60	41.33
	x 10	74.60	75.35	36.90
	x 12	74.70	75.75	31.49
	x 14	74.65	75.50	25.10
	x 16	73.80	73.80	17.71
24	x 18	73.85	73.80	9.35
	x 10	101.20	101.90	58.55
	x 12	101.30	102.20	53.14
	x 14	101.25	102.10	46.74
	x 16	100.35	100.35	39.36
24	x 18	100.30	100.30	31.00
	x 20	100.40	100.40	21.65

* Approximate weight in pounds. For dimensions, see pages 32-34.

LADISH

ASA, MSS
LIGHT TAPER END
CORROSION WEIGHT

- 1 **HEAT CODE PROTECTION**—Heat code symbol makes available certified metallurgical reports attesting chemical composition and physical properties of specific heat of Stainless Steel used in that particular flange.
- 2 **FULL FLANGE THICKNESS**—Applicable specifications are met or exceeded in providing ample strength to withstand bolting strain.
- 3 **ACCURATE BOLT HOLE LOCATION**—Simultaneous drilling with precision jigs and multi-spindle machines assures positive matching of holes when flanges are mated.
- 4 **SPOT OR BACK FACED**—True bolting surfaces, machined without affecting minimum flange thickness, seat bolt heads and nuts squarely.
- 5 **TRUE GEOMETRIC ACCURACY**—Machining with precision fixtures assures that flange bore is always at right angles to gasket face.
- 6 **MACHINED WELDING BEVELS**—Accurately machined bevels and lands make full-circle contact with pipe for sound welds and smooth joints.
- 7 **SMOOTH BORE INTERIORS**—Minimum resistance to flow is provided in Ladish flanges by smooth, accurate bores.

- 8 **STRONG, FULL-SIZE HUBS**—Maximum strength at point of greatest stress is assured by full-sized hubs which fully meet applicable standards.
- 9 **TRUE FINISHED FACES**—Ladish flanges are machined for sure gasket seating... are available in standard facings and commonly used finishes.
- 10 **REFINED GRAIN STRUCTURE**—Dense, homogeneous grain of Ladish forged flanges assures maximum dynamic strength, toughness and resistance to distortion.
- 11 **CONTROLLED GRAIN FLOW**—Ladish forging techniques assure proper grain flow for maximum strength in stressed areas.
- 12 **PROPER IDENTIFICATION**—Size, pressure rating, material specification, the Ladish name, heat code symbol and trademark are permanently marked on each Ladish flange... except as restricted by applicable standards or limitations of available space or efficient manufacturing processes.
- 13 **CONTROLLED QUALITY**—This trademark is visual evidence of conformity to high standards of Ladish manufacturing and metallurgical quality.

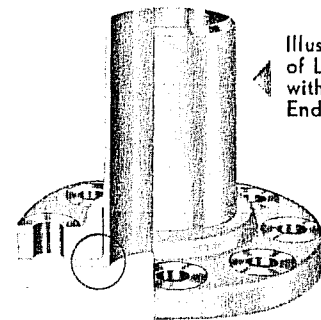
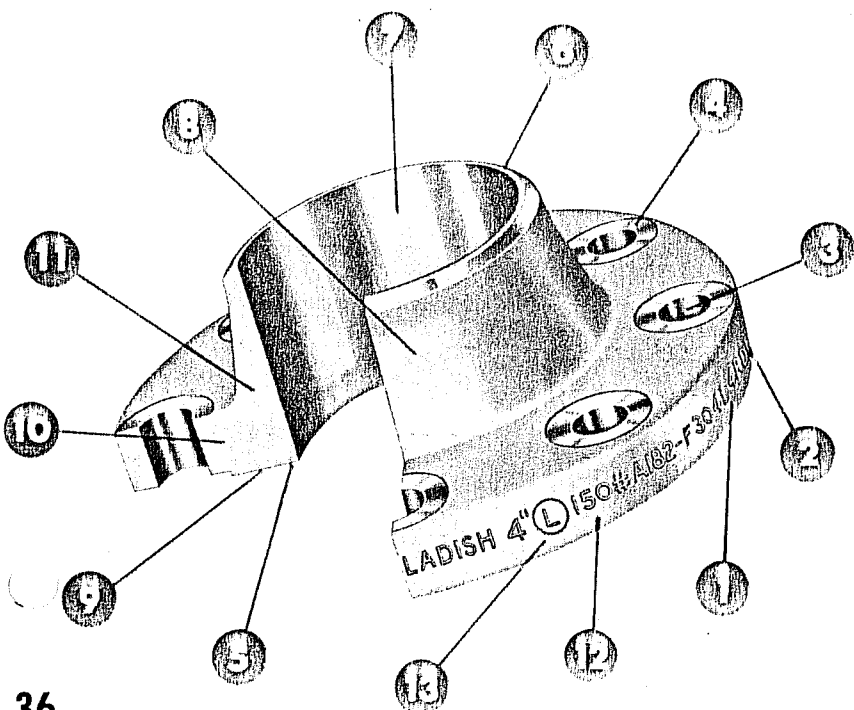
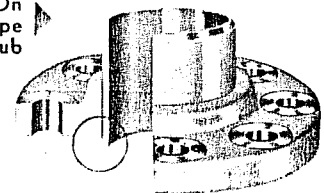


Illustration shows use of Lap Joint Flange with Lap Joint Stub End.

Illustrated here is the use of a Slip-On Flange with a Type B Lap Joint Stub End.



STAINLESS STEEL FLANGES

1 IPS BUTT WELDING FITTINGS

Pages 20-21

2 TUBE O.D. BUTT WELDING FITTINGS

Pages 30-31

3 ASA MSS LIGHT TYPE and CORROSION WEIGHT FLANGES

Pages 36-37

4 SCREWED and SOCKET WELDING FITTINGS

Pages 56-60

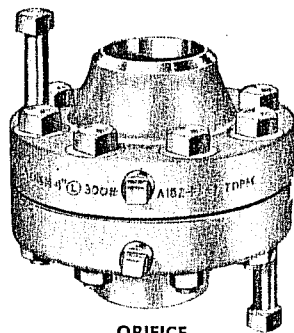
5 PART NUMBER and PRODUCT INDEX

Sections 1 through 4

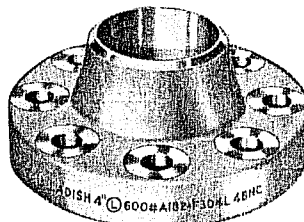
6 TECHNICAL DATA

Page 71—

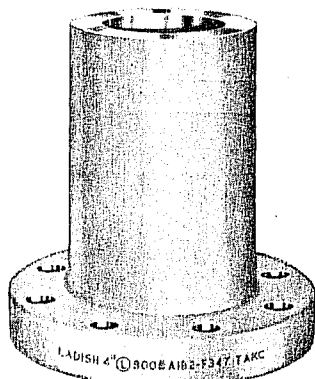
7 OTHER PRODUCTS, SUPPLEMENTAL DATA



ORIFICE
FLANGES



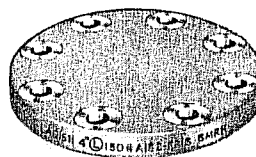
WELDING NECK
FLANGE



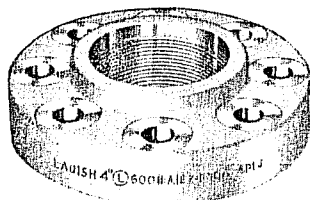
LONG NECK
FLANGE



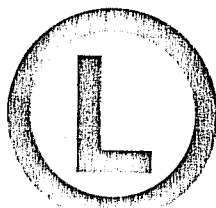
LAP JOINT
FLANGE



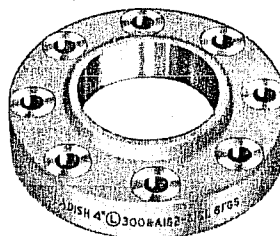
BLIND
FLANGE



THREADED
FLANGE



TO MARK PROGRESS



SLIP-ON
FLANGE

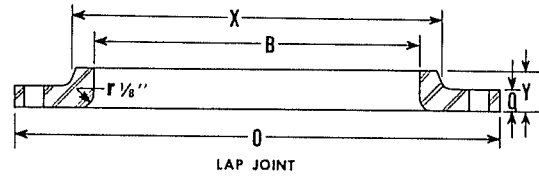
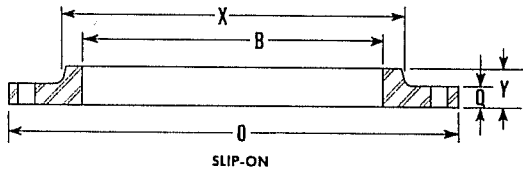
ASA FLANGES—These forged Stainless Steel flanges fully meet all requirements of ASA B16.5. This standard covers flanges with a variety of standard facings having Primary Service Pressure Ratings ranging from 150 psi through 2500 psi and suitable for operating pressures up to 6000 psi and operating temperatures up to 1500° F.

MSS FLANGES—These flanges comply in general with MSS Standard Practice SP-42 for Cast Stainless Steel Flanges. The drilling is identical to that of the 125 pound flanges of ASA Standard B16.1 and the 150 pound flanges of ASA Standard B16.5. Although not covered by SP-42, Slip-On and Welding Neck Flanges are available, with the Slip-On Flanges having the same basic dimensions as the Threaded Flange . . . and with the Welding Neck Flange having the same overall length as that of the 150 pound flange of ASA B16.5. MSS Flanges are normally used where factors of pressure and temperature are not important considerations.

LIGHT TYPE FLANGES (TUBE O.D.)—These light type forged flanges have the same drilling as ASA 125 pound and 150 pound flanges. They are available in Carbon or Stainless Steel for use with Lap Joint Stub Ends or Flared Nipples in low pressure piping systems.

CORROSION WEIGHT FLANGES (IPS)—Corrosion Weight Flanges provide the advantages of a forging, are lighter in weight than 150 pound ASA B16.5 flanges . . . and when used with full face gaskets permit pressures approaching those of the 150 pound ASA flange.

LADISH TUBE O.D. LIGHT TYPE FORGED FLANGES



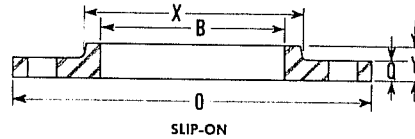
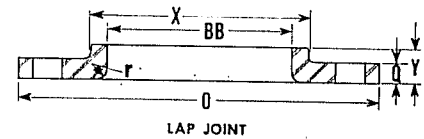
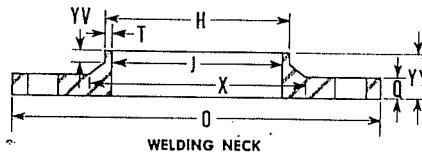
PART NUMBERS	SLIP-ON	LAP JOINT
	12411	15111

NOMINAL PIPE SIZE	SLIP-ON AND LAP JOINT						
	O	O	X	NUMBER AND DIAMETER OF BOLT HOLES	BOLT CIRCLE	Y	B
1/2	3 1/2	3/8	1 3/16	4- 5/8	2 3/8	9/16	.563
3/4	3 7/8	3/8	1 1/2	4- 5/8	2 3/4	9/16	.813
1	4 1/4	3/8	1 15/16	4- 5/8	3 1/8	9/16	1.063
1 1/4	4 5/8	3/8	2 5/16	4- 5/8	3 1/2	5/8	1.313
1 1/2	5	3/8	2 9/16	4- 5/8	3 7/8	5/8	1.563
2	6	7/16	3 1/16	4- 3/4	4 3/4	3/4	2.063
2 1/2	7	7/16	3 9/16	4- 3/4	5 1/2	3/4	2.563
3	7 1/2	1/2	4 1/4	4- 3/4	6	7/8	3.063
4	9	1/2	5 5/16	8- 3/4	7 1/2	7/8	4.063
5	10	9/16	6 7/16	8- 7/8	8 1/2	7/8	5.063
6	11	9/16	7 9/16	8- 7/8	9 1/2	1 1/4	6.063
8	13 1/2	9/16	9 11/16	8- 7/8	11 3/4	1 1/4	8.063
10	16	1 1/16	12	12-1	14 1/4	1 1/4	10.063
12	19	1 1/16	14 3/8	12-1	17	1 1/4	12.063
14	21	3/4	15 3/4	12-1 1/8	18 3/4	1 1/4	14.063
16	23 1/2	3/4	18	16-1 1/8	21 1/4	1 1/4	16.063
18	25	3/4	19 7/8	16-1 1/4	22 3/4	1 1/4	18.063
20	27 1/2	3/4	22	20-1 1/4	25	1 1/4	20.063
24	32	1	26 1/8	20-1 3/8	29 1/2	1 3/4	24.063

Drilling and O.D. match ASA B16.5-150 lb. Steel Flange Standard, MSS SP-42-150 lb. Corrosion Resistant Valve Standard and ASA B16.1-125 lb. Cast Iron Flange Standard.

+ Bolt holes are 1/8" larger in diameter than recommended bolt. Available in Carbon, Stainless Steel and other alloys.

LADISH IPS CORROSION WEIGHT FORGED FLANGES



PART NUMBERS	WELDING NECK	SLIP-ON	LAP JOINT
	11013	12013	15013

NOMINAL PIPE SIZE	COMMON DIMENSIONS					WELDING NECK					SLIP-ON LAP JOINT			
	O	J	X	NUMBER AND DIAMETER OF BOLT HOLES*	BOLT CIRCLE	YY	J	H	T	VV	Y	B	BB	r
1/2	3 1/2	3/8	1 3/16	4- 5/8	2 3/8	7/8	.67	.84	.083	1/4	9/16	.88	.90	1/8
3/4	3 7/8	3/8	1 1/2	4- 5/8	2 3/4	7/8	.88	1.05	.083	1/4	9/16	1.09	1.11	1/8
1	4 1/4	3/8	1 15/16	4- 5/8	3 1/8	7/8	1.09	1.32	.109	1/4	9/16	1.36	1.38	1/8
1 1/4	4 5/8	3/8	2 5/16	4- 5/8	3 1/2	7/8	1.44	1.66	.109	1/4	5/8	1.70	1.72	3/16
1 1/2	5	3/8	2 9/16	4- 5/8	3 3/8	7/8	1.68	1.90	.109	1/4	5/8	1.95	1.97	1/4
2	6	7/16	3 1/16	4- 3/4	4 3/4	1	2.15	2.38	.109	1/4	3/4	2.44	2.46	5/16
2 1/2	7	7/16	3 9/16	4- 3/4	5 1/2	1	2.63	2.88	.120	5/16	3/4	2.94	2.97	5/16
3	7 1/2	1/2	4 1/4	4- 3/4	6	1 1/8	3.26	3.50	.120	5/16	7/8	3.57	3.60	3/8
3 1/2	8 1/2	1/2	4 13/16	8- 3/4	7	1 1/8	3.76	4.00	.120	5/16	7/8	4.07	4.10	3/8
4	9	1/2	5 5/16	8- 3/4	7 1/2	1 1/8	4.26	4.50	.120	5/16	7/8	4.57	4.60	7/16
5	10	9/16	6 7/16	8- 7/8	8 1/2	1 1/4	5.29	5.56	.134	5/16	7/8	5.66	5.69	7/16
6	11	9/16	7 9/16	8- 7/8	9 1/2	1 1/4	6.35	6.63	.134	5/16	1 1/4	6.72	6.75	1/2
8	13 1/2	9/16	9 11/16	8- 7/8	11 3/4	1 1/4	8.33	8.63	.148	5/16	1 1/4	8.72	8.75	1/2
10	16	1 1/16	12	12-1	14 1/4	1 3/8	10.42	10.75	.165	3/8	1 1/4	10.88	10.92	1/2
12	19	1 1/16	14 3/8	12-1	17	1 3/8	12.39	12.75	.180	3/8	1 1/4	12.88	12.92	1/2

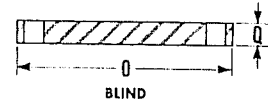
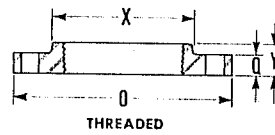
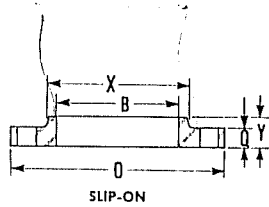
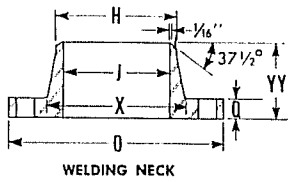
Drilling and O.D. match ASA B16.5-150 lb. Steel Flange Standard, MSS SP-42-150 lb. Corrosion Resistant Valve Standard and ASA B16.1-125 lb. Cast Iron Flange Standard.

For Slip-On and Lap Joint Flanges sizes 14" through 24", refer to page 38.

* Bolt holes are 1/8" larger in diameter than recommended bolt. Available in Carbon, Stainless Steel and other alloys.

* Welding Neck Flanges are bored to match Schedule 10S pipe unless otherwise specified.

LADISH MSS 150 POUND FLANGES



PART NUMBERS	WELDING NECK	SLIP-ON	THREADED	BLIND
	11014	12014	13014	16014

NOMINAL PIPE SIZE	COMMON DIMENSIONS					WELDING NECK			SLIP-ON THREADED	SLIP-ON
	O	B	X	NUMBER AND DIAMETER OF BOLT HOLES*	BOLT CIRCLE	YY	H	J	Y	B
1/2	3 1/2	5/16	1 3/16	4- 5/8	2 3/8	1 7/8	.84	.62	5/8	.88
3/4	3 7/8	1 1/32	1 1/2	4- 5/8	2 3/4	2 1/16	1.05	.82	5/8	1.09
1	4 1/4	3/8	1 15/16	4- 5/8	3 1/8	2 3/16	1.32	1.05	1 1/16	1.36
1 1/2	4 5/8	13/32	2 5/16	4- 5/8	3 1/2	2 1/4	1.66	1.38	1 3/16	1.70
1 1/2	5	7/16	2 9/16	4- 5/8	3 7/8	2 7/16	1.90	1.61	7/8	1.95
2	6	1/2	3 1/16	4- 3/4	4 3/4	2 1/2	2.38	2.07	1	2.44
2 1/2	7	9/16	3 9/16	4- 3/4	5 1/2	2 3/4	2.88	2.47	1 1/8	2.94
3	7 1/2	5/8	4 1/4	4- 3/4	6	2 3/4	3.50	3.07	1 3/16	3.57
4	9	1 1/16	5 5/16	8- 3/4	7 1/2	3	4.50	4.03	1 5/16	4.57
5	10	3/4	6 7/16	8- 7/8	8 1/2	3 1/2	5.56	5.05	1 7/16	5.66
6	11	13/16	7 9/16	8- 7/8	9 1/2	3 1/2	6.63	6.07	1 9/16	6.72
8	13 1/2	15/16	9 11/16	8- 7/8	11 3/4	4	8.63	7.98	1 3/4	8.72
10	16	1	12	12-1	14 1/4	4	10.75	10.02	1 15/16	10.88
12	19	1 1/16	14 3/8	12-1	17	4 1/2	12.75	12.00	2 3/16	12.88

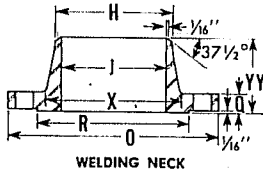
Thicknesses conform to MSS Standards. Diameter and Drillings conform to ASA and MSS Standards.

* Bolt holes are 1/8" larger in diameter than recommended bolt.

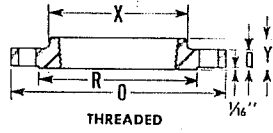
MSS Standard SP-42 does not at publication date include Welding Neck and Slip-On Flanges.

* Welding Neck Flanges are bored to I.D. of standard weight pipe unless otherwise specified.

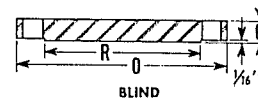
LADISH ASA 150 POUND FORGED FLANGES



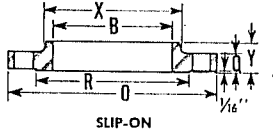
WELDING NECK



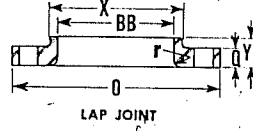
THREADED



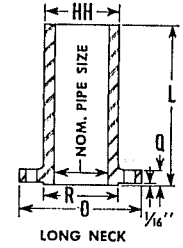
BLIND



SLIP-ON



LAP JOINT



LONG NECK

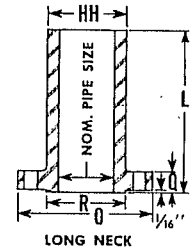
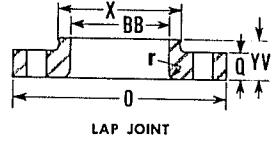
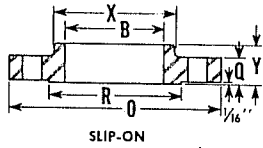
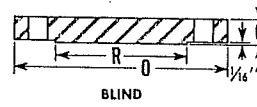
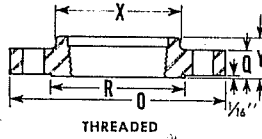
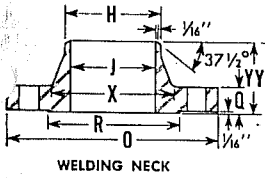
PART NUMBERS	WELDING NECK	SLIP-ON	THREADED	LAP JOINT	BLIND	LONG NECK
	11015	12015	13015	15015	16015	15915

NOMINAL PIPE SIZE	COMMON DIMENSIONS						WELDING NECK		SLIP-ON THREADED	SLIP-ON	LAP JOINT			LONG NECK		
	O	O*	R	X	NUMBER AND DIAMETER OF BOLT HOLES†	BOLT CIRCLE	YY*	H	J	Y*	B	T	YY	BB	HH	L*
1/2	3 1/2	7/16	1 3/8	1 3/16	4- 5/8	2 3/8	1 7/8	.84	.62	5/8	.88	1/8	5/8	.90	...	...
3/4	3 7/8	1/2	1 11/16	1 1/2	4- 5/8	2 3/4	2 1/16	1.05	.82	5/8	1.09	1/8	5/8	1.11	...	...
1	4 1/4	9/16	2	1 15/16	4- 5/8	3 1/8	2 3/16	1.32	1.05	1 1/16	1.36	1/8	1 1/16	1.38	2	9
1 1/4	4 5/8	5/8	2 1/2	2 5/16	4- 5/8	3 1/2	2 1/4	1.66	1.38	1 3/16	1.70	3/16	1 3/16	1.72	2 3/8	9
1 1/2	5	1 1/16	2 7/8	2 9/16	4- 5/8	3 7/8	2 7/16	1.90	1.61	7/8	1.95	1/4	7/8	1.97	2 5/8	9
2	6	3/4	3 5/8	3 1/16	4- 3/4	4 3/4	2 1/2	2.38	2.07	1	2.44	5/16	1	2.46	3 1/4	9
2 1/2	7	7/8	4 1/8	3 9/16	4- 3/4	5 1/2	2 3/4	2.88	2.47	1 1/8	2.94	5/16	1 1/8	2.97	3 3/4	9
3	7 1/2	1 5/16	5	4 1/4	4- 3/4	6	2 3/4	3.50	3.07	1 3/16	3.57	3/8	1 3/16	3.60	4 1/4	9
3 1/2	8 1/2	1 5/16	5 1/2	4 13/16	8- 3/4	7	2 13/16	4.00	3.55	1 1/4	4.07	3/8	1 1/4	4.10	4 7/8	9
4	9	1 5/16	6 3/16	5 5/16	8- 3/4	7 1/2	3	4.50	4.03	1 5/16	4.57	7/16	1 5/16	4.60	5 1/2	12
5	10	1 5/16	7 5/16	6 7/16	8- 7/8	8 1/2	3 1/2	5.56	5.05	1 7/16	5.66	7/16	1 7/16	5.69	6 1/2	12
6	11	1	8 1/2	7 9/16	8- 7/8	9 1/2	3 1/2	6.63	6.07	1 9/16	6.72	1/2	1 9/16	6.75	7 3/4	12
8	13 1/2	1 1/8	10 5/8	9 11/16	8- 7/8	11 3/4	4	8.63	7.98	1 3/4	8.72	1/2	1 3/4	8.75	9 3/4	12
10	16	1 3/16	12 3/4	12	12-1	14 1/4	4	10.75	10.02	1 15/16	10.88	1/2	1 15/16	10.92	12	12
12	19	1 1/4	15	14 3/8	12-1	17	4 1/2	12.75	12.00	2 3/16	12.88	1/2	2 3/16	12.92	14 3/8	12
14	21	1 3/8	16 1/4	15 3/4	12-1 1/8	18 3/4	5	14.00	AS SPECIFIED BY PURCHASER	2 1/4	14.14	1/2	3 1/8*	14.18	16	12
16	23 1/2	1 7/16	18 1/2	18	16-1 1/8	21 1/4	5	16.00		2 1/2	16.16	1/2	3 7/16*	16.19	18	12
18	25	1 9/16	21	19 7/8	16-1 1/4	22 3/4	5 1/2	18.00		2 11/16	18.18	1/2	3 13/16*	18.20	20	12
20	27 1/2	1 11/16	23	22	20-1 1/4	25	5 11/16	20.00		2 7/8	20.20	1/2	4 1/16*	20.25	22	12
24	32	1 7/8	27 1/4	26 1/8	20-1 3/8	29 1/2	6	24.00		3 1/4	24.25	1/2	4 3/8*	24.25	26 1/4	12

Flanges conform to ASA B16.5. Neck section of Long Neck Flange is not covered.
 * 1/8" raised face is included in thickness O and length through hub Y, YY and L.
 † Unless otherwise specified Welding Neck Flanges in sizes 12" and smaller are bored to dimensions as listed to correspond to Schedule 40S pipe. Special bores on application. Sizes 14" and larger—bore to be specified by purchaser.

* Lap Joint Flanges in sizes 14" through 24" are stocked to Y dimensions. Lap Joint Flanges with hub dimensions as listed available on special order.
 † Bolt holes are 1/8" larger in diameter than recommended bolt.
 WHERE EXTERNAL CORROSION IS NOT A FACTOR, FLANGES ARE AVAILABLE IN CARBON STEEL IN THE DIMENSIONS LISTED FOR USE WITH STAINLESS STEEL LAP JOINT STUB ENDS.

LADISH ASA 300 POUND FORGED FLANGES



PART NUMBERS	WELDING NECK	SLIP-ON	THREADED	LAP JOINT	BLIND	LONG NECK
	11030	12030	13030	15030	16030	15930

NOMINAL PIPE SIZE	COMMON DIMENSIONS						WELDING NECK			SLIP-ON THREADED	SLIP-ON	LAP JOINT*		LONG NECK		
	O	O*	R	X	NUMBER AND DIAMETER OF BOLT HOLES	BOLT CIRCLE	YY*	H	J*	Y*	B	r	YV	BB	HH	L*
1/2	3 3/4	9/16	1 3/8	1 1/2	4- 5/8	2 5/8	2 1/16	.84	.62	7/8	.88	1/8	7/8	.90	...	...
3/4	4 5/8	5/8	1 11/16	1 7/8	4- 3/4	3 1/4	2 1/4	1.05	.82	1	1.09	1/8	1	1.11	...	...
1	4 7/8	1 1/16	2	2 1/8	4- 3/4	3 1/2	2 7/16	1.32	1.05	1 1/16	1.36	1/8	1 1/16	1.38	2 1/8	9
1 1/4	5 1/4	3/4	2 1/2	2 1/2	4- 3/4	3 7/8	2 9/16	1.66	1.38	1 1/16	1.70	3/16	1 1/16	1.72	2 1/2	9
1 1/2	6 1/8	13/16	2 7/8	2 3/4	4- 7/8	4 1/2	2 11/16	1.90	1.61	1 3/16	1.95	1/4	1 3/16	1.97	2 3/4	9
2	6 1/2	7/8	3 5/8	3 5/16	8- 3/4	5	2 3/4	2.38	2.07	1 5/16	2.44	5/16	1 5/16	2.46	3 1/4	9
2 1/2	7 1/2	1	4 1/8	3 15/16	8- 7/8	5 7/8	3	2.88	2.47	1 1/2	2.94	5/16	1 1/2	2.97	3 15/16	9
3	8 1/4	1 1/8	5	4 5/8	8- 7/8	6 5/8	3 1/8	3.50	3.07	1 11/16	3.57	3/8	1 11/16	3.60	4 5/8	9
3 1/2	9	1 3/16	5 1/2	5 1/4	8- 7/8	7 1/4	3 3/16	4.00	3.55	1 3/4	4.07	3/8	1 3/4	4.10	5 1/4	9
4	10	1 1/4	6 3/16	5 3/4	8- 7/8	7 7/8	3 3/8	4.50	4.03	1 7/8	4.57	7/16	1 7/8	4.60	5 3/4	12
5	11	1 3/8	7 5/16	7	8- 7/8	9 1/4	3 7/8	5.56	5.05	2	5.66	7/16	2	5.69	7	12
6	12 1/2	1 7/16	8 1/2	8 1/8	12- 7/8	10 5/8	3 7/8	6.63	6.07	2 1/16	6.72	1/2	2 1/16	6.75	8 1/8	12
8	15	1 5/8	10 5/8	10 1/4	12-1	13	4 3/8	8.63	7.98	2 7/16	8.72	1/2	2 7/16	8.75	10 1/4	12
10	17 1/2	1 7/8	12 3/4	12 5/8	16-1 1/8	15 1/4	4 5/8	10.75	10.02	2 5/8	10.88	1/2	3 3/4*	10.92	12 5/8	12
12	20 1/2	2	15	14 3/4	16-1 1/4	17 3/4	5 1/8	12.75	12.00	2 7/8	12.88	1/2	4*	12.92	14 3/4	12
14	23	2 1/8	16 1/4	16 3/4	20-1 1/4	20 1/4	5 5/8	14.00	AS SPECIFIED BY PURCHASER	3	14.14	1/2	4 3/8*	14.18	16 3/4	12
16	25 1/2	2 1/4	18 1/2	19	20-1 3/8	22 1/2	5 3/4	16.00		3 1/4	16.16	1/2	4 3/4*	16.19	19	12
18	28	2 3/8	21	21	24-1 3/8	24 3/4	6 1/4	18.00		3 1/2	18.18	1/2	5 1/8*	18.20	21	12
20	30 1/2	2 1/2	23	23 1/8	24-1 3/8	27	6 3/8	20.00		3 3/4	20.20	1/2	5 1/2*	20.25	23 1/8	12
24	36	2 3/4	27 1/4	27 5/8	24-1 5/8	32	6 5/8	24.00		4 3/16	24.25	1/2	6*	24.25	27 5/8	12

Flanges conform to ASA B16.5. Neck section of Long Neck Flange is not covered.

* 1/16" raised face is included in thickness Q and length through hub Y, YY and L.

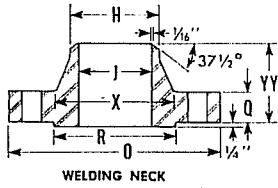
Unless otherwise specified Welding Neck Flanges in sizes 12" and smaller are bored to dimensions as listed to correspond to Schedule 40S pipe. Special bores on application. Sizes 14" and larger—bore to be specified by purchaser.

* Lap Joint Flanges in sizes 10" through 24" are stocked to Y dimensions. Lap Joint Flanges with hub dimensions as listed available on special order.

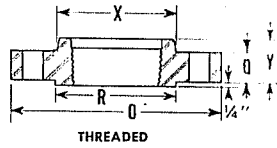
* Bolt holes are 1/8" larger in diameter than recommended bolt.

WHERE EXTERNAL CORROSION IS NOT A FACTOR, FLANGES ARE AVAILABLE IN CARBON STEEL IN THE DIMENSIONS LISTED FOR USE WITH STAINLESS STEEL LAP JOINT STUB ENDS.

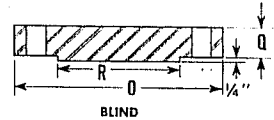
LADISH ASA 600 POUND FORGED FLANGES



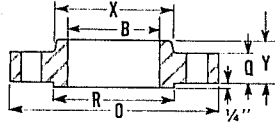
WELDING NECK



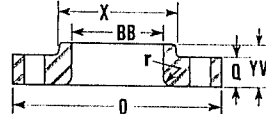
THREADED



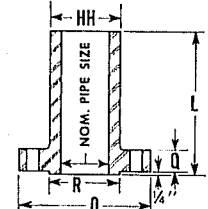
BLIND



SLIP-ON



LAP JOINT



LONG NECK

PART NUMBERS	WELDING NECK	SLIP-ON	THREADED	LAP JOINT	BLIND	LONG NECK
	11050	12050	13050	15050	16050	15950

NOMINAL PIPE SIZE	COMMON DIMENSIONS						WELDING NECK			SLIP-ON THREADED	SLIP-ON	LAP JOINT*			LONG NECK	
	B	Q*	R	X	NUMBER AND DIAMETER OF BOLT HOLES*	BOLT CIRCLE	YY*	H	J	Y*	B	T	YV	BB	HH	L*
1/2	3 3/4	9/16	1 3/8	1 1/2	4- 5/8	2 5/8	2 1/16	.84	.55	7/8	.88	1/8	7/8	.90	...	...
3/4	4 5/8	5/8	1 11/16	1 7/8	4- 3/4	3 1/4	2 1/4	1.05	.74	1	1.09	1/8	1	1.11	...	...
1	4 7/8	1 1/16	2	2 1/8	4- 3/4	3 1/2	2 7/16	1.32	.96	1 1/16	1.36	1/8	1 1/16	1.38	2 1/8	9
1 1/4	5 1/4	1 3/16	2 1/2	2 1/2	4- 3/4	3 7/8	2 5/8	1.66	1.28	1 1/8	1.70	3/16	1 1/8	1.72	2 1/2	9
1 1/2	6 1/8	7/8	2 7/8	2 3/4	4- 7/8	4 1/2	2 3/4	1.90	1.50	1 1/4	1.95	1/4	1 1/4	1.97	2 3/4	9
2	6 1/2	1	3 5/8	3 5/16	8- 3/4	5	2 7/8	2.38	1.94	1 7/16	2.44	5/16	1 7/16	2.46	3 1/4	9
2 1/2	7 1/2	1 1/8	4 1/8	3 15/16	8- 7/8	5 7/8	3 1/8	2.88	2.32	1 5/8	2.94	5/16	1 5/8	2.97	3 15/16	9
3	8 1/4	1 1/4	5	4 5/8	8- 7/8	6 5/8	3 1/4	3.50	2.90	1 13/16	3.57	3/8	1 13/16	3.60	4 5/8	9
3 1/2	9	1 3/8	5 1/2	5 1/4	8-1	7 1/4	3 3/8	4.00	3.36	1 15/16	4.07	3/8	1 15/16	4.10	5 1/4	9
4	10 3/4	1 1/2	6 3/16	6	8-1	8 1/2	4	4.50	3.83	2 1/8	4.57	7/16	2 1/8	4.60	6	12
5	13	1 3/4	7 5/16	7 7/16	8-1 1/8	10 1/2	4 1/2	5.56	4.81	2 3/8	5.66	7/16	2 3/8	5.69	7 1/2	12
6	14	1 7/8	8 1/2	8 3/4	12-1 1/8	11 1/2	4 5/8	6.63	5.76	2 5/8	6.72	1/2	2 5/8	6.75	8 3/4	12
8	16 1/2	2 3/16	10 5/8	10 3/4	12-1 1/4	13 3/4	5 1/4	8.63	7.63	3	8.72	1/2	3	8.75	10 3/4	12
10	20	2 1/2	12 3/4	13 1/2	16-1 3/8	17	6	10.75	9.75	3 3/8	10.88	1/2	4 3/8*	10.92	13 1/2	12
12	22	2 5/8	15	15 3/4	20-1 3/8	19 1/4	6 1/8	12.75	11.75	3 5/8	12.88	1/2	4 5/8*	12.92	15 3/4	12
14	23 3/4	2 3/4	16 1/4	17	20-1 1/2	20 3/4	6 1/2	14.00		3 11/16	14.14	1/2	5*	14.18	17	12†
16	27	3	18 1/2	19 1/2	20-1 5/8	23 3/4	7	16.00		4 3/16	16.16	1/2	5 1/2*	16.19	19 1/2	12†
18	29 1/4	3 1/4	21	21 1/2	20-1 3/4	25 3/4	7 1/4	18.00		4 5/8	18.18	1/2	6*	18.20	21 1/2	12†
20	32	3 1/2	23	24	24-1 3/4	28 1/2	7 1/2	20.00		5	20.20	1/2	6 1/2*	20.25	24	12†
24	37	4	27 1/4	28 1/4	24-2	33	8	24.00		5 1/2	24.25	1/2	7 1/4*	24.25	28 1/4	12†

Flanges conform to ASA B16.5. Neck section of Long Neck Flange is not covered.
 * 1/4" raised face is not included in thickness Q and length through hub Y and YY but is included in length L.

† Unless otherwise specified Welding Neck Flanges in sizes 12" and smaller are bored to dimensions as listed to correspond to Schedule 80S pipe. Special bores on application. Sizes 14" and larger—bore to be specified by purchaser.

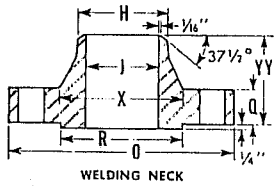
+ Bolt holes are 1/8" larger in diameter than recommended bolt.

* Lap Joint Flanges in sizes 10" through 24" are stocked to Y dimensions. Lap Joint Flanges with hub dimensions as listed available on special order.

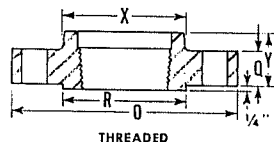
† Furnished 12", 14", 16", 18" or 20" long. Long Necks of greater length than listed are available on special order.

WHERE EXTERNAL CORROSION IS NOT A FACTOR, FLANGES ARE AVAILABLE IN CARBON STEEL IN THE DIMENSIONS LISTED FOR USE WITH STAINLESS STEEL LAP JOINT STUB ENDS.

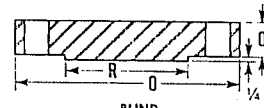
LADISH ASA 900 POUND FORGED FLANGES



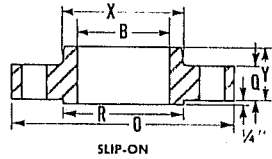
WELDING NECK



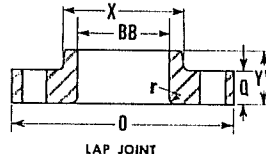
THREADED



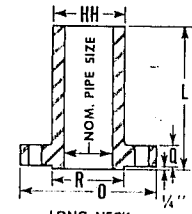
BLIND



SLIP-ON



LAP JOINT



LONG NECK

PART NUMBERS	WELDING NECK	SLIP-ON	THREADED	LAP JOINT	BLIND	LONG NECK
	11059	12059	13059	15059	16059	15959

NOMINAL PIPE SIZE	COMMON DIMENSIONS						WELDING NECK			SLIP-ON, THREADED	SLIP-ON	LAP JOINT*			LONG NECK	
	O	O*	R	X	NUMBER AND DIAMETER OF BOLT HOLES†	BOLT CIRCLE	YY*	H	J	Y*	B	r	YY	BB	HH	L*
† 1/2	4 3/4	7/8	1 3/8	1 1/2	4 - 7/8	3 1/4	2 3/8	.84		1 1/4	.88	1/8	1 1/4	.90	...	...
† 3/4	5 1/8	1	1 11/16	1 3/4	4 - 7/8	3 1/2	2 3/4	1.05		1 3/8	1.09	1/8	1 3/8	1.11	...	...
† 1	5 7/8	1 1/8	2	2 1/16	4-1	4	2 7/8	1.32		1 5/8	1.36	1/8	1 5/8	1.38	2 1/16	9
† 1 1/4	6 1/4	1 1/8	2 1/2	2 1/2	4-1	4 3/8	2 7/8	1.66		1 5/8	1.70	3/16	1 5/8	1.72	2 1/2	9
† 1 1/2	7	1 1/4	2 7/8	2 3/4	4-1 1/8	4 7/8	3 1/4	1.90		1 3/4	1.95	1/4	1 3/4	1.97	2 3/4	9
† 2	8 1/2	1 1/2	3 5/8	4 1/8	8-1	6 1/2	4	2.38	AS SPECIFIED BY PURCHASER	2 1/4	2.44	5/16	2 1/4	2.46	4 1/8	9
† 2 1/2	9 5/8	1 5/8	4 1/8	4 7/8	8-1 1/8	7 1/2	4 1/8	2.88		2 1/2	2.94	5/16	2 1/2	2.97	4 7/8	12
3	9 1/2	1 1/2	5	5	8-1	7 1/2	4	3.50		2 1/8	3.57	3/8	2 1/8	3.60	5	12
4	11 1/2	1 3/4	6 3/16	6 1/4	8-1 1/4	9 1/4	4 1/2	4.50		2 3/4	4.57	7/16	2 3/4	4.60	6 1/4	12
5	13 3/4	2	7 5/16	7 1/2	8-1 3/8	11	5	5.56		3 1/8	5.66	7/16	3 1/8	5.69	7 1/2	12
6	15	2 3/16	8 1/2	9 1/4	12-1 1/4	12 1/2	5 1/2	6.63		3 3/8	6.72	1/2	3 3/8	6.75	9 1/4	12
8	18 1/2	2 1/2	10 5/8	11 3/4	12-1 1/2	15 1/2	6 3/8	8.63		4	8.72	1/2	4 1/2*	8.75	11 3/4	12
10	21 1/2	2 3/4	12 3/4	14 1/2	16-1 1/2	18 1/2	7 1/4	10.75		4 1/4	10.88	1/2	5*	10.92	14 1/2	16
12	24	3 1/8	15	16 1/2	20-1 1/2	21	7 7/8	12.75		4 5/8	12.88	1/2	5 5/8*	12.92	16 1/2	16
14	25 1/4	3 3/8	16 1/4	17 3/4	20-1 5/8	22	8 3/8	14.00		5 1/8	14.14	1/2	6 1/8*	14.18	17 3/4	12†
16	27 3/4	3 1/2	18 1/2	20	20-1 3/4	24 1/4	8 1/2	16.00		5 1/4	16.16	1/2	6 1/2*	16.19	20	12†
18	31	4	21	22 1/4	20-2	27	9	18.00		6	18.18	1/2	7 1/2*	18.20	22 1/4	12†
20	33 3/4	4 1/4	23	24 1/2	20-2 1/8	29 1/2	9 3/4	20.00		6 1/4	20.20	1/2	8 1/4*	20.25	24 1/2	12†
24	41	5 1/2	27 1/4	29 1/2	20-2 5/8	35 1/2	11 1/2	24.00		8	24.25	1/2	10 1/2*	24.25	29 1/2	12†

Flanges conform to ASA B16.5. Neck section of Long Neck Flange is not covered.
 * 1/4" raised face is not included in thickness Q and length through hub Y and YY but is included in length L.

† Furnished 12", 14", 16", 18" or 20" long. Long Necks of greater length than listed are available on special order.

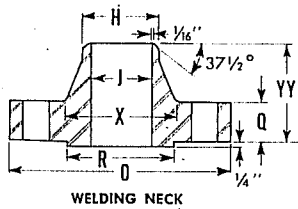
‡ Bolt holes are 1/8" larger in diameter than recommended bolt.

WHERE EXTERNAL CORROSION IS NOT A FACTOR, FLANGES ARE AVAILABLE IN CARBON STEEL IN THE DIMENSIONS LISTED FOR USE WITH STAINLESS STEEL LAP JOINT STUB ENDS.

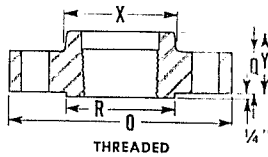
44 † These dimensions are the same as for 1500 pound flanges.

* Lap Joint Flanges in sizes 8" through 24" are stocked to Y dimensions. Lap Joint Flanges with hub dimensions as listed available on special order.

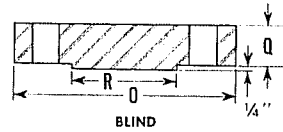
LADISH ASA 1500 POUND FORGED FLANGES



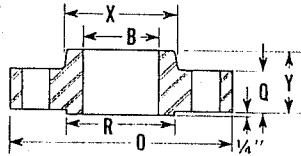
WELDING NECK



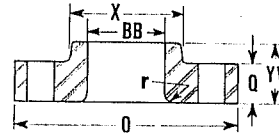
THREADED



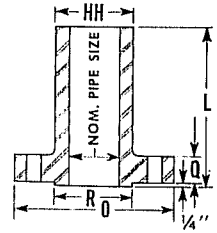
BLIND



SLIP-ON



LAP JOINT



LONG NECK

PART NUMBERS	WELDING NECK	SLIP-ON	THREADED	LAP JOINT	BLIND	LONG NECK
	11065	12065	13065	15065	16065	15965

NOMINAL PIPE SIZE	COMMON DIMENSIONS						WELDING NECK			SLIP-ON, THREADED	SLIP-ON	LAP JOINT*			LONG NECK	
	B	Q*	H	X	NUMBER AND DIAMETER OF BOLT HOLES†	BOLT CIRCLE	YY*	H	J	Y*	B	T	YV	BB	HH	L*
1/2	4 3/4	7/8	1 3/8	1 1/2	4- 7/8	3 1/4	2 3/8	.84		1 1/4	.88	1/8	1 1/4	.90	...	...
3/4	5 1/8	1	1 11/16	1 3/4	4- 7/8	3 1/2	2 3/4	1.05		1 3/8	1.09	1/8	1 3/8	1.11	...	...
1	5 7/8	1 1/8	2	2 1/16	4-1	4	2 7/8	1.32		1 5/8	1.36	1/8	1 5/8	1.38	2 1/16	9
1 1/4	6 1/4	1 1/8	2 1/2	2 1/2	4-1	4 3/8	2 7/8	1.66		1 5/8	1.70	3/16	1 5/8	1.72	2 1/2	9
1 1/2	7	1 1/4	2 7/8	2 3/4	4-1 1/8	4 7/8	3 1/4	1.90		1 3/4	1.95	1/4	1 3/4	1.97	2 3/4	9
2	8 1/2	1 1/2	3 5/8	4 1/8	8-1	6 1/2	4	2.38		2 1/4	2.44	5/16	2 1/4	2.46	4 1/8	9
2 1/2	9 5/8	1 5/8	4 1/8	4 7/8	8-1 1/8	7 1/2	4 1/8	2.88		2 1/2	2.94	5/16	2 1/2	2.97	4 7/8	12
3	10 1/2	1 7/8	5	5 1/4	8-1 1/4	8	4 5/8	3.50		2 7/8	3.57	3/8	2 7/8	3.60	5 1/4	12
4	12 1/4	2 1/8	6 3/16	6 3/8	8-1 3/8	9 1/2	4 7/8	4.50	AS SPECIFIED BY PURCHASER	3 9/16	4.57	7/16	3 9/16	4.60	6 3/8	12
5	14 3/4	2 7/8	7 5/16	7 3/4	8-1 5/8	11 1/2	6 1/8	5.56		4 1/8	5.66	7/16	4 1/8	5.69	7 3/4	12
6	15 1/2	3 1/4	8 1/2	9	12-1 1/2	12 1/2	6 3/4	6.63		4 11/16	6.72	1/2	4 11/16	6.75	9	12
8	19	3 5/8	10 5/8	11 1/2	12-1 3/4	15 1/2	8 3/8	8.63		5 5/8	8.72	1/2	5 5/8	8.75	11 1/2	12
10	23	4 1/4	12 3/4	14 1/2	12-2	19	10	10.75		6 1/4	10.88	1/2	7*	10.92	14 1/2	16
12	26 1/2	4 7/8	15	17 3/4	16-2 1/8	22 1/2	11 1/8	12.75		7 1/8	12.88	1/2	8 5/8*	12.92	17 3/4	16
14	29 1/2	5 1/4	16 1/4	19 1/2	16-2 3/8	25	11 3/4	14.00		...	...	1/2	9 1/2*	14.18	19 1/2	12†
16	32 1/2	5 3/4	18 1/2	21 3/4	16-2 5/8	27 3/4	12 1/4	16.00		...	...	1/2	10 1/4*	16.19	21 3/4	12†
18	36	6 3/8	21	23 1/2	16-2 7/8	30 1/2	12 7/8	18.00		...	...	1/2	10 7/8*	18.20	23 1/2	12†
20	38 3/4	7	23	25 1/4	16-3 1/8	32 3/4	14	20.00		...	...	1/2	11 1/2*	20.25	25 1/4	12†
24	46	8	27 1/4	30	16-3 5/8	39	16	24.00		...	...	1/2	13*	24.25	30	12†

Flanges conform to ASA B16.5. Dimensions listed for Slip-On Flanges in sizes 3" and larger are not covered in the standard for 1500 pound flanges but are in general agreement with ASA B16.5. Neck section of Long Neck Flange is not covered.

* 1/4" raised face is not included in thickness Q and length through hub Y and YY but is included in length L.

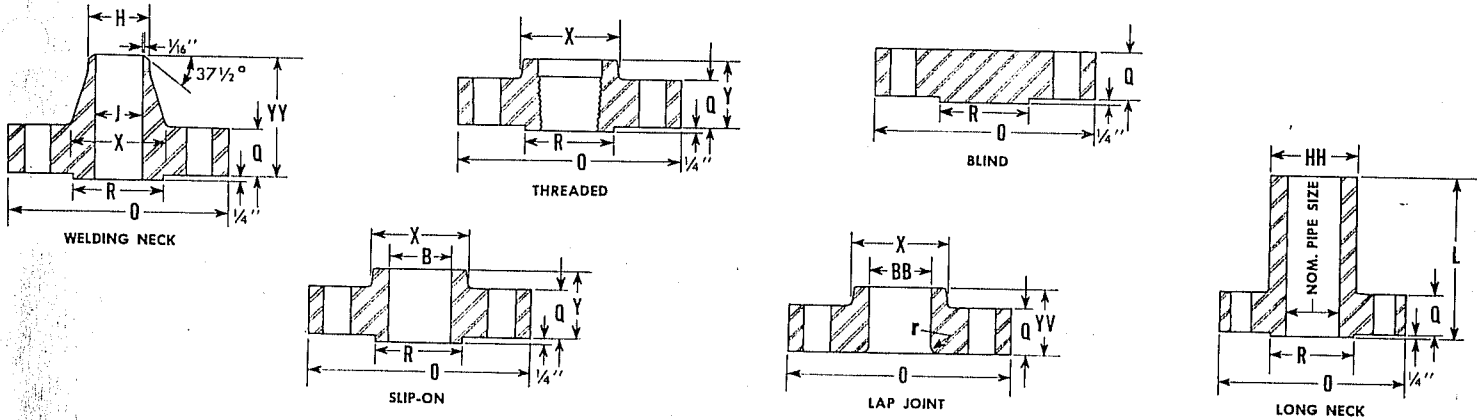
* Lap Joint Flanges in sizes 10" through 24" are stocked to Y dimensions. Lap Joint Flanges with hub dimensions as listed available on special order.

† Furnished 12", 14", 16", 18" or 20" long. Long Necks of greater length than listed are available on special order.

† Bolt holes are 1/8" larger in diameter than recommended bolt.

WHERE EXTERNAL CORROSION IS NOT A FACTOR, FLANGES ARE AVAILABLE IN CARBON STEEL IN THE DIMENSIONS LISTED FOR USE WITH STAINLESS STEEL LAP JOINT STUB ENDS.

LADISH ASA 2500 POUND FORGED FLANGES



PART NUMBERS	WELDING NECK	SLIP-ON	THREADED	LAP JOINT	BLIND	LONG NECK
	11075	12075	13075	15075	16075	15975

NOMINAL PIPE SIZE	COMMON DIMENSIONS						WELDING NECK			SLIP-ON THREADED	SLIP-ON	LAP JOINT			LONG NECK	
	O	Q*	R	X	NUMBER AND DIAMETER OF BOLT HOLES	BOLT CIRCLE	YY*	H	J	Y*	B	r	YY	BB	HH	L*
1/2	5 1/4	1 3/16	1 3/8	1 11/16	4- 7/8	3 1/2	2 7/8	.84		1 9/16	.88	1/8	1 9/16	.90	...	...
3/4	5 1/2	1 1/4	1 11/16	2	4- 7/8	3 3/4	3 1/8	1.05		1 11/16	1.09	1/8	1 11/16	1.11	...	...
1	6 1/4	1 3/8	2	2 1/4	4-1	4 1/4	3 1/2	1.32		1 7/8	1.36	1/8	1 7/8	1.38	2 1/4	9
1 1/4	7 1/4	1 1/2	2 1/2	2 7/8	4-1 1/8	5 1/8	3 3/4	1.66		2 1/16	1.70	3/16	2 1/16	1.72	2 7/8	9
1 1/2	8	1 3/4	2 7/8	3 1/8	4-1 1/4	5 3/4	4 3/8	1.90		2 3/8	1.95	1/4	2 3/8	1.97	3 1/8	9
2	9 1/4	2	3 5/8	3 3/4	8-1 1/8	6 3/4	5	2.38		2 3/4	2.44	5/16	2 3/4	2.46	3 3/4	9
2 1/2	10 1/2	2 1/4	4 1/8	4 1/2	8-1 1/4	7 3/4	5 5/8	2.88	AS SPECIFIED BY PURCHASER	3 1/8	2.94	5/16	3 1/8	2.97	4 1/2	12
3	12	2 5/8	5	5 1/4	8-1 3/8	9	6 5/8	3.50		3 5/8	3.57	3/8	3 5/8	3.60	5 1/4	12
4	14	3	6 3/16	6 1/2	8-1 5/8	10 3/4	7 1/2	4.50		4 1/4	4.57	7/16	4 1/4	4.60	6 1/2	12
5	16 1/2	3 5/8	7 5/16	8	8-1 7/8	12 3/4	9	5.56		5 1/8	5.66	7/16	5 1/8	5.69	8	12
6	19	4 1/4	8 1/2	9 1/4	8-2 1/8	14 1/2	10 3/4	6.63		6	6.72	1/2	6	6.75	9 1/4	12
8	21 3/4	5	10 5/8	12	12-2 1/8	17 1/4	12 1/2	8.63		7	8.72	1/2	7	8.75	12	12
10	26 1/2	6 1/2	12 3/4	14 3/4	12-2 5/8	21 1/4	16 1/2	10.75		9	10.88	1/2	9	10.92	14 3/4	16
12	30	7 1/4	15	17 3/8	12-2 7/8	24 3/8	18 1/4	12.75		10	12.88	1/2	10	12.92	17 3/8	16

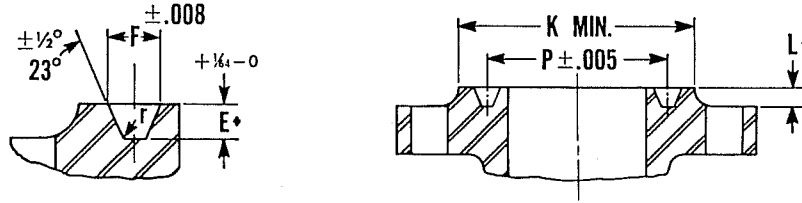
Flanges conform to ASA B16.5. Dimensions listed for Slip-On Flanges are not covered in the standard for 2500 pound flanges but are in general agreement with ASA B16.5. Neck section of Long Neck Flanges is not covered.

* Bolt holes are 1/8" larger in diameter than recommended bolt.

WHERE EXTERNAL CORROSION IS NOT A FACTOR, FLANGES ARE AVAILABLE IN CARBON STEEL IN THE DIMENSIONS LISTED FOR USE WITH STAINLESS STEEL LAP JOINT STUB ENDS.

16 * 1/4" raised face is not included in thickness Q and length through hub Y and YY but is included in length L.

RING JOINT FLANGE FACING DIMENSIONS



RING NUMBERS FOR RING JOINT FLANGES	NOMINAL PIPE SIZE	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
	150 LB.	...	...	R 15	R 17	R 19	R 22	R 25	R 29	R 33	R 36	R 40	R 43	R 48	R 52	R 56	R 59	R 64	R 68	R 72	R 76
	*300 LB.-600 LB.	R 11	R 13	R 16	R 18	R 20	R 23	R 26	R 31	R 34	R 37	R 41	R 45	R 49	R 53	R 57	R 61	R 65	R 69	R 73	R 77
	900 LB.	...	...	...	...	...	...	...	R 31	...	R 37	R 41	R 45	R 49	R 53	R 57	R 62	R 66	R 70	R 74	R 78
	1500 LB.	R 12	R 14	R 16	R 18	R 20	R 24	R 27	R 35	...	R 39	R 44	R 46	R 50	R 54	R 58	R 63	R 67	R 71	R 75	R 79
	2500 LB.	R 13	R 16	R 18	R 21	R 23	R 26	R 28	R 32	...	R 38	R 42	R 47	R 51	R 55	R 60	...	...	...	...	...

RING NUMBER	PITCH DIAM.	WIDTH OF GROOVE	DEPTH OF GROOVE	150 LB.		*300 LB.-600 LB.		900 LB.		1500 LB.		2500 LB.		RING NUMBER	
				RAISED FACE DIAM.	SPACE BETWEEN FLANGES	RAISED FACE DIAM.	SPACE BETWEEN FLANGES X*	RAISED FACE DIAM.	SPACE BETWEEN FLANGES	RAISED FACE DIAM.	SPACE BETWEEN FLANGES				
				K	X*	K	300 LB.	600 LB.	K	X*	K	X*			
R11	1 11/32	9/32	7/32	...	...	2	1/8	1/8	...	...	...	...	...	R11	
R12	1 9/16	1 1/32	1/4	...	...	...	...	...	...	...	2 3/8	5/32	...	R12	
R13	1 11/16	1 1/32	1/4	...	...	2 1/2	5/32	5/32	...	...	...	...	2 9/16	5/32	R13
R14	1 3/4	1 1/32	1/4	...	...	...	...	...	...	...	2 5/8	5/32	...	...	R14
R15	1 7/8	1 1/32	1/4	2 1/2	5/32	...	...	...	...	...	...	...	...	...	R15
R16	2	1 1/32	1/4	...	...	2 3/4	5/32	5/32	...	...	2 13/16	5/32	2 7/8	5/32	R16
R17	2 1/4	1 1/32	1/4	2 7/8	5/32	...	...	...	...	...	...	...	...	...	R17
R18	2 3/8	1 1/32	1/4	...	...	3 1/8	5/32	5/32	...	...	3 3/16	5/32	3 1/4	5/32	R18
R19	2 9/16	1 1/32	1/4	3 1/4	5/32	...	...	...	...	...	...	...	...	...	R19
R20	2 11/16	1 1/32	1/4	...	...	3 9/16	5/32	5/32	...	...	3 5/8	5/32	...	...	R20
R21	2 27/32	1 5/32	5/16	...	...	...	...	...	...	...	...	...	4	1/8	R21
R22	3 1/4	1 1/32	1/4	4	5/32	...	...	...	...	...	...	...	...	...	R22
R23	3 1/4	1 5/32	5/16	...	...	4 1/4	7/32	3/16	...	...	...	...	4 1/2	1/8	R23
R24	3 3/4	1 5/32	5/16	...	...	...	...	...	...	...	4 7/8	1/8	...	...	R24
R25	4	1 1/32	1/4	4 3/4	5/32	...	...	...	...	...	...	...	...	...	R25
R26	4	1 5/32	5/16	...	...	5	7/32	3/16	...	...	...	...	5 1/4	1/8	R26
R27	4 1/4	1 5/32	5/16	...	...	...	...	...	...	...	5 3/8	1/8	...	...	R27
R28	4 3/8	1 7/32	3/8	...	...	...	...	...	...	...	...	...	5 7/8	1/8	R28
R29	4 1/2	1 1/32	1/4	5 1/4	5/32	...	...	...	...	...	...	...	...	...	R29

Regularly cataloged flanges, except Lap Joint, can be furnished with Ring Joint facing. Flanges with Octagonal grooves will be supplied since Oval grooves are no longer standard. Either Oval or Octagonal rings can be used with flanges having Octagonal grooves, but Oval rings must be used with flanges having Oval grooves.

* Columns X show approximate distance between the faces of two Ring Joint Flanges, when ring is compressed.

The maximum corner radius "r" is 1/32" for groove widths of 1 1/2" and smaller, 1/16" for groove widths from 1 7/32" through 2 1/2" and 3/32" for groove widths larger than 1".

* The dimension of rings and grooves of Ring Joint Flanges rated at 300 and 600 lbs. are identical.

♦ Depth of groove is added to the minimum flange thickness. Raised face L is equal to the groove dimension E but is not subject to the tolerance for E.

RING JOINT FLANGE FACING DIMENSIONS (Cont.)

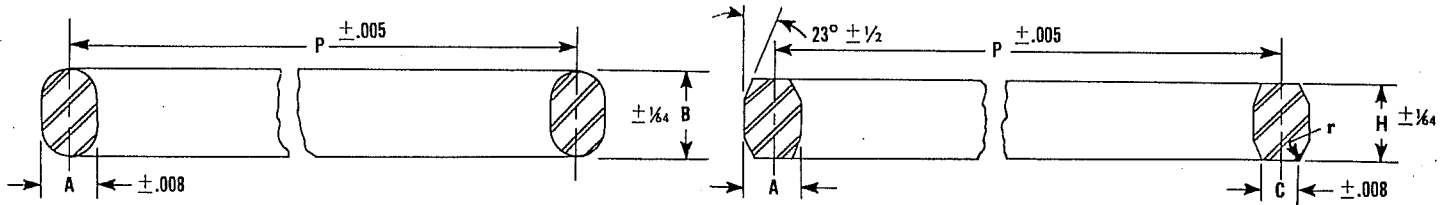
RING NUMBER	PITCH DIAM.	WIDTH OF GROOVE	DEPTH OF GROOVE	150 LB.		*300 LB. - 600 LB.			900 LB.		1500 LB.		2500 LB.		RING NUMBER
				RAISED FACE DIAM.	SPACE BETWEEN FLANGES	RAISED FACE DIAM.	SPACE BETWEEN FLANGES X*		RAISED FACE DIAM.	SPACE BETWEEN FLANGES	RAISED FACE DIAM.	SPACE BETWEEN FLANGES	RAISED FACE DIAM.	SPACE BETWEEN FLANGES	
				K	X*	K	300 LB.	600 LB.	K	X*	K	X*	K	X*	
R30†	4 ⁵ / ₈ †	1 ⁵ / ₃₂	5/16	...	...	...	...	...	...	...	...	...	...	...	R30†
R31	4 ⁷ / ₈	1 ⁵ / ₃₂	5/16	...	...	5 ³ / ₄	7/32	3/16	6 ¹ / ₈	5/32	...	...	...	...	R31
R32	5	1 ⁷ / ₃₂	3/8	...	...	...	...	...	...	...	...	...	6 ⁵ / ₈	1/8	R32
R33	5 ³ / ₁₆	1 ¹ / ₃₂	1/4	6 ¹ / ₁₆	5/32	...	...	...	...	...	...	...	...	...	R33
R34	5 ³ / ₁₆	1 ⁵ / ₃₂	5/16	...	...	6 ¹ / ₄	7/32	3/16	...	...	...	...	...	...	R34
R35	5 ³ / ₈	1 ⁵ / ₃₂	5/16	...	...	...	...	...	...	...	6 ⁵ / ₈	1/8	...	...	R35
R36	5 ⁷ / ₈	1 ¹ / ₃₂	1/4	6 ³ / ₄	5/32	...	...	...	...	...	...	...	...	...	R36
R37	5 ⁷ / ₈	1 ⁵ / ₃₂	5/16	...	...	6 ⁷ / ₈	7/32	3/16	7 ¹ / ₈	5/32	...	...	...	...	R37
R38	6 ³ / ₁₆	2 ¹ / ₃₂	7/16	...	...	...	...	...	...	...	...	...	8	5/32	R38
R39	6 ³ / ₈	1 ⁵ / ₃₂	5/16	...	...	...	...	...	...	...	7 ⁵ / ₈	1/8	...	...	R39
R40	6 ³ / ₄	1 ¹ / ₃₂	1/4	7 ⁵ / ₈	5/32	...	...	...	...	...	...	...	...	...	R40
R41	7 ¹ / ₈	1 ⁵ / ₃₂	5/16	...	...	8 ¹ / ₄	7/32	3/16	8 ¹ / ₂	5/32	...	...	...	...	R41
R42	7 ¹ / ₂	2 ⁵ / ₃₂	1/2	...	...	...	...	...	...	...	...	...	9 ¹ / ₂	5/32	R42
R43	7 ⁵ / ₈	1 ¹ / ₃₂	1/4	8 ⁵ / ₈	5/32	...	...	...	...	...	...	...	...	...	R43
R44	7 ⁵ / ₈	1 ⁵ / ₃₂	5/16	...	...	...	...	...	...	...	9	1/8	...	...	R44
R45	8 ⁵ / ₁₆	1 ⁵ / ₃₂	5/16	...	...	9 ¹ / ₂	7/32	3/16	9 ¹ / ₂	5/32	...	...	...	...	R45
R46	8 ⁵ / ₁₆	1 ⁷ / ₃₂	3/8	...	...	...	...	...	...	...	9 ³ / ₄	1/8	...	...	R46
R47	9	2 ⁵ / ₃₂	1/2	...	...	...	...	...	...	...	...	...	11	5/32	R47
R48	9 ³ / ₄	1 ¹ / ₃₂	1/4	10 ³ / ₄	5/32	...	...	...	...	...	...	...	...	...	R48
R49	10 ⁵ / ₈	1 ⁵ / ₃₂	5/16	...	...	11 ⁷ / ₈	7/32	3/16	12 ¹ / ₈	5/32	...	...	...	...	R49
R50	10 ⁵ / ₈	2 ¹ / ₃₂	7/16	...	...	...	...	...	...	...	12 ¹ / ₂	5/32	...	...	R50
R51	11	2 ⁹ / ₃₂	9/16	...	...	...	...	...	...	...	...	...	13 ³ / ₈	3/16	R51
R52	12	1 ¹ / ₃₂	1/4	13	5/32	...	...	...	...	...	...	...	...	...	R52
R53	12 ³ / ₄	1 ⁵ / ₃₂	5/16	...	...	14	7/32	3/16	14 ¹ / ₄	5/32	...	...	...	...	R53
R54	12 ³ / ₄	2 ¹ / ₃₂	7/16	...	...	...	...	...	...	...	14 ⁵ / ₈	5/32	...	...	R54
R55	13 ¹ / ₂	1 ³ / ₁₆	11/16	...	...	...	...	...	...	...	...	...	16 ³ / ₄	1/4	R55
R56	15	1 ¹ / ₃₂	1/4	16	5/32	...	...	...	...	...	...	...	...	...	R56
R57	15	1 ⁵ / ₃₂	5/16	...	...	16 ¹ / ₄	7/32	3/16	16 ¹ / ₂	5/32	...	...	...	...	R57
R58	15	2 ⁹ / ₃₂	9/16	...	...	...	...	...	...	...	17 ¹ / ₄	3/16	...	...	R58
R59	15 ⁵ / ₈	1 ¹ / ₃₂	1/4	16 ³ / ₄	1/8	...	...	...	...	...	...	...	...	...	R59
R60	16	1 ⁵ / ₁₆	11/16	...	...	...	...	...	...	...	...	...	19 ¹ / ₂	5/16	R60
R61	16 ¹ / ₂	1 ⁵ / ₃₂	5/16	...	...	18	7/32	3/16	...	...	...	...	...	...	R61
R62	16 ¹ / ₂	2 ¹ / ₃₂	7/16	...	...	...	...	...	18 ³ / ₈	5/32	...	...	...	...	R62
R63	16 ¹ / ₂	1 ¹ / ₁₆	5/8	...	...	...	...	...	...	...	19 ¹ / ₄	7/32	...	...	R63
R64	17 ⁷ / ₈	1 ¹ / ₃₂	1/4	19	1/8	...	...	...	...	...	...	...	...	...	R64
R65	18 ¹ / ₂	1 ⁵ / ₃₂	5/16	...	...	20	7/32	3/16	...	...	...	...	...	...	R65
R66	18 ¹ / ₂	2 ¹ / ₃₂	7/16	...	...	...	...	...	20 ⁵ / ₈	5/32	...	...	...	...	R66
R67	18 ¹ / ₂	1 ³ / ₁₆	11/16	...	...	...	...	...	...	...	21 ¹ / ₂	5/16	...	...	R67
R68	20 ³ / ₈	1 ¹ / ₃₂	1/4	21 ¹ / ₂	1/8	...	...	...	...	...	...	...	...	...	R68
R69	21	1 ⁵ / ₃₂	5/16	...	...	22 ⁵ / ₈	7/32	3/16	...	...	...	...	...	...	R69
R70	21	2 ⁵ / ₃₂	1/2	...	...	...	...	...	23 ³ / ₈	3/16	...	...	...	...	R70
R71	21	1 ³ / ₁₆	11/16	...	...	...	...	...	...	...	24 ¹ / ₈	5/16	...	...	R71
R72	22	1 ¹ / ₃₂	1/4	23 ¹ / ₂	1/8	...	...	...	...	...	...	...	...	...	R72
R73	23	1 ⁷ / ₃₂	3/8	...	...	25	7/32	3/16	...	...	...	...	...	...	R73
R74	23	2 ⁵ / ₃₂	1/2	...	...	...	...	...	25 ¹ / ₂	3/16	...	...	...	...	R74
R75	23	1 ⁵ / ₁₆	11/16	...	...	...	...	...	...	...	26 ¹ / ₂	3/8	...	...	R75
R76	26 ¹ / ₂	1 ¹ / ₃₂	1/4	28	1/8	...	...	...	...	...	...	...	...	...	R76
R77	27 ¹ / ₄	2 ¹ / ₃₂	7/16	...	...	29 ¹ / ₂	1/4	7/32	...	...	...	...	...	...	R77
R78	27 ¹ / ₄	1 ¹ / ₁₆	5/8	...	...	...	...	...	30 ³ / ₈	7/32	...	...	...	...	R78
R79	27 ¹ / ₄	1 ¹ / ₁₆	13/16	...	...	...	...	...	...	...	31 ¹ / ₄	7/16	...	...	R79

See other notes on preceding page.

† For ring joints in the Lap Joint Stub Ends used with 3" 300 and 600 pound Lap Joint

flanges, pitch diameter of ring should be 4⁷/₈" instead of 4⁵/₈" and the ring number R30 instead of R31.

DIMENSIONS OF RING JOINT GASKETS



RING NUMBER	PITCH DIAM. P	WIDTH OF RING A	HEIGHT OF RING		WIDTH OF FLAT ON OCTAGONAL RING C
			OVAL B	OCTAGONAL H	
R11	1 11/32	1/4	7/16	3/8	0.170
R12	1 9/16	5/16	9/16	1/2	0.206
R13	1 11/16	5/16	9/16	1/2	0.206
R14	1 3/4	5/16	9/16	1/2	0.206
R15	1 7/8	5/16	9/16	1/2	0.206
R16	2	5/16	9/16	1/2	0.206
R17	2 1/4	5/16	9/16	1/2	0.206
R18	2 3/8	5/16	9/16	1/2	0.206
R19	2 9/16	5/16	9/16	1/2	0.206
R20	2 11/16	5/16	9/16	1/2	0.206
R21	2 27/32	7/16	11/16	5/8	0.305
R22	3 1/4	5/16	9/16	1/2	0.206
R23	3 1/4	7/16	11/16	5/8	0.305
R24	3 3/4	7/16	11/16	5/8	0.305
R25	4	5/16	9/16	1/2	0.206
R26	4	7/16	11/16	5/8	0.305
R27	4 1/4	7/16	11/16	5/8	0.305
R28	4 3/8	1/2	3/4	11/16	0.341
R29	4 1/2	5/16	9/16	1/2	0.206
R30	4 5/8	7/16	11/16	5/8	0.305
R31	4 7/8	7/16	11/16	5/8	0.305
R32	5	1/2	3/4	11/16	0.341
R33	5 3/16	5/16	9/16	1/2	0.206
R34	5 3/16	7/16	11/16	5/8	0.305
R35	5 3/8	7/16	11/16	5/8	0.305
R36	5 7/8	5/16	9/16	1/2	0.206
R37	5 7/8	7/16	11/16	5/8	0.305
R38	6 3/16	5/8	7/8	13/16	0.413
R39	6 3/8	7/16	11/16	5/8	0.305
R40	6 3/4	5/16	9/16	1/2	0.206
R41	7 1/8	7/16	11/16	5/8	0.305
R42	7 1/2	3/4	1	15/16	0.485
R43	7 5/8	5/16	9/16	1/2	0.206
R44	7 5/8	7/16	11/16	5/8	0.305
R45	8 5/16	7/16	11/16	5/8	0.305

RING NUMBER	PITCH DIAM. P	WIDTH OF RING A	HEIGHT OF RING		WIDTH OF FLAT ON OCTAGONAL RING C
			OVAL B	OCTAGONAL H	
R46	8 5/16	1/2	3/4	11/16	0.341
R47	9	3/4	1	15/16	0.485
R48	9 3/4	5/16	9/16	1/2	0.206
R49	10 5/8	7/16	11/16	5/8	0.305
R50	10 5/8	5/8	7/8	13/16	0.413
R51	11	7/8	1 1/8	1 1/16	0.583
R52	12	5/16	9/16	1/2	0.206
R53	12 3/4	7/16	11/16	5/8	0.305
R54	12 3/4	5/8	7/8	13/16	0.413
R55	13 1/2	1 1/8	1 7/16	1 3/8	0.780
R56	15	5/16	9/16	1/2	0.206
R57	15	7/16	11/16	5/8	0.305
R58	15	7/8	1 1/8	1 1/16	0.583
R59	15 5/8	5/16	9/16	1/2	0.206
R60	16	1 1/4	1 9/16	1 1/2	0.879
R61	16 1/2	7/16	11/16	5/8	0.305
R62	16 1/2	5/8	7/8	13/16	0.413
R63	16 1/2	1	1 5/16	1 1/4	0.681
R64	17 7/8	5/16	9/16	1/2	0.206
R65	18 1/2	7/16	11/16	5/8	0.305
R66	18 1/2	5/8	7/8	13/16	0.413
R67	18 1/2	1 1/8	1 7/16	1 3/8	0.780
R68	20 3/8	5/16	9/16	1/2	0.206
R69	21	7/16	11/16	5/8	0.305
R70	21	3/4	1	15/16	0.485
R71	21	1 1/8	1 7/16	1 3/8	0.780
R72	22	5/16	9/16	1/2	0.206
R73	23	1/2	3/4	11/16	0.341
R74	23	3/4	1	15/16	0.485
R75	23	1 1/4	1 9/16	1 1/2	0.879
R76	26 1/2	5/16	9/16	1/2	0.206
R77	27 1/4	5/8	7/8	13/16	0.413
R78	27 1/4	1	1 5/16	1 1/4	0.681
R79	27 1/4	1 3/8	1 3/4	1 5/8	0.977
R80	24 1/4	5/16		1/2	0.206

The corner radius "r" is 1/16" for ring widths 7/8 inch and smaller and 3/32" for ring widths 1 inch and larger. The tolerance for these dimensions is ± 1/64".

Either Oval or Octagonal rings are suitable for use with Octagonal grooves which are standard. Oval rings are required for Oval grooves which are no longer standard.

AMERICAN STANDARD FLANGE FACINGS

The table below gives facing dimensions in accordance with ASA Standard B16.5-1953 for 150, 300, 600, 900, 1500 and 2500-Pound American Standard Flanges. The facings are shown on the opposite page. Complete ring joint facing dimensions are given on pages 47 and 48.

NOMINAL PIPE SIZE	OUTSIDE DIAMETER†			I. D. OF LARGE AND SMALL TONGUE†	OUTSIDE DIAMETER†			I. D. OF LARGE AND SMALL GROOVE*†	HEIGHT		DEPTH OF GROOVE OR FEMALE
	RAISED FACE, LAPPED, LARGE MALE AND LARGE TONGUE*	SMALL MALE**	SMALL TONGUE*		LARGE FEMALE AND LARGE GROOVE*	SMALL FEMALE**	SMALL GROOVE*		RAISED FACE 150 AND 300-LB. STD'S*	RAISED FACE, 600-2500-LB. STD'S* LARGE AND SMALL MALE AND TONGUE	
	R	S	T		U	W	X		Y	Z	
1/2	1 3/8	2 3/32	1 3/8	1	1 7/16	2 5/32	1 7/16	1 5/16	1/16	1/4	3/16
3/4	1 11/16	1 5/16	1 11/16	1 5/16	1 3/4	1	1 3/4	1 1/4	1/16	1/4	3/16
1	2	1 3/16	1 7/8	1 1/2	2 1/16	1 1/4	1 15/16	1 7/16	1/16	1/4	3/16
1 1/4	2 1/2	1 1/2	2 1/4	1 7/8	2 9/16	1 9/16	2 5/16	1 13/16	1/16	1/4	3/16
1 1/2	2 7/8	1 3/4	2 1/2	2 1/8	2 15/16	1 13/16	2 9/16	2 1/16	1/16	1/4	3/16
2	3 5/8	2 1/4	3 1/4	2 7/8	3 11/16	2 5/16	3 5/16	2 13/16	1/16	1/4	3/16
2 1/2	4 1/8	2 11/16	3 3/4	3 3/8	4 3/16	2 3/4	3 13/16	3 5/16	1/16	1/4	3/16
3	5	3 5/16	4 5/8	4 1/4	5 1/16	3 3/8	4 11/16	4 3/16	1/16	1/4	3/16
3 1/2	5 1/2	3 13/16	5 1/8	4 3/4	5 9/16	3 7/8	5 3/16	4 11/16	1/16	1/4	3/16
4	6 3/16	4 5/16	5 11/16	5 3/16	6 1/4	4 3/8	5 3/4	5 1/8	1/16	1/4	3/16
5	7 5/16	5 3/8	6 13/16	6 5/16	7 3/8	5 7/16	6 7/8	6 1/4	1/16	1/4	3/16
6	8 1/2	6 3/8	8	7 1/2	8 9/16	6 7/16	8 1/16	7 7/16	1/16	1/4	3/16
8	10 5/8	8 3/8	10	9 3/8	10 11/16	8 7/16	10 1/16	9 5/16	1/16	1/4	3/16
10	12 3/4	10 1/2	12	11 1/4	12 13/16	10 9/16	12 1/16	11 3/16	1/16	1/4	3/16
12	15	12 1/2	14 1/4	13 1/2	15 1/16	12 9/16	14 5/16	13 7/16	1/16	1/4	3/16
14	16 1/4	13 3/4	15 1/2	14 3/4	16 5/16	13 13/16	15 9/16	14 11/16	1/16	1/4	3/16
16	18 1/2	15 3/4	17 7/8	16 3/4	18 9/16	15 13/16	17 11/16	16 11/16	1/16	1/4	3/16
18	21	17 3/4	20 1/8	19 1/4	21 1/16	17 13/16	20 3/16	19 3/16	1/16	1/4	3/16
20	23	19 3/4	22	21	23 1/16	19 13/16	22 1/16	20 15/16	1/16	1/4	3/16
24	27 1/4	23 3/4	26 1/4	25 1/4	27 5/16	23 13/16	26 5/16	25 3/16	1/16	1/4	3/16

* Regular facing for 150 and 300-lb. steel flanged fittings and companion flange standards is a 1/16" raised face included in the minimum flange thickness. A 1/16" raised face may be supplied also on the 600, 900, 1500 and 2500-lb. flanges, but it must be added to the minimum thickness.

† Regular facing for 600, 900, 1500 and 2500-lb. flange standards is a 1/4" raised face not included in minimum thickness dimensions.

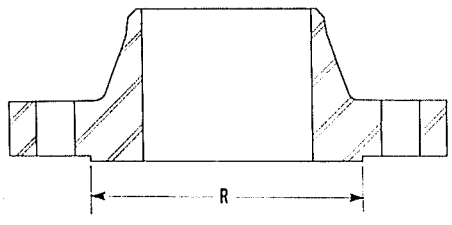
‡ A tolerance of ±1/4" is allowed on the inside and outside diameter of all facings.

• For small male and female joints these dimensions should be used with care to insure

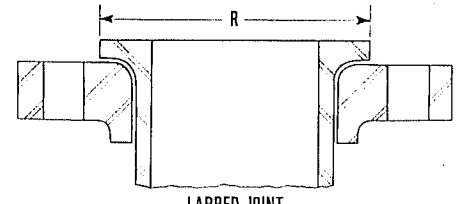
that pipe used is thick enough to provide sufficient bearing surface to prevent crushing of gasket. The dimensions apply particularly on lines where the joint is made on the end of the pipe. Threaded companion flanges for small male and female joints are furnished with plain face and are threaded with American Standard Locknut Thread.

* Gasket for male and female, and tongue and groove joints shall cover the bottom of the recess with minimum clearances, taking into account the 1/4" tolerance mentioned in preceding note.

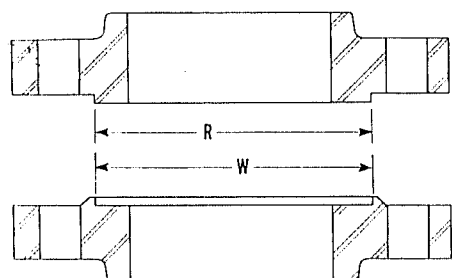
AMERICAN STANDARD FLANGE FACINGS



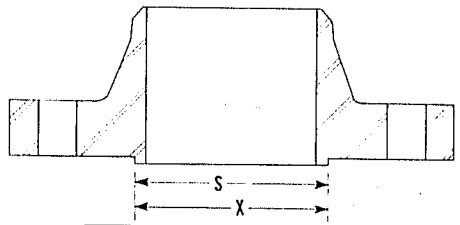
RAISED FACE



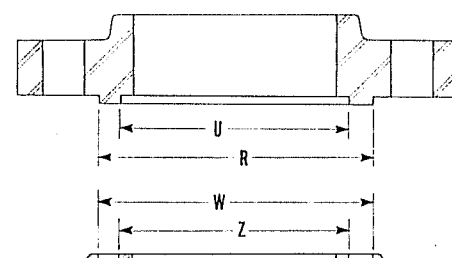
LAPPED JOINT



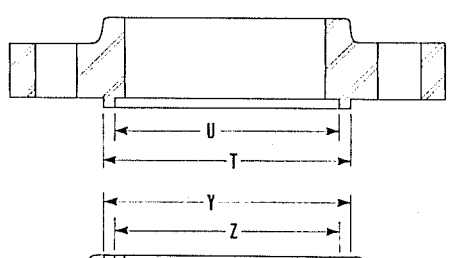
LARGE MALE AND FEMALE



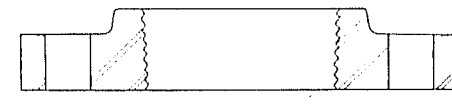
SMALL MALE AND FEMALE



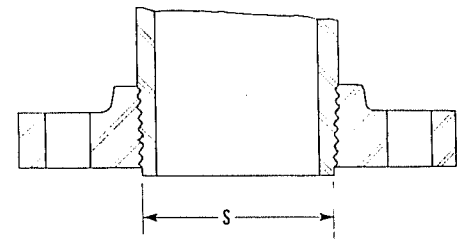
LARGE TONGUE AND GROOVE



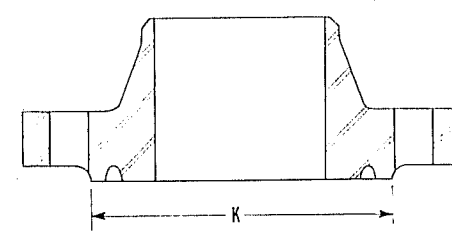
SMALL TONGUE AND GROOVE



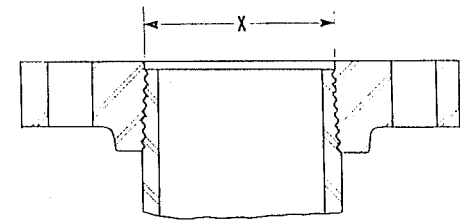
FLAT FACE



SMALL MALE AND FEMALE



RING JOINT



SMALL MALE AND FEMALE

See pages 47 and 48 for K dimensions.

WEIGHTS*—LADISH LIGHT TYPE TUBE O.D., CORROSION WEIGHT AND MSS FLANGES

TYPE	TUBE SIZE	SLIP-ON (12411)	LAP JOINT (15111)
LIGHT TYPE (TUBE O.D.) FLANGES For dimensions, see page 38	1/2	1	1
	3/4	1 1/4	1 1/4
	1	1 1/2	1 1/2
	1 1/4	2	2
	1 1/2	2 1/4	2 1/4
	2	3 1/2	3 1/2
	2 1/2	4 3/4	4 3/4
	3	6	6
	4	8 1/4	8 1/4
	5	10 1/4	10 1/4
	6	13 3/4	13 3/4
	8	19 1/2	19 1/2
	10	28 3/4	28 3/4
	12	40 3/4	40 3/4
	14	46	46
	16	56	56
18	56 1/4	56 1/4	
20	66 1/4	66 1/4	
24	112 3/4	112 3/4	

TYPE	NOMINAL PIPE SIZE	WELDING NECK (11013)	SLIP-ON (12013)	LAP JOINT (15013)
CORROSION WEIGHT (IPS) FLANGES For dimensions, see page 39	1/2	1	1	1
	3/4	1 1/4	1 1/4	1 1/4
	1	1 1/2	1 1/2	1 1/2
	1 1/4	2	1 3/4	1 3/4
	1 1/2	2 1/4	2	2
	2	3 1/2	3 1/4	3 1/4
	2 1/2	4 3/4	4 1/2	4 1/2
	3	6	5 1/2	5 1/2
	3 1/2	6 1/2	6	6
	4	7 3/4	7 1/4	7 1/4
	5	10 1/4	9 1/2	9 1/2
	6	12	11 1/4	11 1/4
8	16 3/4	16	16	
10	25	24	24	
12	35	34	34	

TYPE	NOMINAL PIPE SIZE	WELDING NECK (11014)	THREADED (13014)	SLIP-ON (12014)	BLIND (16014)
150 POUND MSS STANDARD FLANGES For dimensions, see page 40	1/2	1 1/2	3/4	3/4	3/4
	3/4	1 3/4	1	1	1
	1	2	1 1/2	1 1/2	1 1/2
	1 1/4	2 1/2	2	2	2
	1 1/2	3	2	2	2 1/2
	2	5	4	3 1/2	4
	2 1/2	8	6	5 1/2	6 1/4
	3	9	6 1/2	6 1/2	8
	4	14	10	10	12 3/4
	5	19	13	12 3/4	17 1/4
	6	24	15	14 1/2	22 1/2
	8	39	25	25	39
10	51	37	36	58	
12	84	58	56	87	

* Approximate weight in pounds.

WEIGHTS*—LADISH ASA 150 AND 300 POUND FORGED FLANGES

RATING	NOMINAL PIPE SIZE	WELDING NECK (11015)	SLIP ON (12015)	THREADED (13015)	LAP JOINT (15015)	BLIND (16015)	LONG NECK (15915)
150 POUND ASA FLANGES For dimensions, see page 41	1/2	2	1	1	1	2	...
	3/4	2	1 1/2	1 1/2	1 1/2	2	...
	1	2 1/2	2	2	2	2	8
	1 1/4	2 1/2	2 1/2	2 1/2	2 1/2	3	10
	1 1/2	4	3	3	3	3	12
	2	6	5	5	5	4	16
	2 1/2	10	8	8	8	7	21
	3	11 1/2	9	10	9	9	24
	3 1/2	12	11	12	11	13	31
	4	16 1/2	13	13	12	17	47
	5	21	15	15	13	20	57
	6	26	17	19 1/2	18	27	77
	8	42	28	30	28	47	103
	10	54	40	41	36	67	150
	12	88	61	65	60	123	215
	14	114	83	85	77	139	221
	16	142	106	93	104	187	254
18	165	109	120	146	217	278	
20	197	148	155	159	283	324	
24	268	204	210	195	415	439	

RATING	NOMINAL PIPE SIZE	WELDING NECK (11030)	SLIP ON (12030)	THREADED (13030)	LAP JOINT (15030)	BLIND (16030)	LONG NECK (15930)
300 POUND ASA FLANGES For dimensions, see page 42	1/2	2	1 1/2	1 1/2	1 1/2	2	...
	3/4	3	2 1/2	2 1/2	2 1/2	3	...
	1	4	3	3	3	4	10
	1 1/4	5	4 1/2	4 1/2	4 1/2	6	14
	1 1/2	7	6 1/2	6 1/2	6 1/2	7	17
	2	8	7	7	7	8	19
	2 1/2	12	10	10	10	12	28
	3	18	13	14	14 1/2	16	36
	3 1/2	20	16	16	16	21	45
	4	26 1/2	23 1/2	24	24	28	54
	5	36	29	31	26	37	86
	6	45	36	36	38	48	108
	8	69	56	56	55	79	150
	10	100	77	80	88	122	218
	12	142	113	110	139	183	289
	14	206	159	164	184	241	342
	16	249	210	220	234	315	426
18	306	253	280	305	414	493	
20	369	307	325	375	515	575	
24	519	490	490	530	800	823	

* Approximate weight in pounds.

WEIGHTS*—LADISH ASA 600 AND 900 POUND FORGED FLANGES

RATING	NOMINAL PIPE SIZE	WELDING NECK (11050)	SLIP-ON (12050)	THREADED (13050)	LAP JOINT (15050)	BLIND (16050)	LONG NECK (15950)
600 POUND ASA FLANGES For dimensions, see page 43	1/2	3	2	2	2	2	...
	3/4	3 1/2	3	3	3	3	...
	1	4	3 1/2	3 1/2	3 1/2	4	11
	1 1/4	5 1/2	4 1/2	4 1/2	4 1/2	6	14
	1 1/2	8	6 1/2	6 1/2	6 1/2	8	17
	2	10	8	8	8	10	21
	2 1/2	14	12	12	11	15	29
	3	18	15	15	14	20	38
	3 1/2	26	21	21	20	29	48
	4	37	33	33	31	41	80
	5	68	63	63	63	68	128
	6	73	80	80	78	86	158
	8	112	97	97	112	139	215
	10	189	177	177	195	231	324
	12	226	215	215	240	295	500
	14	347	259	259	290	378	417
	16	481	366	366	400	527	564
18	555	476	476	469	665	654	
20	690	612	612	604	855	840	
24	977	876	876	866	1175	1100	

RATING *	NOMINAL PIPE SIZE	WELDING NECK (11059)	SLIP-ON (12059)	THREADED (13059)	LAP JOINT (15059)	BLIND (16059)	LONG NECK (15959)
900 POUND ASA FLANGES For dimensions, see page 44	1/2	7	6	6	6	4	...
	3/4	7	6	6	6	6	...
	1	8 1/2	7 1/2	7 1/2	7 1/2	9	15
	1 1/4	10	10	10	10	10	18
	1 1/2	14	14	14	14	14	23
	2	24	25	25	21	25	44
	2 1/2	36	36	36	29	35	72
	3	29	31	31	25	32	65
	4	51	53	53	51	54	98
	5	86	83	83	81	87	143
	6	110	108	108	105	113	199
	8	187	172	172	188	197	310
	10	268	245	245	277	290	385
	12	372	326	326	371	413	667
	14	562	380	380	397	494	558
	16	685	459	459	488	619	670
	18	924	647	647	670	880	949
20	1164	792	792	868	1107	1040	
24	2107	1480	1480	1659	2099	1775	

*Approximate weight in pounds.

WEIGHTS*—LADISH ASA 1500 AND 2500 POUND FORGED FLANGES

RATING	NOMINAL PIPE SIZE	WELDING NECK (11065)	SLIP ON (12065)	THREADED (13065)	LAP JOINT (15065)	BLIND (16065)	LONG NECK (15965)
1500 POUND ASA FLANGES	1/2	7	6	6	6	4	...
	3/4	7	6	6	6	6	...
	1	8 1/2	7 1/2	7 1/2	7 1/2	9	15
	1 1/4	10	10	10	10	10	18
	1 1/2	14	14	14	14	14	23
	2	24	22	22	21	25	44
	2 1/2	36	36	36	29	35	72
	3	48	48	48	38	48	84
	4	69	73	73	75	73	118
	5	132	132	132	138	142	195
	6	164	164	164	170	159	235
	8	273	258	258	286	302	366
	10	454	436	436	485	507	610
	12	690	667	667	749	775	1028
	14		...	...			1030
16		WEIGHTS	...	WEIGHTS	WEIGHTS	1335	
18		ON	...	ON	ON	1750	
20		APPLICATION	...	APPLICATION	APPLICATION	2130	
24			...			3180	

For dimensions, see page 45

RATING	NOMINAL PIPE SIZE	WELDING NECK (11075)	SLIP ON (12075)	THREADED (13075)	LAP JOINT (15075)	BLIND (16075)	LONG NECK (15975)
2500 POUND ASA FLANGES	1/2	8	7	7	7	7	...
	3/4	9	9	9	8	10	...
	1	13	12	12	12	12	20
	1 1/4	20	18	18	17	18	30
	1 1/2	28	25	25	24	25	38
	2	42	38	38	37	39	55
	2 1/2	52	55	55	53	56	85
	3	94	83	83	80	86	125
	4	146	127	127	122	133	185
	5	244	210	210	204	223	300
	6	378	323	323	314	345	450
	8	576	485	485	471	533	600
	10	1068	925	925	897	1025	1150
12	1608	1300	1300	1262	1464	1560	

For dimensions, see page 46

* Approximate weight in pounds.

FOR SIMPLIFIED ASSEMBLY OF PIPING SYSTEMS IN SIZES 4" AND SMALLER

Ladish Screwed and Socket Welding Fittings are available in a wide range of ratings, types and material specifications . . . for service in lines 4" and smaller in size.

Screwed Fittings offer the flexibility and simplicity of a threaded connection in the assembly and disassembly of piping joints . . . while Socket Welding Fittings meet the need for easy-to-install, permanent, welded connections without the necessity of tack welding or clamping prior to welding.

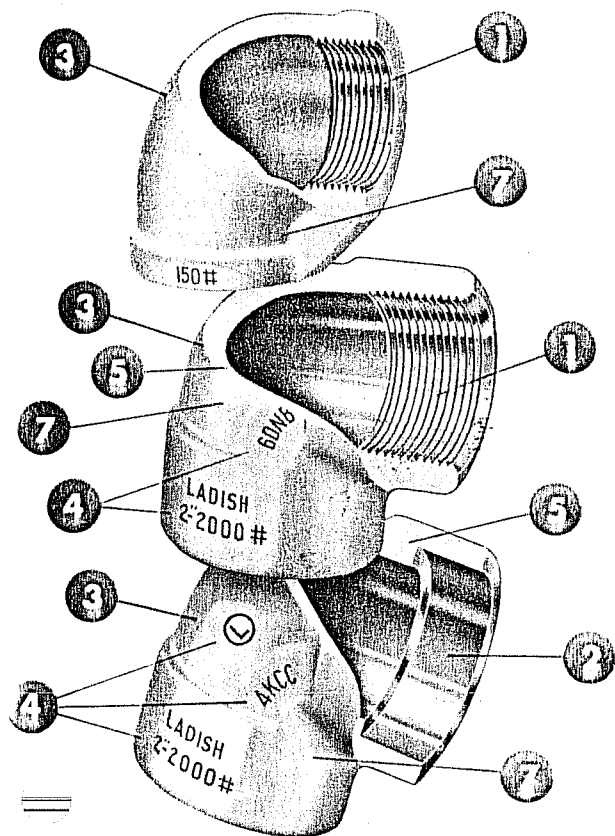
Design of these fittings offers greater latitude in laying out of compact piping systems or nesting of lines in confined areas.

150 POUND FITTINGS—Stocked only in screwed type. Machined from forgings, bars or castings. General dimensions conform to ASA Standard B16.3-1951 for Malleable Iron Screwed Fittings. When manufactured from forgings or bar stock, these fittings are satisfactory for 1000 pound Cold Working Pressure.

2000 and 3000 POUND SCREWED FITTINGS—Machined from forgings or bar stock. Manufactured to applicable requirements of ASME specifications as well as ASA Thread Standard B2.1-1945 for taper pipe threads. Used in piping systems in the service range beyond the limitations of 150 pound fittings where added strength, toughness and safety are vital design factors.

2000, 3000 and 4000 POUND SOCKET WELDING FITTINGS—Machined from forgings or bar stock. Produced in compliance with ASA B16.11-1946 and the applicable requirements of ASME and ASTM specifications. Designed for the simplified, self-aligning make-up of permanent, welded joints.

Exact controls over manufacturing processes, augmented by rigid laboratory standards, assure the uniform dimensional accuracy and metallurgical integrity of each Ladish fitting.



Value Features of LADISH SCREWED AND SOCKET TYPE FITTINGS

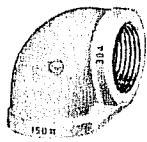
- 1 **TRUE, CLEAN THREADS**—Accurately cut to exacting tolerances and carefully gauged in inspection; the true, clean threads of Ladish Fittings assure easy engagement and tight joints.
- 2 **DEEP, TRUE SOCKETS**—In Socket Type Fittings accurate bores provide proper slip fit and align I.D. of fittings to I.D. of pipe. Location of weld prevents weld icicles inside of pipe.
- 3 **GEOMETRIC ACCURACY**—True angular relationship between outlets consistently facilitates rapid, economical piping makeup.
- 4 **PERMANENT IDENTIFICATION and HEAT CODE PROTECTION**—Material designation, nominal pipe size, pressure rating, trademark and Ladish heat code symbol are permanently marked on Ladish forged fittings.
- 5 **REFINED GRAIN STRUCTURE**—Dense, homogeneous grain of Ladish Forged Fittings provides maximum resistance to corrosion and erosion.
- 6 **MANUFACTURING METHOD**—Complete manufacturing facilities permit utilization of forging, machining of bar stock or casting processes to take advantage of individual characteristics of each manufacturing method.
- 7 **SURFACE FINISH**—Uniformly textured surface . . . free of all scale and foreign matter is achieved by cleaning fittings in chemical solutions. Optimum resistance to corrosion is insured by passivation treatment.

STAINLESS STEEL FITTINGS

150 POUND
SCREWED FITTINGS

2000, 3000, 4000 POUND
SOCKET WELDING FITTINGS

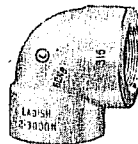
2000, 3000 POUND
SCREWED FITTINGS



90° ELBOW



90° ELBOW



90° ELBOW



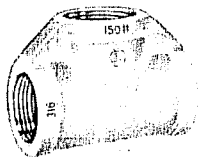
45° ELBOW



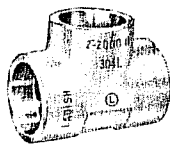
45° ELBOW



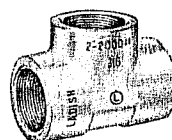
45° ELBOW



TEE



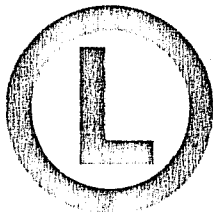
TEE



TEE



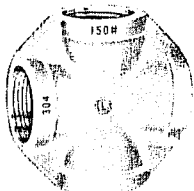
STREET ELBOW



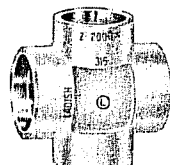
TO MARK PROGRESS



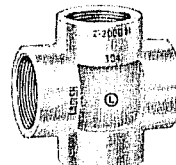
STREET ELBOW



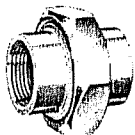
CROSS



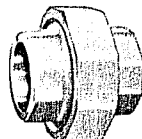
CROSS



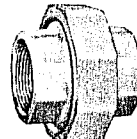
CROSS



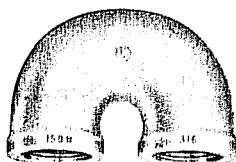
UNION



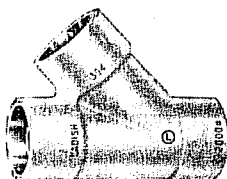
UNION



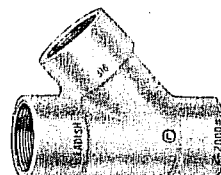
UNION



180° RETURN



LATERAL



LATERAL



WELDING SPUD



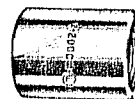
ROUND
HEAD PLUG



SQUARE
HEAD PLUG



HEXAGON
HEAD PLUG



COUPLING



LOCK NUT



FLUSH BUSHING



HEXAGON
HEAD BUSHING



CAP

1 IPS BUTT WELDING FITTINGS

Pages 20-21

2 TUBE O.D. BUTT WELDING FITTINGS

Pages 30-31

3 ASA, MSS, LIGHT TYPE and CORROSION WEIGHT FLANGES

Pages 36-51

4 SCREWED and SOCKET WELDING FITTINGS

Pages 52-61

5 PART NUMBER and PRODUCT INDEX

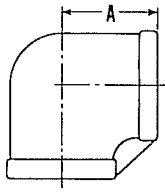
Sections 1 through 7

6 TECHNICAL DATA

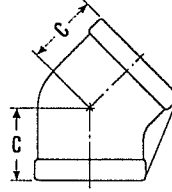
Page 71—

7 OTHER PRODUCTS, SUPPLEMENTAL DATA

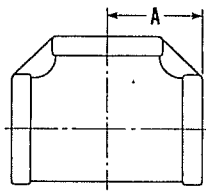
LADISH 150 POUND SCREWED FITTINGS



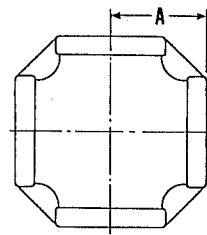
90° ELBOW



45° ELBOW



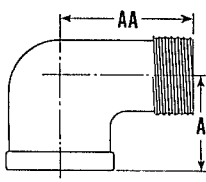
TEE



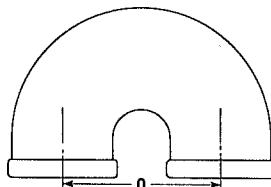
CROSS

PART NUMBERS	90° ELBOW	45° ELBOW	TEE	CROSS
	30015	30115	32015	32215

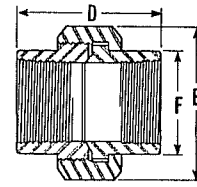
NOMINAL PIPE SIZE	90° ELBOW		45° ELBOW		TEE		CROSS	
	A	C	C	A	A	A	A	A
1/8	13/16		3/4	13/16	13/16		13/16	
1/4	13/16		3/4	13/16	13/16		13/16	
3/8	15/16		13/16	15/16	15/16		15/16	
1/2	1 1/8		7/8	1 1/8	1 1/8		1 1/8	
3/4	1 5/16		1	1 5/16	1 5/16		1 5/16	
1	1 1/2		1 1/8	1 1/2	1 1/2		1 1/2	
1 1/4	1 3/4		1 5/16	1 3/4	1 3/4		1 3/4	
1 1/2	1 15/16		1 7/16	1 15/16	1 15/16		1 15/16	
2	2 1/4		1 11/16	2 1/4	2 1/4		2 1/4	
2 1/2	2 11/16		1 15/16	2 11/16	2 11/16		2 11/16	
3	3 1/16		2 3/16	3 1/16	3 1/16		3 1/16	
4	3 13/16		2 5/8	3 13/16	3 13/16		3 13/16	



STREET ELBOW



180° RETURN



UNION

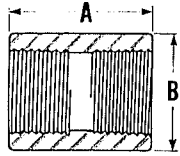
PART NUMBERS	STREET ELBOW	180° RETURN	UNION
	30315	30215	36115

NOMINAL PIPE SIZE	STREET ELBOW		180° RETURN		UNION	
	A	AA	O	D	E	F
1/8	1 1/16	1	...	1 7/16	1 3/16	5/8
1/4	1 3/16	1 3/16	...	1 21/32	1 7/16	13/16
3/8	1 5/16	1 7/16	...	1 13/16	1 9/16	1
1/2	1 1/8	1 5/8	1 1/2	1 15/16	1 13/16	1 3/16
3/4	1 5/16	1 7/8	2	1 15/16	2	1 3/8
1	1 1/2	2 1/8	2 1/2	2 1/4	2 13/32	1 5/8
1 1/4	1 3/4	2 7/16	3	2 3/8	2 3/4	2
1 1/2	1 15/16	2 11/16	3 1/2	2 5/8	3	2 1/4
2	2 1/4	3 1/4	4	3	3 11/16	2 3/4
2 1/2	2 11/16	3 7/8	4 1/2	3 1/2	4 7/16	3 1/4
3	3 1/16	4 1/2	5	4 1/8	5 1/4	3 15/16
4	3 13/16	5 11/16	...	4 7/16	6 5/8	5 3/16

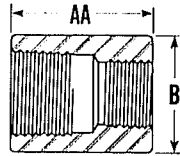
Socket Welding Fittings are available—see page 62 for 2000 pound fittings. General dimensions conform to ASA B16.3-1951 for Malleable Iron Screwed Fittings. Fittings are regularly stocked in Types 304 and 316. Type 347 and Type 304L (extra low Carbon—.03% max.) are welding grade Stainless Steels and not usually applicable for 150 pound Screwed Fittings. UNIONS will be furnished with Type 304 or Type 303 nuts. Unions with all com-

ponents of Type 316 Stainless Steel are available on application. 90° Elbows, 45° Elbows, Tees and Street Elbows in sizes 1/4" and smaller are produced from forgings. Unions in sizes 2 1/2" and smaller are machined from forgings or bar stock. 150 pound Stainless Steel Fittings manufactured from forgings or bar stock are satisfactory for 1000 pound Cold Working Pressure.

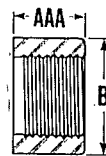
LADISH 150 POUND SCREWED FITTINGS



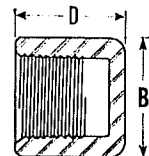
COUPLING



REDUCING COUPLING



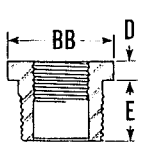
HALF COUPLING



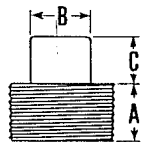
CAP

PART NUMBERS	COUPLING	REDUCING COUPLING	HALF COUPLING	CAP
	32615	32715	32915	32815

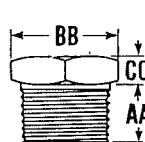
NOMINAL PIPE SIZE	COUPLING		REDUCING COUPLING		HALF COUPLING		CAP	
	A	B	AA	B	AAA	B	D	B
1/8	1 1/4	5/8 3/4	...	...	5/8	3/4	3/4	3/4
1/4	1 3/8	3/4	1 3/8	3/4	1 1/16	3/4	1	3/4
3/8	1 1/2	7/8	1 1/2	7/8	3/4	7/8	1	7/8
1/2	1 9/16	1 1/16	1 5/16	1 1/16	13/16	1 1/16	1	1 1/16
3/4	1 5/8	1 5/16	1 1/2	1 5/16	13/16	1 5/16	1 1/8	1 5/16
1	1 15/16	1 9/16	1 11/16	1 9/16	1	1 9/16	1 5/16	1 9/16
1 1/4	2	1 15/16	1 15/16	1 15/16	1	1 15/16	1 3/8	1 15/16
1 1/2	2 1/8	2 3/16	2 1/8	2 3/16	1 1/16	2 3/16	1 7/16	2 3/16
2	2 1/2	2 3/4	2 1/2	2 3/4	1 1/4	2 3/4	1 9/16	2 3/4
2 1/2	2 7/8	3 9/16	3 1/4	3 9/16	1 7/16	3 9/16	1 13/16	3 9/16
3	3 3/16	4 5/16	3 11/16	4 5/16	1 5/8	4 5/16	1 15/16	4 5/16
4	3 11/16	5 3/8	4 3/8	5 3/8	1 7/8	5 3/8	2 3/16	5 3/8



HEX. HEAD BUSHING



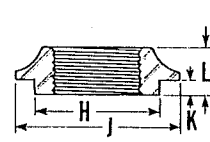
SQUARE HEAD PLUG



HEX. HEAD PLUG



LOCK NUT



WELDING SPUD

PART NUMBERS	HEX. HEAD BUSHING	SQUARE HEAD PLUG	HEX. HEAD PLUG	LOCK NUT	WELDING SPUD
	34115	34315	34415	36215	36315

NOMINAL PIPE SIZE	HEX. HEAD BUSHING			SQUARE HEAD PLUG			HEX. HEAD PLUG			LOCK NUT		WELDING SPUD			
	BB	B	E	B	C	A	BB	CC	AA	F	G	H	J	R	L
1/8	...	...	...	9/32	1/4	3/8	7/16	1/4	9/16	3/16	1 1/16	2 7/32	1 3/8	3/64	3/8
1/4	5/8	1/8	1/2	3/8	1/4	7/16	5/8	1/4	5/8	1/4	7/8	3 1/32	1 1/2	1/8	3/8
3/8	1 1/16	3/16	9/16	7/16	5/16	1/2	1 1/16	5/16	1 1/16	1/4	1	3 1/32	1 5/8	1/8	1 3/32
1/2	7/8	3/16	9/16	9/16	3/8	9/16	7/8	5/16	3/4	5/16	1 3/16	1 5/32	1 13/16	5/32	1 7/32
3/4	1 1/16	1/4	3/4	5/8	9/16	5/8	1 1/16	3/8	1 5/16	5/16	1 7/16	1 11/32	2	5/32	9/16
1	1 7/16	1/4	13/16	13/16	5/8	3/4	1 7/16	3/8	1	3/8	1 13/16	1 23/32	2 1/4	3/16	2 1/32
1 1/4	1 13/16	3/8	7/8	1 5/16	1 1/16	13/16	1 13/16	9/16	1	7/16	2 1/8	1 15/16	2 1 1/16	3/16	3/4
1 1/2	2	3/8	1 5/16	1 1/8	3/4	13/16	2	5/8	1	1/2	2 13/32	2 5/16	3	3/16	2 5/32
2	2 1/2	7/16	1	1 5/16	13/16	7/8	2 1/2	1 1/16	1 1/16	9/16	3	2 1 1/16	3 1/2	3/16	2 7/32
2 1/2	3	1/2	1 3/16	1 1/2	3/4	1 1/16	3	3/4	1 5/16	5/8	3 1/2	3 3/16	4 1/16	3/16	1 1/16
3	3 3/8	1/2	1 1/4	1 1 1/16	13/16	1 1/8	3 1/2	13/16	1 3/8	1 1/16	4 5/16	3 1 1/16	4 5/8	3/16	1 1/8
4	4 5/8	1/2	1 5/8	...	1	1 3/16	4 5/8	1 1/4	1 1/2	13/16	5 3/8	4 3/4	5 13/16	3/16	1 3/16

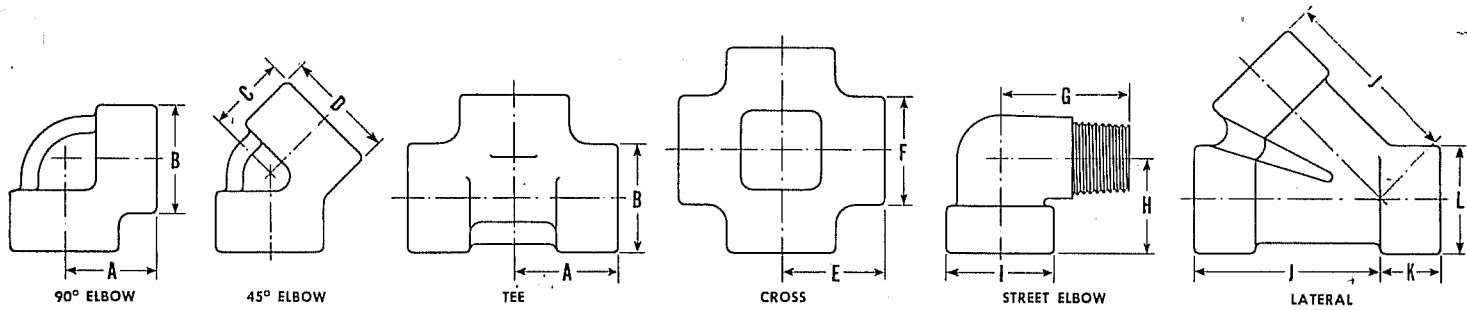
Socket Welding Fittings are available—see Page 62 for 2000 pound fittings. General dimensions conform to ASA B16.3-1951 for Malleable Iron Screwed Fittings. Fittings are regularly stocked in Types 304 and 316. Type 347 and Type 304L (extra low Carbon—.03% max.) are welding grade Stainless Steels and not usually applicable for 150 pound Screwed Fittings. All fittings on this page in sizes 2" and smaller are machined from bar stock.

150 pound Stainless Steel Fittings manufactured from forgings or bar stock are satisfactory for 1000 pound Cold Working Pressure.

Nipples are stocked in pipe sizes from 1/8" through 4" in close, short and longer lengths in increments of 1/2".

* 4" plug is furnished with bar slot instead of square head.

LADISH FORGED SCREWED FITTINGS 2000 and 3000 Pound



PART NUMBERS	90° ELBOW	45° ELBOW	TEE	CROSS	STREET ELBOW	LATERAL
2000 lb. ▶	30070	30170	32070	32270	...	32470
3000 lb. ▶	30080	30180	32080	32280	30380	32480

NOMINAL PIPE SIZE	2000 POUND													
	90° ELBOW		45° ELBOW		TEE		CROSS*		STREET ELBOW †			LATERAL †		
	A	B	C	D	A	B	E	F	G	H	I	J	K	L
1/8	13/16	7/8	11/16	15/16	13/16	7/8	31/32	1	...	...	...	...	...	...
1/4	13/16	7/8	11/16	15/16	13/16	7/8	31/32	1	...	...	...	15/8	11/16	13/16
3/8	1	1	3/4	11/16	31/32	1	31/32	1	...	...	...	17/8	13/16	1
1/2	11/8	15/16	7/8	15/16	11/8	15/16	11/8	15/16	...	...	...	21/8	7/8	11/4
3/4	15/16	11/2	1	11/2	15/16	11/2	15/16	11/2	...	...	...	29/16	1	11/2
1	11/2	113/16	11/8	113/16	11/2	113/16	11/2	113/16	...	...	...	3	11/8	113/16
1 1/4	13/4	23/16	15/16	23/16	13/4	23/16	13/4	23/16	...	...	...	39/16	13/8	23/16
1 1/2	2	27/16	13/8	27/16	2	27/16	2	27/16	...	...	...	4	11/2	27/16
2	23/8	215/16	111/16	215/16	23/8	215/16	23/8	215/16	...	...	...	43/4	13/4	215/16
*2 1/2	3	35/8	21/16	4	3	35/8	31/4	4	...	...	...	...	...	...
*3	33/8	45/16	21/2	45/8	33/8	45/16	33/8	45/8	...	...	...	...	...	...
*4	43/16	53/4	31/8	53/4	43/16	53/4	43/16	53/4	...	...	...	...	...	...

NOMINAL PIPE SIZE	3000 POUND													
	90° ELBOW		45° ELBOW		TEE		CROSS*		STREET ELBOW †			LATERAL †		
	A	B	C	D	A	B	E	F	G	H	I	J	K	L
1/8	13/16	7/8	11/16	15/16	13/16	7/8	1	1	1 1/4	7/8	1 1/16	...	...	...
1/4	1	1	3/4	11/16	1	1	1	1	1 1/4	7/8	1 1/16	17/8	11/16	1
3/8	11/8	15/16	7/8	15/16	11/8	15/16	11/8	15/16	1 1/2	1	1 1/4	21/8	7/8	11/4
1/2	15/16	11/2	1	11/2	15/16	11/2	15/16	11/2	15/8	11/8	1 1/2	29/16	1	11/2
3/4	11/2	113/16	11/8	113/16	11/2	113/16	11/2	113/16	17/8	13/8	13/4	3	11/8	113/16
1	13/4	23/16	15/16	23/16	13/4	23/16	13/4	23/16	2 1/4	13/4	2	39/16	13/8	23/16
1 1/4	2	27/16	13/8	27/16	2	27/16	2	27/16	25/8	2	27/16	4	11/2	27/16
1 1/2	23/8	215/16	111/16	215/16	23/8	215/16	23/8	215/16	213/16	21/8	23/4	43/4	13/4	215/16
2	21/2	35/16	13/4	35/16	21/2	35/16	21/2	35/16	35/16	21/2	35/16	...	...	...
*2 1/2	3 1/4	4	21/16	4	3 1/4	4	3 1/4	4	...	...	...	...	...	...
*3	33/4	43/4	21/2	45/8	33/4	43/4	33/8	45/8	...	...	...	...	...	...
*3 1/2	4 1/2	6	31/8	53/4	4 1/2	6	4 3/16	53/4	...	...	...	...	...	...
*4	4 1/2	6	31/8	53/4	4 1/2	6	4 3/16	53/4	...	...	...	...	...	...

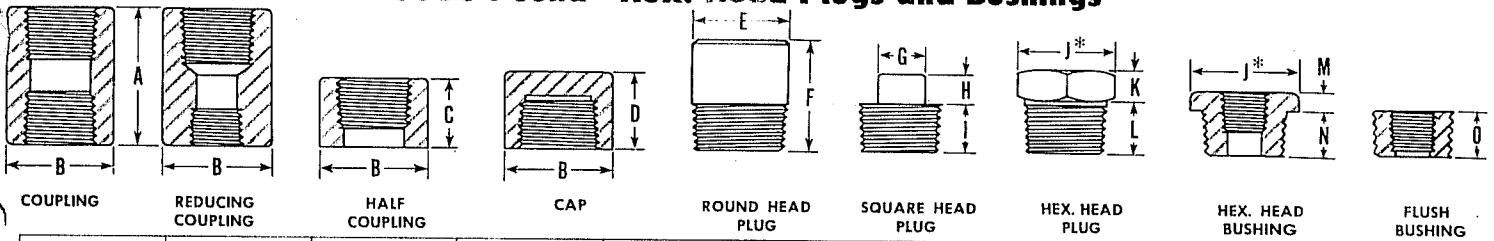
†Fittings conform to Standard Practice SP-49 of the Manufacturers Standardization Society of the Valve and Fittings Industry. This Standard does not at publication include Street Elbows and Laterals or fittings in sizes 2 1/2" and larger.

* Crosses, Street Elbows, Laterals—Contour forgings to the above dimensions or machined block forgings to these approximate dimensions will be furnished at Ladish option. Reducing fittings can be furnished by boring and tapping straight size blanks.

*Modern piping practice would suggest use of butt welding fittings in sizes 2 1/2" and larger.

LADISH SCREWED COUPLINGS, CAPS, PLUGS AND BUSHINGS

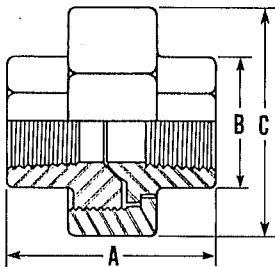
3000 Pound—Couplings, Caps, Square Head Plugs 6000 Pound—Hex. Head Plugs and Bushings



PART NUMBERS	COUPLING	REDUCING COUPLING	HALF COUPLING	CAP	ROUND HEAD PLUG	SQUARE HEAD PLUG	HEX. HEAD PLUG	HEX. HEAD BUSHING	FLUSH BUSHING
	32680	32780	32980	32880	34580	34380	34486	34186	34286

NOMINAL PIPE SIZE	COUPLINGS AND CAP				PLUGS									BUSHINGS		
	A	B	C	D	ROUND HEAD		SQUARE HEAD			HEX. HEAD				M	N	O
1/8	1 1/4	3/8	5/8	3/4	7/16	1 3/8	9/32	1/4	3/8	7/16	1/4	9/16	...	...	...
1/4	1 3/8	3/4	1 1/16	1	9/16	1 5/8	3/8	1/4	7/16	5/8	1/4	5/8	1/8	1/2	7/16	
3/8	1 1/2	7/8	3/4	1	1 1/16	1 5/8	7/16	5/16	1/2	1 1/16	5/16	1 1/16	3/16	9/16	1/2	
1/2	1 7/8	1 1/8	1 5/16	1 1/4	7/8	1 3/4	9/16	3/8	9/16	7/8	5/16	3/4	3/16	9/16	9/16	
3/4	2	1 3/8	1	1 7/16	1 1/8	1 3/4	5/8	9/16	5/8	1 1/16	3/8	1 5/16	1/4	3/4	5/8	
1	2 3/8	1 3/4	1 3/16	1 5/8	1 3/8	2	1 3/16	5/8	3/4	1 7/16	3/8	1	1/4	1 3/16	3/4	
1 1/4	2 5/8	2 1/4	1 5/16	1 3/4	1 11/16	2	1 5/16	1 1/16	1 3/16	1 13/16	9/16	1	3/8	7/8	1 3/16	
1 1/2	3 1/8	2 1/2	1 9/16	1 3/4	2	2	1 1/8	3/4	1 3/16	2	5/8	1	3/8	1 5/16	1 3/16	
2	3 3/8	3	1 11/16	1 7/8	2 1/2	2 1/2	1 5/16	1 3/16	7/8	2 1/2	1 1/16	1 1/16	7/16	1	7/8	
2 1/2	3 5/8	3 5/8	1 13/16	2 3/8	3	2 3/4	1 1/2	1 5/16	1 1/16	3	3/4	1 5/16	1/2	1 3/16	1 1/16	
3	4 1/4	4 1/4	2 1/8	2 9/16	3 5/8	2 3/4	1 11/16	1	1 1/8	3 1/2	1 3/16	1 3/8	1/2	1 1/4	1 1/8	
3 1/2	4 1/2	4 3/4	2 1/4	2 5/8	4 1/8	3	1 7/8	1 1/16	1 3/16	4 1/8	7/8	1 7/16	1/2	1 3/8	1 3/16	
4	4 3/4	5 1/2	2 3/8	2 11/16	4 5/8	3	2 1/2	1 1/4	1 1/2	4 5/8	1 1/4	1 1/2	5/8	1 1/2	1 1/4	

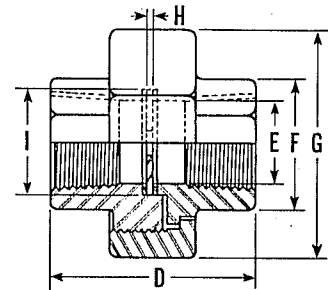
3000 POUND FORGED SCREWED AND SOCKET WELDING UNIONS



SCREWED UNION (Part No. 60180)—Pressure ratings range from vacuum to 3000 pounds Cold Working Pressure and 900 pounds Steam Working Pressure. Temperature ratings range from -325° F. to 1000° F.

SOCKET WELDING UNIONS are also available.

ORIFICE UNION (Part No. 63180)—Recommended working pressure is 3000 pounds at 250° F. Furnished with stainless steel orifice plate drilled to specification (minimum drilled hole—1/64") and two stainless steel jacketed asbestos filled gaskets.



NOMINAL PIPE SIZE	SCREWED UNION				ORIFICE UNION				
	A	B	C	D	E	F	G	H	I
1/4	1 5/8	3/4	1 3/8	1 5/8	3/8	3/4	1 3/8	1/16	1 9/32
3/8	1 13/16	1 5/16	1 9/16	1 3/4	9/16	1 5/16	1 9/16	1/16	3/4
1/2	1 15/16	1 1/8	1 13/16	1 15/16	1 1/16	1 1/8	1 13/16	3/32	1 5/16
3/4	2 1/4	1 3/8	2 3/16	2 1/4	7/8	1 3/8	2 3/16	3/32	1 1/8
1	2 1/2	1 11/16	2 9/16	2 7/16	1 1/8	1 11/16	2 9/16	3/32	1 3/8
1 1/4	2 13/16	2 1/16	3 1/16	2 13/16	1 7/16	2 1/16	3 1/16	3/32	1 11/16
1 1/2	3 1/16	2 5/16	3 7/16	3	1 11/16	2 5/16	3 7/16	3/32	1 29/32
2	3 7/16	2 7/8	4 1/16	3 3/8	2 1/16	2 7/8	4 1/16	3/32	2 5/16
2 1/2	...	...	...	4	2 9/16	3 7/16	4 7/8	3/32	2 7/8
3	...	...	...	4 1/4	3 1/16	4 1/8	5 3/4	3/32	3 3/8

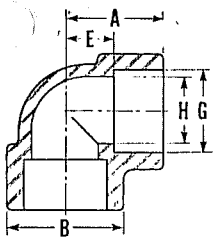
UNIONS—Dimensions for nuts and ends are measured across octagon flats.

* Dimensions J for Hex. Head Plug and Hex. Head Bushing are identical.

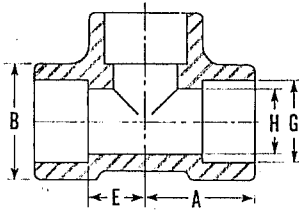
† Couplings and Caps conform to Standard Practice SP-49 of the Manufacturers Standardization Society of the Valve and Fittings Industry. This Standard does not at publication include sizes 2 1/2" and larger. Plugs and Bushings conform to Standard Practice SP-50.

LADISH FORGED SOCKET WELDING FITTINGS

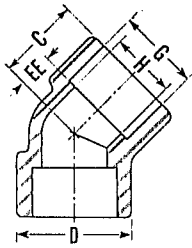
2000, 3000 and 4000 Pound



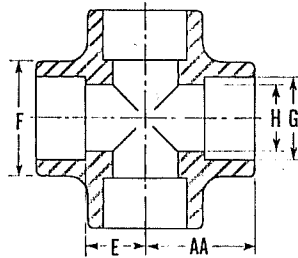
90° ELBOW



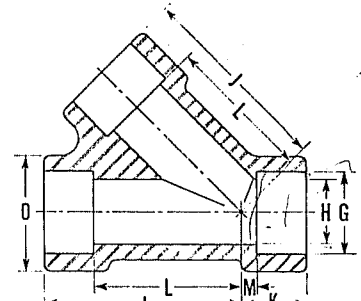
TEE



45° ELBOW



CROSS



LATERAL

PART NUMBERS	90° ELBOW	TEE	45° ELBOW	CROSS	LATERAL
2000 lb. ▶	31070	33070	31170	33270	33470
3000 lb. ▶	31080	33080	31180	33280	33480
4000 lb. ▶	31084	33084	31184	33284	33484

NOMINAL PIPE SIZE	COMMON DIMENSIONS		2000 POUND—3000 POUND														
	G	H	90° ELBOW AND TEE			45° ELBOW			CROSS*			LATERAL*					
			A	B	E	C	D	EE	AA	E	F	J	K	L	M	O	
1/8	.420	1/4	...	13/16	7/8	7/16	11/16	15/16	5/16	31/32	7/16	1	...	...	...	...	...
1/4	.555	3/8	5/16	13/16	7/8	7/16	11/16	15/16	5/16	31/32	7/16	1	15/8	11/16	1 1/4	5/16	13/16
3/8	.690	1/2	7/16	31/32	1	17/32	3/4	1 1/16	5/16	31/32	17/32	1	1 7/8	13/16	1 7/16	3/8	1
1/2	.855	5/8	9/16	1 1/8	1 5/16	5/8	7/8	1 5/16	7/16	1 1/8	5/8	1 5/16	2 1/8	7/8	1 5/8	3/8	1 1/4
3/4	1.065	13/16	3/4	1 5/16	1 1/2	3/4	1	1 1/2	1/2	1 5/16	3/4	1 1/2	2 9/16	1	2	7/16	1 1/2
1	1.330	1 1/16	31/32	1 1/2	1 13/16	7/8	1 1/8	1 13/16	9/16	1 1/2	7/8	1 13/16	3	1 1/8	2 3/8	1/2	1 13/16
1 1/4	1.675	1 3/8	1 9/32	1 3/4	2 3/16	1 1/16	1 5/16	2 3/16	1 1/16	1 3/4	1 1/16	2 3/16	3 1/2	1 5/16	2 13/16	5/8	2 3/16
1 1/2	1.915	1 5/8	1 1/2	2	2 7/16	1 1/4	1 11/32	2 7/16	1 3/16	2	1 1/4	2 7/16	3 15/16	1 7/16	3 3/16	1 1/16	2 7/16
2	2.406	2 1/16	1 15/16	2 3/8	2 15/16	1 1/2	1 11/16	2 15/16	1	2 3/8	1 1/2	2 15/16	4 3/4	1 11/16	3 7/8	1 3/16	2 15/16
2 1/2	2.906	2 1/2	2 5/16	3	3 5/8	1 5/8	2 1/16	4	1 1/8	3 1/4	1 5/8	4	...	...	...	...	...
3	3.535	3 1/16	2 7/8	3 3/8	4 5/16	2 1/4	2 1/2	4 5/8	1 1/4	3 3/8	2 1/4	4 5/8	...	...	...	...	...
4	4.545	4	3 7/8	4 3/16	5 3/4	2 5/8	3 1/8	5 3/4	1 5/8	4 3/16	2 5/8	5 3/4	...	...	...	...	...

NOMINAL PIPE SIZE	COMMON DIMENSIONS		4000 POUND														
	G	H	90° ELBOW AND TEE			45° ELBOW			CROSS*			LATERAL*					
			A	B	E	C	D	EE	AA	E	F	J	K	L	M	O	
1/2	.855	1 5/32	1 5/16	1 1/2	3/4	1	1 1/2	1/2	1 5/16	3/4	1 1/2	2 9/16	1	2	7/16	1 1/2	
3/4	1.065	5/8	1 1/2	1 13/16	7/8	1 1/8	1 13/16	9/16	1 1/2	7/8	1 13/16	3	1 1/8	2 3/8	1/2	1 13/16	
1	1.330	13/16	1 3/4	2 3/16	1 1/16	1 5/16	2 3/16	1 1/16	1 3/4	1 1/16	2 3/16	3 1/2	1 5/16	2 13/16	5/8	2 3/16	
1 1/4	1.675	1 5/32	2	2 7/16	1 1/4	1 11/32	2 7/16	1 3/16	2	1 1/4	2 7/16	3 15/16	1 7/16	3 3/16	1 1/16	2 7/16	
1 1/2	1.915	1 11/32	2 3/8	2 15/16	1 1/2	1 11/16	2 15/16	1	2 3/8	1 1/2	2 15/16	4 3/4	1 11/16	3 7/8	1 3/16	2 15/16	
2	2.406	1 11/16	2 1/2	3 5/16	1 5/8	1 23/32	3 5/16	1 1/8	2 1/2	1 5/8	3 5/16	...	...	...	...	...
2 1/2	2.906	2 1/8	3 1/4	4	2 1/4	2 1/16	4	1 1/4	3 1/4	2 1/4	4	...	...	...	...	...
3	3.535	2 5/8	3 3/4	4 3/4	2 1/2	2 1/2	4 5/8	1 3/8	3 3/8	2 1/2	4 5/8	...	...	...	...	...
4	4.545	3 7/16	4 3/16	5 3/4	2 5/8	3 1/8	5 3/4	1 5/8	4 3/16	2 5/8	5 3/4	...	...	...	...	...

† Fittings conform to ASA B16.11. This Standard does not at publication include laterals or fittings in the 4" size.

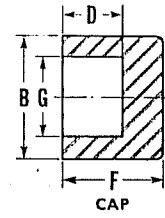
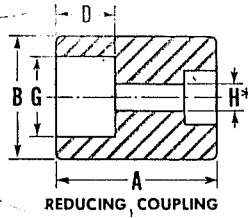
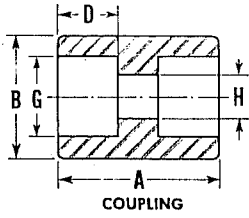
* Crosses, Laterals—Contour forgings to the above dimensions or machined block forgings to these approximate dimensions will be furnished at Ladish option.

‡ Modern piping practice would suggest use of butt welding fittings in sizes 2 1/2" and larger.

Reducing fittings can be furnished by boring straight size blanks. Unions are also available, see page 61.

LADISH FORGED SOCKET WELDING FITTINGS

2000, 3000 and 4000 Pound



PART NUMBERS	COUPLING	REDUCING COUPLING	CAP
2000 lb. ▶	33670	33770	33870
3000 lb. ▶	33680	33780	33880
4000 lb. ▶	33684	33784	33884

NOMINAL PIPE SIZE	COMMON DIMENSIONS 2000-3000 POUND		2000 POUND					3000 POUND				
			COUPLING AND REDUCING COUPLING			CAP		COUPLING AND REDUCING COUPLING			CAP	
			D	G	A	B	H*	B	F	A	B	H*	B	F
1/8	3/8	.420	1	3/4	1/4	3/4	5/8	...	...	...	...	...
1/4	3/8	.555	1	7/8	3/8	3/4	5/8	1	7/8	5/16	7/8	1 1/16
3/8	7/16	.690	1 1/8	1	1/2	1	1 1/16	1 1/8	1 1/8	7/16	1	3/4
1/2	1/2	.855	1 3/8	1 1/4	5/8	1 1/4	3/4	1 3/8	1 1/4	9/16	1 1/4	7/8
3/4	9/16	1.065	1 1/2	1 1/2	13/16	1 1/2	13/16	1 1/2	1 1/2	3/4	1 1/2	1
1	5/8	1.330	1 3/4	1 3/4	1 1/16	1 3/4	1	1 3/4	1 7/8	3 1/32	1 3/4	1 1/16
1 1/4	1 1/16	1.675	1 7/8	2 1/4	1 3/8	2 1/4	1 1/16	1 7/8	2 1/4	1 9/32	2 1/4	1 3/16
1 1/2	3/4	1.915	2	2 1/2	1 5/8	2 1/2	1 3/16	2	2 1/2	1 1/2	2 1/2	1 1/4
2	7/8	2.406	2 1/2	3	2 1/16	3	1 3/8	2 1/2	3	1 15/16	3	1 1/2
2 1/2	7/8	2.906	2 1/2	3 5/8	2 1/2	3 5/8	1 1/2	2 1/2	3 5/8	2 5/16	3 5/8	1 1/2
3	1	3.535	2 3/4	4 1/4	3 1/16	4 1/8	1 5/8	2 3/4	4 3/8	2 7/8	4 1/4	1 3/4
4	1 1/8	4.545	3	5 1/4	4	5 1/4	1 7/8	3	5 1/2	3 7/8	5 1/2	1 7/8

NOMINAL PIPE SIZE	4000 POUND						
	COUPLING, REDUCING COUPLING, CAP				COUPLINGS		CAP
	B	D	G	H*	A	F	
1/2	1 1/2	1/2	.855	15/32	1 3/8	7/8	
3/4	1 3/4	9/16	1.065	5/8	1 1/2	15/16	
1	2 1/4	5/8	1.330	13/16	1 3/4	1 1/8	
1 1/4	2 1/2	1 1/16	1.675	1 5/32	1 7/8	1 3/16	
1 1/2	3	3/4	1.915	1 11/32	2	1 3/8	
2	3 5/8	7/8	2.406	1 11/16	2 1/2	1 1/2	
2 1/2	4 1/8	7/8	2.906	2 1/8	2 1/2	1 5/8	
3	4 3/4	1	3.535	2 5/8	2 3/4	1 3/4	
4	6	1 1/8	4.545	3 7/16	3	2	

REDUCER INSERTS

PART NUMBERS	FOR USE WITH PIPE		
	SCH. 40	SCH. 80	SCH. 160
▶	35070	35080	35084

Reducer inserts are designed for use with straight size fittings to serve the same purpose as threaded bushings used with screwed fittings. Use of these inserts avoids delays and extra costs encountered in producing regular socket welding fittings with reduced outlet. The drawing above illustrates one of three types available.

† Fittings conform to ASA B16.11. This Standard does not at publication include Reducer Inserts or fittings in the 4" size.
 * Modern piping practice would suggest use of butt welding fittings in sizes 2 1/2" and larger.

* Inside diameter of Reducing Coupling is that of the size to which the reduction is being made.

WEIGHTS*—LADISH 150 POUND SCREWED FITTINGS

RATING	NOMINAL PIPE SIZE	90° ELBOW (30015)	45° ELBOW (30115)	TEE (32015)	CROSS (32215)	STREET ELBOW (30315)	180° RETURN (30215)	UNION (36115)
150 POUND For dimensions, see page 58	1/8	.20	.20	.27	.61	.08	.41	.25
	1/4	.17	.16	.22	.54	.14	.34	.22
	3/8	.27	.23	.34	.67	.23	.55	.31
	1/2	.41	.33	.53	.82	.34	.82	.63
	3/4	.66	.52	.89	.91	.52	1.38	.80
	1	.85	.82	1.19	1.44	.69	1.70	1.19
	1 1/4	1.47	1.91	1.88	2.06	1.41	2.94	1.63
	1 1/2	1.56	1.69	2.31	2.63	2.00	8.13	2.13
	2	3.00	2.63	3.56	4.69	3.09	6.00	3.22
	2 1/2	4.53	3.81	6.09	9.00	5.09	9.06	6.28
	3	6.31	5.63	8.81	13.00	8.25	12.63	9.47
4	11.69	9.44	14.88	21.00	13.69	23.38	16.41	

RATING	NOMINAL PIPE SIZE	COUPLING (32615)	REDUCING COUPLING (32715)	HALF COUPLING (32915)	CAP (32815)	HEX. HEAD BUSHING (34115)	SQUARE HEAD PLUG (34315)	HEX. HEAD PLUG (34415)	LOCK NUT (36215)	WELDING SPUD (36315)
150 POUND For dimensions, see page 59	1/8	.04	.04	.02	.02	...	.02	.03	.02	.08
	1/4	.06	.06	.03	.06	.03	.03	.06	.04	.09
	3/8	.10	.10	.04	.08	.05	.06	.09	.05	.09
	1/2	.15	.15	.09	.12	.09	.11	.16	.07	.20
	3/4	.26	.26	.13	.20	.22	.18	.36	.10	.22
	1	.43	.43	.16	.29	.36	.34	.69	.20	.36
	1 1/4	.59	.59	.31	.68	.75	.58	1.16	.25	.45
	1 1/2	.78	.78	.36	.75	1.06	.81	1.61	.35	.53
	2	1.38	1.38	.70	1.13	1.63	1.38	2.75	.60	.72
	2 1/2	3.13	3.13	1.09	3.31	2.69	1.41	4.00	.90	1.10
	3	4.16	4.16	1.80	2.91	4.69	2.03	4.06	1.50	1.55
4	6.91	6.91	3.10	5.28	7.16	4.34	8.69	2.50	2.00	

*Approximate weight in pounds.

WEIGHTS*—LADISH 2000 AND 3000 POUND FORGED SCREWED FITTINGS

RATING	NOMINAL PIPE SIZE	90° ELBOW (30070)	45° ELBOW (30170)	TEE (32070)	CROSS (32270)	LATERAL (32470)	UNION† (60180)	ORIFICE-UNION (63180)
2000 POUND	1/8	.25	.13	.25	.50	...	...	...
	1/4	.25	.13	.25	.50	.25	.34	.36
	3/8	.31	.25	.31	.50	.63	.49	.52
	1/2	.56	.44	.56	.88	1.00	.68	.72
	3/4	.69	.63	.94	1.13	1.75	1.19	1.24
	1	1.13	.94	1.44	1.69	2.38	1.68	1.75
	1 1/4	1.69	1.38	2.00	2.50	3.00	2.54	2.61
	1 1/2	2.25	1.63	2.75	3.19	4.13	3.33	3.40
	2	3.50	2.69	4.63	5.25	6.63	5.30	5.40
	2 1/2	6.50	7.38	8.69	16.44	...	...	...
	3	10.50	11.31	13.19	19.50	...	...	...
4	22.75	19.06	27.25	32.00	...	...	...

For dimensions, see pages 60-61

RATING	NOMINAL PIPE SIZE	90° ELBOW (30080)	45° ELBOW (30180)	TEE (32080)	CROSS (32280)	STREET ELBOW (30380)	LATERAL (32480)	GAP (32880)
3000 POUND	1/8	.25	.25	.25	.44	.25	...	.03
	1/4	.38	.25	.38	.38	.25	.63	.06
	3/8	.63	.50	.81	1.00	.38	1.31	.13
	1/2	1.31	.75	1.19	1.50	.50	1.75	.25
	3/4	1.38	1.19	1.88	2.50	.88	2.75	.31
	1	2.25	1.88	2.50	3.56	1.44	4.63	.50
	1 1/4	2.75	2.13	3.13	4.13	2.25	5.50	1.00
	1 1/2	3.50	3.00	5.00	6.50	3.00	10.81	1.63
	2	5.44	4.25	6.75	8.13	5.19	...	3.13
	2 1/2	10.69	7.75	13.13	16.75	...	...	5.00
	3	14.44	10.50	20.38	19.75	...	...	8.50
	3 1/2	38.25	24.75	47.50	39.00	...	...	11.00
	4	30.38	19.13	39.50	32.69	...	...	14.00

For dimensions, see page 60

RATING	NOMINAL PIPE SIZE	COUPLING (32680)	REDUCING COUPLING (32780)	HALF COUPLING (32980)	ROUND HEAD PLUG (34580)	SQUARE HEAD PLUG (34380)	HEX HEAD PLUG (34486)	HEX HEAD BUSHING (34186)	FLUSH BUSHING (34286)
3000 POUND	1/8	.13	.13	.06	.13	.02	.06	...	...
	1/4	.13	.13	.06	.13	.03	.06	.06	.06
	3/8	.25	.25	.19	.19	.06	.13	.06	.06
	1/2	.25	.25	.19	.25	.13	.19	.06	.06
	3/4	.44	.44	.25	.38	.19	.31	.13	.13
6000 POUND	1	.63	.63	.31	.75	.31	.50	.19	.13
	1 1/4	1.56	1.56	.75	1.13	.56	1.13	.38	.13
	1 1/2	2.19	2.19	1.13	1.56	.88	1.38	.69	.19
	2	3.13	3.13	1.56	3.00	1.50	2.25	1.63	.38
	2 1/2	4.00	4.00	2.00	4.75	2.25	3.88	2.38	.63
	3	6.75	6.75	3.38	7.63	2.88	5.88	3.50	1.00
	3 1/2	11.25	11.25	5.62	10.00	4.19	9.50	5.50	1.13
	4	16.75	16.75	8.38	12.88	7.19	13.00	8.31	2.00

For dimensions, see page 61

* Approximate weight in pounds.
 † Pressure rating of Forged Unions, see page 61.

WEIGHTS*—LADISH 2000, 3000 AND 4000 LB. FORGED SOCKET WELDING FITTINGS

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2000 POUND	1/8	.13	.13	.25	.2513	.13	.06
	1/4	.13	.13	.25	.25	.25	.13	.13	.06
	3/8	.25	.19	.31	.38	.63	.13	.13	.13
	1/2	.50	.38	.63	.81	1.00	.19	.19	.19
	3/4	.69	.50	.88	1.13	1.75	.31	.31	.31
	1	1.06	.88	1.38	1.50	2.38	.56	.56	.38
	1 1/4	1.56	1.25	2.00	2.25	3.75	.81	.81	.81
	1 1/2	1.88	1.63	2.50	3.06	4.13	1.00	1.00	1.13
	2	3.25	2.69	3.75	5.13	6.88	2.00	2.00	1.69
	2 1/2	5.88	6.75	8.38	18.00	...	2.63	2.63	3.00
	3	10.25	10.50	12.50	23.00	...	3.88	3.88	3.63
4	20.75	18.19	27.00	40.00	...	6.63	6.63	6.69	

For dimensions, see pages 62-63

RATING	NOMINAL PIPE SIZE	90° ELBOW (31080)	45° ELBOW (31180)	TEE (33080)	CROSS (33280)	LATERAL (33480)	COUPLING (33680)	REDUCING COUPLING (33780)	CAP (33880)
3000 POUND	1/4	.13	.13	.25	.31	.25	.13	.13	.13
	3/8	.25	.19	.31	.31	.63	.19	.19	.19
	1/2	.50	.44	.69	.81	1.00	.25	.25	.25
	3/4	.69	.50	.88	1.13	1.75	.38	.38	.38
	1	1.31	.88	1.44	1.56	2.38	.75	.75	.44
	1 1/4	1.63	1.31	2.13	2.44	3.75	1.13	1.13	.94
	1 1/2	2.13	1.75	2.44	3.25	5.00	1.31	1.31	1.19
	2	3.56	2.88	4.44	5.50	7.75	2.00	2.00	2.00
	2 1/2	6.38	7.38	8.88	15.81	...	3.25	3.25	3.00
	3	10.88	11.50	13.69	20.19	...	4.56	4.56	4.63
4	23.69	19.75	28.44	31.50	...	8.63	8.63	8.50	

For dimensions, see pages 62-63

RATING	NOMINAL PIPE SIZE	90° ELBOW (31084)	45° ELBOW (31184)	TEE (33084)	CROSS (33284)	LATERAL (33484)	COUPLING (33684)	REDUCING COUPLING (33784)	CAP (33884)
4000 POUND	1/2	.94	.88	1.38	1.50	2.00	.38	.38	.38
	3/4	1.44	1.31	2.00	2.50	3.06	.56	.56	.50
	1	2.25	2.06	3.31	4.13	5.13	1.00	1.00	1.13
	1 1/4	3.19	2.50	3.75	5.25	6.25	1.44	1.44	1.13
	1 1/2	5.25	4.31	6.50	8.75	11.94	2.00	2.00	2.25
	2	6.69	4.81	7.88	9.44	...	3.88	3.88	3.50
	2 1/2	11.88	9.63	16.63	20.25	...	5.50	5.50	5.63
	3	19.25	14.25	23.50	27.00	...	6.63	6.63	6.00
4	26.38	27.25	33.00	39.00	...	13.13	13.13	13.50	

For dimensions, see pages 62-63

*Approximate weight in pounds.

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Electronic equipment speeds the processing of your orders when you specify Ladish part numbers.

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2 TUBE O.D. BUTT WELDING FITTINGS

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3 ASA, MSS, LIGHT TYPE and CORROSION WEIGHT FLANGES

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To facilitate the prompt, efficient processing of your orders—
always include reference to part numbers

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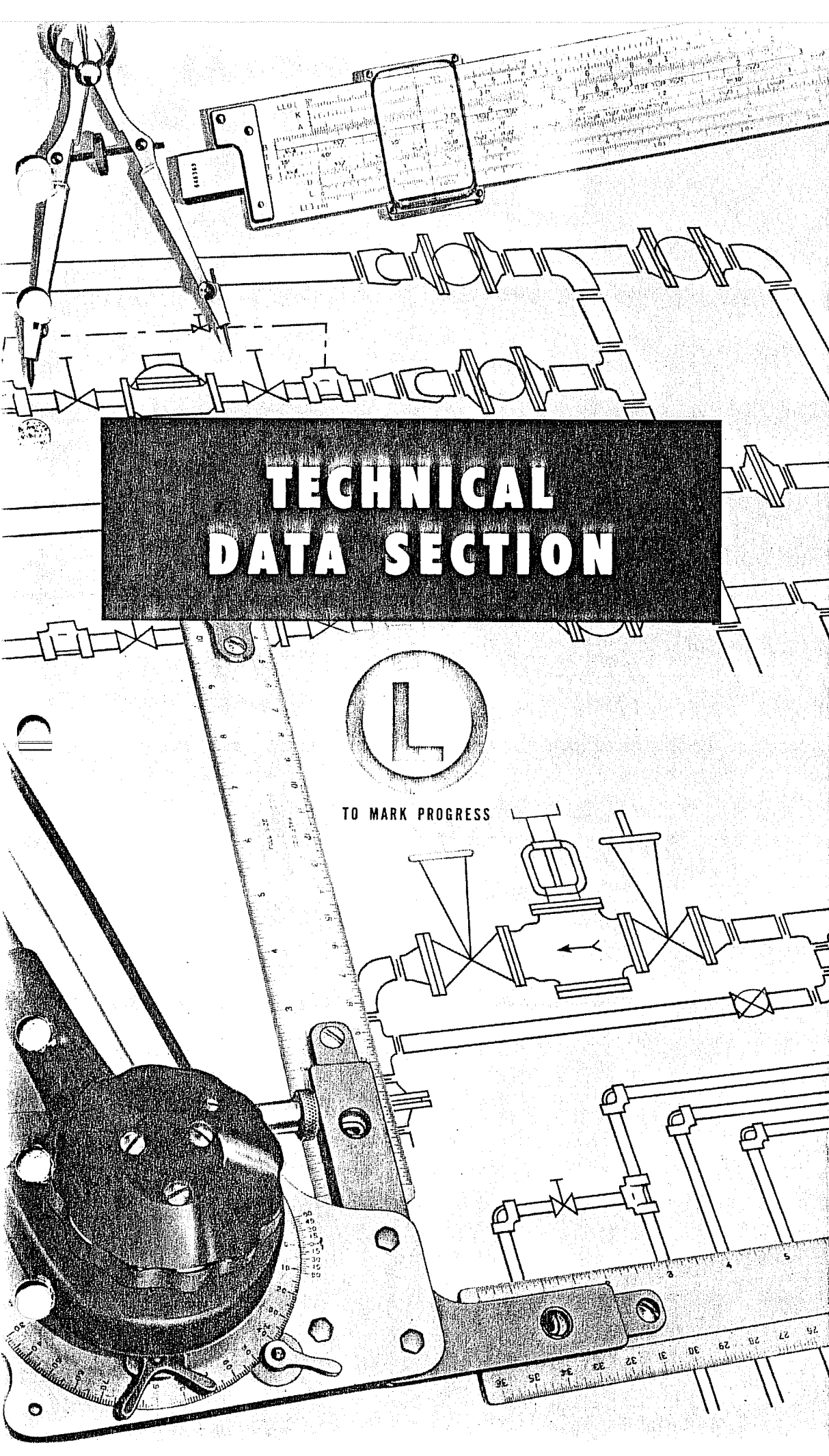
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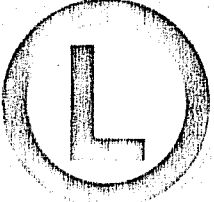
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2 TUBE O.D. BUTT WELDING FITTINGS

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5 PART NUMBER and PRODUCT INDEX

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7 OTHER PRODUCTS, SUPPLEMENTAL DATA

MANUFACTURING STANDARDS AND MATERIAL SPECIFICATIONS

LADISH BUTT WELDING FITTINGS

Ladish Butt Welding Fittings are manufactured to the dimensional standards of the Manufacturer's Standardization Society of the Valves & Fittings Industry and the American Standards Association and from material included in the ASTM and ASME specifications and to the special requirements of the purchaser.

MSS Standard Practice SP43 covers Schedules 5S and 10S Stainless Steel (and other corrosion resistant materials by reference) fittings in sizes from 3/4" to 12" inclusive. The linear dimensions listed in this catalog for sizes 14" and

larger conform to ASA B16.9, with radial dimensions and wall thicknesses conforming to common industry practice.

Schedule 40S and heavier fittings conform to ASA B16.9, to the extent covered therein.

Since no nationally recognized standards exist for Tube O.D. Butt Welding Fittings, Ladish fittings conform to dimensions commonly used in the industry.

The material specifications for Stainless Steel and Aluminum generally carried in stock are listed below.

TYPE OF MATERIAL	IDENTIFICATION SYMBOL	ASTM SPECIFICATION AND GRADE OF PERMISSIBLE RAW MATERIALS			
		PIPE	PLATE	BAR	FORGING
304 (18-8)	WP304	A312, grade TP304	A240, grade S	A276, type 304	A182, grade F304
304L (18-8) ¹	WP304L	A312, grade TP304 ^{2 4}	A240, grade S ⁴	A276, type 304L ⁴	...
347 (18-8, Cb plus Ta)	WP347	A312, grade TP347	A240, grade C	A276, type 347	A182, grade F347
316 (18-8, Mo)	WP316	A312, grade TP316	A240, grade M	A276, type 316	A182, grade F316
316L (18-8, Mo) ¹	WP316L	A312, grade TP316 ⁴	A240, grade M ⁴	A276, type 316L ⁴	...
Aluminum Base Manganese Alloy	3003S	B241, grade M1A ⁵	B209, grade M1A	B273, grade M1A	B247, grade M1A

¹ Carbon 0.030 per cent maximum.

² Materials in accordance with Specification A358 or A376 may be used when required as alternates to Specification A312.

⁴ No ASTM specification is available. Use composition 304L of American Iron and Steel Institute except that, on pierced tubing, the Nickel may be 8.00 to 13.00 per cent provided that the Chromium is adjusted to insure fully austenitic structure.

⁴ Except that Carbon content shall be 0.030 per cent, maximum, on ladle analysis and 0.034 per cent, maximum, on check analysis, minimum tensile strength shall be 65,000 psi and minimum yield strength shall be 28,000 psi.

⁵ Materials in accordance with Specifications B210, B234, B235, and B274 may be used when required as alternates to Specification B241.

LADISH FORGED FLANGES

Ladish Forged Steel American Standard Flanges are manufactured to the dimensional standards of ASA B16.5-1957. This standard covers the range of sizes listed below and the dimensional tolerances shown on page 75.

RANGE OF SIZES COVERED BY AMERICAN STANDARD ASA B16.5-1957¹

TYPE OF FLANGE	PRESSURE RATINGS	SIZE RANGE
Welding Threaded Blind Lap Joint	150 lb., 300 lb., 400 lb., 600 lb., 900 lb., 1500 lb.	1/2" thru 24"
	2500 lb.	1/2" thru 12"
Slip-On	150 lb., 300 lb., 400 lb., 600 lb., 900 lb.	1/2" thru 24"
	1500 lb.	1/2" thru 2 1/2"
Socket Welding	150 lb., 300 lb., 600 lb.	1/2" thru 3"
	1500 lb.	1/2" thru 2 1/2"

¹ This standard covers the above types and range of pressures and sizes as of the publication date of this catalog.

Ladish Forged Flanges are manufactured from material included in the ASTM and ASME Specifications and to the special requirements of the purchaser. The material specifications for Stainless Steel and Aluminum generally carried in stock are listed below.

MATERIAL SPECIFICATIONS FOR FORGED FLANGES

ASTM SPECIFICATION	TYPE OF MATERIAL	IDENTIFICATION SYMBOL
A182	18% Cr-8% Ni	F304
A182	18% Cr-8% Ni-Mo	F316
A182	18% Cr-8% Ni-Cb	F347
A182	25% Cr-20% Ni	F310
A182 ²	18% Cr-8% Ni ²	F304L
A182 ²	18% Cr-8% Ni-Mo ²	F316L
B247	Aluminum Base Manganese Alloy	M1A

² Carbon 0.030 per cent maximum.

³ ASTM specifications directly covering forged flanges and fittings for these general material specifications do not presently exist. Flanges and fittings shall be specified to conform to the nearest grade in A182, except chemistry to conform to corresponding grade in American Iron and Steel Institute manual.

MANUFACTURING STANDARDS AND MATERIAL SPECIFICATIONS

LADISH MSS 150 POUND FLANGES

Ladish MSS 150 Pound Flanges are manufactured to the dimensional requirements of the Manufacturer's Standardization Society of Valves and Fittings Industry Standard Practice SP51. This Standard Practice covers Threaded and Blind Flanges in sizes 1/2" through 12" inclusive. The Ladish Slip-On and Welding Neck Flanges match the O.D. and drilling of this Standard Practice. The Slip-On Flange hub also matches the Threaded flange hub, while the Welding Neck Flange overall length matches that of the 150 Pound

ASA B16.5 Welding Neck Flange. These flanges are compatible with the end flanges of MSS SP42 flanged end valves.

Ladish MSS 150 Pound Flanges in sizes 1/2" to 2" are generally machined from forgings conforming to the chemical and mechanical properties of ASTM Specification A182 grades 304 and 316. Sizes 2 1/2" and larger are machined from castings of material which complies in general with the chemical compositions of ASTM Specification A351, grades CF8 and CF8M.

LADISH FORGED SCREWED AND SOCKET WELDING FITTINGS

Ladish Forged Socket Welding Fittings comply with the dimensional requirements of American Standard B16.11-1946. This standard covers the range of sizes and the dimensional tolerances shown on page 75.

Ladish 2000 Pound and 3000 Pound Forged Screwed Fittings comply with the dimensional requirements of MSS Standard Practice SP49. This standard covers fittings in sizes 1/8" to 2" inclusive.

Ladish Forged Plugs and Bushings comply with the dimensional requirements of MSS Standard Practice SP50. This Standard Practice covers fittings in sizes 1/8" to 4" inclusive.

Ladish Forged Fittings are manufactured from material included in the ASTM and ASME Specifications and to the special requirements of the purchaser.

The material specifications for Stainless Steel generally carried in stock are tabulated below.

MATERIAL SPECIFICATIONS FOR FORGED SCREWED AND SOCKET WELDING FITTINGS

ASTM SPECIFICATION	TYPE OF MATERIAL	IDENTIFICATION SYMBOL
A182	18% Cr-8% Ni	F304
A182	18% Cr-8% Ni-Mo	F316
A182	18% Cr-8% Ni ¹	F304L ²

¹ .030% Maximum Carbon.

² No ASTM specification is available. Use composition 304L of American Iron & Steel Institute manual.

LADISH 150 POUND SCREWED FITTINGS

Ladish 150 Pound Screwed Fittings are manufactured to dimensions generally based upon those of the American Standard ASA B16.3 (150 Pound Malleable Iron Screwed Fittings). They are manufactured from material included in

ASTM and ASME Specifications and to the special requirements of the purchaser. The material specifications for Stainless Steel generally carried in stock are listed below.

MATERIAL SPECIFICATIONS FOR 150 POUND SCREWED FITTINGS

SIZES INCHES	ELBOWS, TEES, STREET ELBOWS	CROSSES, 180° RETURNS	UNIONS	BUSHINGS	COUPLINGS, CAPS, PLUGS, WELDING SPUDS, LOCK NUTS
1/8—3/4	A182 ¹	A351 ³	A182 ¹	A182 ¹	A182 ¹
1—2	A351 ²	A351 ³	A182 ¹	A182 ¹	A182 ¹
2 1/2	A351 ³	A351 ³	A182 ¹	A182 ¹	A351 ³
3—4	A351 ³	A351 ³	A351 ³	A351 ³	A351 ³

¹ These fittings are machined from forgings or bar material conforming to the chemical and mechanical properties of ASTM specification A182, grades 304 and 316. Grades 304L, 347 and Carpenter 20 are available on special order when quantities warrant production.

² These fittings are machined from shell moulded castings of material which complies in general with the chemical compositions of ASTM A351, grades CF8 and CF8M.

³ These fittings are machined from castings of material which complies in general with the chemical compositions of ASTM specification A351, grades CF8 and CF8M.

DIMENSIONAL TOLERANCES

LADISH BUTT WELDING FITTINGS

Ladish Welding Fittings are manufactured in accordance with the dimensional tolerances and material specifications of the American Standard ASA B16.9-1951, and MSS¹ Standard Practice SP43. The dimensional tolerances listed

below are the maximum permitted. Rigid standards for inspection procedure assure accuracy in production and result in Ladish Fittings which normally run much closer to nominal dimensions than to the permitted extremes.

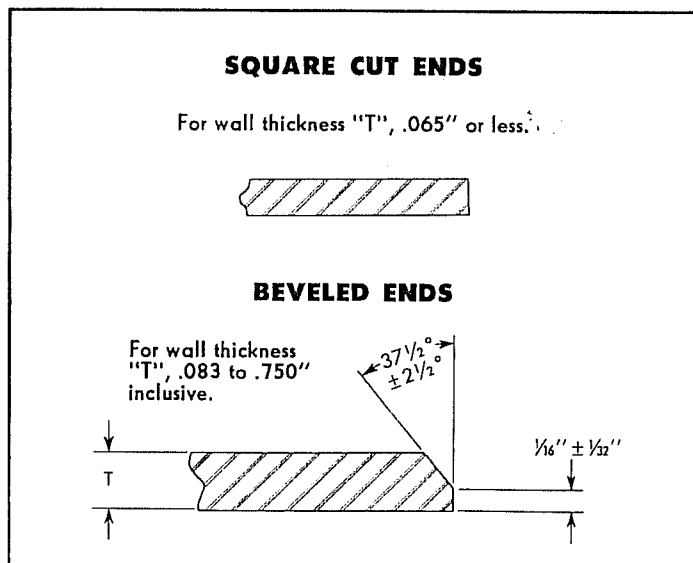
NOMINAL PIPE SIZE	ALL FITTINGS				90° AND 45° ELBOWS, TEES	REDUCERS, LAP JOINT STUB ENDS	180° RETURNS			CAPS	LAP JOINT STUB ENDS			
	OUTSIDE DIAMETER AT BEVEL		INSIDE DIAMETER AT END	WALL THICKNESS	CENTER-TO-END	OVERALL LENGTH	CENTER-TO-CENTER	BACK-TO-FACE	ALIGNMENT OF ENDS	OVERALL LENGTH	OUTSIDE DIAMETER OF LAP	THICKNESS OF LAP	FILLET RADIUS OF LAP	OUTSIDE DIAMETER OF BARREL
	SCHEDULES 65 AND 105 AND TUBE O.D.	SCHEDULES HEAVIER THAN SCH. 105												
1/2-1 1/2	+1/64 -1/32	+1/16 -1/32	± 1/32	Not less than 87 1/2% of nominal thickness	± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+0 -1/32	+1/16 -0	+0 -1/32	Tolerances assure slip fit into Lap Joint Flange of minimum permissible inside diameter
2-2 1/2	± 1/32	+1/16 -1/32	± 1/32		± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+0 -1/32	+1/16 -0	+0 -1/32	
3-3 1/2	± 1/32	± 1/16	± 1/16		± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+0 -1/32	+1/16 -0	+0 -1/32	
4	± 1/32	± 1/16	± 1/16		± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/8	+0 -1/32	+1/16 -0	+0 -1/16	
5-8	+1/16 -1/32	+3/32 -1/16	± 1/16		± 1/16	± 1/16	± 1/4	± 1/4	± 1/32	± 1/4	+0 -1/32	+1/16 -0	+0 -1/16	
10-12	+3/32 -1/32	+5/32 -1/8	± 1/8		± 3/32	± 3/32	± 3/8	± 1/4	± 1/16	± 1/4	+0 -1/16	+1/16 -0	+0 -1/16	
14-18	+3/32 -1/32	+5/32 -1/8	± 1/8		± 3/32	± 3/32	± 3/8	± 1/4	± 1/16	± 1/4	+0 -1/16	+1/16 -0	+0 -1/16	
20-24	+1/8 -1/32	+1/4 -3/16	± 3/16		± 3/32	± 3/32	± 3/8	± 1/4	± 1/16	± 1/4	+0 -1/16	+1/16 -0	+0 -1/16	

¹ Manufacturer's Standardization Society of the Valve & Fittings Industry.
² Tolerance applicable on any element of the cross section at end of fitting.

Since no nationally recognized standard for Tube O.D. Butt Welding Fittings exists, Ladish tolerances for these fittings parallel those of the similar SP43 fittings.

WELDING BEVEL DETAILS

Ladish Tube O.D. Butt Welding Fittings for use with light gauge tubing are furnished with square-cut ends to facilitate fusion welding without the use of filler metal. IPS Butt Welding Fittings are furnished with ends cut square for wall thicknesses of 0.065" and with the standard 37 1/2° bevel for wall thicknesses of 0.083" to 0.750" inclusive.



DIMENSIONAL TOLERANCES

LADISH FLANGES

Exact control over manufacture and inspection assures accurate forging and machining of Ladish Flanges... resulting in generally closer tolerances than required by ASA. The dimensional tolerances listed below include

those of the American Standard B16.5-1957 and additional manufacturing tolerances not covered by this standard. Ladish Co. also applies these tolerances to flanges not specifically covered by this standard.

NOMINAL SIZE	ALL TYPES OF FLANGES							WELDING NECK FLANGES		LONG NECKS	SLIP-ON AND LAP JOINT FLANGES	THREADED FLANGES	
	OUTSIDE DIAMETER	DIAMETER OF CONTACT FACE	DIAMETER OF BOLT CIRCLE	BOLT HOLE SPACING	BOLT CIRCLE ECCENTRICITY WITH BORE	FLANGE THICKNESS	OVERALL HEIGHT	OUTSIDE DIAMETER AT POINT OF WELD	HUB THICKNESS AT POINT OF WELD	INSIDE DIAMETER	OUTSIDE DIAMETER OF NECK	INSIDE DIAMETER	DIAMETER OF COUNTER BORE
1/2-5	± 1/16" for flanges with O.D. of 24" or less	± 1/32" for 1/16" height raised faces	± 1/16" for special drilling	± 1/32" for special drilling	1/32" Max.	+ 1/8" - 0"	± 1/16"	+ 3/32"	Not less than 87 1/2% of nominal thickness of pipe to which flange is to be welded	± 1/32"	+ 3/32"	+ 1/32"	+ 1/32"
6-10								- 1/32"			- 1/32"	- 0"	
12-18								+ 5/32"			+ 3/32"	+ 1/32"	+ 1/32"
20-24								- 1/32"			- 1/32"	- 0"	- 0"

LADISH FORGED SOCKET WELDING FITTINGS

Ladish Socket Welding Fittings are manufactured in accordance with the dimensional tolerances of the American Standard ASA B16.11-1946 for Steel Socket Welding Fittings. The dimensional tolerances listed below are the maximum permitted.

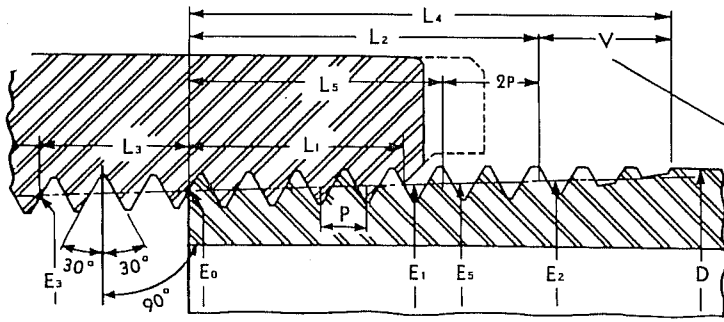
Outstanding controls over manufacturing processes augmented by rigid inspection standards have been instituted by Ladish to assure that fittings are produced to closer tolerances than the maximum set by the Standard.

NOMINAL SIZE INCHES	ALL FITTINGS						ELLS, TEES, CROSSES AND LATERALS	COUPLINGS	HALF-COUPLINGS
	INSIDE DIAMETER OF SOCKET	SOCKET WALL THICKNESS	BORE DIAMETER OF FITTING	FITTING WALL THICKNESS	CONCENTRICITY OF BORES	COINCIDENCE OF AXES	CENTER TO BOTTOM OF SOCKET	BOTTOM TO BOTTOM OF SOCKETS	BOTTOM OF SOCKET TO OPPOSITE FACE
1/8-1/4	+ .010" - .000"	Not less than 125% of nominal pipe thickness nor less than 1/8"	± .015"	Not less than nominal pipe wall thickness	Socket and fitting bores within ± .030"	Maximum variation in alignment of socket and fitting bores 1/16" in 12"	± 0.03"	± 0.06"	± 0.03"
3/8-3/4	+ .010" - .000"		± .015"				± 0.06"	± 0.12"	± 0.06"
1-2	+ .010" - .000"		± .015"				± 0.08"	± 0.16"	± 0.08"
2 1/2-3	+ .015" - .000"		± .030"				± 0.10"	± 0.20"	± 0.10"

Ladish screwed fittings are threaded in accordance with American Standard Taper Pipe Threads B2.1.

See Page 76 for summary of thread standards.

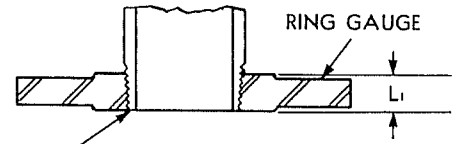
THREAD STANDARDS



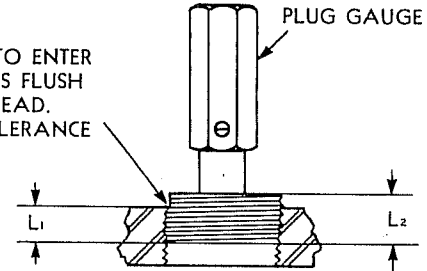
0.8P = THREAD DEPTH—AMER. STD.
 0.760P = THREAD DEPTH—A.P.I. STD.
 TOTAL TAPER 3/4" PER FOOT
 (MEASURED ON DIAMETER)

IMPERFECT THREADS
 DUE TO LEAD OR DIE

PLUG GAUGE TO ENTER
 UNTIL NOTCH IS FLUSH
 WITH FIRST THREAD.
 STANDARD TOLERANCE
 IS ± ONE TURN



GAUGE TO GO ON FLUSH BY HAND.
 STANDARD TOLERANCE IS ± ONE TURN



NOMINAL PIPE SIZE	OUTSIDE DIAMETER OF PIPE D	THREADS PER INCH N	PITCH OF THREAD P	PITCH DIAMETER AT BEGINNING OF EXTERNAL THREADS E ₀	HANDTIGHT ENGAGEMENT		EFFECTIVE THREAD EXTERNAL		WRENCH MAKE-UP LENGTH FOR INTERNAL THREAD		OVERALL LENGTH EXTERNAL THREAD L ₄
					LENGTH L ₁ †	PITCH DIAMETER E ₁	LENGTH L ₂ †	PITCH DIAMETER E ₂	LENGTH L ₃	PITCH DIAMETER E ₃	
1/8	.405	27	.0370	.3635	.180	.3748	.2639	.3800	.1111	.3566	.3924
1/4	.540	18	.0556	.4774	.200	.4899	.4018	.5025	.1667	.4670	.5946
3/8	.675	18	.0556	.6120	.240	.6270	.4078	.6375	.1667	.6016	.6006
1/2	.840	14	.0714	.7584	.320	.7784	.5337	.7918	.2143	.7450	.7815
3/4	1.050	14	.0714	.9677	.339	.9889	.5457	1.0018	.2143	.9543	.7935
1	1.315	11 1/2	.0870	1.2136	.400	1.2386	.6828	1.2563	.2609	1.1973	.9845
1 1/4	1.660	11 1/2	.0870	1.5571	.420	1.5834	.7068	1.6013	.2609	1.5408	1.0085
1 1/2	1.900	11 1/2	.0870	1.7961	.420	1.8223	.7235	1.8413	.2609	1.7798	1.0252
2	2.375	11 1/2	.0870	2.2690	.436	2.2963	.7565	2.3163	.2609	2.2527	1.0582
2 1/2	2.875	8	.1250	2.7195	.682	2.7622	1.1375	2.7906	.2500	2.7039	1.5712
3	3.500	8	.1250	3.3406	.766	3.3885	1.2000	3.4156	.2500	3.3250	1.6337
3 1/2	4.000	8	.1250	3.8375	.821	3.8888	1.2500	3.9156	.2500	3.8219	1.6837
4	4.500	8	.1250	4.3344	.844	4.3871	1.3000	4.4156	.2500	4.3188	1.7337
* 4 1/2	5.000	8	.1250	4.8313	.875	4.8859	1.3500	4.8418	...	...	...
5	5.563	8	.1250	5.3907	.937	5.4493	1.4063	5.4786	.2500	5.3751	1.8400
6	6.625	8	.1250	6.4461	.958	6.5060	1.5125	6.5406	.2500	6.4305	1.9462
* 7	7.625	8	.1250	7.4398	1.000	7.5023	1.6125	7.4524	...	...	...
8	8.625	8	.1250	8.4336	1.063	8.5000	1.7125	8.5406	.2500	8.4180	2.1462
* 9	9.625	8	.1250	9.4273	1.130	9.4980	1.8125	9.4415	...	...	...
10	10.750	8	.1250	10.5453	1.210	10.6209	1.9250	10.6656	.2500	10.5297	2.3587
* 11	11.750	8	.1250	11.5391	1.285	11.6194	2.0250	11.5549	...	...	...
12	12.750	8	.1250	12.5328	1.360	12.6178	2.1250	12.6656	.2500	12.5172	2.5587
14	14.000	8	.1250	13.7750	1.562	13.8726	2.2500	13.9156	.2500	13.7594	2.6837
* 15	15.000	8	.1250	14.7688	1.687	14.8742	2.3500	14.7872	...	...	...
16	16.000	8	.1250	15.7625	1.812	15.8758	2.4500	15.9156	.2500	15.7469	2.8837
* 17	17.000	8	.1250	16.7563	1.900	16.8750	2.5500	16.7762	...	...	...
18	18.000	8	.1250	17.7500	2.000	17.8750	2.6500	17.9156	.2500	17.7344	3.0837
20	20.000	8	.1250	19.7375	2.125	19.8703	2.8500	19.9156	.2500	19.7219	3.2837
* 22	22.000	8	.1250	21.7250	2.250	21.8656	3.0500	21.7488	...	...	...
24	24.000	8	.1250	23.7125	2.375	23.8609	3.2500	23.9156	.2500	23.6969	3.6837

Data per American Standard B2.1-1945 (For Taper Pipe Threads) and API Standard 6-A (for line pipe threads).

* Sizes discontinued in American Standards listed for reference only.

† L₁ is also length of plug gauge.

† L₁ is also length of thin ring gauge and length from gauging notch to small end of plug gauge.

The American Standard Pipe Thread and the API Standard Line Pipe Thread are interchangeable.

THREADING PRACTICE FOR AMERICAN STANDARD FLANGES

NOMINAL PIPE SIZE	MINIMUM THREAD LENGTH—INCHES "A"						
	150 LB.	300 LB.	400 LB.	600 LB.	900 LB.	1500 LB.	2500 LB.
1/2	5/8	5/8	5/8	5/8	7/8	7/8	1 1/8
3/4	5/8	5/8	5/8	5/8	1	1	1 1/4
1	1 1/16	1 1/16	1 1/16	1 1/16	1 1/8	1 1/8	1 3/8
1 1/4	1 3/16	1 3/16	1 3/16	1 3/16	1 3/16	1 3/16	1 1/2
1 1/2	7/8	7/8	7/8	7/8	1 1/4	1 1/4	1 3/4
2	1	1 1/8	1 1/8	1 1/8	1 1/2	1 1/2	2
2 1/2	1 1/8	1 1/4	1 1/4	1 1/4	1 7/8	1 7/8	2 1/4
3	1 3/16	1 1/4	1 3/8	1 3/8	1 5/8	2	2 1/2
3 1/2	1 1/4	1 7/16	1 9/16	1 9/16	...	...	...
4	1 5/16	1 7/16	1 7/16	1 5/8	1 7/8	2 1/4	2 3/4
5	1 7/16	1 11/16	1 11/16	1 7/8	2 1/8	2 1/2	3
6	1 9/16	1 13/16	1 13/16	2	2 1/4	2 3/4	3 1/4
8	1 3/4	2	2	2 1/4	2 1/2	3	3 3/4
10	1 15/16	2 3/16	2 3/16	2 9/16	2 13/16	3 5/16	4 1/4
12	2 3/16	2 3/8	2 3/8	2 3/4	3	3 5/8	4 3/4
14	2 1/4	2 1/2	2 1/2	2 7/8	3 1/4	...	...
16	2 1/2	2 11/16	2 11/16	3 1/16	3 3/8	...	...
18	2 11/16	2 3/4	2 3/4	3 1/8	3 1/2	...	...
20	2 7/8	2 7/8	2 7/8	3 1/4	3 5/8	...	...
24	3 1/4	3 1/4	3 1/4	3 5/8	4	...	...

Flanges shall be tapped with American Standard Taper Pipe Threads in accordance with ASA Standard B2.1 (Page 76) but shall have longer thread lengths in proportion to the flange thickness for high pressure-temperature services. Pitch diameter E₁, at intersection of chamfer cone, and pitch diameter of thread cone are maintained. Gauge-

ing notch of the plug gauge should come flush at this point with a manufacturing tolerance of ± one turn. Pitch diameter at small end of thread E₀, is made proportionately smaller in flanges.

THREADING PIPE FOR ASA THREADED STEEL FLANGES

NOMINAL PIPE SIZE	PROJECTION OF THREADED PIPE THROUGH RING GAUGE—INCHES						
	150 LB.	300 LB.	400 LB.	600 LB.	900 LB.	1500 LB.	2500 LB.
1/2	*	*	...	*	...	1/4	1/2
3/4	*	*	...	*	...	2 3/64	1/2
1	*	*	...	*	...	7/16	2 1/32
1 1/4	*	*	...	*	...	7/16	2 1/32
1 1/2	*	*	...	*	...	7/16	2 1/32
2	*	*	...	*	...	7/16	2 1/32
2 1/2	*	*	...	*	...	5/8	1
3	*	*	...	1/8	3/8	3/4	1 1/4
3 1/2	*	*	...	1/8	...	...	...
4	*	*	*	3/16	7/16	1 3/16	1 5/16
5	*	*	*	3/16	7/16	1 3/16	1 5/16
6	*	*	*	3/16	7/16	1 5/16	1 7/16
8	*	*	*	1/4	1/2	1	1 3/4
10	*	*	*	3/8	5/8	1 1/8	2
12	*	*	*	3/8	5/8	1 1/4	2 3/8
14	*	*	*	3/8	3/4	...	...
16	*	*	*	3/8	3/4	...	...
18	*	*	*	3/8	3/4	...	...
20	*	*	*	3/8	3/4	...	...
24	*	*	*	3/8	3/4	...	...

In order to bring the end of the threaded pipe reasonably close to the face of the flange it becomes necessary, because of the increased thread length of the flange, to add additional threads to the small end of standard pipe thread. As a result the pitch diameter (E₀, Page 76) becomes proportionately smaller than that of the standard pipe thread. This table supplies the additional length in inches to the nearest fraction of an inch of threaded pipe that should extend beyond the small end of the ring gauge.

*Regular American Standard pipe thread is used for this size.

DIMENSIONS OF WELDED AND SEAMLESS PIPE

STAINLESS STEELS

ASA B36.19-1957

NOMINAL PIPE SIZE	OUTSIDE DIAMETER	WALL THICKNESS INSIDE DIAMETER	NOMINAL WALL THICKNESS AND INSIDE DIAMETER			
			SCHEDULE 5S*	SCHEDULE 10S*	SCHEDULE 40S	SCHEDULE 80S
1/8	.405	Wall	...	.049	.068	.095
		I.D.	...	.307	.269	.215
1/4	.540	Wall	...	.065	.088	.119
		I.D.	...	.410	.364	.302
3/8	.675	Wall	...	.065	.091	.126
		I.D.	...	.545	.493	.423
1/2	.840	Wall	.065	.083	.109	.147
		I.D.	.710	.674	.622	.546
3/4	1.050	Wall	.065	.083	.113	.154
		I.D.	.920	.884	.824	.742
1	1.315	Wall	.065	.109	.133	.179
		I.D.	1.185	1.097	1.049	.957
1 1/4	1.660	Wall	.065	.109	.140	.191
		I.D.	1.530	1.442	1.380	1.278
1 1/2	1.900	Wall	.065	.109	.145	.200
		I.D.	1.770	1.682	1.610	1.500
2	2.375	Wall	.065	.109	.154	.218
		I.D.	2.245	2.157	2.067	1.939
2 1/2	2.875	Wall	.083	.120	.203	.276
		I.D.	2.709	2.635	2.469	2.323
3	3.500	Wall	.083	.120	.216	.300
		I.D.	3.334	3.260	3.068	2.900
3 1/2	4.000	Wall	.083	.120	.226	.318
		I.D.	3.834	3.760	3.548	3.364
4	4.500	Wall	.083	.120	.237	.337
		I.D.	4.334	4.260	4.026	3.826
5	5.563	Wall	.109	.134	.258	.375
		I.D.	5.345	5.295	5.047	4.813
6	6.625	Wall	.109	.134	.280	.432
		I.D.	6.407	6.357	6.065	5.761
8	8.625	Wall	.109	.148	.322	.500
		I.D.	8.407	8.329	7.981	7.625
10	10.750	Wall	.134	.165	.365	.500**
		I.D.	10.482	10.420	10.020	9.750**
12	12.750	Wall	.156	.180	.375**	.500**
		I.D.	12.438	12.390	12.000**	11.750**
14†	14.000	Wall	.156	.188	...	...
		I.D.	13.688	13.624	...	...
16†	16.000	Wall	.165	.188	...	...
		I.D.	15.670	15.624	...	...
18†	18.000	Wall	.165	.188	...	...
		I.D.	17.670	17.624	...	...
20†	20.000	Wall	.188	.218	...	...
		I.D.	19.624	19.564	...	...
24†	24.000	Wall	.218	.250	...	...
		I.D.	23.564	23.500	...	...
30†	30.000	Wall	.250	.312	...	...
		I.D.	29.500	29.376	...	...

All dimensions given in inches.

The wall thicknesses shown represent nominal or average wall dimensions which are subject to a -1 1/2% mill tolerance.

†Sizes 14" through 30" are not at publication date covered in B36.19, and dimensions listed are those commonly used in the industry.

*Schedule 5S and 10S wall thicknesses do not permit threading in accordance with ASA B2.1.

**NOTE THAT SCHEDULE 40S AND SCHEDULE 80S IN THESE SIZES DO NOT AGREE WITH SCHEDULE 40 AND SCHEDULE 80 OF ASA B36.10, AND THAT THEY ARE IDENTICAL TO STANDARD WEIGHT AND EXTRA STRONG RESPECTIVELY OF ASA B36.10.

DIMENSIONS OF WELDED AND SEAMLESS PIPE

CARBON AND ALLOY STEELS

ASA B36.10-1950

NOMINAL PIPE SIZE	OUTSIDE DIAM.	WALL I.D.	NOMINAL WALL THICKNESS AND INSIDE DIAMETER													
			SCHEDULE 10	SCHEDULE 20	SCHEDULE 30	STANDARD WEIGHT	SCHEDULE 40	SCHEDULE 60	EXTRA STRONG	SCHEDULE 80	SCHEDULE 100	SCHEDULE 120	SCHEDULE 140	SCHEDULE 160	DBL EX STRONG	
1/8	.405	Wall	...	...	...	.068	.068	...	.095	.095	...	...	...	...	...
		I.D.	...	...	...	.269	.269	...	.215	.215	...	...	...	...	...
1/4	.540	Wall	...	...	...	.088	.088	...	.119	.119	...	...	...	...	...
		I.D.	...	...	...	.364	.364	...	.302	.302	...	...	...	...	...
3/8	.675	Wall	...	...	...	.091	.091	...	.126	.126	...	...	...	...	...
		I.D.	...	...	...	.493	.493	...	.423	.423	...	...	...	...	...
1/2	.840	Wall	...	...	...	.109	.109	...	.147	.147	...	...	...	...	...
		I.D.	...	...	...	.622	.622	...	.546	.546	...	...	...	.187	.294	
3/4	1.050	Wall	...	...	...	.113	.113	...	.154	.154	...	...	...	...	.466	.252
		I.D.	...	...	...	.824	.824	...	.742	.742	...	...	...	...	.218	.308
1	1.315	Wall	...	...	...	.133	.133	...	.179	.179	...	...	...	...	.614	.434
		I.D.	...	...	...	1.049	1.049	...	.957	.957	...	...	...	...	.250	.358
1 1/4	1.660	Wall	...	...	...	.140	.140	...	.191	.191	...	...	...	...	.815	.599
		I.D.	...	...	...	1.380	1.380	...	1.278	1.278	...	...	...	...	.250	.382
1 1/2	1.900	Wall	...	...	...	.145	.145	...	.200	.200	...	...	...	...	1.160	.896
		I.D.	...	...	...	1.610	1.610	...	1.500	1.500	...	...	...	...	.281	.400
2	2.375	Wall	...	...	...	.154	.154	...	.218	.218	...	...	...	...	1.338	1.100
		I.D.	...	...	...	2.067	2.067	...	1.939	1.939	...	...	...	...	.343	.436
2 1/2	2.875	Wall	...	...	...	.203	.203	...	.276	.276	...	...	...	...	1.689	1.503
		I.D.	...	...	...	2.469	2.469	...	2.323	2.323	...	...	...	...	.375	.552
3	3.500	Wall	...	...	...	.216	.216	...	.300	.300	...	...	...	...	2.125	1.771
		I.D.	...	...	...	3.068	3.068	...	2.900	2.900	...	...	...	...	.438	.600
3 1/2	4.000	Wall	...	...	...	.226	.226	...	.318	.318	...	...	...	...	2.624	2.300
		I.D.	...	...	...	3.548	3.548	...	3.364	3.364	...	...	...	...	...	.636†
4	4.500	Wall	...	...	...	.237	.237	...	.337	.337	...	...	...	...	...	2.728†
		I.D.	...	...	...	4.026	4.026	...	3.826	3.826	...	3.624	...	3.438	3.152	.674
5	5.563	Wall	...	...	...	.258	.258	...	.375	.375	...	...	...	...	3.438	3.152
		I.D.	...	...	...	5.047	5.047	...	4.813	4.813	...	4.563	...	4.313	4.063	.750
6	6.625	Wall	...	...	...	.280	.280	...	.432	.432	...	...	...	...	4.313	4.063
		I.D.	...	...	...	6.065	6.065	...	5.761	5.761	...	5.501	...	5.189	4.897	.864
8	8.625	Wall	...	.250	.277	.322	.322	.406	.500	.500	.593	.718	.812	.906	5.189	4.897
		I.D.	...	8.125	8.071	7.981	7.981	7.813	7.625	7.625	7.439	7.189	7.001	6.813	6.875	.875
10	10.750	Wall	...	.250	.307	.365	.365	.500	.500	.593	.718	.843	1.000	1.125	...	6.875
		I.D.	...	10.250	10.136	10.020	10.020	9.750	9.750	9.564	9.314	9.064	8.750	8.500	...	...
12	12.750	Wall	...	.250	.330	.375	.406	.562	.500	.687	.843	1.000	1.125	1.312	...	...
		I.D.	...	12.250	12.090	12.000	11.938	11.626	11.750	11.376	11.064	10.750	10.500	10.126	...	...
14	14.000	Wall	.250	.312	.375	.375	.438	.593	.500	.750	.937	1.093	1.250	1.406	...	...
		I.D.	13.500	13.375	13.250	13.250	13.124	12.814	13.000	12.500	12.126	11.814	11.500	11.188	...	...
16	16.000	Wall	.250	.312	.375	.375	.500	.656	.500	.843	1.031	1.218	1.438	1.593	...	...
		I.D.	15.500	15.375	15.250	15.250	15.000	14.688	15.000	14.314	13.938	13.564	13.124	12.814	...	...
18	18.000	Wall	.250	.312	.438	.375	.562	.750	.500	.937	1.156	1.375	1.562	1.781	...	...
		I.D.	17.500	17.375	17.124	17.250	16.876	16.500	17.000	16.126	15.688	15.250	14.876	14.438	...	...
20	20.000	Wall	.250	.375	.500	.375	.593	.812	.500	1.031	1.281	1.500	1.750	1.968	...	...
		I.D.	19.500	19.250	19.000	19.250	18.814	18.376	19.000	17.938	17.438	17.000	16.500	16.064	...	...
24	24.000	Wall	.250	.375	.562	.375	.687	.968	.500	1.218	1.531	1.812	2.062	2.343	...	...
		I.D.	23.500	23.250	22.875	23.250	22.626	22.064	23.000	21.564	20.938	20.376	19.876	19.314	...	...
30	30.000	Wall	.312	.500	.625	.375†	...	...	.500†	...	...	...	...	...	...	...
		I.D.	29.376	29.000	28.750	29.250†	29 000†

All dimensions given in inches.

†Not included in B36.10-1950.

The wall thicknesses shown represent nominal or average wall dimensions which are subject to a -12 1/2% mill tolerance.

NOTE THAT SCHEDULE 40 IN SIZES 12" AND LARGER AND THAT SCHEDULE 80 IN SIZES 10" AND LARGER DO NOT AGREE WITH SCHEDULES 40S AND 80S OF ASA B36.19 NOR WITH STANDARD WEIGHT AND EXTRA STRONG RESPECTIVELY.

WELDING OF STAINLESS STEEL FITTINGS, PIPE and TUBING

In welding of the Stainless Steel materials, several problems will be encountered which are not normally present in welding of mild steels and the Carbon alloy steels. The specific application for the material will usually govern the choice of material, choice of filler metal if it is used and the choice of welding process.

Generally, where Stainless Steel is applied to an installation, it is required that the inner surface of the welded joint shall be as smooth and as clean as possible.

WELDING PROCESSES

The choice of process or combination of processes will be determined by several factors. Among these are: schedule of pipe and fittings to be welded, necessity for filler metal, accessibility to the weld area and availability of equipment. Three common processes are at present most generally used, either separately or in combination.

TUNGSTEN INERT GAS (TIG)

Tungsten Inert Gas Process (TIG) has many advantages and is in wide-spread use in industry for welding stainless steels. The TIG process makes use of a non-consumable Tungsten electrode to maintain an arc which is shielded from the atmosphere by introduction of a monatomic inert gas. The gases used are usually Argon or Helium. The power used can be either A-C or D-C with straight polarity. The D-C power source is generally preferred.

Helium is generally preferred on Stainless Steel, except where wall thickness is 14 gauge (.083") or under. At equal mechanical arc lengths and equal welding current, the Tungsten arc in Helium will show about 50% higher arc voltage than the same arc in Argon. While this permits a more uniform penetration and a higher welding speed, it also limits the use of this combination to heavier sections. The "colder arc" in Argon assists in control of penetration in the thinner sections.

Lighter wall, Schedule 5S and up to Schedule 10S, fittings and pipe are frequently welded by fusion only, without the use of filler metal. Wall thicknesses up to 1/4" are welded by this process with the manual addition of filler metal (in a manner similar to the oxy-acetylene process).

For welding of heavier wall thicknesses, the TIG process is usually employed to put in the root pass of the weld.

This is done in some cases as a fusion process only . . . in others, with the addition of small amounts of filler metal . . . and still in other cases, using a consumable type of back-up ring.

In welding the fully austenitic steels, where permissible, this consumable back-up ring or filler metal may be made of such composition as to contain small percentages of ferrite to assist in prevention of cracks. The use of the consumable back-up ring also assists greatly in maintaining a smooth bead contour on the inner diameter of the weld.

In all cases where full penetration is to be obtained, protection of the molten metal on the inside diameter is necessary. This can be accomplished best by use of an inert gas shield.

Several methods can be employed to accomplish this protection. In small diameter pipe, the entire system may be purged. In larger diameters it is more usual that the weld area be blocked off with a withdrawable type of device. This device would consist of two diaphragms inter-connected with either a flexible or a rigid tube. The diaphragms should be adequate to make an effective seal within the pipe. The tube should be drilled to provide for introduction of the backing gas. Either one or both of the diaphragms should be vented so as to prevent excessive build-up of pressure within the system and to effect the exclusion of the atmosphere originally contained in the system.

An initial purging of the system will be required before welding can be started. This can be accomplished by a flow of not less than three volumes of the contained area. Larger areas that pose difficulty in venting will require a greater volume. After initial purging, the gas flow can be cut to approximately three to five cubic feet per hour. Regulation of this flow will normally be sufficient as a control of internal pressure. With experience, the welder can control this pressure by observation of the contour of the molten weld puddle. In the flat position, a concave puddle will indicate insufficient pressure. A flat puddle indicates correct pressure . . . a convex puddle indicates excessive pressure.

When welding in the overhead position, a gauge pressure of essentially zero must be maintained to prevent excessive slumping of the weld metal.

WELDING OF STAINLESS STEEL FITTINGS, PIPE and TUBING

TUNGSTEN INERT GAS PROCESS (TIG)

- CURRENT:** Alternating current high frequency (ACHF) will give satisfactory results with Helium gas. Direct current (D-C) negative polarity is also recommended with Helium gas.
- POSITION:** Flat is preferred with a Copper back-up bar under the joint preparation.
- TEMPERATURE:** Pre-heat and Inter-pass Temperatures: Pre-heating is unnecessary and inter-pass temperatures up to 600° F. are permissible.
- CLEANING:** All surfaces to be joined must be cleaned thoroughly of dirt, grease and oxide film. Craters, undercutting and other flaws should be chipped out to clean metal. If full penetration is not obtained in root pass, back chip to clean metal and re-weld.
- TACKING:** Tack with 3/4" welds at intervals of 4" to 8".
- MANIPULATION:** Arc should be started on a steel or Copper striking pad. Forehand or back-hand technique may be used. Back-step welding will tend to minimize distortion.

METAL INERT GAS (MIG) CONSUMABLE ELECTRODE PROCESS

Metal Inert Gas (MIG) Consumable Electrode Process is both an automatic and a semi-automatic process. Bare wire is fed from a spool by a motor-driven device through a gun-type fixture which provides contact with power source and introduction of shielding medium and coolant.

The MIG process has limited applications in this field. However, where the pipe to be welded is accessible and of heavier wall thickness, the process has excellent characteristics. The rate of metal deposit is high and the weld metal composition can be closely controlled. This process is also applicable to all positions of welding.

Argon or Helium can be used as the shielding medium. A mixture of Argon and Helium may be desirable to aid in control of the arc and its penetration characteristics. The addition of 2.0% Oxygen will aid materially in stabilizing the arc.

MANUAL METAL ARC (MMA)

The Manual Metal Arc, using coated electrodes, is still the most widely used method for applying filler metal. This process is used in combination with the TIG process by many fabricators, using the TIG process for root pass followed by filler metal deposited from coated electrodes.

Due to the tendency of the fully austenitic weld deposits toward cracking, certain precautions should be taken when using the process. Where possible, an electrode designed to produce a weld deposit containing small percentages of ferrite can be used to aid in crack prevention. In all cases, the deposited metal should be put in small stringer type beads. Weaving to produce a wide, thin weld deposit should be discouraged.

Any crater cracks at weld stops must be completely removed prior to making a new start. This should be accomplished by chipping, or by grinding with a resinoid or rubber bonded Aluminum oxide wheel.

Where corrosion due to Carbon pick-up is a problem, slag removal should be accomplished by use of tools made of Stainless Steel material.

Welding of the austenitic Chrome-Nickel stainless steels creates another problem due to the heat effects of the welding operation. Heating of types such as 304 and 316 Stainless Steel, in the temperature range 800° F. to 1650° F., will cause a precipitation of Chromium carbides into the grain boundaries. This precipitation results in a deficiency of Chromium in the areas immediately adjacent to the grain boundary and consequently the affected material will be vulnerable to attack in a corrosive medium.

The re-solution of these carbides can be effected by a post-weld heat treatment. This can be accomplished by heating the weldment in the temperature range 1850° F. to 2050° F., holding at temperature one-half to one hour and rapidly cooling. Thin sections can be cooled in air, but heavy sections must be cooled by water quenching.

Where post-weld heat treatments of this nature cannot be accomplished, a selection of a low Carbon (.03% Max.) material can be made. However, welding of the low Carbon material must be done under close control. Utmost cleanliness is mandatory. Even the smallest amounts of carbonaceous materials introduced in the welding process will result in Carbon pick-up sufficient to reduce corrosion resistance.

Handling of electrodes with dirty gloves, laying electrodes on a dirty table, chipping, or wire brushing with Carbon steel tools, or grinding with a wheel which has contacted Carbon steel can introduce a sufficient amount of Carbon to cause ultimate failure of the weldment in a corrosive atmosphere.

WELDING OF STAINLESS STEEL FITTINGS, PIPE and TUBING

Where Stainless Steel materials are to be exposed to elevated temperatures in the range 800° F. to 1650° F. and to corrosive media, the harmful effects of Chromium carbide precipitation are avoided by addition of a minimum amount of a stabilizing element. Type 321 contains Titanium. Type 347 contains Columbium as a stabilizing element. The stabilizing elements will combine with the Carbon at a higher temperature than will Chromium, thus, effectively tying up the available Carbon and thereby eliminating the vulnerable Chromium deficient areas. These materials may be welded and will retain their resistance to corrosion, even in the as-welded state. However, subsequent heat treatment, if possible, will improve the mechanical properties of the weldment.

Welding of the straight Chromium stainless steels will present much the same problems as encountered in the high

Carbon or medium Carbon alloy steels. Rapid cooling of the weldment will result in a highly stressed, brittle structure. Use of these materials will make pre-heating and post-weld heat treatment mandatory.

To effectively reduce stresses during welding, a pre-heat and interpass temperature of not less than 600° F. should be maintained. When welding is completed, a stress-relief treatment must follow. However, in these materials the transformation of austenite to martensite must be completed prior to the stress-relief treatment. This can best be checked by allowing the weldment to cool until it becomes magnetic. At this time, it should be re-heated and stress relieved prior to cooling to room temperature. This treatment will result in a tempered martensitic structure which will have the desired mechanical properties.

CORROSION

Corrosion may be simply defined as the destruction of a metal or alloy by a mechanism which is basically electrochemical in nature.

Stainless steels and many other corrosion-resistant alloys are also subject to corrosion. It is only with reservations that the metallurgists use the word "stainless" to designate certain types of steels. Yet this name has become accepted terminology because the users have found that these steels do have desirable corrosion resistance and certain "noble" characteristics. However, to fulfill the promise of their name, the austenitic stainless steels require proper handling to obtain maximum service life and corrosion resistance. By understanding the principles underlying the corrosion resistance of these steels and applying a few precautions which these principles indicate, we can maintain the desirable "noble" characteristics of these steels.

PASSIVATION

Most researchers agree that the austenitic steels obtain their corrosion resistance from a thin metal oxide layer which forms a protective film on the surface of the metal. This condition is known as passivation. (All Ladish fittings are passivated.) Air will form this film in time. However, the film formation can be greatly accelerated by exposure to an oxidizing acid such as Nitric Acid, HNO₃. Destruction of this film wholly or partially will greatly affect the corrosion resistance of this type of alloy.

FACTORS AND CONDITIONS WHICH MAY AFFECT CORROSION RESISTANCE OF STAINLESS STEEL

Galvanic Corrosion—Bi-metal attack. When two or more dissimilar metals are connected or in contact, or when metals of the same analysis have variations in surface conditions, a galvanic cell may be established when an electrolyte is present. The least noble metal in the galvanic series will become sacrificial to the more noble metal.

GALVANIC SERIES

ANODIC END (least noble)	Hastelloy C (active)
Magnesium	Brasses
Magnesium Alloys	Copper
Zinc	Bronzes
Aluminum AA1100	Cupro-Nickel Alloys
Cadmium	Monel
Aluminum AA2017	Silver Solder
Iron and Carbon Steel	Nickel (passive)
Copper Steel	Inconel (passive)
4-6% Cr. Steel	Ferritic Stainless (passive)
Ferritic Stainless (active) 400 series	Austenitic Stainless (passive)
Austenitic Stainless (active) 18-8	Titanium
Lead-Tin-Solder	Hastelloy C (passive)
Lead	Silver
Tin	Graphite
Nickel (active)	Gold
Inconel (active)	Platinum
	CATHODIC END (most noble)

CORROSION

Stainless Steel in the passive state appears in a relatively noble position in the galvanic series and is usually cathodic. Therefore, not subject to attack. However, under certain conditions all or portions of a piece of Stainless Steel may become active.

This active surface becomes anodic to the more noble mass and in the presence of an electrolyte a galvanic cell is set up and attack will occur. The rate of attack will vary with different electrolytes and the area relationship of the anode and cathode. A small anodic or active area in relationship to a large cathodic or passive area will result in rapid, severe attack. The rate of attack will be greater with acid solutions and those having a high degree of ionization. However, with basic solutions, even though a high degree of ionization is possible, corrosion may not occur in basic solutions due to the insolubility of the elements which make up stainless steels.

Electrolytic or Stray Current Corrosion—Stray electric currents may produce pitting attack on Stainless Steel. This attack may occur with A-C or D-C although the rate of attack with A-C is considerably less than D-C and in most cases insufficient to be considered.

If there is the possibility of current leakage, the installation should be grounded. If this is impossible, the attack can be eliminated or reduced by inducing a small counter-current into the system to neutralize the effect of stray current. Another method which may be employed is to connect sacrificial anodes, such as Magnesium, to the system.

Chemical Attack—Austenitic steels are resistant to most chemicals. However, there are a few which cause serious attack. Halogen and Sulphur compounds are notorious for attack on stainless steels. Again acidic solutions cause more severe attack than basic solutions of the same elements.

If possible, exposure to these harmful chemicals should be avoided. In cases where it is necessary to use compounds of this type with Stainless Steel, exposure time should be kept to a minimum and temperatures as low as possible used. In many cases inhibitors can be used in the solutions to render them less harmful.

Contact or Crevice Corrosion—This probably is the most common cause of pitting of stainless steels. Whenever a solid or semi-solid material adheres or lies against a Stainless Steel surface in contact with an electrolyte, pitting may occur. The passivity of the steel is destroyed under the

substances, due to Oxygen starvation. This area will then become anodic to the mass and pitting will occur. The rate of attack will be governed by the relative anode and cathode areas and the type of electrolyte.

Oxygen concentration cells may also develop in crevices or fissures and may set up a galvanic cell and result in pitting attack.

These types of corrosion will spread as products of corrosion deposit on other areas of the metal and form new cells which cause further pitting. To overcome crevice, contact or concentration-cell corrosion an installation should be designed with a minimum of laps and crevices. If gaskets or seals are used they must be non-absorbent and well seated. Regular, efficient cleaning with correct cleaning agents will minimize these types of attack.

Stress Corrosion and Corrosion Fatigue—This type of corrosion cracking is a result of residual or applied stresses. Metal under stress is slightly anodic in relation to the unstressed metal of the same analysis. Austenitic steels under stress are subject to attack when exposed to certain corrosive agents. The Halogen salts are probably the most serious offenders.

Correct heat treatment after forming and fabrication will eliminate residual stresses from these operations. It is also important in designing an installation to eliminate sources of stress such as applied loads, vibrations, flexing and excessive expansion and contraction due to changes in temperatures.

Erosion Corrosion—Certain liquids or gases moving at high speeds may cause erosion corrosion, though these same materials if motionless would not affect the Stainless Steel. It is believed, by most investigators, that the attack is due in part to the destruction of the passive film on the surfaces. The action of fluids in rapid motion is not always destructive. In some cases the scouring effect keeps the Stainless Steel free of deposits and sludge which may cause other types of corrosion. Many Oxygen bearing solutions maintain the passivity of the stainless steels even at high velocities. To reduce the possibility of erosion corrosion, turbulence and impingement should be kept to a minimum. This will also improve the overall flow efficiency.

Austenitic stainless steels offer excellent corrosion resistance to most corrosives. By correct application, design and maintenance, stainless steels will perform in accordance with their noble characteristics.

LABORATORY CORROSION RESISTANCE DATA*

The data presented in the following table give the corrosion-resistance of Types 304 and 316 Stainless Steel to various chemical media. The results should be regarded only as indicative of the service life to be expected and not as a guarantee of performance.

Due to variations encountered in service which cannot be duplicated in the laboratory, such as the impurities under commercial conditions which may exert an effect that would not be present when dealing with chemically pure materials in a laboratory test, it is highly advisable whenever possible to subject samples to actual operating conditions before drawing definite conclusions. Also, the condition of the material as furnished by the mill may be somewhat altered during fabrication. Furthermore, it should

not be concluded that in instances where Stainless Steel is not affected by several substances used alone, that their combination will have no reaction on the steel.

The symbols in this table indicate approximate corrosion-resistance of Types 304 and 316 Stainless Steel to a variety of reagents on a laboratory test basis. The values shown for Type 304 are equally applicable to Type 347.

CODE	RELATIVE RESISTANCE
1	Fully Resistant
2	Satisfactorily Resistant
3	Fairly Resistant
4	Slightly Resistant
5	Not Resistant

SUBSTANCE CONDITION	TEMP. F.	TYPE 304	TYPE 316
Acetic Acid			
5% Agitated	70°	1	1
5% Aerated	70°	1	1
5%	100°	1	1
5%	180°	1	1
10% Agitated	70°	1	1
10% Aerated	70°	1	1
10%	100°	1	1
10%	180°	1	1
10%	Boiling	3	1
10%	60°	1	1
15%	100°	1	1
15%	180°	1	1
15%	Boiling	3	1
20% Agitated	70°	1	1
20% Aerated	70°	1	1
20%	180°	1	1
33%	70°	1	1
33%	100°	1	1
33%	180°	1	1
33%	Boiling	3	1
40% Aerated	180°	1	1
50%	70°	1	1
50%	Boiling	3	1
60%	60°	1	1
60%	100°	1	1
60%	180°	1	1
60%	Boiling	3	2
80%	70°	1	1
80%	100°	1	1
80%	180°	1	1
80%	Boiling	4	2
90% Aerated	180°	3	1
100%	70°	1	1
100%	100°	1	1
100%	180°	1	1
100%	Boiling	3	2
100%—150-lb. Press.	400°	5	3
Acetic Anhydride			
(90% Anhydride)	70°	1	1
(90% Anhydride)	180°	1	1
(90% Anhydride)	Boiling	1	1
Aerated			
(90% Anhydride)	180°	4	3
(60% Anhydride)	180°	2	2
(30% Anhydride)	180°	4	2
Acetic Acid Vapors			
30%	Hot	3	2
100%	Hot	5	3
Acetone			
	70°	1	1
	Boiling	1	1
Acetyl Chloride			
	Cold	2	2
	Boiling	2	2
Acetylene			
	70°	1	1
Acid Salt Mix			
10% H ₂ SO ₄ Sp. G. 1.07 +10% CuSO ₄ · 5 H ₂ O	Boiling	1	1
10% H ₂ SO ₄ Sp. G. 1.07 +2% FeSO ₄ · 7 H ₂ O	Boiling	1	1
Alcohol, Ethyl			
	70°	1	1
	Boiling	1	1
Alcohol, Methyl			
	70°	1	1
	150°	*3	2
Aluminum, Molten			
	1400°	5	5
Aluminum Acetate			
Saturated	70°	1	1
Saturated	Boiling	1	1

SUBSTANCE CONDITION	TEMP. F.	TYPE 304	TYPE 316
Aluminum Chloride			
10% Quiescent	70°	4	3
25% Quiescent	70°	4	3
Aluminum Fluoride			
	70°	4	3
Aluminum Hydroxide			
Saturated	70°	*1	1
Aluminum Sulphate			
5%	150°	*1	1
10%	70°	*1	1
10%	Boiling	*2	1
Saturated	70°	*1	1
Saturated	Boiling	*2	1
Aluminum Chromium Sulphate 5% Sp. G. 1.6	70°	*1	1
	Boiling	*5	...
Aluminum Potassium Sulphate (Alum)			
2%	70°	*1	1
10%	70°	*1	1
10%	Boiling	*2	1
Saturated	Boiling	*3	2
Ammonia (Dry or Moist)			
All concentrations	70–212°	1	1
Ammonia (Anhydrous)			
	80° up	5	5
Ammonium Hydroxide			
	70°	1	1
	Boiling	1	1
	Hot	1	1
Ammonium Bicarbonate			
	70°	1	1
Ammonium Bromide			
5%	70°	1	1
Ammonium Carbonate			
1% Quiescent	70°	1	1
5% Quiescent	70°	1	1
1% Aerated	70°	1	1
5% Aerated	70°	1	1
1% Agitated	70°	1	1
5% Agitated	70°	1	1
Ammonium Chloride			
1% Quiescent	70°	*1	1
1% Aerated	70°	*1	1
1% Agitated	70°	*1	1
10%	Boiling	*1	*1
20%	Boiling	*1	*1
28%	Boiling	*2	*1
50%	Boiling	*2	*1
Ammonium Chlorostannate			
Saturated	70°	2	1
Saturated	140°	5	3
Ammonium Nitrate			
All Conc. Agitated } Aerated }	70°	1	1
Saturated	Boiling	1	1
Ammonium Oxalate			
5%	70°	1	1
Ammonium Perchlorate			
10%	Boiling	1	1
Ammonium Persulphate			
5%	70°	1	1
Ammonium Phosphate			
5%	70°	1	1
Ammonium Potassium Sulphate (Alum)			
Dilute and saturated	Various	*1	1
Ammonium Sulphate			
1% Aerated	70°	1	1

SUBSTANCE CONDITION	TEMP. F.	TYPE 304	TYPE 316
Ammonium Sulphate (cont.)			
1% Agitated	70°	1	1
5% Aerated	70°	1	1
5% Agitated	70°	1	1
10%	Boiling	*2	*1
Saturated	Boiling	2	1
Ammonium Sulphite			
	70°	1	1
	Boiling	1	1
Aniline			
3%	70°	1	1
Concentrated Crude	70°	1	1
Aniline Hydrochloride			
	70°	5	4
Antimony			
Molten	1100°	5	5
Antimony Sulphide			
Molten	1200–1600°	5	5
Antimony Trichloride			
	70°	5	4
Arsenic Acid			
	150°	1	1
Barium Carbonate			
	70°	1	1
Barium Chloride			
5%	70°	1	1
Saturated	70°	1	1
Aqueous Solution			
	Hot	*2	*1
Barium Hydroxide			
All concentrations	Cold & Hot	1	1
Barium Nitrate			
Aqueous Solution			
	Hot	1	1
Barium Sulphate (Barytes-Blanc Fixe)			
	70°	1	1
Beer			
(Barley Malt and Hops)	70°	1	1
3.5%–4.5% Alcohol	150°	1	1
Benzene (Benzol)			
	70°	1	1
	Hot	1	1
Benzoic Acid			
	70°	1	1
Blood (Meat Juices)			
	Cold	*1	1
Borax 5%			
	Hot	1	1
Boric Acid 5%			
	Hot or Cold	1	1
Boric Acid, Saturated			
	Boiling	1	1
Bromine—			
Bromine Water			
	70°	5	4
Buttermilk			
	70°	1	1
Butyric Acid			
5%	70°	1	1
5%	150°	1	1
Aqueous Solution			
Sp. G. 964	Boiling	1	1
Calcium Carbonate			
	70°	1	1
Calcium Chlorate			
Dilute	Cold & Hot	1	1
Calcium Chloride			
Dilute	70°	*2	*1
Conc. Solutions	70°	*2	*1
Calcium Chlorohypochlorite (Bleaching Powder)			
1%	70°	†3	†2
5%	70°	†3	†3
Calcium Hypochlorite			
2%	70°	†2	†1
Aqueous Solution			
Sp. G. 1.04	100°	†3	†1
Calcium Chlorate			
Dilute Solution	70°	1	1
Dilute Solution	Hot	1	1

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LABORATORY CORROSION RESISTANCE DATA*

SUBSTANCE CONDITION	TEMP. F.	TYPE 304	TYPE 316
Calcium Hydroxide			
10%	Boiling	1	1
20%	Boiling	1	1
50%	Boiling	3	2
Calcium Sulphate			
Saturated	70°	1	1
Cadmium	Molten	3	3
Camphor	70°	1	1
Cane Juice (Sugar Cane)	Hot	1	1
Carbolic Acid (Phenol)			
C.P. plus 10% water	Boiling	1	1
C.P.	70°	1	1
C.P. (Boil) 360°	360°	1	1
Crude	212°	1	1
Crude	Boiling	1	1
Carbon Bisulphide	70°	1	1
Carbon Monoxide Gas	1400° 1600°	1	1
Carbon Tetrachloride			
C.P.	70°	1	1
C.P.	Boiling	1	1
Commercial plus 1% water	Boiling	...	*2
Commercial plus 1% HCl	Boiling	...	*2
Carbonated Beverages Various concentrations ...	Cold	1	1
Carbonated Water (Carbonic Acid)		1	1
Carbonic Acid All concentrations	Cold & Hot	1	1
Carnallite— Saturated Solution (KCl • MgCl ₂ • 6H ₂ O)	Boiling	2	2
Caustic Soda (See Sodium Hydroxide)			
Chinisol Antiseptic Aqueous Solution 1-500 dilution	70°	1	1
Cellulose		1	1
Chloroacetic Acid	70°	4	3
Chlorine Gas			
Dry	70°	1	1
Moist	70° 212°	4 5	3 4
Chlorinated Water			
Saturated	70°	†3	†2
Chloric Acid	70°	5	4
Chlorobenzene (Phenyl Chloride) C. P.	70° Boiling	1 1	1 1
Chloroform	70°	1	1
Chlorosulphonic Acid Dilute	70°	5	5
Chromic Acid			
5% C.P.	70°	1	1
10% C.P.	70°	2	2
10% C.P.	Boiling	3	2
50% C.P.	70°	2	2
50% C.P.	Boiling	3	...
Commercial 50% (Cont. SO ₃)	70°	1	1
Commercial 50% (Cont. SO ₃)	Boiling	*4	3
Chromium Plating Bath	70°	1	1
Cider	70°	1	1
Citric Acid			
5% Quiescent	70°	1	1
5% Quiescent	150°	1	1
10%	70°	1	1
10%	Boiling	2	1
15%	70°	1	1
15%	Boiling	2	1
25%	70°	1	1
25%	Boiling	4	1
50%	70°	1	1
50%	Boiling	4	1
Conc.	Boiling	3	2
5% -45-lb. sq. in. Pressure	284°	4	2
Coca-Cola Syrup (Pure)	70°	1	1
Coffee	Boiling	1	1
Copperas. (See Ferrous Sulphate)			
Copper Acetate Sat. Solution	70°	1	1
Copper Carbonate Sat. Sol. in 50% NH ₄ OH		1	
Copper Chloride (Cupric Chloride)			
1% Agitated	70°	*2	*1
1% Aerated	70°	*2	*1
5% Agitated	70°	*3	*2
5% Aerated	70°	*5	*3

SUBSTANCE CONDITION	TEMP. F.	TYPE 304	TYPE 316
Copper Cyanide (Cupric Cyanide) Sat. Solution	Boiling	1	1
Copper Nitrate (Cupric Nitrate)			
1% Quiescent	70°	1	1
1% Agitated	70°	1	1
1% Aerated	70°	1	1
5% Quiescent	70°	1	1
5% Agitated	70°	1	1
5% Aerated	70°	1	1
50% Aqueous Sol.	Boiling	1	1
Copper Sulphate (Cupric Sulphate)			
5% Agitated	70°	1	1
5% Aerated	70°	1	1
Sat. Solution	Boiling	1	1
Cream of Tartar	Cold & Hot	1	1
Creosote (Coal Tar)	Hot	1	1
Creosote Oil	Hot	1	1
Cyanogen Gas	70°	1	1
Dichloroethane	Boiling	1	1
Dinitrochlorobenzene Melted and Solidified ...	70°	1	1
Distillery Wort	70°	1	1
Dye-wood Liquor	70°	†1	1
Epsom Salt (Magnesium Sulphate)	Hot & Cold	1	1
Ether	70°	1	1
Ethyl Chloride	70°	1	1
Ethylene Chloride	70°	1	1
Ferric Chloride 1% to Saturation	70°	5	5
Ferric Hydroxide (Hydrated Iron Oxide)	70°	*1	1
Ferric Nitrate			
1% Quiescent	70°	1	1
5% Quiescent	70°	1	1
1% Agitated	70°	1	1
5% Agitated	70°	1	1
1% Aerated	70°	1	1
5% Aerated	70°	1	1
Ferric Sulphate			
1% Quiescent	70°	1	1
1% Aerated	70°	1	1
1% Agitated	70°	1	1
5% Quiescent	70°	1	1
5% Aerated	70°	1	1
5% Agitated	70°	1	1
10%	Boiling	1	1
Ferrous Sulphate			
10%	70°	*1	1
10%	Boiling	*1	1
Fluorine (Gas)	70°	5	5
Formalin (40% Formaldehyde)	70°	1	...
Formic Acid			
5%	70°	2	1
5%	150°	2	1
10%	70°	2	1
10%	Boiling	1	1
50%	70°	2	1
50%	Boiling	1	1
90%	Boiling	1	1
100%	Boiling	2	2
100%	Boiling	1	1
Fruit Juices	70°	1	1
Fuel Oil	Hot	1	1
Cont. Sulphuric Acid.		3	2
Furfural	70°	1	1
Gallic Acid			
5%	70°	1	1
5%	150°	1	1
Sat. at 212° F.	Boiling	1	1
Gasoline	70°	1	1
Gelatin	Cold to 140°	1	1
Glauber's Salt (See Sodium Sulphate)			
Glue, Dry	70°	1	1
Acid Solution	70°	*2	1
Acid Solution	140°	*2	1
Glycerine	70°	1	1
Gypsum (See Calcium Sulphate)			
Hydrochloric Acid All concentrations	70°	5	5
Hydrobromic Acid All concentrations	Cold & Hot	5	5
Hydrocyanic Acid	70°	1	1
Hydrofluosilicic Acid	70°	5	4
Hydrofluoric Acid All concentrations	Cold & Hot	5	5
Hydrogen Peroxide	70° Boiling	†1 †2	1 1

SUBSTANCE CONDITION	TEMP. F.	TYPE 304	TYPE 316
Hydrogen Sulphide			
Dry	70°	1	1
Wet	70°	†3	†1
Ink	70°	†2	1
Iodine	70°	5	4
Iodoform	70°	1	1
Kerosene	70°	1	1
Ketchup			
Quiescent	70°	*1	1
Quiescent	150°	*1	1
Lactic Acid			
1%	70°	1	1
1%	Boiling	1	1
5%	70°	1	1
5%	150°	2	1
5%	Boiling	2	1
10%	70°	1	1
10%	150°	2	1
10%	Boiling	2	1
Conc.	70°	1	1
Conc.	Boiling	3	2
Lard	70°	1	1
Lead, Molten	750°	2	2
Lead Acetate 5%	Boiling	1	1
Linseed Oil	70°	1	1
Plus 3% H ₂ SO ₄	390°	1	1
Lysol	70°	1	1
Magnesium Carbonate All concentrations	Cold & Hot	1	1
Magnesium Chloride			
1% Quiescent	70°	*1	1
1% Quiescent	Hot	*3	*2
5% Quiescent	70°	*1	1
5% Quiescent	Hot	*3	*2
Magnesium Hydroxide Thick suspension	70°	1	1
Magnesium Nitrate All concentrations	Cold & Hot	1	1
Magnesium Oxychloride	70°	*3	*2
Magnesium Sulphate (See Epsom Salt)			
Malic Acid	Cold & Hot	1	1
Manganese Carbonate All concentrations	Cold & Hot	1	1
Mash	Hot	1	1
Mayonnaise	70°	*1	1
Mercury		1	1
Mercuric Chloride Dilute Solution	70°	*5	*4
Mercurous Nitrate All concentrations	Cold & Hot	1	1
Methanol (See Alcohol, Methyl)			
Methylene Chloride 40%	Cold & Hot	1	1
Milk, Fresh or Sour	70° Boiling	1 1	1 1
Mine Water—Acid	60°	*1	*1
Molasses		1	1
Molybdenic Acid			
5%	70°	1	1
Mustard	70°	*1	1
Muriatic Acid	70°	5	5
Naphtha, Pure	70°	1	1
Crude	70°	1	1
Naphthalenesulphonic Acid	70°	1	1
Nickel Chloride, Solution ...	70°	*1	*1
Nickel Nitrate All concentrations	Cold & Hot	1	1
Nickel Sulphate	Cold & Hot	1	1
Niter Cake	Fused	2	1
Nitrating Solutions	Cold & Hot	2	2
Nitric Acid			
5%	70°	1	1
5%	Boiling	1	1
20%	70°	1	1
20%	Boiling	1	1
40%	70°	1	1
40%	Boiling	1	1
50%	70°	1	1
50%	Boiling	1	1
65%	70°	1	1
65%	Boiling	2	2
Conc.	70°	1	1
Conc.	Boiling	2	2
Fuming Conc.	70°	1	1
Fuming Conc.	110°	1	1
Fuming Conc.	Boiling	4	4
Nitrous Acid 5%	70°	1	1
Oils, Crude	Cold & Hot	†1	†1
Oils, Vegetable, Mineral ...	Cold & Hot	†1	1

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LABORATORY CORROSION RESISTANCE DATA*

SUBSTANCE	CONDITION	TEMP. °F.	TYPE 304	TYPE 316	SUBSTANCE	CONDITION	TEMP. °F.	TYPE 304	TYPE 316	SUBSTANCE	CONDITION	TEMP. °F.	TYPE 304	TYPE 316
Oleic Acid		70°	*1	1	Potassium Permanganate					Soy Bean Oil	Cold & Hot		1	1
		300°	*1	1	5%		70°	1	1	Stannic Chloride,		70°	4	3
		400°	*1	1	10%		Boiling	1	1	Sp. G. 1.21		Boiling	5	4
Oxalic Acid		70°	1	1	Potassium Sulphate					Stannous Chloride,		120°	2	1
5%		Boiling	1	1	1% Quiescent		70°	1	1	Saturated		Boiling	5	...
5%		70°	1	1	1% Agitated		70°	1	1	Starch, Aq. Solution			1	1
10%		Boiling	4	3	1% Aerated		70°	1	1	Stearic Acid			1	1
10%		Boiling	4	3	5% Quiescent		70°	1	1	Strontium Hydroxide			1	1
25%		Boiling	4	3	5% Agitated		70°	1	1	Strontium Nitrate,			1	1
50%		Boiling	4	3	5% Aerated		70°	1	1	Solution		Hot	1	1
Paraffin		Cold & Hot	1	1	5%		Hot	1	1	Sugar Juice		Hot	1	1
Paregoric Compound		70°	1	1	Pyrogallol Acid			1	1	Sulphur Chloride		Cold & Hot	5	5
Phenol (See Carbolol Acid)					Quinine Sulphate, Dry			1	1	Sulphur, Moist		70°	*2	*1
Phenolic Resins		Cold & Hot	1	1	Quinine Bisulphate, Dry			2	1	Molten		266°	1	1
Petroleum Ether			1	1	Rosin, Molten			1	1	Molten		833°	3	3
Phosphoric Acid					Sauerkraut Brine		70°	5	1	Sulphur Monochloride		70°	1	1
1%		70°	*1	*1	Sea Water		70°	*1	*1	Sulphur Dioxide Gas				
1%		Boiling	1	1	Sewage			†1	†1	Moist		70°	2	1
1%—45-lb. Pressure		284°	1	1	Silver Bromide			*2	*1	Gas		575°	1	1
5% Quiescent		70°	1	1	Silver Chloride			5	5	Sulphuric Acid				
5% Agitated		70°	1	1	Silver Nitrate					5%		70°	3	2
5% Aerated		70°	1	1	10%		70°	1	1	5%		Boiling	5	3
10% Quiescent		70°	1	1	10%		Boiling	1	1	10%		70°	3	2
10% Agitated		70°	1	1	Soaps		70°	1	1	10%		Boiling	5	4
10% Aerated		70°	1	1	Sodium Acetate, Moist			*1	1	50%		70°	4	3
10%		Boiling	1	1	Sodium Bicarbonate					50%		Boiling	5	4
25%		Boiling	1	2	All Concentrations		70°	1	1	Conc.		70°	1	1
45%		Boiling	2	2	5% Quiescent		150°	1	1	Conc.		Boiling	4	4
50%		Boiling	2	2	Sodium Bichromate					Conc.		300°	5	5
80%		230°	2	2	All concentrations					Fuming		70°	3	2
80%		70°	5	3	(neutral)		Cold & Hot	1	1	Sulphurous Acid				
85%		Boiling	5	3	Sodium Bisulphate					Saturated		70°	3	2
Phosphoric Anhydride, Dry		Cold & Hot	1	1	All concentrations		Cold & Hot	*1	1	Saturated,				
Photographic Solutions					Sodium Borate					60-lb. Pressure		250°	3	2
Film and Paper					All concentrations		Cold & Hot	1	1	Saturated,				
Developers		70°	1	1	Sodium Carbonate					70-125-lb. Pressure		310°	3	3
Hypo (Acid Fixing Baths)		70°	†1	†1	5%		70°	1	1	Saturated,				
Other Solutions					5%		150°	1	1	150-lb. Pressure		375°	3	3
(Toners, Reducers, Tray Cleaners, etc.)		Details on request			5%		Boiling	1	1	Spray		70°	*4	*4
Picric Acid		70°	1	1	5%		Boiling	1	1	Sweet Water		Hot	1	1
Pine Tar Oil		Cold & Hot	1	1	5%		Boiling	1	1	Syrup		Hot	1	1
Potash (See Potassium Hydroxide)					50%		Boiling	1	1	Tannic Acid		70°	1	1
Potassium Bichromate					Molten		1650°	5	5			150°	2	1
25%		70°	1	1	Sodium Chlorate					Tanning Liquor		70°	1	1
25%		Boiling	1	1	25%		Cold & Hot	1	1	Tar			1	1
Potassium Bromide		70°	*2	*1	Sodium Chloride					Tartaric Acid				
Potassium Carbonate					5% Quiescent		70°	*1	1	10%		70°	1	1
1% Quiescent					5% Quiescent		150°	*1	1	10%		Boiling	1	1
Agitated		70°	1	1	20% Aerated		70°	*1	1	50%		Boiling	1	1
Aerated		70°	1	1	Saturated		70°	*1	1	Saturated at 212°		Boiling	5	...
50%		Boiling	1	1	Saturated		Boiling	*2	1	Tin, Molten			3	3
Potassium Chlorate					Sodium Citrate					Trichloroacetic Acid		70°	5	4
Sat. at 212°		Boiling	1	1	All concentrations		Cold & Hot	1	1	Tung Oil		Cold & Hot	1	1
Potassium Chloride					Sodium Ferricyanide					Turpentine Oil		95°	1	1
1% Quiescent		70°	1	1	5% (neutral)		Cold & Hot	*1	*1	Uric Acid		70°	1	1
1% Agitated		70°	1	1	Sodium Hypochlorite					Varnish		70°	1	1
1% Aerated		70°	1	1	5%		70°	†2	†1	Vegetable Juices		Hot	1	1
5% Quiescent		70°	1	1	Sodium Lactate 10%		Cold & Hot	1	1	Vinegar, Quiescent		70°	1	1
5% Agitated		70°	1	1	Sodium Nitrate					Agitated		70°	1	1
5% Aerated		70°	1	1	All concentrations		Cold & Hot	1	1	Aerated		70°	1	1
5%		Boiling	1	1	Sodium Nitrite					Hot		Hot	1	1
Potassium Dichromate					All concentrations		Cold & Hot	1	1	Vinegar Fumes		70°	2	1
All concentrations					Sodium Fluoride 5%		70°	*2	*1	Whiskey			1	1
(neutral)		Cold & Hot	1	1	Sodium Hydroxide		70°	1	1	Wine, In all phases of processing and storage		75°	1	1
Potassium Ferricyanide					20%		Boiling	1	1	Wood Pulp			1	1
5%		70°	1	1	30%		Boiling	2	2	Wood Pulp Liquors				
25%		70°	1	1	Molten		600°	2	2	Digestive Liquors				
25%		Boiling	1	1	Sodium Nitrate		Fused	2	1	(3% Ca (HSO ₃) ₂ + 2% H ₂ SO ₄ + SO ₂ + Air)		Boiling	5	1
Potassium Ferrocyanide					Sodium Perchlorate					Black Waste Liquors (Alkaline) Fired		1800°	5	5
5%		70°	1	1	10%		70°	1	1	Black Waste Liquors		Boiling	1	1
Potassium Hydroxide					10%		Boiling	1	1	Wort			1	1
5% Quiescent		70°	1	1	Sodium Peroxide					Yeast			1	1
5% Agitated		70°	1	1	10%		70°	1	1	Zinc, Molten			5	5
5% Aerated		70°	1	1	10%		200°	1	1	Zinc Chloride				
27%		Boiling	1	1	Sodium Phosphate					5%		70°	1	1
50%		Boiling	2	1	5%		Cold & Hot	1	1	5%		Boiling	*2	*1
Potassium Hypochlorite					Sodium Salicylate					20%		70°	1	1
Conc.		70°	2	2	All concentrations		70°	1	1	20%		Boiling	2	1
Potassium Iodide					Sodium Silicate		Cold & Hot	1	1	70%		70°	1	1
All concentrations		Cold & Hot	1	1	Sodium Sulphate 5%			1	1	70%		Boiling	4	1
Potassium Nitrate					Saturated		Boiling	1	1	Zinc Cyanide, Moist		70°	1	1
Quiescent—					Sodium Sulphite					Zinc Nitrate, Solution		Hot	1	1
1% Agitated		70°	1	1	5%		70°	1	1	Zinc Sulphate				
Aerated		70°	1	1	10%		150°	1	1	5%		Boiling	1	1
Quiescent—					25%		Boiling	1	1	25%		1022°	1	1
5% Agitated		70°	1	1	50%		Boiling	1	1	Saturated		70°	1	1
Aerated		70°	1	1	Sodium Hyposulphite									
50%		70°	1	1	25%		70°	†1	1					
50%		Boiling	1	1	25%		Boiling	1	1					
Molten		1022°	1	1	Sodium Sulphide									
Potassium Oxalate		70°	1	1	Saturated		70°	*2	1					

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*May attack when hydrochloric acid is present.
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