

# GLOSSARY OF TERMS

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**ACCURACY OF REGULATION** is the value of controlled variable (pressure, or differential pressure) expressed as a percentage of the set value (at minimum controllable flow) when with a constant supply pressure the flow through the regulator is increased from the minimum controllable flow to the rated capacity (also equal to 100% minus the offset (droop) %).

**BACK PRESSURE REGULATOR**—A device that controls and responds to change in its inlet pressure.

**BALANCED**—A regulator style featuring a pressure balanced plug. May be single or double seated.

**DEAD BAND**—The range through which the controlled variable can reverse direction without and observable regulator response.

**DIAPHRAGM ACTUATED REGULATOR**—A regulator utilizing a diaphragm as the position actuator.

**DIFFERENTIAL PRESSURE REGULATOR**—A device that maintains a constant differential pressure between a reference pressure and the pressure of the controlled fluid.

**DIRECT ACTION**—A regulator that decreases its output as the measured variable increases.

**DIRECT OPERATED**—A regulator that uses a temperature thermal system to directly provide the power to move the plug.

**DRIFT**—A change in set point over an extended period of time.

**DROOP**—See accuracy of regulation.

**FLOW COEFFICIENT (Cv)** is the regulator capacity in GPM of H<sub>2</sub>O at 20 degrees C with one PSI pressure drop at full rated travel. Refer to ISA S75.01 and S75.02 for Testing Procedures and Sizing Equations.

**MINIMUM CONTROLLABLE FLOW** is the lowest flow at which a steady regulated condition of the controlled variable can be maintained.

**PACKLESS**—A construction that does not employ a dynamic seal isolating internal fluid from ambient or atmosphere.

**PILOT OPERATED**—A regulator that uses a temperature thermal system to power a pilot mechanism which generates an amplified signal to position the plug of the regulator. The pilot may be internal or external.

**PRESSURE REDUCING REGULATOR**—A device that controls and responds to changes in its outlet pressure.

**PRESSURE REGULATOR**—A self-operated device, either pilot or direct operated, in which power to position the valve closure member is provided by the pressure of the controlled variable.

**PRESSURE TEMPERATURE**—A dual function piloted regulator combining the control of both temperature and pressure. Control of pressure and temperature may be by a single pilot or multiple pilots. Pilot(s) may be internal or external or these functions in combination may be available.

**PUMP PRESSURE REGULATOR**—A device that controls the speed of a pump in response to changes in pump discharge pressure.

**REPEATABILITY**—Ability to return to any defined point within stated limits of regulation within a specified tolerance.

**REVERSE ACTION**—A regulator that increases its output as the measured variable increases.

**TEMPERATURE REGULATOR**—A self operated device in which the energy to position valve closure member(s) is provided by changes of temperature energy of the controlled variable.

**UNBALANCED**—A regulator where the plug closure number is not pressure balanced. Generally a single regulator.

# INDUSTRY STANDARDS

## APPLICABLE INDUSTRY STANDARDS

All Leslie control valves are 100% factory tested and serialized. Leslie Controls' quality assurance program is accredited and certified to ISO 9001<sup>1</sup>. All Leslie control valves are also designed, built and tested to meet the following industry standards.

**ANSI B1.20.1 Pipe Threads** - Conforms to pipe thread requirements.

**ANSI B16.1 Cast Iron Flanges and Flanged Fittings** - Conforms to wall thickness, flange dimensions, materials, pressure/temperature ratings, markings and hydrostatic test requirements.

**ANSI B16.11 Socketweld Ends** - Conforms to socketweld end requirements.

**ANSI B16.5 Pipe Flanges and Flanged Fittings** - Conforms to flange thickness, diameter and drilling requirements.

**ANSI B16.10 Face-To-Face Dimensions** - Conforms to globe style control valve face-to-face dimension requirements.

**ANSI B16.25 Buttwelding Ends** - Conforms to requirements of Schedule 40 or Schedule 80 pipe, without backing rings.

**ANSI B16.34 Valves, Flanged and Butt-weld** - Integral flanged and BWE valve conforms to wall thickness, materials, pressure/temperature ratings, markings, and hydrostatic test requirements.

**ANSI B16.37 Hydrotesting of Control Valves** - Conforms to hydrotesting requirements.

**ANSI/ISA 70-2 Control Valve Seat Leakage** - Conforms to Class III, IV, and V shutoff requirements.

**ISA S75.01 Flow Equations for Sizing Control Valves.**

**ISA S75.02 Control Valve Capacity Test Procedure** - Conforms to flow capacity test procedure requirements.

**ISA S75.03 Uniform Face-To-Face Dimensions for Flanged Globe Style Control Valves** - Conforms to face-to-face dimension requirements.

**ISA S75.12 Face-To-Face Dimensions for Socketweld End and Screwed End Globe Style Control Valves** - Conforms to face-to-face dimension requirements.

**ISA S75.15 Face-To-Face Dimensions for Butt-weld End Globe Style Control Valves** - Conforms to face-to-face dimension requirements.

**MSS SP25 Standard Marking System for Valves, Fittings, Flanges, and Unions** - Conforms to marking requirements for flanged, screwed and weld end fittings.

**MSS SP84 Steel Valves, Socketweld End and Threaded End** - Conforms to end connection requirements.

In addition, when required, control valves can be manufactured and tested in compliance with:

CAN 3 Z299.3  
ANSI N45.2  
MIL-I-STD-45662  
MIL-I-45208  
B 31.1

1. Assessed and certified by ABS, Houston, Texas

# FLANGE STANDARDS

## 125 lb. CAST IRON

### ANSI STANDARD B16.1

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
Diameter of Flange	—	—	4 1/4	4 5/8	5	6	7	7 1/2	8 1/2	9	10	11	13 1/2	16	19
Thickness of Flange (min) <sup>a</sup>	—	—	7/16	1/2	9/16	5/8	1 1/16	3/4	13/16	15/16	15/16	1	1 1/8	13/16	1 1/4
Diameter of Bolt Circle	—	—	3 1/8	3 1/2	3 3/8	4 3/4	5 1/2	6	7	7 1/2	8 1/2	9 1/2	11 3/4	14 1/4	17
Number of Bolts	—	—	4	4	4	4	4	4	8	8	8	8	8	12	12
Diameter of Bolts	—	—	1/2	1/2	1/2	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4	7/8	7/8

<sup>a</sup> 125 lb. cast iron flanges have plain faces.

## 250 lb. CAST IRON

### ANSI STANDARD B16.1

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
Diameter of Flange	—	—	4 7/8	5 1/4	6 1/8	6 1/2	7 1/2	8 1/4	9	10	11	12 1/2	15	17 1/2	20 1/2
Thickness of Flange (min) <sup>b</sup>	—	—	1 1/16	3/4	13/16	7/8	1	1 1/8	1 3/16	1 1/4	1 3/8	1 7/16	1 5/8	1 7/8	2
Diameter of Raised Face	—	—	2 11/16	3 1/16	3 9/16	4 3/16	4 15/16	5 11/16	6 5/16	6 15/16	8 5/16	9 11/16	11 5/16	14 1/16	16 7/16
Diameter of Bolt Circle	—	—	3 1/2	3 7/8	4 1/2	5	5 7/8	6 5/8	7 1/4	7 7/8	9 1/4	10 5/8	13	15 1/4	17 3/4
Number of Bolts	—	—	4	4	4	8	8	8	8	8	8	8	12	16	16
Diameter of Bolts	—	—	5/8	5/8	3/4	5/8	3/4	3/4	3/4	3/4	3/4	3/4	7/8	1	1 1/8

<sup>b</sup> 250 lb. cast iron flanges have a 1/16" raised face which is included in the flange thickness dimensions.

## 150 lb. BRONZE

### ANSI STANDARD B16.24

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
Diameter of Flange	3 1/2	3 7/8	4 1/4	4 5/8	5	6	7	7 1/2	8 1/2	9	10	11	13 1/2	16	19
Thickness of Flange (min) <sup>c</sup>	5/16	11/32	3/8	13/32	7/16	1/2	9/16	5/8	11/16	1 1/16	3/4	13/16	15/16	1	1 1/16
Diameter of Bolt Circle	2 5/8	2 3/4	3 1/8	3 1/2	3 3/8	4 3/4	5 1/2	6	7	7 1/2	8 1/2	9 1/2	11 3/4	14 1/4	17
Number of Bolts	4	4	4	4	4	4	4	4	8	8	8	8	8	12	12
Diameter of Bolts	1/2	1/2	1/2	1/2	1/2	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4	7/8	7/8

<sup>c</sup> 150 lb. bronze flanges have plain faces with two concentric gasket-retaining grooves between the port and the bolt holes.

## 300 lb. BRONZE

### ANSI STANDARD B16.24

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
Diameter of Flange	3 3/4	4 5/8	4 7/8	5 1/4	6 1/2	6 1/2	7 1/2	8 1/4	9	10	11	12 1/2	15	—	—
Thickness of Flange (min) <sup>d</sup>	1/2	17/32	19/32	5/8	1 1/16	3/4	13/16	29/32	3 1/32	1 1/16	1 1/8	13/16	1 3/8	—	—
Diameter of Bolt Circle	2 5/8	3 1/4	3 1/2	3 7/8	4 1/2	5	5 7/8	6 5/8	7 1/4	7 7/8	9 1/4	10 5/8	13	—	—
Number of Bolts	4	4	4	4	4	8	8	8	8	8	8	12	12	—	—
Diameter of Bolts	1/2	5/8	5/8	5/8	3/4	5/8	3/4	3/4	3/4	3/4	3/4	3/4	7/8	—	—

<sup>d</sup> 300 lb. bronze flanges have plain faces with two concentric gasket-retaining grooves between the port and the bolt holes.

## 150 lb. STEEL

### ANSI STANDARD B16.5

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
Diameter of Flange	—	—	4	4 5/8	5	6	7	7 1/2	8 1/2	9	10	11	13 1/2	16	19
Thickness of Flange (min) <sup>e</sup>	—	—	7/16	1/2	9/16	5/8	1 1/16	3/4	13/16	15/16	15/16	1	1 1/8	13/16	1 1/4
Diameter of Raised Face	—	—	2	2 1/2	2 7/8	3 5/8	4 1/8	5	5 1/2	6 3/16	7 5/16	8 1/2	10 5/8	12 3/4	15
Diameter of Bolt Circle	—	—	3 1/8	3 1/2	3 7/8	4 3/4	5 1/2	6	7	7 1/2	8 1/2	9 1/2	11 3/4	14 1/4	17
Number of Bolts	—	—	4	4	4	4	4	4	8	8	8	8	8	12	12
Diameter of Bolts	—	—	1/2	1/2	1/2	5/8	5/8	5/8	5/8	5/8	3/4	3/4	3/4	7/8	7/8

<sup>e</sup> 150 lb. steel flanges have a 1/16" raised face which is included in the flange thickness dimensions.

## 300 lb. STEEL

### ANSI STANDARD B16.5

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
Diameter of Flange	—	—	4 7/8	5 1/4	6 1/8	6 1/2	7 1/2	8 1/4	9	10	11	12 1/2	15	17 1/2	20 1/2
Thickness of Flange (min) <sup>f</sup>	—	—	1 1/16	3/4	13/16	7/8	1	1 1/8	1 3/16	1 1/4	1 3/8	1 7/16	1 5/8	1 7/8	2
Diameter of Raised Face	—	—	2	2 1/2	2 7/8	3 5/8	4 1/8	5	5 1/2	6 3/16	7 5/16	8 1/2	10 5/8	12 3/4	15
Diameter of Bolt Circle	—	—	3 1/2	3 7/8	4 1/2	5	5 7/8	6 5/8	7 1/4	7 7/8	9 1/4	10 5/8	13	15 1/4	17 3/4
Number of Bolts	—	—	4	4	4	8	8	8	8	8	8	12	12	16	16
Diameter of Bolts	—	5/8	5/8	3/4	5/8	3/4	3/4	3/4	3/4	3/4	3/4	3/4	7/8	1	1 1/8

<sup>f</sup> 300 lb. steel flanges have a 1/16" raised face which is included in the flange thickness dimensions.

## 400 lb. STEEL

### ANSI STANDARD B16.5

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
Diameter of Flange	3 3/4	4 5/8	4 7/8	5 1/4	6 1/8	6 1/2	7 1/2	8 1/4	9	10	11	12 1/2	15	17 1/2	20 1/2
Thickness of Flange (min) <sup>g</sup>	9/16	5/8	1 1/16	13/16	7/8	1	1 1/8	1 1/4	1 3/8	1 3/8	1 1/2	1 5/8	1 7/8	2 1/8	2 1/4
Diameter of Raised Face	1 3/8	1 11/16	2	2 1/2	2 7/8	3 5/8	4 1/8	5	5 1/2	6 3/16	7 5/16	8 1/2	10 5/8	12 3/4	15
Diameter of Bolt Circle	25/8	3 1/4	3 1/2	3 7/8	4 1/2	5	5 7/8	6 5/8	7 1/4	7 7/8	9 1/4	10 5/8	13	15 1/4	17 3/4
Number of Bolts	4	4	4	4	4	8	8	8	8	8	8	12	12	16	16
Diameter of Bolts	1/2	5/8	5/8	5/8	3/4	5/8	3/4	3/4	3/4	7/8	7/8	7/8	7/8	1	1 1/8

<sup>g</sup> 400 lb. steel flanges have a 1/4" raised face which is included in the flange thickness dimensions.

## 600 lb. STEEL

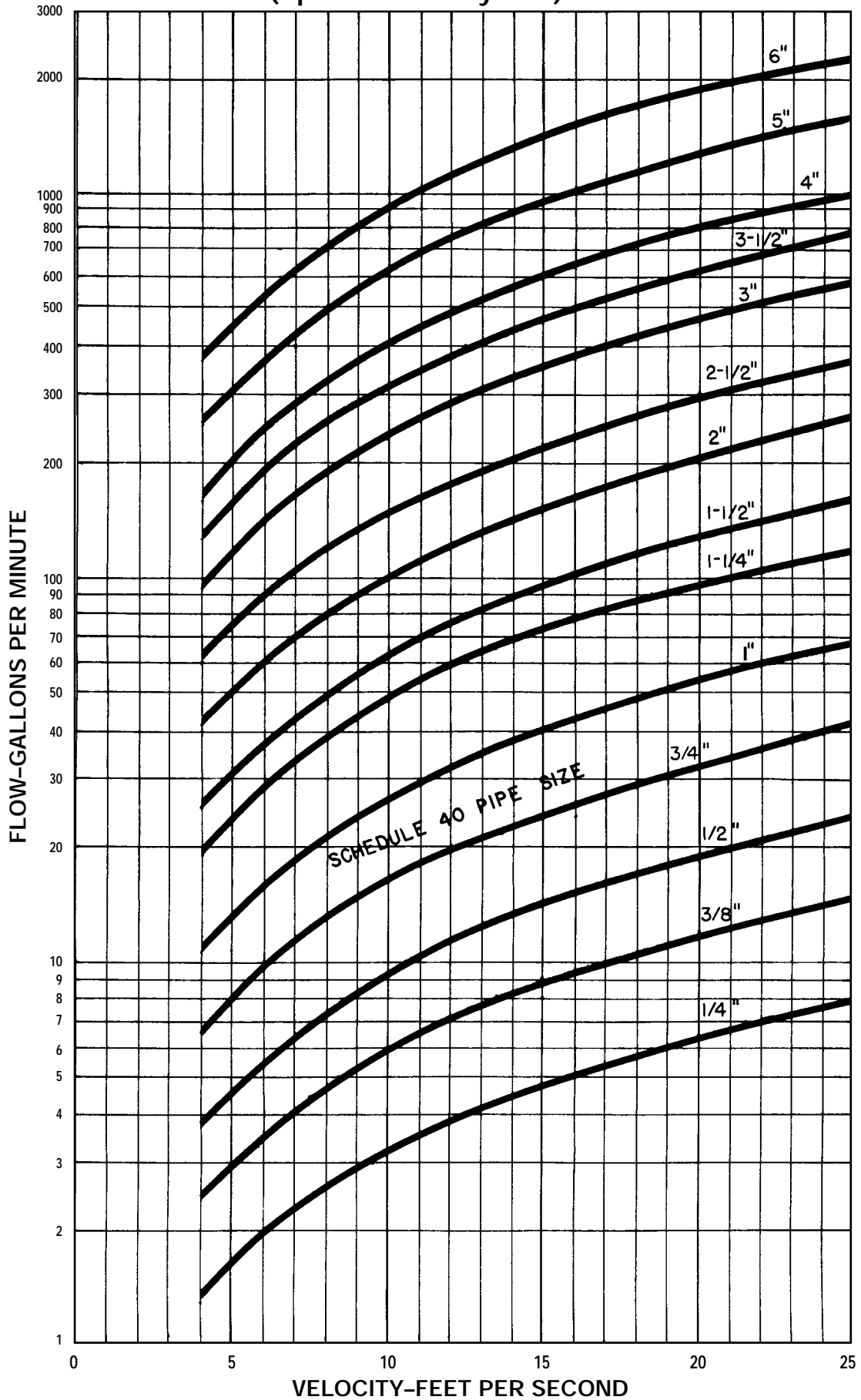
### ANSI STANDARD B16.5

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
Diameter of Flange	3 3/4	4 5/8	4 7/8	5 1/4	6 1/8	6 1/2	7 1/2	8 1/4	9	10 3/4	13	14	16 1/2	20	22
Thickness of Flange (min) <sup>h</sup>	9/16	5/8	1 1/16	13/16	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 3/4	1 7/8	2 3/16	2 1/2	2 5/8
Diameter of Raised Face	1 3/8	1 11/16	2	2 1/2	2 7/8	3 5/8	4 1/8	5	5 1/2	6 3/16	7 5/16	8 1/2	10 5/8	12 3/4	15
Diameter of Bolt Circle	2 5/8	3 1/4	3 1/2	3 7/8	4 1/2	5	5 7/8	6 5/8	7 1/4	8 1/2	10 1/2	11 1/2	13 3/4	17	19 1/4
Number of Bolts	4	4	4	4	4	8	8	8	8	8	8	12	12	16	20
Diameter of Bolts	1/2	5/8	5/8	5/8	3/4	5/8	3/4	3/4	7/8	7/8	1	1	1 1/8	1 1/4	1 1/4

<sup>h</sup> 600 lb. steel flanges have a 1/4" raised face which is included in the flange thickness dimensions.

# FLOW VS. VELOCITY CHART

(Specific Gravity of 1)



REFERENCE

# PRESSURE TO VACUUM

Gage Indicated		Absolute Pressure		
PSIG	Inches of Hg	PSIA	Inches of Hg	Torriceili
-14.70000	29.92000	0.0	0.0	0.0
-14.69998	29.91996	0.00002	0.00004	0.001
-14.69996	29.91992	0.00004	0.00008	0.002
-14.69994	29.91988	0.00006	0.00012	0.003
-14.69992	29.91984	0.00008	0.00016	0.004
-14.69990	29.91980	0.00010	0.00020	0.005
-14.69981	29.91961	0.00019	0.00039	0.010
-14.69961	29.91921	0.00039	0.00079	0.020
-14.69942	29.91882	0.00058	0.00118	0.030
-14.69923	29.91843	0.00077	0.00157	0.040
-14.69903	29.91803	0.00097	0.00197	0.050
-14.69806	29.91606	0.00194	0.00394	0.100
-14.69613	29.91212	0.00387	0.00788	0.200
-14.69449	29.90818	0.00551	0.01182	0.300
-14.69226	29.90424	0.00774	0.01576	0.400
-14.69032	29.90030	0.00968	0.01970	0.500
-14.68066	29.88063	0.01934	0.03937	1.000
-14.66698	29.84126	0.03302	0.07874	2.000
-14.64197	29.80189	0.05803	0.11811	3.000
-14.62262	29.76252	0.07738	0.15748	4.000
-14.60329	29.72315	0.09671	0.19685	5.000
-14.50658	29.52630	0.19342	0.39370	10.000
-14.40980	29.32940	0.29020	0.59060	15.000
-14.31320	29.13260	0.38680	0.78740	20.000
-14.21840	28.93570	0.48160	0.98430	25.000
-14.20870	28.920	0.49130	1.000	25.400
-14.11970	28.740	0.58030	1.181	30.000
-13.75700	28.000	0.94330	1.920	48.770
-12.28300	25.000	2.41700	4.920	124.970
-10.31800	21.000	4.38200	8.920	226.570
-8.84400	18.000	5.85600	11.920	302.770
-7.37000	15.000	7.320	14.920	378.970
-5.89600	12.000	8.804	17.920	455.770
-4.91300	10.000	9.787	19.920	505.970
-3.93000	8.000	10.770	21.920	556.770
-2.94800	6.000	11.752	23.920	607.570
-1.96500	4.000	12.735	25.920	658.370
-0.98300	2.000	13.732	27.920	709.170
-0.49100	1.000	14.209	28.920	733.570
-0.24600	0.500	14.454	29.420	747.270
ATMOSPHERIC				
0.0	0.0	14.700	29.920	760.000
+ 0.30		15.000	30.540	775.720
+ 1.00		15.700	31.970	811.910
+ 2.00		16.700	34.000	863.630
+ 10.00		24.700	50.290	277.35

REFERENCE

# PROPERTIES OF WATER

Water Temp.	Saturation Pressure	Weight	Weight Density	Specific Volume
Deg. F	PSIA	lbs/Gallon	lbs/Cu.Ft.	Cu.Ft./lb
32	0.0886	8.344	62.414	0.016022
40	0.1216	8.345	62.426	0.016019
50	0.1780	8.343	62.410	0.016023
60	0.2561	8.338	62.371	0.016033
70	0.3629	8.329	62.305	0.016050
80	0.5068	8.318	62.220	0.016072
90	0.6981	8.304	62.116	0.016099
100	0.9492	8.288	61.996	0.016130
110	1.2750	8.270	61.862	0.016165
120	1.6927	8.250	61.713	0.016204
130	2.2230	8.228	61.550	0.016247
140	2.8892	8.205	61.376	0.016293
150	3.7184	8.180	61.188	0.016343
160	4.7414	8.154	60.994	0.016395
170	5.9926	8.126	60.787	0.016451
180	7.5110	8.097	60.569	0.016510
190	9.340	8.067	60.343	0.016572
200	11.526	8.035	60.107	0.016637
210	14.123	8.002	59.862	0.016705
212	14.696	7.996	59.812	0.016719
220	17.186	7.969	59.613	0.016775
240	24.968	7.898	59.081	0.016926
260	35.427	7.823	58.517	0.017089
280	49.200	7.743	57.924	0.017264
300	67.005	7.661	57.307	0.01745
350	134.604	7.431	55.586	0.01799
400	247.259	7.172	53.648	0.01864
450	422.55	6.880	51.467	0.01943
500	680.86	6.543	48.948	0.02043
550	1045.43	6.143	45.956	0.02176
600	1543.2	5.655	42.301	0.02364
650	2208.4	4.999	37.397	0.02674
700	3094.3	3.651	27.307	0.03662

NOTE: Weight of water per gallon is based on 7.48052 gallons per cubic foot.  
Specific gravity of water @ 60°F = 1.00

# PIPE DATA TABLES

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
1/8	.405	—	—	10S	.049	.307	1.27	.96	.074	.19	.032	.004	.00437	1/8
		STD	40	40S	.068	.269		.85	.057	.24	.025	.003	.00523	
		XS	80	80S	.095	.215		.68	.036	.31	.016	.002	.00602	
1/4	.540	—	—	10S	.065	.410	1.70	1.29	.132	.33	.057	.007	.01032	1/4
		STD	40	40S	.088	.364		1.14	.104	.42	.045	.005	.01227	
		XS	80	80S	.119	.302		.95	.072	.54	.031	.004	.01395	
3/8	.675	—	—	10S	.065	.545	2.12	1.71	.233	.42	.101	.012	.01736	3/8
		STD	40	40S	.091	.493		1.55	.191	.57	.083	.010	.0216	
		XS	80	80S	.126	.423		1.33	.141	.74	.061	.007	.0255	
1/2	.840	—	—	5S	.065	.710	2.64	2.23	.396	.54	.172	.021	.0285	1/2
		—	—	10S	.083	.674		2.12	.357	.67	.155	.019	.0341	
		STD	40	40S	.109	.622		1.95	.304	.85	.132	.016	.0407	
		XS	80	80S	.147	.546		1.72	.234	1.09	.102	.012	.0478	
		—	160	—	.187	.466		1.46	.171	1.31	.074	.009	.0527	
		XXS	—	—	.294	.252		.79	.050	1.71	.022	.003	.0577	
3/4	1.050	—	—	5S	.065	.920	3.30	2.89	.665	.69	.288	.035	.0467	3/4
		—	—	10S	.083	.884		2.78	.614	.86	.266	.032	.0566	
		STD	40	40S	.113	.824		2.59	.533	1.13	.231	.028	.0706	
		XS	80	80S	.154	.742		2.33	.433	1.47	.188	.022	.0853	
		—	160	—	.219	.612		1.92	.296	1.94	.128	.015	.1004	
		XXS	—	—	.308	.434		1.36	.148	2.44	.064	.008	.1103	
1	1.315	—	—	5S	.065	1.185	4.13	3.72	1.103	.87	.478	.057	.0760	1
		—	—	10S	.109	1.097		3.45	.945	1.40	.409	.049	.1151	
		STD	40	40S	.133	1.049		3.30	.864	1.68	.375	.045	.1328	
		XS	80	80S	.179	.957		3.01	.719	2.17	.312	.037	.1606	
		—	160	—	.250	.815		2.56	.522	2.84	.230	.027	.1903	
		XXS	—	—	.358	.599		1.88	.282	3.66	.122	.015	.2136	
1 1/4	1.660	—	—	5S	.065	1.530	5.22	4.81	1.839	1.11	.797	.096	.1250	1 1/4
		—	—	10S	.109	1.442		4.53	1.633	1.81	.708	.085	.1934	
		STD	40	40S	.140	1.380		4.34	1.495	2.27	.649	.078	.2346	
		XS	80	80S	.191	1.278		4.02	1.283	3.00	.555	.067	.2913	
		—	160	—	.250	1.160		3.64	1.057	3.76	.458	.055	.3421	
		XXS	—	—	.382	.896		2.81	.630	5.21	.273	.033	.4110	
1 1/2	1.900	—	—	5S	.065	1.770	5.97	5.56	2.461	1.28	1.066	.128	.1662	1 1/2
		—	—	10S	.109	1.682		5.28	2.222	2.09	.963	.115	.2598	
		STD	40	40S	.145	1.610		5.06	2.036	2.72	.882	.106	.3262	
		XS	80	80S	.200	1.500		4.71	1.767	3.63	.765	.092	.4118	
		—	160	—	.281	1.338		4.20	1.406	4.86	.608	.073	.5078	
		XXS	—	—	.400	1.100		3.46	.950	6.41	.420	.049	.5977	
2	2.375	—	—	5S	.065	2.245	7.46	7.05	3.958	1.61	1.72	.206	.2652	2
		—	—	10S	.109	2.157		6.78	3.654	2.64	1.58	.190	.4204	
		STD	40	40S	.154	2.067		6.49	3.355	3.65	1.45	.174	.5606	
		XS	80	80S	.218	1.939		6.09	2.953	5.02	1.28	.153	.7309	
		—	160	—	.344	1.687		5.30	2.241	7.46	.97	.116	.9790	
		XXS	—	—	.436	1.503		4.72	1.774	9.03	.77	.092	1.1040	
2 1/2	2.875	—	—	5S	.083	2.709	9.03	8.51	5.764	2.48	2.50	.299	.4939	2 1/2
		—	—	10S	.120	2.635		8.28	5.453	3.53	2.36	.283	.6868	
		STD	40	40S	.203	2.469		7.76	4.788	5.79	2.07	.249	1.064	
		XS	80	80S	.276	2.323		7.30	4.238	7.66	1.87	.220	1.339	
		—	160	—	.375	2.125		6.68	3.546	10.01	1.54	.184	1.638	
		XXS	—	—	.552	1.771		5.56	2.464	13.69	1.07	.128	1.997	

REFERENCE

# PIPE DATA TABLES CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
3	3.500	—	—	5S	.083	3.334	11.00	10.47	8.730	3.03	3.78	.454	.744	3
		—	—	10S	.120	3.260		10.24	8.347	4.33	3.62	.434	1.041	
		STD	40	40S	.216	3.068		9.64	7.393	7.58	3.20	.384	1.724	
		XS	80	80S	.300	2.900		9.11	6.605	10.25	2.86	.343	2.225	
		—	160	—	.438	2.624		8.24	5.408	14.32	2.35	.281	2.876	
		XXS	—	—	.600	2.300		7.23	4.155	18.58	1.80	.216	3.424	
4	4.500	—	—	5S	.083	4.334	14.14	13.62	14.75	3.92	6.39	.766	1.249	4
		—	—	10S	.120	4.260		13.38	14.25	5.61	6.18	.740	1.761	
		STD	40	40S	.237	4.026		12.65	12.73	10.79	5.50	.661	3.214	
		XS	80	80S	.337	3.826		12.02	11.50	14.98	4.98	.597	4.271	
		—	120	—	.438	3.624		11.39	10.31	19.00	4.47	.536	5.178	
		—	160	—	.531	3.438		10.80	9.28	22.51	4.02	.482	5.898	
5	5.563	XXS	—	—	.674	3.152	17.48	9.90	7.80	27.54	3.38	.405	6.791	5
		—	—	5S	.109	5.345		16.79	22.44	6.36	9.72	1.17	2.498	
		—	—	10S	.134	5.295		16.63	22.02	7.77	9.54	1.14	3.029	
		STD	40	40S	.258	5.047		15.86	20.01	14.62	8.67	1.04	5.451	
		XS	80	80S	.375	4.813		15.12	18.19	20.78	7.88	.945	7.431	
		—	120	—	.500	4.563		14.34	16.35	27.04	7.09	.849	9.250	
6	6.625	—	—	160	.625	4.313	20.81	13.55	14.61	32.96	6.33	.759	10.796	6
		XXS	—	—	.750	4.063		12.76	12.97	38.55	5.61	.674	12.090	
		—	—	5S	.109	6.407		20.13	32.24	7.60	13.97	1.68	3.576	
		—	—	10S	.134	6.357		19.97	31.74	9.29	13.75	1.65	4.346	
		STD	40	40S	.280	6.065		19.05	28.89	18.97	12.51	1.50	8.496	
		XS	80	80S	.432	5.761		18.10	26.07	28.57	11.29	1.35	12.22	
8	8.625	—	—	120	.562	5.501	27.10	17.28	23.77	36.39	10.30	1.24	14.98	8
		—	—	160	.719	5.187		16.30	21.15	45.35	9.16	1.10	17.81	
		XXS	—	—	.864	4.897		15.38	18.84	53.16	8.16	.978	20.02	
		—	—	5S	.109	8.407		26.41	55.51	9.93	24.06	2.88	6.131	
		—	—	10S	.148	8.329		26.17	54.48	13.40	23.61	2.83	8.212	
		—	20	—	.250	8.125		25.53	51.85	22.36	22.47	2.69	13.39	
		—	30	—	.277	8.071		25.36	51.16	24.70	22.17	2.66	14.69	
		STD	40	40S	.322	7.981		25.07	50.03	28.55	21.70	2.60	16.81	
		—	60	—	.406	7.813		24.55	47.94	35.64	20.77	2.49	20.58	
		XS	80	80S	.500	7.625		23.95	45.66	43.39	19.78	2.37	24.51	
10	10.750	—	—	100	.594	7.437	33.77	23.36	43.46	50.95	18.83	2.26	28.14	10
		—	—	120	.719	7.187		22.58	40.59	60.71	17.59	2.11	32.58	
		—	—	140	.812	7.001		21.99	38.50	67.76	16.68	2.00	35.65	
		XXS	—	—	.875	6.875		21.60	37.12	72.42	16.10	1.93	37.56	
		—	160	—	.906	6.813		21.40	36.46	74.69	15.80	1.89	38.48	
		—	—	5S	.134	10.482		32.93	86.29	15.19	37.39	4.48	11.71	
		—	—	10S	.165	10.420		32.74	85.28	18.65	36.95	4.43	14.30	
		—	20	—	.250	10.250		32.20	82.52	28.04	35.76	4.29	21.15	
		—	30	—	.307	10.136		31.84	80.69	34.24	34.96	4.19	25.57	
		STD	40	40S	.365	10.020		31.48	78.86	40.48	34.20	4.10	29.90	
XS	60	80S	.500	9.750	30.63	74.66	54.74	32.35	3.88	39.43				
10	10.750	—	—	80	.594	9.562	33.77	30.04	71.84	64.43	31.13	3.73	45.54	10
		—	—	100	.719	9.312		29.25	68.13	77.03	29.53	3.54	53.22	
		—	—	120	.844	9.062		28.47	64.53	89.29	27.96	3.35	60.32	
		XXS	140	—	1.000	8.750		27.49	60.13	104.13	26.06	3.12	68.43	
		—	160	—	1.125	8.500		26.70	56.75	115.64	24.59	2.95	74.29	

REFERENCE

# PIPE DATA TABLES CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs./Ft.)	Weight of Water (lbs./Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)			
12	12.750	—	—	5S	.156	12.438	40.06	39.08	121.50	20.98	52.65	6.31	19.2	12			
		—	—	10S	.180	12.390		38.92	120.57	24.17	52.25	6.26	22.0				
		—	—	20	—	.250		12.250	38.48	117.86	33.38	51.07	6.12		30.2		
		—	—	30	—	.330		12.090	37.98	114.80	43.77	49.74	5.96		39.0		
		—	—	STD	—	40S		.375	12.000	37.70	113.10	49.56	49.00		5.88	43.8	
		—	—	—	—	40		—	.406	11.938	37.50	111.93	53.52		48.50	5.81	47.1
		—	—	XS	—	80S		.500	11.750	36.91	108.43	65.42	46.92		5.63	56.7	
		—	—	—	—	60		—	.562	11.626	36.52	106.16	73.15		46.00	5.51	62.8
		—	—	—	—	80		—	.688	11.374	35.73	101.64	88.63		44.04	5.28	74.6
		—	—	—	—	100		—	.844	11.062	34.75	96.14	107.32		41.66	4.99	88.1
		—	—	XXS	—	120		—	1.000	10.750	33.77	90.76	125.49		39.33	4.71	100.7
		—	—	—	—	140		—	1.125	10.500	32.99	86.59	139.67		37.52	4.50	109.9
—	—	—	—	160	—	1.312	10.126	31.81	80.53	160.27	34.89	4.18	122.6				
14	14.000	—	—	5S	.156	13.688	43.98	43.00	147.15	23.07	63.77	7.64	23.2	14			
		—	—	10S	.188	13.624		42.80	145.78	27.73	63.17	7.57	27.8				
		—	—	10	—	.250		13.500	42.41	143.14	36.71	62.03	7.44		36.6		
		—	—	—	—	20		—	.312	13.376	42.02	140.52	45.61		60.89	7.30	45.0
		—	—	STD	—	30		—	.375	13.250	41.63	137.88	54.57		59.75	7.16	53.2
		—	—	—	—	40		—	.438	13.124	41.23	135.28	63.44		58.64	7.03	61.3
		—	—	XS	—	—		.500	13.000	40.84	132.73	72.09	57.46		6.90	69.1	
		—	—	—	—	60		—	.594	12.812	40.25	128.96	85.05		55.86	6.70	80.3
		—	—	—	—	80		—	.750	12.500	39.27	122.72	106.13		53.18	6.37	98.2
		—	—	—	—	100		—	.938	12.124	38.09	115.49	130.85		50.04	6.00	117.8
		—	—	—	—	120		—	1.094	11.812	37.11	109.62	150.79		47.45	5.69	132.8
		—	—	—	—	140		—	1.250	11.500	36.13	103.87	170.28		45.01	5.40	146.8
—	—	—	—	160	—	1.406	11.188	35.15	98.31	189.11	42.60	5.11	159.6				
16	16.00	—	—	5S	.165	15.670	50.27	49.23	192.85	27.90	83.57	10.02	32.2	16			
		—	—	10S	.188	15.624		49.08	191.72	31.75	83.08	9.96	36.5				
		—	—	10	—	.250		15.500	48.69	188.69	42.05	81.74	9.80		48.0		
		—	—	—	—	20		—	.312	15.376	48.31	185.69	52.27		80.50	9.65	59.2
		—	—	STD	—	30		—	.375	15.250	47.91	182.65	62.58		79.12	9.49	70.3
		—	—	XS	—	40		—	.500	15.000	47.12	176.72	82.77		76.58	9.18	91.5
		—	—	—	—	60		—	.656	14.688	46.14	169.44	107.50		73.42	8.80	116.6
		—	—	—	—	80		—	.844	14.312	44.96	160.92	136.61		69.73	8.36	144.5
		—	—	—	—	100		—	1.031	13.938	43.79	152.58	164.82		66.12	7.93	170.5
		—	—	—	—	120		—	1.219	13.562	42.61	144.50	192.43		62.62	7.50	194.5
		—	—	—	—	140		—	1.438	13.124	41.23	135.28	233.64		58.64	7.03	220.0
		—	—	—	—	160		—	1.594	12.812	40.26	128.96	245.25		55.83	6.70	236.7
18	18.00	—	—	5S	.165	17.67	56.55	55.51	245.22	31.43	106.26	12.74	40.8	18			
		—	—	10S	.188	17.62		55.37	243.95	35.76	105.71	12.67	46.4				
		—	—	10	—	.250		17.50	54.98	240.53	47.39	104.21	12.49		61.1		
		—	—	—	—	20		—	.312	17.38	54.59	237.13	58.94		102.77	12.32	75.5
		—	—	STD	—	—		.375	17.25	54.19	233.71	70.59	101.18		12.14	89.6	
		—	—	—	—	30		—	.438	17.12	53.80	230.30	82.15		99.84	11.96	103.4
		—	—	XS	—	—		.500	17.00	53.41	226.98	93.45	98.27		11.79	117.0	
		—	—	—	—	40		—	.562	16.88	53.02	223.68	104.87		96.93	11.62	130.1
		—	—	—	—	60		—	.750	16.50	51.84	213.83	138.17		92.57	11.11	168.3
		—	—	—	—	80		—	.938	16.12	50.66	204.24	170.92		88.50	10.61	203.8
		—	—	—	—	100		—	1.156	15.69	49.29	193.30	207.96		83.76	10.04	242.3
		—	—	—	—	120		—	1.375	15.25	47.91	182.66	244.14		79.07	9.49	277.6
—	—	—	—	140	—	1.562	14.88	46.73	173.80	274.22	75.32	9.03	305.5				
—	—	—	—	160	—	1.781	14.44	45.36	163.72	308.50	70.88	8.50	335.6				

REFERENCE

# PIPE DATA TABLES CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
20	20.00	—	—	5S	.188	19.62	62.83	61.65	302.46	39.78	131.06	15.71	57.4	20
		—	—	10S	.218	19.56		61.46	300.61	46.06	130.27	15.62	66.3	
		—	10	—	.250	19.50		61.26	298.65	52.73	129.42	15.51	75.6	
		STD	20	—	.375	19.25		60.48	290.04	78.60	125.67	15.12	111.3	
		XS	30	—	.500	19.00		59.69	283.53	104.13	122.87	14.73	145.7	
		—	40	—	.594	18.81		59.10	278.00	123.11	120.46	14.44	170.4	
		—	60	—	.812	18.38		57.73	265.21	166.40	114.92	13.78	225.7	
		—	80	—	1.031	17.94		56.35	252.72	208.87	109.51	13.13	277.1	
		—	100	—	1.281	17.44		54.78	238.83	256.10	103.39	12.41	331.5	
		—	120	—	1.500	17.00		53.41	226.98	296.37	98.35	11.79	375.5	
		—	140	—	1.750	16.50		51.84	213.82	341.09	92.66	11.11	421.7	
		—	160	—	1.969	16.06		50.46	202.67	379.17	87.74	10.53	458.5	
22	22.00	—	—	5S	.188	21.62	69.12	67.93	367.25	43.80	159.14	19.08	69.7	22
		—	—	10S	.218	21.56		67.75	365.21	50.71	158.26	18.97	80.4	
		—	10	—	.250	21.50		67.54	363.05	58.07	157.32	18.86	91.8	
		STD	20	—	.375	21.25		66.76	354.66	86.61	153.68	18.42	135.4	
		XS	30	—	.500	21.00		65.97	346.36	114.81	150.09	17.99	117.5	
		—	60	—	.875	20.25		63.62	322.06	197.41	139.56	16.73	295.0	
		—	80	—	1.125	19.75		62.05	306.35	250.81	132.76	15.91	366.4	
		—	100	—	1.375	19.25		60.48	291.04	302.88	126.12	15.12	432.6	
		—	120	—	1.625	18.75		58.90	276.12	353.61	119.65	14.34	493.8	
		—	140	—	1.875	18.25		57.33	261.59	403.00	113.36	13.59	550.3	
		—	160	—	2.125	17.75		55.76	247.45	451.06	107.23	12.85	602.4	
		24	24.00	—	—	5S		.218	23.56	75.40	74.03	436.10	55	
—	10			10S	.250	23.50	73.83	433.74	63		187.95	22.53	109.6	
STD	20			—	.375	23.25	73.04	424.56	95		183.95	22.05	161.9	
XS	—			—	.500	23.00	72.26	415.48	125		179.87	21.58	212.5	
—	30			—	.562	22.88	71.86	411.00	141		178.09	21.35	237.0	
—	40			—	.688	22.62	71.08	402.07	171		174.23	20.88	285.1	
—	60			—	.969	22.06	69.31	382.35	238		165.52	19.86	387.7	
—	80			—	1.219	21.56	67.74	365.22	297		158.26	18.97	472.8	
—	100			—	1.531	20.94	65.78	344.32	367		149.06	17.89	570.8	
—	120			—	1.812	20.38	64.01	326.08	430		141.17	16.94	652.1	
—	140			—	2.062	19.88	62.44	310.28	483		134.45	16.12	718.9	
—	160			—	2.344	19.31	60.67	292.98	542		126.84	15.22	787.9	
30	30.00	—	—	5S	.250	29.50	94.25	92.68	683.49	79	296.18	35.51	172.3	30
		—	10	10S	.312	29.38		92.29	677.71	99	293.70	35.21	213.8	
		STD	—	—	.375	29.25		91.89	671.96	119	291.18	34.91	255.3	
		XS	20	—	.500	29.00		91.11	660.52	158	286.22	34.31	336.1	
		—	30	—	.625	28.75		90.32	649.18	196	281.31	33.72	414.9	

REFERENCE

# RATINGS FOR ASTM A216-WCB

## ASME B16.34-2004 TABLE 2-1.1

### A STANDARD CLASS

Temperature, °F	Working Pressure by Classes, psig						
	150	300	600	900	1500	2500	4500
-20 to 100	285	740	1480	2220	3705	6170	11110
200	260	680	1360	2035	3395	5655	10185
300	230	655	1310	1965	3270	5450	9815
400	200	635	1265	1900	3170	5280	9505
500	170	605	1205	1810	3015	5025	9040
600	140	570	1135	1705	2840	4730	8515
650	125	550	1100	1650	2745	4575	8240
700	110	530	1060	1590	2665	4425	7960
750	95	505	1015	1520	2535	4230	7610
800	80	410	825	1235	2055	3430	6170
850	65	320	640	955	1595	2655	4785
900	50	230	460	690	1150	1915	3455
950	35	135	275	410	685	1145	2055
1000	20	85	170	255	430	715	1285

### B SPECIAL CLASS

Temperature, °F	Working Pressure by Classes, psig						
	150	300	600	900	1500	2500	4500
-20 to 100	290	750	1500	2250	3750	6250	11250
200	290	750	1500	2250	3750	6250	11250
300	285	740	1480	2220	3700	6170	11105
400	280	735	1465	2200	3665	6105	10995
500	280	750	1465	2200	3665	6105	10995
600	280	735	1465	2200	3665	6105	10995
650	275	715	1430	2145	3575	5960	10730
700	265	690	1380	2075	3455	5760	10365
750	245	635	1270	1905	3170	5285	9515
800	195	515	1030	1545	2570	4285	7715
850	155	400	795	1195	1995	3320	5980
900	110	285	575	860	1435	2395	4305
950	65	170	345	515	855	1430	2570
1000	40	105	215	320	535	895	1605

NOTE: Upon prolonged exposure to temperatures above 800°F, the carbide phase of steel may be converted to graphite. Permissible, but not recommended for prolonged use above 800°F.

# RATINGS FOR ASTM A217-WC9

## ASME B16.34-1996 TABLE 2-1.10

### A STANDARD CLASS

Temperature, °F	Working Pressure by Classes, psig						
	150	300	600	900	1500	2500	4500
-20 to 100	290	750	1500	2250	3750	6250	11250
200	260	750	1500	2250	3750	6250	11250
300	230	730	1455	2185	3640	6070	10925
400	200	705	1410	2115	3530	5880	10585
500	170	665	1330	1995	3325	5540	9965
600	140	605	1210	1815	3025	5040	9070
650	125	590	1175	1765	2940	4905	8825
700	110	570	1135	1705	2840	4730	8515
750	95	530	1065	1595	2660	4430	7970
800	80	510	1015	1525	2540	4230	7610
850	65	485	975	1460	2435	4060	7305
900	50	450	900	1350	2245	3745	6740
950	35	385	755	1160	1930	3220	5795
1000	20	266	535	800	1335	2230	4010
1050	20	175	350	525	875	1455	2625
1100	20	110	220	330	550	915	1645
1150	20	70	135	205	345	570	1030
1200	15	40	80	125	205	345	615

### B SPECIAL CLASS

Temperature, °F	Working Pressure by Classes, psig						
	150	300	600	900	1500	2500	4500
-20 to 100	290	750	1500	2250	3750	6250	11250
200	290	750	1500	2250	3750	6250	11250
300	285	740	1480	2220	3695	6160	11090
400	280	730	1455	2185	3640	6065	10915
500	280	725	1450	2175	3620	6035	10865
600	275	720	1440	2165	3605	6010	10815
650	275	715	1430	2145	3580	5965	10735
700	270	705	1415	2120	3535	5895	10605
750	270	705	1415	2120	3535	5895	10605
800	270	705	1415	2120	3535	5895	10605
850	260	680	1355	2030	3385	5645	10160
900	230	600	1200	1800	3000	5000	9000
950	180	470	945	1415	2360	3930	7070
1000	130	335	670	1005	1670	2785	5015
1050	85	220	435	655	1095	1820	3280
1100	55	135	275	410	685	1145	2055
1150	35	85	170	255	430	715	1285
1200	20	50	105	155	255	430	770

NOTES: Not to be used over 1100°F.

Flanged end valve ratings terminate at 1000°F.

# RATINGS FOR A351 CF8M (316SS)

## ASME B16.34-1996 TABLE 2-2.2

### A STANDARD CLASS

Temperature, °F	Working Pressure by Classes, psig						
	150	300	600	900	1500	2500	4500
-20 to 100	275	720	1440	2160	3600	6000	10800
200	235	620	1240	1860	3095	5160	9290
300	215	560	1120	1680	2795	4660	8390
400	195	515	1025	1540	2570	4280	7705
500	170	480	955	1435	2390	3980	7165
600	140	450	900	1355	2255	3760	6770
650	125	440	885	1325	2210	3680	6625
700	110	435	870	1305	2170	3620	6515
750	95	425	855	1280	2135	3560	6410
800	80	420	845	1265	2110	3520	6335
850	65	420	835	1255	2090	3480	6265
900	50	415	830	1245	2075	3460	6230
950	35	385	775	1160	1930	3220	5795
1000	20	365	725	1090	1820	3030	5450
1050	20	160	720	1080	1800	3000	5400
1100	20	305	610	915	1525	2545	4575
1150	20	235	475	710	1185	1970	3550
1200	20	185	370	555	1925	1545	2775
1250	20	145	295	440	735	1230	2210
1300	20	115	235	350	585	970	1750
1350	20	95	190	290	480	800	1440
1400	20	75	150	225	380	630	1130
1450	20	60	115	175	290	485	875
1500	15	40	85	125	205	345	620

### B SPECIAL CLASS

Temperature, °F	Working Pressure by Classes, psig						
	150	300	600	900	1500	2500	4500
-20 to 100	290	750	1500	2250	3750	6250	11250
200	265	690	1380	2075	3455	5260	10365
300	240	625	1250	1870	3120	5200	9360
400	220	575	1145	1720	2865	4775	8600
500	205	535	1065	1600	2665	4440	7795
600	195	505	1005	1510	2520	4195	7555
650	190	495	985	1480	2465	4105	7395
700	185	485	970	1455	2425	4040	7270
750	185	475	955	1430	2385	3975	7150
800	180	470	945	1415	2355	3930	7070
850	175	465	930	1400	2330	3885	6990
900	180	465	925	1390	2315	3860	6950
950	185	460	915	1375	2290	3815	6870
1000	170	420	840	1260	2105	3505	6310
1050	160	420	840	1260	2105	3505	6310
1100	145	380	765	1145	1905	3180	5720
1150	115	295	590	885	1480	2465	4435
1200	90	230	465	695	1155	1930	3470
1250	70	185	370	555	1920	1535	2765
1300	55	145	290	435	730	1215	2185
1350	45	120	240	360	600	1000	1800
1400	35	95	190	285	470	785	1415
1450	30	75	145	220	365	605	1095
1500	20	50	105	155	260	430	770

NOTE: Flanged end ratings terminate at 1000°F.

## FCI 70-2 SEAT LEAKAGE

Class II = .5% Valve Rated Capacity Differential of 45 to 60 psi  
Test Medium Water

Class III = .1% Valve Rated Capacity Differential of 45 to 60 psi  
Test Medium Water

Class IV = .01% Valve Rated Capacity Differential of 45 to 60 psi  
Test Medium Water

Class V =  $5 \times 10^{-4}$  ml / min of water / in. seat diameter / psi DP  
Tested @ Rated Differential  
Test Medium Water

Class VI =	1"	.15 ml/min.	1 bubble/min.
	1.5"	.30 ml/min.	2 bubble/min.
	2"	.45 ml/min.	3 bubble/min.
	2.5"	.60 ml/min.	4 bubble/min.
	3"	.90 ml/min.	6 bubble/min.
	4"	1.7 ml/min.	11 bubble/min.
	6"	4 ml/min.	27 bubble/min.
	8"	6.75 ml.min.	45 bubble/min.
Differential of 50 psi Test Medium Air or Nitrogen			

Leslie  
"ZERO" Less than one drop per minute, Tested @ Rated Differential  
Test Medium Water

# LIQUID BODY VELOCITY LIMITATION

## Carbon Steel (WCB)

Continuously Modulating or DP > 500 psi	20 ft/sec
Intermittent Modulating or DP < 500 psi	30 ft/sec
2% Intermittent Flow	40 ft/sec

## Alloy or Stainless Steel

Continuously Modulating or DP > 500 psi	45 ft/sec
Intermittent Modulating or DP < 500 psi	60 ft/sec
2% Intermittent Flow	90 ft/sec

Notes: Use Alloy or SS if flashing or cavitation exists  
Body erosion and noise will occur above these limits

## Compressible Velocity

Noise cannot be predicted  $\geq$  Mach .5  
Carbon Steel Limit is .35 Mach  
Alloy or SS Limit is .9 Mach

## INSULATION DECIBEL REDUCTION

Thickness	Type	Decibel Reduction
1"	Thermal	-4
2"	Thermal	-8
3.5"	Thermal	-10.5
5"	Thermal	-13
	Cladding	add -5

REFERENCE

## NOISE ATTENUATION

PIPE SIZE	PIPE SCHEDULE												
	10	20	30	40	60	80	100	120	140	160	STD	XS	XXS
1	—	—	—	0	—	-3	—	—	—	-6	0	-3	—
1.5	—	—	—	0	—	-3	—	—	—	-6	0	-3	-9
2	—	—	—	0	—	-3	—	—	—	-7	0	-3	-9
3	—	—	—	0	—	-3	—	—	—	-9	0	-3	-9
4	—	—	—	0	—	-5	—	-6	—	-7	0	-6	-9
6	—	—	—	0	—	-4	—	-6	—	-8	0	-6	-10
8	—	+2	+1	0	-2	-4	-6	-7	-8	-9	0	-4	-9
10	—	+3	+1	0	-3	-4	-6	-8	-9	-10	0	-3	—
12	—	+3	+1	-1	-3	-5	-7	-9	-10	-11	0	-3	—
14	+3	+1	0	-2	-4	-6	-8	-10	-11	-12	0	-3	—
16	+3	+1	0	-3	-5	-7	-9	-10	-12	-13	0	-3	—
18	+3	+1	-2	-4	-6	-8	-10	-11	-13	-14	0	-3	—
20	+3	0	-3	-4	-7	-9	-10	-12	-14	-15	0	-3	—
24	+3	0	-4	-6	-9	-10	-12	-14	-15	-16	0	-3	—
30	+1	-3	-5	—	—	—	—	—	—	—	0	-3	—

# PRESSURE TEMPERATURE LIMITS

## Body Material and End Connection Selection

BASED ON: ANSI B16.1-1989 (Cast Iron) B16.24-1991 (Cast Bronze) B16.5-1996 (All Steels)

Enter selection table at the service temperature and read down the column. Obtain a figure for maximum allowable pressure which equals or exceeds the inlet pressure in the system. The materials are ranked in the order of their relative cost.

It is wise in most cases to make several tentative selections for body material and end connection to determine which is most economical. For instance, it may be advantageous to go to a higher body rating than to select a stronger alloy.

See product design limitations published in Leslie bulletins and data sheets prior to final selection. Regular type (not bold) indicate temperatures recommended by Leslie Controls for each material.

Bold type areas indicate temperatures permitted by ANSI B16.5-1996, but NOT recommended by Leslie Controls.

Code Designations	
2	= Class B Cast Iron
6	= Grade WC1 (0.50% Moly)
4	= Grade C5 (5.50% Chrome)
22	= Cast Bronze
8	= Grade WC6 (1.25% Chrome)
9	= Grade CF8 (304 SST)
3	= Grade WCB Carbon Steel
7	= Grade WC9 (2.25% Chrome)
5	= Grade CF8M (316 SST)

END CONNECTIONS	BODY MAT'L CODE	ASTM SPEC.	MAXIMUM PRESSURE (PSIG) AT SERVICE TEMPERATURE (°F) - (NON-SHOCK)																			
			100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050
125# FLANGES THREADS	2	A126	200	200	190	175	165	150	140	125												
150# FLANGES SWE, BWE THREADS	22	B61	225	225	215	205	195	180	170	160	150	140										
	3	A216	285		260		230		200		170		140	125	110	95	80	<b>65</b>	<b>50</b>	<b>35</b>	<b>20</b>	
	6	A217	265		260		230		200		170		140	125	110	95	80	65	<b>50</b>	<b>35</b>	<b>20</b>	
	8	A217	290		260		230		200		170		140	125	110	95	80	65	50	35	20	
	7	A217	290		260		230		200		170		140	125	110	95	80	65	50	35	20	
	4	A217	290		260		230		200		170		140	125	110	95	80	65	50	35	20	
9	A351	275		230		205		190		170		140	125	110	95	80	65	50	35	20		
5	A351	275		235		215		195		170		140	125	110	95	80	65	50	35	20		
250# FLANGES THREADS	2	A126	500	500	460	415	375	335	290	250												
300# FLANGES SWE, BWE THREADS	22	B61	500	500	475	450	425	400	375	350	325	300										
	3	A216	740		675		655		635		600		550	535	535	505	410	<b>270</b>	<b>170</b>	<b>105</b>	<b>50</b>	
	6	A217	695		680		655		640		620		605	590	570	530	510	485	<b>450</b>	<b>280</b>	<b>165</b>	
	8	A217	750		750		720		695		665		605	590	570	530	510	485	450	320	215	<b>145</b>
	7	A217	750		750		730		705		665		605	590	570	530	510	485	450	375	260	<b>175</b>
	4	A217	750		745		715		705		665		605	590	570	530	510	485	370	275	200	145
9	A351	720		600		540		495		465		435	430	425	415	405	395	390	380	320	<b>305</b>	
5	A351	720		620		560		515		480		450	445	430	425	420	420	415	385	350	350	345
600# FLANGES SWE, BWE THREADS	3	A216	1480		1350		1315		1270		1200		1095	1075	1065	1010	825	<b>535</b>	<b>345</b>	<b>205</b>	<b>105</b>	
	6	A217	1390		1360		1305		1280		1245		1210	1175	1135	1065	1015	975	<b>900</b>	<b>560</b>	<b>330</b>	
	8	A217	1500		1500		1445		1385		1330		1210	1175	1135	1065	1015	975	900	640	430	<b>290</b>
	7	A217	1500		1500		1455		1410		1330		1210	1175	1135	1065	1015	975	900	755	520	<b>350</b>
	4	A217	1500		1490		1430		1410		1330		1210	1175	1135	1055	1015	965	740	550	400	<b>290</b>
	9	A351	1440		1200		1080		995		930		875	860	850	830	805	790	780	765	640	<b>615</b>
5	A351	1440		1240		1120		1025		955		900	890	870	855	845	835	830	775	700	685	
900# FLANGES SWE, BWE	3	A216	2220		2025		1970		1900		1795		1640	1610	1600	1510	1235	<b>805</b>	<b>515</b>	<b>310</b>	<b>155</b>	
	6	A217	2085		2035		1955		1920		1865		1815	1765	1705	1595	1525	1460	<b>1350</b>	<b>845</b>	<b>495</b>	
	8	A217	2250		2250		2165		2080		1995		1815	1765	1705	1595	1525	1460	1350	955	650	<b>430</b>
	7	A217	2250		2250		2185		2115		1995		1815	1765	1705	1595	1525	1460	1350	1130	780	<b>525</b>
	4	A217	2250		2235		2150		2115		1995		1815	1765	1705	1585	1525	1450	1110	825	595	430
	9	A351	2160		1800		1620		1490		1395		1310	1290	1275	1245	1210	1190	1165	1145	965	<b>925</b>
5	A351	2160		1860		1680		1540		1435		1355	1330	1305	1280	1265	1255	1245	1160	1050	1030	
1500# FLANGES SWE, BWE	3	A216	3705		3375		3280		3170		2995		2735	2685	2665	2520	2060	<b>1340</b>	<b>860</b>	<b>515</b>	<b>260</b>	
	6	A217	3470		3395		3260		3200		3105		3025	2940	2840	2660	2540	2435	<b>2245</b>	<b>1405</b>	<b>825</b>	
	8	A217	3750		3750		3610		3465		3325		3025	2940	2840	2660	2540	2435	2245	1595	1080	<b>720</b>
	7	A217	3750		3750		3640		3530		3325		3025	2940	2840	2660	2540	2435	2245	1885	1305	<b>875</b>
	4	A217	3750		3725		3580		3530		3325		3025	2940	2840	2640	2540	2415	1850	1370	995	720
	9	A351	3600		3000		2700		2485		2330		2185	2150	2125	2075	2015	1980	1945	1910	1605	<b>1545</b>
5	A351	3600		3095		2795		2570		2390		2255	2220	2170	2135	2110	2090	2075	1930	1750	1720	
2500# FLANGES SWE, BWE	3	A216	6170		5625		5470		5280		4990		4560	4475	4440	4200	3430	<b>2230</b>	<b>1430</b>	<b>860</b>	<b>430</b>	
	6	A217	5785		5660		5435		5330		5180		5040	4905	4730	4430	4230	4060	<b>3745</b>	<b>2345</b>	<b>1370</b>	
	8	A217	6250		6250		6015		5775		5540		5040	4905	4730	4430	4230	4060	3745	2655	1800	<b>1200</b>
	7	A217	6250		6250		6070		5880		5540		5040	4905	4730	4430	4230	4060	3745	3145	2170	<b>1455</b>
	4	A217	6250		6205		5965		5880		5540		5040	4905	4730	4400	4230	4030	3085	2285	1655	1200
	9	A351	6000		5000		4500		4140		3880		3640	3580	3540	3460	3360	3300	3240	3180	2675	<b>2570</b>
5	A351	6000		5160		4660		4280		3980		3760	3700	3620	3560	3520	3480	3460	3220	2915	2865	
3500# FLANGES SWE, BWE	3	A216	8640		7870		7655		7390		6985		6385	6265	6215	5880	4800	<b>3120</b>	<b>2000</b>	<b>1200</b>	<b>600</b>	
	6	A217	8100		7920		7605		7460		7250		7055	6865	6620	6200	5920	5680	<b>5240</b>	<b>3280</b>	<b>1920</b>	
	8	A217	8750		8750		8420		8085		7750		7055	6865	6620	6200	5920	5680	5240	3720	2520	<b>1680</b>
	7	A217	8750		8750		8495		8230		7750		7055	6865	6620	6200	5920	5680	5240	4405	3040	<b>2040</b>
	4	A217	8750		8685		8350		8230		7750		7055	6865	6620	6160	5920	5640	4320	3200	2320	1680
	9	A351	8400		7000		6300		5795		5430		5095	5010	4955	4845	4705	4620	4535	4450	3745	<b>3600</b>
5	A351	8400		7225		6525		5990		5570		5265	5180	4955	4925	4845	4730	4590	4505	4240	4200	
4500# FLANGES SWE, BWE	3	A216	11110		10120		9845		9505		8980		8210	8055	7990	7560	6170	<b>4010</b>	<b>2570</b>	<b>1545</b>	<b>770</b>	
	6	A217	10415		10185		9780		9595		9320		9070	8825	8515	7970	7610	7305	<b>6740</b>	<b>4215</b>	<b>2470</b>	
	8	A217	11250		11250		10830		10400		9965		9070	8825	8515	7970	7610	7305	6740	4785	3240	<b>2160</b>
	7	A217	11250		11250		10925		10585		9965		9070	8825	8515	7970	7610	7305	6740	5665	3910	<b>2625</b>

# MATERIAL SELECTION CHART

The following chart is intended to serve as a visual guide or indicator in the selection of piping and valve materials for use with various fluids in process industries. It will be well to remember that this is a tentative comparison of materials under a similar set of conditions. Therefore the suggestions

given are subject to change in accordance with the specific conditions of the actual problem.

For example, it is quite possible to have unusual conditions of pressure, temperature, concentration, or product control which would prevent the use of a material normally satisfactory for the fluid involved.

## Legend

- 1 — generally found satisfactory in practice
- 2 — generally unsatisfactory in practice
- 3 — caution: tests should be made to determine suitability
- 4 — actual information unknown

REFERENCE

	IRON AND STEEL	NI-RESIST CAST IRON	18-8 MO	MONEL METAL	NICKEL	RED BRASS	ACID-RESISTING BRONZE	ALUMINUM	"TYGON T" (Plastic)*
Acetate solvents, crude	3	3	3	1	1	3	1	1	2
Acetate solvents, pure	3	1	1	1	1	1	1	1	2
Acetic acid, crude	3	3	1	3	3	3	1	3	2
Acetic acid, pure	2	2	1	1	3	2	1	1	2
Acetic acid vapors	2	2	1	3	4	3	2	3	2
Acetic anhydride	3	1	1	1	4	2	3	1	3
Acetone	1	1	1	1	1	1	1	1	2
Acetylene	1	1	1	1	1	2	2	1	2
Alcohols	1	1	1	1	1	1	1	1	3
Aluminum sulfate	2	3	1	1	4	3	3	3	1
Ammonia gas	1	1	1	1	1	2	2	1	3
Ammonium chloride	3	1	3	1	1	3	3	2	1
Ammonium hydroxide	1	1	1	3	3	2	2	1	3
Ammonium nitrate	1	3	1	3	3	2	2	1	3
Ammonium phosphate (mono)	2	3	1	3	4	3	1	2	1
Ammonium phosphate (di)	3	1	1	1	4	3	3	1	1
Ammonium phosphate (tri)	1	1	1	1	1	3	3	1	1
Ammonium sulfate	1	1	3	1	1	3	1	4	1
Asphalt	1	1	1	1	1	1	1	4	2
Beer (1)	3	3	1	1	1	1	1	1	1
Beet sugar liquors	1	1	1	1	1	3	3	1	1
Benzene or benzol	1	1	1	1	1	1	1	1	2
Benzine	1	1	1	1	1	1	1	1	2
Borax	1	1	1	1	1	3	3	3	1
Boric acid	2	3	1	1	1	3	1	1	1
Butane, butylenes, butadiene	1	1	1	3	3	1	1	1	2
Calcium bisulfite	2	2	1	2	2	2	3	3	1
Calcium chloride	1	1	3	1	1	1	1	2	4
Calcium hypochloride	3	3	3	3	3	3	3	4	3
Cane sugar liquors	1	1	1	1	1	1	1	1	1
Carbolic acid or phenol	3	3	1	1	1	3	3	1	3
Carbon dioxide, dry	1	1	1	1	1	1	1	1	1
Carbon dioxide, wet	3	3	1	1	1	3	3	1	1
Carbon disulfide	1	1	1	3	4	2	2	1	2
Carbon acid	2	2	1	1	1	3	3	1	1
Carbon tetrachloride (2)	3	3	3	1	1	3	3	3	3
Chlorine, dry (3)	1	1	3	1	1	3	3	4	1
Chlorine, wet (3)	2	2	2	2	2	2	2	2	3
Chlorex	1	4	4	1	4	1	1	4	3

	IRON AND STEEL	NI-RESIST CAST IRON	18-8 MO	MONEL METAL	NICKEL	RED BRASS	ACID-RESISTING BRONZE	ALUMINUM	"TYGON T" (Plastic)*
Chromic acid	3	3	1	3	3	2	3	3	3
Citric acid	2	3	1	1	1	3	1	1	1
Coke oven gas	1	4	1	3	4	3	3	1	3
Copper sulfate	2	3	1	3	3	2	2	2	1
Core oils	1	4	4	4	4	1	1	4	4
Cottonseed oil	1	1	1	1	1	3	1	4	3
Creosote, crude	1	1	1	1	1	3	1	1	2
Doctor solutions	1	1	1	1	4	2	2	2	1
Ethers	4	4	1	1	1	1	1	1	3
Ethylene glycol	1	1	1	1	1	1	1	1	1
Ferric chloride	2	2	2	2	2	2	2	2	1
Ferric sulfate	2	2	1	3	3	2	3	2	1
Formaldehyde	3	3	1	1	1	1	1	1	3
Formic acid	2	4	3	3	3	2	3	2	1
Freon, wet	3	1	3	1	1	1	1	1	2
Freon, dry	1	1	1	1	1	1	1	1	2
Furfural	1	4	4	1	1	1	1	1	3
Gasoline, sour	3	3	1	3	4	2	2	1	3
Gasoline, refined	1	1	1	1	4	1	1	1	3
Gelatine	4	4	1	1	1	2	3	1	1
Glucose	1	1	1	1	1	1	1	1	1
Glue	1	1	1	1	1	1	1	1	1
Glycerine glycerol	1	1	1	1	1	1	1	1	1
Hydrochloric acid	2	2	2	3	3	2	3	2	1
Hydrocyanic acid	3	4	1	1	4	4	1	1	3
Hydrofluoric acid	3	2	2	3	3	2	3	2	3
Hydrogen gas	1	1	1	1	1	1	1	1	1
Hydrogen peroxide	2	2	1	1	1	2	3	1	3
Hydrogen sulfide	1	1	1	3	3	2	2	1	3
Hydrogen sulfide, wet	3	3	1	3	3	2	2	1	1
Lacquers and solvents	3	1	1	1	1	1	1	1	2
Lime-sulfur	1	1	1	1	1	2	2	4	1
Magnesium chloride	3	3	3	1	1	3	1	2	1
Magnesium hydroxide	1	1	1	1	1	3	3	2	4
Magnesium sulfate	1	1	1	1	1	1	1	1	1
Mercuric chloride	3	3	2	3	3	2	2	2	1
Mercury	1	1	1	1	1	2	2	2	1
Milk	2	2	1	3	1	2	2	1	1
Molasses	1	1	1	1	1	1	1	1	1

# MATERIAL SELECTION CHART – CONT'D.

## Legend

- 1 — generally found satisfactory in practice
- 2 — generally unsatisfactory in practice
- 3 — caution: tests should be made to determine suitability
- 4 — actual information unknown

	IRON AND STEEL	NI-RESIST CAST IRON	18-8 MO	MONEL METAL	NICKEL	RED BRASS	ACID-RESISTING BRONZE	ALUMINUM	"TYGON T" (Plastic)*
Natural gas	1	1	1	1	1	3	3	1	3
Nickel chloride	4	4	3	3	3	2	2	2	1
Nickel sulfate	4	4	3	3	3	3	3	2	1
Nitrating acids (sulfuric > 15%)	3	3	3	2	2	2	2	2	2
Nitrating acids (sulfuric < 15%)	2	2	3	2	2	2	2	2	2
Nitrating acids (nitric > 15%)	2	2	2	2	2	2	2	2	3
Nitrating acids (sulfuric + nitric = 1%)	2	3	1	2	2	2	2	1	2
Nitric acid, crude	2	4	3	2	2	2	2	3	4
Nitric acid, pure	2	4	1	2	2	2	2	3	3
Oleic acid	3	3	1	1	4	3	1	1	3
Oxalic acid	3	3	4	1	4	3	1	1	1
Oxygen	1	4	1	1	4	1	1	1	1
Palmitic acid	3	3	1	1	4	3	1	1	1
Petroleum oils	1	1	3	4	4	3	3	4	2
Petroleum oils, refined	1	1	1	1	1	1	1	1	2
Phosphoric acid, crude	3	4	3	3	3	2	2	2	1
Phosphoric acid, pure (< 45%)	2	4	1	3	4	2	3	2	3
Phosphoric acid, pure (< 45%, cold)	2	4	1	3	4	2	2	2	3
Phosphoric acid, pure (< 45%, hot)	2	4	3	3	2	2	2	2	3
Picric acid (molten)	1	4	1	2	2	2	2	4	2
Picric acid	3	4	1	2	2	2	2	1	1
Potassium chloride	1	1	3	1	1	1	1	3	1
Potassium hydroxide	3	1	3	1	1	2	2	2	1
Potassium sulfate	1	1	3	1	1	1	1	1	1
Propane gas	1	1	1	1	1	1	1	1	2
Rosin, dark	1	1	1	1	1	3	1	1	2
Rosin, light	2	3	1	1	1	2	2	1	2
Shellac, orange	1	1	1	1	1	1	1	1	1
Shellac, bleached	2	3	1	1	1	3	3	1	1
Sodium carbonate	1	1	1	1	1	3	3	2	1
Sodium bicarbonate	3	1	1	1	1	3	1	3	1
Sodium bisulfate	2	3	3	1	1	3	1	3	1
Sodium chloride	1	1	3	1	1	1	1	3	1
Sodium cyanide	1	3	1	3	3	2	2	2	1
Sodium hydroxide	1	1	3	1	1	3	3	2	1
Sodium hypochlorite	2	3	3	3	3	2	2	2	3

1. Iron and steel used for handling beer in the alcohol industry but not permissible in the beverage industry.
2. Based on industrial uses of the solvent galvanized steel commonly used for tanks, piping, etc. Iron and steel are widely used in manufacture of solvent with good success.
3. Industrial applications of "dry" chlorine frequently involve locations where moisture is present. Steel gives good results as piping material but something better is required for critical parts. Steel valves trimmed with monel give good results. Non-metals required for wet gas and aqueous solutions.
4. When gas is wet apply recommendation for sulfuric acid (< 10%).
5. Special high chrome-nickel alloys having good resistance to a wide range of concentrations are being used. Ordinary iron and steel good where concentration is always over 90%. Absorption

	IRON AND STEEL	NI-RESIST CAST IRON	18-8 MO	MONEL METAL	NICKEL	RED BRASS	ACID-RESISTING BRONZE	ALUMINUM	"TYGON T" (Plastic)*
Sodium metaphosphate	3	4	1	1	4	3	1	1	1
Sodium nitrate	1	1	1	1	1	3	3	1	3
Sodium perborate and peroxide	3	1	1	1	1	3	3	1	3
Sodium phosphate (mono)	3	4	1	1	1	3	1	1	1
Sodium phosphate (di)	3	1	1	1	1	1	1	1	4
Sodium phosphate (tri)	1	1	1	1	1	2	2	2	4
Sodium silicate	1	1	1	1	1	2	2	2	1
Sodium sulfate	1	1	3	1	1	1	1	4	1
Sodium sulfide	1	1	1	1	1	2	2	2	1
Sodium thiosulfate	3	4	1	3	3	2	2	3	1
Sludge acid	2	3	2	3	4	2	3	2	3
Stearic acid	3	3	1	1	1	3	3	1	1
Sulfate liquors	1	1	1	1	4	2	2	2	1
Sulfur	1	3	3	3	3	2	2	1	3
Sulfur chloride	3	1	3	1	1	2	2	4	3
Sulfur dioxide, dry	1	1	1	1	4	1	1	1	1
Sulfur trioxide, dry	1	1	1	1	4	1	1	1	1
Sulfuric acid(98% to fuming) (4)	1	1	3	2	2	2	2	3	2
Sulfuric acid (75-95%) (5)	1	4	2	2	2	2	2	2	3
Sulfuric acid (10-75%)	2	3	2	1	3	2	3	2	3
Sulfuric acid (< 10%)	2	3	3	1	3	3	1	2	3
Sulfurous acid	2	4	1	2	2	2	1	3	3
Tar	1	1	1	1	1	1	1	1	2
Tartaric acid	2	3	1	1	1	3	1	1	1
Toluene or toluol	1	4	4	1	4	1	1	1	2
Trichloroethylene	3	3	3	1	1	3	3	4	2
Turpentine	3	1	1	1	4	3	3	1	1
Varnish	3	3	1	1	1	3	3	1	3
Vegetable oils	1	1	1	1	1	1	1	1	1
Vinegar	3	3	1	1	1	3	3	3	3
Water, acid mine (oxidizing salts)	2	3	1	2	2	2	2	2	3
Water, acid mine (no oxidizing salts)	3	1	2	1	1	3	1	2	3
Water, fresh (boiler feed)	1	1	4	1	1	1	1	3	1
Water, distilled	2	2	1	3	1	2	2	1	1
Water, distilled (condensate)	1	1	1	1	1	1	1	1	1
Water, salt	3	1	3	1	3	1	1	3	1
Whiskey and wines	2	3	1	3	1	3	3	3	1
Zinc chloride	3	3	2	1	4	2	2	2	1
Zinc sulfate	3	1	4	1	4	3	3	4	1

of moisture from the air dilutes exposed acid and makes it more corrosive to iron.

- \* Temperatures and concentrations should be known in all cases in order to suggest proper procedure. In general, when the operating temperature is increased, a corresponding decrease in concentration is indicated for satisfactory service. Recommendations in above table are based on room temperatures. Recommendations in this table are based on "TYGON T", one of the "TYGON T" series of formulations. Special formulations can be prepared to provide specific properties other than those listed. We suggest that in all cases of special applications the U.S. Stoneware Process Equipment Division be consulted.

† Synthetic Rubber — Product of E.I. DuPont De Nemours.



NOTES:

# STEAM TABLE<sup>1</sup>

h = Total heat of steam, Btu per pound  
v = Specific volume, cubic feet per pound

TOTAL TEMPERATURE, °F															Temperature °F (sat.)	Pressure psi (gage)	
480	500	520	540	560	580	600	620	640	660	680	700	720	740	750			
1277.6 37.96	1287.1 38.78	1296.6 39.60	1306.2 40.41	1315.7 41.23	1325.3 42.04	1334.8 42.86	1344.5 43.68	1354.2 44.49	1363.8 45.31	1373.5 46.12	1383.2 46.94	1393.0 47.75	1402.8 48.56	1407.7 48.97	h v	212	0
1277.1 27.86	1286.6 28.46	1296.2 29.06	1305.7 29.67	1315.3 30.27	1324.8 30.87	1334.4 31.47	1344.1 32.07	1353.8 32.67	1363.5 33.27	1373.2 33.87	1382.9 34.47	1392.7 35.07	1402.6 35.67	1407.5 35.96	h v	228	5
1276.6 22.26	1286.2 22.74	1295.8 23.22	1305.3 23.71	1314.9 24.19	1324.5 24.68	1334.1 25.16	1343.8 25.64	1353.5 26.12	1363.2 26.60	1372.9 27.08	1382.6 27.56	1392.5 28.04	1402.3 28.52	1407.2 28.76	h v	240	10
1276.2 18.528	1285.7 18.933	1295.3 19.337	1304.9 19.741	1314.5 20.144	1324.2 20.547	1333.8 20.95	1343.5 21.35	1353.2 21.75	1362.9 22.15	1372.6 22.56	1382.4 22.96	1392.3 23.36	1402.1 23.76	1407.0 23.96	h v	250	15
1275.7 15.862	1285.3 16.210	1294.9 16.558	1304.5 16.905	1314.1 17.251	1323.8 17.597	1333.5 17.943	1343.2 18.288	1352.9 18.633	1362.6 18.977	1372.3 19.322	1382.1 19.666	1391.9 20.01	1401.8 20.35	1406.7 20.52	h v	259	20
1275.2 13.862	1284.8 14.168	1294.5 14.473	1304.1 14.778	1313.8 15.082	1323.4 15.385	1333.1 15.688	1342.8 15.990	1352.5 16.293	1362.3 16.595	1372.1 16.896	1381.9 17.198	1391.7 17.499	1401.6 17.8001	1406.5 7.951	h v	267	25
1274.7 12.307	1284.4 12.580	1294.0 12.852	1303.7 13.123	1313.4 13.394	1323.1 13.665	1332.8 13.935	1342.5 14.204	1352.2 14.473	1362.0 14.742	1371.8 15.011	1381.6 15.279	1391.5 15.547	1401.4 15.815	1406.3 15.949	h v	274	30
1273.7 10.044	1283.4 10.269	1293.2 10.493	1302.9 10.717	1312.6 10.940	1322.4 11.162	1332.1 11.384	1341.9 11.605	1351.7 11.826	1361.5 12.047	1371.3 12.268	1381.1 12.488	1391.0 12.708	1400.9 12.927	1405.8 13.037	h v	287	40
1272.7 8.478	1282.5 8.670	1292.3 8.861	1302.1 9.051	1311.9 9.240	1321.7 9.429	1331.5 9.618	1341.3 9.806	1351.1 9.993	1360.9 10.181	1370.8 10.368	1380.6 10.555	1390.5 10.741	1400.4 10.928	1405.4 11.021	h v	298	50
1271.6 7.329	1281.5 7.496	1291.4 7.663	1301.3 7.829	1311.1 7.994	1321.0 8.159	1330.8 8.323	1340.6 8.486	1350.5 8.649	1360.3 8.812	1370.2 8.975	1380.1 9.138	1390.0 9.300	1399.9 9.462	1404.9 9.543	h v	308	60
1270.6 6.450	1280.6 6.599	1290.5 6.747	1300.5 6.894	1310.4 7.041	1320.2 7.187	1330.1 7.332	1340.0 7.477	1349.9 7.622	1359.8 7.766	1369.7 7.910	1379.6 8.054	1389.6 8.198	1399.5 8.341	1404.5 8.413	h v	316	70
1269.5 5.756	1279.6 5.891	1289.6 6.024	1299.6 6.156	1309.6 6.288	1319.5 6.419	1329.4 6.550	1339.4 6.680	1349.3 6.810	1359.3 6.940	1369.2 7.069	1379.1 7.199	1389.1 7.327	1399.0 7.456	1404.0 7.520	h v	324	80
1268.5 5.195	1278.6 5.317	1288.7 5.439	1298.8 5.559	1308.8 5.679	1318.8 5.799	1328.7 5.918	1338.7 6.036	1348.7 6.154	1358.6 6.272	1368.6 6.389	1378.5 6.506	1388.5 6.623	1398.5 6.740	1403.5 6.798	h v	331	90
1267.4 4.730	1277.7 4.843	1287.8 4.955	1297.9 5.066	1308.0 5.176	1318.0 5.285	1328.1 5.394	1338.1 5.503	1348.0 5.611	1358.0 5.719	1368.0 5.827	1378.0 5.934	1388.1 6.041	1398.1 6.148	1403.1 6.201	h v	338	100
1266.7 3.860	1275.2 3.954	1285.5 4.047	1295.8 4.140	1306.0 4.232	1316.2 4.323	1326.4 4.413	1336.5 4.503	1346.6 4.593	1356.6 4.683	1366.7 4.772	1376.8 4.861	1386.9 4.949	1397.0 5.038	1402.0 5.082	h v	353	125
1261.9 3.252	1272.6 3.334	1283.2 3.414	1293.6 3.494	1304.0 3.573	1314.3 3.652	1324.6 3.730	1334.8 3.807	1345.0 3.884	1355.2 3.960	1365.3 4.037	1375.4 4.113	1385.6 4.188	1395.8 4.264	1400.8 4.301	h v	366	150
1259.0 2.804	1270.0 2.877	1280.8 2.948	1291.4 3.019	1302.0 3.089	1312.4 3.157	1322.8 3.226	1333.2 3.294	1343.5 3.361	1353.7 3.429	1363.9 3.495	1374.2 3.562	1384.4 3.628	1394.6 3.694	1399.7 3.727	h v	378	175
1256.0 2.460	1267.3 2.525	1278.3 2.590	1289.2 2.653	1299.9 2.716	1310.5 2.777	1321.0 2.839	1331.4 2.900	1341.8 2.960	1352.2 3.019	1362.5 3.079	1372.8 3.139	1383.1 3.198	1393.3 3.256	1398.5 3.286	h v	388	200
1253.0 2.187	1264.5 2.247	1275.8 2.306	1286.9 2.364	1297.8 2.421	1308.5 2.477	1319.2 2.533	1329.8 2.587	1340.3 2.642	1350.7 2.696	1361.1 2.750	1371.5 2.804	1381.9 2.857	1392.2 2.910	1397.3 2.936	h v	397	225
1249.9 1.9654	1261.7 2.021	1273.2 2.076	1284.5 2.129	1295.6 2.181	1306.5 2.233	1317.3 2.284	1328.0 2.334	1338.7 2.384	1349.2 2.434	1359.7 2.483	1370.2 2.532	1380.6 2.580	1391.0 2.629	1396.2 2.653	h v	406	250
1246.6 1.7816	1258.8 1.8338	1270.6 1.8846	1282.1 1.9342	1293.4 1.9829	1304.5 2.031	1315.5 2.078	1326.3 2.125	1337.0 2.171	1347.7 2.217	1358.3 2.262	1368.8 2.307	1379.3 2.352	1389.8 2.396	1395.0 2.418	h v	414	275
1243.3 1.6266	1255.8 1.6759	1267.9 1.7237	1279.7 1.7703	1291.2 1.8159	1302.5 1.8607	1313.6 1.9048	1324.5 1.9483	1335.4 1.9912	1346.1 2.034	1356.8 2.076	1367.4 2.118	1378.0 2.159	1388.6 2.200	1393.8 2.220	h v	422	300
1236.4 1.3795	1249.6 1.4243	1262.4 1.4675	1274.7 1.5094	1286.6 1.5501	1298.2 1.5900	1309.7 1.6291	1320.9 1.6676	1332.0 1.7056	1343.0 1.7430	1353.9 1.7801	1364.7 1.8168	1375.4 1.8531	1386.1 1.8892	1391.4 1.9071	h v	436	350
1229.0 1.1908	1243.2 1.2325	1256.6 1.2724	1269.4 1.3108	1281.8 1.3480	1293.9 1.3842	1305.7 1.4196	1317.2 1.4544	1328.6 1.4885	1339.8 1.5222	1350.9 1.5554	1361.9 1.5883	1372.8 1.6207	1383.6 1.6529	1389.0 1.6689	h v	448	400
1221.2 1.0416	1236.3 1.0811	1250.5 1.1186	1264.0 1.1544	1276.9 1.1889	1289.4 1.2224	1301.6 1.2550	1313.5 1.2868	1325.1 1.3180	1336.5 1.3488	1347.8 1.3789	1359.0 1.4088	1370.1 1.4382	1381.1 1.4675	1386.5 1.4819	h v	460	450
1212.8 0.9204	1229.0 0.9584	1244.0 0.9941	1258.3 1.0280	1271.8 1.0604	1284.8 1.0917	1297.3 1.1221	1309.6 1.1516	1321.5 1.1805	1333.2 1.2088	1344.7 1.2367	1356.1 1.2641	1367.3 1.2913	1378.4 1.3180	1384.0 1.3313	h v	470	500
	1221.4 0.8565	1237.4 0.8909	1252.4 0.9234	1266.5 0.9542	1280.0 0.9838	1293.0 1.0124	1305.6 1.0401	1317.8 1.0671	1329.8 1.0935	1341.6 1.1195	1353.2 1.1449	1364.6 1.1700	1375.8 1.1947	1381.4 1.2070	h v	480	550
	1213.2 0.7703	1230.3 0.8040	1246.1 0.8353	1261.0 0.8649	1275.1 0.8931	1288.5 0.9203	1301.5 0.9465	1314.1 0.9720	1326.3 0.9968	1338.3 1.0211	1350.2 1.0450	1361.8 1.0684	1373.2 1.0916	1378.9 1.1030	h v	489	600

REFERENCE

1. Adapted with permission from "Thermodynamic Properties of Steam", Keenan and Keyes, published by John Wiley & Sons, Inc.

# STEAM TABLE<sup>1</sup>

h = Total heat of steam, Btu per pound  
v = Specific volume, cubic feet per pound

Pres- sure psi (gage)	Temper- ature F° (sat.)		Satur- ated Liquid	Satur- ated Vapor	TOTAL TEMPERATURE, °F																
					220	240	260	280	300	320	340	360	380	400	420	440	460				
0	212	h v	180.1 0.0167	1150.4 26.80	1154.4 27.15	1164.2 28.00	1173.8 28.85	1183.3 29.70	1192.8 30.53	1202.3 31.37	1211.7 32.20	1221.1 33.03	1230.5 33.85	1239.9 34.68	1249.3 35.50	1258.8 36.32	1268.2 37.14				
5	228	h v	196.2 0.0168	1156.3 20.089		1162.3 20.48	1172.2 21.11	1182.0 21.74	1191.6 22.36	1201.2 22.98	1210.8 23.60	1220.3 24.21	1229.7 24.82	1239.2 25.43	1248.7 26.04	1258.2 26.65	1267.6 27.25				
10	240	h v	208.4 0.0169	1160.6 16.303			1170.7 16.819	1180.6 17.330	1190.5 17.836	1200.2 18.337	1209.8 18.834	1219.4 19.329	1229.0 19.821	1238.5 20.31	1248.1 20.80	1257.6 21.29	1267.1 21.77				
15	250	h v	218.8 0.0170	1164.1 13.746			1169.1 13.957	1179.3 14.390	1189.3 14.816	1199.1 15.238	1208.9 15.657	1218.6 16.072	1228.3 16.485	1237.9 16.897	1247.5 17.306	1257.0 17.714	1266.6 18.121				
20	259	h v	227.9 0.0171	1167.1 11.898			1167.5 11.911	1177.9 12.288	1188.1 12.659	1198.1 13.025	1208.0 13.387	1217.8 13.746	1227.5 14.103	1237.2 14.457	1246.8 14.810	1256A 15.162	1266.1 15.512				
25	267	h v	236.0 0.0171	1169.7 10.498				1176.5 10.711	1186.8 11.040	1197.0 11.364	1207.0 11.684	1216.9 12.001	1226.7 12.315	1236.5 12.628	1246.2 12.938	1255.9 13.247	1265.5 13.555				
30	274	h v	243.4 0.0172	1172.0 9.401				1175.0 9.484	1185.6 9.781	1195.9 10.072	1206.0 10.359	1216.0 10.643	1225.9 10.925	1235.8 11.204	1245.6 11.482	1255.3 11.758	1265.0 12.0033				
40	287	h v	256.3 0.0173	1175.9 7.787					1183.0 7.947	1193.6 8.192	1204.0 8.432	1214.3 8.668	1224.4 8.902	1234.3 9.134	1244.3 9.364	1254.1 9.592	1263.9 9.819				
50	298	h v	267.5 0.0174	1179.1 6.655					1180.3 6.676	1191.3 6.889	1202.0 7.096	1212.5 7.300	1222.7 7.501	1232.9 7.700	1242.9 7.896	1252.9 8.091	1262.8 8.285				
60	308	h v	277.4 0.0175	1181.9 5.816						1188.9 5.9321	1199.9 6.116	1210.6 6.296	1221.1 6.473	1231.4 6.648	1241.6 6.820	1251.7 6.991	1261.7 7.161				
70	316	h v	286.4 0.0176	1184.2 5.168						1186.4 5.200	1197.7 5.366	1208.7 5.528	1219.4 5.687	1229.9 5.843	1240.2 5.997	1250.4 6.150	1260.6 6.301				
80	324	h v	294.6 0.0177	1186.2 4.652							1195.5 4.773	1206.7 4.921	1217.7 5.065	1228.3 5.207	1238.8 5.347	1249.2 5.485	1259.4 5.621				
90	331	h v	302.1 0.0178	1188.1 4.232							1193.2 4.292	1204.7 4.429	1215.9 4.562	1226.7 4.693	1237.4 4.821	1247.9 4.947	1258.2 5.071				
100	338	h v	309.1 0.0178	1189.7 3.882							1190.8 3.895	1202.7 4.022	1214.1 4.146	1225.2 4.267	1236.0 4.385	1246.6 4.502	1257.1 4.617				
125	353	h v	324.8 0.0180	1193.0 3.220								1197.3 3.258	1209.4 3.365	1211.1 3.468	1232.3 3.569	1243.3 3.667	1254.1 3.764				
150	366	h v	338.5 0.0182	1195.6 2.752									1204.5 2.818	1216.7 2.910	1228.4 2.998	1239.8 3.085	1251.0 3.169				
175	378	h v	350.8 0.0183	1197.6 2.404										1199.3 2.414	1212.2 2.498	1224.5 2.577	1236.3 2.655	1247.8 2.730			
200	388	h v	361.9 0.0185	1199.3 2.134											1207.4 2.180	1220.3 2.253	1232.6 2.324	1244.5 2.393			
225	397	h v	372.1 0.0186	1200.6 1.9183												1202.5 1.9276	1216.0 1.9964	1228.8 2.062	1241.1 2.126		
250	406	h v	381.6 0.0187	1201.7 1.7422													1211.5 1.7870	1224.9 1.8488	1237.6 1.9081		
275	414	h v	390.5 0.0188	1202.6 1.5954														1206.8 1.6130	1220.8 1.6717	1234.0 1.7277	
300	422	h v	398.8 0.0190	1203.2 1.4711															1216.5 1.5222	1230.3 1.5755	
350	436	h v	414.1 0.0192	1204.1 1.2720																1207.5 1.2831	1222.4 1.3326
400	448	h v	428.1 0.0194	1204.6 1.1194																	1214.0 1.1468
450	460	h v	440.9 0.0196	1204.6 0.9985																	
500	470	h v	452.9 0.0198	1204.2 0.9004																	
550	480	h v	464.1 0.0200	1203.7 0.8191																	
600	489	h v	474.7 0.0202	1203.0 0.7503																	

REFERENCE

1. Adapted with permission from "Thermodynamic Properties of Steam", Keenan and Keyes, published by John Wiley & Sons, Inc.