



Columbia Specialty Company, Inc.

Distributor of Mechanical and Industrial Piping Products

Phone:(562) 634-6425 Fax:(562) 408-2914

Company: _____

Project: _____

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Pipe Size	O.D. (Inches)	SCH 5s	SCH 5	SCH 10s	SCH 10	SCH 20	SCH 30	SCH 40	STD	SCH 60	SCH 80	XH	SCH 100	SCH 120	SCH 140	SCH 160	XXH
1/2	.840	.065 .5383	.065 .5380	.083 .6710	.083 .6710			.109 .8510	.109 .8510		.147 1.088	.147 1.088				.188 1.304	.294 1.714
3/4	1.050	.065 .6838	.065 .6838	.083 .8572	.083 .8572			.113 1.131	.113 1.131		.154 1.474	.154 1.474				.219 1.937	.308 2.441
1	1.315	.065 .8678	.065 .8678	.109 1.404	.109 1.404			.133 1.1679	.133 1.679		.179 2.172	.179 2.172				.250 2.844	.358 3.659
1 1/4	1.660	.065 1.107	.065 1.107	.109 1.806	.109 1.806			.140 2.273	.140 2.273		.191 2.997	.191 2.997				.250 3.765	.382 5.214
1 1/2	1.900	.065 1.274	.065 1.274	.109 2.085	.109 2.085			.145 2.718	.145 2.718		.200 3.631	.200 3.631				.281 4.859	.400 6.408
2	2.375	.065 1.604	.065 1.604	.109 2.638	.109 2.638			.154 3.653	.154 3.653		.218 5.022	.218 5.022				.344 7.444	.436 9.029
2 1/2	2.875	.083 2.475	.083 2.475	.120 3.531	.120 3.531			.203 5.793	.203 5.793		.279 7.661	.279 7.661				.375 10.01	.552 13.70
3	3.5	.083 3.029	.083 3.029	.120 4.332	.120 4.332			.216 7.576	.216 7.576		.300 10.25	.300 10.25				.438 14.32	.600 18.58
3 1/2	4.0	.083 3.472	.083 3.472	.120 4.973	.120 4.973			.226 9.109	.226 9.109		.318 12.51	.318 12.51					.636 22.85
4	4.5	.083 3.915	.083 3.915	.120 5.613	.120 5.613			.237 10.79	.237 10.79	.281 12.66	.337 14.98	.337 14.98		.438 19.00		.531 22.51	.674 27.54
4 1/2	5.0							.247 12.53			.335 17.61						.710 32.53
5	5.563	.109 6.349	.109 6.349	.134 7.770	.134 7.770			.258 14.62	.258 14.62		.375 20.78	.375 20.78		.500 27.04		.625 32.96	.750 38.55
6	6.625	.109 7.585	.109 7.585	.134 9.290	.134 9.289			.280 18.97	.280 18.97		.432 28.57	.432 28.57		.562 36.39		.719 45.30	.864 53.16
7	7.625							.301 23.57			.500 38.05						.875 63.08
8	8.625	.109 9.914	.109 9.914	.148 13.40	.148 13.40	.250 22.36	.277 24.70	.322 28.55	.322 28.55	.406 35.64	.500 43.39	.500 43.39	.594 50.87	.719 60.63	.812 67.76	.906 74.69	.875 72.42
9	9.625							.342 33.90			.500 48.72						
10	10.75	.134 15.19	.134 15.19	.165 18.65	.165 18.70	.250 28.04	.307 34.24	.365 40.48	.365 40.48	.500 54.74	.594 64.33	.500 54.74	.719 76.93	.844 89.20	1.000 104.1	1.125 115.6	
11	11.75										.500 60.07						
12	12.75	.156 21.07	.165 22.18	.188 24.16	.180 24.20	.250 33.38	.330 43.77	.406 53.53	.375 49.56	.562 73.16	.688 88.51	.500 65.42	.844 107.2	1.000 125.5	1.125 139.7	1.312 160.3	
14	14.0	.156 23.07		.180 27.73	.250 36.71	.312 45.68	.375 54.57	.438 63.37	.375 54.57	.594 84.91	.750 106.1	.500 72.09	.938 130.7	1.094 150.7	1.250 170.2	1.406 189.1	
16	16.0	.165 27.90		.188 31.75	.250 42.05	.312 52.36	.375 62.58	.500 82.77	.375 62.58	.656 107.5	.844 136.5	.500 82.77	1.031 164.8	1.219 192.3	1.438 223.5	1.594 245.1	
18	18.0	.165 31.43		.188 35.76	.250 47.39	.312 59.03	.437 82.06	.562 104.8	.375 70.59	.750 138.2	.938 170.8	.500 93.45	1.156 208.0	1.375 244.1	1.562 274.2	1.781 308.5	
20	20.0	.188 39.78		.218 46.05	.250 52.73	.375 78.60	.500 104.1	.594 122.9	.375 78.60	.812 166.4	1.031 208.9	.500 104.1	1.281 256.1	1.500 296.4	1.750 341.1	1.969 379.0	
22	22.0			.250 58.07	.375 86.61	.500 114.81		.375 86.61	.875 197.42	1.125 250.82	.500 114.84	1.375 302.88	1.625 353.61	1.875 403.01	2.125 451.07		
24	24.0	.218 55.37		.250 63.41	.250 63.41	.375 94.62	.562 140.8	.688 171.2	.375 94.62	.969 238.1	1.219 296.4	.500 125.5	1.531 367.4	1.812 429.4	2.062 483.1	2.344 541.9	

Columbia Specialty Company

West Sacramento, CA

Tel #916-371-9333 Fax #916-371-9533

Azusa Pipe & Tube Bending

Azusa, CA

Tel #626-334-2941 Fax #626-334-0128

Plumbing World

Long Beach, CA

Tel #562-422-0444 Fax #562-428-5276



Abbreviation Definitions IE: ASME, API, BTU

AAR--	Association of American Railroads
AGA--	American Gas Association
AISI--	American Iron & Steel Institute
ANSI--	American National Standards -Formerly ASA
API--	American Petroleum Institute
ASA--	American Standard Institute-Now known as ANSI
ASM--	American Society for Metals
ASME--	American Society for Mechanical Engineers
ASTM--	American Society for Testing Materials
AWWA--	American Water Works Association
BALES--	Banded lifts of pipe
BAR MILL--	Rolling mill where blooms are processed to form billets
BESS--	Bessemer
BEVEL--	The angle formed between the prepared edge of the end of the pipe and a plane perpendicular to the surface. Standard line pipe bevel is 30 degrees.
BILLET--	Round solid bar of steel which is pierced to form a seamless tube or pipe
BLK-- BLACK:	Term used when O.D. surface of pipe is protected with a varnish-type oil. Also applies to bare pipe to denote not galvanized.
BLOOM--	A semi finished hot rolled product produced on a blooming mill.
B.O.F.--	Basic Oxygen Furnace
BRIGOS STANDARD--	A standard thread dimensions. Same as American Standard
B.T.U.--	British Thermal Unit
BLDS--	Bundles--practice of packaging pipe from 1/8 inch to 1 1/2 inch. Pieces per bundle vary with size.
BURST TEST--	A destructive hydraulic test to determine actual yield strength and ultimate strength of seamless and welded pipe.
B.W.--	Butt Weld Pipe-- See continuous weld pipe
B.W.G.--	Birmingham Wire Gauge
CASING--	Pipe used as a structural retainer for the walls of a water, gas, or oil well.
C.D.--	Cold Drawn--Drawing pipe or tubing through a die to reduce diameter and wall, to obtain closer tolerances, a better finish or higher physical properties.
CHAMFER--	A beveled surface to eliminate an otherwise sharp corner. A finishing operation prior to threading.
CHEMICAL PROPERTIES--	Normally associated with a limited number of chemical elements. Minimum or maximum limits are established in most ASTM and API specifications.
CUT LENGTH--	Pipe cut to a specific length as ordered
CONDUIT--	Pipe serving as a duct for electrical wiring. Usually supplied in 10 foot lengths, threaded and coupled. Pipe used is normally galvanized, slightly lighter than standard weight with a smooth interior surface.



Abbreviation Definitions IE: ASME, API, BTU

CPLG--	Coupling-- threaded sleeve used to connect two lengths of pipe
C.W.--	Continuous-Weld method of producing pipe normally in sizes from 1/2 inch to 4 inch.
CU--	Copper
C.W.T.--	Per hundred weight
DIA--	Diameter
DIE STAMPING--	Permanent marking placed on pipe as required in some specifications.
DOUBLE EXTRA HEAVY--	Also known as double extra strong. Available from 1/2 inch to 8 inch of 8 inch diameter. nominal pipe. Wall thickness is twice as heavy as extra heavy pipe with the exception
DRL--	Double random length (35 foot minimum average)
DRIFTED--	Attaining a certain minimum I.D. clearance by pushing a mandrel through pipe or tubing.
DRIVE PIPE--	Pipe used for driving into ground in water well applications. Supplied with drive coupling.
DUCTILITY--	The ability of a material to deform plastically without fracturing. Measured by elongation in a tensile test.
ERW--	Electric Resistance Weld Pipe-- method of producing pipe normally in sizes from 2 3/8" O.D. through 22" O.D.
E.U.E.--	External upset ends-- used in API tubing and drill pipe
EXPANDED PIPE--	Pipe which has been enlarged circumferentially by mechanical or hydraulic pressure
EXTRA HEAVY--	Also known as extra-- pipe with walls heavier than standard weight. Same as schedule 80 in sizes 1.8 inch to 8 inch diameter
F.O.B.--	Free on board
FRI--	Freight
GALV-- GALVANIZING:	Coating pipe with a protective coating of zinc
GRADE A OR B--	Designations used to indicate minimum yield and tensile strengths of steel in seamless and welded pipe
G.T.--	2,240 pounds
HYDROSTATIC TESTING--	High pressure, water test to predetermine pressures as required by specifications
I.D.-- INSIDE DIAMETER:	The O.D. measurement less double the wall thickness is the I.D. measurement of a pipe or tube
INGOT--	Usually first solid form of steel, suitable for reworking or remelting
I.P.S-- IRON PIPE SIZE:	Same as nominal size from 1/8 inch to 12 inch
JOINT--	Term used to refer to one length of pipe
LGTH--	Length
L.T.C.--	Long threads and coupling (OCTG)
LARGE O.D. PIPE-	Pipe 14 inch O.D. and larger
L.W.-- LAP WELD:	Old method of producing pipe 5 inch diameter and over
MECHANICAL PROPERTIES--	Tensile strength, elongation, hardness and fatigue limit of steel
MID-WELDS--	Two or more joints welded to form on long joint.



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Abbreviation Definitions IE: ASME, API, BTU

MINIMUM WALL--	Minimum thickness permissible calculated by subtracting minus tolerance from nominal wall.
MN--	Manganese
N.A.S.P.D.--	The National Association of Steel Pipe Distributors
N.B.S--	National Bureau of Standards
Ni--	Nickel
NIPPLE--	Short length of pipe 12 inches and under normally threaded both ends.
NOM-- NOMINAL:	Name given to standard pipe designations 1/8 inch through 12 inch. Does not indicate actual measurements, wall thickness are also expressed as nominal
N.T.-- NET TON:	2,000 pounds
O-D.--	Outside Diameter
O.H.--	Open hearth
PCS--	Pieces
P.E.--	Plain ends
PERC--	Plain end roller cut
PESC--	Plain end square cut or saw cut or machine cut
PICKLING--	Pipe immersed in acid bath to remove scale, oil, dirt, etc.
PROTECTOR--	Sleeve with threads to protect threads
PSI--	Pounds per square inch
RANGE--	Allowable lengths of oil field casing and tubing. Expressed as range 1 (20 foot R/L)/ Range 2 (30 foot R/L) and Rang 3 (40 foot R/L).
R/L--	Random length. Varying lengths of pipe.
R&D--	Reamed and Drifted--commonly used in water wells to guarantee I.D. clearance.
SAW--	Submerged Arc Weld-- a method of producing very large OD pipe.
SCALE--	An oxide of Iron which forms on the surface of steel.
SCHEDULE NUMBERS--	ANSI numbers assigned to pipe to designate wall thickness.
SMLS-- SEAMLESS:	Pipe without a seam or weld in the circumference.
SPEC--	Specification
SKELP--	Long narrow strip of plate of correct thickness and width to produce CW or ERW pipe.
SRL--	Single random lengths--usually 18 foot to 22 foot. Minimum average of 17'6".
S.T. & C--	Short thread & coupled (OCTG).
STENCIL--	Identification painted on pipe. Specification, size, wall, grade, test pressure, method of manufacture and mill identification are usually indicated.
STO--	Standard --Same as Sch. 40 1/8"-1.0"
STRETCH REDUCE--	A technique employed in the manufacture of OW pipe in which one or of rolls to achieve several master sizes or pipe are produced, then stretched reduced through a number. A variety of pipe diameters. Also used in certain instances in seamless and ERW manufacturing.



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TBE--	Thread both ends
T & C--	Threaded and Coupled
TOE--	Thread one end
TENSILE STRENGTH--	Ultimate bursting strength to resist being pulled apart. (Expressed in PSI)
TUBE ROUND--	Billet
VICTAULIC JOINT--	Pipe is grooved near ends to accommodate a Victaulic coupling.
YIELD STRENGTH--	The tensile stress required to produce a total elongation of .5% of the gauge length as determined by an extensometer. (Expressed in PSI)
XHY--	Extra heavy
XXHY--	Double extra heavy (double extra strong)



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Pipe Specification A53

Specification	A53	NPS 1/8 -- 26 STD. XS and XXS, ANSI Schedules 10 through 160			
Scope	Covers Seamless and Welded, Black and hot-dipped galvanized nominal (average) wall pipe for coiling, bending, flanging and other special purposes and is suitable for welding, Continuous-Welded pipe is not intended for flanging. Purpose for which pipe is intended should be stated on order.				
Kinds of Steel Permitted for Pipe Material	Open-hearth Basic Oxygen Electric-furnace				
Hot-Dipped Galvanizing	Sets standards for coating of pipe with zinc inside and outside by the hot-dipped process. Weight of coating must not average less than 1.8oz. Per square foot and not less than 1.6oz. Per square foot.				
Permissible Variations in Wall Thickness	The minimum wall thickness at any point shall not be more than 12.5% under the nominal wall thickness specified.				
Chemical Requirements		<u>C max %</u>	<u>Mn max %</u>	<u>P max %</u>	<u>S max %</u>
	Seamless or ERW				
	Grade A	0.25	0.95	0.05	0.06
	Grade B	0.30	1.20	0.05	0.06
	Continuous-weld	-	-	0.08	0.06
Tensile Requirements		<u>Continuous-Weld</u>		<u>Seamless and Electric-resistance-welded</u>	
				<u>Grade A</u>	<u>Grade B</u>
	Tensile Strength, min., psi.....	45,000		48,000	60,000
	Yield Strength, min., psi.....	25,000		30,000	35,000
Hydrostatic Testing	Hydrostatic inspection test pressures for plain end and threaded and coupled pipe are specified. Hydrostatic pressure shall be maintained for not less than 5 seconds for all sizes of seamless and electric resistance-weld pipe.				
Permissible Variations in Weights per Foot	Plus or Minus 10%				
Permissible Variations in Outside Diameter	Outside Diameter at any point shall not vary from standard specified more than -- <u>For NPS 1 1/2 and Smaller Sizes</u> <u>For NPS 2 and Larger Sizes</u> 1/64" 1/32" under 1% over 1% under				
Mechanical Tests Specified	Tensile Test -- Transverse required on ERW for NPS 8 and larger. Sending Test (Cold) -- STD and XS-NPS 2 and under XXS-NPS 1 1/4 and under. <u>Degree of Bend</u> <u>Diameter of Mandrel</u> For Normal A53 uses 90 12 x nom. dia. of pipe For Close Coiling 180 8 x nom. dia. of pipe Flattening Test -- NPS 2 and larger STD and XS. (Not required for XXS pipe.)				
Number of Tests Required	Seamless and Electric-Resistance-Welded -- Bending, flattening, tensile on one length of pipe from each lot of 500 lengths or less of a size Continuous-Weld -- Bending, flattening, tensile <u>NPS 1 1/2 & smaller</u> <u>NPS 2 & larger</u> one/25 tons one/50 tons				
Lengths	Standard Weight Single Random -- 16' - 22'. 5% may be jointers. If Plain Ends -- 5% may be 12' - 16'. Double Random -- Shortest Length 22', minimum average for orders 35'. Extra Strong & Double Extra Strong Single Random -- 12' - 22'. 5% may be 6' - 12'. Double Random (XS and lighter) -- Shortest Length 22', minimum average for order 35'. Lengths longer than single random with wall thickness heavier than XS subject to negotiation.				
Required Markings on Each Length (On Tags attached to each Bundle in case of Bundled Pipe)	Rolled, Stamped or Stenciled (Mfgs. Option) Name or brand of manufacturer. Kind of pipe, that is, Continuous Welded, Electric-Resistance-Welded A, Electric-Resistance-Welded B, Seamless A; or Seamless B; XS for extra strong, XXS for double extra strong. ASTM A53 Length of pipe.				



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Pipe Specification A53

Specification	A53 NPS 1/8 -- 26 STD. XS and XXS, ANSI Schedules 10 through 160
General Information	<p>Couplings -- Applied handling tight. Couplings, 2" and smaller straight tapped, other sizes taper tapped.</p> <p>Thread Protection -- Applied to pipe 4" and large.</p> <p>End Finish (unless otherwise specified) --</p> <p>STD or XS, or wall thickness less than 0.500 in. (excluding XXS): Plain and beveled.</p> <p>All XXS and wall thickness over 0.500 in.: Plain end square cut.</p>



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Pipe Specification A106

Specification	A106	NPS 1/8--48 ANSI Schedules to 160		
Scope	Covers SEAMLESS carbon steel nominal wall pipe for high-temperature service, suitable for bending, flanging and similar forming operations. NPS 1 1/2 and under may be either hot finished or cold drawn. NPS 2 and larger shall be hot finished unless otherwise specified.			
Kinds of Steel Permitted for Pipe Material	Killed Steel Open-hearth Electric-furnace Basic-oxygen			
Hot-Dipped Galvanizing	Not covered in specification.			
Permissible Variations in Wall Thickness	The minimum wall thickness at any point shall not be more than 12.5% under the nominal wall thickness specified.			
Chemical Requirements		<u>Grade A</u>	<u>Grade B</u>	<u>Grade C</u>
	Carbon max. %.....	0.25	0.30	0.35
	Manganese max. %.....	0.27 to 0.93	0.29 to 1.06	0.29 to 1.06
	Phosphorous, max. %.....	0.025	0.025	0.025
	Sulfur, max. %.....	0.025	0.025	0.025
	Silicon, min. %.....	0.10	0.10	0.10
Tensile Requirements		Seamless		
		<u>Grade A</u>	<u>Grade B</u>	<u>Grade C</u>
	Tensile Strength, min,psi.....	48,000	60,000	70,000
	Yield Strength, min, psi.....	30,000	35,000	40,000
Hydrostatic Testing	Inspection test pressures produce a stress in the pipe wall equal to 60% or specified minimum yield strength (SMYS) at room temperature. Maximum Pressures are not to exceed 2500 psi for NPS 3 and under and 2800 psi for the larger sizes. Pressure is maintained for not less than 5 seconds.			
Permissible Variations in Weights per Foot	Weight of any length shall not vary more than 10% over and 3.5% under that specified. NOTE -- NPS 4 and smaller -- weighted in lots. Larger sizes -- by length			
Permissible Variations in Outside Diameter	Outside Diameter at any point shall not vary from standard specified more than--			
		<u>NPS</u>	<u>Over</u>	<u>Under</u>
	1 1/2 and smaller		1/64"	1/32"
	2 -- 4		1/32"	1/32"
	5 -- 8		1/16"	1/32"
	10 -- 18		3/32"	1/32"
	20 -- 26		1/8"	1/32"
Mechanical Tests Specified	Tensile Test -- NPS 8 or larger -- either transverse or longitude acceptable. Smaller than NPS 8 -- weighed in lots. Larger sizes -- by length. Flattening Test -- NPS 2 and larger. Bending Test(Cold) -- NPS 2 and under.			
			<u>Degree of Bend</u>	<u>Diameter of Mandrel</u>
		For Normal A106 uses	90	12 x nom. dia. of pipe
		For Close Coiling	180	8 x nom. dia. of pipe
Number of Tests Required		<u>NPS</u>	<u>On One Length From Each Lot of</u>	
	Tensile	5 and smaller	400 or less	
		6 and larger	200 or less	
	Bonding	2 and smaller	400 or less	
	Flattening	2 through 5	400 or less	
		6 and over	200 or less	
Lengths	Lengths required shall be specified on order. No "jointers" permitted unless otherwise specified. If no definite lengths required, following practice applies: Single Random -- 16' - 22'. 5% may be 12' - 16' Double Random -- Minimum length 22', Minimum average 35'. 5% may be 16' - 22'.			



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Pipe Specification A106

Specification	A106	NPS 1/8--48 ANSI Schedules to 160
Required Markings on Each Length (On Tags attached to each Bundle in case of Bundled Pipe)	Rolled, Stamped or Stenciled (Mfgs. Option) Manufacturer's name or brand. Length of pipe. A106 A, A106 B, A106 C ANSI schedule number. Hydrostatic test pressure and/or NDE. Weight per foot (NPS 4 and larger) or NH if neither is specified. Additional "S" if tested supplementary requirements.	
General Information	* Unless otherwise specified, pipe furnished with plain ends. *Purchaser may specify NDE * Surfaced finish standards are outlined in specification. in lieu of hydrostatic test or neither	



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Pipe Specification A135

Specification	A135 NPS 1/4 -- 30", Schedules 10, 40 and XL THD, light wall																				
Scope	Covers two grades of electric resistance welded steel pipe. Grade A is adapter for flanging and bending and is suitable for welding. Purpose for which pipe is intended should on order.																				
Kinds of Steel Permitted for Pipe Material	Open-hearth Basic Oxygen Electric-furnace																				
Permissible Variations in Wall Thickness	The minimum wall thickness at any point shall not be more than 12.5% under the nominal wall thickness specified. Thread able, light wall (XL) must meet manufacturers minimums.																				
Chemical Requirements	<table border="1"> <thead> <tr> <th></th> <th>C max %</th> <th>Mn max %</th> <th>P max %</th> <th>S max %</th> </tr> </thead> <tbody> <tr> <td>Seamless or ERW</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Grade A</td> <td>0.25</td> <td>0.95</td> <td>0.05</td> <td>0.06</td> </tr> <tr> <td>Grade B</td> <td>0.30</td> <td>1.20</td> <td>0.05</td> <td>0.06</td> </tr> </tbody> </table>		C max %	Mn max %	P max %	S max %	Seamless or ERW					Grade A	0.25	0.95	0.05	0.06	Grade B	0.30	1.20	0.05	0.06
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Tensile Strength, min., psi.....	48,000	60,000																			
Yield Strength, min., psi.....	30,000	35,000																			
NDE & Hydrostatic Testing	Hydrostatic inspection test pressures for plain end and threaded are specified. Hydrostatic pressure shall be maintained for not less than 5 seconds for all sizes of electric resistance-weld pipe. Non-destructive electric test should be in accordance with practice E213, method E227 or practice E213.																				
Permissible Variations in Weights per Foot	Plus or Minus 10% schedule 10 Plus 10% minus 3 1/2% schedule 40																				
Permissible Variations in Outside Diameter	Plus or minus 1%																				
Mechanical Tests Specified Number of Tests Required	Tensile Test -- Transverse returned on pipe NPS 8 and larger Flattening Test -- Three steps required with weld located 0* or 90* from the line of direction of force required Flattening and tensile on one length of pipe from each lot of 400 lengths or less of a style.																				
Lengths	Pipe shall be furnished in 38' with a minimum of 20 ft. Pipe furnished to schedule 10 shall be in a specified length between 16 and 22 ft.																				
Required Markings on Each Length (On Tags attached to each Bundle in case of Bundled Pipe)	Rolled, Stamped or Stenciled (Mfgs. Option) Name or brand of manufacturer. Kind of pipe, that is, electric-resistance welded A, electric-resistance weld B, same schedule wall thickness, schedule 10 or 40, NL ASTM A53 Length of pipe.																				
General Information	End finish may be plain end beveled or plain end square cut.																				



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Pipe Specification A795

Spec	A795 NPS 1/2 -- 10" Schedule 10 and Schedule 40																														
Scope	Covers seamless and welded, black and hot dipped galvanized nominal wall pipe. For coiling, bending, flanging and is suitable for welding. Pipe ordered for this specification is intended for use in free protection system.																														
Kinds of Steel Permitted for Pipe Material	Open-hearth Basic-oxygen Electric-furnace																														
Hot-Dipped Galvanizing	Sets standards for coating of pipe with zinc inside and outside by the hot-dipped process. Weight of coating must not average less than 1.8oz per square ft and not less than 1.6oz per sq. ft.																														
Permissible Variations in Wall Thickness	The minimum wall thickness at any point shall not be more than 12.5% under the nominal wall thickness specified.																														
Chemical Requirements	<table border="1"> <thead> <tr> <th></th> <th><u>C max %</u></th> <th><u>Mn max %</u></th> <th><u>P max %</u></th> <th><u>S max %</u></th> </tr> </thead> <tbody> <tr> <td>Seamless or ERW</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Grade A</td> <td>0.25</td> <td>0.95</td> <td>0.05</td> <td>0.06</td> </tr> <tr> <td>Grade B</td> <td>0.30</td> <td>1.20</td> <td>0.05</td> <td>0.06</td> </tr> <tr> <td>Furnace-weld Pipe</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Type F</td> <td>---</td> <td>---</td> <td>0.08</td> <td>0.08</td> </tr> </tbody> </table>		<u>C max %</u>	<u>Mn max %</u>	<u>P max %</u>	<u>S max %</u>	Seamless or ERW					Grade A	0.25	0.95	0.05	0.06	Grade B	0.30	1.20	0.05	0.06	Furnace-weld Pipe					Type F	---	---	0.08	0.08
	<u>C max %</u>	<u>Mn max %</u>	<u>P max %</u>	<u>S max %</u>																											
Seamless or ERW																															
Grade A	0.25	0.95	0.05	0.06																											
Grade B	0.30	1.20	0.05	0.06																											
Furnace-weld Pipe																															
Type F	---	---	0.08	0.08																											
NDE & Hydrostatic Testing	Hydrostatic inspection test pressures for plain end and threaded are specified. Hydrostatic pressure shall be maintained for not less than 5 second for all sizes of seamless electric resistance weld pipe. Non destructive electric test in accordance with practice E 213 or E 309 for the larger sizes. Pressure is maintained for not less than 5 seconds.																														
Permissible Variations in Weights per Foot	Plus or minus 5%																														
Permissible Variations in Outside Diameter	Outside Diameter at any point shall not vary from standard specified more than-- <table border="1"> <thead> <tr> <th><u>For NPS 1 1/2 and Smaller Sizes</u></th> <th><u>For NPS 2 and Larger Sizes</u></th> </tr> </thead> <tbody> <tr> <td>1/64" over 1/32" under</td> <td>1% over 1% under</td> </tr> </tbody> </table>	<u>For NPS 1 1/2 and Smaller Sizes</u>	<u>For NPS 2 and Larger Sizes</u>	1/64" over 1/32" under	1% over 1% under																										
<u>For NPS 1 1/2 and Smaller Sizes</u>	<u>For NPS 2 and Larger Sizes</u>																														
1/64" over 1/32" under	1% over 1% under																														
Number of Tests Required	Flattening -- Tests are to be performed on electric-resistance welded pipe, and furnace welded pipe.																														
Lengths	Unless specified, pipe shall be furnished on single random lengths or 16 to 22ft.																														
Required Markings on Each Length (On Tags attached to each Bundle in case of Bundled Pipe)	Rolled, Stamped or Stenciled (Mfgs. Option) Manufacturer's name or brand. Electric-resistance welded A, Electric-resistance welded B, Seamless A, Seamless B, Grade A or B for type E or S pipe, wall thickness schedule ASTM A795, the letters NH if not hydrstatically tested. The length of pipe.																														
General Information	End finish may be plain end beveled or plain end square cut.																														



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Pipe Specification API 5L

Spec	API 5L NPS 1/8 -- 26			
Scope	Covers WELDED and SEAMLESS pipe suitable for use in conveying gas, water and oil in both the oil and natural gas industries			
Kinds of Steel Permitted for Pipe Material	Open-hearth Basic Oxygen Electric-furnace			
Hot-Dipped Galvanized	May be ordered Galvanized.			
Permissible Variations in Wall Thickness		Grade A, B, A25	X42 through X80	
	NPS 2 1/2 and Smaller--Seamless and Welded, %	+20 -- 12.5	+15 -- 12.5	
	NPS 3 --Seamless and Welded, %	+18 -- 12.5	+15 -- 12.5	
	NPS 4 through 18 -- Seamless and Welded, %	+15 -- 12.5	+15 -- 12.5	
	NPS 20 and larger -- Welded, %	+17.5 -- 10.0	+19.5 -- 8.0	
	NPS 20 and larger -- Seamless, %	+15.0 -- 12.5	+17.5 -- 10.0	
Chemical Requirements		<u>C max %</u>	<u>Mn max %</u>	<u>P max %</u> <u>S max %</u>
	Seamless or ERW			
	Grade A	0.25	0.95	0.05 0.06
	Grade B	0.30	1.20	0.05 0.06
	Continuous-Weld	-	-	0.08 0.06
Tensile Requirements	Lists minimum yield and tensile strength for all grades as well as a maximum tensile strength for X80. Maximum yield-to-tensile ratios outlined for cold-expanded pipe-- may be waived when a fracture toughness requirement is specified.			
Hydrostatic Testing	Lists hydrostatic inspection test pressures for all sizes and grades covered by the specification.	Test Pressures are held for not less than: Seamless (all sizes) -- 5 seconds Welded (NPS 18 smaller) -- 5 seconds (NPS 20 and larger) --10 seconds		
Permissible Variations in Weights Per Foot	For each length of Standard Weight, Regular Weight, Extra Strong, and Double Extra Strong -- Not more than	10% minus 5%.		
	Extra Strong, and Double Extra Strong -- Not more than	10% minus 5%.		
	plus 10% minus 3.5%.	For carload Lots -- Not more than minus 1.75%		
Permissible Variations in Outside Diameter	Outside Diameter	Sizes	Over	Under
	at any point shall not vary from standard specified more than:-----			
		NPS 1 1/2 and smaller	1/64"	1/32"
		NPS 2 through 4	1%	1% (BW Only)
		NPS 2 through 18	.75%	.75%
		NPS 20 through 26		
		Non-expanded	1%	1%
Mechanical Tests Specified	Tensile Test	Bending Test (Cold)--2" and smaller Buttweld.		
	Seamless and Buttwelded--All sizes--Longitudinal Specimens	<u>Degree of Bend</u>	<u>Diameter of Mandrel</u>	
	Electric Weld -- NPS 6 and smaller --Longitudinal	For all API uses 90	12x OD of pipe	
	NPS 8 and Larger -- Transverse			
Number of Tests Required		On One Length From Each Lot of	Flattening	
	Tensile		Non-Expanded Electric-Weld for single lengths crop ends from each length. For multiple lengths, crop ends from each length, plus 2 intermediate rings.	
	5 and smaller	40 or less		
	6 through 12	200 or less		
	14 and larger	100 or less		
	2 and smaller (BW)	25 tons or less		
	Bending			
	1 1/2 and smaller (BW)	50 tons or less		



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Pipe Specification API 5L

Spec	API 5L	NPS 1/8 -- 26		
Lengths			Minimum	
		Shortest	Shortest	Average
		Length	Length in 95%	Length
	Threaded & Coupled Pipe	In Entire Shipment	of Entire Shipment	of Entire Shipment
	Single Random	16' 0"	18' 0"	--
	Double Random	22' 0"	--	35' 0"
Required Markings on Each Length (On Tags attached to each Bundle in case of Bundled Pipe)	Paint Stenciled or Die Stamped (by agreement)			
	Manufacturer's name or mark. Spec 5L, size, weight per foot, grade, process of manufacture, type of steel, length (NPS 4 and larger only). Test pressure when higher than labulated (NPS 2 and larger only).			
	Heat treat symbols, as applicable -- HN, HS, HA or HQ.			
General Information	Supplementary Requirements available when specified.			
	SR5--Charpy impact Testing--Welded Pipe 20" & larger--Grade X52 or higher.			
	SR3 -- Color Identifications SR6 -- Drop Weight Tear testing -- Welded Pipe 20" & larger -- Grade X52 or higher.			
	SR4 -- Nondestructive Inspection of Seamless Pipe. SR8 -- Fracture Toughness Testing of Line Pipe.			



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ANSI, ASTM and API Designations for Piping

ANSI DESIGNATION	ASTM or API DESIGNATION	Title
B36.1	ASTM A53	Welded and Seamless Steel Pipe
B36.2	ASTM A72	Welded Wrought Iron Pipe
B36.3	ASTN A106	Seamless Carbon-Steel Pipe for High-Temperature Service
B36.20	ASTNM A120	Black and Hot-Dipped Zinc-Coated (galvanized) Welded and Seamless Steel Pipe for Ordinary Uses
B36.4	ASTM A134	Electric-Fusion (Arc)-Welded Steel Plate Pipe, Sizes 16 in and Over
B36.5	ASTM A135	Electric-Resistance-Welded Steel Pipe
B36.9	ASTM A139	Electric-Fusion (Arc)-Welded Steel Plate Pipe, Sizes 14 in and Over
B36.11	ASTM A155	Electric-Fusion-Welded Steel Pipe for High -Temperature Service
B36.16	ASTM A211	Spiral-Welded Steel or Iron Pipe
B36.26	ASTM A312	Seamless and Welded Austenitic Stainless Steel Pipe
	Redesignated B125.16	
B36.40	ASTM A333	Seamless and Welded Steel Pipe for Low-Temperature Service
	Redesignated B26.27	
B36.42	ASTM A335	Seamless Ferritic Alloy Steel Pipe for High-Temperature Service
B36.47	ASTM A358	Electric-Fusion-Welded Austenitic Chromium-Nickel Alloy Steel Pipe for High-Temperature Service
B36.48	ASTM A369	Ferritic Alloy Steel Forged and Bored Pipe for High-Temperature Station Service
B36.43	ASTM A376	Seamless Austenitic Steel Pipe for High-Temperature Central-Station Service
B36.49	ASTM A381	Metal-Arc Welded Steel Pipe for High-Pressure Transmission Service
B36.44	ASTM A405	Seamless Ferritic Alloy Steel Pipe Specially Treated for High-Temperature Service
	ASTM A419	Electric-Fusion (Arc)-Welded Wrought Iron Plate Pipe
	ASTM A523	Plain End Seamless and Electric-Resistance-Welded Steel Pipe for High-Pressure Pipe-Type Cable Circuits
B36.56	ASTM A524	Seamless Carbon Steel Pipe for Process Piping
B36.57	ASTM A530	General Requirements for Specialized Carbon Steel and Alloy
	API 5L	Line Pipe
	API 5LX	High-Test Line Pipe
	API 5LS	Spiral Weld Line Pipe



ASME SPECIFICATIONS

ASME #	Explanation
SA-36*	Covers carbon steel shapes, plates, and bars of structural quality for use in riveted, bolted, or welded construction of bridges and buildings, and for general structural purposes. When the steel is used in welded construction, welding procedure shall be suitable for the steel and the intended service.
SA-53*	Covers seamless and welded black and hot-dipped galvanized steel pipe in nominal sizes 1/8 in. to 26 in., incl, with nominal (average) wall thickness. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification. 1.2 Pipe may be furnished in the following types and grades; 1.2.1 Type F-Furnace-butt welded, continuous welded. 1.2.2 Type E- Electric-resistance welded Grades A and B. 1.2.3 Type S- Seamless, Grades A and B. 1.3 Pipe ordered under this specification is suitable for welding, and suitable for forming operations involving coiling, bending and flanging. Subject to the following qualifications; 1.3.1 Type F is not intended for flanging. 1.3.2 When Type S and E are required for close coiling or cold bending, Grade A should be specified. This provision is not intended to prohibit the cold bending of Grade B pipe. 1.3.3 When pipe is required for close coiling, this should be specified on the order. 1.3.4 Type E may be furnished either non- expanded or cold expanded at the option of the manufacturer. When pipe is cold expanded, the amount of expansion shall not exceed 1.5% of the O.D. pipe size.
SA-105	Covers forged carbon steel piping components for ambient and higher temperature service in pressure systems. Included are flanges, fittings, valves and similar parts to specified dimensions or to dimensional standards such as those ANSI and API specifications.
SA-155**	Covers electric-fusion-welded steel pipe suitable for high-pressure service and for use at high, intermediate, or lower temperatures, depending upon grade of material specified in outside diameters 16 in. and larger with all thickness up to 3,000 in. incl.
SA-178*	Covers electric-resistance-welded tubes made of carbon steel and intended for use as boiler tubes, boiler flues, superheater flues, and safe ends. The Tubing sizes and thicknesses usually furnished to this specification are 1/2 in. to 5 in. O.D. and 0.320 in. inclusive in minimum wall thickness.
SA-179*	Covers seamless cold-drawn low-carbon steel tubes for tubular heat exchangers, condensers, and similar heat transfer apparatus. Covers tubes 1/8 to 3 in., incl. In outside diameter.
SA-181*	Covers forged or rolled steel pipe flanges, forged fittings and valves and parts for general service. Two grades or material are covered, designated as grades I and II, respectively, and are classified in accordance with their chemical and physical properties.

* Identical with ASTM Specifications

** Identical with ASTM Specifications with revisions or additions.



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ASME SPECIFICATIONS

ASME #	Explanation
SA-182*	Covers forged or rolled alloy-steel pipe flanges, forged fittings and valves and parts intended for high-temperature service. The term "forgings" used in this specification shall be understood to cover one of all of the products mentioned above, either forged or rolled.
SA-192*	Covers seamless carbon steel boiler and super-heater tubes for high-pressure service. The tubing sizes and thicknesses usually furnished to this specification are ½ in. to 7 in. O.D. and 0.085 in. to 1.000 in., inclusive in minimum wall thickness.
SA-226*	Covers electric-resistance-welded carbon steel boiler and super-heater tubes for high pressure service. The tubing sizes and thicknesses usually furnished to this specification are ½ in. to 5 in. O.D. and 0.085 in. to 0.360 in., inclusive in minimum wall thickness.
SA-234*	Covers wrought carbon steel and alloy steel fittings of seamless and welded construction for use in pressure piping and in pressure vessel fabrication for service at moderate and elevated temperatures. The term "fitting" applies to butt-welding, socket-end, and threaded end parts such as 45-deg and 90 deg elbows. 180-deg return bends, caps, tees, reducers, lap-joint stub ends, and other types as covered by the latest revision of ANSI B16.9, MSS SP48, and ANSI B16.11.
SA-249*	Covers welded tubes made from the austenitic steels with various grades intended for such use as boiler, super-heater, heat exchanger, or condenser tubes. Grades TP 304H, TP 316H, TP 321 H, TP 347H, and TP 348H are modifications of grades TP 304, TP 316, TP 321., TP 347, and TP 348. and are intended for high-temperature Ser vice such as for super-heaters and re-heaters. The tubing sizes and thickness usually furnished to this specification are 1/8 in. in inside diameter to 5 in. in outside diameter and 0.015 in. to 0.320 In., incl. in minimum wall thickness.
SA-250*	Covers several grades, designated T 1, T 1a. T lb. of electric-resistance-welded, carbon-molybdenum alloy-steel boiler and super heater tubes. The tubing sizes and thicknesses usually furnished to this specification are T/2 in. to 5 in. O.D. and 0.035 in. to 0.320 in., inclusive in minimum wall thickness.
SA-335*	Covers nominal (average) wall seamless alloy-steel pipe intended for high temperature service. Pipe ordered to this specification shall be suitable for bending, flanging (van. stoning), and similar forming operations, and for fusion welding. Selection will depend upon design, service conditions, mechanical properties, and high-temperature characteristics.
SA-358**	Covers electric-fusion-welded austenitic chromium-nickel alloy steel pipe suitable for Corrosive or high-temperature service, or both. (Although no restrictions are placed on the sizes of pipe which may be furnished under this specification, commercial practice is commonly limited to sizes not less than 8- in. (203-mm) nominal diameter.) Covers seven grades of alloy steel. The selection of the proper alloy and requirements for heat treatment shall be at the discretion of the purchaser, dependent on the service conditions to be encountered. Two classes of pipe are covered as follows: Class 1—All welded joints to be completely examined by radiography. Class 2—No radiographic examination required.
SA-376**	Covers seamless austenitic steel pipe in tended for high-temperature central-station service. Among the ten grades covered are five H grades which are specifically intended for high-temperature service.

* Identical with ASTM Specifications

** Identical with ASTM Specifications with revisions or additions.



ASME SPECIFICATIONS

ASME #	Explanation
SA-376**	Covers wrought fittings for pressure piping made from austenitic stainless steel. The term "fittings" applies to butt-welding, socket welding, or threaded parts such as 45-deg and 90-deg elbows, 180-deg return bends, caps, tees, reducers, lap-joint stub ends, and other types as covered by the latest revision of ANSI B16.9 ANSI B16.11 and MSS Standard Practice SP-43.
SA-106**	Covers seamless carbon steel pipe for high temperature service in nominal sizes 1/8 in. to 26 in. inclusive. With nominal (average) wall thickness as given in ANSI B36.10. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of these specifications. Pipe ordered under this specification shall be suitable for bending, flanging and similar forming operations.
A-120	This specification covers black and hot-dipped galvanized welded and seamless steel pipe in nominal sizes 1/8in. to 16 in. inclusive with nominal (average) wall thickness. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification . Pipe ordered under this specification is intended for ordinary uses in steam, water, gas, and air lines, but is not intended for close coiling or bending, or high temperature service. No to this specification, except hydrostatic test which shall be made at the mills, as this specification is intended to cover pipe purchased mainly from jobber's stocks.
SA-134**	Covers electric-fusion (arc)-welded straight seam or spiral seam steel plate pipe 16 in. and over in diameter (inside or outside as specified by purchaser), with wall thicknesses up to 3/4 in., inclusive. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of these specifications. The pipe is intended for conveying liquid, gas or vapor.
SA-135*	Covers two grades of electric-resistance welded steel pipe in nominal sizes 2 in. to 30 in. inclusive with nominal (average) wall thickness up to 0.500 in. (12.70 mm), inclusive and in nominal sizes 3/4 to 5 in. inclusive with nominal (average) wall thickness 0.083 in. (2.11 mm) to 0.134 in. (3.40mm) depending on size. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification. The pipe is intended for conveying liquid, gas or vapor: and only Grade A is adapted for flanging and bending.
SA-199*	Covers several grades of chromium molybdenum and chromium-molybdenum silicon seamless cold-drawn intermediate alloy steel tubes for heat exchangers, condensers, and similar heat transfer apparatus. The tubing Sizes usually furnished to this specification are 1/8 in. to 3 in. O.D.
SA-209*	Covers several grades of seamless carbon molybdenum alloy-steel boiler and super-heater tubes. Covers tubes 1/2 to 5 in., incl., in minimum wall thickness.
SA-210*	Covers seamless medium-carbon steel boiler tubes and boiler flues, including safe ends, arch and stay tubes, and super-heater tubes. The tubing sizes and thicknesses usually furnished to this specification are 1/2 in. to 5 in. O.D. and 0.035 in. to 0.500 in.. inclusive in minimum wall thickness.
SA-213*	Covers seamless ferritic and austenitic steel boiler and super-heater tubes and austenitic steel heat exchanger tubes, designated Grades T 5, TP 304, etc. These steels are listed in Tables I and II, respectively. Grades IP 304 H, TP 316 H. TP 321 H. TP 347 H, and IP 348 H are modifications of Grades TP 304, TP 316, TP 321. TP 347, and TP 348. and are intended for high temperature service such as for super-heaters and re-heaters. The tubing sizes and thicknesses usually furnished to this specification are 1/8 in. in inside diameter to 5 in. in outside diameter and 0.015 in. to 0.500 in., inclusive, in minimum wall thickness.

* Identical with ASTM Specifications

** Identical with ASTM Specifications with revisions or additions.

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ASME SPECIFICATIONS

ASME #	Explanation
SA-214*	Covers electric-resistance-welded carbon steel tubes to be used for heat exchangers, condensers, and similar heat-transfer apparatus. The tubing sizes usually furnished to this specification are to 3 in. O.D. inclusive.
SA-268*	Covers nine grades of stainless steel tubing for general corrosion-resisting and high-temperature service. These grades are commonly known as the "straight chromium" types and are characterized by being ferro-magnetic. Two of these grades, TP 410 and TP 329 (Table 1). are amenable to hardening by heat treatment, and the high-chromium ferritic alloys are sensitive to notch-brittleness on slow cooling to ordinary temperatures. These features should be recognized in the use of these materials. Grade 409 may be ordered with no final heat treatment provided the purchase order so specifies and the material meets all of the other requirements of the specifications.
SA-312**	Covers seamless and welded austenitic steel pipe intended for high-temperature and general corrosive service. Sixteen grades are covered. Grades TP 304H, TP 316H, TP 321H, TP 347H and TP 387H are modification of Grades TP 304, TP 316, TP 321, TP347 and TP 387, and are intended for high temperature service.
SA-333**	Covers nominal (average) wall seamless and welded carbon and alloy steel pipe intended for use at low temperatures, Several grades of ferritic steel are included. Some product sizes may not be available under this specification because heavier wall thicknesses have an adverse affect on low-temperature impact properties.
SA-334*	Covers several grades of seamless and welded carbon and alloy-steel tubes intended for use at low temperatures. Some product sizes may not be available under this specification because heavier wall thicknesses have an adverse effect on low temperature impact properties.
SA-409**	Covers straight seam or spiral seam electric-fusion-welded, light wall, austenitic chromium-nickel alloy steel pipe for corrosive or high-temperature service. The sizes covered are 14 to 30 in. (355 to 762 mm) incl. in nominal diameter with extra light (schedule 5S) and light (schedule 10S) wall thicknesses.
SA-423*	Covers seamless and electric resistance welded low alloy steel tubes for pressure containing parts such as economizers or other applications where corrosion resistance is important. The tubing sizes and thicknesses usually furnished to this specification are ½ in. to 5 in. O.D. and 0.035 in. to 0.500 in. inclusive in minimum wall thickness.
A-714-75 (YOLOY)	Covers seamless and welded high-strength (YOLOY) low-alloy steel pipe in nominal sizes ½ to 26 in., inclusive. Pipe having other dimensions may be furnished provided such pipe complies with all other requirements of this specification. This material is intended for pressure piping service, and other general purposes, where savings in weight or added durability are important.

* Identical with ASTM Specifications

** Identical with ASTM Specifications with revisions or additions.



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ASME SPECIFICATIONS

ASME # Explanation

AMERICAN PETROLEUM INSTITUTE

API #

SPECIFICATIONS (PIPE)

API 5-L Covers welded and seamless steel pipe for use in conveying gas, water, and oil. Used mainly in the oil and natural gas industries. Seamless and electric-weld covers two grades: Grade A (30,000 psi Min Yield) and Grade B (35,000 psi Min Yield). Butt-welded manufacture is covered by two classes: Class I (25,000 psi Min Yield) and Class II (28,000 psi Min Yield). Size range 1/8 inch to 36 inch nominal diameters.

API 5LX Covers more rigorously tested line pipe, having greater tensile and bursting strengths. Size range 4 1/2 O.D. to 42 inch O.D.. in grades X 42 (42,000 psi Min Yield) to X 65 (65,000 psi Min Yield). Not intended for high temperature service.

* Identical with ASTM Specifications

** Identical with ASTM Specifications with revisions or additions.

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Military Specifications by material type for piping

SPECIFICATION	TYPE	ANALYSIS	SERVICE
MIL-P-1144	Seamless or Welded	Types 304, 316, 321, 347	High Temp. & Pressure
MIL-P-11087	Seamless or Welded	Medium Carbon	Line Transmission
MIL-P-24338	Seamless	Medium Carbon	High Pressure
MIL-T-1368	Seamless or Welded	Nickel Copper Alloy	Corrosion applications
MIL-T-5066	Seamless or Welded	1025	Aircraft
MIL-T-6736	Seamless or Welded	4130	Aircraft
MIL-T-15005	Seamless or Welded	Copper Nickel Alloy	Condenser & Heat Exchanger
MIL-T-16286 (SHIPS)	Seamless	Class A Low Carbon	Boiler
MIL-T-16286 (SHIPS)	Seamless	Class G Medium Carbon	Boiler
MIL-T-16286 (SHIPS)	Seamless	Type 321 or 347	High Pressure Steam & Super Heater Generator
MIL-T-16343	Seamless or Welded	Medium Carbon	Structural
MILT-T-16420 (SHIPS)	Seamless or Welded	Copper Nickel Alloy	Corrosion Applications
MIL-T-17188	Welded	Low Carbon	Boiler
MIL-T-3520	Welded	Low Carbon	Equipment Manufacture
MIL-T-18165	Seamless	Chrome Moly Alloy	High Temp & Pressure
MIL-T-20155	Seamless	Carbon Moly	Pressure
MIL-T-20157	Seamless	Carbon Class A, B, C, O, E	Pressure
MIL-T-20160	Seamless or Welded	Low Carbon	Pressure
MIL-T-20162	Seamless or Welded	Low & Medium Carbon	Pressure
MIL-T-23226	Seamless	Type 304, 3041, 348	High Pressure Steam & Super Heater Generator
MIL-T-8504	Seamless or Welded	Type 304, 316	Corrosion & Hydraulic
MIL-T-8606	Seamless or Welded	Type 304, 316	Corrosion & High Temperature
WW-P-406 D	Seamless or Welded	Low & Medium Carbon	Ordinary use
WW-P404 D	Seamless or Welded	Low & Medium Carbon	Pressure applications



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ASTM specifications for weld fittings and flanges
Grade & composition symbols for carbon weld fittings.

Material Specifications for
Carbon Steel
BUTT WELD FITTINGS

ASTM SPECIFICATION		
	A234	
GRADE SYMBOL	WPA (GRADE A)	WPB (GRADE B)
TYPE OF STEEL	Carbon	Carbon
CHEMICAL COMPOSITION	C-0.25 max.	C-0.30 max.
MINIMUM PHYSICAL COMPOSITION	TS-48,000 YP-30,000	TS-60,000 YP-35,000
HEAT TREATMENT	COOLED IN STILL AIR	COLLED IN STILL AIR

Material Specifications for
Carbon Steel
FLANGES*

ASTM SPECIFICATION					
		A181		A105	
GRADE	SYMBOL	I	II	I	II
TYPE OF STEEL		Carbon		Carbon	
CHEMICAL COMPOSITION		C-0.35 max.		C-0.35 max.	
MINIMUM PHYSICAL COMPOSITION		TS-60,000 YP-30,000	TS-70,000 YP-36,000	TS-60,000 YP-30,000	TS-70,000 YP-36,000
HEAT TREATMENT		Hot forged with finishing temp. above upper critical Cooled in still air		Normalized	

GRADE AND COMPOSITION SYMBOLS FOR
CARBON STEEL BUTTWELDING FITTINGS

WPA Seamless Pipe..... ASTM A106 Grade A
 Plate..... ASTM A285 Grade C
 Forgings..... ASTM A105 Grade 1
 Bars*..... ASTM A107 GR. 1008-1022

WPB Seamless Pipe..... ASTM A106 Grade B
 Plate..... ASTM A515 Grade 6S
 Forgings..... ASTM A105 Grade 11
 Bars*..... ASTM A107 GR. 1025-1030

Seamless Pipe..... ASTM A106 Grade C
 Plate.....
 Forgings..... ASTM A104 Grade 11'

*For fittings 2" nominal size and smaller

Low Temperature Carbon Steel
 Seamless and Welded Pipe.... ASTM A332 Grade O
 Plate..... ASTM A300 Class 1
 Forgings..... ASTM A350 Grade LF1

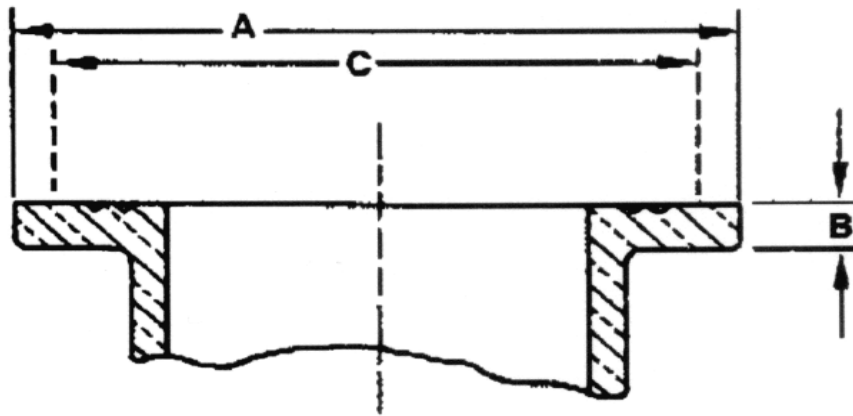
*Material specifications for the ASME Boiler Code are the same ASTM except the letter S is prefixed thereto.

A 35% Carbon maximum for flanges which are welded have been established by ASTM A181 and A105.

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TEMPLATES FOR DRILLING FLANGES

Flange diameters and drilling templates of 150-lb bronze flanges are the same as the 125-lb. USA Cast-Iron Standard (B16.1). Flanges diameters and drilling templates of 250-lb and 300-lb. Broze flanges are the same as the 250-lb. USA Cast-Iron Flange Standard (B16.5) The faces of these flanges are machined with a serrated spiral finish. When cast iron or steel flanges with raised face are bolted to these flanges, the raised faces should be removed. Full fac gaskets should be used. Metallic Gaskets should not be used.



150 POUND FLANGES

Nominal Size of Pipe Inches	A Outside Diameter of Flange Inches	B Minimum Thickness of Flange Inches	C Diameter of Bolt Circle Inches	Diameter of Drilled Bolt Holes Inches	Diameter of Bolts Inches	Length of Bolts Inches	Number of Bolts
1/2	3 1/2	1/16	2 1/8	5/8	1/2	1 1/4	4
3/4	3 7/8	11/32	2 3/4	5/8	1/2	1 1/2	4
1	4 1/4	3/8	3 1/8	5/8	1/2	1 1/2	4
1 1/4	4 3/8	13/32	3 1/2	5/8	1/2	1 1/2	4
1 1/2	5	7/16	3 7/8	5/8	1/2	1 1/2	4
2	6	1/2	4 3/4	3/4	1/8	1 3/4	4
2 1/2	7	9/16	5 1/2	3/4	1/8	2	4
3	7 1/2	5/8	6	3/4	1/8	2	4
3 1/2	8 1/2	11/16	7	3/4	5/8	2 1/4	8
4	9	11/16	7 1/2	3/4	5/8	2 1/4	8
5	10	3/4	8 1/2	?/8	3/4	2 1/2	8
6	11	13/16	9 1/2	?/8	3/4	2 1/2	8
8	13 1/2	15/16	11 3/4	?/8	3/4	2 1/4	8
10	16	1	14 1/4	1	7/8	3 1/4	12
12	19	1 1/16	17	1	7/8	3 1/4	12



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TEMPLATES FOR DRILLING

FLANGES

250 POUND FLANGES

Nominal Size of Pipe Inches	A Outside Diameter of Flange Inches	B Minimum Thickness of Flange	C Diameter of Bolt Circle Inches	Diameter of Drilled Bolt Holes Inches	Diameter of Bolts Inches	Length of Bolts Inches	Number of Bolts
1/2	3 3/4	13/32	2 3/8	5/8	1/2	1 1/2	4
3/4	4 1/8	7/16	3 1/4	3/4	3/8	1 3/4	4
1	4 7/8	1/2	3 1/2	3/4	3/8	1 3/4	4
1 1/4	5 1/4	17/32	3 7/8	3/4	3/8	2	4
1 1/2	6 1/8	9/16	4 1/2	7/8	3/4	2	4
2	6 1/2	5/8	5	3/4	3/8	2	8
2 1/2	7 1/2	11/14	5 7/8	7/8	3/4	2 1/4	8
3	8 1/4	7/8	6 5/8	7/8	3/4	2 1/2	8
3 1/2	9	13/16	7 1/4	7/8	3/4	2 1/2	8
4	10	7/8	7 7/8	7/8	3/4	2 1/4	8
5	11	13/16	9 1/4	7/8	3/4	2 1/4	8
6	12 1/2	1	10 3/8	7/8	3/4	3	12
8	15	1 1/8	13	1	3/8	3 1/4	12
10	17 1/2	1 3/16	15 1/4	1 1/8	1	3 3/4	16
12	20 1/2	1 1/4	17 3/4	1 1/4	1 1/8	3 3/4	16

300 POUND FLANGES

Nominal Size of Pipe Inches	A Outside Diameter of Flange Inches	B Minimum Thickness of Flange	C Diameter of Bolt Circle Inches	Diameter of Drilled Bolt Holes Inches	Diameter of Bolts Inches	Length of Bolts Inches	Number of Bolts
1/2	3 3/4	1/2	2 5/8	5/8	1/2	1 3/4	4
3/4	4 3/8	17/32	3 1/4	3/4	3/8	2	4
1	4 7/8	19/32	3 1/2	3/4	3/8	2	4
1 1/4	5 1/4	5/8	3 7/8	3/4	3/8	2	4
1 1/2	6 1/8	11/16	4 1/2	7/8	3/4	2 1/4	4
2	6 1/2	3/4	5	3/4	3/8	2 1/4	8
2 1/2	7 1/2	13/16	5 7/8	7/8	3/4	2 1/2	8
3	8 1/4	29/32	6 5/8	7/8	3/4	2 3/4	8
3 1/2	9	31/32	7 1/4	7/8	3/4	3	8
4	10	1 1/16	7 7/8	7/8	3/4	3	8
5	11	1 1/8	9 1/4	7/8	3/4	3 1/4	8
6	12 1/2	1 3/16	10 5/8	7/8	3/4	3 1/4	12
8	15	1 3/8	13	1	3/8	3 1/4	12

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PVC/CPVC physical properties and ASTM specifications for piping

Physical Properties of PVC and CPVC

Poly (Vinyl Chloride) PVC

This thermoplastic is the largest volume member of the vinyl family. It is the most widely used material for plastic pipe, valves, and fittings.

PVC has many advantage over conventional piping materials. Just a few are:

Corrosion Resistance- outstanding chemical resistance to nearly all acids, alkalis, alcohols, halogens and many other corrosive materials, **Fluid Friction-** less friction loss as compared to metallic's. lower pressure drop smaller pumps = less electricity.

Thermal- lower thermal conductivity than for metallics. Less moisture condensation, reduced heat loss, and more uniform fluid temperature. (Insulation is usually not required.)

Electrical- a nonconductor of electricity. Eliminates galvanic or electrolytic corrosion that causes expensive repairs.

Other- weather resistance, high strength-to-weight ratio, dent resistant, non-toxic, maintains properties over long periods of time, easy to install, maintenance-free.

Chlorinated Poly (Vinyl Chloride) CPVC

An industrial thermoplastic piping material which can be used for higher temperature applications. It is polyvinyl chloride with additional chlorine added to reduce reaction to heat, which means advantages over regular PVC pipe and things while retaining the excellent chemical of PVC.

CPVC retains its mechanical strength at higher temperatures.

CPVC = 180* F Max.

PVC = 140* F Max.

Elson PVC and CPVC pipe and fittings compounds are blended according to strict industry guidelines. Specifications and requirements are set forth by agencies such as the American Society of Testing and Materials (ASTM) and the National Sanitation Foundation (NSF). Compliance with these standards assures the customer that they are receiving products manufactured from materials that will perform the tasks for which they are designed.

BASIC MATERIAL DATA	PVC	CPVC
Basic Resin	Poly (vinyl chloride) Homopolymer	Chlorinated Poly (vinyl chloride)
Commercial Classification of Rigid Compound*	Type 1, Grade 1 PVC 1120	Type IV, Grade 1 CPVC 4120
Class Designation	12454-B	23447-A

*Rigid Material is also known as Un Plasticized (U-PVC)



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PVC/CPVC physical properties and ASTM specifications for piping

TYPE PIPE	Standard Specifications	
	Material	Dimensions
PVC SDR (Plain End)	ASTM D-1784	ASTM D-2241
PVC SDR (Belled End)	ASTM D-1785	ASTM D-2672
PVC Scheduled 40	ASTM D-1786	ASTM D-1785
PVC Scheduled 40 (DWV)	ASTM D-1787	ASTM D-2665
PVC Scheduled 40 (Belled End)	ASTM D-1788	ASTM D-2672
PVC Scheduled 80	ASTM D-1789	ASTM D-1785
CPVC Scheduled 40 and 80	ASTM D-1790	ASTM F-441

CPVC Physical Properties & ASTM Standards for Fittings

CPVC Schedule 80 Fittings

PHYSICAL PROPERTIES

Physical Property	Test Condition	Value	Reference
Specific Gravity	73° F	1.52	ASTM D-792
Rockwell Hardness (R)	73° F	121	ASTM D-785
Heat Deflection @ 264 psi	° F	212	ASTM D-645
Tensile Strength	73° F	8200	ASTM D-638
Tensile Modulus (psi)	73° F	430,00	ASTM D-638
Flexural Strength (psi)	73° F	15,000	ASTM D-790
Flexural Modulus (psi)	73° F	410,000	ASTM D-790
Izod Impact Ft. Lbs./ In. Notch	73° F	2	ASTM D-256
Water Absorption (24 hrs.)	73° F	+ .04	ASTM D-570
Coefficient of Expansion (*F), in./in./x 10		3.7	ASTM D-696
Flammability	.062"	V-0	UL-94
Cell Designation		23557B	ASTM D-1784

STANDARDS

ASTM F437

CPVC Scheduled 80 threaded fitting specifications
 specifications

ANSI B2.1

Specifications for threaded fittings and
 pipe

ASTM F439

CPVC Schedule 80 socket fitting
 specifications

ANSI B16.1

Specifications for flange type fittings

ASTM F441

CPVC Schedule 80 pipe specifications

NSF14

Specifications for potable water and
 quality control standards

ASTM F493

CPVC Solvent Cements

ASTM D1784

Rigid CPVC Compounds



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CPVC Physical Properties & ASTM Standards for Fittings

PHYSICAL PROPERTIES

PVC SCHEDULE 80 TYPE I, GRADE I

Physical Property	Value	Reference
Specific Gravity +/- 0.02	1.40	ASTM D792
Tensile Strength, psi @ 73°F	7100	ASTM D638
Modulus of Elasticity in Tension, psi @ 73 °F	400,000	ASTM D638
Flexural Strength, psi	12,000 - 14,000	ASTM D790
Izod Impact, Ft. Lbs./in., Notch at 73°F	0.65	ASTM D256
Heat Deflection °F @ 264 psi	160	ASTM D648
Heat Resistance ° F	140	
Thermal Conductivity, BTU/hr./sq. Ft./°F/ in.	1	ASTM C177
Coefficient of Expansion, in./in./°F x 10	3.0	ASTM D696
Water Absorption. % 24 hrs. @ 73°F	0.05	ASTM D570
Cell Classification	12454B	ASTM D1784
Color Code	Dark Gray	

STANDARDS

ASTM D1784

Rigid PVC Compounds

ASTM D1785

PVC Schedule 80 pipe specifications

ASTM D2464

PVC Schedule 80 threaded fitting specifications

ASTM D2467

PVC Schedule 80 socket fitting specifications

ASTM D 2564

PVC Solvent Cements

ASTM D2855

Standard practice for solvent cemented Joints for PVC pipe and fittings

ANSI B2.1

Specifications for flange type fittings

ANSI B16.1

Specifications for flange type fittings

NSF 14

Specifications for potable water and quality control standards



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CPVC Physical Properties & ASTM Standards for Fittings

PHYSICAL PROPERTIES

PVC SCHEDULE 40 TYPE I, GRADE I

Physical Property	Value	Reference
Specific Gravity +/- 0.02	1.40	ASTM D792
Tensile Strength, psi @ 73°F	7100	ASTM D638
Modulus of Elasticity in Tension, psi @ 73 °F	400,000	ASTM D638
Flexural Strength, psi	12,000 - 14,000	ASTM D790
Izod Impact, Ft. Lbs./in.,Notch at 73°F	0.65	ASTM D256
Heat Deflection °F @ 264 psi	160	ASTM D648
Heat Resistance ° F	140	
Thermal Conductivity, BTU/hr./sq. Ft./°F/ in.	1	ASTM C177
Coefficient of Expansion, in./in./°F x 10	3.0	ASTM D696
Water Absorption. % 24 hrs. @ 73°F	0.05	ASTM D570
Cell Classification	12454B	ASTM D1784
Color Code	White	

STANDARDS

ASTM D1784

Standard specifications for PVC Compounds

ASTM D1785

Standard specifications for PVC Schedule 40 pipe

ASTM D2466

Standard specifications for socket type PVC Schedule 40 plastic fittings

ASTM D2564

Standard specifications for PVC Solvent Cements

ASTM D2855

Standard specifications for making Solvent cemented joints with PVC pipe and fittings

NSF 14

Standard specifications for potable water and quality control

Stainless Steel Pipe Specifications

STAINLESS STEEL PIPE AND TUBING Stainless steels are iron-based alloys usually containing at least 11.5% chromium. Other elements, nickel being the most Important, may be added in combination with chromium to obtain special properties.

Stainless steels are highly resistant to corrosive attack and to oxidation at high temperatures. In general, resistance to corrosion and oxidation increases progressively, though not proportionately, with the increase in chromium content.

Stainless steel pipe and tubing are used for a variety of reasons: to resist corrosion and oxidation, to resist high temperatures, for cleanliness and low maintenance costs, and to maintain the purity of materials which come in contact with stainless. The inherent characteristics of stainless steel permit the design of thin wall piping systems without fear of early failure due to corrosion. The use of fusion welding to join such piping eliminates the need for threading.

Type 304 stainless is the most widely used analysis for general corrosive resistant tubing and pipe applications; it is used in chemical plants, refineries, paper mills, and food processing industries. Type 304 has a maximum carbon content of .08%. It is not recommended for use in the temperature range between 800° F and 1650° F due to carbide precipitation at the grain boundaries which can result in inter-granular corrosion and early failure under certain conditions.

Type 304L is the same as 304 except that a .03% maximum carbon content is maintained which precludes carbon precipitation and permits the use of this analysis in welded assemblies under more severe corrosive conditions. Type 318 is much more resistant to pitting than other chromium nickel alloys due to the addition of 2% to 3% molybdenum. It is particularly valuable wherever acids, brines, sulphur water, seawater or halogen salts are encountered. Type 316 is widely used in the sulphite paper industry and for manufacturing chemical plant apparatus, photographic equipment, and plastics.

Type 316L like 304L is held to a maximum carbon content of .03%. This permits its use in welded assemblies without the need of final heat treatment. It is used extensively for pipe assemblies with welded fitting.

Other fields where stainless steel pipe and tubing are used are: aviation, electronics, automotive, cryogenic, marine, air conditioning and heating, medical, architectural and textiles.

Specifications:

ASTM A-312/ASME SA-312

ASTM A-358/ASME SA-358

WELDED STAINLESS PIPE

Scope: Pipe intended for high temperature and general corrosive service as in A-312, plus electric fusion welded pipe as in A-358 and intended for high temperature and general corrosive service or both.

Stainless Steel Pipe Specifications

General Requirements:

Conforming to the above specifications plus applicable parts us ASTM A-530.

Range:

ASTM A-312 pipe is more commonly found from 1/8" IPS to and including 24" IPS in standard schedules 5, 10, 20, and 40. On special applications, sizes can be produced to 60" IPS through schedule 80 walls by certain mills. ASTM A-358 is usually produced in sizes 8" IPS and larger and where filler metal is added to the weld. This specification covers five classes of pipe and is usually determined by the end application and needs of the pipe.

ASTM A-312 pipe is manufactured by two different processes. Pipe through 6" IPS is manufactured by the continuous welding process and is very similar to welded tubing.

Coils of flat roll strips are fed into sizing rolls and welded. Material is then annealed (usually in an open air furnace), straightened, cut, pickled, tested, and inspected.

In full finished pipe, material is cold worked after welding. This can be done by rolling, forging, or drawing the weld bead; but primarily the weld is rolled.

Pipe 8" IPS and larger is manufactured by the batch method or process. Unlike the continuous welding method. Material made by this batch method is made in single lengths. Plates, cut to length and width, are formed from flat into tubular shape by a press and welded. Material is then annealed, sized, and straightened, ends trimmed or cut to specific smaller lengths, pickled, and inspected.

Pipe and Tubing

"As-Welded" Grade "

"As-welded" pipe and tubing is straight-seam welded using ASME qualified automatic gas tungsten-arc procedures and can be supplied in a wide range of diameters and wall thicknesses from any of the weldable corrosion resistant alloys. Normally furnished with square cut ends, pipe with beveled, beveled, or roll-grooved ends can be provided. Spot radiography or 100% radiography of welded seams can also be performed. "As-welded" pipe and tubing is commonly used in pulp and paper mills, food processing plants and other industries where corrosion resistance is essential.

ASTM A 778

This specification covers welded unannealed stainless steel pipe intended for low to moderate temperatures and corrosive service where heat treatment is not required for corrosion resistance. A 778 is considered to be the most applicable ASTM specification for "as welded" pipe and differs from it only in that a transverse guided-bend test and a transverse tension test are required per lot.

Stainless Steel Pipe Specifications

ASTM A 213 (ASME SA-213 is identical)

This specification includes minimum wall thickness seamless austenitic stainless steel tubing intended for high temperature usage such as boiler, superheater and heat exchanger tubes, Production is generally limited to tubing 'A' inside diameter to 5" outside diameter and .015" to .500" inclusive in wall thickness. All material is to be furnished in the heat treated condition.

ASTM A 249 (ASME SA-249 is generally identical)

This specification covers welded austenitic stainless steel tubing intended for high temperature usage such as boiler, superheater, heat exchanger, or condenser tubes. Production is generally limited to tubing 1/8" inside diameter through 5" outside diameter and .015" to .320" inclusive in wall thickness. All material is to be furnished in the heat treated condition.

The principal manufacturing procedures specified under A 249 are:

1. Automatic welding process with no addition of filler metal.
2. Hydrostatic or non-destructive electric test of each tube.
3. Tension, flattening, flange. reverse-bend and hardness tests required each lot.

ASTMA 269

This specification covers seamless and welded austenitic stainless steel tubing intended for low or high temperature and general corrosive service. Production is generally limited to tubing 1/4" inside diameter and larger and .020" in nominal wall thickness and heavier. All material is to be furnished in the heat treated condition, Mechanical requirements are the same as listed under A 249.

ASTMA 372 (ASME SA-312 is generally identical)

This specification covers seamless and straight-seam welded stainless steel pipe intended for high temperature and general corrosive service. The A 312 manufacturing process is suited to high-volume production and is therefore generally limited to diameters and schedule wall thicknesses shown in ANSI B36.10 and ANSI B36.19 The principal manufacturing procedures specified under A 312 are;

1. Welding without the addition of filler metal.
2. Annealing after welding.

ASTM A 358 (ASME SA -358 is generally identical with some additional requirements)

This specification covers stainless steel pipe intended for high temperature and general corrosive service. Production is generally limited to diameters and schedule wall thicknesses of 8" and larger as shown in ANSI B36.10 and ANSI B36.19. Pipe is normally welded with filler metal (except the root pass on Class 4) and can be specified as (a) single or double welded; (b) 100% spot, or no radiography; (c) heat treated after welding. made from annealed plate and not heat treated after welding, or made from unannealed plate and not heat treated after welding. The principal manufacturing procedures specified under A 358 are:

1. Hydrostatic testing of each length (unless waived).
2. Transverse guided-bend tests and transverse tension tests per lot.

Stainless Steel Pipe Specifications

ASTM A 376 (ASME SA-376) is generally identical)

This specification covers seamless austenitic stainless steel pipe intended for high temperature service. Among the grades covered are five H grades and two nitrogen grades that are specifically intended for high temperature service. All material is furnished in the heat treated condition unless waived and specifically marked 'HT-O". Hydrostatic tests are required for each length of pipe. Tension and flattening tests are required per lot.

ASTM A 409 (ASME SA-409 is generally identical with some additional requirements)

This specification covers Schedule 5s and 10s straight-seam or spiral-seam welded stainless steel pipe intended for high temperature and general corrosive service. Production is normally limited to sizes of 14" through 30", however, special diameters, lengths and alloys can be specified. Pipe manufactured to A 409 may be heat treated after welding, made from annealed plate and not heat treated after welding, or made from unannealed plate and not heat treated after welding.

The principal manufacturing procedures specified under A 409 are:

- Either hydrostatic, air or gas pressure testing per lot.
- Transverse guided-bend tests and transverse tension tests each length.

MIL-P-1144 - This specification covers seamless and welded austenitic stainless steel pipe intended for elevated temperature and general corrosive service, including cryogenic applications. This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense. All pipe is to be furnished in the heat treated condition and subjected to nondestructive electric or hydrostatic pressure test as applicable. Tension, flattening and intergranular corrosion tests are required by lot.



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Stainless Steel Fitting Specifications

Welding Fittings

"As-Welded" Grade

"as-welded" fittings are welded using ASME qualified welding procedures and can be supplied in a wide range of diameters and wall thicknesses from any of the weldable corrosion resistant alloys. Welding elbows can be provided with smooth flow or mitered construction, tees and crosses can be drawn outlet or nozzle-welded types and reducers can be conical or bell-shaped. Manufacturers "as-welded" fittings to ANSI B16.9, ANSI B16.28 or MSS SP-43 dimensions, with weld ends furnished square cut. Fitting with special dimensions or those that require beveled, beveled or roll-grooved ends can be provided. Spot radiography or 100% radiography of welded seams can also be performed. Alaskan pickles and passivates its fittings to maintain corrosion resistance and to prevent surface discoloration from free iron oxidation. "As-welded" fittings are commonly used with "as-welded" pipe and tubing in pulp and paper mills, food processing plants and other industries where corrosion resistance is essential.

ASTMA 774

This specification covers "as-welded" stainless steel pipe fittings for low pressure piping intended for low to moderate temperatures and general corrosive service where heat treatment is not required for corrosion resistance. Fittings are normally furnished per MSS SP-43 dimensions unless otherwise agreed upon between the purchaser and manufacturer. A 774 is generally considered to be the most applicable ASTM specification for "as-welded" fittings.

ASTM A 403

This specification includes seamless and welded wrought austenitic stainless steel butt welding fittings and consists of two general Classes. WP and CR. Class WP fittings are manufactured to the dimensional requirements of ANSI B16.9 or ANSI B16.28 and have the pressure ratings equal to that prescribed for the specific matching pipe. Class CR fittings are manufactured to the dimensional requirements and pressure ratings of MSS SP-43, Both Classes require carbide solution heat treatment which includes rapid cooling to prevent reprecipitation of carbides, Fitting subclasses covered by ASTM A 403 include the following specific requirements:

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Stainless Steel Fitting Specifications

<i>Sub-Class</i>	<i>Requirement</i>
WP.S	Seamless construction
WP-W	Welded fitting where fitting construction welds are 100% radiographed or ultrasonically examined and where side med. With the addition of filter metal in any starting material (e.g., welded pipe) are 100% radiographed.
WF-WX	Welded fittings where all welds are 100% radiographed or ultrasonically examined.
CR	Seamless or welded fittings with no nondestructive testing required.

Special fittings with sizes and shapes not included in the above dimensional specifications can be ordered per A 403, provided they are marked "S9" and meet all other requirements of the sub-class specified.

ASME SA-403

This specification includes seamless and welded wrought austenitic stainless steel butt welding fittings intended for use as commercial components that comply with Sections I, IV and VII and nuclear power plant components that comply with Sections III of the ASME Boiler and Pressure Vessel Code. With the exception of changes in tensile properties of 304L 316L and 316N, and the additional requirements for ASME Code documentation. This specification is identical to ASTM A 403. Alaskan produces and stocks SA-403 quality fittings, welded with filler metal and stamped with the "U" symbol (Sections VIII) under a Certificate of Authorization from the American Society of Mechanical Engineers.

ASTM B 361

This specification includes seamless and welded aluminum and aluminum alloy butt welding fittings manufactured to the dimensional requirements of ANSI B16.9 and B16.28 and are generally available. In diameters and schedule wall thickness shown in ANSI b36, 10 and ANSI B36.19.

ASTM B 363

This specification covers seamless and welded unalloyed titanium butt welding fittings intended for general corrosion resisting and elevated temperature service. Dimensions are in accordance with ANSI B18.9 or MSS SP-43 standards and are generally available in diameters and schedule wall thicknesses shown in ANSI b36.10 and ANSI 636.19. Alaskan manufacturers these fittings using ASME qualified welders and welding procedures.



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Stainless Steel Fitting Specifications

ASTM B 366

This specification includes seamless and welded wrought nickel and nickel alloy butt welding fittings and consists of two general Classes, WP and CR. Class WP fittings are manufactured to the dimensional requirements of ANSI b16.9 or ANSI B16.28 and have pressure ratings equal to that prescribed for the specified matching pipe. Class CR fittings are manufactured to the dimensional requirements and have pressure ratings of MSS SP-43.

Heat treating is optional as agreed upon with the purchaser. Fitting sub-classes covered by ASTM B 366 include the following specific requirements:

<i>Sub-Class</i>	<i>Requirement</i>
WP-S	Seamless construction
WP-W	Welded fittings where fitting construction welds are 100% radiographed or ultrasonically examined end where welds made with the addition of filler metal in any starting material (e.g., welded pipe) are 100% radio graphically examined.
WP-WX	Welded fittings where all welds are 100% radio-graphically examined.
CR	Seamless or welded fittings with no nondestructive testing required.



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Copper Tube Federal & ASTM Specifications

WROT PRESSURE SOLDER -JOINT FITTINGS -- To ANSI B16.22

CAST PRESSURE SOLDER -JOINT FITTINGS -- To ANSI B16.18

CAST BRONZE FLARED TUBE FITTINGS --To ANSI B18.26

STREAMLINE COPPER TUBE -- TYPES K, L & M --To ANSI H23.1, ASTM B88 and WWT-799
REFRIGERATION

FLARE-TYPE FITTINGS -- To ANSI B70.1 and SAE J513

STREAMLINE COPPER REFRIGERATION SERVICE TUBE -- To ANSI H23.5, ASTM B280, and WWT-775

STREAMLINE NITROGENIZED ACR HARD DRAWN COPPER TUBE -- To ANSI h23.1 Type L, and ASTM
B88 Type L, in accordance with ASTM 8280

OXYGEN SERVICE TUBE -- To ANSI H23.1 Types K and L and ASTM B88, Types K and L -- hard drawn
lengths only -- in accordance to CDA cleanliness specifications and NFPA 56F, Seamless
Copper Tube cleaned for Oxygen Gas Service.

WROT DWV SOLDER-JOINT FITTINGS -- To ANSI B16.29

CAST DWV SOLDER-JOINT FITTINGS -- To ANSI B16.23

STREAMLINE COPPER TUBE -TYPE DWV -- To ANSI H23.6 and ASTM B306

COPPER PIPE - To ASTM B42

RED BRASS PIPE - To ASTM B43

PRODUCT CERTIFICATION

Elkhart Products Corporation manufactures and/ or supplies products which meet the following specifications:

MSS SP104 *Wrought Copper LW Solder Joint Pressure Fittings*

ANSI B16.29-19 *Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings-DWV*

ANSI B16.18-19 *Cast Copper Alloy Solder Joint Pressure Fittings*

Copper Tube Federal & ASTM Specifications

- ANSI B16.15-19: *Cast Bronze Threaded Fittings*
- ANSI B16.26-19: *Cast Copper Alloy Fittings for Flared Copper Tube*
- ANSI B16.23-19: *Cast Copper Alloy Solder Joint Drainage Fittings -DWV*
- ANSI B16.24-19: *Bronze Pipe Ranges and Flanged Fittings*

EPC's wrought copper solder joint fittings also are manufactured to comply with the material, performance and installation/ joining dimensions of ANSI B16.22.

The materials used to manufacture these fittings are also in compliance with the following specifications:

Tubular Wrought Copper:

*ASTM B75 Alloy C12200. Standard Specification for Seamless Copper Tube

Products Made From Sheet:

*ASTM B152 Alloy C11000, Standard specification for Copper Sheet Strip, Plate and Rolled Bar.

Cast Products:

*ASTM B584 Alloy C84400, Standard Specification for Copper Alloy Sand Castings for General applications.

*Classes A and B Copper Alloy Unions.

- B-42 This specification covers seamless copper pipe in all standard pipe sizes, both regular and extra-strong, suitable for use in plumbing, boiler feed lines, and for similar purposes.
- B-43 This specification covers seamless red brass (Copper Alloy UNS No.C23000) pipe in all standard pipe sizes, both regular and extra-strong, suitable for use in plumbing, boiler feed lines, and for similar purposes.
- B-68 This specification covers annealed copper seamless copper tube suitable for use in refrigerators oil line, gasoline lines, etc., where tube absolutely free from scale end dirt is required.
- B-75 This specification covers seamless copper, round and rectangular including square tube suitable for general engineering purposes.
- B-88 This specification covers seamless copper water tube suitable for general plumbing, and similar applications for the conveyance of fluids, and commonly used with solder, flared, or compression type fittings.



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Copper Tube Federal & ASTM Specifications

- B-111 This specification covers seamless tube and ferrule stock of copper and various copper alloys up to 2 in (50.8mm) inc., in diameter, for use in surface condensers, evaporators, and heat exchangers.
- B-135 This specification covers seamless round and rectangular including square copper alloy tube in straight lengths.
- B-251 This specification covers a group of general requirements common to several wrought product specifications. Unless otherwise specified in the purchase order, or in an individual specification, these general requirements shall apply to copper and copper-alloy tube supplied under specifications B 68, B75, B 135 and B 466.
- B-280 This specification covers seamless copper tube for air conditioning and refrigeration service and intended for use in the field for connection, repairs, and alterations.
- B-302 This specification covers thread less, seamless, deoxidized copper pipe (TP) in straight lengths, for pipe systems that are assembled with brazed-joint pipe fittings.
- B-306 This specification covers seamless copper drainage tube (DWV) intended for use with soldered fittings for sanitary drainage, such as soil, waste, and vent piping.



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Copper Tube Federal & ASTM Specifications

Product	Temper	Lengths	Color Code	Uses	Specifications
Copper Water Tube Type K (heavy wall)	Hard Soft	10ft straight 20ft straight 20ft straight 40ft coils (2") 60ft coils(1/4" thru 1 1/2") 100ft coils (1/4" thru 1 1/4")	Green	Underground services*; general plumbing and heating purposes; gas steam and oil lines; severe service conditions *soft recommended	Federal- WW-T-799 ASTM B-88 Underwriters' Approved 1/4" thru 2"
Copper Water Tube Type L Type ACR (hard only)	Hard Soft	10ft straight 20ft straight 20ft straight 30ft coils (1/4" thru 1 1/2") 40ft coils (2") 60ft coils(1/4" thru 1 1/2") 100ft coils (1/4" thru 1 1/4")	Blue	General plumbing and heating purposes. Interior gas, steam and oil line: panel heating. Types ACR for air conditioning and refrigeration uses.	Federal- WW-T-799 ASTM B-88 U.L Approved Fire Service Systems 1/2"-8 incl.
Copper Water Tube Type M	Hard	10ft straight 20ft straight	Red	General plumbing and heating purposes; drainage waste, vent and other light pressure uses.	Federal- WW-T-799 ASTM B-88
Copper Drainage Tube	Hard	10ft straight 20ft straight	Yellow	Drainage, waste, vents, soil and other non-pressure applications (above ground use only.)	ASTM B-306
Copper Pipe (regular or extra heavy)	Hard	12ft straight 20ft straight	Black	General plumbing and heating purposes; gas, steam and oil lines: severe service conditions including high pressure industrial applications	Navy-44P2 Federal- WW-P-377 ASTM B-42
Copper Threadless Pipe	Hard	20ft straight	Gray	General plumbing and heating purposes	ASTM B-302 Federal- WW-T-775
Copper Refrigeration Tube	Soft	50ft coils 100ft coils	Crimson	Manufacture, installation and maintenance of refrigeration equipment	ASTM B-280 Federal- WW-T-775
Special Dimensional Tube	As Specified	As Specified		Special industrial applications. Composition and dimensions to fit individual requirement.	ASTM B-68 ASTM B-75



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REFERENCE INFORMATION COPPER TUBE*

SIZE		TYPE K		TYPE L/ ACR		TYPE M		DWV	
NOM	O.D.	HARD	COILS	HARD	COILS	HARD	COILS	HARD	
STANARD LENGTH		20' LENGTHS	60' THRU 1 1/2 100 THRU 1 1/4 40' AND 60'-2" ONLY	20' LENGTHS	80' THRU 1 1/2 100 THRU 1 1/4 40'-2" ONLY	20' LENGTHS	CONSULT	20' LENGTHS	
NOM	O.D.	Wall	WGT/FT	Wall	WGT/FT	Wall	WGT/FT	Wall	WGT/FT
1/4	3/8	0.035	0.145	0.03	0.125	0.025	0.106	...	...
3/8	1/2	0.049	0.269	0.035	0.198	0.025	0.145	...	...
1/2	1	0.049	0.344	0.04	0.285	0.28	0.204	...	...
5/8	3/4	0.049	0.418	0.042	0.362	0.03	0.283	...	...
3/4	7/8	0.065	.641	0.045	0.455	0.032	0.328	...	...
1	1 1/8	0.065	0.839	0.05	0.655	0.035	0.465	...	...
1 1/4	1 3/8	0.065	1.04	0.055	0.884	0.042	0.682	0.04	0.65
1 1/2	1 5/8	0.072	1.36	0.06	1.14	0.049	0.94	0.042	0.809
2	2 1/8	0.083	2.06	0.07	1.75	0.058	1.46	0.042	1.07
2 1/2	2 5/8	0.095	2.93	0.08	2.48	0.065	2.03	...	...
3	3 1/8	0.109	4	0.09	3.33	0.072	2.68	0.045	1.69
3 1/2	3 5/8	0.12	5.12	0.1	4.29	0.083	3.58	...	...
4	4 1/8	0.134	6.51	0.11	5.38	0.095	4.66	0.058	2.87
5	5 1/8	0.16	9.67	0.125	7.81	0.109	6.66	0.072	4.43
6	6 1/8	0.192	13.9	0.14	10.2	.0122	8.92	0.083	6.1
8	8 1/8	0.271	25.9	0.2	19.3	0.17	16.46	...	0

REFRIGERATION SERVICE TUBE

O.D. SIZE	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	1 5/8
Wall Thickness	0.03	0.03	0.03	0.032	0.032	0.032	0.035	0.035	0.045	0.05	0.055	0.06
Weight per Foot	0.035	0.575	0.804	0.109	0.134	0.182	0.251	0.305	0.455	0.655	0.884	1.14
Weight per Coil	1.74	2.88	4.02	5.45	6.7	9.1	12.55	15.25	22.75	32.75	44.2	57
Coil Diameter	14.75"	14.75"	14.75"	16.5"	16.5"	20"	22"	25"	27.5"	34.5"	39.5"	42"
Coils per Master	10	10	10	10	10	5	5	3	...	...	...	...
Weight per Master	17.4	28.8	40.2	54.5	67	45.5	62.75	45.75	22.75	32.75	44.2	57

TEMPERATURE CONTROL TUBE

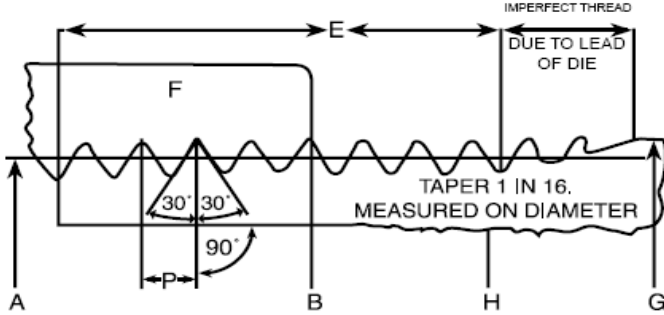
PACKED 2000 FT PER WOOD BOX

O.D.	WALL	WGT/FT
1/4	0.025	0.0685

O.D.	WALL	WGT/FT
1/4	0.032	0.0849



ANSI STANDARD IRON PIPE TAPER THREADS



$A = G - (0.05 + 1.1) P$

$B = A + .0625 F$

$E = P(0.8G + 6.8)$

Depth of Thread = $0.8P$

Total Taper $3/4$ " in. per foot

(Inch)

	A	B	E	F	G	H		P	
Nominal Size of Pipe	Pitch Dia. At End of Pipe	Pitch Dia. At Gauging Notch	Length of Effective Thread	Normal Engagement by Hand Between Male & Female Thread	Outside Dia. Of Pipe	Actual Inside Dia. Of Pipe	Number of Threads	Pitch of Thread	Depth of Thread
Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
1/8	0.36351	0.37476	0.2638	0.18	0.405	0.269	27	0.37	0.0296
1/4	0.47739	0.48989	0.4018	0.2	0.54	0.364	18	0.556	0.0444
3/8	0.61201	0.62701	0.4078	0.24	0.675	0.493	18	0.556	0.0444
1/2	0.75843	0.77843	0.5337	0.32	0.84	0.622	14	0.714	0.0571
3/4	0.96768	0.98886	0.5457	0.339	1.05	0.824	14	0.714	0.0571
1	1.21363	1.23863	0.6828	0.4	1.315	1.049	11 1/2	0.087	0.0696
1 1/4	1.55713	1.58338	0.7068	0.42	1.66	1.38	11 1/2	0.087	0.0696
1 1/2	1.79609	1.82234	0.7235	0.42	1.9	1.61	11 1/2	0.087	0.0696
2	2.26902	2.29627	0.7565	0.436	2.375	2.067	11 1/2	0.087	0.0696
2 1/2	2.71953	2.76216	1.1375	0.682	2.875	2.469	8	0.125	0.1
3	3.34063	3.3885	1.2	0.766	3.5	3.068	8	0.125	0.1
3 1/2	3.8375	3.8881	1.25	0.821	4	3.548	8	0.125	0.1
4	4.33438	4.38713	1.3	0.844	4.5	4.026	8	0.125	0.1
5	5.39073	5.44929	1.4063	0.937	5.563	5.047	8	0.125	0.1
6	6.44609	6.50597	1.5125	0.958	6.625	6.065	8	0.125	0.1
8	8.43359	8.50003	1.7125	1.063	8.625	7.981	8	0.125	0.1
10	10.54531	10.62094	1.925	1.21	10.75	10.02	8	0.125	0.1
12	12.53281	12.61781	2.125	1.36	12.75	12	8	0.125	0.1
14 O.D.	13.775	13.87262	2.25	1.562	14	13.25	8	0.125	0.1
16 O.D.	15.7625	15.87575	2.45	1.812	16	15.25	8	0.125	0.1
18 O.D.	17.75	17.875	2.65	2	18	17.25	8	0.125	0.1
20 O.D.	19.7375	19.87031	2.85	2.125	20	19.25	8	0.125	0.1
22 O.D.	21.725	21.86562	3.05	2.25	22	21.25	8	0.125	0.1
24 O.D.	23.7125	23.86094	3.25	2.375	24	23.25	8	0.125	0.1

Data abstracted from the USA Standard for Pipe Threads B2.1



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Standards in the Valve Industry IE: API, ANSI, ASTM, MSS
STANDARDS IN THE VALVE & FITTING INDUSTRY

Many standards play an important role in the design and production of forged steel valves, fittings, flanges and unions. These standards cover material, product dimension and design, procedure, and safety.

Material standards are sponsored by such organizations as the American Society for Testing and Materials (ASTM), the American Iron & Steel Institute (AISI), and the Society of Automotive Engineers (SAE).

The American National Standards Institute, Inc., whose membership is composed of both user and producer groups, serves as the issuing agency for the majority of product standards related to the valve and fittings industry. Product standards are also issued by Individual user and producer agencies such as the American Petroleum Institute (API) and the Manufacturers' Standardization Society of the Valve & Fittings Industry (MSS). The latter is an active member of ANSI.

Procedural and safety standards are issued by ANSI, MSS and the American Society of Mechanical Engineers (ASME).

Following is a partial list of agencies whose standards have a direct bearing on the design and production of forged steel valves, fittings, flanges and unions. Some of the more significant standards are listed under the issuing agency.

American Iron & Steel Institute
1000 16th Street, N.W.
Washington, D.C. 20036

Division of Refining
2101 L Street, N.W.
Washington, D.C. 20037

- API Std. 598 - Valve Inspection and Test.
- API Std. 600 - Flanged & Butt Welded End Steel Gate & Plug Valves for Refinery Use.
- API Std. 602 - Compact Design Carbon Steel Gate Valves for Refinery Use.
- API Std. 606 - Compact Carbon Steel Gate Valves Extended Body.

American Petroleum Institute
Division of Production
300 Corrigan Tower Bldg.
Dallas, Texas 75201

-
- API Std. 6D - Steel Gate, Plug & Check Valves for Pipe Line Service.

The American National Standards Institute, Inc.
1430 Broadway
New York, N. Y. 10018

-
- ANSI B1.1 - Unified & American Screw Threads.
 - ANSI B1 .2 - Screw Thread Gauges & Gauging.
 - ANSI B1 .5 - Acme Screw Threads.
 - ANSI B2.1 - Pipe Threads.
 - ANSI B16.5 - Steel Pipe Flanges & Flanged Fittings.
 - ANSI B16.9 - Steel Butt Welding Fittings.
 - ANSI B16.10 - Face-to-Face Dimensions of Ferrous Flanged & Welding End Valves.
 - ANSI B16.11 - Forged Steel Fittings. Socket-Welding and Threaded.
 - ANSI B16.14 - Ferrous Plugs. Bushings & Lock Nuts with Pipe Threads.
 - ANSI B16.20 - Ring Joint Gaskets in Grooves for Steel Pipe Flanges.
 - ANSI B16.21 - Non-Metallic Gaskets for Pipe Flanges.
 - ANSI 16.25 - Butt Welding Ends.
 - ANSI B16.34 - Valves - Flanged and Butt Welding Ends.
 - ANSI B18.2 - Square & Hexagon Bolts & Nuts.
 - ANSI - Code for Pressure Piping**
 - B31.1.0 - Power Piping (Section 1)
 - B31 .2 - Fuel Gas Piping (Section 2)
 - B31.3 - Chemical Plant end Petroleum Refinery Piping (Section 3)
 - B31.4 - Liquid Petroleum Transportation Piping Systems (Section 4)
 - B31 .5 - Refrigeration Piping (Section 5)
 - B31.8 - Gas Transmission and Distribution Piping Systems (Section 8)

American Society for Testing Materials
1916 Race Street
Philadelphia, Pa. 19103 ' 4

-
- ASTM A105 - Forgings. Carbon Steel, for Piping Components.
 - ASTM A106 - Seamless Carbon Steel Pipe for High Temperature Service.
 - ASIM A182 - Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings & Valves & Parts for High Temperature Service.
 - ASTM A193 - Alloy Steel Bolting Materials for High Temperature Service.
 - ASTM A194 - Carbon & Alloy Steel Nuts for Bolts for High Pressure & High Temperature Service.



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Standards in the Valve Industry IE: API, ANSI, ASTM, MSS
STANDARDS IN THE VALVE & FITTING INDUSTRY

American Society of Mechanical Engineers
United Engineering Center
345 E. 47th Street
New York, N. Y., 10017

ASME Boiler & Vessel Code:

- Power Boilers (Section. I)
- Material Specifications (Section II)
- Nuclear Power Plant Components (Section III)
- Heating Boilers (Section IV)
- Recommended Rules for care of Power Boilers (Section VII)
- Pressure Vessels (Section VIII)
- Welding Qualifications (Section IX)

Manufacturers Standardization Society of the Valve & Fittings Industry
5203 Leesburg Pike, Suite 502
Arlington, Virginia 22209

MSS SP-6 - Standard Finishes for Contact Faces of Pipe Flanges & Connecting End Flanges of Valves & Fittings.

MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges, & Unions.

MSS SP-45 - Bypass & Drain Connection Standard.

MSS SP-61 - Hydrostatic Testing of Steel Valves.

MSS SP-85 - High Pressure Chemical Industry Flanges and Threaded Stubs for use with Lens Gaskets.

MSS SP-79 - Socket Welding Reducer Inserts.

MSS SP-83 - Carbon Steel Pipe Unions —Socket Welding & Threaded.

MSS SP-84 - Steel Valves — Socket Welding & Threaded Ends.

MSS SP-86 - MSS Guidelines for Metric Data in Standards for Valves. Flanges. & Fittings.

Society of Automotive Engineers
2 Pennsylvania Plaza
New York, N. Y. 10001



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Federal valve specifications for bronze and cast iron valves

Bronze Valve Specifications * (below valves conform to MSS-SP-80)

Federal Specification WW-V-51e:

Class A, Type I Covers
125 lb. S.W.P Globe Valves

Class A, Type II Covers
125 lb. S.W.P Angle Valves

Class A, Type IV Covers
125 lb. S.W.P Swing Check Valves

Class B, Type I Cover
150 lb. S.W.P. Globe Valves

Class B, Type II Covers
150 lb. S.W.P Angle Valves

Class B, Type IV Covers
150 lb. S.W.P Globe Valves

Federal Specification WW-V-54d:

Class A, Type I Covers
125 lb. S.W.P. Wedge Disc, Non-Rising Stem Gate Valves

Class A, Type II Covers
125 lb. S.W.P. Wedge Disc, Rising Stem, Inside Screw
Gate Valves

Class A, Type III Covers
125 lb. S.W.P. Double Disc, Rising Stem, Inside Screw
Gate Valves

Class B, Type I Covers
150 lb. S.W.P. Wedge Disc, Non-Rising Stem Gate Valves

Class B, Type II Covers
150 lb. S.W.P. Wedge Disc, Rising Stem, Inside Screw
Gate Valves

Class B, Type III Covers
150 lb. S.W.P. Double Disc, Rising Stem, Inside Screw
Gate Valves



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Federal valve specifications for bronze and cast iron valves

Iron Valve Specifications * (below valves conform to MS-SP-70)

Federal Specification WW-V-58b:

Class 1, Type I Covers

125lb. S.W.P. Wedge Disc, OS&Y, Screwed End, Cast Iron Gate Valves

Class 2, Type I Covers

250lb. S.W.P. Wedge Disc, OS&Y, Screwed End, Cast Iron Gate Valves

Class 1, Type I Covers

125lb. S.W.P. Non-Rising Stem, Inside Screw Screwed End, Cast Iron Gate Valves

Class 2, Type I Covers

250lb. S.W.P. Non-Rising Stem, Inside Screw, Screwed End, Cast Iron Gate Valves

Class 1, Type I Covers

125lb. S.W.P. OS&Y, Flanged End, Cast iron Gate Valves

Class 2, Type I Covers

250lb. S.W.P. OS&Y, Flanged End, Cast Iron Gate Valves

Class 1, Type I Covers

125lb. S.W.P. Non-Rising Stem, Inside Screw, Flanged End, Cast Iron Gate Valves

Class 2, Type I Covers

250lb. S.W.P. Non-Rising Stem, Inside Screw, Flanged End, Cast Iron Gate Valves

* The Federal Government has now accepted MSS-SP specifications in lieu of the WW-V Series of specifications.

Note: WW-V-51, WW-V-54, WW-V-58 have been cancelled and replaced by the corresponding MSS Specifications

Federal valve specifications for bronze and cast iron valves

BRONZE

Federal Specification WW-V-51e Class A, Type I

Covers 125lb S.W.P. Globe Valves (MSS-SP-80)

Federal Specification WW-V-51e Class A, Type II

Covers 125lb S.W.P. Angle Valves (MSS-SP-80)

Federal Specification WW-V-51e Class B, Type I

Covers 125lb S.W.P. Swing Check Valves (MSS-SP-80).

Federal Specification WW-V-51e Class B, Type I

Covers 150lb S.W.P. Globe Valves (MSS-SP-80).

Federal Specification WW-V-51e Class C, Type II

Covers 150lb S.W.P. Angle Valves (MSS-SP-80).

Federal Specification WW-V-51e Class B, Type IV

Covers 150lb S.W.P. Swing Check Valves (MSS-SP-80).

Federal Specification WW-V-51e Class C, Type I

Covers 200lb S.W.P. Globe Valves (MSS-SP-80.)

Federal Specification WW-V-54d Class A, Type I

Covers 125lb S.W.P. Wedge Disc, Non-Rising Stem Gate Valves (MSS-SP-80).

Federal Specification WW-V-51e Class C, Type II

Covers 200lb S.W.P. Angle Valves (MSS-SP-80).

Federal Specification WW-V-51e Class C, Type IV

Covers 200lb S.W.P. Swing Check Valves (MSS-SP-80).

Federal Specification WW-V-54d Class A, Type II

Covers 125lb S.W.P. Wedge Disc, Rising Stem, Inside Screw Gate Valves (MSS-SP-80).

Federal Specification WW-V-54d Class A, Type I

Covers 125lb S.W.P. Double Disc, Rising Stem, Inside Screw Gate Valves (MSS-SP-80).

Federal Specification WW-V-54d Class B, Type II

Covers 150lb S.W.P. Wedge Disc, Non-Rising, Stem Gate Valves (MSS-SP-80).

Federal Specification WW-V-54d Class B, Type II

Covers 150lb S.W.P. Wedge Disc, Rising Stem, Inside Screw gate Valves (MSS-SP-80).

Federal Specification WW-V-54d Class B, Type II

Covers 150lb S.W.P. Double Disc, Rising Stem, Inside Screw Gate Valves (MSS-SP-80).

Federal Specification WW-V-54d Class C, Type I

Covers 200lb S.W.P. Wedge Disc, Non-Rising, Stem Gate Valves (MSS-SP-80).

Federal Specification WW-V-54d Class C, Type II

Covers 200lb S.W.P. Wedge Disc, Rising Stem, Inside Stem Gate Valves (MSS-SP-80).

Federal Specification WW-V-35d Covers 15lb S.W.P. Ball Valves

IRON

Federal Specification WW-V-58d Class 1, Type I

Covers 125lb S.W.P. Wedge Disc, OS&Y, Screwed End, Cast Iron Gate Valves (MSS-SP-70).

Federal Specification WW-V-58d Class 2, Type I

Covers 200lb S.W.P. Wedge Disc, OS&Y, Screwed End, Cast Iron Gate Valves (MSS-SP-70).

Federal Specification WW-V-58d Class 1, Type I

Covers 125lb S.W.P. Non-Rising Stem, Inside Screw, Screwed End, Cast Iron Gate Valves (MSS-SP-70).

Federal Specification WW-V-58d Class 2, Type I

Covers 250lb S.W.P. Non-Rising Stem, Inside Screw, Screwed End, Cast Iron Gate Valves (MSS-SP-70).

Federal Specification WW-V-58d Class 1, Type I

Covers 125lb S.W.P. OS&Y Flanged End, Cast Iron Gate Valves (MSS-SP-20).

Federal Specification WW-V-58d Class 2, Type I

Covers 250lb S.W.P. OS&Y, Flanged End, Cast Iron Gate Valves (MSS-SP-70).

Federal Specification WW-V-58d Class 1, Type I

Covers 125lb S.W.P. Non-Rising Stem, Inside Screw, Flanged End, Cast Iron Gate Valves (MSS-SP-70).

Federal Specification WW-V-58d Class 2, Type I

Covers 250lb S.W.P. Non-Rising Stem, Inside Screw, Flanged End, Cast Iron Gate Valves (MSS-SP-70).

STANDARDS -- FOR INFORMATION

PURPOSES ONLY

MSS-SP-67 Covers Butterfly Valves of the Single Flanged Type (Lug Wafer)

MSS-SP-67 Covers Butterfly Valves of the Flangeless Type (Water)

MSS-SP-70 Covers Cast Iron Gate Valves, Flanged and Threaded Ends

MSS-SP-71 Covers Cast Iron Swing Check Valves, Flanged and Threaded Ends

MSS-SP-80 Covers Bronze Gate, Globe Angle and Check Valves

MSS-SP-85 Covers Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

A.N.S.I. Standard B1.1- The Unified Screw Threads Standard that covers manufacturing tolerances of screw threads.

A.N.S.I. Standard B1.20.1- This standards controls NIBCO pipe threads

A.N.S.I. Standard B2.4- This standard controls NIBCO hose coupling screw threads

A.N.S.I. Standard B16.18- This standard controls NIBCO valve solder cups

A.N.S.I Standard B16.1- Covers cast iron pipe flanges and flanged fittings (Class 125 and 250)

A.N.S.I. Standard B16.10- Covers face-to-face and end-to-end dimensions of ferrous valves

MILITARY Standard MIL-V-18826- Covers cast iron globe valves

MILITARY Standard MIL-V-18436- Applies to bronze and iron check valves sizes 1/2" thru 12".



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Ball Valves

CHEMICAL APPLICATION

Corrosion Resistance

Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Acealdehyde	D	C	A	A
Acetic Acid, Pure	C	C	A	A
Acetic Anhydride	C	D	B	A
Acetone	A	A	A	A
Acetylene, Dry	B	A	A	A
Acrylonitrile	A	A	A	A
Air	A	A	A	A
Alcohol	B	B	A	A
Aluminum Chloride, Dry	B	B	A	A
Aluminum Sulfate (Alums)	C	C	A	A
Alums	C	C	A	A
Amines	A	A	A	A
Ammonia, Anhydrous	D	A	A	A
Ammonia, Aqueous	D	A	A	A
Ammonia Solutions	D	B	A	A
Ammonium Bicarbonate	B	C	B	A
Ammonium Carbonate	B	B	B	A
Ammonium Chloride	D	D	C	C
Ammonium Hydroxide 28%	D	C	B	A
Ammonium Hydroxide (conc.)	D	C	B	A
Ammonium Monophosphate	D	D	B	A
Ammonium Nitrate	D	D	A	A
Ammonium Phosphate	D	D	B	A
Ammonium Phosphate, Di-Basic	C	D	B	A
Ammonium Phosphate, Tri-Basic	C	D	B	A
Ammonium Sulfate	B	C	B	A
Ammonium Sulfide	D	D	B	A
Ammonium Sulfite	B	C	B	A
Amyl Acetate	B	C	B	A
Aniline	D	A	B	A
Aniline Dyes	C	C	A	A
Apple Juice	C	D	B	A
Aqua Regina	C	D	B	A
Aromatic Acid	A	C	A	A
Arsenic Acid	D	D	B	A
Asphalt Emulsion	A	A	A	A
Asphalt Liquid	A	A	A	A
Barium Carbonate	B	B	B	A
Barium Chloride	B	C	C	A

Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Aniline Dyes	C	C	A	A
Apple Juice	C	D	B	A
Aqua Regina	C	D	B	A
Aromatic Acid	A	C	A	A
Arsenic Acid	D	D	B	A
Asphalt Emulsion	A	A	A	A
Asphalt Liquid	A	A	A	A
Barium Carbonate	B	B	B	A
Barium Chloride	B	C	C	A
Barium Hydroxide	B	C	B	A
Barium Sulfate	C	B	B	A
Barium Sulfide	C	B	B	A
Beer (Alcohol Industry)	B	C	A	A
Beer (Beverage Industry)	B	C	A	A
Beet Sugar Liquors	A	B	A	A
Benzaldehyde	A	A	A	A
Benzene (Benzol)	B	B	A	A
Benzoic Acid	B	D	B	A
Black Sulfate Liquor	B	A	A	A
Borax (Soidum Borate)	D	C	A	A
Borax Liquors	A	C	B	A
Boric Acid	B	D	B	A
Brake Fluid	B	O	B	A
Brines	B	C	B	A
Bromine, Dry	A	D	D	A
Bromine, Wet	B	D	D	A
Bunker Oils (Fuel Oils)	B	B	A	A
Butadine	C	B	A	A
Butane	A	A	A	A
Butter	O	O	A	A
Barium Hydroxide	B	C	B	A
Barium Sulfate	C	B	B	A
Barium Sulfide	C	B	B	A
Beer (Alcohol Industry)	B	C	A	A
Beer (Beverage Industry)	B	C	A	A
Beet Sugar Liquors	A	B	A	A
Benzaldehyde	A	A	A	A
Benzene (Benzol)	B	B	A	A
Benzoic Acid	B	D	B	A

(A) Excellent (B) Good (C) Fair-Probably Unsited (D) Not Recommended (O) No Information



Columbia Specialty Company, Inc.

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Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Black Sulfate Liquor	B	A	A	A
Borax (Sodium Borate)	D	C	A	A
Borax Liquors	A	C	B	A
Boric Acid	B	D	B	A
Brake Fluid	B	O	B	A
Brines	B	C	B	A
Bromine, Dry	A	D	D	A
Bromine, Wet	B	D	D	A
Bunker Oils (Fuel Oils)	B	B	A	A
Butadine	C	B	A	A
Butane	A	A	A	A
Butter	O	O	A	A
Buttermilk	D	D	A	A
Butylene	A	A	A	A
Butyric Acid	C	D	B	A
Calcium Bisulfate	B	D	B	A
Calcium Carbonate	C	D	B	A
Calcium Chloride	B	C	B	A
Calcium Hydroxide 20%	A	C	B	A
Calcium Hypochlorite	D	D	C	A
Calcium Phosphate	C	O	B	A
Calcium Silicate	C	O	B	A
Calcium Sulfate	C	C	B	A
Cane Sugar Liquors	B	O	A	A
Carbolic Acids	B	D	B	A
Carbolic Acid (Phenol)	B	D	B	A
Carbonated Beverage	B	D	B	A
Carbonated Water	B	B	A	A
Carbon Bisulfide	C	B	B	A
Carbon Dioxide, Dry	A	A	A	A
Carbonic Acid	D	D	B	A
Carbon Monoxide	A	O	A	A
Carbon Tetrachloride (Dry)	C	B	A	A
Carbon Tetrachloride (Wet)	D	D	B	A
Casein	C	O	B	A
Castor Oil	A	B	A	A
China Wood Oil (Tung)	C	C	A	A
Chlorinated Solvents (Dry)	C	C	B	A
Chlorinated Water	O	O	C	A
Chlorine Gas (Dry)	C	B	B	A
Chlorine (Wet)	D	D	D	A
Chloroacetic Acid	C	D	C	A
Chlorobenzene (Dry)	B	B	A	A
Chloroform (Dry)	B	B	A	A
Chlorophyll, Dry	B	O	B	A

Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Chlorosulphonic Acid (Dry)	B	B	B	A
Chlorosulphonic Acid (Wet)	D	D	D	A
Chrome Alum	C	B	A	A
Chromic Acid 50%	D	D	C	A
Chromium Sulfate	C	O	B	A
Cider	O	O	A	A
Citrus (Juices)	B	D	B	A
Citrus Acid	C	D	A	A
Coca Cola Syrup	O	O	A	A
Coconut Oil	B	C	B	A
Cod Liver Oil	O	O	O	A
Coffee Extract (Hot)	B	C	A	A
Coke Oven Gas	C	B	A	A
Cooking Oil	B	B	A	A
Copper Acetate 10%	D	C	B	A
Copper Carbonate	O	O	A	A
Copper Chloride	D	D	D	A
Copper Cyanide	D	O	A	A
Copper Nitrate	D	D	B	A
Copper Sulfate	D	D	C	A
Corn Oil	B	C	B	A
Cottonseed Oil	B	C	B	A
Creosote Oil	B	B	B	A
Cresylic Acid	C	B	B	A
Crude Oil, Sour	C	B	A	A
Crude Oil, Sweet	B	B	A	A
Cutting Oils, Water Emulsions	A	B	A	A
Cyanide Plating Solutions	D	O	B	A
Cyclohexane	A	A	A	A
Detergents, Synthetic	B	O	B	A
Dextrin	B	O	B	A
Diacetone Alcohol	A	A	A	A
Dichloroethane	O	O	C	A
Dichloroethyl Ether	B	O	B	A
Diesel Fuels	A	A	A	A
Diethylamine	B	O	A	A
Diethylene Glycol	B	O	B	A
Diethyl Sulfate	B	O	B	A
Dimethyl Formamide	B	O	A	A
Dipentane (Pinene)	A	O	A	A
Dowtherms	A	B	A	A
Drilling Mud	B	B	A	A
Drip Cocks, Gas	B	B	A	A
Dry Cleaning Fluids	B	B	A	A
Drying Oils	C	C	B	A

(A) Excellent (B) Good (C) Fair-Probably Unsuitable (D) Not Recommended (O) No Information



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Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Epson Salts	B	C	B	A
Ethane	A	A	A	A
Ethers	B	B	A	O
Ethyl Acetate	C	B	B	A
Ethyl Acrylate	B	C	A	A
Ethyl Alcohol	B	B	B	A
Ethyl Bromide	A	O	B	A
Ethyl Chloride, Dry	B	B	A	A
Ethyl Chloride, Wet	C	D	B	A
Ethylene Glycol	B	B	B	A
Ethylene Oxide	D	B	B	A
Fatty Acids	B	D	A	A
Ferric Chloride	D	D	D	A
Ferric Nitrate	D	D	C	A
Ferric Sulfate	D	D	B	A
Ferrous Chloride	B	D	D	A
Ferrous Sulfate	C	D	B	A
Ferrous Sulfate (Sat.)	C	C	A	A
Fertilizer Solution	C	B	B	A
Fish Oils	B	B	A	A
Fluorine (Dry)	D	O	O	C
Fluorosilicic Acid	A	D	C	A
Formaldehyde, Cold	A	A	A	A
Formaldehyde, Hot	B	D	C	A
Formic Acid, Cold	B	D	B	A
Formic Acid, Hot	B	D	B	A
Freon, Dry	B	B	A	A
Freon, Wet	D	O	C	A
Fruit Juices	B	D	A	A
Fuel Oil	B	B	A	A
Furfural	A	A	A	A
Gallic Acid 5%	C	D	B	A
Gas, Manufactured	B	B	B	A
Gas, Natural	B	B	A	A
Gas, Odeizers	A	B	B	A
Gasoline (Leaded)	A	A	A	A
Gasoline (Unleaded)	A	A	A	A
Gasoline (Aviation)	A	A	A	A
Gasoline, Refined	B	B	A	A
Gasoline, Sour	B	B	A	A
Gelatin	A	D	A	A
Glucose	A	B	A	A
Glue	B	A	A	A
Glycerine (Glycerol)	B	B	A	A
Glycol Amine	D	O	B	A

Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Glycols	B	B	B	A
Graphite	B	O	B	A
Grease	B	A	A	A
Hleium Gas	D	D	D	A
Heptane	A	B	A	A
Hexane	B	B	B	A
Hexanol, Tertiary	A	A	A	A
Hydraulic Oil, Pet Base	B	A	A	A
Hydrazine	D	O	B	A
Hydrobromic Acid	D	D	D	A
Hydrochloric Acid (Air Free)	D	D	D	A
Hydrocyanic Acid	D	D	B	A
Hydrofluoric Acid	D	D	D	C
Hydrofluosilicic Acid	A	D	C	A
Hydrogen Gas, Cold	B	B	A	A
Hydrogen Gas, Hot	O	B	B	A
Hydrogen Peroxide (Conc.)	D	D	B	A
Hydrogen Peroxide (Dilute)	B	D	B	A
Hydrogen Sulfide (Dry)	CONSULT FACTORY			
Hydrogen Sulfide (wet)	CONSULT FACTORY			
Hypo (Sodium Thiosulfate)	C	D	A	A
Hypochlorotes, Sodium	D	D	C	A
Illuminating Gas	A	A	A	A
Ink	C	D	A	A
Iodine (Wet)	D	D	D	A
Iodoform	B	B	B	A
Iso-Octane	A	A	A	A
Isopropyl Alcohol	B	B	B	A
Isopropyl Acetate	O	O	B	A
Isopropyl Ether	A	A	A	A
JP-4 Fuel, Jet	A	A	A	A
JP-5 Fuel, Jet	A	A	A	A
JP-6 Fuel, Jet	A	A	A	A
Kerosene	A	B	A	A
Ketchup	D	D	A	A
Ketones	A	A	A	A
Lacquer (and Solvent)	A	C	A	A
Lactic Acid	C	D	A	A
Lactic Acid (Conc. Hot)	D	D	B	A
Lactose	B	O	B	A
Lard	B	O	A	A
Lard Oil	A	C	A	A
Lead Acetate	C	D	B	A
Lead Sulfate	C	O	B	A
Lecithin	C	O	B	A

(A) Excellent (B) Good (C) Fair-Probably Unsited (D) Not Recommended (O) No Information



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Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Linoleic Acid	B	B	A	A
Linseed Oil	B	A	B	A
LPG Gas	A	B	B	A
Lubricating Oils. Petro Base	B	A	A	A
Ludox	D	O	B	A
Magnesium Bisulfite 10%	B	C	A	A
Magnesium Bisulfide	D	O	B	A
Magnesium Carbonate	B	O	A	A
Magnesium Chloride	B	C	D	A
Magnesium Hydroxide	B	B	A	A
Magnesium Hydroxide (Hot)	D	B	A	A
Magnesium Nitrate	O	O	A	A
Magnesium Sulfate	B	B	B	A
Maleic Acid	B	B	C	A
Maleic Anhydride	B	O	B	A
Malic Acid	B	D	A	A
Mayonnaise	D	D	A	A
Menthol	B	O	B	A
Mercuric Chloride	D	D	D	A
Mercuric Cyanide 10%	O	D	B	A
Mercurous Nitrate	D	O	A	A
Mercury	D	A	A	A
Methane	A	A	A	A
Methyl Acetate	A	A	A	A
Methyl Acetone	A	A	A	A
Methyl Alcohol	B	B	B	A
Methylamine	D	B	A	A
Methyl Bromide 100%	C	O	B	A
Methyl Cellosolve	B	B	B	A
methyl Chloride	A	B	A	A
Methyl Ethyl Ketone	A	A	A	A
Mehtyl Formate	A	B	B	A
Methylene Chloride	A	B	B	A
Milk	A	D	A	A
Mine Waters (Acid)	C	D	B	A
Mineral Oils	B	B	A	A
Mineral Spirits	B	B	B	A
Mixed Acids (Cold)	D	C	A	A
Molasses, Edible	A	A	A	A
Molasses, Crude	A	A	A	A
Muriatic Acid	D	D	D	A
Morpholine	B	O	B	A
Mustard	A	B	A	A
Naptha	B	B	A	A
Naphthalene	B	A	A	A

Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Nickel Ammonium Sulfate 20%	D	D	A	A
Nickel Chloride	D	D	B	A
Nickel Nitrate 30%	D	D	B	A
Nickel Sulfate	D	D	C	A
Nicotinic Acid	A	B	A	A
Nitric Acid 10%	D	D	A	A
Nitric Acid 30%	D	D	A	A
Nitric Acid 80%	D	D	A	A
Nitric Acid 100%	D	A	A	A
Nitric Acid Anyhdrous	D	A	A	A
Nitrobenzene	D	B	B	A
Nitrogen	A	A	A	A
Nitrous Acid 10%	D	D	B	A
Nitrous Gases	D	B	A	A
Nitrous Oxide	C	A	B	A
Oils, Animal	A	A	A	A
Oils, Petro Redefined	B	A	A	A
Oils, Petro Sour	C	B	A	A
Oils, Water Mixture	A	B	A	A
Oils, Cottonseed	B	C	B	A
Oils, Fish	B	B	A	A
Oleic Acid	B	C	A	A
Oleum	D	B	B	A
Oleum Spirits	D	O	B	A
Olive Oil	B	B	A	A
Oxalic Acid	B	D	D	A
Oxygen	A	B	A	A
Ozone (Dry)	A	A	A	A
Ozone (Wet)	B	C	A	A
Paints and Solvents	A	A	A	A
Palmitic Acid	B	C	A	A
Palm Oil	B	C	B	A
Paper Pulp	B	CO	B	A
Paraffin	A	B	A	A
Paraformaldehyde	B	B	B	A
Pentane	A	B	A	A
Perchlorethylene (Dry)	C	B	B	A
Petroleum (Vaseline)	B	C	B	A
Phenol	B	B	A	A
Phosphate Ester	D	A	A	A
Phosphoric Acid 10% Cold	D	D	B	A
Phosphoric Acid 10% Hot	D	D	D	A
Phosphoric Acid 50% Cold	D	D	B	A
Phosphoric Acid 50% Hot	D	D	D	A
Phosphoric Acid 85% Cold	D	B	A	A

(A) Excellent (B) Good (C) Fair-Probably Unsuted (D) Not Recommended (O) No Information



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Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Phosphoric Acid 85% Hot	D	C	A	A
Phosphorous Trichloride	D	B	A	A
Phthalic Acid	B	C	B	A
Phthalic Anhydride	B	C	B	A
Picric Acid	B	C	B	A
Pineapple Juice	C	C	A	A
Pine Oil	B	B	A	A
Potassium Bisulfite 10%	C	D	B	A
Potassium Bromide	C	D	B	A
Potassium Carbonate	D	C	A	A
Potassium Chlorate	D	B	A	A
Potassium Chloride	A	C	C	A
Potassium Chromate	B	O	B	A
Potassium Cyanide	D	B	B	A
Potassium Dichromate	B	B	A	A
Potassium Diphosphate	B	A	A	A
Potassium Ferricyanide	C	B	A	A
Potassium Ferrocyanide	B	B	A	A
Potassium Hydroxide (Dilute Cold)	D	A	A	A
Potassium Hydroxide (Dilute Hot)	D	B	A	B
Potassium Hydroxide (to 70% cold)	D	A	A	B
Potassium Hydroxide (to 70% hot)	B	A	A	B
Potassium Iodide	D	C	B	A
Potassium Nitrate	B	B	A	A
Potassium Permanganate	B	A	A	A
Potassium Sulfate	A	B	B	A
Potassium Sulfide 10%	B	C	B	A
Potassium Sulfite 10%	A	D	B	A
Producer Gas	A	B	B	A
Propane Gas	B	A	A	A
Propyl Alcohol	B	A	A	A
Propyl Bromide	B	O	B	A
Propylene Glycol	B	B	B	A
Pyrogalllic Acid	B	B	B	A
Quench Oil	A	A	A	A
Quinine Sulfate	O	O	A	A
Resins & Rosins	C	C	A	A
Road Tar	B	A	A	A
Roof Pitch	B	A	A	A
Rosin Emulsions	B	C	A	A
RP-1 Fuel	D	A	A	A
Rubber Latex Emulsions	D	B	A	A
Rubber Solvents	D	A	A	A
Salad Oil	D	C	B	A
Salicylic Acid	D	D	A	A

Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Salt (NaCl)	D	C	B	A
Salt Brine	B	O	A	A
Sea Water	C	D	A	A
Sewage	C	C	B	A
Shellac (Bleached)	B	A	A	A
Shellac (Orange)	B	A	A	A
Silicone Oils	A	A	A	A
Silver Cyanide	D	O	A	A
Silver Nitrate	D	D	A	A
Soap Solutions	A	A	A	A
Sodium Acetate	C	B	B	A
Sodium Aluminate	C	C	A	A
Sodium Bicarbonate	B	C	B	A
Sodium Bichromate	O	O	A	A
Sodium Bisulfate (10%)	B	D	A	A
Sodium Bisulfate (10%)	B	D	A	A
Sodium Borate	B	C	D	A
Sodium Bromide (10%)	B	C	B	A
Sodium Carbonate (Soda Ash)	B	B	B	A
Sodium Chlorate	B	C	B	A
Sodium Chloride	B	C	B	A
Sodium Chlorate	C	B	A	A
Sodium Citrate	O	O	A	A
Sodium Cyanide 10%	D	A	A	A
Sodium Fluoride	C	D	B	A
Sodium Hydroxide, Cold 20%	A	A	A	A
Sodium Hydroxide, Hot 20%	A	C	B	A
Sodium Hydroxide, Cold 50%	B	B	B	C
Sodium Hydroxide, Hot 50%	B	B	B	C
Sodium Hydroxide, Cold 70%	C	C	B	C
Sodium Hydroxide, Hot 70%	C	B	B	D
Sodium Hypochloride	D	D	D	A
Sodium Metaphosphate	C	A	B	A
Sodium Metasilicate (Cold)	B	C	A	A
Sodium Metasilicate (Hot)	B	D	A	A
Sodium Nitrate	B	B	B	A
Sodium Perborate	B	B	B	A
Sodium Peroxide	D	C	B	A
Sodium Phosphate	C	C	A	A
Sodium Phosphate (Dibasic)	B	B	B	A
Sodium Phosphate (Tribasic)	B	B	B	A
Sodium Silicate	A	A	A	A
Sodium Silicate (Hot)	B	B	B	A
Sodium Silicate Na2 SO4	B	B	A	A
Sodium Silicate NA2 SO2	D	B	B	A

(A) Excellent (B) Good (C) Fair-Probably Unsited (D) Not Recommended (O) No Information



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Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Sodium Sulfide (Hot)	D	C	B	A
Sodium Sulfite	C	O	A	A
Sodium Thiosulfate	B	B	A	A
Soyboean Oil	B	C	A	A
Starch	B	A	A	A
Stannic Chloride	C	D	D	A
Stannous Chloride	D	D	C	A
Steam (212 F)	A	A	A	A
Stearic Acid	C	C	A	A
Stoddard Solvent	B	B	B	A
Styrene	A	A	A	A
Sugar Liquids	A	B	A	A
Sugar, Syrups, and Jam	B	O	O	A
Sulfate, Black Liquor	C	C	B	A
Sulfate, Green Liquor	C	C	B	A
Sulfate, White Liquor	D	D	B	A
Sulfonic Acid	B	O	B	A
Sulfur	D	C	B	A
Sulfur Chlorides	B	D	D	A
Sulfur Dioxide, Dry	B	B	A	A
Sulfur Dioxide, Wet	D	O	A	A
Sulfur Hexafluoride	B	O	A	A
Sulfur, Molten	D	C	B	A
Sulfur Trioxide, Dry	B	B	A	A
Sulfuric Acid (0-7%)	C	D	B	A
Sulfuric Acid (20%)	C	D	D	A
Sulfuric Acid (50%)	B	D	D	A
Sulfuric Acid (100%)	A	B	A	A
Sulfuric Anydride	P	O	O	A
Sulfurous Acid	C	D	B	A
Synthesis Gas	B	B	B	A

Chemical	Bronze	Carbon Steel	316 S.S.	Reinforced TFE Seats
Tall Oil	B	B	B	A
Tannic Acid	B	C	B	A
Tar & Tar Oils	A	A	A	A
Tartic Acid	A	D	B	A
Tetaethyl Lead	B	C	B	A
Toluol (Toluene)	A	A	A	A
Tomato Juice	C	C	A	A
Transformer Oil	B	A	A	A
Tributyl Phosphate	A	A	A	A
Trichloroethylene	B	B	B	A
Tung Oil	B	B	A	A
Turpentine	B	B	B	A
Urea	B	C	B	A
Uric Acid	O	O	A	A
Varnish	A	C	A	A
Vegetable Oils	B	B	A	A
Vinegar	B	D	A	A
Vinyl Acetate	B	O	B	A
Water, Distilled	A	D	A	A
Water, Fresh	A	C	A	A
Water, Acid Mine	D	D	B	A
Water, Sea	B	D	A	A
Wax Emulsions	A	A	A	A
Waxes	A	A	A	A
Whiskey & Wines	A	D	A	A
Xylene	A	B	A	A
Zinc Bromide	B	O	B	A
Zinc Chloride	D	D	D	A
Zinc Hydrosulfite	C	A	A	A
Zinc Sulfate	B	D	B	A

(A) Excellent (B) Good (C) Fair-Probably Unsuted (D) Not Recommended (O) No Information

This chemical resistance guide has been compiled to assist in selecting chemical resistant material. The information given is intended as a guide only. Many conditions can affect the material choices. Careful consideration must be given to temperature, pressure and chemical concentrations before a final material can be selected.



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PRESSURE - TEMPERATURE RATINGS

BRONZE - GATE, GLOBE, ANGLE And Check Valves

MANUFACTURER'S STANDARDIZATION SOCIETY (MSS) STANDARD PRACTICE SP-80.

MSS-SP 80 provides a temperature pressure chart for 125,150, 200, 300 and 350 class bronze valves, covering temperatures from - 20°F. to 550* F.

There are some special exceptions noted such as temperature below -20* F. and for solder joints, but this is a chart that provides the basic temperature pressure relationships for the bronze valves themselves. The maximum recommended pressure temperature ratings for solder joints vary with the solder and the size and they are specified in ANSI B16. 18.

Press. Class End. Conn.	125	150		200	300			350
	THD	THD	FLG	THD	THD	THD	FLG	THD
Temp. deg. F	MATERIAL							
	ASTM B-62			ASTM B-61				
neg. 20* to 150*	200	300	225	400	1000	600	500	1000
200*	185	270	210	375	920	560	475	920
250*	170	240	195	350	830	252	450	830
300*	155	210	180	325	740	490	425	750
350*	140	180	165	300	650	450	400	670
400*	---	---	---	275	560	410	375	590
406*	125	150	150	---	---	---	---	---
450*	120	145	---	250	480	375	350	510
500*	---	---	---	225	390	340	325	430
550*	---	---	---	200	300	300	300	350



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PRESSURE - TEMPERATURE RATINGS

Iron - Gate, Globe And Check Valves

MANUFACTURER'S STANDARDIZATION SOCIETY (MSS)
STANDARD PRACTICE SP-70, SP-71 AND SP-85
MILWAUKEE ITON BODY GATE, GLOBE AND CHECK VALES

MAXIMUM ALLOWABLE NON-SHOCK PRESSURE			
Material	ASTM A126 CLASS B		
Class	125		250
Temperature Degrees F.	Sizes 2" - 12"	Sizes 14" - 24"	Sizes 2" - 12"
neg. 20* to 150*	200	150	500
200*	190	135	460
225*	180	130	440
250*	175	125	415
275*	170	120	395
300*	165	110	375
325*	155	105	355
350*	150	100	335
375*	145	---	315
400*	140	---	290
425*	130	---	270
450*	125	---	250



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STEAM TEMPERATURE PRESSURE TABLE

SATURATED STEAM TEMPERATURES

Inches Mercury Vacuum	Absolute Pressure (P.S.I.A.)	Temperature Of	Gauge Pressure (P.S.I.G.)	Temperature Of	Gauge Pressure (P.S.I.G.)	Temperature Of	Gauge Pressure (P.S.I.G.)	Temperature Of	Gauge Pressure (P.S.I.G.)	Temperature Of
29.74	0.089	32	0	212	135	358.3	285	417.2	570	483.4
29	0.451	76.5	2	218.5	140	360.8	290	418.7	580	485.2
28	0.942	99.7	4	224.4	145	363.4	295	420.2	590	487
27	1.43	114	6	229.8						
26	1.92	124.6	8	234.6	150	365.9	300	421.7	600	488.8
					155	368.3	310	424.6	650	497.4
25	2.42	133.3	10	239	160	370.6	320	427.4	700	505.4
24	2.91	140.3	15	249.7	165	372.9	330	430.3		
23	3.4	146.3	20	258.8	170	375.2	340	433	750	513.1
22	3.89	151.7							800	520.3
21	4.38	156.5	25	266.8	175	377.4	350	435.6	850	527.3
			30	274	180	379.5	360	438.2	900	533.9
20	4.87	161	35	280.6	185	381.7	370	440.8	950	540.3
19	5.36	165.2	40	286.7	190	383.7	380	443.3		
18	5.85	168.9	45	292.4	195	385.8	390	445.7	1000	546.4
17	6.35	172.5								
16	6.84	175.8	50	297.7	200	387.8	400	448.1		
			55	302.6	205	389.7	410	450.5		
15	7.33	178.9	60	307.3	210	391.7	420	452.8		
14	7.82	181.8	65	311.8	215	393.6	430	455.1		
13	8.31	184.6	70	316	220	395.4	440	457.3		
12	8.8	187.2								
11	9.29	198.7	75	320	225	397.3	450	459.5		
			80	323.9	230	399.1	460	461.7		
10	9.78	192.1	85	327.6	235	400.8	470	463.8		
9	10.27	194.4	90	331.1	240	402.6	480	465.9		
8	10.77	196.7	95	334.6	245	404.3	490	468		
7	11.26	198.8								
6	11.75	200.9	100	337.9	250	406	500	470		
			105	341.1	255	407.7	510	472		
5	12.24	202.9	110	344.1	260	409.3	520	474		
4	12.73	204.8	115	347.1	265	410.9	530	475.9		
3	13.22	206.7	120	350	270	412.5	540	477.8		
2	13.71	208.5								
1	14.2	210.3	125	352.8	275	414.1	550	479.7		
0	14.696	212	130	355.6	280	415.7	560	481.6		