

### Steel Pipe Data

Nom. Size, in.	Pipe OD, in	Schedule Number or weight	Wall Thkns t, in.	Inside Diam. d, in.	Surface Area		Cross Section		Weight of		Working Pressure ASTM A53 B to 400°		
					Outside, ft_/ft	Inside, ft_/ft	Metal Area, in_	Flow Area, in_	Pipe, lb/ft	Water, lb/ft	Mfr. Process	Joint Type	psig
1/4	0.540	40ST	0.088	0.364	0.141	0.095	0.125	0.104	0.424	0.045	CW	T	188
		80XS	0.119	0.302	0.141	0.079	0.157	0.072	0.535	0.031	CW	T	871
3/8	0.675	40ST	0.091	0.493	0.177	0.129	0.167	0.191	0.567	0.083	CW	T	203
		80XS	0.126	0.423	0.177	0.111	0.217	0.141	0.738	0.061	CW	T	820
1/2	0.840	40ST	0.109	0.622	0.220	0.163	0.250	0.304	0.850	0.131	CW	T	214
		80XS	0.147	0.546	0.220	0.143	0.320	0.234	1.087	0.101	CW	T	753
3/4	1.050	40ST	0.113	0.824	0.275	0.216	0.333	0.533	1.13	0.231	CW	T	217
		80XS	0.154	0.742	0.275	0.194	0.433	0.432	1.47	0.187	CW	T	681
1	1.315	40ST	0.133	1.049	0.344	0.275	0.494	0.864	1.68	0.374	CW	T	226
		80XS	0.179	0.957	0.344	0.251	0.639	0.719	2.17	0.311	CW	T	642
1-1/4	1.660	40ST	0.140	1.380	0.435	0.361	0.669	1.50	2.27	0.647	CW	T	229
		80XS	0.191	1.278	0.435	0.335	0.881	1.28	2.99	0.555	CW	T	594
1-1/2	1.900	40ST	0.145	1.610	0.497	0.421	0.799	2.04	2.72	0.881	CW	T	231
		80XS	0.200	1.500	0.497	0.393	1.068	1.77	3.63	0.765	CW	T	576
2	2.375	40ST	0.154	2.067	0.622	0.541	1.07	3.36	3.65	1.45	CW	T	230
		80XS	0.218	1.939	0.622	0.508	1.48	2.95	5.02	1.28	CW	T	551
2-1/2	2.875	40ST	0.203	2.469	0.753	0.646	1.70	4.79	5.79	2.07	CW	W	533
		80XS	0.276	2.323	0.753	0.608	2.25	4.24	7.66	1.83	CW	W	835
3	3.500	40ST	0.216	3.068	0.916	0.803	2.23	7.39	7.57	3.20	CW	W	482
		80XS	0.300	2.900	0.916	0.759	3.02	6.60	10.25	2.86	CW	W	767
4	4.500	40ST	0.237	4.026	1.178	1.054	3.17	12.73	10.78	5.51	CW	W	430
		80XS	0.337	3.826	1.178	1.002	4.41	11.50	14.97	4.98	CW	W	695
6	6.625	40ST	0.280	6.065	1.734	1.588	5.58	28.89	18.96	12.50	ERW	W	696
		80XS	0.432	5.761	1.734	1.508	8.40	26.07	28.55	11.28	ERW	W	1209
8	8.625	30	0.277	8.071	2.258	2.113	7.26	51.16	24.68	22.14	ERW	W	526
		40ST	0.322	7.981	2.258	2.089	8.40	50.03	28.53	21.65	ERW	W	643
		80XS	0.500	7.625	2.258	1.996	12.76	45.66	43.35	19.76	ERW	W	1106
10	10.75	30	0.307	10.136	2.814	2.654	10.07	80.69	34.21	34.92	ERW	W	485
		40ST	0.365	10.020	2.814	2.623	11.91	78.85	40.45	34.12	ERW	W	606
		XS	0.500	9.750	2.814	2.552	16.10	74.66	54.69	32.31	ERW	W	887

		80	0.593	9.564	2.814	2.504	18.92	71.84	64.28	31.09	ERW	W	1081
12	12.75	30	0.330	12.090	3.338	3.165	12.88	114.8	43.74	49.68	ERW	W	449
		ST	0.375	12.000	3.338	3.141	14.58	113.1	49.52	48.94	ERW	W	528
		40	0.406	11.938	3.338	3.125	15.74	111.9	53.48	48.44	ERW	W	583
		XS	0.500	11.750	3.338	3.076	19.24	108.4	65.37	46.92	ERW	W	748
		80	0.687	11.376	3.338	2.978	26.03	101.6	88.44	43.98	ERW	W	1076
14	14.00	30ST	0.375	13.250	3.665	3.469	16.05	137.9	54.53	59.67	ERW	W	481
		40	0.437	13.126	3.665	3.436	18.62	135.3	63.25	58.56	ERW	W	580
		XS	0.500	13.000	3.665	3.403	21.21	132.7	72.04	57.44	ERW	W	681
		80	0.750	12.500	3.665	3.272	31.22	122.7	106.05	53.11	ERW	W	1081
16	16.00	30ST	0.375	15.250	4.189	3.992	18.41	182.6	62.53	79.04	ERW	W	421
		40XS	0.500	15.000	4.189	3.927	24.35	176.7	82.71	76.47	ERW	W	596
18	18.00	ST	0.375	17.250	4.712	4.516	20.76	233.7	70.54	101.13	ERW	W	374
		30	0.437	17.126	4.712	4.483	24.11	230.3	81.91	99.68	ERW	W	451
		XS	0.500	17.000	4.712	4.450	27.49	227.0	93.38	98.22	ERW	W	530
		40	0.562	16.876	4.712	4.418	30.79	223.7	104.59	96.80	ERW	W	607
20	20.00	20ST	0.375	19.250	5.236	5.039	23.12	291.0	78.54	125.94	ERW	W	337
		30XS	0.500	19.000	5.236	4.974	30.63	283.5	104.05	122.69	ERW	W	477
		40	0.593	18.814	5.236	4.925	36.15	278.0	122.82	120.30	ERW	W	581

The table below indicates maximum working pressure of carbon steel pipes manufactured according [ASME/ANSI B 36.10](#) and ASTM A53 B:

Carbon Steel Pipes - Working Pressure							
Nominal Size (inches)	Pipe Outside Diameter OD (inches)	<a href="#">Schedule Number or weight</a>	Wall Thickness - t - (inches)	Inside Diameter - d - (inches)	Working Pressure ASTM A53 B to 400°F		
					Manu- facturing Process	Joint Type	psig
1/4	0.540	40ST	0.088	0.364	CW <sup>1)</sup>	T	188
		80XS	0.119	0.302	CW	T	871
3/8	0.675	40ST	0.091	0.493	CW	T	203
		80XS	0.126	0.423	CW	T	820
1/2	0.840	40ST	0.109	0.622	CW	T	214
		80XS	0.147	0.546	CW	T	753
3/4	1.050	40ST	0.113	0.824	CW	T	217
		80XS	0.154	0.742	CW	T	681
1	1.315	40ST	0.133	1.049	CW	T	226

		80XS	0.179	0.957	CW	T	642
1 1/4	1.660	40ST	0.140	1.380	CW	T	229
		80XS	0.191	1.278	CW	T	594
1 1/2	1.900	40ST	0.145	1.610	CW	T	231
		80XS	0.200	1.500	CW	T	576
2	2.375	40ST	0.154	2.067	CW	T	230
		80XS	0.218	1.939	CW	T	551
2 1/2	2.875	40ST	0.203	2.469	CW	W	533
		80XS	0.276	2.323	CW	W	835
3	3.500	40ST	0.216	3.068	CW	W	482
		80XS	0.300	2.900	CW	W	767
4	4.500	40ST	0.237	4.026	CW	W	430
		80XS	0.337	3.826	CW	W	695

6	6.625	40ST	0.280	6.065	ERW <sup>2)</sup>	W	696
		80XS	0.432	5.761	ERW	W	1209
8	8.625	30	0.277	8.071	ERW	W	526
		40ST	0.322	7.981	ERW	W	643
		80XS	0.500	7.625	ERW	W	1106
10	10.75	30	0.307	10.136	ERW	W	485
		40ST	0.365	10.020	ERW	W	606
		XS	0.500	9.750	ERW	W	887
		80	0.593	9.564	ERW	W	1081
12	12.75	30	0.330	12.090	ERW	W	449
		ST	0.375	12.000	ERW	W	528
		40	0.406	11.938	ERW	W	583
		XS	0.500	11.750	ERW	W	748

		80	0.687	11.376	ERW	W	1076
14	14.00	30ST	0.375	13.250	ERW	W	481
		40	0.437	13.126	ERW	W	580
		XS	0.500	13.000	ERW	W	681
		80	0.750	12.500	ERW	W	1081
16	16.00	30ST	0.375	15.250	ERW	W	421
		40XS	0.500	15.000	ERW	W	596
18	18.00	ST	0.375	17.250	ERW	W	374
		30	0.437	17.126	ERW	W	451
		XS	0.500	17.000	ERW	W	530
		40	0.562	16.876	ERW	W	607
20	20.00	20ST	0.375	19.250	ERW	W	337
		30XS	0.500	19.000	ERW	W	477

		40	0.593	18.814	ERW	W	581
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<sup>1)</sup> CW - continuous weld - a method of producing small diameter pipe (1/2-4")

<sup>2)</sup> ERW - electric resistance weld - most common form of manufacture for pipe in sizes from 2 3/8-22" OD

- $1 \text{ in (inch)} = 25.4 \text{ mm}$
- $1 \text{ psi (lb/in}^2\text{)} = 6,894.8 \text{ Pa (N/m}^2\text{)} = 6.895 \times 10^{-2} \text{ bar}$

Sponsored Links

**TABLE C4.9** Material Application Chart for Water Systems\*,†,‡

Line	Pipe							Fitting		
	Material	ASTM standard	Mfr. process	Wall thickness	Joint	Pressure rating			Material	Class
						@ 75°F (psig)	@ 150°F (psig)	@ 220°F (psig)		
In the building or above ground										
NPS 2 and smaller										
G. (1)	Steel	A 53 B	Type F(CW)	Std.	Thread	230	230	230	Cast iron	125
(2)	Steel	A 53 B	Type F(CW)	Std.	Groove	275	275	275	D.I. or M.I.	
(3)	Steel	A 53 B	Type F(CW)	Sch 10	Roll groove	400	400	400		
(4)	Copper	B 88	Drawn	Type L	95-5 solder	400	350	220	Wrought copper	
(5)	Copper	B 88	Drawn	Type K	Braze	380	380	300	Wrought copper	
(6)	Steel	A 53 B	Seamless	Std	Thread	510	510	510	Cast iron	250
(7)	Steel	A 53 B	Seamless	Std	Groove	605	605	605	Malleable iron	150
(8)	CPVC	F441	Seamless	Sch 40	Solvent	280	125	NR	CPVC	Sch 40
NPS 2½–12										
H. (1)	Steel	A 53 B	ERW	Std	Weld	530	530	530	Wrought steel	Std
(2)	Steel	A 53 B	ERW	Std	Groove	310	310	310	D.I. or M.I.	
(3)	Steel	A 53 B	Seamless	Std	Weld	620	620	620	Cast iron	125
(4)	Steel	A 53 B	Seamless	Std	Groove	365	365	365	Wrought steel	150
(5)									Std ERW steel unreinforced 90° weld branch	
(6)									Wrought steel	300
(7)	Copper	B 88	Drawn	Type L	95-5 solder	150	150	130	Wrought copper	
(8)	Copper	B 88	Drawn	Type L	Braze	260	220	190	Wrought copper	
(9)	Copper	B 88	Drawn	Type K	Braze	380	320	285		
(10)	Copper (to 6 in)	B 88	Drawn	Type L	Roll groove	300	300	300	Wrought copper	(to 6 in)
(11)	CPVC	F 441	Seamless	Sch 40	Solvent	130	70	NR	CPVC (to 6 in)	Sch 40
(12)	CPVC	F 441	Seamless	Sch 80	Solvent	230	105	NR	CPVC (to 6 in)	Sch 80
NPS 14–20										
I. (1)	Steel	A 53 B	ERW	Std	Weld	335	335	335	Wrought steel	Std
(2)	Steel	A 53 B	ERW	Std	Groove	195	195	195	D.I. or M.I.	
(3)	Steel	A 53 B	Seamless	Std	Weld	395	395	395	Cast iron	125
(4)	Steel	A 53 B	Seamless	Std	Groove	230	230	230	Wrought steel	150
(5)									Std ERW steel unreinforced 90° weld branch	
(6)									Wrought steel	300

**MATERIAL SELECTION**

The selection of the material to be used for each system is based on an evaluation of the following factors:

1. Requirements and limitations of the building and piping codes
2. The fluid in the pipe
3. The pressure and temperature of the fluid in the pipe
4. The location and external environment of the pipe

Fitting					Valve						
Joint	ASTM standard	Pressure rating			Class	Material	Type	Joint	Pressure rating		
		@ 75°F (psig)	@ 150°F (psig)	@ 220°F (psig)					@ 75°F (psig)	@ 150°F (psig)	@ 220°F (psig)
		Thread	B 16.4	175					175	160	125
Groove	—	500	500	500		Bronze	Ball	Thread	400	400	400
95-5 solder	B 16.22	375	320	220	200	Bronze	Ball	95-5 solder	400	350	220
Brazed	B 16.22	445	375	310		Bronze	Gate	Thread	400	400	365
Thread	B 16.4	400	400	360							
Thread	B 16.3	300	300	255							
Solvent	F 438	280	125	NR		CPVC	Ball	Socket	150	100	NR
Weld	B 16.9	510	510	510	125	Cast iron	Gate	Flange	150	150	130
Groove	—	500	500	500	150	Ductile iron	Gate	Flange	250	250	230
Flange	B 16.1	200	200	180	250	Cast iron	Gate	Flange	500	500	445
Flange	B 16.5	285	270	250		Buna-N liner	Butterfly	Wafer	150	150	NR
		375	375	375		EPDM liner	Butterfly	Wafer	150	150	150
						Hi-service	Butterfly	Lug	250	250	250
Flange	B 16.5	720	710	695							
95-5 solder	B 16.22	150	150	130	200	Cast iron	Plug	Flange	200	200	180
Braze	B 16.22	380	320	285		500	Cast iron	Plug	Flange	500	500
Roll groove	—	300	300	300							
Solvent	F 438	180	80	NR							
Solvent	F 439	280	125	NR							
Weld	B 16.9	400	400	400	125	Cast iron	Gate	Flange	150	150	130
Groove	—	300	300	300	150	Ductile iron	Gate	Flange	250	250	230
Flange	B 16.1	150	150	130	250	Cast iron	Gate	Flange	300	300	275
Flange	B 16.5	275	255	235		Buna-N liner	Butterfly	Wafer	150	150	NR
		230	230	230		EPDM liner	Butterfly	Wafer	150	150	150
Flange	B 16.5	720	710	695		Hi-service	Butterfly	Lug	250	250	250

### 5. Availability of the material

### 6. The expected life of the facility where the system is to be installed

### 7. The installed cost of the system

The first four factors relate to safety and are of primary importance. The last three are related to the economics of the project and are weighted to suit.

## Steam and Condensate Systems (to 150 psig) (1035 kPa)

Steel pipe is used for steam and condensate systems. Fittings for sizes under NPS 2½ (DN 65) are threaded cast iron. Larger fittings are steel with welding ends.

**TABLE C4.9** Material Application Chart for Water Systems\*,†,‡ (Continued)

Line	Pipe								Fitting	
	Material	ASTM standard	Mfr. process	Wall thickness	Joint	Pressure rating			Material	Class
						@ 75°F (psig)	@ 150°F (psig)	@ 220°F (psig)		
	Below ground (Corrosion protected materials from lines G, H, I may be used underground.)									
J. (1)	NPS 4–20 Ductile iron	A 21.51	Cast	Class 50	Mech. jt.	300	300	—	Ductile iron	Class B
(2)	Ductile iron	A 21.15	Cast	Class 50	Flange	250	250	—	Ductile iron	Class B
K. (1)	NPS 2–16 RTRP-11AF	D 2996	Fil. wound	—	B&S adhesive	150	150	@ 210°F 150	RTRP-11AF	
L. (1)	NPS 4–24 PVC	AWWA C900	Seamless	Class 100	B&S O-ring	100	@ 100°F 60	NR	Ductile iron	Class B
(2)	PVC	AWWA C900	Seamless	Class 150	B&S O-ring	150	90	NR		
(3)	PVC	AWWA C900	Seamless	Class 200	B&S O-ring	200	120	NR		

\* Pressure ratings for steel pipe are calculated using (a) a mill tolerance or –12.5% of the wall thickness, (b) the thread or groove depth where used, and (c) a corrosion allowance of 0.025 to NPS 2 and 0.065 for NPS 2½ and larger. No pipe-wall reinforcement value is applied for the strength of threaded fittings or grooved couplings.

† Copper tube pressures are based on the joint strength when soldered or brazed.

‡ Pressure ratings are for the largest pipe size in each group. Smaller pipe sizes have higher ratings.

Bronze valves are used for small sizes and cast or ductile iron, as required by the pressure, for valves NPS 2½ (DN 65) and over. Large gate valves in high-pressure systems should be provided with a bypass to allow warm-up of the downstream pipe before full opening. Equalizing the pressure with a bypass also allows the valve to open.

Ball valves and special steam butterfly valves may be used, but only if the valve has a gear operator so it cannot be opened rapidly. Ball valves can be used for small valves on low-pressure systems.

Copper tubing with brazed joints may be used up to 120 psig (827 kPa). The high energy content of steam makes mechanically restrained joints preferred. However, when space is limited, copper tubing with wrought brazed fittings, which is a much less bulky system than steel, can be used. Welding and brazing should be performed by qualified operators.

Steam condensate piping requires additional attention, since condensate corrodes steel pipe. To lengthen the life of small size pipe, extra heavy weight pipe is often specified. For larger pipe sizes, the increased wall thickness of standard weight pipe provides added material to prolong pipe life. For small low-pressure systems, copper tube with 95-5 solder joints may be used. Fittings and valves for condensate are the same as those used for steam.

Table C4.8 shows some of the materials which can be used for steam and condensate service. Code pressure ratings for the various components or joints are



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## **GUIDELINE FOR DETERMINING THE MAXIMUM WORKING PRESSURE IN PSI, CALCULATIONS ARE BASED ON ASME B31.1 POWER PIPING CODE**

CONTINUOUS WELD PIPE ASTM A 53 TYPE F GRADE A, APL5L GRADE A25 PSL				
	SCHEDULE 40		SCHEDULE 80	
NPS	PLAIN END	THREADED	PLAIN END	THREADED
1/2	1750	750	2500	1400
3/4	1450	650	2050	1150
1	1350	550	1900	1050
1 1/4	1100	500	1550	900
1 1/2	1000	450	1400	850
2	850	400	1200	800
2 1/2	900	400	1250	750
3	800	400	1150	700
3 1/2	700	350	1050	650
4	650	350	950	650

  

ELECTRIC RESISTANCE WELD PIPE ASTM A 53 GRADE B & API5L GRADE B PSL 1				
	SCHEDULE 40		SCHEDULE 80	
NPS	PLAIN END	THREADED	PLAIN END	THREADED
1	2400	1000	3350	1900
1 1/4	2000	900	2800	1650
1 1/2	1800	850	2500	1550
2	1500	750	2200	1400
2 1/2	1650	750	2300	1350
3	1400	700	2000	1250
3 1/2	1300	650	1850	1200
4	1200	650	1750	1150
5	1050	600	1550	1100
6	950	600	1500	1100
8	850	550	1350	1050

**A SAFETY FACTOR SHOULD ALWAYS BE INCULDED WHEN USING THE ABOVE PRESSURES. WORKING PRESSURES ARE THEORETICAL; THE ACTUAL WORKING PRESSURE MAY VARY BASED ON DESIGN CALCULATIONS.**

Safety Factor	Multiplier
5	0.80
6	0.67
7	0.57
8	0.50
9	0.44
10	0.40

A safety factor of 8 would be suitable for the majority of applications, local codes or specific applications may require a higher safety factor. A piping design engineer should be consulted for specific applications. To determine a safe working pressure using a safety factor, multiply the values found in the tables by one of the above multipliers.

Note:

1. The pressures listed are based on ASME B31.1 Power Piping Code.
2. No provision is made for abnormal or unusual conditions
3. No allowance for the coupling design or limitations
4. No allowance for the thinning of the pipe wall due to corrosion, bending etc.
5. Temperature rating: -20 degrees to 400 degrees Fahrenheit.
6. ERW or CW pipe may not be suitable for specific applications, consult a piping design engineer for specific applications.

### LIGHT WALL SPRINKLER PIPE MAXIMUM WORKING PRESSURE

Type	Maximum Pressure in PSI
WST, Wheatland Super Tube	175
WLS, MEGA-FLOW, MLT, GL, MEGA-THREAD & SCH. 10	300

All information contained herein is accurate at the time of publication. Wheatland Tube Company reserves the right to change without notice and without incurring obligations.