



TECH TIP #44

PIPE PRESSURE AND TEMPERATURE DESIGN LIMITS

2004 ASHRE Systems and Equipment Handbook

Table 5 Application of Pipe, Fittings, and Valves for Heating and Air Conditioning

Application	Pipe Material	Weight	Joint Type	Class	System		
					Fitting Material	Temperature, °F	Maximum Pressure at Temperature ^a , psig
Recirculating Water 2 in. and smaller	Steel (CW)	Standard	Thread	125	Cast iron	250	125
	Copper, hard	Type L	Braze or silver solder ^b		Wrought copper	250	200
	PVC	Sch 80	Solvent	Sch 80	PVC	75	
	CPVC	Sch 80	Solvent	Sch 80	CPVC	150	
	PB	SDR-11	Heat fusion		PB	160	
			Insert crimp		Metal	160	
2.5 to 12 in.	A53 B ERW Steel	Standard	Weld	Standard	Wrought steel	250	400
			Flange	150	Wrought steel	250	250
			Flange	125	Cast iron	250	175
			Flange	250	Cast iron	250	400
			Groove		MI or ductile iron	230	300
	PB	SDR-11	Heat fusion		PB	160	
	Steam and Condensate 2 in. and smaller	Steel (CW)	Standard ^c	Thread	125	Cast iron	
Thread				150	Malleable iron		90
A53 B ERW Steel		Standard ^c	Thread	125	Cast iron		100
			Thread	150	Malleable iron		125
A53 B ERW Steel		XS	Thread	250	Cast iron		200
		Thread	300	Malleable iron		250	
2.5 to 12 in.	Steel	Standard	Weld	Standard	Wrought steel		250
			Flange	150	Wrought steel		200
			Flange	125	Cast iron		100
	A53 B ERW Steel	XS	Weld	XS	Wrought steel		700
			Flange	300	Wrought steel		500
			Flange	250	Cast iron		200
Refrigerant	Copper, hard	Type L or K	Braze		Wrought copper		
	A53 B SML Steel	Standard	Weld		Wrought steel		
Underground Water							
Through 12 in.	Copper, hard	Type K	Braze or silver solder ^b		Wrought copper	75	350
Through 6 in.	Ductile iron	Class 50	MJ	MJ	Cast iron	75	250
	PB	SDR 9, 11	Heat fusion		PB	75	
		SDR 7, 11.5	Insert crimp		Metal	75	
Potable Water, Inside Building	Copper, hard	Type L	Braze or silver solder ^b		Wrought copper	75	350
	Steel, galvanized	Standard	Thread	125	Galv. cast iron	75	125
				150	Galv. mall. iron	75	125
	PB	SDR-11	Heat fusion		PB	75	
			Insert crimp		Metal	75	

^aMaximum allowable working pressures have been derated in this table. Higher system pressures can be used for lower temperatures and smaller pipe sizes. Pipe, fittings, joints, and valves must all be considered.

^bLead- and antimony-based solders should not be used for potable water systems. Brazing and silver solders should be employed.

^cExtra strong pipe is recommended for all threaded condensate piping to allow for corrosion.

From Chapter 41, "Pipes, Tubes and Fittings", Page 41.6



TECH TIP #44 (Cont)

STANDARD STEEL PIPE (SCH 40)

Nominal Size, Inches	WEIGHT, LBS. PER FT.		Wall Thickness, Inches	DIAMETER		Threads Per Inch	COUPLINGS			TEST PRESSURES, PSI *
	Threaded & Coupled	Plain End		Outside, Inches	Inside, Inches		Length, Inches	Outside Diameter, Inches	Wt. Per Piece, Pounds	A 53
1/8	.24	.24	.068	.405	.269	27	13/16	.563	.03	700
1/4	.42	.42	.088	.540	.364	18	1 3/16	.719	.07	700
3/8	.57	.57	.091	.675	.493	18	1 3/16	.875	.09	700
1/2	.85	.85	.109	.840	.622	14	1 9/16	1.063	.17	700
3/4	1.13	1.13	.113	1.050	.824	14	1 5/8	1.313	.26	700
1	1.68	1.68	.133	1.315	1.049	11 1/2	2	1.576	.40	700
1 1/4	2.28	2.27	.140	1.660	1.380	11 1/2	2 1/16	1.900	.48	1000
1 1/2	2.73	2.72	.145	1.900	1.610	11 1/2	2 1/16	2.200	.67	1000
2	3.68	3.65	.154	2.375	2.067	11 1/2	2 1/8	2.750	1.05	1000
2 1/2	5.82	5.79	.203	2.875	2.469	8	3 1/8	3.250	2.09	1000
3	7.62	7.58	.216	3.500	3.068	8	3 1/4	4.000	3.35	1000
3 1/2	9.20	9.11	.226	4.000	3.548	8	3 3/8	4.625	4.82	1200
4	10.89	10.79	.237	4.500	4.026	8	3 1/2	5.000	4.61	1200

EXTRA STRONG STEEL PIPE (SCH 80)

Nominal Size, Inches	WEIGHT, LBS. PER FT.		Wall Thickness, Inches	DIAMETER		Threads Per Inch	COUPLINGS			TEST PRESSURES, PSI *
	Threaded & Coupled	Plain End		Outside, Inches	Inside, Inches		Length, Inches	Outside Diameter, Inches	Wt. Per Piece, Pounds	A 53
1/8	.31	.31	.095	.405	.215	27	1 1/16	.563	.04	850
1/4	.54	.54	.119	.540	.302	18	1 5/8	.719	.09	850
3/8	.74	.74	.126	.675	.423	18	1 5/8	.875	.13	850
1/2	1.09	1.09	.147	.840	.546	14	2 1/8	1.063	.24	850
3/4	1.48	1.47	.154	1.050	.742	14	2 1/8	1.313	.34	850
1	2.18	2.17	.179	1.315	.957	11 1/2	2 5/8	1.576	.54	850
1 1/4	3.02	3.00	.191	1.660	1.278	11 1/2	2 3/4	2.054	.03	1300
1 1/2	3.66	3.63	.200	1.900	1.500	11 1/2	2 3/4	2.200	.90	1300
2	5.07	5.02	.218	2.375	1.939	11 1/2	2 7/8	2.875	1.86	1300
2 1/2	7.73	7.66	.276	2.875	2.323	8	4 1/8	3.375	3.27	1300
3	10.33	10.25	.300	3.500	2.900	8	4 1/4	4.000	4.09	1300
3 1/2	12.63	12.51	.318	4.000	3.364	8	4 3/8	4.625	5.92	1700
4	15.17	14.98	.337	4.500	3.826	8	4 1/2	5.200	7.59	1700

7

* Test pressures are pressures used at the mill for leak checks. See previous page for pressure limit guides.



TECH TIP #44 (Cont)

PVC & CPVC PIPE PRESSURE LIMITS



Pressure/Temperature Relationship

MAXIMUM OPERATING PRESSURE — PSI (WATER @ 73°F)

Nominal Pipe Size (IPS)	Schedule 40 PVC and CPVC	Schedule 80 PVC			Schedule 80 CPVC	SDR Pressure Rated Pipe ⁴ PVC Plain and Belled End		
	Plain & Belled ¹	Plain End	Threaded ²	Roll Grooved	Plain End ³	SDR 26	SDR 21	SDR 13.5
1/4"	NA	1130	NA	NA	NA	NA	NA	NA
1/2"	600	850	420	NA	850	NA	NA	315
3/4"	480	690	340	NA	690	NA	200	—
1"	450	630	320	NA	630	NA	200	—
1 1/4"	370	520	260	NA	520	160	200	—
1 1/2"	330	470	240	NA	470	160	200	—
2"	280	400	200	400	400	160	200	—
2 1/2"	300	420	210	420	420	160	200	—
3"	260	370	190	370	370	160	200	—
4"	220	320	160	320	320	160	200	—
5"	190	290	NR	290	290	160	200	—
6"	180	280	NR	280	280	160	200	—
8"	160	250	NR	250	250	160	200	—
10"	140	230	NR	230	230	160	200	—
12"	130	230	NR	230	230	160	200	—
14"	130	220	NR	220	NA	160	200	—
16"	130	220	NR	220	NA	160	200	—

(NR-Not Recommended)
(NA-Not Available)

1. Threading Schedule 40 and SDR/PR pipe is not recommended.
2. Threading Schedule 80 pipe above 4" is not recommended.

3. CPVC threaded connections should be avoided when possible at elevated temperatures and pressures. (Consult factory.)
4. Standard dimensional ratio pipe (SDR) will carry the same pressure rating for all diameters according to the SDR number.

The operating pressures listed above are based on the hydrostatic design of the product using water as a test medium at 73°F. Compounding nomenclature for Eslon PVC is PVC 1120 with a cell class of 12454-B. For Eslon CPVC pipe it is CPVC 4120 with a cell class of 23447-A.

For schedule-rated products and SDR/PR pipe, the following equation was used to determine operating pressures for outside diameter controlled pipe:

$$P = \frac{2ST}{D - T}$$

Where: P = pressure (PSI)
D = average outside diameter
T = minimum wall thickness
S = hydrostatic design stress (HDS)
for Eslon PVC Type I, Grade 1,
HDS = 2,000 PSI
Eslon CPVC also = 2,000 PSI

The following temperature corrections must be used to derate all PVC and CPVC pipe, valves and fittings when operating temperatures are expected to exceed 73°F.

The working pressure of PVC and CPVC pipe is directly affected by temperature changes. When the operating temperature of the pipe increases, the pipe loses its stiffness and tensile strength decreases. A drop in pressure capacity results. The drop can be calculated using this chart. Multiply the pipe's maximum working pressure by the temperature correction factor for a known temperature.

Example: For 2" Schedule 80 PVC pipe, the maximum working pressure is 400 psi. If the operating temperature is known to be 110°F, the correction factor can be found on the chart to be 0.50. The adjusted pressure would then be 400 × 0.50 = 200 psi.

TEMPERATURE CORRECTION FACTORS

Operating Temperature (°F)	70	80	90	100	110	115	120	125	130	140	150	160	170	180	200
PVC 1120	1.00	.88	.75	.62	.50	.45	.40	.35	.30	.22	Not Recommended				
CPVC 4120	1.00	1.00	.91	.82	.77	.74	.65	.66	.62	.50	.47	.40	.32	.25	.20

CAUTION: Eslon Thermoplastics does not recommend its products for use in air or compressed gas systems.