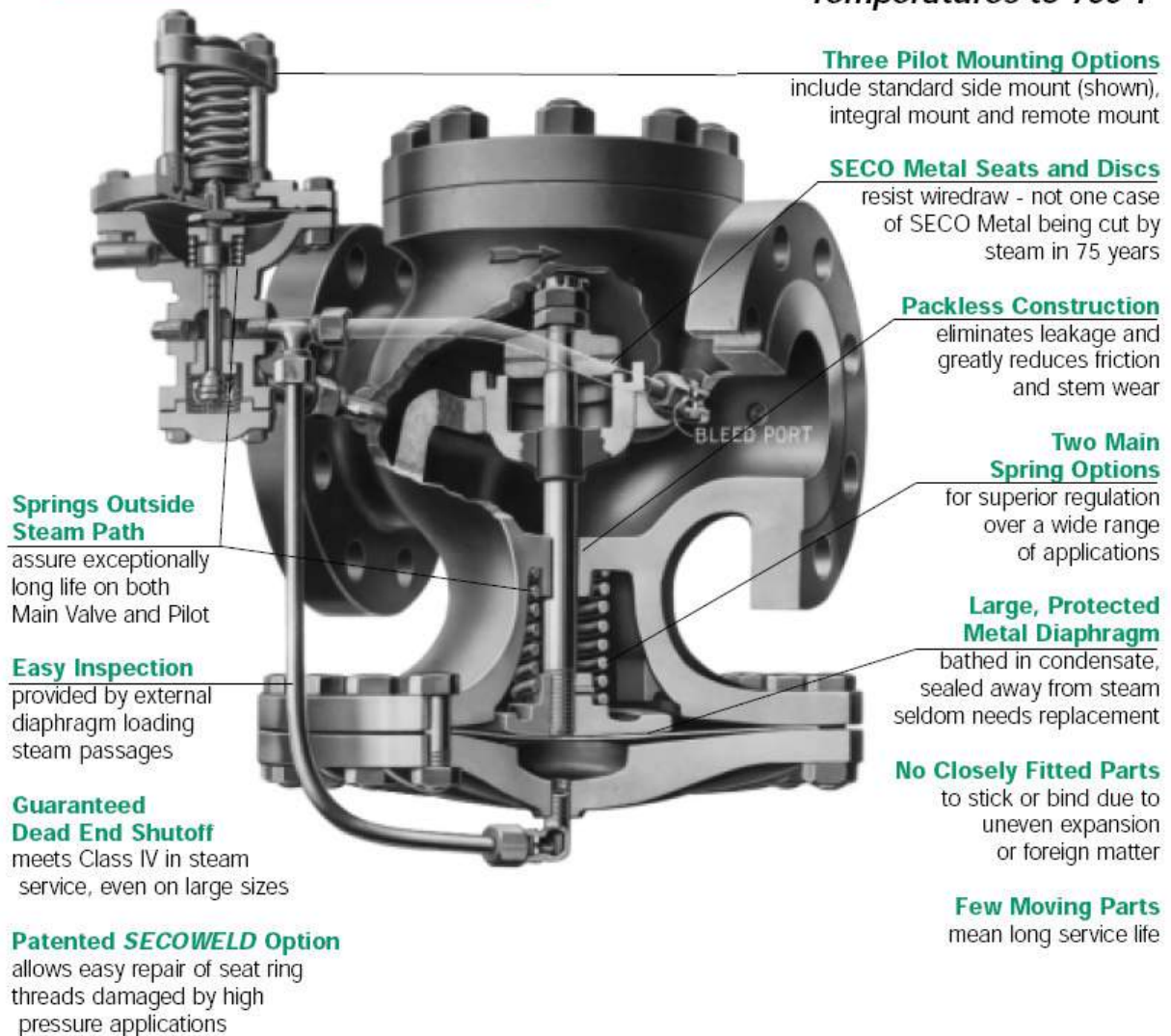


Applications

- Pressure Regulation for Steam Distribution
- Single Point or Multiple Use Applications
- Pressure Control for Steam Plants
- District Heating Systems
- Single Stage Reduction Stations
- Two Stage Reduction Stations
- Parallel Reduction Stations

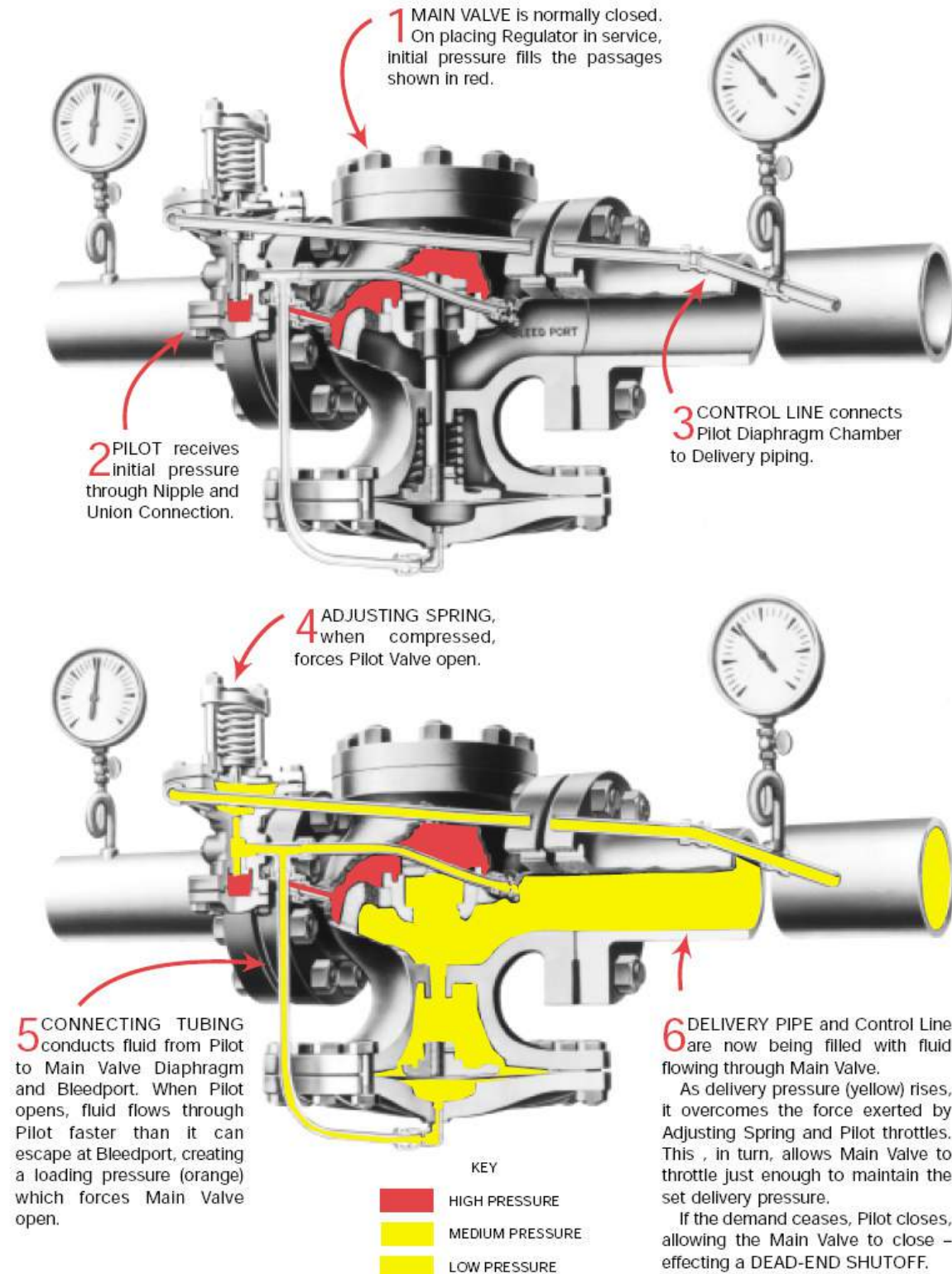
Iron Horse ED Series Pressure Regulator

**Pressures To 600 PSIG
Temperatures to 750°F**



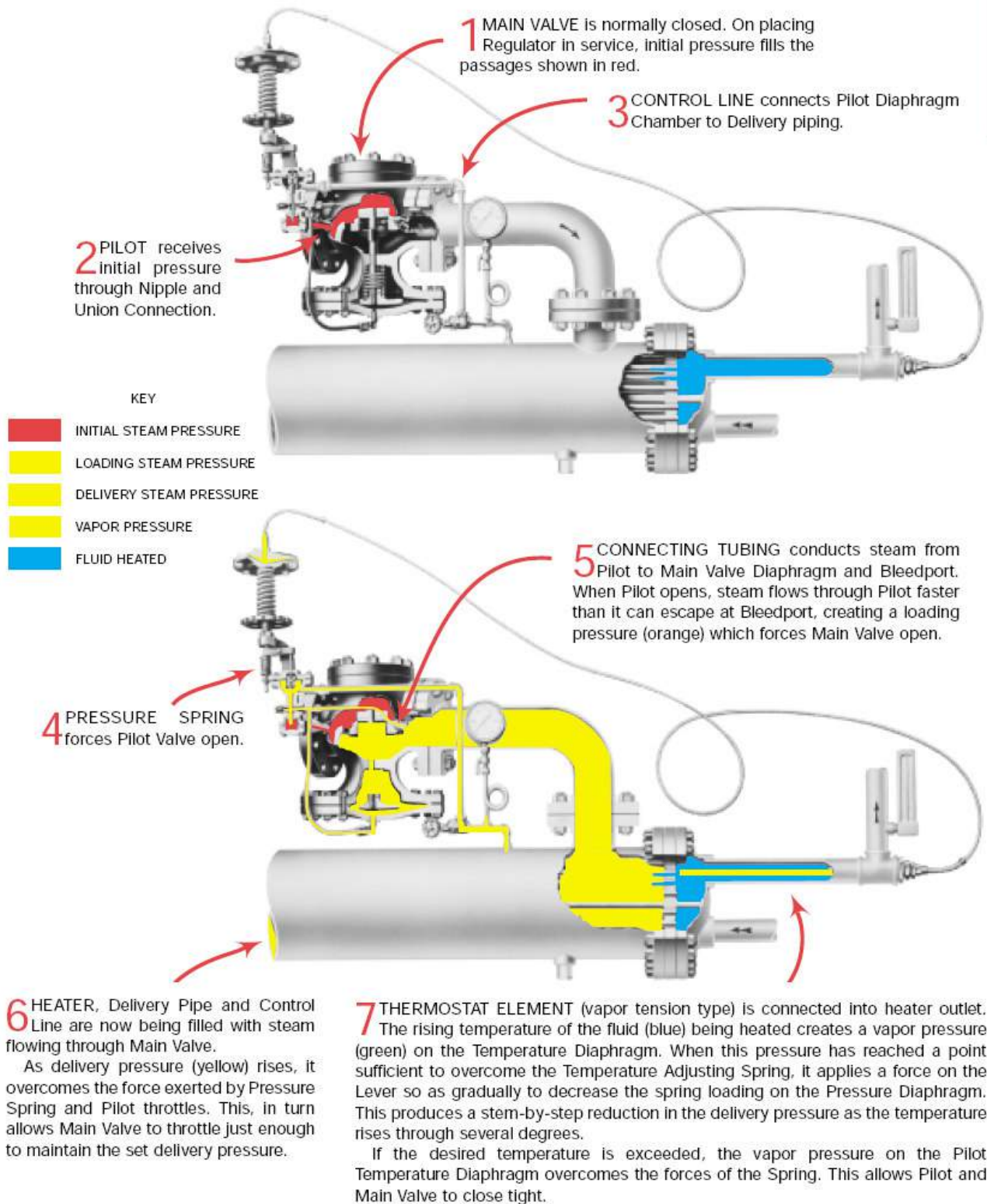
THE OPERATING CYCLE OF A SPENCE PRESSURE REGULATOR

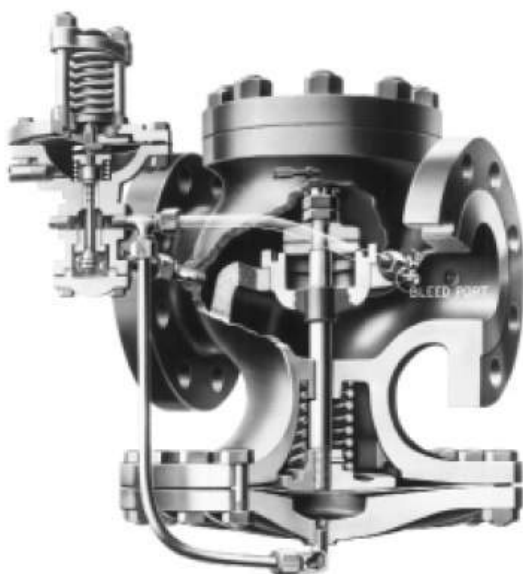
The basic Type ED has been selected to illustrate the operation of a SPENCE Pilot Operated Pressure Regulator. This presentation describes the successive steps in the mechanical cycle of the Regulator.



THE OPERATING CYCLE OF A SPENCE TEMPERATURE REGULATOR

The Type ET134 has been selected to illustrate the operation of a SPENCE Pilot Operated Temperature Regulator. This presentation describes the successive steps in the mechanical cycle of the Regulator.





TYPE ED SERIES PRESSURE REGULATOR

CAST IRON or STEEL
PRESSURES to 600 PSIG at 750°F

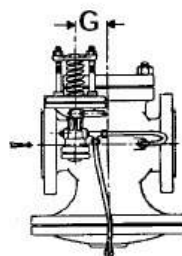
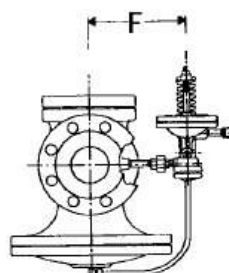
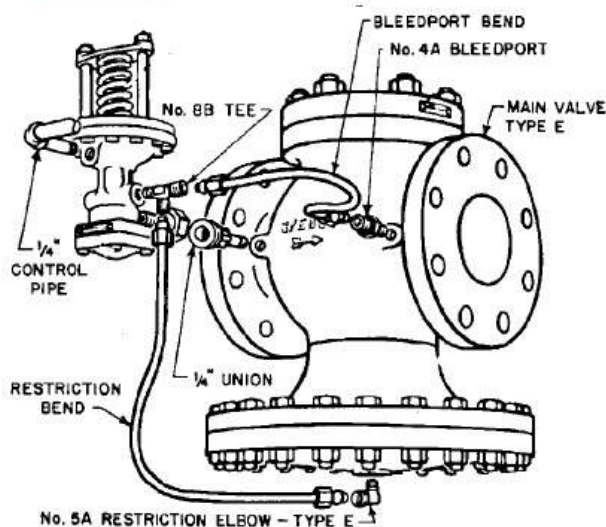
APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Single Point or Multiple use Applications
- Pressure Control for Steam Plants
- District Heating Systems
- Single Stage Reductions
- Two Stage Reductions
- Parallel Reduction

TYPE ED PRESSURE REGULATOR

VALVE INFO
PAGE 28

PILOT INFO
PAGE 48



Valve is tapped so that
Pilot may be mounted
on either side.

DIMENSIONS inches (mm)

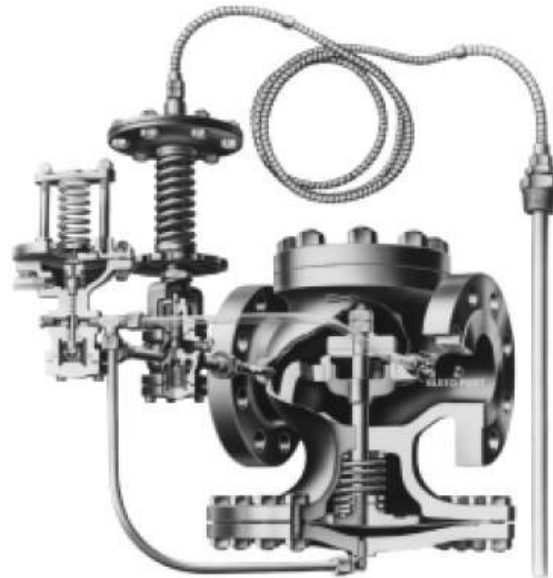
SIZE	F	G
3/8 (10)	5 3/8 (136)	1 1/4 (32)
1/2 (15)	5 3/8 (136)	1 1/4 (32)
3/4 (20)	5 3/8 (136)	1 3/8 (35)
1 (25)	5 3/4 (146)	1 1/2 (38)
1 1/4 (32)	6 (152)	1 7/8 (48)
1 1/2 (40)	6 1/4 (159)	2 (51)
2 (60)	6 5/8 (168)	2 1/8 (54)
2 1/2 (65)	6 3/4 (171)	2 3/8 (60)
3 (80)	7 1/4 (184)	2 3/4 (70)
4 (100)	8 (203)	3 1/2 (89)
5 (125)	9 (229)	3 1/2 (89)
6 (150)	9 7/8 (251)	4 (102)
8 (200)	10 1/2 (267)	6 1/4 (159)
10 (250)	12 1/2 (318)	6 (152)
12 (300)	14 (356)	8 1/2 (216)

TYPE ET14D PRESSURE LIMITING TEMPERATURE REGULATOR

CAST IRON or STEEL
CONTROLS 20 to 500°F

APPLICATION DATA

- Temperature & Pressure Regulation for large volume Heat Exchangers
- Storage Heaters
- Jacketed Kettles
- Vats

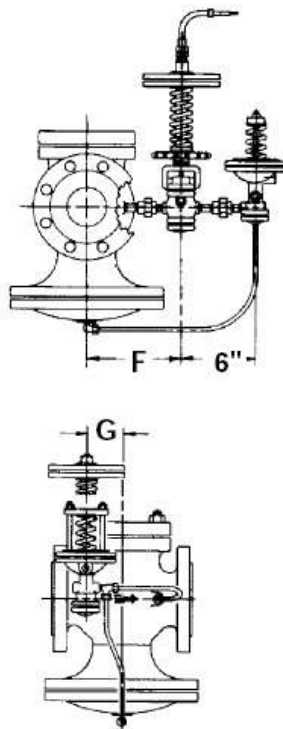


TYPE ET14D
TEMP. REGULATOR

TYPE ET14D TEMPERATURE
& PRESSURE REGULATOR

DIMENSIONS inches (mm)

SIZE	F	G
3/8 (10)	5 3/8 (136)	1 1/4 (32)
1/2 (15)	5 3/8 (136)	1 1/4 (32)
3/4 (20)	5 5/8 (143)	1 3/8 (35)
1 (25)	5 3/4 (146)	1 1/2 (38)
1 1/4 (32)	6 (152)	1 7/8 (48)
1 1/2 (40)	6 1/4 (159)	2 (51)
2 (50)	6 3/8 (168)	2 1/8 (54)
2 1/2 (65)	6 3/4 (171)	2 3/8 (60)
3 (80)	7 1/4 (184)	2 3/4 (70)
4 (100)	8 (203)	3 1/2 (89)
5 (125)	9 (229)	3 1/2 (89)
6 (150)	9 7/8 (251)	4 (102)
8 (200)	10 1/2 (267)	6 1/4 (159)
10 (250)	12 1/2 (318)	6 (152)
12 (300)	14 (356)	8 1/2 (216)

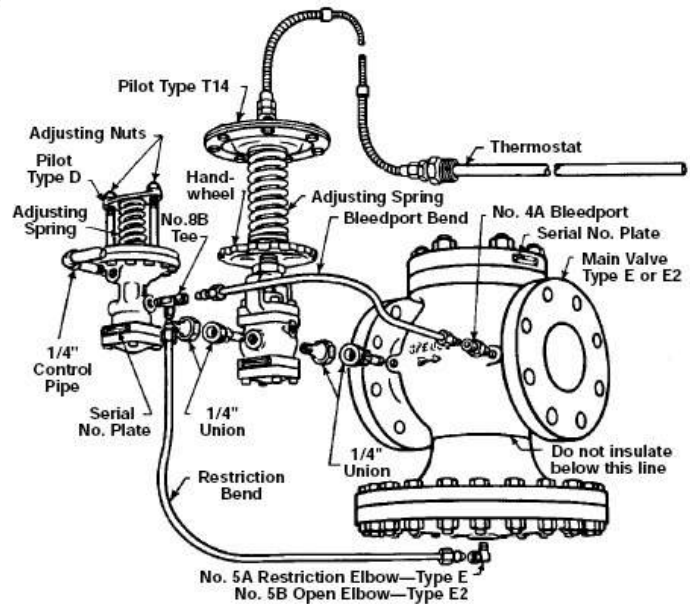


Valve is tapped so that
Pilot may be mounted on
either side.

VALVE INFO
PAGE 28

D PILOT INFO
PAGE 48

T14 PILOT INFO
PAGE 76

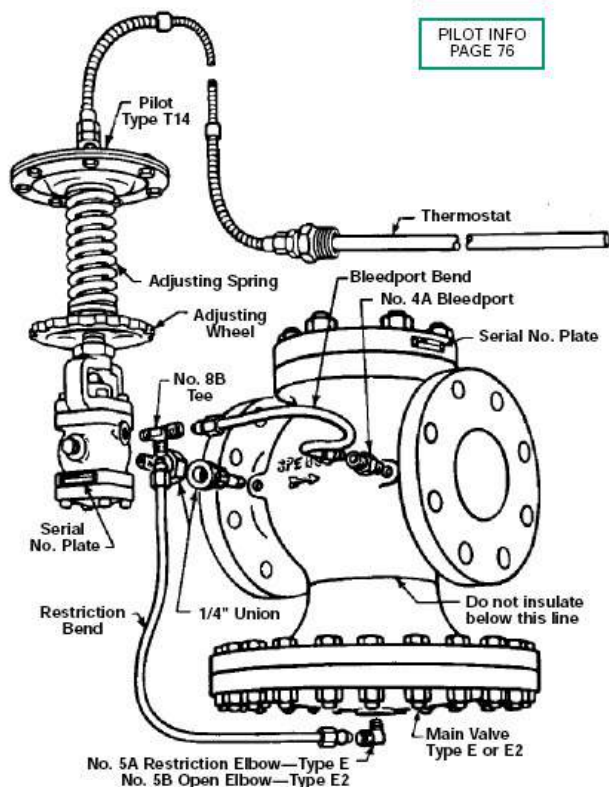




TYPE ET14 TEMPERATURE REGULATOR

VALVE INFO
PAGE 28

PILOT INFO
PAGE 76



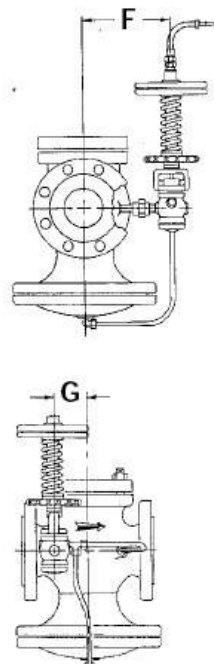
TYPE ET14 TEMPERATURE REGULATOR

CAST IRON or STEEL
CONTROLS 20 to 500°F

APPLICATION DATA

- Temperature Regulation for Batch Process
- Storage Heaters (Water, Fuel Oil or Chemical)
- Air Heating

DIMENSIONS inches (mm)



Valve is tapped so that
Pilot may be mounted
on either side.

SIZE	F	G
3/8 (10)	5 3/8 (136)	1 1/4 (32)
1/2 (15)	5 3/8 (136)	1 1/4 (32)
3/4 (20)	5 5/8 (143)	1 3/8 (35)
1 (25)	5 3/4 (146)	1 1/2 (38)
1 1/4 (32)	6 (152)	1 7/8 (48)
1 1/2 (40)	6 1/4 (159)	2 (51)
2 (50)	6 5/8 (168)	2 1/8 (54)
2 1/2 (65)	6 3/4 (171)	2 3/8 (60)
3 (80)	7 1/4 (184)	2 3/4 (70)
4 (100)	8 (203)	3 1/2 (89)
5 (125)	9 (229)	3 1/2 (89)
6 (150)	9 7/8 (251)	4 (102)
8 (200)	10 1/2 (267)	6 1/4 (159)
10 (250)	12 1/2 (318)	6 (152)
12 (300)	14 (356)	8 1/2 (216)

PLANNING MAIN VALVE INSTALLATION

A. PLANNING THE INSTALLATION

1. Locate the valve in a straight run of horizontal pipe. See Fig. 1.
2. Allow headroom above the valve for access through the blind flange. Provide clearance for stem withdrawal underneath.
3. Prevent water hammer and erratic operation by installing traps to provide proper drainage before and after the valve, and before secondary PRV or control valve.
4. Avoid damaging affects of scale and dirt in pipe lines by using a strainer as shown in Fig. 1.
5. Provide a 3-valve by-pass to facilitate inspection without interrupting service.
6. To eliminate excessive noise and erratic regulation with steam and other compressible fluids enlarge the delivery pipe size to effect a reasonable flow velocity at the reduced pressure. A tapered transition is recommended. If possible, avoid a sharp turn close to the regulator outlet and a bull-headed tee connection to the low pressure main.
7. Install initial and delivery pressure gauges to indicate performance. If the pressure rating of the delivery system or connected equipment is less than the initial steam pressure, provide a safety valve.

B. CONTROL PIPE

1. Use 1/4" pipe for this line which connects the pilot diaphragm chamber to the desired point of pressure control. See Fig. 1.
2. Take the control at a point of minimum turbulence. Avoid control immediately at the valve outlet or after a turn. When the delivery pipe expands in size select a spot at least 4 pipe diameters beyond the point of enlargement.
3. Pitch away from pilot to avoid erratic operation and fouling. Eliminate water pockets.
4. Locate delivery pressure gauge in control pipe to show pressure actually reaching pilot diaphragm.

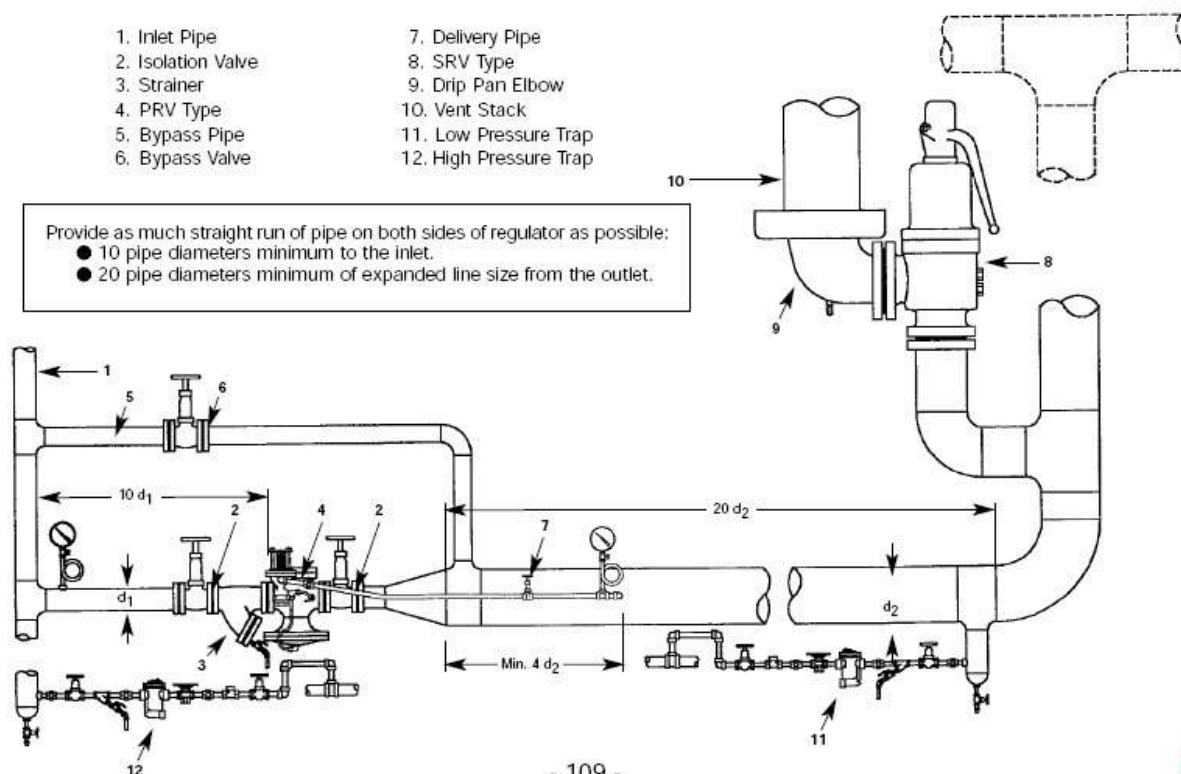
C. DESIGN GUIDELINES TO MINIMIZE NOISE

1. Size the regulator to provide a maximum inlet velocity of about 10,000 FPM.
2. Determine the regulator outlet velocity. If it would exceed 30,000 FPM, use a Spence muffling orifice or a second stage regulator.
3. Expand regulator outlet piping to limit discharge line velocity to about 10,000 FPM.
4. Avoid abrupt changes in pipe size. Limit pipe diameter changes to two pipe sizes per stage of expansion. Do not use eccentric reducers.
5. Directional changes in downstream piping should be made only after the line size has been increased. Use long radius fittings; avoid bull-head tee connection.
6. Provide as much straight run of pipe on both sides of regulator as possible:
 - a - 10 pipe diameters minimum to the inlet.
 - b - 20 pipe diameters minimum of expanded line size from the outlet.
7. Size all piping components, including strainer and stop valves for a maximum flow velocity of about 10,000 FPM (Exception: An outlet stop valve mounted at the regulator outlet should be equal in size to the regulator). In areas where low sound levels are specified, reduce this limit by 25% to 50%.
8. To limit noise transmission through the building's structure, keep the regulator and piping at least 3 feet away from solid surfaces. Use sound-isolating piping supports.
9. Apply high density insulation to the regulator body, piping and system components. Insulation reduces heat loss significantly and can provide moderate (3-6 dB) local noise attenuation.
10. Use a Spence noise suppressor to reduce the propagation of noise via the downstream piping.

- | | |
|--------------------|------------------------|
| 1. Inlet Pipe | 7. Delivery Pipe |
| 2. Isolation Valve | 8. SRV Type |
| 3. Strainer | 9. Drip Pan Elbow |
| 4. PRV Type | 10. Vent Stack |
| 5. Bypass Pipe | 11. Low Pressure Trap |
| 6. Bypass Valve | 12. High Pressure Trap |

Provide as much straight run of pipe on both sides of regulator as possible:

- 10 pipe diameters minimum to the inlet.
- 20 pipe diameters minimum of expanded line size from the outlet.



VALVE SIZING BY COMPUTATION

FORMULA KEY

A = Area of Pipe in (inches)²
 C_v = Valve Coefficient
 EDR = Equivalent Direct Radiation (Sq. Ft.)
 F = Pipe Area Factor (see Pipe Factors Table)
 ft = Feet
 G = Specific Gravity
 ΔP = Pressure Drop, $P_1 - P_2$ psi
 P_1 = Inlet Pressure, psia (psi + 14.7)
 P_2 = Reduced Pressure, psia (psi + 14.7)
 P_c = Pressure at Thermodynamic Critical Point, psia (water = 3206 psia)
 P_v = Vapor Pressure, psia

$\Delta P_s = P_1 - P_v$ when $P_2 > P_v$
 $\Delta P_s = P_1 - (.96 - .28 \sqrt{\frac{P_v}{P_c}}) P_v$ when $P_2 \leq P_v$
 q = Liquid Flow Rate, U.S. gpm
 Q = Flow Rate, SCFH
 T = Absolute T ($T + 460$)°R
 T_{SH} = Steam Superheat (°F) =
 Total Steam Temp. - Saturated Steam Temp.
 \bar{V} = Specific Volume $ft^3/\#$
 V = Velocity, FPM
 W = Steam Flow, #/Hr.
 W_s = Flow, #/Hr. Superheated Steam

VALVE SIZING BY
COMPUTATION

To avoid interpolation or solve problems beyond the scope of the table, valve sizes may be determined by calculation as follows:

C_v

SUBCRITICAL

CRITICAL

SATURATED STEAM:

$$C_v = \frac{W}{2.1 \sqrt{\Delta P (P_1 + P_2)}} \quad P_2 > .58 P_1$$

$$C_v = \frac{W}{1.71 P_1} \quad P_2 \leq .58 P_1$$

SUPERHEATED STEAM:

$$C_v = \frac{W (1 + .0007 T_{SH})}{2.1 \sqrt{\Delta P (P_1 + P_2)}} \quad P_2 > .55 P_1$$

$$C_v = \frac{W (1 + .0007 T_{SH})}{1.75 P_1} \quad P_2 \leq .55 P_1$$

GAS:

$$C_v = \frac{Q}{963} \sqrt{\frac{GT}{\Delta P (P_1 + P_2)}} \quad P_2 > .5 P_1$$

$$C_v = \frac{Q \sqrt{GT}}{834 P_1} \quad P_2 \leq .5 P_1$$

LIQUID:

$$C_v = q \sqrt{\frac{G}{\Delta P}} \quad P_2 > P_1 - .85 \Delta P_s$$

$$C_v = .93q \sqrt{\frac{G}{\Delta P_s}} \quad P_2 \leq P_1 - .85 \Delta P_s$$

LOADS

WATER $W = \frac{GPM}{2} \times \text{Temp. Rise (°F)}$

FUEL OIL $W = \frac{GPM}{4} \times \text{Temp. Rise (°F)}$

AIR $W = \frac{CFM}{900} \times \text{Temp. Rise (°F)}$

RADIATION $W = \frac{I^2 EDR}{4}$

ABSORPTION $W = 16-20 \text{ \#/Hr./Ton-Hr.}$

STM. ATOM $W = 0.1 \text{ \#/Hr./\#Oil}$

VELOCITY

STEAM $V = 2.4 \frac{W \bar{V}}{A}$

FLOW

STEAM $W = \frac{.0433 \times V \times F}{\bar{V}}$

AIR & GASES $Q = \frac{.0259 \times V \times F \times P_1}{T}$

LIQUIDS $q = .0054 \times V \times F$

PIPE FACTORS FOR STANDARD (SCHEDULE 40) PIPE

SIZE	FACTOR	SIZE	FACTOR
1/8	.55	3 1/2	95
1/4	1.0	4	122
3/8	1.8	5	192
1/2	2.9	6	278
3/4	5.1	8	481
1	8.3	10	758
1 1/4	14	12	1076
1 1/2	20	14	1301
2	32	16	1699
2 1/2	46	18	2151
3	71	20	2673

PRESSURE REDUCING STATION DESIGN GUIDELINES

I. SINGLE STAGE PRESSURE REGULATOR

1. When to use single stage regulator:
 - A. When load turndown requirement is generally no greater than 10:1.
 - B. When ratio of specific volume of steam, outlet to inlet, is no greater than 3 to 1.
 - C. When only one reduced steam pressure level is required.

II. PARALLEL PRESSURE REGULATORS

1. When to use parallel pressure regulator stations:
 - A. When maximum specified capacity requires selection of a pressure regulator greater than 12 inch pipe size. (It may be more economical to install two smaller valves than one very large one.)
 - B. When normal conditions require operation at 10% or less of specified maximum capacity for sustained periods.
 - C. When there are two distinct load requirements; i.e., summer/winter operation.
2. When to use a pneumatically operated parallel pressure regulator station:
 - A. When the combined accuracy of regulation of mechanically operated controls is unacceptable.
 For Spence mechanically operated regulators normal sizing/selection results in accuracy of regulation of approximately 5% of set pressure. Combined accuracy of regulation of mechanically operated parallel installed regulators is approximately 10% of set pressure.
 Pneumatically operated regulators equipped with reset maintain set point within 1% for all sustained flows.

III. TWO STAGE PRESSURE REGULATORS†

1. When to use two stage pressure regulator stations:

† Primary PRV requires optional base bypass and 1/8" bleedport.

- A. When intermediate steam pressure is required.
- B. When concerned with PRV generated noise, use two stage station when specific volume ratio, outlet to inlet, is greater than 3 to 1, unless manufacturer offers assurance or other means of meeting noise specification.
- C. When complying with Power Piping Code ANSI B31.1-1986, which reads, in part, "in district heating and steam distribution systems where the steam pressure does not exceed 400 psi (2758 kPa) and where the use of relief valves and vent piping are not feasible, two or more pressure reducing valves may be installed in series, each set at or below the safe working pressure of equipment served and no relief valve is required."

IV. TWO STAGE PARALLEL PRESSURE REGULATORS†

1. Whenever any condition from II and any condition from III applies.

SPACE CONSIDERATIONS FOR REDUCING STATIONS

1. Following are rules of thumb for approximating space requirements for installing reducing stations:
 - A. Single stage (with or without noise suppressors)

Inlet side: ten (10) diameters of PRV pipe size

Outlet side: twenty (20) diameters of final pipe size, where final pipe size is determined on the basis of 10,000 fpm line velocity.
 - B. Two stage

Inlet side of primary: ten (10) diameters of PRV pipe size.

Intermediate: twenty (20) diameters of secondary PRV pipe size.

Outlet side: twenty (20) diameters of final pipe size, where final pipe size is determined on the basis of 10,000 fpm line velocity.
 - C. Two stage with muffling orifice; same as A above.

PRESSURE REDUCING STATION GENERAL SPECIFICATION

A. Pressure Reducing Station shall consist of:

- pressure regulator
- inlet strainer
- inlet and outlet stop valves (gate type)
- by-pass valve (globe type)
- trap at inlet to pressure regulator
- pressure gauges on inlet and outlet of station
- pressure relief valve downstream of regulator

B. Stop valves and strainer shall be at least pressure regulator size

C. Expand pressure regulator outlet pipe size to obtain discharge line velocity which will not exceed:

Up to and including 2"	15,000 FPM
2 1/2" up to 8"	10,000 FPM
Above 8"	8,000 FPM

Regulator outlet velocity shall be limited to:

Up to and including 2"	45,000 FPM
2 1/2" up to 8"	30,000 FPM
Above 8"	24,000 FPM

D. Unions shall be used on either side of screwed end by-pass valve and pressure regulator to facilitate removal.

E. Pressure regulators 2-1/2" and larger shall have flanged ends and be suitable for pressure and temperature specified.

F. Limit pressure regulator inlet velocity to:

Up to and including 2"	15,000 FPM
2 1/2" thru 8"	10,000 FPM
Above 8"	8,000 FPM

G. Regulator sound pressure level while operating at specified maximum capacity shall not exceed 90 dBA as measured at a point three feet downstream and three feet from uninsulated pipe surface.

H. Pressure regulator capacity shall not be greater than 120 of specified maximum capacity.

I. For details of safety valve sizing and installation, please refer to the latest National Board Inspection Code and ANSI B31.1 Code.

RATED STEAM CAPACITY TABLE

TYPE E MAIN VALVE—FULL PORT

Pounds of Saturated Steam per Hour

VALVE INFO
PAGE 26

TYPE E FULL PORT
CAPACITY TABLE

PRESSURE-psig		VALVE SIZE (inches)														
INLET	REDUCED	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12
20	5-0	90	165	370	520	835	1175	1840	2610	4390	6470	10030	14715	26345	41890	66040
25	10	100	185	350	575	920	1290	2025	2870	4830	7115	11030	16185	28980	46080	72645
	5-0	100	190	365	595	955	1345	2105	2985	5025	7400	11475	16835	30140	47930	75560
30	15	105	195	380	615	990	1390	2175	3085	5190	7645	11855	17400	31150	49530	78080
	10-0	115	215	415	675	1080	1515	2370	3365	5655	8330	12920	18955	33940	53965	85075
40	25	120	220	425	695	1115	1565	2450	3475	5850	8615	13355	19600	35085	55790	87950
	20	135	250	480	780	1250	1760	2755	3905	6570	9680	15005	22020	39425	62690	98830
	15-0	140	260	505	825	1320	1850	2900	4115	6920	10195	15805	23195	41530	66035	104105
50	35	130	245	470	765	1225	1720	2695	3830	6435	9480	14700	21575	38625	61415	96820
	30	150	275	530	865	1385	1945	3045	4320	7270	10705	16600	24360	43615	69350	109330
	25	160	300	580	945	1515	2125	3325	4720	7940	11695	18130	26605	47635	75745	119410
	20-0	165	310	600	975	1560	2190	3430	4870	8185	12060	18700	27440	49125	78110	123140
60	45	140	265	510	830	1330	1865	2925	4150	6975	10280	15935	23385	41865	66570	104945
	40	160	300	575	940	1505	2115	3310	4700	7905	11645	18055	26495	47435	75425	118905
	35	175	330	630	1030	1650	2320	3630	5155	8665	12765	19790	29045	51995	82680	130345
	30-0	190	350	680	1105	1770	2490	3895	5530	9300	13700	21240	31170	55805	88735	139885
75	55	180	330	640	1045	1670	2350	3675	5215	8775	12925	20040	29405	52645	83710	131970
	50	195	365	705	1150	1840	2585	4045	5740	9655	14220	22050	32355	57930	92110	145215
	45	210	395	760	1235	1980	2785	4360	6185	10405	15325	23760	34865	62420	99255	156475
	40-0	225	420	805	1315	2105	2955	4630	6570	11050	16275	25230	37025	66285	105400	166160
100	75	225	420	810	1320	2115	2970	4655	6605	11110	16365	25370	37230	66650	105985	167080
	60	275	510	985	1610	2575	3620	5665	8045	13525	19925	30890	45330	81155	129045	203440
	50-0	295	550	1060	1725	2765	3885	6080	8630	14515	21380	33145	48640	87085	138475	218300
125	100	250	470	905	1475	2360	3315	5190	7370	12395	18255	28305	41535	74360	118235	186400
	75	335	630	1215	1980	3170	4455	6970	9895	16645	24515	38010	55775	99860	158785	250320
	65-0	360	670	1290	2100	3370	4730	7405	10510	17680	26040	40370	59245	106065	168655	265880
150	125	275	515	990	1610	2585	3625	5680	8060	13555	19970	30960	45430	81340	129335	203895
	100	370	695	1340	2185	3500	4915	7695	10920	18370	27055	41945	61555	110205	175235	276255
	80-0	425	790	1520	2480	3970	5575	8730	12390	20840	30700	47595	69845	125045	198835	313460
175	150	295	555	1065	1740	2785	3915	6130	8695	14625	21545	33405	49020	87765	139555	220005
	125	405	755	1455	2370	3800	5335	8355	11860	19945	29375	45545	66835	119660	190270	299960
	100	475	890	1715	2790	4475	6285	9835	13960	23480	34585	53625	78690	140880	224015	353155
	95-0	485	910	1750	2855	4575	6425	10055	14275	24005	35360	54820	80450	144030	229015	361045
200	150	435	810	1560	2545	4080	5725	8965	12725	21405	31525	48880	71730	128420	204200	321920
	125	515	960	1850	3015	4825	6780	10615	15065	25335	37320	57980	84910	152015	241715	381060
	110-0	550	1030	1980	3230	5175	7265	11380	16150	27160	40005	62025	91020	162960	259120	408500
225	175	460	860	1660	2710	4340	6095	9540	13540	22770	33540	52000	76310	136620	217240	342475
	150	550	1025	1975	3220	5155	7240	11335	16090	27065	39865	61810	90700	162380	258200	407055
	125-0	615	1145	2210	3600	5765	8100	12680	18000	30270	44585	69130	101440	181615	288785	455265
250	200	490	910	1755	2860	4585	6440	10080	14305	24060	35440	54945	80630	144355	229540	361865
	175	580	1085	2095	3410	5465	7675	12020	17060	28690	42255	65515	96145	172130	273700	431485
	150	655	1220	2350	3830	6135	8615	13490	19145	32200	47435	73540	107920	193210	307225	484355
	140-0	675	1265	2435	3970	6360	8930	13985	19845	33380	49165	76230	111860	200270	318445	502025

Based on 10% (2 psi minimum) accuracy of regulation.

PRESSURE TEMPERATURE LIMITS

Body Material and End Connection Selection

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

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

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

See product design limitations prior to final selection. Regular type (not bold) indicates recommended temperatures for each material.

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

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

MAXIMUM PRESSURE (PSIG) AT SERVICE TEMPERATURE (°F) - (NON-SHOCK)

END CONNECTIONS	BODY MAT'L CODE	ASTM SPEC.	TEMPERATURE (°F)																			
			100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050
125# FLANGES THREADS 2" - 12"	2 22	A126 B62	200 200	200 200	190 190	175 180	165 165	150 150	140 125	125												
125# FLANGES THREADS 14" - 24"	2 22	A126 B62	150 200	150 200	135 190	125 180	110 165	100 150	125													
150# FLANGES SWE, BWE THREADS	22	B61	225	225	215	205	195	180	170	160	150	140										
	22	B62	225	225	210	195	180	165	150													
	3	A216	285	285	260		230	200	170		170		140	125	110	95	80	65	50	35	20	
	6	A217	265		260		230	200	170		170		140	125	110	95	80	65	50	35	20	
	8	A217	290		260		230	200	170		170		140	125	110	95	80	65	50	35	20	
	7	A217	290		260		230	200	170		170		140	125	110	95	80	65	50	35	20	
	4	A217	290		260		230	200	170		170		140	125	110	95	80	65	50	35	20	
	9	A351	275		230		205	190	170		170		140	125	110	95	80	65	50	35	20	
	5	A351	275		235		215	195	170		170		140	125	110	95	80	65	50	35	20	
250# FLANGES THREADS	2 22	A126 B62	500 400	500 400	460 385	415 365	375 335	335 300	290 250	250												
300# FLANGES SWE, BWE THREADS	22	B61	500	500	475	450	425	400	375	350	325	300										
	22	B62	500	500	465	425	390	350	315													
	3	A216	740		675		655	635	600		600		550	535	535	505	410	270	170	105	50	
	6	A217	695		680		655	640	620		620		605	590	570	530	510	485	450	375	260	
	8	A217	750		750		720	695	665		665		605	590	570	530	510	485	450	375	260	145
	7	A217	750		750		730	705	665		665		605	590	570	530	510	485	450	375	260	175
	4	A217	750		745		715	705	665		665		605	590	570	530	510	485	370	275	200	145
	9	A351	720		600		540	495	465		465		435	430	425	415	405	395	390	380	329	305
	5	A351	720		620		560	515	480		480		450	445	430	425	420	420	415	385	350	345
600# FLANGES SWE, BWE THREADS	3	A216	1480		1350		1315	1270	1200		1200		1095	1075	1065	1010	825	535	345	205	105	
	6	A217	1390		1360		1305	1280	1245		1245		1210	1175	1135	1065	1015	975	900	560	330	
	8	A217	1500		1500		1445	1385	1330		1330		1210	1175	1135	1065	1015	975	900	640	430	290
	7	A217	1500		1500		1455	1410	1330		1330		1210	1175	1135	1065	1015	975	900	755	520	350
	4	A217	1500		1490		1430	1410	1330		1330		1210	1175	1135	1055	1015	965	740	550	400	290
	9	A351	1440		1200		1080	995	930		930		875	860	850	830	805	790	780	765	640	615
	5	A351	1440		1240		1120	1025	955		955		900	890	870	855	845	835	830	775	700	685
	5	A351	1440		1240		1120	1025	955		955		900	890	870	855	845	835	830	775	700	685
	5	A351	1440		1240		1120	1025	955		955		900	890	870	855	845	835	830	775	700	685
900# FLANGES SWE, BWE	3	A216	2220		2025		1970	1900	1795		1795		1640	1610	1600	1510	1235	805	515	310	155	
	6	A217	2085		2035		1955	1920	1865		1865		1815	1765	1705	1595	1525	1460	1350	845	495	
	8	A217	2250		2250		2165	2080	1995		1995		1815	1765	1705	1595	1525	1460	1350	955	650	430
	7	A217	2250		2250		2185	2115	1995		1995		1815	1765	1705	1595	1525	1460	1350	1130	780	525
	4	A217	2250		2235		2150	2115	1995		1995		1815	1765	1705	1585	1525	1450	1110	825	595	430
	9	A351	2160		1800		1620	1490	1395		1395		1310	1290	1275	1245	1210	1190	1165	1145	965	925
	5	A351	2160		1860		1680	1540	1435		1435		1355	1330	1305	1280	1265	1255	1245	1160	1050	1030
	5	A351	2160		1860		1680	1540	1435		1435		1355	1330	1305	1280	1265	1255	1245	1160	1050	1030
	5	A351	2160		1860		1680	1540	1435		1435		1355	1330	1305	1280	1265	1255	1245	1160	1050	1030
1500# FLANGES SWE, BWE	3	A216	3705		3375		3280	3170	2995		2995		2735	2685	2665	2520	2060	1340	860	515	260	
	6	A217	3470		3395		3260	3200	3105		3105		3025	2940	2840	2660	2540	2435	2245	1405	825	
	8	A217	3750		3750		3610	3465	3325		3325		3025	2940	2840	2660	2540	2435	2245	1595	1080	720
	7	A217	3750		3750		3640	3530	3325		3325		3025	2940	2840	2660	2540	2435	2245	1885	1305	875
	4	A217	3750		3725		3580	3530	3325		3325		3025	2940	2840	2640	2540	2415	1850	1370	995	720
	9	A351	3600		3000		2700	2485	2330		2330		2185	2150	2125	2075	2015	1980	1945	1910	1605	1545
	5	A351	3600		3095		2795	2570	2390		2390		2255	2220	2170	2135	2110	2090	2075	1930	1750	1720
	5	A351	3600		3095		2795	2570	2390		2390		2255	2220	2170	2135	2110	2090	2075	1930	1750	1720
	5	A351	3600		3095		2795	2570	2390		2390		2255	2220	2170	2135	2110	2090	2075	1930	1750	1720
2500# FLANGES SWE, BWE	3	A216	6170		5625		5470	5280	4990		4990		4560	4475	4440	4200	3430	2230	1430	860	430	
	6	A217	5785		5660		5435	5330	5180		5180		5040	4905	4730	4430	4230	4060	3745	2345	1370	
	8	A217	6250		6250		6015	5775	5540		5540		5040	4905	4730	4430	4230	4060	3745	2655	1800	1200
	7	A217	6250		6250		6070	5880	5540		5540		5040	4905	4730	4430	4230	4060	3745	3145	2170	1455
	4	A217	6250		6205		5965	5880	5540		5540		5040	4905	4730	4400	4230	4030	3085	2285	1655	1200
	9	A351	6000		5000		4500	4140	3880		3880		3640	3580	3540	3460	3360	3300	3240	3180	2675	2570
	5	A351	6000		5160		4660	4280	3980		3980		3760	3700	3620	3560	3520	3480	3460	3220	2915	2865
	5	A351	6000		5160		4660	4280	3980		3980		3760	3700	3620	3560	3520	3480	3460	3220	2915	2865
	5	A351	6000		5160		4660	4280	3980		3980		3760	3700	3620	3560	3520	3480	3460	3220	2915	2865
3500# FLANGES SWE, BWE	3	A216	8640		7870		7655	7390	6985		6985		6385	6265	6215	5880	4800	3120	2000	1200	600	
	6	A217	8100		7920		7605	7460	7250		7250		7055	6865	6820	6200	5920	5680	5240	3280	1920	
	8	A217	8750		8750		8420	8085	7750		7750		7055	6865	6820	6200	5920	5680	5240	3720	2520	1680
	7	A217	8750		8750		8495	8230	7750		7750		7055	6865	6820	6200	5920	5680	5240	4405	3040	2040
	4	A217	8750		8685		8350	8230	7750		7750		7055	6865	6820	6160	5920	5640	4320	3200	2320	1680
	9	A351	8400		7000		6300	5795	5430		5430		5095	5010	4955	4845	4705	4620	4535	4450	3745	3600
	5	A351	8400		7225		6525	5990	5570		5570		5265	5180	5065	4925	4845	4730	4590	4505	4240	4200
	5	A351	8400		7225		6525	5990	5570		5570		5265	5180	5065	4925	4845	4730	4590	4505	4240	4200
	5	A351	8400		7225		6525	5990	5570		5570		5265	5180	5065	4925	4845	4730	4590	4505	4240	4200
4500# FLANGES SWE, BWE	3	A216	11110		10120		9845	9505	8980		8980		8210	8055	7990	7560	6170	4010	2570	1545	770	
	6	A217	10415		10185		9780	9595	9320		9320		9070	8825	8515	7970	7610	7305	6740	4215	2470	
	8	A217	11250		11250		10830	10400	9965		9965		9070	8825	8515	7970	7610	7305	6740</			