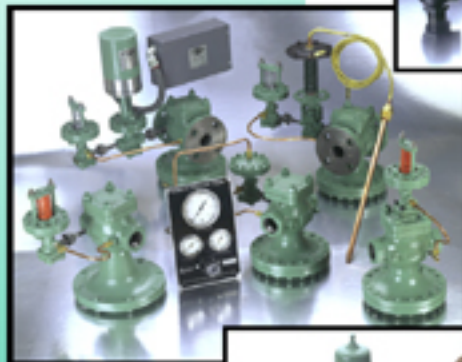


# SPENCE

SPENCE ENGINEERING COMPANY, INC.

## PRESSURE AND TEMPERATURE CONTROLS & STEAM SPECIALTIES



- [Temperature & Pressure Regulators](#)
- [Safety Relief Valves](#)
- [Condensate Pumps](#)
- [Steam Traps](#)
- [Blocking Valves](#)
- [Application Guide](#)
- [Help](#)



ISO 9001

Certificate Number: 33694

1.800.398.2493

# SPENCE ENGINEERING COMPANY, INC.

The Spence Engineering Company was founded in 1926 by Paulsen Spence in Walden, New York. Paulsen Spence developed the original patent for the normally closed external pilot operated packless pressure regulator. This design is the basis for the products offered today. This technology offers the maximum in application and selection flexibility. Spence stands alone in their ability to produce regulators up to 12 inches in cast iron and cast steel. Their pilots are used to control pressure, temperature, differential pressure or back pressure either mechanically or with a pneumatic pilot.

Spence Engineering is a widely recognized leader in the steam regulator and flow control field. Spence regulators are used extensively for heating systems in buildings, institutions and district heating systems as well as major industrial plants.

In 1984, Spence Engineering was acquired by Watts Industries. The company continued to grow and develop new fluid control and steam specialty products. A new line of pneumatic control valves was introduced in 1986. In 1989, a range of self contained temperature regulators was added to the line to meet the demand for an economical temperature regulator.

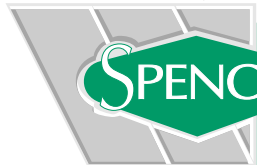
1990 was an active year, with Spence becoming certified by the ASME for the assembly and setting of safety relief valves manufactured by their sister Watts company in Canada. Spence was also instrumental in the acquisition and management of the Nicholson Steam Trap Company. In 1994, Nicholson was integrated into the Spence Plant.

Spence continued its product development program with the introduction of free float steam traps and pressure operated condensate pumps. In 1996, Watts moved the manufacturing responsibility for safety valves to the Spence Engineering plant in Walden, New York. Spence is now an ASME certified manufacturer of bronze and iron safety relief valves.

Spence Engineering continues to focus their attention on providing single source steam specialty products for regulating and control of steam and fluids for the institutional and industrial marketplace. Their growth efforts are to expand the already comprehensive product capabilities to reach new developing markets.

For more information on Spence Engineering Co., visit our website at [www.spenceengineering.com](http://www.spenceengineering.com) or reach us via e-mail at [sales@spenceengineering.com](mailto:sales@spenceengineering.com)

WATTS INDUSTRIES, INC.



**SPENCE ENGINEERING COMPANY, INC.**



# HOW TO USE THIS CATALOG

If you already know the product that you want information on, find the product page in the Table of Contents. Pages showing popular combinations of Pilot and Regulators are found in the Combinations Section. Detailed product information on materials, ratings, dimensions, weights and applications are found in the Products Sections. All sizing information is contained in the Sizing Section.

If you are not sure of what you need, collect all the following information. You will need it to select the right product for your needs.

**Inlet Pressure**

**Flow Rate**

**Flow Media (i.e.: Steam, Water, etc.)**

**Desired Delivery Pressure**

**Noise Restrictions, if any**

**Type of Pilot Control (i.e.: Self Contained, Pneumatic, Electronic, etc.)**

**Application (i.e.: Temperature Regulation, Single Stage Pressure Regulation, etc.)**

Application data is listed on all Product Pages. If you identify the nature of the installation, it will assist you selecting the proper equipment.

## **DIRECT ACTING OR PILOT OPERATED REGULATOR?**

You may be able to use a Direct Operated Regulator for your application. They are generally less expensive than Pilot Operated Regulators. However, they do not provide the same level of accuracy or rangeability.

If a Direct Acting Regulator is an option, consult the Product Pages at the end of the Valves Section to determine which best fits your specific needs. Then, consult the appropriate pages in the Sizing Section to select the exact size you need.

If a Pilot Operated Regulator is required, go to Page 6 (for Pressure Regulators) or Page 7 (for Temperature Regulators) in this Section. These selection charts will help you to quickly determine the type of product that you need. The Pilot can be self contained, pneumatically or electronically actuated. Consult the appropriate pages in the Sizing Section to select the exact size Regulator and Pilot you need. Overall dimensions of the most popular combinations are provided in the Combined Section.

## **ECONOMICAL, ENGINEERED OR ENGINEERED WITH NOISE SUPPRESSION?**

The choice of how to size a regulator for an application is up to you. The most economical choice does not necessarily take into consideration the optimum loading of the Regulator, which could affect its service life. Properly engineered Spence Regulators have been in continuous service for as much as 40 years. In high pressure reduction stations, noise can be a serious environmental problem. Spence offers a number of Noise Suppression products to reduce this problem. You will find comprehensive noise reduction sizing and selection information in the Sizing Section.

## **READY TO START?**

The best way to make a selection is to contact your local Spence Engineering Technical Sales Representative. Our network of factory trained Representatives will offer you a choice of solutions for your application utilizing our Computer Valve Sizing Program. For the name and number of your local Spence Representative, call our Hotline at 1-800-398-2493 or visit our website at [www.spenceengineering.com](http://www.spenceengineering.com).

# THE SPENCE ADVANTAGE IS SERVICE

## LOCAL TECHNICAL SUPPORT

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Spence Engineering has a network of technically trained Representatives around the world. These Representatives can direct you to local inventory of our products for fast, fast service. They can also help you in the selection and sizing of Regulators, Pilots, Desuperheaters and Noise Suppression Products.

## TECHNICAL TRAINING

---

We offer a regular schedule of workshops covering various technical issues in our state of the art Valve Technology Training Center. We can also schedule customized training sessions to suit your particular needs.

**ENGINEERING SEMINARS.** These seminars provide the engineer with the skills of regulator selection and sizing.

**DISTRIBUTOR SEMINARS.** This seminar will provide you with all the information you need to serve your customers.

**MAINTENANCE SEMINARS.** Maintenance personnel will receive hands-on training in selection, installation, operation, maintenance and troubleshooting.



## INTERNATIONAL SALES

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Spence is well equipped to provide product to our customers around the world. We regularly ship our products to all parts of the world. Our experienced international sales group can meet the transport and documentation requirements of our international customers with ease. Our network of International Technical Sales Representatives will also be able to provide you with product from local inventory.

## ENGINEERED SOLUTIONS

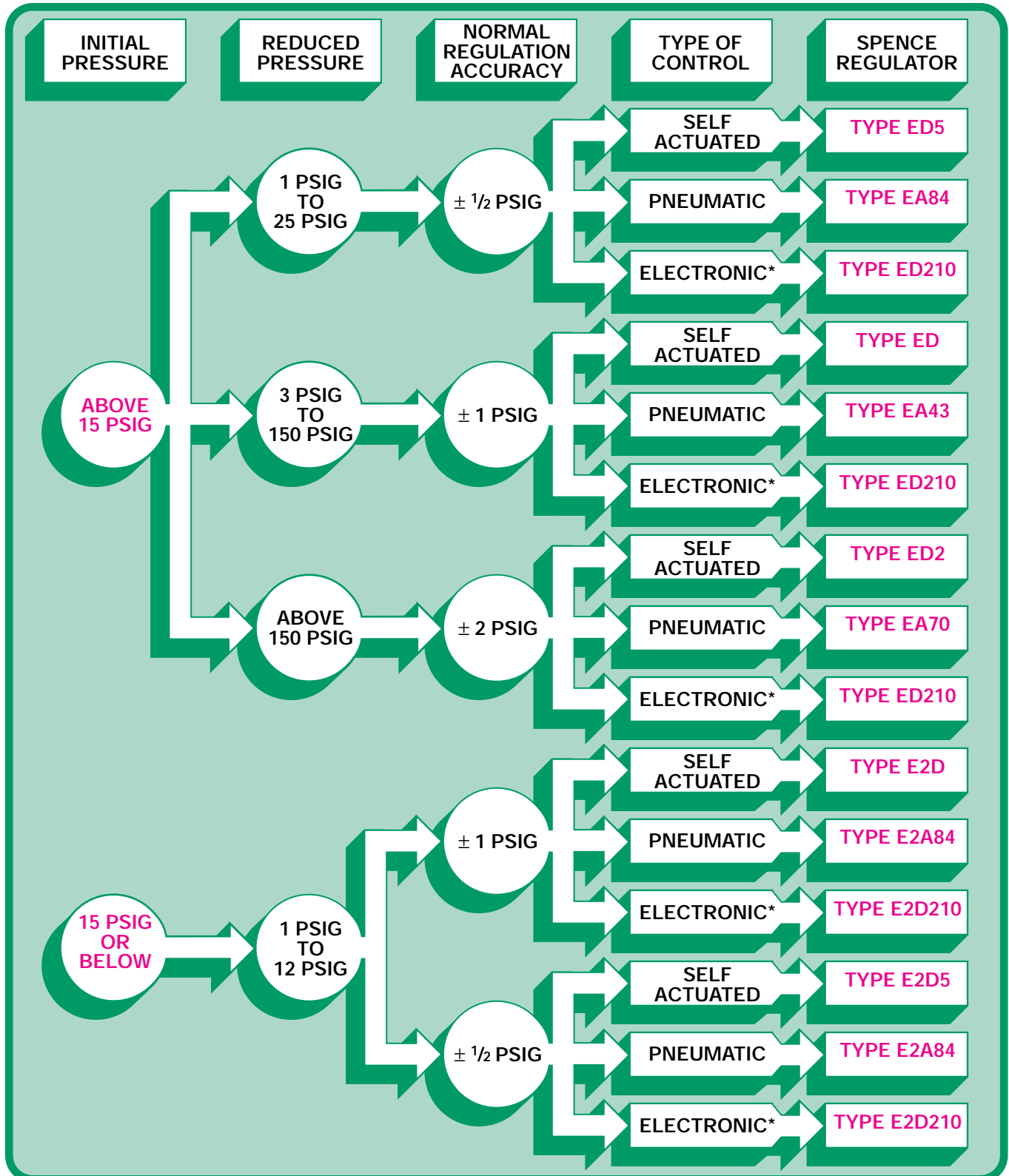
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Spence offers a very comprehensive line of specialty options to enhance and optimize valve performance. We can tailor custom solutions for your most unique process applications. Call us for solutions.

# QUICK SELECTION CHART FOR STEAM PRESSURE REGULATORS

Review the application data that you have collected. Consult the chart, starting with the inlet pressure that matches the inlet pressure you have. Next, select your outlet pressure (reduced or delivery pressure). Then select the type of pilot control that you will be using and, finally, the level of accuracy that your system requires. This will lead you to a recommended regulator.

Please bear in mind that these recommendations are general in nature and you should check the Product Pages and Sizing Section to ensure you have selected the correct product. If you need assistance, contact your local Spence Technical Sales Representative.

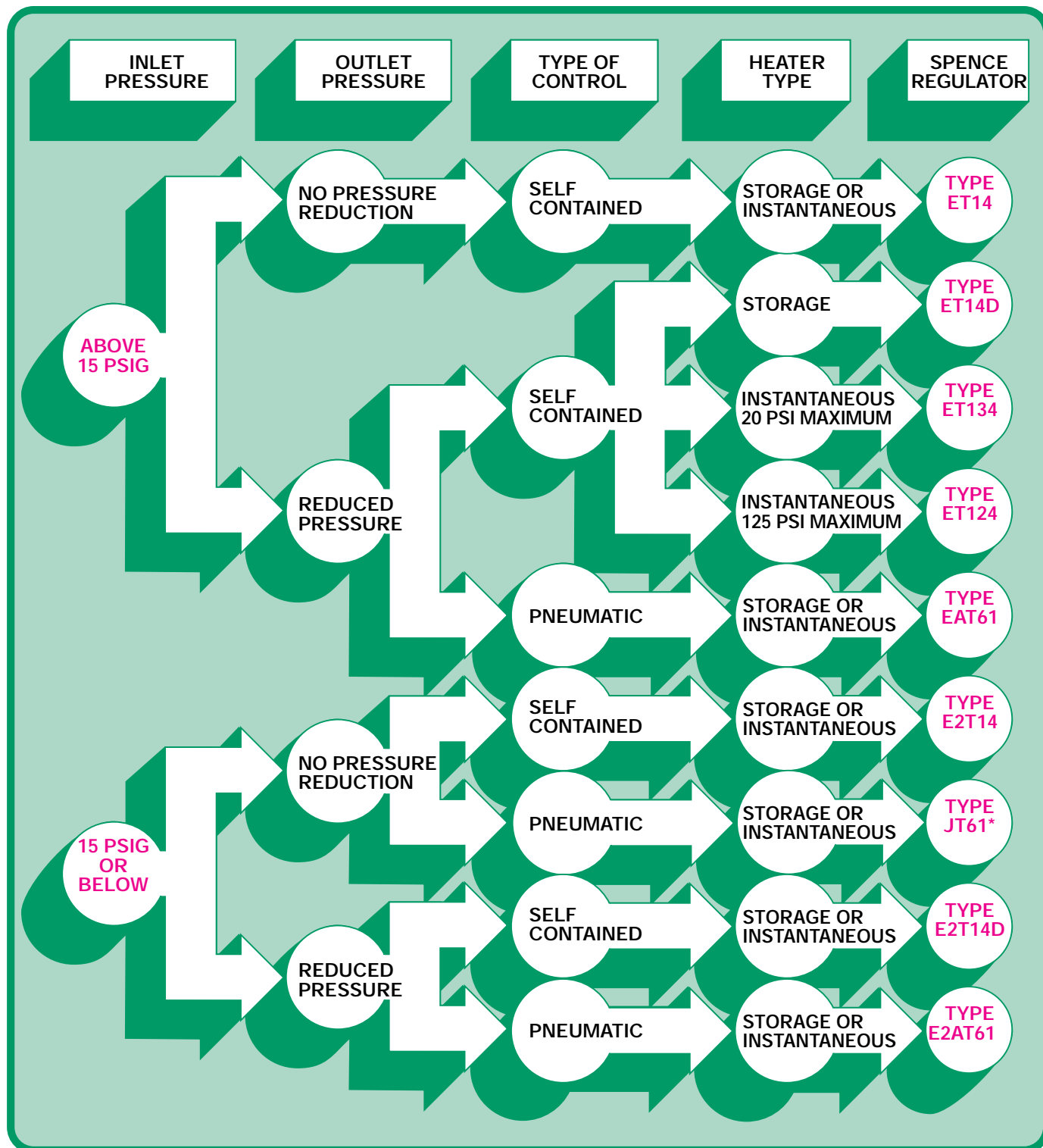


\* Electronic Pilot accuracy is a function of controller accuracy.

# QUICK SELECTION CHART FOR TEMPERATURE REGULATORS

Review the application data that you have collected. Consult the chart, starting with the inlet pressure that matches the inlet pressure you have. Next, select your outlet pressure (reduced or delivery pressure). Then select the type of pilot control that you will be using and, finally, the level of accuracy that your system requires. This will lead you to a recommended regulator.

Please bear in mind that these recommendations are general in nature and you should check the Product Pages and Sizing Section to ensure you have selected the correct product. If you need assistance, contact your local Spence Technical Sales Representative.

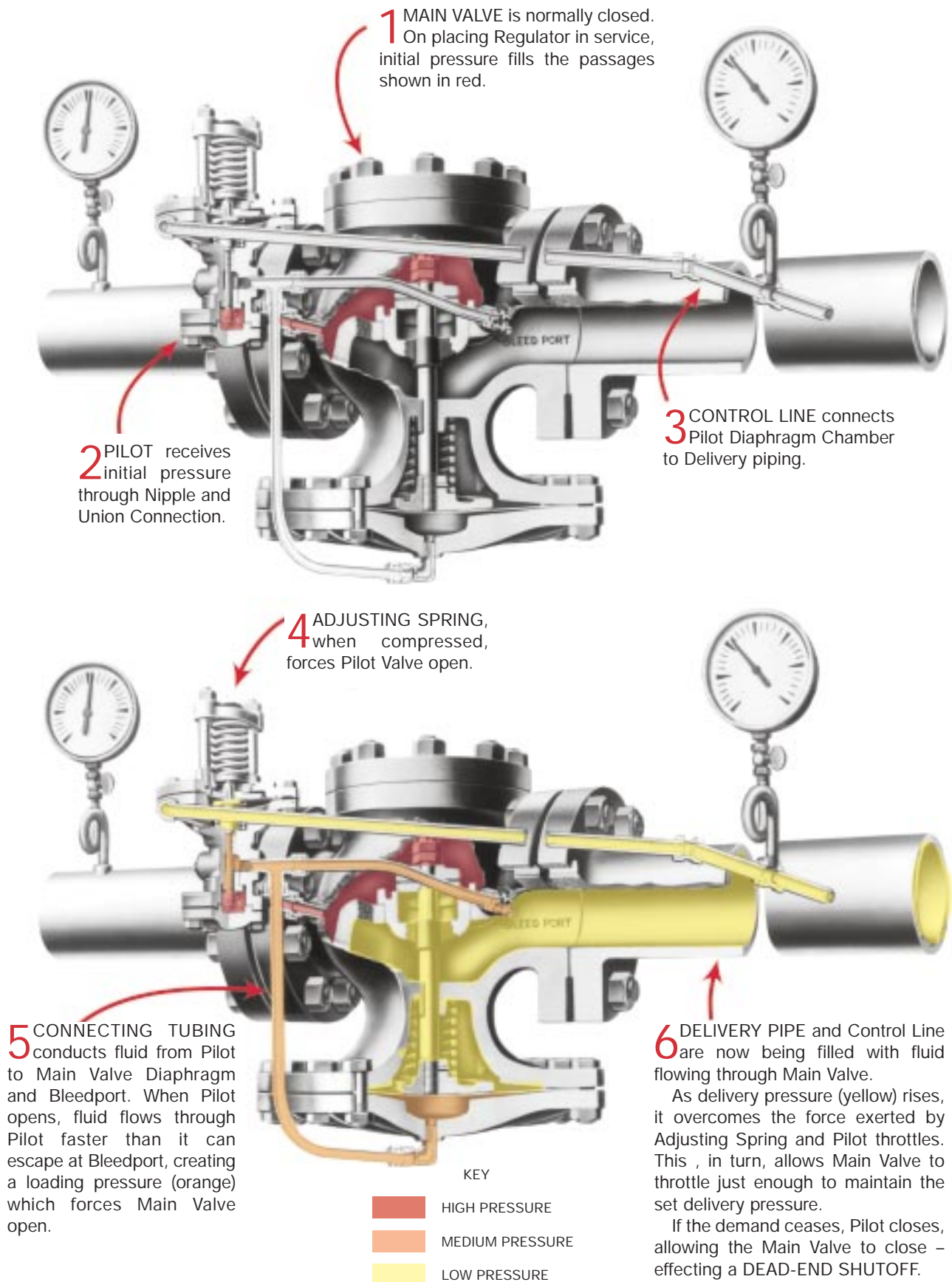


\* See Control Valve Catalog.



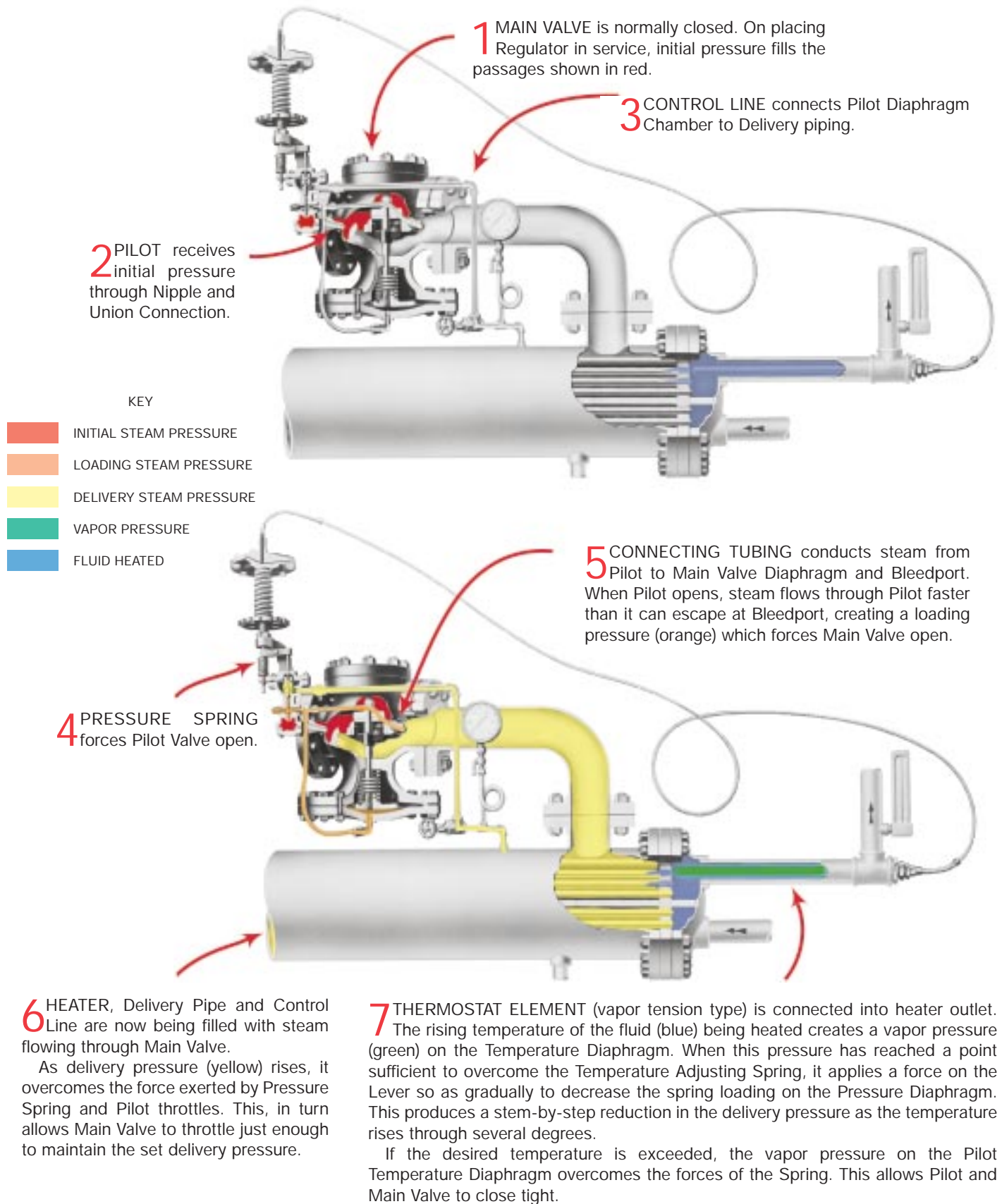
# THE OPERATING CYCLE OF A SPENCE PRESSURE REGULATOR

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.





# OTHER PRODUCTS AVAILABLE FROM SPENCE

Spence Engineering has a complete line of Steam Specialties and Fluid Control Products. Complete technical literature and product assistance is available on all of these products by contacting your local Spence Technical Representative.



● **TYPE "J" CONTROL VALVES** – A complete line of control valves and pneumatic actuators and positioners is available from Spence Engineering. In bronze, cast iron, cast steel and stainless steel body materials, these control valves are excellent for many applications from HVAC through process control. Sizes available are 1/2" through 4". Available with screwed and ANSI flanged end connections.

● **GENERAL USE STEAM TRAPS** – A complete line of general purpose steam traps are available from Spence Engineering. Mechanical traps, such as Float and Thermostatic and Inverted Bucket and widely used Thermodynamic traps are all readily available in a wide range of sizes and pressures.



● **SAFETY AND RELIEF VALVES** – Bronze and Cast Iron body Safety and Relief Valve are available to meet ASME Code for Section I (Fired Vessels) and Section VIII (Unfired Vessels). Valves are available in sizes to 6" x 8" and pressures to 300 psi.

● **CONDENSATE PUMPS** – The Condensate Commander is the Spence line of pressure operated condensate pumps. Ideal for installations where electric power is not available or not recommended, these pumps provide high capacity and long service life for efficient return of condensate.





TYPE E MAIN VALVE

# TYPE E MAIN VALVE

SIZES 3/8" – 12"

PRESSURES to 600 PSIG at 750°F

- Normally Closed
- Single Seat
- Balanced Metal Diaphragms
- Protected Main Spring
- Fluid, Gas & Vapor Applications
- Accurate Regulation Unaffected by Service Conditions
- ANSI/FCI 70-2 Class IV Shutoff
- Virtually Frictionless for Long Service Life
- Packless Construction
- Easy In-line Maintenance
- Wide Variety of Pilots for Many Applications
- Minimum Operating  $\Delta P$  10 psi (.7 bar)

## APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Regulating for Process Control (Temperature or Pressure)
- Maintain Back Pressure or Differential Pressure
- For use with Self-contained, Pneumatic or Electronic Pilots
- Single Point or Multiple Use Applications
- Slow Start-up or Shutdown

## VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
-------------------------	------------------------	------------------------

### CAST IRON

Class 250 NPT	250 (17.2)	@ 450 (232)
B16.1 Class 125 Flanged	125 (8.6)	@ 450 (232)
B16.1 Class 250 Flanged	250 (17.2)	@ 450 (232)

### CAST BRONZE

B16.15 Class 250 NPT	250 (17.2)	@ 450 (232)
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### CAST STEEL

B16.34 Class 300 NPT	300 (21.0)	@ 600 (315)†
B16.34 Class 150 Flanged	150 (10.3)	@ 500 (260)†
B16.34 Class 300 Flanged	300 (21.0)	@ 600 (315)†
B16.34 Class 600 Flanged	600 (41.4)	@ 600 (315)†

† 750°F (400°C) construction available on request.  
Other pressure/temperature ratings available; consult factory.  
Maximum downstream pressure is 300 psi.

**SIZING  
INFO**

## OPTIONS

- Composition Disc
- Balanced Construction
- Insulcap Insulating Jacket
- High Temperature Construction
- Parabolic Disc
- Integral Mount Pilot
- Secoweld
- Dashpot

## TYPICAL CONFIGURATIONS

- PRESSURE REDUCING .....TYPE ED SERIES
- AIR ADJUSTED .....TYPE EA SERIES
- BACK PRESSURE .....TYPE EQ SERIES
- PUMP GOVERNOR .....TYPE EP SERIES
- LOAD ALLOCATING .....TYPE EFD
- AIR CONTROLLED .....TYPE EAP60
- ELECTRONIC SLOW START .....TYPE ED208D
- SOLENOID CONTROLLED .....TYPE EMD
- SOLENOID ACTUATED .....TYPE EM
- DIFFERENTIAL .....TYPE EN
- TEMPERATURE CONTROL .....TYPE ET SERIES

## RATED FLOW COEFFICIENTS (Cv)

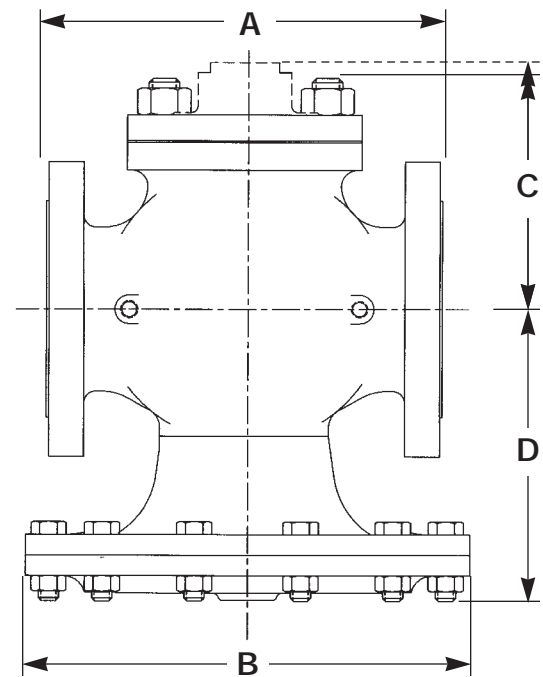
SEAT FACTOR	REGULATOR SIZE														
	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12
Full	1.5	2.8	5.4	8.8	14.1	19.8	31	44	74	109	169	248	444	706	1113
Full 75 %	—	2.1	4.0	6.6	10.6	14.8	23.3	33	56	82	127	186	333	530	835
Full 50 %	—	1.4	2.7	4.4	7.0	9.9	15.5	22	37	55	85	124	222	353	557
Normal	.65	1.5	4.8	7.5	10.4	14.6	17.6	24	43	78	115	151	249	377	631
Normal 75 %	—	—	—	—	—	—	—	18	33	59	87	114	187	283	474
Normal 50 %	—	—	—	—	—	—	—	12	22	39	58	76	125	189	316

# TYPE E MAIN VALVE SPECIFICATION

The valve shall be self-operated, external pilot type, single seated, metal diaphragm actuated, normally closed design. The valve will function quickly and shut tight on dead end service. Internal parts including seats, discs, stems and diaphragms shall be of stainless steel. There shall be no springs in the steam space and no stuffing box. The valve shall be easy to maintain with all parts accessible without removal from the line.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....ASTM A126 Cl. B  
Body, Cast Bronze .....ASTM B61 UNS C92200  
Body, Cast Steel .....ASTM A216 WCB  
Stem .....303 St. Stl. ASTM A582  
Disc 3/4 - 5" .....420 St. Stl. ASTM A743 CA-40  
Disc 6 - 12" .....304 St. Stl. ASTM A167/A240  
Seat 3/4 - 5" .....420 St. Stl. ASTM A743 CA-40  
Seat 6 - 12" .....316 St. Stl. ASTM A743-79 CF-8M  
Gasket .....Non-asbestos  
Diaphragm .....Stainless Steel MIL-S-5059C  
Spring .....Steel



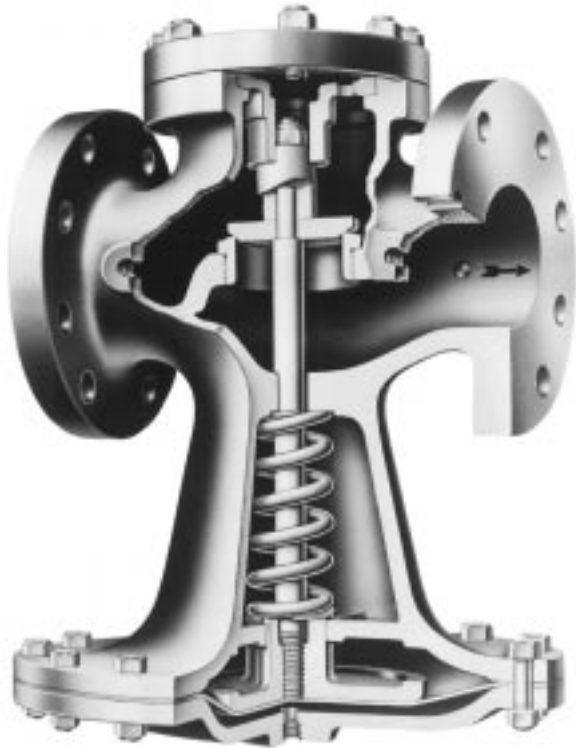
TYPE E MAIN VALVE

FITTINGS

**DIMENSIONS** inches (mm) **AND WEIGHTS** pounds (kg)

SIZE	FACE TO FACE DIMENSIONS					B	C					D*	APPROX. WT.			
	A						Std. Mount		Integral Mount				ANSI NPT	ANSI 125,150	ANSI 250,300	ANSI 600
	ANSI NPT	ANSI 125,150	ANSI 250	ANSI 300	ANSI 600			ANSI 600	Cl & Brz. All	Steel	Steel 600					
3/8 (10)	4 3/8 (111)	— —	— —	— —	— —	5 7/8 (149)	2 3/4 (70)	— —	3 1/2 (89)	3 1/2 (89)	— —	5 1/4 (133)	14 (6)	— —	— —	— —
1/2 (12)	4 3/8 (111)	— —	— —	— —	6 (152)	5 7/8 (149)	2 3/4 (70)	2 3/4 (70)	3 1/2 (89)	3 1/2 (89)	3 5/8 (92)	5 1/4 (133)	14 (6)	— —	— —	20 (9.1)
3/4 (19)	4 3/8 (111)	— —	— —	— —	6 3/8 (162)	6 1/2 (165)	2 7/8 (73)	3 7/8 (98)	3 3/8 (92)	3 3/4 (95)	4 1/2 (114)	5 1/2 (140)	18 (8)	— —	— —	28 (13)
1 (25)	5 3/8 (137)	5 1/2 (140)	6 (152)	6 1/2 (165)	6 1/2 (165)	7 (178)	3 5/8 (92)	4 1/4 (108)	4 3/8 (111)	4 3/8 (111)	4 3/4 (121)	6 1/4 (159)	23 (10)	26 (12)	31 (14)	32 (15)
1 1/4 (32)	6 1/2 (165)	6 3/4 (171)	7 1/4 (184)	7 7/8 (200)	7 7/8 (200)	7 7/8 (200)	4 1/8 (105)	4 5/8 (117)	4 (102)	4 5/8 (117)	5 (127)	6 1/2 (165)	33 (15)	37 (17)	41 (19)	45 (20)
1 1/2 (38)	7 1/4 (184)	6 7/8 (175)	7 3/8 (187)	8 (203)	8 (203)	8 3/4 (222)	4 3/8 (111)	5 1/8 (130)	4 3/8 (111)	5 (127)	— —	7 1/8 (181)	43 (20)	47 (21)	55 (25)	58 (26)
2 (51)	7 1/2 (191)	8 1/2 (216)	9 (229)	10 1/4 (260)	10 1/4 (260)	9 7/8 (251)	5 1/4 (133)	5 3/4 (146)	5 (127)	5 5/8 (143)	5 3/4 (146)	7 5/8 (194)	62 (28)	73 (33)	78 (35)	83 (38)
2 1/2 (64)	— —	9 3/8 (238)	10 (254)	11 1/4 (286)	11 1/4 (286)	10 7/8 (276)	5 3/4 (146)	7 7/8 (200)	5 1/2 (140)	6 (152)	8 1/4 (210)	8 3/8 (213)	— —	95 (43)	100 (45)	130 (59)
3 (76)	— —	10 (254)	10 3/4 (273)	12 1/4 (311)	12 1/4 (311)	11 3/4 (298)	6 5/8 (168)	9 1/8 (232)	6 3/8 (162)	7 1/8 (181)	— —	9 1/4 (235)	— —	125 (57)	140 (64)	175 (80)
4 (102)	— —	11 7/8 (302)	12 1/2 (318)	12 1/2 (318)	14 1/2 (368)	14 3/4 (375)	7 5/8 (194)	10 5/8 (270)	7 1/4 (184)	8 (203)	— —	11 7/8 (302)	— —	210 (95)	230 (105)	310 (141)
5 (127)	— —	13 5/8 (346)	14 1/2 (368)	14 1/2 (368)	16 1/2 (419)	16 7/8 (429)	8 1/2 (216)	12 1/2 (318)	8 1/8 (206)	8 1/2 (216)	— —	12 1/2 (318)	— —	295 (134)	310 (141)	490 (223)
6 (152)	— —	15 1/8 (384)	16 (406)	16 (406)	17 3/8 (441)	19 3/4 (502)	10 (254)	13 3/4 (349)	9 1/2 (241)	9 1/2 (241)	13 5/8 (346)	14 1/8 (359)	— —	420 (191)	470 (214)	655 (298)
8 (203)	— —	19 (483)	20 (508)	20 (508)	21 5/8 (549)	22 1/2 (572)	11 1/2 (292)	15 3/8 (391)	11 1/4 (286)	11 3/4 (298)	— —	17 1/4 (438)	— —	700 (318)	710 (323)	1070 (486)
10 (254)	— —	23 5/8 (600)	25 (635)	25 (635)	— —	28 (711)	13 3/4 (349)	— —	— —	— —	— —	23 3/8 (594)	— —	1240 (563)	1300 (591)	— —
12 (305)	— —	26 1/2 (673)	28 (711)	28 (711)	— —	33 (838)	15 7/8 (403)	— —	— —	— —	— —	25 1/4 (641)	— —	2060 (936)	2140 (972)	— —

\*Add 65% to D dimension for stem removal clearance.



TYPE E2 MAIN VALVE

#### APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Regulating for Process Control (Temperature or Pressure)
- Maintain Back Pressure or Differential Pressure
- For use with Self-contained, Pneumatic or Electronic Pilots
- Single Point or Multiple Use Applications
- Slow Start-up or Shutdown

#### VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
<b>CAST IRON</b>		
B16.4 Class 250 NPT	15 (1.03)	250°F (121°C)
B16.1 Class 125 Flanged	15 (1.03)	250°F (121°C)
<b>CAST BRONZE</b>		
B16.15 Class 250 NPT	15 (1.03)	250°F (121°C)

**SIZING  
INFO**

# TYPE E2 MAIN VALVE

**LOW PRESSURE  
LOW DIFFERENTIAL**

**SIZES 3/4" – 12"**  
**PRESSURES to 15 PSIG at 250°F**

- Normally Closed
- Single Seat
- Hycar Diaphragm
- Protected Main Spring
- Gas & Steam Applications
- Accurate Regulation Unaffected by Service Conditions
- ANSI/FCI 70-2 Class IV Shutoff
- Virtually Frictionless for Long Service Life
- Packless Construction
- Easy In-line Maintenance
- Wide Variety of Pilots for Many Applications
- Minimum Operating  $\Delta P$  3 psi (.2 bar)

#### OPTIONS

- Integral Mount Pilot
- Composition Disc for liquid, air or gas service
- Insulcap Insulating Jacket

#### TYPICAL CONFIGURATIONS

**PRESSURE REDUCING** .....TYPE E2**D**  
**AIR ADJUSTED** .....TYPE E2**A** SERIES  
**BACK PRESSURE** .....TYPE E2**Q**  
**LOAD ALLOCATING** .....TYPE E2**FD**  
**AIR CONTROLLED** .....TYPE E2**AP60**  
**ELECTRONIC SLOW START** .....TYPE E2**D208D**  
**SOLENOID CONTROLLED** .....TYPE E2**MD**  
**SOLENOID ACTUATED** .....TYPE E2**M**  
**DIFFERENTIAL** .....TYPE E2**N**  
**TEMPERATURE CONTROL** .....TYPE E2**T14**  
**TEMP. & PRESSURE CONTROL** .....TYPE E2**T134**

#### RATED FLOW COEFFICIENTS (Cv)

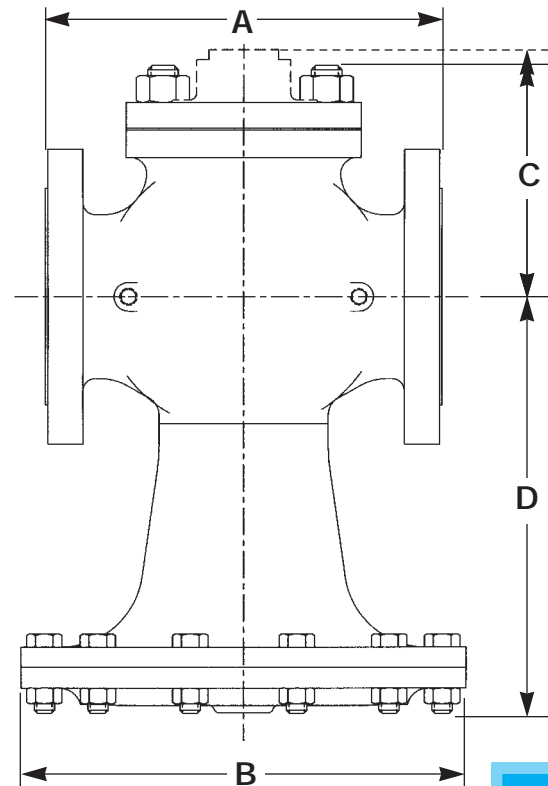
SEAT FACTOR	REGULATOR SIZE												
	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12
Full	7.6	11.7	18.9	27.4	44	68	96	143	202	255	465	748	1118

# TYPE E2 MAIN VALVE SPECIFICATION

The valve shall be self-operated, external pilot type, single seated, hycar diaphragm actuated, normally closed design. The valve will function quickly and shut tight on dead end service. Internal parts including seats, discs and stems shall be of stainless steel. There shall be no springs in the steam flow path and no stuffing box. The valve shall be easy to maintain with all parts accessible without removal from the line.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....ASTM A126 Cl. B  
Body, Cast Bronze.....ASTM B61-80 61UNSC 92200  
Stem .....303 St. Stl. ASTM A582  
Disc 3/4 - 2" .....420 St. Stl. ASTM A743 CA-40  
Disc 2-1/2 - 12" .....304 St. Stl. ASTM A167/A240  
Seat .....420 St. Stl. ASTM A743 CA-40  
Gasket .....Non-asbestos  
Diaphragm .....Hycar  
Spring .....Steel



TYPE E2 MAIN VALVE

FITTINGS

**DIMENSIONS** inches (mm), **WEIGHTS** pounds (kg)

SIZE	A		OTHER DIMENSIONS				APPROX. WT.	
	CI, BRZ ANSI NPT	CI ANSI 125	B	C		D*	CI, BRZ ANSI NPT	CI ANSI 125
				Std. Mount	Integral Mount			
3/4 (19)	4 3/4 (121)	— —	8 (203)	2 7/8 (73)	3 5/8 (92)	7 3/4 (197)	18 (8)	— —
1 (25)	5 3/8 (137)	5 1/2 (140)	8 (203)	3 5/8 (92)	4 3/8 (111)	8 1/8 (206)	19 (9)	21 (10)
1 1/4 (32)	6 1/2 (165)	6 3/4 (171)	9 (229)	4 1/8 (105)	4 (101)	8 1/4 (210)	30 (14)	33 (15)
1 1/2 (38)	7 1/4 (184)	6 7/8 (175)	9 3/4 (248)	4 3/8 (111)	4 1/2 (118)	8 3/4 (222)	36 (16)	40 (18)
2 (51)	7 1/2 (191)	8 1/2 (216)	10 1/2 (267)	5 1/4 (133)	5 (127)	10 (254)	50 (23)	57 (26)
2 1/2 (64)	— —	9 3/8 (238)	10 1/2 (267)	5 3/4 (146)	5 3/8 (136)	11 1/2 (292)	— —	70 (32)
3 (76)	— —	10 (254)	11 1/4 (286)	6 5/8 (168)	6 3/8 (162)	12 3/4 (324)	— —	98 (45)
4 (102)	— —	11 7/8 (302)	13 1/2 (343)	6 3/4 (171)	6 5/8 (168)	13 5/8 (346)	— —	135 (61)
5 (127)	— —	13 5/8 (346)	14 1/4 (362)	7 1/2 (191)	7 3/8 (187)	15 (381)	— —	185 (84)
6 (152)	— —	15 1/8 (384)	16 (406)	7 7/8 (200)	7 (178)	16 5/8 (422)	— —	250 (114)
8 (203)	— —	19 (483)	20 (508)	9 1/2 (241)	9 1/4 (235)	19 7/8 (505)	— —	1210 (550)
10 (254)	— —	23 5/8 (600)	24 (610)	10 7/8 (276)	— —	23 7/8 (606)	— —	690 (314)
12 (305)	— —	26 1/2 (673)	28 (711)	12 3/4 (324)	— —	27 1/8 (689)	— —	1060 (482)

\*Add 55% to D dimension for stem removal clearance.





**TYPE E5 MAIN VALVE**

#### APPLICATION DATA

- Pressure Regulating for Steam Distribution
- High Pressure/Low Differential Pressure Regulating
- Fluid Regulation
- For use with Self-contained, Pneumatic or Electronic Pilots
- Slow Start-up or Shutdown

#### VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
-------------------------	------------------------	------------------------

##### CAST IRON

Class 250 NPT	250 (17.2) @	450 (232)
B16.1 Class 125 Flanged	125 (8.6) @	450 (232)
B16.1 Class 250 Flanged	250 (17.2) @	450 (232)

##### CAST BRONZE

B16.15 Class 250 NPT	250 (17.2) @	450 (232)
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##### CAST STEEL

B16.34 Class 300 NPT	300 (21.0) @	600 (315)
B16.34 Class 150 Flanged	150 (10.3) @	500 (260)
B16.34 Class 300 Flanged	300 (21.0) @	600 (315)

Other pressure/temperature ratings available; consult factory.  
Maximum downstream pressure is 300 psi.

**SIZING  
INFO**

## TYPE E5 MAIN VALVE

**HIGH PRESSURE-HIGH LIFT  
LOW DIFFERENTIAL**

**SIZES  $\frac{3}{4}$ " - 8"**

**PRESSURES to 300 PSIG at 600°F**

- Normally Closed
- Single Seat
- Balanced Hycar Diaphragm
- Protected Main Spring
- Long Main Spring Operates on 5 psi Minimum Differential
- Internal & External Condensation Chambers
- Fluid, Gas & Vapor Applications
- Accurate Regulation Unaffected by Service Conditions
- ANSI/FCI 70-2 Class IV Shutoff
- Virtually Frictionless for Long Service Life
- Packless Construction
- Easy In-line Maintenance
- Wide Variety of Pilots for Many Applications

#### OPTIONS

- Composition Disc for liquid, air or gas service
- Balanced Construction
- Secoweld
- Integral Mount Pilot

#### TYPICAL CONFIGURATIONS

PRESSURE REDUCING	.....TYPE E5D
AIR ADJUSTED	.....TYPE E5A
BACK PRESSURE	.....TYPE E5Q
PUMP GOVERNOR	.....TYPE E5P
LOAD ALLOCATING	.....TYPE E5FD
AIR CONTROLLED	.....TYPE E5AP60
ELECTRONIC SLOW START	.....TYPE E5D208D
SOLENOID CONTROLLED	.....TYPE E5MD
SOLENOID ACTUATED	.....TYPE E5M
DIFFERENTIAL	.....TYPE E5N
TEMPERATURE CONTROL	.....TYPE E5T

#### RATED FLOW COEFFICIENTS (Cv)

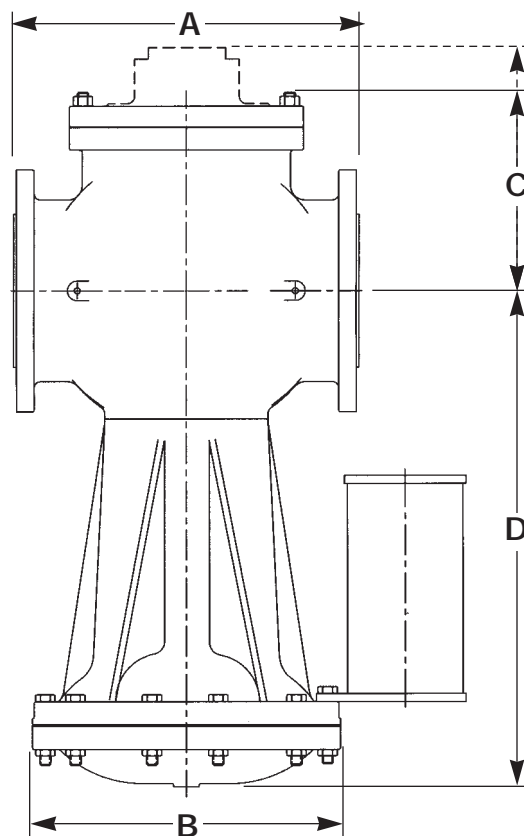
SEAT FACTOR	REGULATOR SIZE												
	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	4	5	6	8	10	12
Full	7.6	11.7	18.9	27.4	43	67	95	159	258	350	665	1018	1611
Normal	5.7	10.0	13.4	19.8	25	35	59	120	176	228	366	525	952

# TYPE E5 MAIN VALVE SPECIFICATION

The valve shall be self-operated, external pilot type, single seated, diaphragm actuated, normally closed design. The valve will function quickly and shut tight on dead end service. Internal parts including seats, discs and stems shall be of stainless steel. The diaphragm shall be a balanced Hycar material for high lift. There shall be an external condensation chamber supplied. The main valve spring shall operate on a 5 psi minimum differential. There shall be no springs in the steam flow path and no stuffing box. The valve shall be easy to maintain with all parts accessible without removal from the line.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....ASTM A126 Cl. B  
Body, Cast Bronze .....ASTM B61 UNS C92200  
Body, Cast Steel .....ASTM A216 WCB  
Stem .....303 St. Stl. ASTM A582  
Disc 3/4 - 5" .....420 St. Stl. ASTM A582 Cond A  
Disc 6 - 12" .....304 St. Stl. ASTM A167/A240  
Seat 3/4 - 5" .....420 St. Stl. ASTM A582 Cond A  
Seat 6 - 12" .....316 St. Stl. ASTM A743 CF-8M  
Gasket .....Non-asbestos  
Diaphragm .....Hycar  
Spring .....Steel



TYPE E5 MAIN VALVE

FITTINGS

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A,C1			B	C				D*	APPROX.WT				
	ANSI NPT	ANSI 125	ANSI 250		Std. Mount		Integral Mount			Iron,Brz. Stl.ANSI NPT	Iron		Steel	
					ANSI 125	SCR 250	CI	Stl.			ANSI 125	ANSI 250	ANSI 150	ANSI 300
¾ (19)	4¾ (111)	— —	— —	2⅞ (73)	11¼ (286)	11¼ (286)	3⅝ (92)	3½ (89)	6⅞ (175)	23 (10)	— —	— —	— —	— —
1 (25)	5⅜ (137)	5½ (140)	6 (152)	3⅝ (92)	11⅝ (295)	11⅝ (295)	4⅜ (111)	4⅜ (111)	6⅞ (175)	24 (11)	30 (14)	33 (15)	35 (16)	39 (18)
1¼ (32)	6½ (165)	6¾ (171)	7¼ (184)	4⅞ (105)	13½ (343)	13½ (343)	4 (102)	4⅝ (117)	9⅞ (232)	49 (22)	46 (21)	49 (22)	58 (26)	63 (29)
1½ (38)	7¼ (184)	6⅞ (175)	7⅜ (187)	4⅜ (111)	13⅝ (346)	13⅝ (346)	4½ (114)	5 (127)	9⅞ (232)	53 (24)	58 (26)	68 (31)	67 (30)	74 (34)
2 (51)	7½ (191)	8½ (216)	9 (229)	5¼ (133)	16¼ (413)	16¼ (413)	5 (127)	5⅝ (143)	11⅞ (283)	84 (38)	90 (41)	97 (44)	113 (51)	120 (55)
2½ (64)	— —	9⅝ (238)	10 (254)	5¾ (146)	16½ (419)	16½ (419)	5⅝ (137)	6 (152)	11⅞ (283)	— —	97 (44)	112 (51)	130 (59)	135 (61)
3 (76)	— —	10 (254)	10¾ (273)	6⅝ (168)	19¼ (489)	19¼ (489)	6⅝ (162)	7 (178)	13½ (343)	— —	148 (67)	170 (77)	210 (95)	226 (103)
4 (102)	— —	11⅞ (302)	12½ (318)	7⅝ (194)	18⅜ (467)	23⅜ (594)	6⅝ (168)	8 (203)	13½ (343)	— —	208 (95)	293 (133)	307 (139)	330 (150)
5 (127)	— —	13⅝ (346)	14½ (368)	8½ (216)	18¾ (476)	23¾ (603)	7⅝ (187)	8¾ (222)	13½ (343)	— —	240 (109)	333 (151)	335 (152)	366 (166)
6 (152)	— —	15⅞ (384)	16 (406)	10 (254)	23½ (597)	27⅝ (695)	7 (178)	— —	16¾ (425)	— —	348 (158)	616 (280)	560 (254)	503 (274)
8 (203)	— —	19 (483)	20 (508)	11½ (292)	23¾ (603)	29⅝ (752)	9¼ (235)	— —	16¾ (425)	— —	650 (295)	814 (370)	795 (361)	862 (392)
10 (254)	— —	23⅝ (600)	25 (635)	13¾ (349)	30¾ (781)	35⅝ (899)	— —	— —	20 (508)	— —	910 (414)	1130 (513)	1345 (611)	1420 (645)
12 (305)	— —	26½ (673)	28 (711)	15⅞ (403)	39¾ (1010)	39¾ (1010)	— —	— —	24¾ (629)	— —	1580 (718)	1920 (872)	1990 (904)	2160 (982)



TYPE E6 MAIN VALVE

# TYPE E6 MAIN VALVE

HIGH PRESSURE-HIGH LIFT  
COLD SERVICE

SIZES 3/4" - 12"

PRESSURES to 250 PSIG at 200°F

- Normally Closed
- Single Seat
- Balanced Hycar Diaphragm
- Protected Main Spring
- Composition Disc for Tight Shutoff
- Air & Gas Applications
- Accurate Regulation Unaffected by Service Conditions
- ANSI/FCI 70-2 Class VI Shutoff
- Virtually Frictionless for Long Service Life
- Packless Construction
- Easy In-line Maintenance
- Wide Variety of Pilots for Many Applications

## APPLICATION DATA

- Pressure Regulating for Compressed Air Distribution
- Pressure Regulating for Gas Service
- Maintain Back Pressure or Differential Pressure
- For use with Self-contained, Pneumatic or Electronic Pilots
- Single Point or Multiple Use Applications
- Slow Start-up or Shutdown

## VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
-------------------------	------------------------	------------------------

### CAST IRON

B16.4 Class 250 NPT	250 (17.2) @	200 (93)
B16.1 Class 125 Flanged	125 (8.6) @	200 (93)
B16.1 Class 250 Flanged	250 (17.2) @	200 (93)

### CAST BRONZE

B16.15 Class 250 NPT	250 (17.2) @	200 (93)
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Other pressure/temperature ratings available; consult factory.

## OPTIONS

- Dashpot for Water Service
- Integral Mount Pilot
- Insulcap Insulating Jacket
- Balanced Construction

## TYPICAL CONFIGURATIONS

PRESSURE REDUCING	.....TYPE E6D
AIR ADJUSTED	.....TYPE E6A
BACK PRESSURE	.....TYPE E6Q
PUMP GOVERNOR	.....TYPE E6P
LOAD ALLOCATING	.....TYPE E6FD
AIR CONTROLLED	.....TYPE E6AP60
ELECTRONIC SLOW START	.....TYPE E6D208D
SOLENOID CONTROLLED	.....TYPE E6MD
SOLENOID ACTUATED	.....TYPE E6M
DIFFERENTIAL	.....TYPE E6N
TEMPERATURE CONTROL	.....TYPE E6T

SIZING  
INFO

## RATED FLOW COEFFICIENTS (Cv)

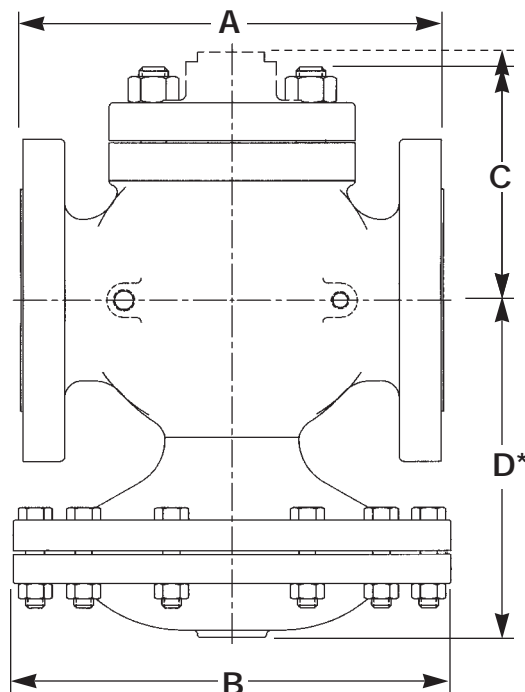
SEAT FACTOR	REGULATOR SIZE													
	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12	
Full	7.6	11.7	18.9	27.4	43	67	95	159	258	350	665	1018	1611	
Normal	5.7	10.0	13.4	19.8	25	35	59	120	176	228	366	525	952	

# TYPE E6 MAIN VALVE SPECIFICATION

The valve shall be self-operated, external pilot type, single seated, composition disc, hycar diaphragm actuated, normally closed design. The valve will function quickly and shut tight on dead end service. Seats and stems shall be of stainless steel. There shall be no springs in the flow space and no stuffing box. The valve shall be easy to maintain with all parts accessible without removal from the line.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....ASTM A126 Cl. B  
Body, Cast Bronze .....ASTM B61 UNS C92200  
Stem .....303 St. Stl. ASTM A582  
Disc .....Hycar Comp.  
Seat 3/4 - 5".....420 St. Stl. ASTM 473 CA-40  
Seat 6 - 8".....316 St. Stl. ASTM A743 CF-8M  
Gasket .....Non-asbestos  
Diaphragm .....Hycar  
Spring .....Steel  
Disc Holder .....ASTM B16 UNS C36000



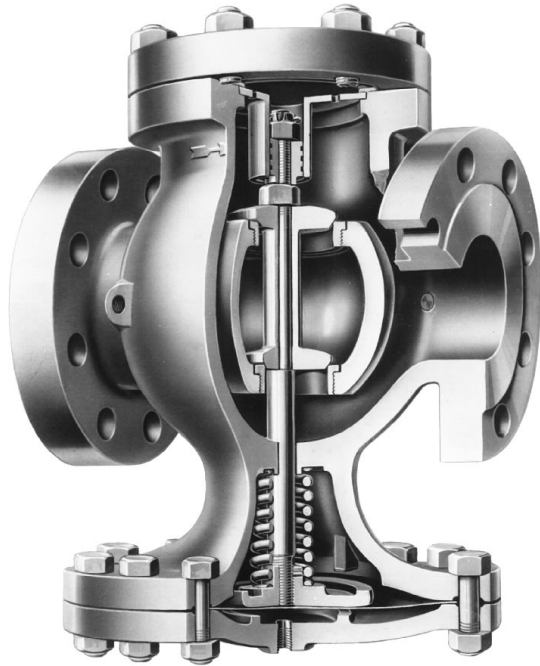
TYPE E6 MAIN VALVE

FITTINGS

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	DIMENSIONS							APPROX. WT.		
	A			B	C		D*			
	ANSI NPT	ANSI 125	ANSI 250		Std. Mount	Integral Mount		ANSI NPT	ANSI 125	ANSI 250
3/4 (19)	4 3/4 (111)	—	—	6 7/8 (175)	2 7/8 (73)	3 5/8 (92)	6 3/8 (162)	18 (8)	—	—
1 (25)	5 3/8 (137)	5 1/2 (140)	6 (152)	6 7/8 (175)	3 5/8 (92)	4 3/8 (111)	6 5/8 (168)	18 (8)	27 (129)	30 (14)
1 1/4 (32)	6 1/2 (165)	6 3/4 (171)	7 1/4 (184)	9 1/8 (232)	4 1/8 (105)	4 (102)	7 3/4 (197)	37 (17)	39 (18)	44 (20)
1 1/2 (38)	7 1/4 (184)	6 7/8 (175)	7 3/8 (187)	9 1/8 (232)	4 3/8 (111)	4 1/2 (114)	7 7/8 (200)	42 (19)	50 (23)	56 (25)
2 (51)	7 1/2 (191)	8 1/2 (216)	9 (229)	11 1/8 (283)	5 1/4 (133)	5 (127)	8 5/8 (219)	66 (30)	73 (33)	81 (37)
2 1/2 (64)	—	9 3/8 (238)	10 (254)	11 1/8 (283)	5 3/4 (146)	5 3/8 (137)	9 (229)	—	83 (38)	95 (43)
3 (76)	—	10 (254)	10 3/4 (273)	13 1/2 (343)	6 5/8 (168)	6 3/8 (162)	9 7/8 (251)	—	124 (56)	146 (66)
4 (102)	—	11 7/8 (302)	12 1/2 (318)	13 1/2 (343)	7 5/8 (194)	6 5/8 (168)	12 3/4 (324)	—	206 (94)	234 (106)
5 (127)	—	13 5/8 (346)	14 1/2 (368)	13 1/2 (343)	8 1/2 (216)	7 3/8 (187)	13 1/4 (337)	—	275 (125)	287 (130)
6 (152)	—	15 1/8 (384)	16 (406)	16 3/4 (425)	10 (254)	7 (178)	15 1/2 (394)	—	363 (165)	431 (196)
8 (203)	—	19 (483)	20 (508)	16 3/4 (425)	11 1/2 (292)	9 1/4 (235)	17 5/8 (448)	—	508 (231)	610 (277)

\*Add 100% to D dimension for stem removal clearance.



TYPE C20 MAIN VALVE

# TYPE C20 MAIN VALVE

## DOUBLE SEAT METAL DIAPHRAGM

SIZES 1" – 12"  
PRESSURES to 250 PSIG at 450°F

- Normally Closed
- Double Seat
- Balanced Metal Diaphragm
- Protected Main Spring
- Fluid, Gas & Vapor Applications
- Accurate Regulation Unaffected by Service Conditions
- Minimum Differential of 20 psi
- ANSI/FCI 70-2 Class III Shutoff
- Virtually Frictionless for Long Service Life
- Packless Construction
- Wide Variety of Pilots for Many Applications

### OPTIONS

- High Temperature Construction

### TYPICAL CONFIGURATIONS

PRESSURE REDUCING .....TYPE C20**D**  
 AIR ADJUSTED .....TYPE C20**A**  
 BACK PRESSURE .....TYPE C20**Q**  
 PUMP GOVERNOR .....TYPE C20**P**  
 LOAD ALLOCATING .....TYPE C20**FD**  
 AIR CONTROLLED .....TYPE C20**AP60**  
 ELECTRONIC SLOW START .....TYPE C20**D208D**  
 SOLENOID CONTROLLED .....TYPE C20**MD**  
 SOLENOID ACTUATED .....TYPE C20**M**  
 DIFFERENTIAL .....TYPE C20**N**  
 TEMPERATURE CONTROL .....TYPE C20**T**

### APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Regulating for Process Control (Temperature or Pressure)
- Maintain Back Pressure or Differential Pressure
- For use with Self-contained, Pneumatic or Electronic Pilots
- Single Point or Multiple Use Applications
- Slow Start-up or Shutdown
- High Turndown

### VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
-------------------------	------------------------	------------------------

#### CAST IRON

B16.4 Class 250 NPT	250 (17.2) @ 450 (232)
B16.1 Class 125 Flanged	125 (8.6) @ 450 (232)
B16.1 Class 250 Flanged	250 (17.2) @ 450 (232)

#### CAST STEEL

Consult Factory

Other pressure/temperature ratings available; consult factory.  
Maximum downstream pressure is 300 psi.

SIZING  
INFO

### RATED FLOW COEFFICIENTS (Cv)

REGULATOR SIZE											
1	1¼	1½	2	2½	3	4	5	6	8	10	12
7.5	14.0	20.0	30	47	69	115	186	250	436	700	1083

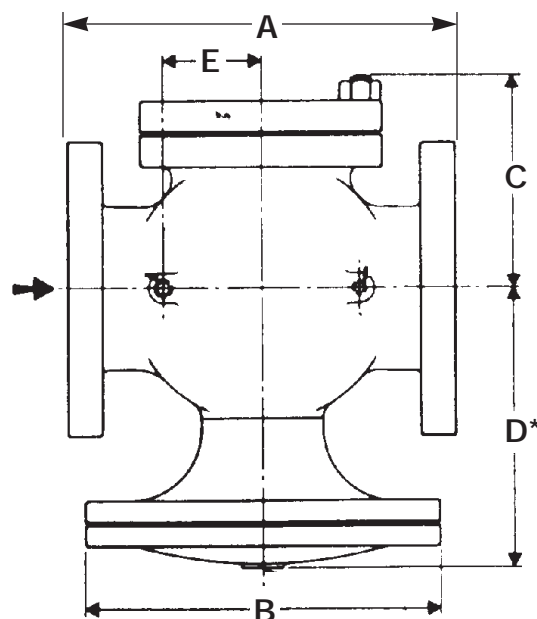


# TYPE C20 MAIN VALVE SPECIFICATION

The valve shall be self-operated, external pilot type, double seated, metal diaphragm actuated, normally closed design. The valve will function quickly. Internal parts including seats, discs, stems and diaphragms shall be of stainless steel. There shall be no springs in the steam space and no stuffing box.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....ASTM A126 Cl. B  
Body, Cast Steel .....ASTM A216 WCB  
Stem .....303 St. Stl. ASTM A582  
Disc 1 - 2½" .....303 St. Stl. ASTM A582 Cond A  
Disc 3 - 10" .....304 St. Stl. ASTM A276 Cond A  
Seat 1- 2" .....303 St. Stl. ASTM A582 Cond A  
Seat 2½ - 10" .....304 St. Stl. ASTM A286 Cond A  
Gasket .....Non-asbestos  
Diaphragm .....Stainless Steel MIL-5-5059C  
Spring .....Steel



TYPE C20 MAIN VALVE

FITTINGS

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	DIMENSIONS							APPROX. WT.		
	A			B	C	D*	E	ANSI NPT	ANSI 125	ANSI 250
	ANSI NPT	ANSI 125	ANSI 250							
1 (25)	5⅞ (137)	—	—	6½ (165)	3⅞ (86)	5 (127)	1⅜ (35)	19 (9)	18 (8)	17 (8)
1¼ (32)	6½ (165)	—	—	7 (178)	3⅞ (98)	5⅞ (136)	1⅞ (48)	26 (12)	23 (10)	24 (11)
1½ (38)	7¼ (184)	—	—	7⅞ (200)	4¼ (108)	6 (152)	2 (51)	35 (16)	44 (20)	39 (18)
2 (51)	7½ (191)	8½ (216)	9 (229)	4⅞ (117)	6⅞ (175)	8¾ (222)	2⅞ (54)	44 (20)	51 (23)	60 (27)
2½ (64)	—	9⅞ (238)	10 (254)	5½ (140)	7⅞ (181)	9⅞ (251)	2⅞ (60)	—	71 (32)	82 (37)
3 (76)	—	10 (254)	10¾ (273)	6 (152)	8 (203)	10⅞ (276)	2¾ (70)	—	95 (43)	111 (50)
4 (102)	—	11⅞ (302)	12½ (318)	6⅝ (168)	9⅞ (232)	12¾ (324)	3 (76)	—	147 (67)	169 (77)
5 (127)	—	13⅞ (346)	14½ (368)	7⅞ (194)	11¼ (286)	14¾ (375)	3½ (89)	—	220 (100)	243 (110)
6 (152)	—	15⅞ (384)	16 (406)	9⅞ (232)	12⅞ (314)	16⅞ (429)	4¼ (108)	—	314 (143)	350 (159)
8 (203)	—	19 (483)	20 (508)	10½ (267)	15⅞ (384)	19¾ (502)	6¼ (159)	—	482 (219)	580 (264)
10 (254)	—	23⅞ (600)	25 (635)	22½ (572)	12⅞ (314)	18 (457)	8 (203)	—	1110 (505)	1220 (555)
12 <sup>†</sup> (305)	—	—	28 (711)	28 (711)	14⅞ (378)	22⅞ (567)	8½ (216)	—	1680 (764)	1710 (777)

\*Add 40% to D dimension for stem removal clearance.  
†Consult factory.



TYPE C34 MAIN VALVE

#### APPLICATION DATA

- Pressure Regulating for Liquid Distribution
- Regulating for Process Control (Temperature or Pressure)
- Maintain Back Pressure or Differential Pressure
- For use with Self-contained, Pneumatic or Electronic Pilots
- Single Point or Multiple Use Applications
- Slow Start-up or Shutdown

#### VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
-------------------------	------------------------	------------------------

##### CAST IRON

B16.4 Class 250 NPT	200 (13.8)	@ 200 (93)
B16.1 Class 125 Flanged	165 (11.4)	@ 200 (93)
B16.1 Class 250 Flanged	200 (13.8)	@ 200 (93)

**SIZING  
INFO**

# TYPE C34 MAIN VALVE

## BALANCED SINGLE SEAT LIQUID SERVICE

SIZES 1" – 6"

PRESSURES to 200 PSIG at 200°F

- Normally Closed
- Single Seat
- Hycar Diaphragm
- Balanced Composition Disc
- Protected Main Spring
- Balanced Piston Design without Dashpot
- Fluid Applications
- Accurate Regulation for Non-violent Load Fluctuations
- ANSI/FCI 70-2 Class VI Shutoff
- Virtually Frictionless for Long Service Life
- Packless Construction
- Wide Variety of Pilots for Many Applications

#### TYPICAL CONFIGURATIONS

PRESSURE REDUCING .....	TYPE C34D
AIR ADJUSTED .....	TYPE C34A
BACK PRESSURE .....	TYPE C34Q
PUMP GOVERNOR .....	TYPE C34P
LOAD ALLOCATING .....	TYPE C34FD
AIR CONTROLLED .....	TYPE C34AP60
ELECTRONIC SLOW START .....	TYPE C34D208D
SOLENOID CONTROLLED .....	TYPE C34MD
SOLENOID ACTUATED .....	TYPE C34M
DIFFERENTIAL .....	TYPE C34N
COOLING CONTROL .....	TYPE C34T

#### RATED FLOW COEFFICIENTS (Cv)

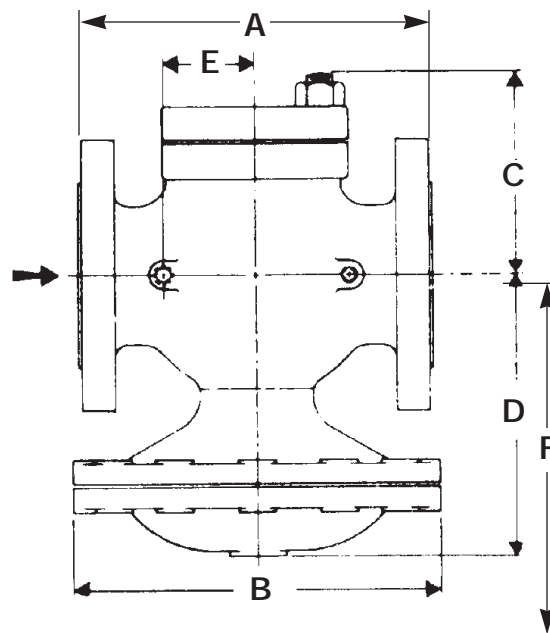
REGULATOR SIZE								
1	1¼	1½	2	2½	3	4	5	6
5.5	12.5	17.3	24	36	53	86	139	196

# TYPE C34 MAIN VALVE SPECIFICATION

The valve shall be self-operated, external pilot type, single seated, diaphragm actuated, normally closed design. The valve will shut tight on dead end service and shall maintain a discharge pressure which will not vary more than 10% (2 psi minimum) of set point from zero flow to rated flow regardless of inlet pressure variation. Valve shall be suitable for 200°F (93°C) service temperature. Bodies shall be cast iron. Sizes 2-1/2" and larger shall have flanged ends. Trim shall be stainless steel. Valves shall be equipped with a reversible composition disc. Diaphragms and discs shall be hycar. There shall be no springs in the fluid space and no stuffing box.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....ASTM A126 Cl. B  
Stem .....303 St. Stl. ASTM A582  
Disc .....Hycar Comp  
Seat 1 - 2" .....303 St. Stl. ASTM A582  
Seat 2 1/2 - 6" .....304 St. Stl. ASTM A276 Cond A  
Gasket .....Non-asbestos  
Diaphragm .....Hycar  
Spring .....Steel



TYPE C34 MAIN VALVE

FITTINGS

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	FACE TO FACE			OTHER DIMENSIONS						APPROX. WT.		
	A			B	C	D	E	F	G	ANSI NPT	ANSI 125	ANSI 250
	ANSI NPT	ANSI 125	ANSI 250									
1 (25)	5 3/8 (137)	—	—	6 7/8 (175)	3 3/8 (86)	7 (178)	1 3/8 (35)	6 (152)	10 3/8 (264)	19 (9)	—	—
1 1/4 (32)	6 1/2 (165)	—	—	6 7/8 (175)	3 7/8 (98)	7 (178)	1 13/16 (46)	6 5/8 (168)	11 1/4 (286)	24 (11)	—	—
1 1/2 (38)	7 1/4 (184)	—	—	6 7/8 (175)	4 1/4 (108)	7 (178)	1 15/16 (49)	6 3/8 (162)	11 7/8 (302)	29 (13)	—	—
2 (51)	7 1/2 (191)	8 1/2 (216)	9 (229)	9 1/8 (232)	4 1/2 (114)	7 (178)	2 1/16 (52)	6 1/2 (165)	12 1/2 (318)	46 (21)	51 (13)	60 (27)
2 1/2 (64)	—	9 3/8 (238)	10 (254)	9 1/8 (232)	5 1/2 (140)	7 3/8 (187)	2 3/8 (60)	6 7/8 (175)	14 1/2 (368)	—	65 (30)	74 (34)
3 (76)	—	10 (254)	10 3/4 (273)	11 1/8 (283)	6 (152)	8 3/4 (222)	2 3/4 (70)	7 1/4 (184)	15 7/8 (403)	—	94 (43)	111 (50)
4 (102)	—	11 7/8 (302)	12 1/2 (318)	13 1/2 (343)	6 5/8 (168)	9 3/8 (238)	3 (76)	7 3/4 (197)	17 3/4 (451)	—	148 (67)	172 (78)
5 (127)	—	13 5/8 (346)	14 1/2 (368)	13 1/2 (343)	7 5/8 (194)	10 7/8 (276)	3 1/2 (89)	8 5/8 (219)	20 1/4 (514)	—	194 (88)	226 (103)
6 (152)	—	15 1/8 (384)	16 (406)	13 1/2 (343)	9 1/8 (232)	13 1/8 (333)	4 1/4 (108)	10 5/8 (270)	25 1/8 (638)	—	280 (127)	325 (148)

# TYPE T3 TEMPERATURE REGULATOR

SIZES 1/2" – 2"  
UP to 250 PSIG at 400°F



TYPE T3 TEMPERATURE REGULATOR

- Self-contained
- Self-acting
- Stainless Steel Trim
- Bronze Vapor Tension Thermal Element
- Easily Interchangeable Thermal System
- Cap and Thermal Assembly permit 360° Rotation
- Enclosed Spring Chamber
- Overload Spring
- Superior Stem Finish and Graphite Packing
- Union Connections

## APPLICATION DATA

- Product storage tanks
- Hot water storage heaters
- Metal finishing baths and tanks
- Fuel oil preheaters
- Air heater units
- Dryers
- Cooking vats and kettles
- Sterilizers, pasturizers and bottle washing units
- Engine and compressor cooling systems
- After-coolers and oil coolers

## VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
Class 250 NPT	250 (17.2)	@ 400 (204)

## TEMPERATURE RANGES °F (°C)

40-100 (4.4-38)	130-190 (54-88)
60-120 (16-49)	180-235 (82-113)
90-150 (32-66)	

## MAXIMUM DIFFERENTIAL PRESSURES PSIG (bar)

1/2"	250 (17.2)	1 1/4"	30 (2.1)
3/4"	250 (17.2)	1 1/2"	30 (2.1)
1"	80 (5.5)	2"	20 (1.4)

**SIZING  
INFO**

## OPTIONS

- Dial Temperature Gage
- Bronze, Steel, Stainless Steel or Monel Bulb Well
- Steel, Stainless Steel or Monel Bulb
- Stainless Steel Armored Capillary
- Tubing longer than 10'
- Plain bulb replacing union connection

## RATED FLOW COEFFICIENTS (Cv)

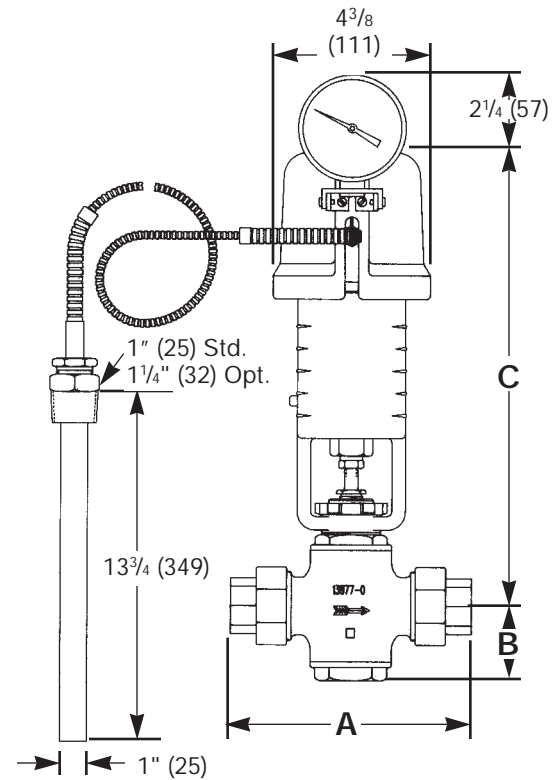
NOMINAL VALVE SIZE					
1/2	3/4	1	1 1/4	1 1/2	2
5.3	7.0	8.7	16.0	18.5	31

# TYPE T3 TEMPERATURE REGULATOR SPECIFICATION

The valve shall be self operated, requiring no external energy source. The valve shall be direct acting (heating) or reverse acting (cooling). Thermal system must be interchangeable. Actuating spring must be enclosed to protect from contamination. Vapor tension thermal element must be selected to provide fast response within selected range. Valve must be rated 250 psig at 400°F. Trim must be made from stainless steel materials. Body materials must be of Bronze.

## MATERIALS OF CONSTRUCTION

Body .....	Bronze ASTM B62-80 C83600
Trim .....	Stainless Steel
Packing .....	Graphite
Union Connections .....	Iron
Yoke .....	Aluminum
Cap .....	Aluminum
Thermal Bellows .....	Bronze
Springs .....	Steel
Thrust Screw .....	Bronze
Spring Plate .....	Iron
Capillary .....	Copper
Bulb .....	Bronze
Flexible Armor .....	Brass
Stem .....	303 St. Stl. ASTM 582 Cond. A
Disc .....	316 St. Stl. ASTM 276 Cond. A
Seat .....	303 St. Stl. ASTM 582 Cond. A



**DIMENSIONS** inches (mm)  
**AND WEIGHTS** pounds (kg)

Size	Dimensions, Inches			Weight
	A	B	C	
1/2 (13)	5 3/8 (137)	1 7/8 (48)	12 3/4 (324)	13 (6)
3/4 (19)	5 1/2 (140)	1 7/8 (48)	12 3/4 (324)	14 (6.4)
1 (25)	6 7/8 (175)	2 1/8 (54)	13 (330)	16 (7.3)
1 1/4 (32)	8 1/8 (206)	2 7/16 (64)	13 3/8 (340)	22 (10)
1 1/2 (38)	7 7/8 (200)	2 7/16 (64)	13 3/8 (340)	21 (9.5)
2 (51)	9 (229)	3 3/4 (95)	13 1/2 (343)	27 (12.3)





# SERIES 2000 TEMPERATURE REGULATOR

SIZES 1/2" – 2"  
CONTROLS -25 to 450°F

## SERIES 2000 TEMPERATURE REGULATOR

### APPLICATION DATA

#### DIRECT ACTING

- Bottle Washing Machinery
- Steam Tables
- Plating Tanks
- Heating Ducts
- Fuel Oil Heaters
- Cooking Vats
- Water Heaters
- Heat Exchangers
- Parts Washer

#### THREE-WAY MIXING

- Fire Tube Boiler
- Internal Combustion Engine

#### REVERSE ACTING

- Induction Furnaces
- Industrial Compressors
- Cold Storage Boxes
- Cooling Ducts
- Engine Jacket Cooling
- Liquid Chillers

#### GAS SERVICE

- Oil Treaters
- Line Heaters
- Separators
- Glycol Dehydrators
- Storage Tanks

### VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
Class 250 NPT	250 (17.2)	406 (207)

- Self-actuated
- Two and Three Way Valve Bodies
- Single or Double Seat
- Overtemperature Protection
- Spring Loaded Teflon Chevron Type Packing Assembly
- Double Guided Stainless Steel Monolithic Disc Assembly
- Stainless Steel Seat Rings and Disc
- Adjusting Key Attached
- Galvanized Iron Union Ends
- Full Ported and Full Flow Bronze Body
- Copper Bulb with 8' Armored Capillary

### MODELS

- Type 2010 — Single Seat, Direct Acting
- Type 2020 — Single Seat, Reverse Acting
- Type 2030 — Double Seat, Direct Acting
- Type 2040 — Double Seat, Reverse Acting
- Type 2050 — Three-way Mixing and Diverting
- Type 2060 — Gas Service-15 psig maximum. If pressure exceeds 15 psi, a pressure reducing regulator should be used ahead of the temperature regulator.

### OPTIONS

- Dial Temperature Gage (Indicating)
- Stainless Steel, PVC Coated or Teflon Coated Bulb
- Armored Capillary
- Capillary lengths greater than 8'
- Extra Large Bulb
- Union Bushings & Wells

# SERIES 2000

## TEMPERATURE REGULATOR

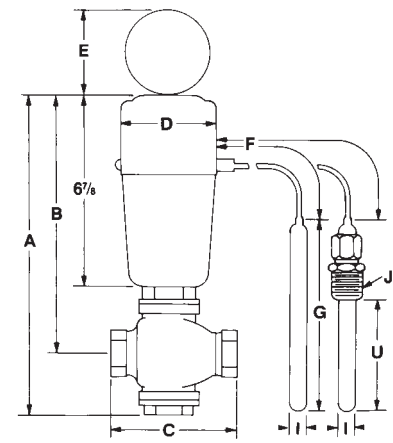
### SPECIFICATION

The valve shall be self-operated, requiring no external energy source. It shall have single or double stainless steel seats with double guided monolithic disc assembly for proper alignment. The valve shall be direct acting (heating) or reverse acting (cooling) and have two way or three way operation. The packing assembly shall be spring loaded, self adjusting with chevron type teflon packing. The thermal system line and bulb assembly shall be partially filled with a liquid/gas combination and in a range selected for fast response. The valve rating shall be 250 PSIG at 406°F. Body materials shall be bronze.

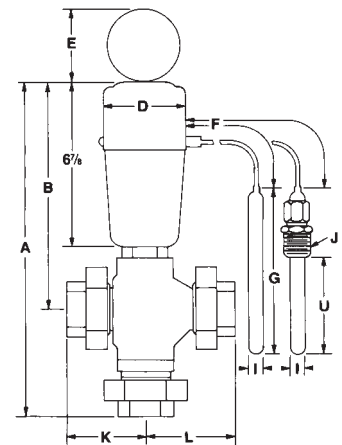
**MODEL 2060 FOR GAS SERVICE ONLY:** The valve shall be self-operated, requiring no external energy source and designed to control process temperature by regulating gas flow. It shall be normally open and close with increased temperature. "Bubble tight" dead end shutoff shall be provided by Buna-N vulcanized to disc backing. The packing assembly shall be spring loaded, self adjusting with chevron type teflon packing. The thermal system line and bulb assembly shall be partially filled with a liquid/gas combination and in a range selected for fast response. The valve rating shall be 15 PSIG. Body materials shall be nodular iron.

### MATERIALS OF CONSTRUCTION

ITEM	TYPE 2010-2050	TYPE 2060
Body	Bronze ASTM B62 C83600	Ductile Iron ASTM A536 65-45-12
Trim	Stainless Steel	Buna-N
Packing	Teflon	Buna-N
Unions	Iron	Iron
Yoke & Cap	Steel	Steel
Bellows	Bronze	Bronze
Spring	Steel	Steel
Capillary	Copper	Copper
Bulb	Copper	Copper
Armor	Bronze	Bronze
Stem	304 Stainless Steel	304 Stainless Steel
Disc	304 Stainless Steel	Buna-N
Seat	303 Stainless Steel	—



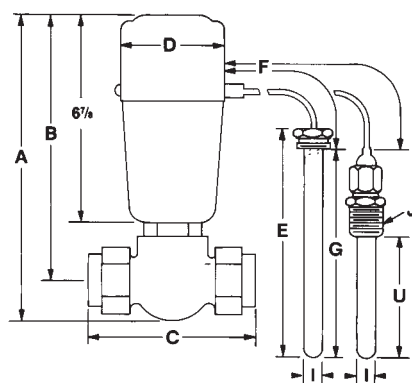
**TYPE 2010-2040 DIRECT & REVERSE ACTING**



**TYPE 2050 THREE WAY**

**TYPE 2010-2040 DIRECT & REVERSE ACTING**  
**DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)**

Size	Type No.	Dimensions						Shipping Weight (Approx.)
		A	B	C	D	E	F†	
1/2" (A, B, C, D, E)	2010	9 3/4	8 1/2	5 1/2	3 1/2	2 13/16	8 Ft.	10 (4.5)
1/2, 3/4	2020	(248)	(216)	(140)	(89)	(71)		
1/2"	2030	12 7/16	9 3/4	7 3/16	3 1/2	2 13/16	8 Ft.	13 (5.9)
3/4"	2040	(316)	(248)	(182)	(89)	(71)		
1"	2010	12 7/16	9 3/4	7 3/16	3 1/2	2 13/16	8 Ft.	13 (5.9)
	2020	(316)	(248)	(182)	(89)	(71)		
1 1/4"	2030	12 7/8	9 31/32	8 15/16	3 1/2	2 13/16	8 Ft.	20 (9.1)
1 1/2"	2040	(327)	(253)	(227)	(89)	(71)		25 (11)
2"								30 (14)



**TYPE 2060 GAS SERVICE**

**TYPE 2060 GAS SERVICE DIMENSIONS**  
**inches (mm) AND WEIGHTS pounds (kg)**

Size	Dimensions					Shipping Weight (Approx.)
	A	B	C	D	F†	
1/2"	9 3/4	8 1/2	5 5/8	3 1/2	10 Ft.	8
3/4"	(248)	(216)	(143)	(89)	(3 m.)	(3.6)
1"						

**TYPE 2050 THREE WAY**  
**DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)**

Size	Dimensions						Shipping Weight (Approx.)
	A	B	D	F†	K	L	
1/2"	13 7/8	9 3/4	3 1/2	8 Ft.	3 5/16	3 5/8	12 (5.5)
3/4"	(352)	(248)	(89)		(84)	(92)	12 (5.5)
1"							13 (5.9)
1 1/4"	14 21/32	9 31/32	3 1/2	8 Ft.	4 1/8	4 11/16	27 (12)
1 1/2"	(372)	(253)	(89)		(105)	(119)	
2"	14 7/8	9 31/32	3 1/2	8 Ft.	4 3/16	4 7/8	33 (15)
	(378)	(253)	(89)		(106)	(124)	

†See following pages for standard lengths, ranges, bulb sizes and maximum line lengths.

# SERIES 2000 TEMPERATURE REGULATOR SELECTION

## DIRECT & REVERSE ACTING & THREE WAY FLOW AND PRESSURE RATINGS psig (bar)

Size	Single Seat			Double Seat				Three Way			
	Type Number		Flow Coefficient C <sub>v</sub>	Max. Upstream Pressure	Type Number		Flow Coefficient C <sub>v</sub>	Max. Upstream Pressure	Type Number	Flow Coefficient C <sub>v</sub>	Max. Difference Between Inlet Pressures*
	Direct	Reverse			Direct	Reverse					
1/2"C	2010	2020	.40	250 (17.2)	NOT AVAILABLE IN DOUBLE SEAT				NOT AVAILABLE IN THREE WAY		
1/2"D			1.00								
1/2"E			1.80								
1/2"A			3.29								
1/2"B			4.29	200 (13.8)							
1/2"T			5.22	140 (9.7)	2030	2040	7.93	250 (17.2)	2050	5.22	140 (9.7)
3/4"T			6.85	90 (6.2)			10.4			6.85	90 (6.2)
1"T			9.15	65 (4.5)			12.9			9.15	65 (4.5)
1 1/4"T			14.3	40 (2.8)			20.6			14.3	40 (2.8)
1 1/2"T			15.1	30 (2.1)			24.8			15.1	30 (2.1)
2"T			17.2	20 (1.4)			33.0			17.2	20 (1.4)

### How to Select Range & Bulb Size

- Select a temperature range with the control point in the upper half of the temperature range.
- Determine line length required (8' is standard).
- Use line length and temperature range to find correct bulb size in chart at right.

#### EXAMPLE:

Control point: 130°F.

Temperature range: 45/145°F.

Line length: 15'

#### SOLUTION:

Bulb size: extra large – G = 19"

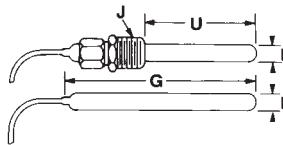
### RANGES, BULB SIZES & MAXIMUM LINE LENGTHS

Short Ranges (Gold Spring)		Long Ranges (Silver Spring)		Bulb Size	†Max. Line Length	‡Maximum Over-Temperature	
°F	°C	°F	°C			°F	°C
-15 to 50	-26 to 10	-15 to 75	-26 to 24	Large X Large	15 Ft. 40 Ft.	450	232
45 to 115	7.2 to 46	45 to 145	7.2 to 63	Large X Large	10 Ft. 40 Ft.	450	232
65 to 140	18 to 60	65 to 170	18 to 77	Large X Large	20 Ft. 40 Ft.	450	232
90 to 165	32 to 74	90 to 195	32 to 91	Large X Large	20 Ft. 40 Ft.	300	149
120 to 200	49 to 93	120 to 230	49 to 110	Small	40 Ft.	300	149
240 to 310	116 to 154	240 to 340	116 to 171	Small	40 Ft.	350	177
280 to 375	138 to 190	280 to 415	138 to 212	Small	40 Ft.	450	232

‡Maximum operating temperature PVC coated copper: 180°F (82°C) Teflon coated copper: 450°F (232°C)

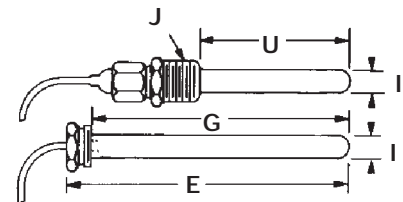
†Standard line lengths are 8', 15', 20', 30' and 40'. Maximum line length for teflon coated copper: 15 feet.

### SIZING INFO



### BULB DIMENSIONS\* inches (mm)

Bulb Sizes	G			U	I			J (NPT)
	Copper	Stain. Stl.	Coated		Plain	Union	Well	
Small	13 3/8 (340)	13 1/4 (337)	11 3/8 (289)	10 1/2 (267)	5/8 (16)	5/8 (16)	3/4 (19)	3/4 or 1
Large	15 5/8 (397)	15 1/8 (384)	13 1/4 (337)	12 1/2 (317)	1 (25)	1 (25)	1 1/8 (29)	1
Extra Large	19 (483)	18 5/8 (473)	19 (483)	16 (406)	1 (25)	1 (25)	1 1/8 (29)	1



### GAS SERVICE BULB & WELL DIMENSIONS inches (mm)

E	G	I		U	J (NPT)
		Bulb	Well		
8 1/4 (210)	7 3/8 (187)	25/32 (20)	15/16 (24)	7 11/16 (195)	1

# SERIES 2000 TEMPERATURE REGULATOR

## HOW TO ORDER

BODY UNIT			THERMOSTAT UNIT			
<u>2010</u>	<u>T</u>	<u>C</u>	-	<u>G</u>	<u>Q</u>	<u>K</u>
XXXX	X	X	-	X	X	X
TYPE NO.	ORIFICE	INLET SIZE		LINE & BULB STYLE	MATERIAL	RANGE °F
2010-Single Seat, Direct Acting	A	C-1/2		G-Indicating	Q-Copper Bz Armor 8'	A--15/50
2020-Single Seat, Reverse Acting	B	D-3/4		N-Non-indicating	R-Copper Bz Armor 15'	B--15/75
2030-Double Seat, Direct Acting	C	E-1			T-SS Unarmored 8'	C-45/115
2040-Double Seat, Reverse Acting	D	F-1-1/4			V-SS Unarmored 15'	D-45/145
2050-Three Way	E	G-1-1/2			J-PVC Coated Copper 8'	E-65/140
	T-Standard	H-2			K-PVC Coated Copper 15'	F-65/170
					F-Teflon Coated Copper 8'	G-90/165
					G-Teflon Coated Copper 15'	H-90/195
					Z-Other	J-120/200
						K-120/230
						L-240/310
						M-240/340
						N-280/375
						P-280/415
						Z-Other
2060-Gas Regulator	T-Standard	C-1/2		N-Non-indicating	A-Bronze 5'	1-40/90
		D-3/4			B-Bronze 10'	2-45/115
		E-1			C-Bronze 15'	3-65/170
					D-Bronze 20'	4-110/190
					Z-Other	5-110/220
						6-240/340
						7-330/440
						8-65/140

† Large bulb standard for H-90/195 range and lower. Small bulb standard for J-120/200 range and higher.

Extra large bulb may be required for extra line length and are special order.

Line lengths are standard 8' and 15'. Other sizes are special order.

Unions and wells are to be entered as separate line items.

### WELLS

Cat. No.	Bulb Size	Material	Inches (mm)			
			Bulb Dia.	NPT	U	Well Dia.
99A	S	Brass	5/8 (16)	3/4 (19)	10 1/2 (267)	3/4 (19)
99B	S	Brass		1 (25)		
99C	S	Carbon St.		3/4 (19)		
99D	S	Carbon St.		1 (25)		
99E	S	304 St. St.		3/4 (19)		
99F	S	304 St. St.		1 (25)		
99G	S	316 St. St.		3/4 (19)		
99H	S	316 St. St.		1 (25)		
99J	L	Brass	1 (25)	1 (25)	12 1/2 (318)	1 1/8 (29)
99K	X	Brass			16 (406)	
99L	L	Carbon St.			12 1/2 (318)	
99M	X	Carbon St.			16 (406)	
99N	L	304 St. St.			12 1/2 (318)	
99P	X	304 St. St.			16 (406)	
99Q	L	316 St. St.			12 1/2 (318)	
99R	X	316 St. St.			16 (406)	

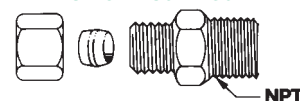
### UNION BUSHINGS

Cat. No.	Bulb Size	Material	Inches (mm)	
			Bulb Dia.	NPT
98A	S	Brass	5/8 (16)	3/4
98B	S	Brass		1
98C	S	St. St.		3/4
98D	S	St. St.		1
98E	L & X	Brass	1	1
98F	L & X	St. St.	(25)	1

#### THERMOWELL



#### UNION BUSHINGS



Thermowells and union bushings are utilized as separate items and should be specified on separate lines.



# TYPE N6 DIFFERENTIAL PRESSURE VALVE

SIZES  $\frac{3}{4}$ " – 2"

PRESSURES to 250 PSIG at 350°F

- Maintains Constant Differential Pressure
- Stainless Steel Valve Trim
- High Temperature Sealing Ring
- Polished Stainless Steel Piston
- ANSI/FCI 70-2 Class IV Shutoff

## TYPE N6 DIFFERENTIAL PRESSURE VALVE

### APPLICATION DATA

- Maintain Pump Discharge Pressure
- Pump Bypass Valve
- Boiler Feedwater Valve

### VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
B16.4 Class 250 NPT	250 (17.2)	@ 350 (176.7)
B16.1 Class 250 Flanged	250 (17.2)	@ 350 (176.7)

### SPRING RANGES (Differential Pressure, psi)

5-50	100-200
40-125	

### RATED FLOW COEFFICIENTS (Cv)

VALVE SIZE					
$\frac{3}{4}$	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	2	2 $\frac{1}{2}$
5.3	9.2	14.3	20.8	37.5	60

**SIZING  
INFO**

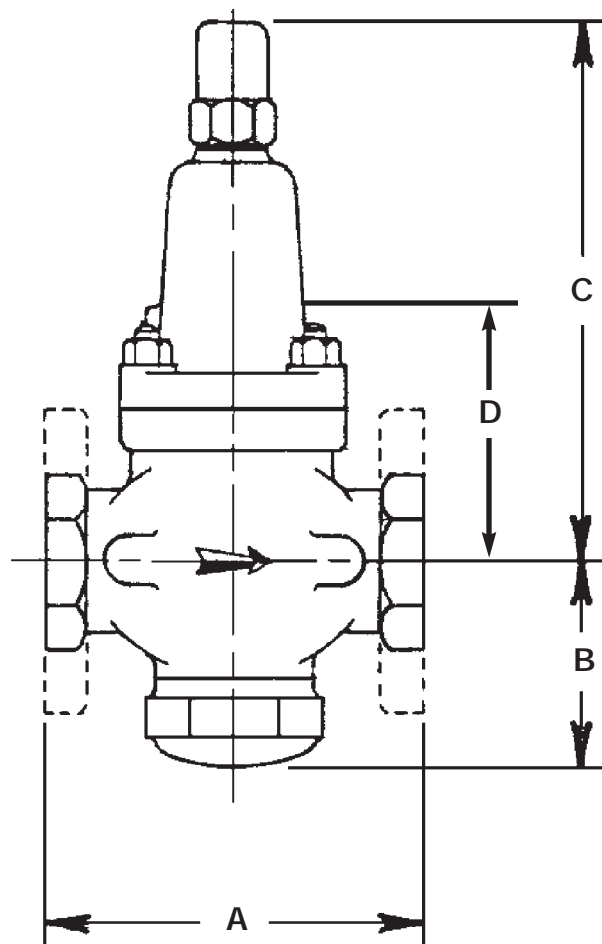


# TYPE N6 DIFFERENTIAL PRESSURE VALVE SPECIFICATIONS

Valve to maintain pump discharge pressure at a constant differential. Valve to be suitable for 250 psig and 350°F. Body to be of cast iron. Trim to be stainless steel. Spring to be enclosed to prevent contamination. Adjusting screw shall be protected by cap and to be easily accessible. Piston and disc to be balanced construction.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron ..... ASTM 126 C. B  
 Body, Carbon Steel ..... ASTM 216 Gr. WCB  
 Stem ..... 303 St. Stl. ASTM 582 Cond. A  
 Disc ..... 420 St. Stl. ASTM 276 Cond. A  
 Seat Ring ..... 420 St. Stl. ASTM 276 Cond. A  
 Piston ..... 303 St. Stl. ASTM 582 Cond. A  
 Sealing Ring ..... Viton  
 Gasket ..... Copper Jacket Asbestos  
 Spring ..... St. Stl. 17-4



TYPE N6 DIFFERENTIAL PRESSURE VALVE

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A		B	C	D	APPROX. WT.	
	ANSI NPT	ANSI 250				ANSI NPT	ANSI 250
3/4 (19)	4 3/4 (121)	—	2 3/4 (70)	7 1/2 (190)	3 (76)	10 (4.5)	—
1 (25)	5 3/8 (137)	—	3 (76)	8 1/2 (216)	3 5/8 (92)	12 (5.5)	—
1 1/4 (32)	6 1/2 (165)	—	3 5/8 (92)	9 3/8 (238)	3 7/8 (98)	19 (8.6)	—
1 1/2 (38)	7 1/4 (184)	—	3 3/4 (95)	10 7/8 (276)	4 1/4 (108)	26 (12)	—
2 (51)	7 1/2 (191)	—	4 3/8 (111)	11 7/8 (302)	4 7/8 (124)	39 (18)	—
2 1/2 (64)	—	10 (254)	4 1/2 (114)	14 3/8 (365)	5 3/8 (136)	—	74 (34)



# TYPE D34 WATER PRESSURE REDUCING VALVE

SIZES 1" – 6"

PRESSURES to 200 PSIG at 200°F

- Self-contained
- Closes Tight on Dead-end Shutoff
- Fast Acting for Rapid Changes in Flow
- Sediment Settles away from Control Ports when Installed Horizontally
- ANSI/FCI 70-2 Class VI Shutoff

**TYPE D34  
WATER PRESSURE REDUCING VALVE**

## APPLICATION DATA

- Dead-end water service where flow is intermittent and changes rapidly
- Flushometers
- Snap cocks

## VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
-------------------------	------------------------	------------------------

### CAST IRON

B16.4 Class 250 NPT	200 (13.8)	@ 200 (93)
B16.1 Class 125 Flanged	165 (11.4)	@ 200 (93)
B16.1 Class 250 Flanged	200 (13.8)	@ 200 (93)

## SPRING RANGES (psi)

10-40	30-80
-------	-------

## RATED FLOW COEFFICIENTS (Cv)

**SIZING  
INFO**

	VALVE SIZE								
	1	1¼	1½	2	2½	3	4	5	6
Cv	3.3	7.5	10.4	14.4	21.6	32	52	84	118

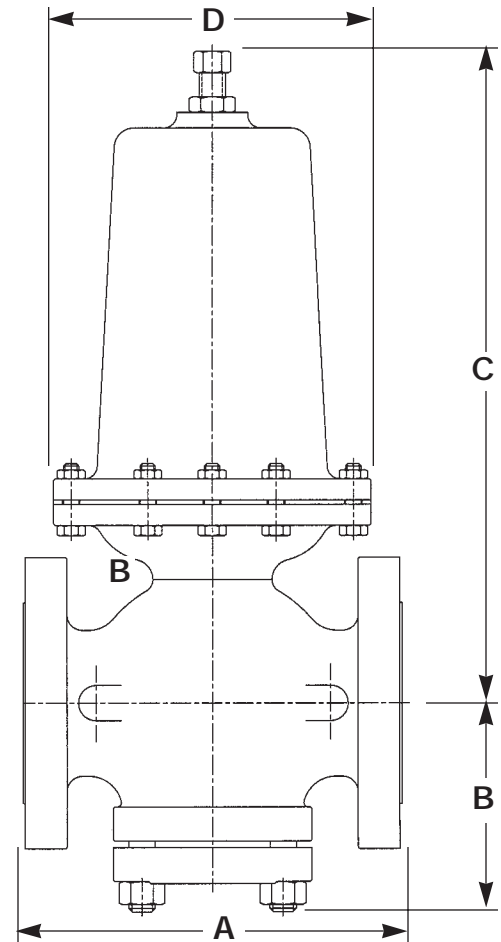
# TYPE D34 WATER PRESSURE REDUCING VALVE SPECIFICATION

The Valve shall be adjustable, direct operated, packless, diaphragm actuated, balanced and single seated. The valve shall close tight on dead end shutoff and shall maintain a discharge pressure which will not vary more than 1 psig for each 10 psig inlet pressure variation. Delivery pressure variations from zero flow to rated flow shall not exceed 15% of the maximum spring pressure rating. The valve shall be suitable for 200°F service temperature.

Valve body shall be cast iron. Sizes 2-1/2" and larger shall have flanged ends. Trim shall be stainless steel. Valve shall be equipped with a reversible composition disc and diaphragms and discs shall be nitrile. All working parts shall be easily accessible without removal of valve from the line.

## MATERIALS OF CONSTRUCTION

Body ..... Cast Iron ASTM 126 Cl. B  
Stem ..... 303 St. Stl. ASTM 582 Cond. A  
Disc ..... 304 St. Stl. ASTM 276 Cond. A  
Seat ..... 304 St. Stl. ASTM 276 Cond. A  
Gasket ..... Non-asbestos  
Diaphragm ..... Hycar  
Spring ..... Steel



**TYPE D34  
WATER PRESSURE REDUCING VALVE**

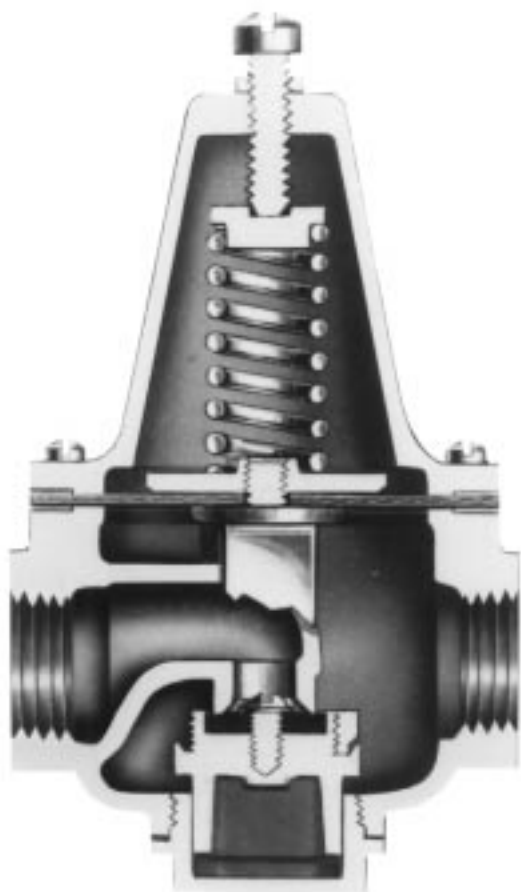
## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	FACE TO FACE			OTHER DIMENSIONS			APPROX. WT.		
	A			B	C	D			
	ANSI NPT	ANSI 125	ANSI 250				ANSI NPT	ANSI 125	ANSI 250
1 (25)	5 <sup>3</sup> / <sub>8</sub> (136)	— —	— —	3 <sup>3</sup> / <sub>8</sub> (86)	12 <sup>1</sup> / <sub>8</sub> (308)	5 <sup>1</sup> / <sub>2</sub> (140)	22 (10)	— —	— —
1 <sup>1</sup> / <sub>4</sub> (32)	6 <sup>1</sup> / <sub>2</sub> (165)	— —	— —	3 <sup>5</sup> / <sub>8</sub> (92)	12 <sup>1</sup> / <sub>2</sub> (316)	5 <sup>1</sup> / <sub>2</sub> (140)	24 (11)	— —	— —
1 <sup>1</sup> / <sub>2</sub> (38)	7 <sup>1</sup> / <sub>4</sub> (184)	— —	— —	4 <sup>1</sup> / <sub>4</sub> (108)	13 <sup>3</sup> / <sub>8</sub> (340)	6 (152)	34 (15)	— —	— —
2 (51)	7 <sup>1</sup> / <sub>2</sub> (191)	8 <sup>1</sup> / <sub>2</sub> (216)	9 (228)	4 <sup>5</sup> / <sub>8</sub> (117)	14 <sup>3</sup> / <sub>4</sub> (375)	6 <sup>3</sup> / <sub>4</sub> (171)	44 (20)	51 (23)	57 (26)
2 <sup>1</sup> / <sub>2</sub> (64)	— —	9 <sup>3</sup> / <sub>8</sub> (238)	10 (254)	5 <sup>1</sup> / <sub>2</sub> (140)	18 <sup>3</sup> / <sub>4</sub> (476)	8 (203)	— —	78 (35)	89 (40)
3 (76)	— —	10 (254)	10 <sup>3</sup> / <sub>4</sub> (273)	6 (152)	21 <sup>3</sup> / <sub>4</sub> (552)	9 (229)	— —	108 (49)	128 (58)
4 (102)	— —	11 <sup>7</sup> / <sub>8</sub> (302)	12 <sup>1</sup> / <sub>2</sub> (318)	6 <sup>5</sup> / <sub>8</sub> (168)	26 <sup>5</sup> / <sub>8</sub> (676)	11 <sup>1</sup> / <sub>4</sub> (283)	— —	198 (90)	225 (102)
5 (127)	— —	13 <sup>5</sup> / <sub>8</sub> (346)	14 <sup>1</sup> / <sub>2</sub> (268)	7 <sup>5</sup> / <sub>8</sub> (194)	33 <sup>1</sup> / <sub>8</sub> (841)	14 <sup>1</sup> / <sub>4</sub> (362)	— —	352 (160)	394 (252)
6 (152)	— —	15 <sup>1</sup> / <sub>8</sub> (384)	16 (406)	9 <sup>1</sup> / <sub>8</sub> (232)	35 <sup>7</sup> / <sub>8</sub> (911)	16 (406)	— —	500 (227)	550 (250)

# TYPE D36 WATER PRESSURE REDUCING VALVE

SIZES 1/2" – 2"

PRESSURES to 300 PSIG at 160°F



TYPE D36  
WATER PRESSURE REDUCING VALVE

- High Capacity
- Sensitive Spring and Large Diaphragm Area for Accurate Pressure Control
- Renewable Stainless Steel Single Seat
- Watertight Cage Assembly
- Soft Seat for Tight Shutoff
- Quiet Operation due to Opening in Direction of Flow
- ANSI/FCI 70-2 Class VI Shutoff

## OPTIONS

- Strainer and nipple

## APPLICATION DATA

- Liquid pressure reduction in industrial, commercial and domestic applications

## VALVE RATINGS

Valve Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
-------------------------	------------------------	------------------------

### CAST BRONZE

B16.15 Class 250 NPT      300 (21.0) @ 160 (71)

## SPRING RANGES (psi)

10-35	75-100
25-75	

**SIZING  
INFO**

## RATED FLOW COEFFICIENTS (Cv)

VALVE SIZE					
1/2	3/4	1	1 1/4	1 1/2	2
2.5	3.6	5	9	14	17

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

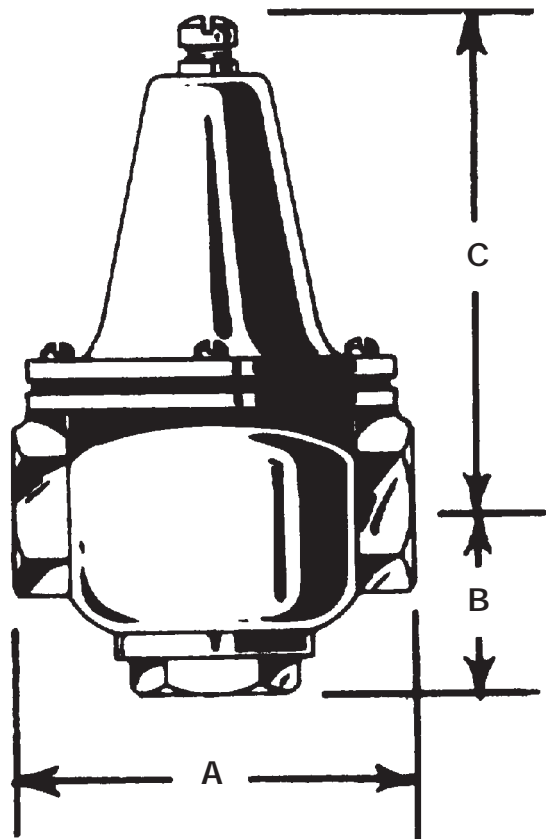
Size	Dimensions, Inches			Weight (lbs.)
	A	B	C	
1/2 (13)	4 1/4 (108)	2 (51)	6 1/4 (159)	5.25 (2.4)
3/4 (19)	4 1/4 (108)	2 (51)	6 1/4 (159)	5.25 (2.4)
1 (25)	4 3/4 (121)	2 1/8 (54)	6 1/2 (165)	8 (3.5)
1 1/4 (32)	5 (127)	2 3/4 (70)	6 3/4 (171)	10 (4.4)
1 1/2 (38)	6 3/4 (171)	2 3/4 (70)	9 7/8 (251)	20 (9.1)
2 (51)	8 (203)	3 1/4 (83)	10 3/4 (273)	33 (15)

# TYPE D36 WATER PRESSURE REDUCING VALVE SPECIFICATION

Valve shall be self operated requiring no external energy source. Valve shall have a bronze body and stainless steel renewable seat. Diaphragm shall be suitable for water service. Valve rated to 300 psi at 160°F. Disc to be removable without disassembly of the valve. Valve to meet A.S.S.E. Standard 1003, Southern Standard Plumbing Code and I. A. P. M O. Military Standard MIL-V-1846A Type I. City of Los Angeles and W.P.O.A. Uniform Plumbing Code.

## MATERIALS OF CONSTRUCTION

Body .....	Bronze ASTM B61-80 UNS C92200
Stem .....	Bronze ASTM B61-80 UNS C92200
Disc .....	Buna N
Seat .....	304 St. Stl ASTM 276 Cond. A
Gasket .....	Nylatron-GS
Diaphragm .....	Buna N
Spring .....	302 St. Stl.



TYPE D36  
WATER PRESSURE REDUCING VALVE



**TYPE D50 DIRECT ACTING  
PRESSURE REDUCING VALVE**

# TYPE D50 PRESSURE REDUCING VALVE

**PRESSURES to 300 PSIG at 420°F**

- Direct Acting
- Steam, Water or Gas
- Spherical Seating Surface on Floating Stainless Steel Disc for Tight Shutoff
- Unique Adjustable Aspirator
- Five Spring Ranges
- Integral Stainless Steel Strainer
- ANSI/FCI 70-2 Class IV Shutoff

## OPTIONS

- Teflon® Disc for Dead-end Service for Liquid and Gas

## APPLICATION DATA

- Steam Irons
- Autoclaves
- Laundry Mangles
- Single Radiators
- Steam Tables
- Vulcanizers

## VALVE RATINGS

Body Material	Pressure PSIG (bar)	Temperature °F (°C)
<b>WITH ST. STL. DISC</b>		
Cast Iron	200 (13.8)	@ 400 (204.4)
Bronze	300 (21.0)	@ 420 (215.6)
Stainless Steel	300 (21.0)	@ 420 (215.6)
<b>WITH TEFLON® DISC</b>		
All	300 (21.0)	@ 300 (148.9)
	200 (13.8)	@ 400 (204.4)

## SPRING RANGES

3-15	All Sizes	75-140	1/2-1 1/4" CI & Brz.
10-30	All Sizes	30-100	1 1/2-2" CI
25-80	1/2-1 1/4" C.I. & Brz.	30-140	1/2-1" St. Stl.

**SIZING  
INFO**

## RATED FLOW COEFFICIENTS (Cv)

VALVE SIZE					
1/2	3/4	1	1 1/4	1 1/2	2
2.2	3.3	4.9	5.0	10.1	10.8

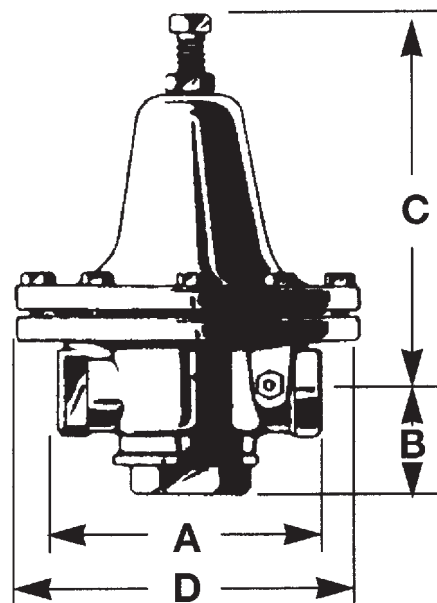


# TYPE D50 PRESSURE REDUCING VALVE SPECIFICATION

The valve shall be self operated, requiring no external energy source. The valve shall operate quickly and provide dead end shut-off. The body materials and rating shall be cast iron for 200 psig and 400°F, Bronze or Stainless Steel for 300 psi and 420°F. Valve trim material is to be stainless steel. Valve to have a standard aspirator to allow for adjustment of operation.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....ASTM 126 Cl. B  
 Body, Bronze .....ASTM B61-80 UNS C92200  
 Body, St. Stl.....ASTM 743 CF-8M  
 Stem .....304 St. Stl ASTM 276 Cond. A  
 Disc.....316 St. Stl. ASTM 276 Cond. A  
 Seat .....304 St. Stl ASTM 276 Cond. A  
 Gasket.....Teflon  
 Diaphragm .....304 St. Stl ASTM 276 Cond. A  
 Spring .....302 St. Stl.



**TYPE D50 DIRECT ACTING  
PRESSURE REDUCING VALVE**

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Body Mat'l.	Size	Dimensions, Inches				Weight (lbs.)
		A	B	C	D	
C.I. & Brz	1/2, 3/4 (13, 19)	4 5/8 (143)	1 3/4 (44)	6 7/8 (175)	6 (152)	12 (5.5)
C.I.	1, 1 1/4 (25, 32)	5 5/8 (143)	2 (51)	7 1/4 (184)	7 1/2 (191)	19 (8.6)
C.I.	1 1/2, 2 (38, 51)	6 5/8 (168)	2 3/4 (70)	11 1/2 (292)	9 (229)	30 (13.6)
St. Stl.	1/2 (13)	5 (127)	1 5/8 (41)	5 1/2 (140)	4 7/8 (124)	8 (3.6)
St. Stl.	3/4, 1 (19, 25)	5 5/8 (143)	2 1/4 (57)	6 1/2 (165)	7 1/16 (191)	22 (10)

# FLANGE STANDARDS

## 125 lb. CAST IRON

### ANSI STANDARD B16.1

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

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

## 250 lb. CAST IRON

### ANSI STANDARD B16.1

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

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

## 150 lb. BRONZE

### ANSI STANDARD B16.24

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

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

## 300 lb. BRONZE

### ANSI STANDARD B16.24

Pipe Size	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12
Diameter of Flange	3 3/4	4 5/8	4 7/8	5 1/4	6 1/2	6 1/2	7 1/2	8 1/4	9	10	11	12 1/2	15	—	—
Thickness of Flange (min) <sup>d</sup>	1/2	17/32	19/32	5/8	1 1/16	3/4	13/16	29/32	31/32	1 1/16	1 1/8	13/16	1 3/8	—	—
Diameter of Bolt Circle	2 5/8	3 1/4	3 1/2	3 7/8	4 1/2	5	5 7/8	6 5/8	7 1/4	7 7/8	9 1/4	10 5/8	13	—	—
Number of Bolts	4	4	4	4	4	8	8	8	8	8	8	8	12	—	—
Diameter of Bolts	1/2	5/8	5/8	5/8	3/4	5/8	3/4	3/4	3/4	3/4	3/4	3/4	7/8	—	—

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

## 150 lb. STEEL

### ANSI STANDARD B16.5

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

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

## 300 lb. STEEL

### ANSI STANDARD B16.5

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

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

## 400 lb. STEEL

### ANSI STANDARD B16.5

Pipe Size	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12
Diameter of Flange	3 3/4	4 5/8	4 7/8	5 1/4	6 1/8	6 1/2	7 1/2	8 1/4	9	10	11	12 1/2	15	17 1/2	20 1/2
Thickness of Flange (min) <sup>g</sup>	9/16	5/8	1 1/16	13/16	7/8	1	1 1/8	1 1/4	1 3/8	1 3/8	1 1/2	1 5/8	1 7/8	2 1/8	2 1/4
Diameter of Raised Face	1/38	1 11/16	2	2 1/2	2 7/8	3 5/8	4 1/8	5	5 1/2	6 3/16	7 5/16	8 1/2	10 5/8	12 3/4	15
Diameter of Bolt Circle	25/8	3 1/4	3 1/2	3 7/8	4 1/2	5	5 7/8	6 5/8	7 1/4	7 7/8	9 1/4	10 5/8	13	15 1/4	17 3/4
Number of Bolts	4	4	4	4	4	8	8	8	8	8	8	12	12	16	16
Diameter of Bolts	1/2	5/8	5/8	5/8	3/4	5/8	3/4	3/4	7/8	7/8	7/8	7/8	1	1 1/8	1 1/4

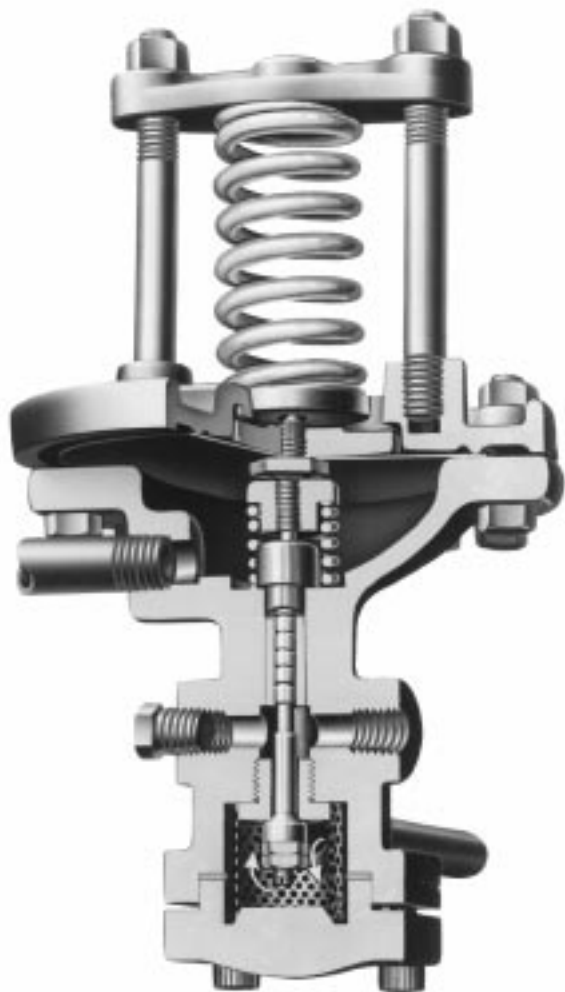
<sup>g</sup> 400 lb. steel flanges have a 1/4" raised face which is included in the flange thickness dimensions.

## 600 lb. STEEL

### ANSI STANDARD B16.5

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

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



TYPE D PRESSURE PILOT

### APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Regulating for Process Control
- Can be used with Temperature Pilot to Regulate Pressure on Temperature control Application

### RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

### SPRING PRESSURE RANGES (PSIG)

TYPE D	TYPE D2	TYPE D5	TYPE D120
3-20 <sup>†</sup>	100-300	1-10	5-25
5-50 <sup>†</sup>		5-25	10-75
10-100			40-150
20-150			

<sup>†</sup>With Vacuum Spring Assembly, minimum range is 30 inches Hg; maximum is reduced by 15 PSIG.

# TYPE D PRESSURE REDUCING PILOT

CONTROLS 3 - 300 PSIG

- Self Contained
- Spring Operated
- Normally Closed
- Packless Construction
- Fluid, Gas & Vapor Applications
- Accurate Regulation Unaffected by Service Conditions
- Easy In-line Maintenance

### MODELS

- **TYPE D** for  $\pm 1$  psi control of delivery pressures between 3 and 150 psi.
- **TYPE D2** for  $\pm 2$  psi control of delivery pressures between 100 and 300 psi.
- **TYPE D5** for  $\pm 1/2$  psi control of delivery pressures between 1 and 25 psi.
- **TYPE D120** for exceptionally fast response controlling delivery pressures between 5 and 150 psi.

### OPTIONS

- Spring Chamber
- Wall Bracket
- Composition Disc
- Vacuum Spring Assembly
- Adjusting Handwheel
- Locking Device
- Integral Mount Body

### TYPICAL CONFIGURATIONS

PRESSURE REDUCING .....TYPE **ED**  
 PRESSURE REDUCING .....TYPE **E2D**  
 PRESSURE REDUCING .....TYPE **E5D**  
 PRESSURE REDUCING .....TYPE **E6D**  
 PRESSURE REDUCING .....TYPE **C20D**  
 WATER PRESSURE REDUCING.....TYPE **C34D**  
 TEMPERATURE & PRESSURE.....TYPE **ET14D**

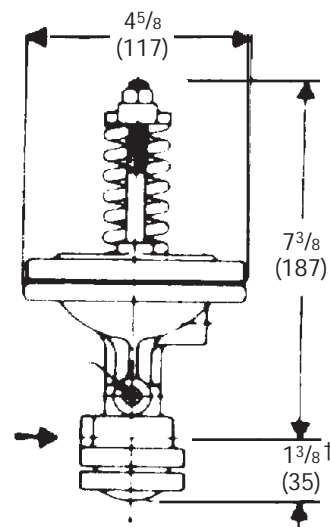
**SIZING  
INFO**

# TYPE D PRESSURE REDUCING PILOT SPECIFICATION

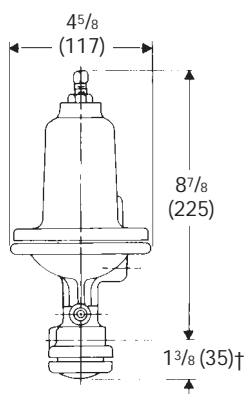
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves.

## MATERIALS OF CONSTRUCTION

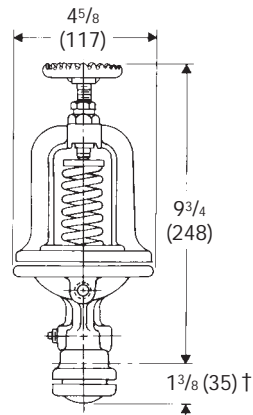
Body, Cast Iron .....	ASTM A126 CI B
Body, Cast Bronze .....	ASTM B61 UNS C92200
Body, Cast Steel .....	ASTM A216 GR. WCB
Stem .....	303 St. Stl. ASTM A582 COND A
Disc .....	440 St. Stl. ASTM A276-75 COND A
Seat .....	420 St. Stl. ASTM A276 COND A
Gasket .....	Non-Asbestos
Diaphragm .....	301 St. Stl. MIL-5-5059C
Spring .....	Inconel



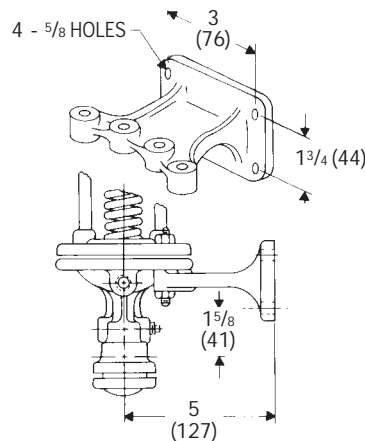
**STANDARD D PILOT**  
**7 LBS.**  
**(3.2 KG)**



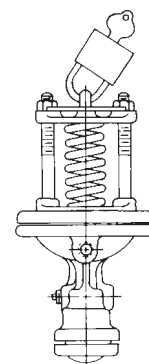
**D SPRING CHAMBER**  
**8 LBS. (3.6 KG)**



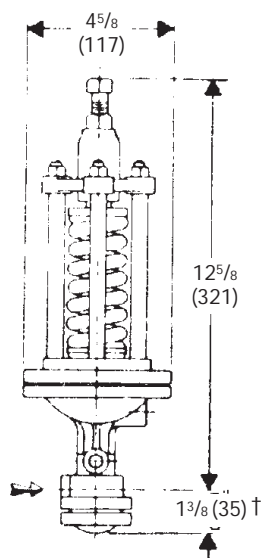
**D ADJUSTING  
HANDWHEEL**  
**9 LBS. (4.1 KG)**



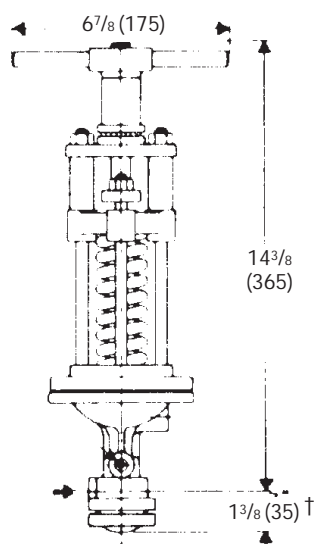
**D WALL BRACKET**  
**8 LBS. (3.6 KG)**



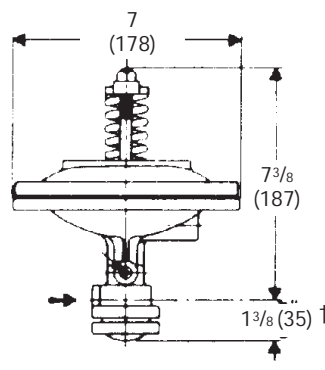
**LOCKING  
DEVICE**  
**7 1/2 LBS.**  
**(3.4KG)**



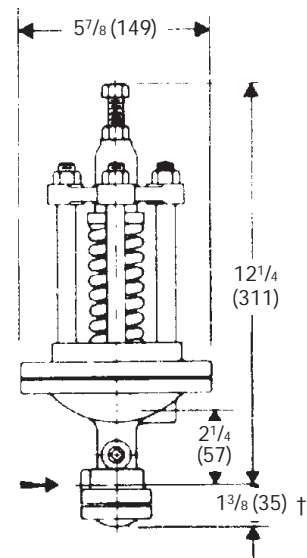
**TYPE D2**  
**10 LBS.**  
**(4.5 KG)**



**D2 ADJUSTING  
HANDWHEEL**  
**12 LBS. (5.4 KG)**

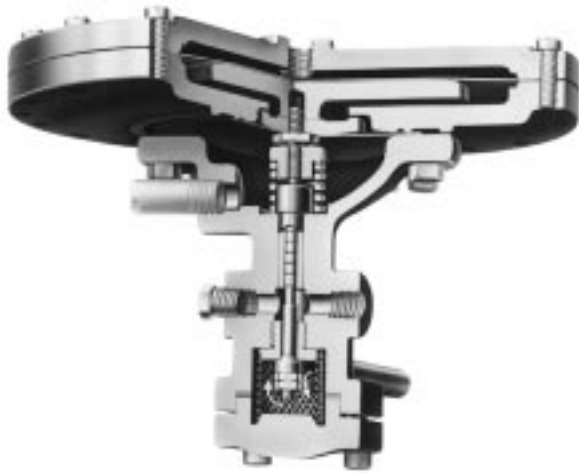


**TYPE D5**  
**14 LBS.**  
**(6.4 KG)**

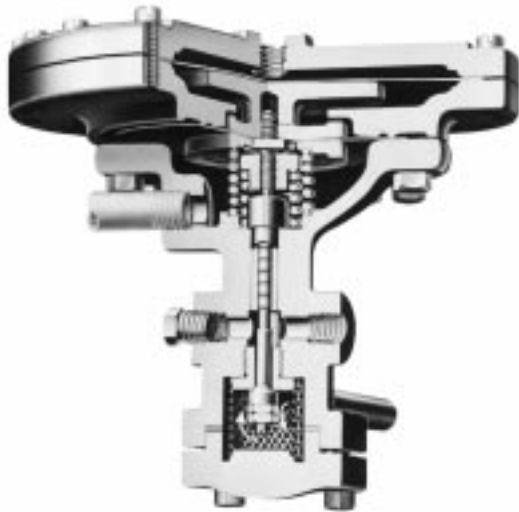


**TYPE D120**  
**16 LBS.**  
**(7.3 KG)**

†For Integral Mount Pilot, this dimension is 5/8" (16).



TYPE A73 AIR ADJUSTED PILOT



TYPE A85 AIR ADJUSTED VACUUM PILOT

#### APPLICATION DATA

- Pressure Regulating for Remote Locations
- Pneumatic Pressure Control
- Pneumatic Temperature Control
- Process Control where Controller is Far from Pilot

#### RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

#### TYPICAL CONFIGURATIONS

PRESSURE REDUCING .....TYPE **EA**  
 PRESSURE REDUCING .....TYPE **E2A**  
 PRESSURE REDUCING .....TYPE **E5A**  
 PRESSURE REDUCING .....TYPE **E6A**  
 PRESSURE REDUCING .....TYPE **C20A**  
 WATER PRESSURE REDUCING.....TYPE **C34A**  
 TEMPERATURE & PRESSURE .....TYPE **EAT61**

## TYPE A AIR ADJUSTED PILOT

CONTROLS -30 in. hg to 150 PSIG

- Air Loaded
- Remote Control
- Spring Operated
- Normally Closed
- Packless Construction
- Economic Use of Air
- Ease of Adjustment
- Accurate to  $\pm 1$  psi
- Delivery to Loading Air Pressure Ratios from 5/8 to 1 up to 6-2/3 to 1 psi
- Fluid, Gas & Vapor Applications
- Accurate Regulation Unaffected by Service Conditions
- Easy In-line Maintenance

#### OPTIONS

- Integral Mount

#### MODELS

- **TYPE A** for pressure control at low pressures. Delivery to loading pressure is 1 to 1 psi.
- **TYPE A35** for pressure control at very low delivery pressures as in some heating system control. Delivery to loading pressure is 5/8 to 1 psi.
- **TYPE A53** for pressure control at medium pressures. Delivery to loading pressure is 4-1/3 to 1 psi.
- **TYPE A70 & A73** for pressure control at high delivery pressures when available loading air is at low pressure. Delivery to loading pressure is 6-2/3 to 1 psi.
- **TYPE A82** Vacuum for pressure control of very low pressure or systems varying between very low pressure and light vacuum. Delivery to loading pressure is 1 to 1 psi.
- **TYPE A83** Vacuum for temperature control. Delivery to loading pressure is 1 to 1 psi.
- **TYPE A84** Vacuum for temperature control at lower delivery pressure features more gradual response. Delivery to loading pressure is 2 to 1 psi.
- **TYPE A85** Vacuum for temperature, pressure and vacuum control. Delivery to loading pressure is 2-2/3 to 1 psi.
- **TYPE A86** for pressure control at low pressures. Delivery to loading pressure is 1 to 1 psi.
- **TYPE A87** Vacuum for temperature, pressure and vacuum control. Delivery to loading pressure is 8 $\frac{2}{3}$  to 1 psi.

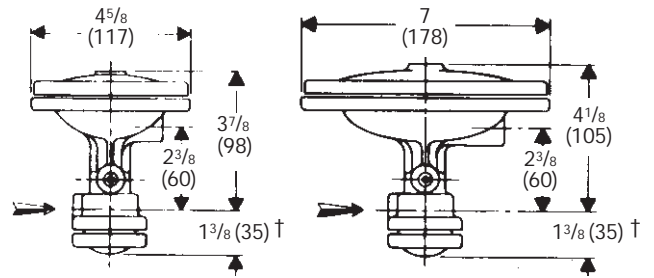
**SIZING  
INFO**

# TYPE A AIR ADJUSTED PILOT SPECIFICATION

The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves.

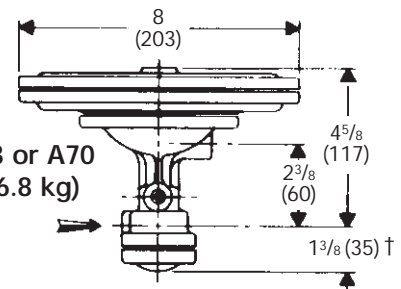
## MATERIALS OF CONSTRUCTION

Body, Cast Iron	ASTM A126 CI B
Body, Cast Bronze	ASTM B61 UNS C92200
Body, Cast Steel	ASTM A216 GR. WCB
Stem	303 St. Stl. ASTM A582 COND A
Disc	440 St. Stl. ASTM A276-75 COND A
Seat	420 St. Stl. ASTM A276 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Inconel

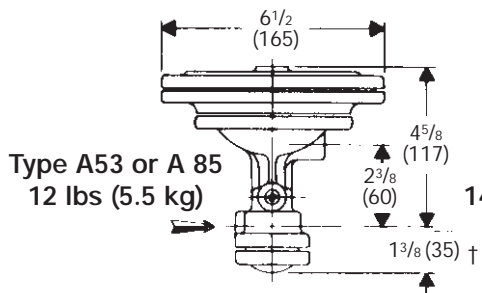


**Type A or A83**  
6 lbs (2.7 kg)

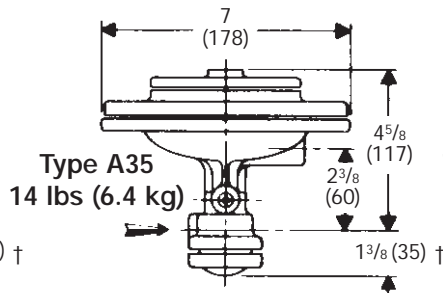
**Type A82**  
11 lbs (5 kg)



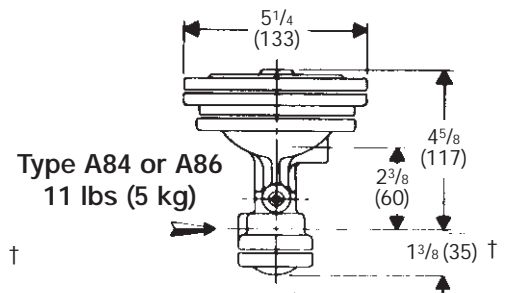
**Type A73 or A70**  
15 lbs (6.8 kg)



**Type A53 or A85**  
12 lbs (5.5 kg)



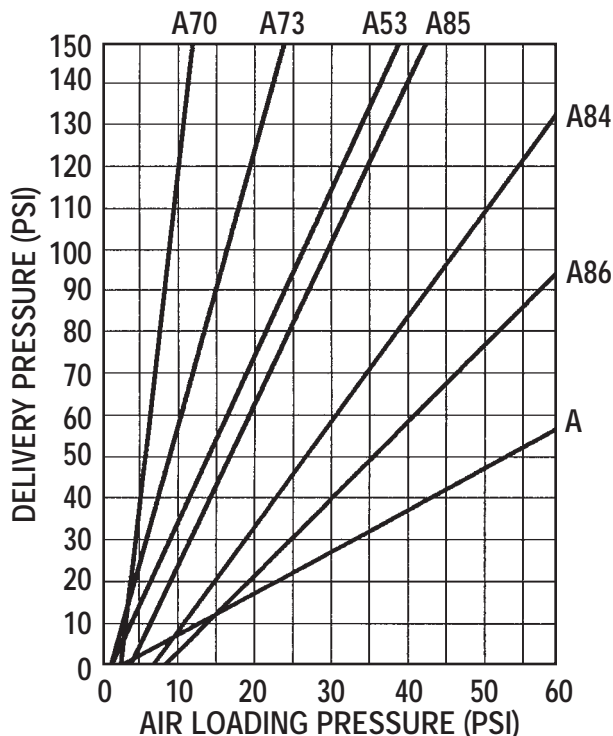
**Type A35**  
14 lbs (6.4 kg)



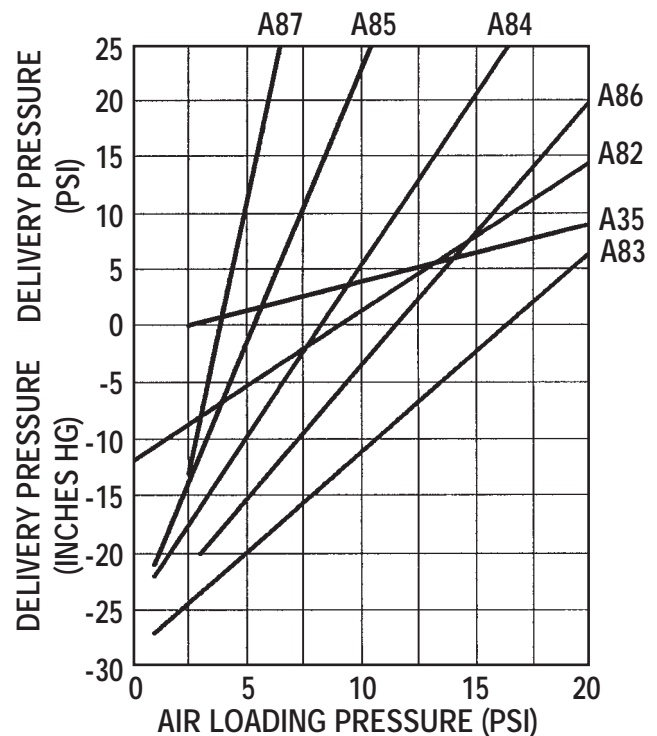
**Type A84 or A86**  
11 lbs (5 kg)

†For Integral Mount Pilot, this dimension is 5/8" (16).

## PILOTS FOR POSITIVE PRESSURE



## PILOTS FOR VACUUM PRESSURE







## TYPE P60 PNEUMATIC CONTROLLER

### APPLICATION DATA

- Pneumatic Control of Diaphragm actuated Valves
- Pressure Reduction
- Back Pressure control
- Switchover (automatic transfer) PRV's as primary controller and/or safety pilot.

### RATINGS (Maximum Inlet Conditions)

Supply Pressure (PSIG)	Output Range (PSIG)
20	3-15
35	3-27
35	6-30
65	12-60

### CONTROL RANGES (PSIG)

0-15	0-60
0-30	0-100

# TYPE P60 PNEUMATIC CONTROLLER

CONTROLS to 100 PSIG

- Pinpoint Accuracy
- Low Air Consumption (.1 scfm)
- Adjustable Proportional Band 2-200%
- Control Mode Proportional + Reset (PI)
- Air Supply Pressure 20-65 psig

### OPTIONS

- P, PD or PID Control Mode

### TYPICAL CONFIGURATIONS

PRESSURE & TEMPERATURE .....EAP60

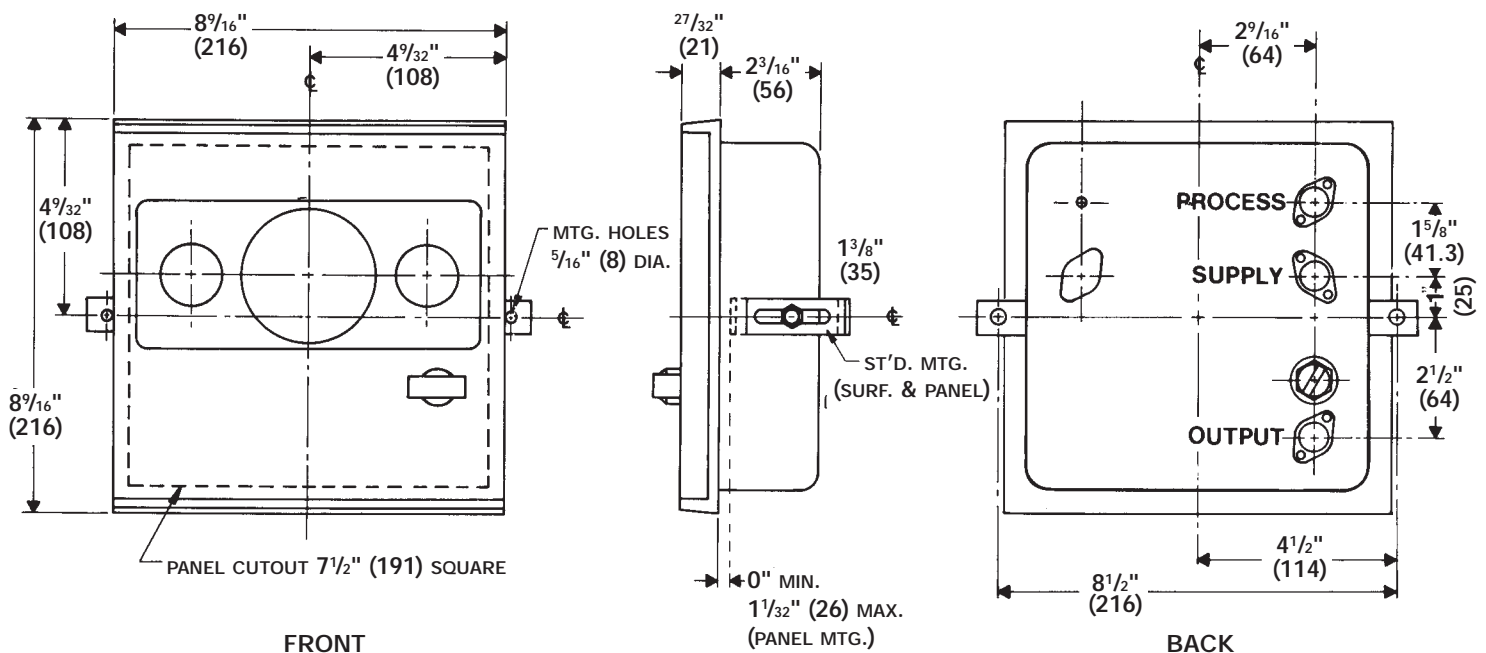
PRESSURE & TEMPERATURE .....CAP60

# TYPE P60 PNEUMATIC CONTROLLER SPECIFICATION

The pressure controller shall be of the indicating type. It shall be non-bleeding with high capacity, capable of fast response. It shall be equipped with 0-30 psig supply and loading gages, a 3-1/2" dial with control and set point indicators and shall have a 2-200% adjustable proportional band. Control point adjustments to be made by a knob inside the case.

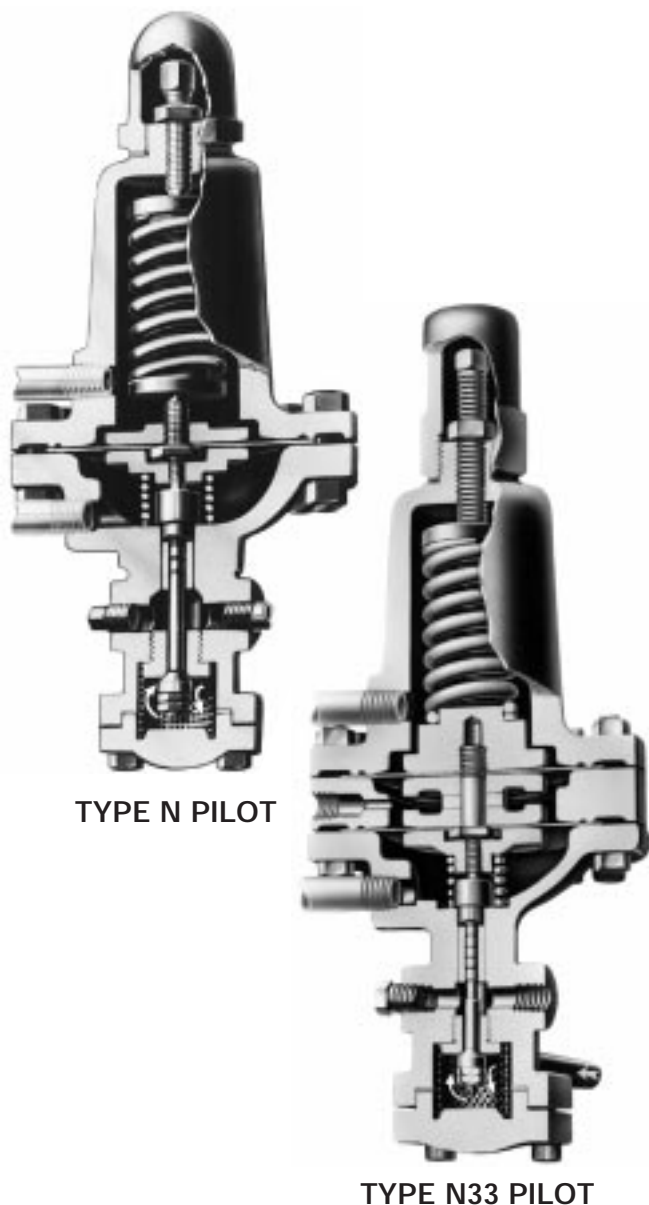
## SPECIFICATIONS

Air Connections ..... 1/4" FNPT  
 Air Consumption, Maximum ..... 0.2 SCFM  
 Air Consumption, Normal..... 0.1 SCFM  
 Ambient Temperature Limits -40° to 180°F (-40° to 82°C)  
 Weight ..... 8 1/2 lbs. (19 kg)  
 Proportional Band ..... Adjustable, 2 - 200%  
 Control Action ..... Adjustable, Reverse or Direct  
 Control Mode, Standard ..... Proportional + Reset (PI)  
 Control Mode, Optional ..... P, PD or PID



# TYPE N DIFFERENTIAL PRESSURE PILOT

CONTROLS 3 to 150 PSIG



TYPE N PILOT

TYPE N33 PILOT

## APPLICATION DATA

- Boiler Feedwater Makeup
- Steam Atomizing for Oil Burners
- Heat Exchanger to maintain Constant Differential

## RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

## SPRING PRESSURE RANGES (PSIG)

3-20	10-100
5-50	20-150

**SIZING  
INFO**

- Self Contained
- Spring Operated
- Normally Closed
- Packless Construction
- Accurate to  $\pm 1$  psi
- Four Adjustable Spring Ranges
- Fluid, Gas & Vapor Applications
- Loading Pressure Supplied by any Fluid
- Accurate Regulation Unaffected by Service Conditions
- Easy In-line Maintenance

## OPTIONS

- Integral Mount (for N and N33)

## MODELS

- **TYPE N** for delivery pressure at set differential above loading pressure. Available in four spring ranges. Includes integral strainer.
- **TYPE N20** for fixed differential between regulator's inlet pressure and some other lower pressure.
- **TYPE N33** for delivery pressure at set differential above loading pressure where it is essential there be no mixing of two fluids. Ensured by two diaphragms, separated by a vented space. Available in four spring ranges. Includes integral strainer.

## TYPICAL CONFIGURATIONS

PRESSURE REDUCING .....TYPE **EN**  
 PRESSURE REDUCING .....TYPE **E2N**  
 PRESSURE REDUCING .....TYPE **E5N**  
 PRESSURE REDUCING .....TYPE **C20N**

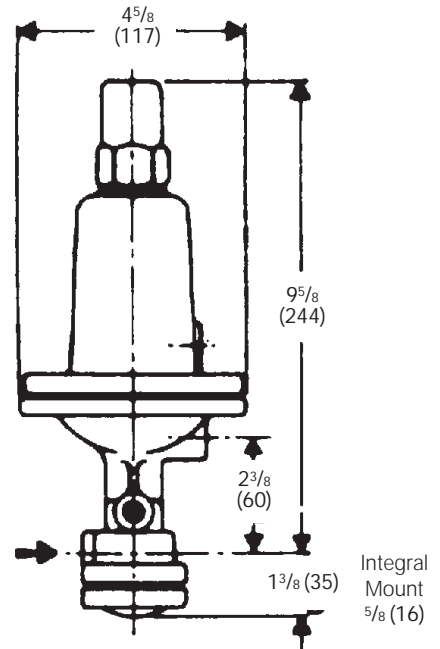
# TYPE N DIFFERENTIAL PRESSURE PILOT

## SPECIFICATION

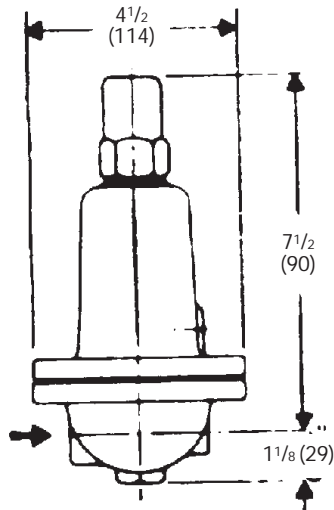
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall have packless construction. The Pilot shall be interchangeable on all sizes of main valves.

### MATERIALS OF CONSTRUCTION

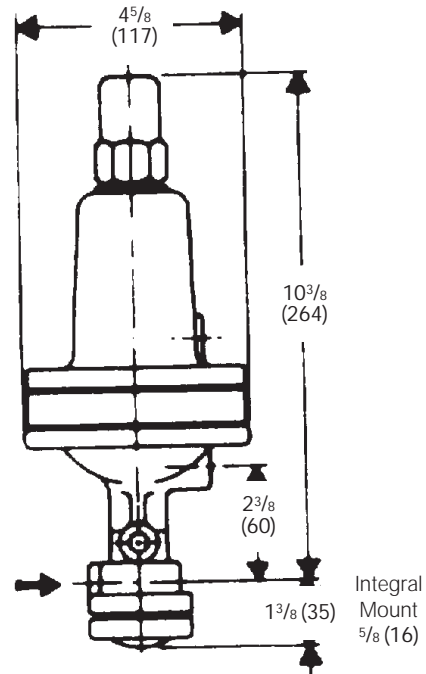
Body, Cast Iron .....	ASTM A126 CI B
Body, Cast Bronze .....	ASTM B61 UNS C92200
Body, Cast Steel .....	ASTM A216 GR. WCB
Stem .....	303 St. Stl. ASTM A582 COND A
Disc .....	440 St. Stl. ASTM A276 COND A
Seat .....	420 St. Stl. ASTM A276 COND A
Gasket .....	Non-Asbestos
Diaphragm .....	301 St. Stl. MIL-5-5059C
Spring .....	Inconel



**TYPE N PILOT**  
**8 LBS.**  
**(3.6 KG)**



**TYPE N20 PILOT**  
**8 LBS.**  
**(3.6 KG)**



**TYPE N33 PILOT**  
**11 LBS.**  
**(5 KG)**



TYPE P14 PILOT

# TYPE P PUMP GOVERNOR PILOT

CONTROLS 3 to 2000 psi

- Self Contained
- Spring Operated
- Normally Open
- ANSI/FCI 70-2 Class IV Shutoff
- Packless Construction
- Accurate to  $\pm 1$  psi
- Three Adjustable Spring Ranges
- Steam Applications
- Constant Average Discharge Pressure
- Accurate Regulation Unaffected by Service Conditions
- Easy In-line Maintenance

## OPTIONS

- Adjustment Indicator
- Integral Mount

## MODELS

- **TYPE P13** features a spring for controlling pressures 100 to 300 PSI.
- **TYPE P14** features three spring ranges for controlling pressures 5 to 150 PSI.
- **TYPE P15** features two spring ranges for controlling pressures 3 to 25 PSI.
- **TYPE P32** is piston driven and features three spring ranges for controlling pressures 200 to 2000 PSI.

## TYPICAL CONFIGURATIONS

STEAM PUMP CONTROL .....TYPE **EP**  
 STEAM PUMP CONTROL.....TYPE **E2P**  
 STEAM PUMP CONTROL.....TYPE **E5P**  
 STEAM PUMP CONTROL .....TYPE **C20P**

## APPLICATION DATA

- Steam Driven Pump Control

## RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)		Temperature °F (°C)
Cast Iron	250 (17.2)	@	450 (232)
Cast Bronze	250 (17.2)	@	450 (232)
Cast Steel	600 (41.4)	@	750 (400)

## SPRING PRESSURE RANGES (PSIG)

P13	100-300		
P14	5-30	20-100	40-150
P15	3-10	5-25	
P32	200-450	400-1200	1000-2000

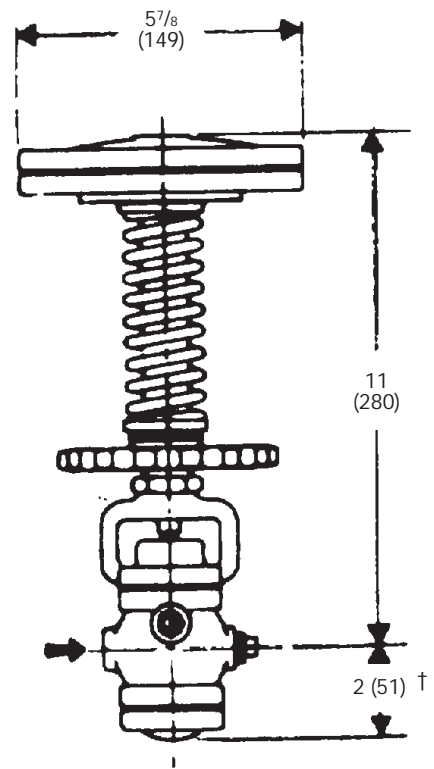
**SIZING  
INFO**

# TYPE P PUMP GOVERNOR PILOT SPECIFICATION

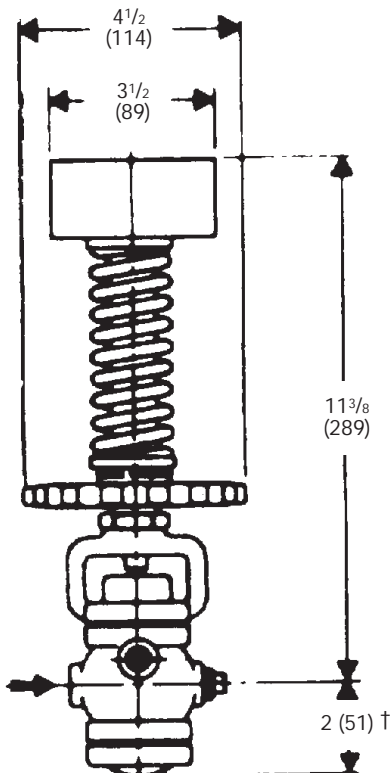
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves. The pilot shall automatically adjust pump discharge pressures within the spring range to maintain a constant average pressure.

## MATERIALS OF CONSTRUCTION

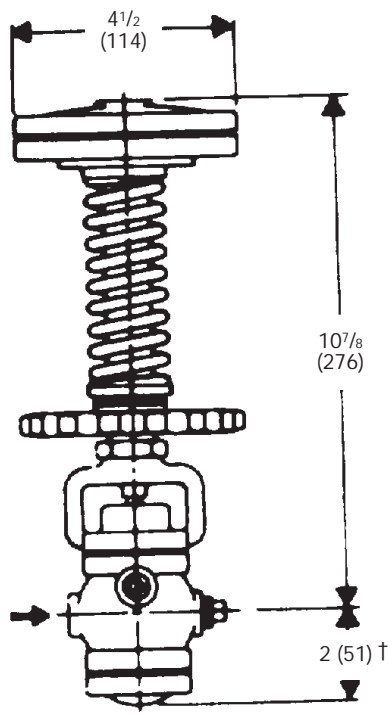
Body, Cast Iron .....	ASTM A126 CI B
Body, Cast Bronze .....	ASTM B61 UNS C92200
Body, Cast Steel .....	ASTM A216 GR. WCB
Stem .....	2024-T4 ASTM B211-75
Disc .....	440 St. St. ASTM A276-75 COND A
Seat .....	420 St. St. ASTM A276 COND A
Gasket .....	Non-Asbestos
Diaphragm .....	301 St. St. MIL-5-5059C
Spring .....	Steel ASTM A231



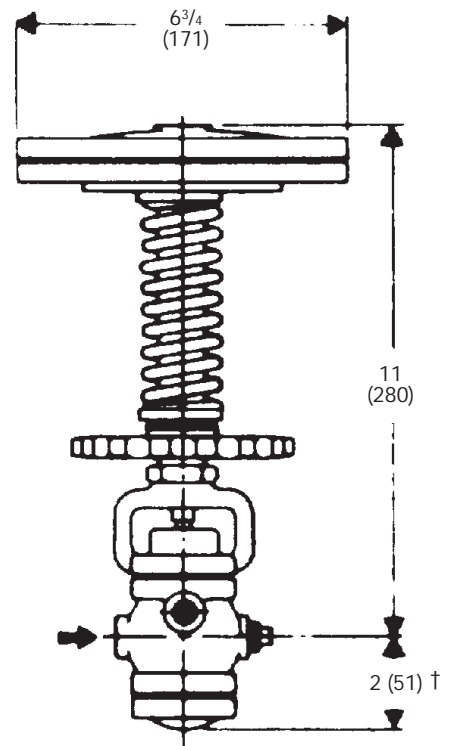
**TYPE P14 PILOT**  
**13 LBS.**  
**(5.9 KG)**



**TYPE P32 PILOT**  
**10 LBS.**  
**(4.5 KG)**



**TYPE P13 PILOT**  
**11 LBS.**  
**(5 KG)**



**TYPE P15 PILOT**  
**15 LBS.**  
**(6.8 KG)**

†For Integral Mount Pilot, this dimension is 1 1/16" (27).



# TYPE F46 VACUUM PUMP GOVERNOR PILOT

CONTROLS to -30" Hg



TYPE F46 PILOT

- Self Contained
- Spring Operated
- Normally Closed
- ANSI/FCI 70-2 Class IV Shutoff
- Packless Construction
- Accurate to  $\pm 1$  psi
- Steam Applications
- Constant Average Discharge Pressure
- Accurate Regulation Unaffected by Service Conditions
- Easy In-line Maintenance

## OPTIONS

- Adjustment Indicator
- Integral Mount

## APPLICATION DATA

- Steam Driven Vacuum Pump Control

## RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

## SPRING PRESSURE RANGES (PSIG)

30" hg-0 psi

**SIZING  
INFO**

## TYPICAL CONFIGURATIONS

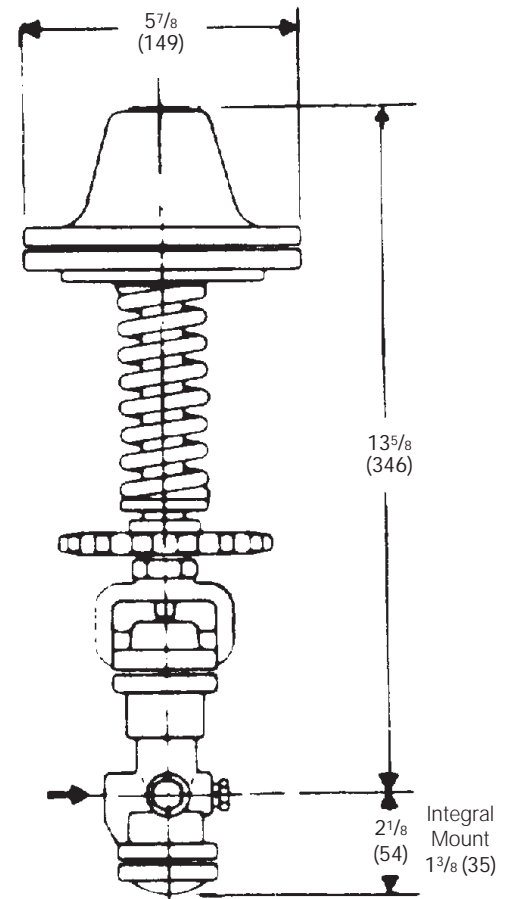
VACUUM PUMP CONTROL .....TYPE **EF**  
 VACUUM PUMP CONTROL .....TYPE **E2F**  
 VACUUM PUMP CONTROL .....TYPE **E5F**  
 VACUUM PUMP CONTROL .....TYPE **C20F**

# TYPE F46 VACUUM PUMP GOVERNOR PILOT SPECIFICATION

The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves. The pilot shall automatically adjust pump discharge pressures within the spring range to maintain a constant average pressure.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....	ASTM A126 CI B
Body, Cast Steel .....	1018 St. ASTM A108-79
Stem.....	303 St. St. ASTM A582 COND A
Disc .....	440 St. St. ASTM A276-75 COND A
Seat .....	420 St. St. ASTM A276 COND A
Gasket .....	Non-Asbestos
Diaphragm .....	301 St. St. MIL-5-5059C
Spring .....	Inconel



**TYPE F46 PILOT**  
**15 LBS.**  
**(6.8 KG)**

# TYPE Q BACK PRESSURE PILOT

CONTROLS 3 to 300 PSIG



TYPE Q PILOT



TYPE Q35 PILOT

## APPLICATION DATA

- Pump Bypass
- Maintain Upstream Pressure in Steam Distribution Systems
- Maintain Upstream Pressure in Liquid Distribution Systems

## RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

## SPRING PRESSURE RANGES (PSIG)

TYPE Q	TYPE Q2	TYPE Q5
3-20	100-300	1-10
5-50		5-25
10-100		
20-150		

- Self Contained
- Spring Operated
- Normally Open
- Packless Construction
- Four Adjustable Spring Ranges
- Fluid, Gas & Vapor Applications
- Loading Pressure Supplied by any Fluid
- Accurate Regulation Unaffected by Service Conditions
- Easy In-line Maintenance

## OPTIONS

- Enclosed Spring Chamber
- Adjusting Handle
- Locking Device
- Wall Bracket
- High Pressure

## MODELS

- **TYPE Q** for  $\pm 1$  psig accuracy controlling back pressures between 3 and 150 psig.
- **TYPE Q2** for  $\pm 2$  psig accuracy controlling back pressures between 100 and 300 psig.
- **TYPE Q5** for  $\pm 1/2$  psig accuracy controlling back pressures between 1 and 25 psig, 267°F.
- **TYPE Q35** air adjusted for  $\pm 1/2$  psig accuracy controlling back pressure at very low retained pressures. Delivery to loading pressure is 5/8 to 1 psig.
- **TYPE Q73** air adjusted for  $\pm 1$  psig accuracy controlling back pressure at high retained pressures when available loading air is at low pressure. Delivery to loading pressure is 6-2/3 to 1 psig.

## TYPICAL CONFIGURATIONS

BACK PRESSURE CONTROL.....TYPE **EQ**  
 BACK PRESSURE CONTROL .....TYPE **E2Q**  
 BACK PRESSURE CONTROL .....TYPE **E5Q**  
 BACK PRESSURE CONTROL .....TYPE **C20Q**

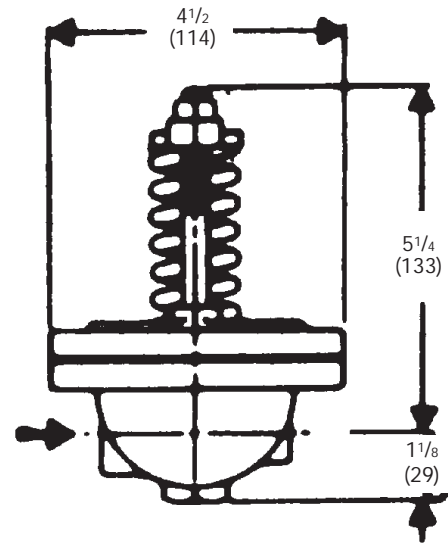
**SIZING  
INFO**

# TYPE Q BACK PRESSURE PILOT

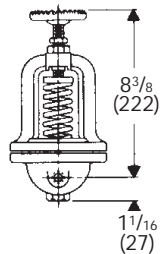
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves.

## MATERIALS OF CONSTRUCTION

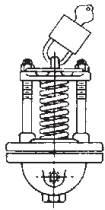
Body, Cast Iron .....ASTM A126 CI B  
 Body, Cast Bronze .....ASTM B61 UNS C92200  
 Body, Cast Steel .....ASTM A216 GR. WCB  
 Disc .....440 St. St. ASTM A276-75 COND A  
 Seat .....440 St. St. ASTM A276-75 COND A  
 Gasket .....Non-Asbestos  
 Diaphragm .....301 St. St. MIL-5-5059C  
 Spring .....Steel



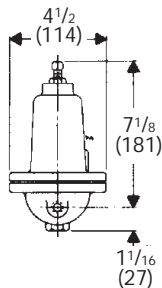
**TYPE Q PILOT**  
**7 LBS.**  
**(3.2 KG)**



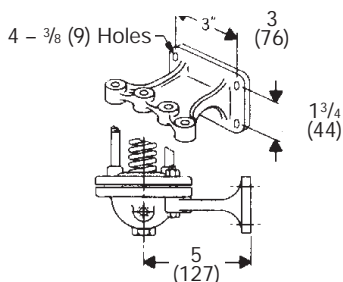
**ADJUSTING  
 HANDWHEEL**



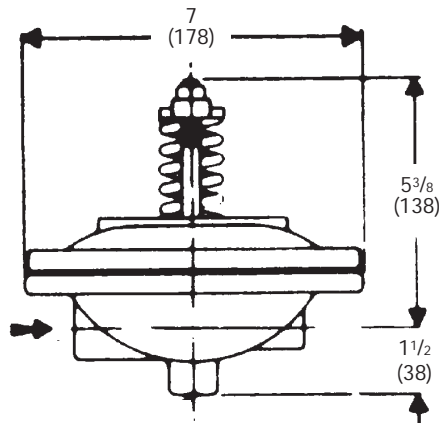
**LOCKING  
 DEVICE**



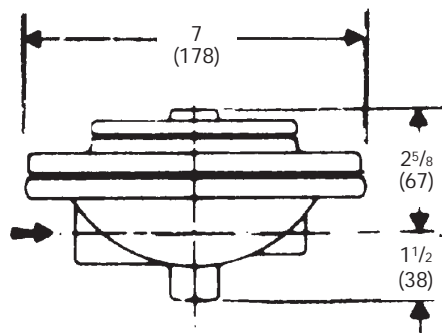
**SPRING CHAMBER**



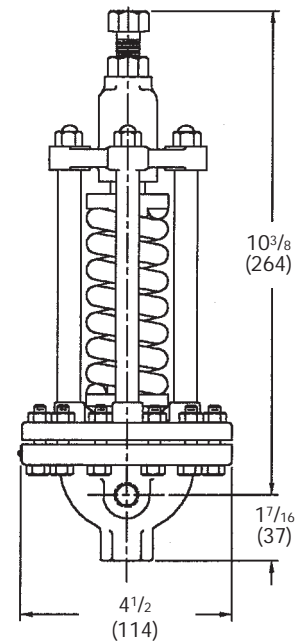
**WALL BRACKET**



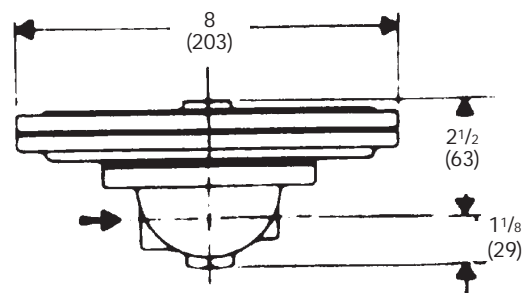
**TYPE Q5 PILOT**  
**13 LBS.**  
**(5.9 KG)**



**TYPE Q35 PILOT**  
**14 LBS.**  
**(6.4 KG)**



**TYPE Q2 PILOT**  
**10 LBS.**  
**(4.5 KG)**



**TYPE Q73 PILOT**  
**15 LBS.**  
**(6.8 KG)**



# TYPE SP/P PRESSURE SAFETY PILOT

CONTROLS to 600 PSIG

- Self Contained
- Spring Operated
- Normally Closed
- Packless Construction
- Fluid, Gas & Vapor Applications
- Accurate Regulation Unaffected by Service Conditions
- Easy in-line Maintenance

## TYPICAL CONFIGURATIONS

PRESSURE REDUCING .....TYPE **ED**SP/T

PRESSURE REDUCING .....TYPE **E5D**SP/T

PRESSURE REDUCING .....TYPE **C20D**SP/T

## TYPE SP/P PRESSURE SAFETY PILOT

### APPLICATION DATA

- Where overpressure could cause personal injury or damage

### RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

### SPRING PRESSURE RANGES (PSIG)

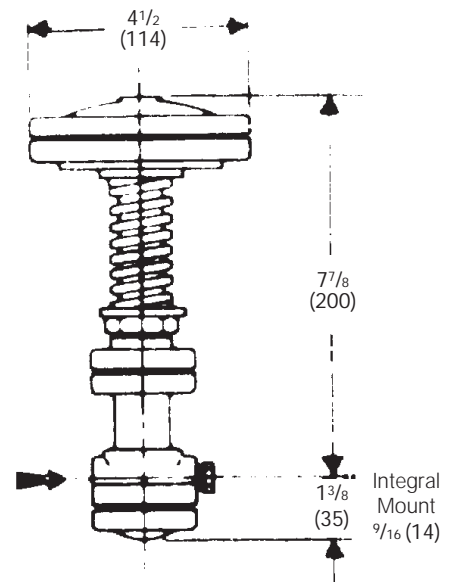
5-13	31-65	121-175
13-30	66-120	

# TYPE SP/P PRESSURE SAFETY PILOT SPECIFICATION

Pilot to be used to prevent an accidental rise in reducing valve pressure and not to be used as substitute for a safety relief valve. Valve is normally closed. Body to be cast steel rated 600 psig 750°F or bronze rated 300 psig 500°F. Valve must provide for easy in line maintenance and of packless construction. Operating pressure range to be determined by spring selection.

## MATERIALS OF CONSTRUCTION

Body, Cast Bronze .....	ASTM B61-80 C92200
Body, Cast Steel .....	ASTM A216 GR. WCB
Stem.....	303 St. St. ASTM A582 COND A
Disc .....	440 St. St. ASTM A276 COND A
Seat .....	420 St. Stl ASTM A276 COND A
Gasket .....	Non-Asbestos
Diaphragm .....	301 St. Stl. MIL-5-5059C
Spring .....	Inconel



**TYPE SP/P PRESSURE  
SAFETY PILOT  
8 LBS. (3.6 KG)**





# TYPE D208 ELECTRONIC ACTUATOR PILOT

WITH ELECTRONIC  
TIME CONTROLLER

CONTROLS to 150 PSIG

- Can save more than 4 times it's cost in building heating in one year.
- Controlled Incremental Positioning of Main Valve
- Electronic Time Controller (ETC) Opens and/or Closes Valve in up to 96 Minute Time Period\*
- Ambient Temperatures 20 to 120 °F (-7 to 49°C)
- For use with Balanced Main Valve

## OPTIONS

---

- Back-up (B.U.) Power Supply for up to 6 hours continued service during power failure.
- Explosion proof actuator, NEMA

## TYPICAL CONFIGURATIONS

---

SLOW OPEN/CLOSE PRESSURE .....ED208D

## TYPE D208 ELECTRONIC PILOT ACTUATOR

### APPLICATION DATA

---

- Building Control Systems

### RATINGS

---

D208	120VAC, 50-60HZ, .3 AMPS
ETC	120VAC, 50-60HZ, .3 AMPS
B.U. Power Supply	120VAC, 60HZ, up to 6 AMPS

\*Timing periods are selectable from 6-96 minutes in 6 minute increments by setting a binary dip switch.

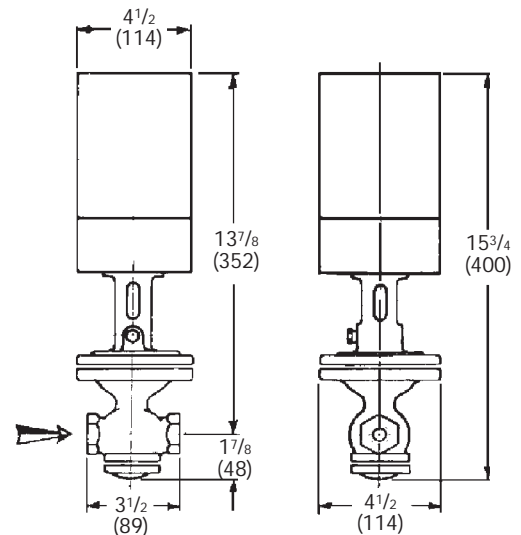
# TYPE D208 ELECTRONIC ACTUATOR PILOT WITH ELECTRONIC TIME CONTROLLER SPECIFICATION

The Actuator Pilot shall slowly close and/or open the steam system in a safe, quiet manner by incrementally reducing and/or increasing the pressure under the main valve diaphragm until it reaches dead-end shutoff or is fully open. In the event of a power failure, it shall stop in its present position unless a back-up power supply is specified. Such backup power supply shall provide a minimum of specified hours of operation and be maintained in a fully charged standby condition automatically.

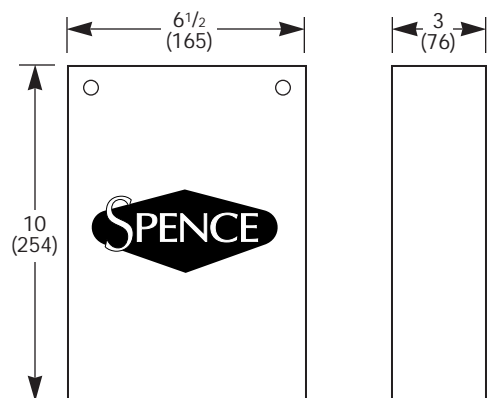
The Actuator Pilot shall be controlled by a totally solid state Electronic Time Controller which shall incrementally open and/or close the Actuator Pilot with 320 pulses in periods from 1-1/2, 2-1/2, 3, 6 - 96 minutes and shall be field adjustable in multiples of 6 minutes.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron	.....ASTM 126 Cl. B
Body, Carbon Steel	.....ASTM 216 Gr. WCB
Stem	.....303 St. Stl. ASTM 582 Cond. A
Disc	.....440 St. Stl. ASTM 276-75 Cond. A
Seat	.....420 St. Stl. ASTM 276 Cond. A
Gasket	.....Non-asbestos



**TYPE D208 ELECTRONIC  
ACTUATOR PILOT**



**TYPE D208 ELECTRONIC  
TIME CONTROLLER (ETC)**



# TYPE D210 ELECTRONIC ACTUATOR PILOT

## WITH MODULATING SERVO-AMPLIFIER

**CONTROLS to 150 PSIG**

- Modulate Process Variable in Relation to a Proportional Control Input Signal
- Servo-Amplifier provides Continuous Signal for Immediate Response
- Ambient Temperatures 20 to 120°F (-7 to 49°C)

### OPTIONS

---

- Back-up Power Supply for up to 6 hours continued service during power failure.
- Explosion proof actuator, NEMA
- Fail-Safe Device to stroke Actuator half or full open on input signal failure.
- For use with Balanced Main Valve

### TYPICAL CONFIGURATIONS

---

**4-20 MA PROPORTIONAL CONTROL .....ED210**

## TYPE D210 ELECTRONIC PILOT ACTUATOR

### APPLICATION DATA

---

- Building Control Systems

### RATINGS

---

D210	120VAC, 50-60HZ, .3 AMPS
Servo-Amplifier	120VAC, 50-60HZ, .3 AMPS
B.U. Power Supply	120VAC, 60HZ, up to 6 AMPS

### INPUT SIGNALS

---

1-5mA	10-50mA
4-20mA	Selectable from 0-24 VDC

# TYPE D210 ELECTRONIC ACTUATOR PILOT

## WITH MODULATING SERVO-AMPLIFIER SPECIFICATION

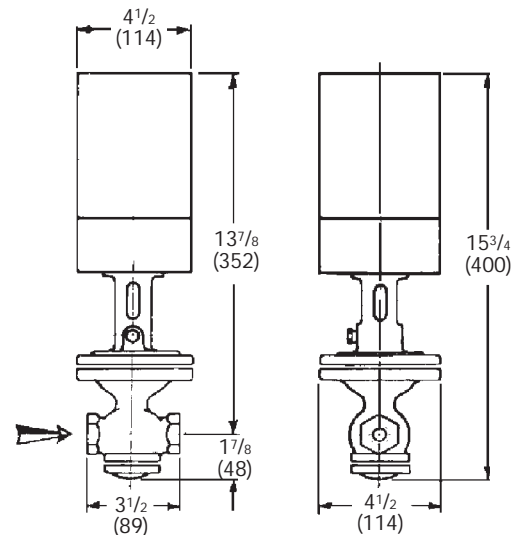
The Actuator Pilot shall maintain a system and modulate that system as requirements dictate. A continuous signal (1-5mA, 4-20mA, 10-50mA or 0-24 VCD) is transmitted by the system control to the Servo-Amplifier which positions the Actuator Pilot.

In the event of a power failure, the Actuator Pilot shall stop in its present position unless a back-up power supply is specified. Such backup power supply shall provide a minimum of specified hours of operation and be maintained in a fully charged standby condition automatically.

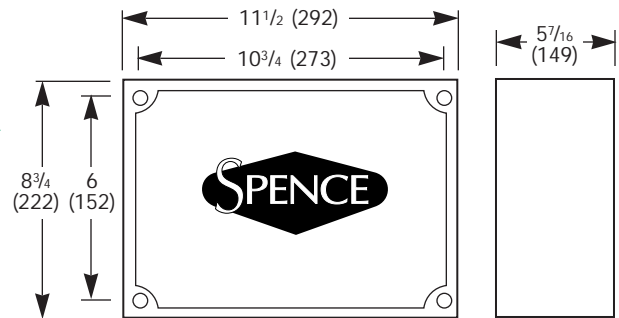
In the event of signal failure, the Actuator Pilot shall close unless a Fail-Safe Device is specified in the Servo-Amplifier which will be factory set to stroke the Actuator Pilot half open or full open.

### MATERIALS OF CONSTRUCTION

Body, Cast Iron	.....ASTM 126 Cl. B
Body, Bronze	.....ASTM B61-80 UNS C92200
Body, Carbon Steel	.....ASTM 216 Gr. WCB
Stem	.....303 St. Stl. ASTM 582 Cond. A
Disc	.....440 St. Stl. ASTM 276-75 Cond. A
Seat	.....304 St. Stl. ASTM 276 Cond. A
Gasket	.....Non-asbestos



**TYPE D210 ELECTRONIC  
ACTUATOR PILOT**



**TYPE D210 SERVO-AMPLIFIER**

# TYPE T14 TEMPERATURE PILOT

CONTROLS 20 to 500°F



TYPE T14 TEMPERATURE PILOT

- Spring Operated
- Self Contained
- Normally Open
- Packless Construction
- Fluid, Gas and Vapor Applications
- Strainer Screen Built-in
- Easy in-line Maintenance

## OPTIONS

- Stainless Steel Flexible Tubing
- Stainless Steel Capillary Tubing
- Tubing longer than 10'
- Thermostat Well
- Dial Thermometer
- Integral Mount
- Thermostat other than #700

## THERMOSTATS

700	706	731
701	708	732
702	711	740
703	712	800
704	713	801

## APPLICATION DATA

- Storage Heaters
- Jacketed Kettles
- Vats

## RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

## TEMPERATURE RANGES (°F)

20-120	150-300	300-400
50-150	170-270	330-430
70-170	250-350	400-500
120-220	290-390	

**SIZING  
INFO**

## TYPICAL CONFIGURATIONS

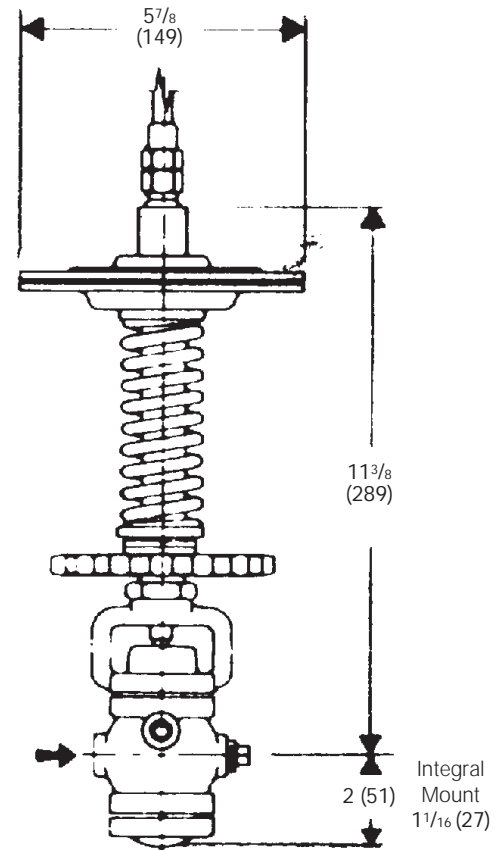
TEMPERATURE REGULATING .....	ET14
TEMPERATURE & PRESSURE .....	ET14D
TEMPERATURE REGULATING .....	E2T14
TEMPERATURE & PRESSURE .....	E2T14D
TEMPERATURE REGULATING .....	E5T14
TEMPERATURE & PRESSURE .....	E5T14D
TEMPERATURE REGULATING .....	C20T14
TEMPERATURE & PRESSURE .....	C20T14D

# TYPE T14 TEMPERATURE PILOT SPECIFICATION

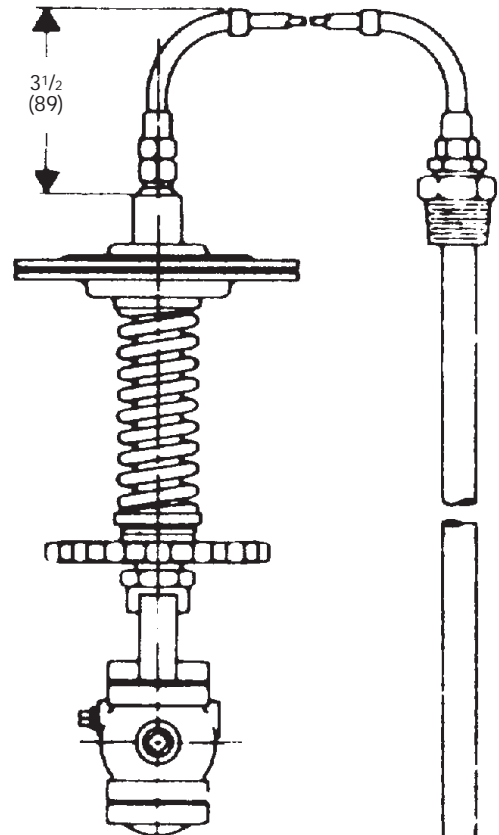
Pilot valve shall be separate from the main valve and connected to it by unions. Pilot seats shall be protected by built-in strainer screens. Pilot shall be interchangeable on all sizes of main valves. Thermal elements shall provide a 100°F (38°C) range of temperature adjustment and shall withstand 100°F overheating without damage. Handwheel adjustment for temperature shall be standard. Unless otherwise scheduled, thermal elements shall be equipped with 10 feet of brass flexible tubing. Number 700 bronze bulb, Number 728 bronze well shall be supplied for storage tank applications. Steel wells shall be supplied for fuel oil service.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....	ASTM A126 CI B
Body, Cast Bronze .....	ASTM B61-80 UNS C92200
Body, Cast Steel .....	ASTM A216 GR. WCB
Stem .....	2024-T4 ASTM B211-75
Disc .....	440 St. St. ASTM A276-75 COND A
Seat .....	420 St. Stl ASTM A276 COND A
Gasket .....	Non-Asbestos
Diaphragm .....	Bronze ASTM B103-77 UNS C51000
Spring .....	Steel



TYPE T14 TEMPERATURE PILOT  
13 LBS. (6 KG)



# TYPE T124/134 TEMPERATURE/ PRESSURE PILOT

CONTROLS 20 to 500°F



## TYPE T134 TEMPERATURE/PRESSURE PILOT

### APPLICATION DATA

- Instantaneous Water Heaters
- Oil Heaters
- Storage Heaters
- Process Heaters
- Jacketed Kettles
- Vats
- Driers
- Ovens

### RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

### TEMPERATURE RANGES (°F)

20-120	150-300	300-400
50-150	170-270	330-430
70-170	250-350	400-500
120-220	290-390	

\*Cast Steel available in T134 only.

- Vapor Tension Thermostat Spring Operated
- Self Contained
- Normally Open
- Packless Construction
- Fluid, Gas and Vapor Applications
- Strainer Screen Built-in
- Easy in-line Maintenance
- Temperature and Pressure in One Pilot

### MODELS

- **TYPE T124** for heater operating pressures between 20 and 125 psi.
- **TYPE 134** for heater operating pressures up to 20 psi.

### OPTIONS

- Stainless Steel Flexible Tubing
- Stainless Steel Capillary Tubing
- Tubing longer than 10'
- Thermostat other than #700
- Thermostat Well
- Dial Thermometer
- Integral Mount

### THERMOSTATS

700	706	731
701	708	732
702	711	740
703	712	800
704	713	801

### TYPICAL CONFIGURATIONS

TEMPERATURE & PRESSURE .....ET124

TEMPERATURE & PRESSURE .....ET134

TEMPERATURE & PRESSURE .....E2T134

TEMPERATURE & PRESSURE .....E5T124

TEMPERATURE & PRESSURE .....C20T124

**SIZING  
INFO**

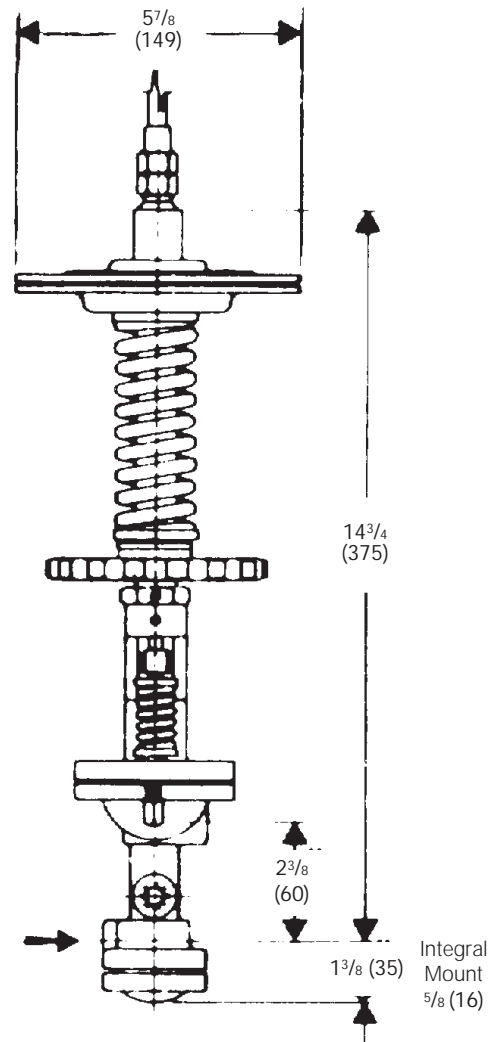


# TYPE T124/134 TEMPERATURE PILOT SPECIFICATION

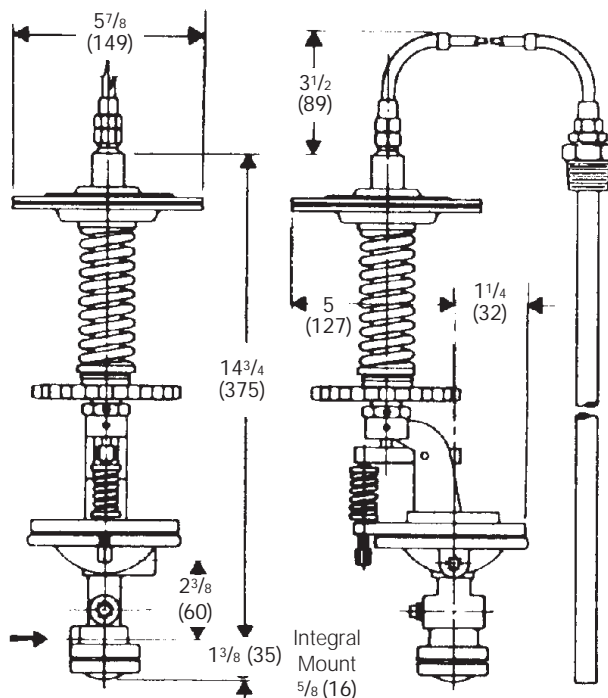
Pilot valve shall be separate from the main valve and connected to it by unions. Pilot seats shall be protected by built-in strainer screens. Pilots shall be interchangeable on all sizes of main valves. Thermal elements shall provide a 100°F (38°C) range of temperature adjustment and shall withstand 100°F (38°C) overheating without damage. Handwheel adjustment for temperature shall be standard. Unless otherwise scheduled, thermal elements shall be equipped with 10 feet of brass flexible tubing. Number 700 bronze bulb and Number 728 bronze well shall be included except with instantaneous heaters serving intermittent demand. Steel wells shall be supplied for fuel oil service on storage tank applications.

## MATERIALS OF CONSTRUCTION

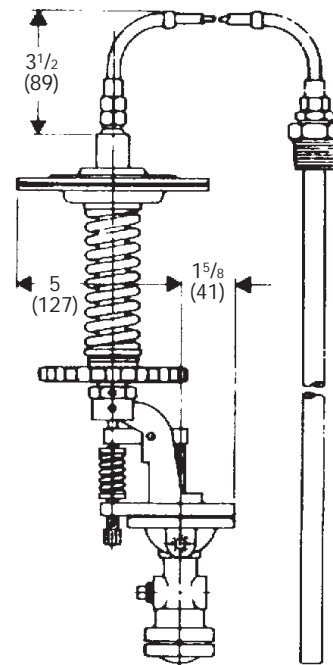
Body, Cast Iron .....	ASTM A126 CI B
Body, Cast Bronze .....	ASTM B61 UNS C92200
Body, Cast Steel .....	ASTM A216 WCB
Stem .....	416 St. Stl. ASTM A582-75
Disc .....	440 St. Stl. ASTM A582 COND A
Seat .....	420 St. Stl. ASTM A582 COND A
Gasket .....	Non-Asbestos
Diaphragm .....	301 St. Stl. MIL-5-5059C
Spring .....	Steel



**TYPE T124 PILOT**  
**16 LBS. (7.3 KG)**

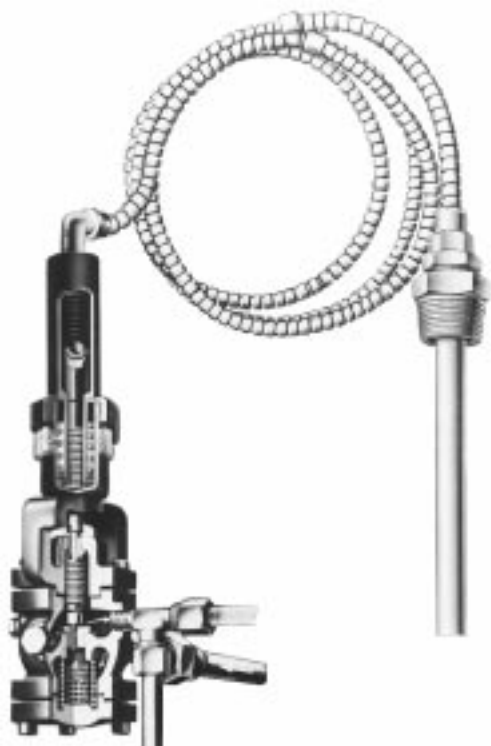


**TYPE T134 PILOT**  
**18 LBS. (8.2 KG)**



# TYPE T10 TEMPERATURE PILOT

CONTROLS 0 to 460 °F



TYPE T10 TEMPERATURE PILOT

- Spring Operated
- Self Contained
- Normally Open
- Packless Construction
- Fluid, Gas and Vapor Applications
- Strainer Screen Built-in
- Easy in-line Maintenance

## OPTIONS

- Stainless Steel Flexible Tubing
- Stainless Steel Capillary Tubing
- Tubing longer than 10'
- Thermostat other than bronze
- Thermostat Well
- Dial Thermometer
- Integral Mount

## THERMOSTATS

810

## TYPICAL CONFIGURATIONS

TEMPERATURE REGULATING .....	ET10
TEMPERATURE & PRESSURE .....	ET10D
TEMPERATURE REGULATING .....	E2T10
TEMPERATURE & PRESSURE .....	E2T10D
TEMPERATURE REGULATING .....	E5T10
TEMPERATURE & PRESSURE .....	E5T10D
TEMPERATURE REGULATING .....	C20T10
TEMPERATURE & PRESSURE .....	C20T10D

## APPLICATION DATA

- Storage Heaters
- Jacketed Kettles
- Vats
- Indoor applications only

## RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

## TEMPERATURE RANGES (°F)

0-100	270-370
90-190	360-460
180-280	

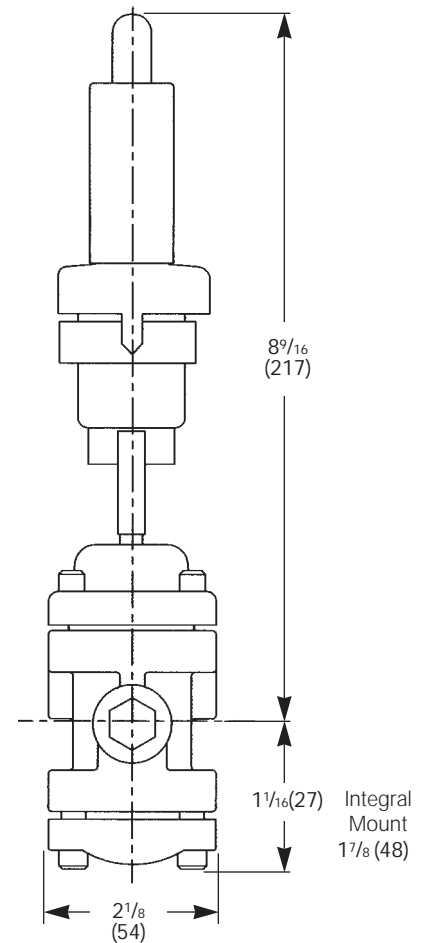
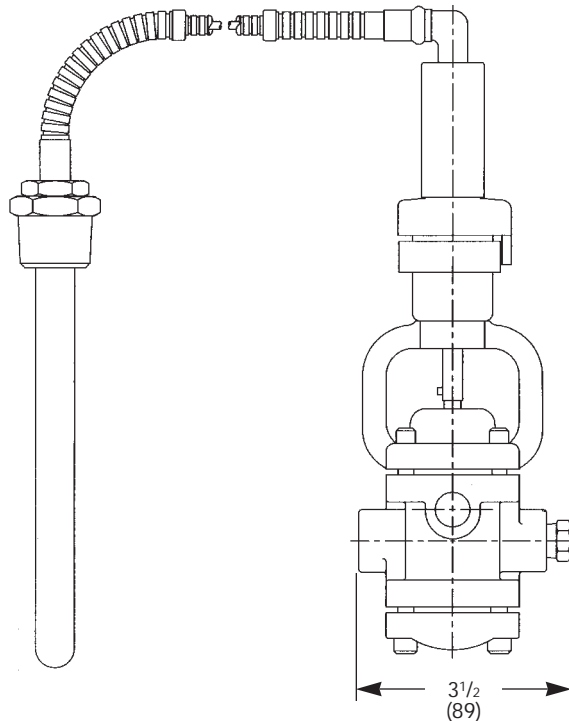
**SIZING  
INFO**

# TYPE T10 TEMPERATURE PILOT SPECIFICATION

Pilot valve shall be separate from the main valve and connected to it by unions. Pilot seats shall be protected by built-in strainer screens. Pilot shall be interchangeable on all sizes of main valves. Thermal elements shall provide a 100°F (38°F) range of temperature adjustment and shall withstand 100°F (38°F) overheating without damage. Temperature adjustment shall be of the indicating type, calibrated in both °F and °C. Unless otherwise scheduled, thermal elements shall be equipped with 10 feet of brass flexible tubing and Number 810 bronze bulb. With the exception of instantaneous heaters serving intermittent demand, an optional Number 820 bronze thermostat well should also be specified.

## MATERIALS OF CONSTRUCTION

Body, Cast Iron .....	ASTM A126 CI B
Body, Cast Bronze .....	ASTM B61 UNS C92200
Body, Cast Steel .....	ASTM A216 WCB
Stem .....	303 St. Stl. ASTM A582
Disc .....	440 St. Stl. ASTM A276-75COND A
Seat .....	420 St. Stl ASTM A582 COND A
Gasket .....	Non-Asbestos
Bellows .....	Ryton
Spring .....	Steel



**TYPE T10 TEMPERATURE PILOT  
5 LBS. (2.5 KG)**

# TYPE T52 TEMPERATURE PILOT

CONTROLS 20 to 500°F



TYPE T52 TEMPERATURE PILOT

## APPLICATION DATA

- Control Flow of Cooling Liquid
- Blending

## RATINGS (Maximum Inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	450 (232)
Cast Bronze	250 (17.2) @	450 (232)
Cast Steel	600 (41.4) @	750 (400)

## TEMPERATURE RANGES (°F)

20-120	150-300	300-400
50-150	170-270	330-430
70-170	250-350	400-500
120-220	290-390	

- Spring Operated
- Self Contained
- Normally Closed
- Packless Construction
- Fluid, Gas and Vapor Applications
- Strainer Screen Built-in
- Easy in-line Maintenance

## OPTIONS

- Stainless Steel Flexible Tubing
- Stainless Steel Capillary Tubing
- Tubing longer than 10'
- Thermostat Well
- Dial Thermometer
- Integral Mount
- Thermostat other than #700

## THERMOSTATS

700	706	731
701	708	732
702	711	740
703	712	800
704	713	801

## TYPICAL CONFIGURATIONS

COOLING .....	C34T52
COOLING & PRESSURE .....	C34T52D
COOLING .....	E6T52
COOLING & PRESSURE .....	E6T52D
COOLING .....	ET52
COOLING & PRESSURE .....	ET52D
COOLING .....	E2T52
COOLING & PRESSURE .....	E2T52D
COOLING .....	E5T52
COOLING & PRESSURE .....	E5T52D
COOLING .....	C20T52
COOLING & PRESSURE .....	C20T52D

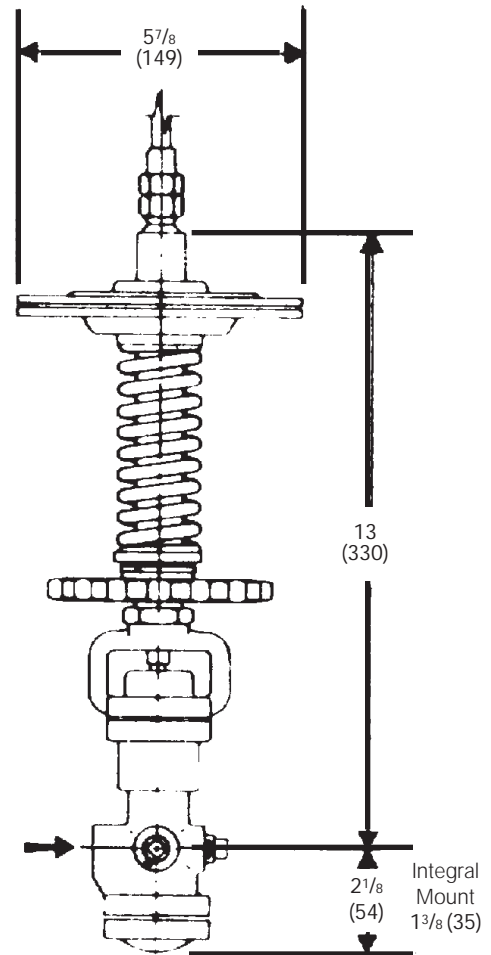
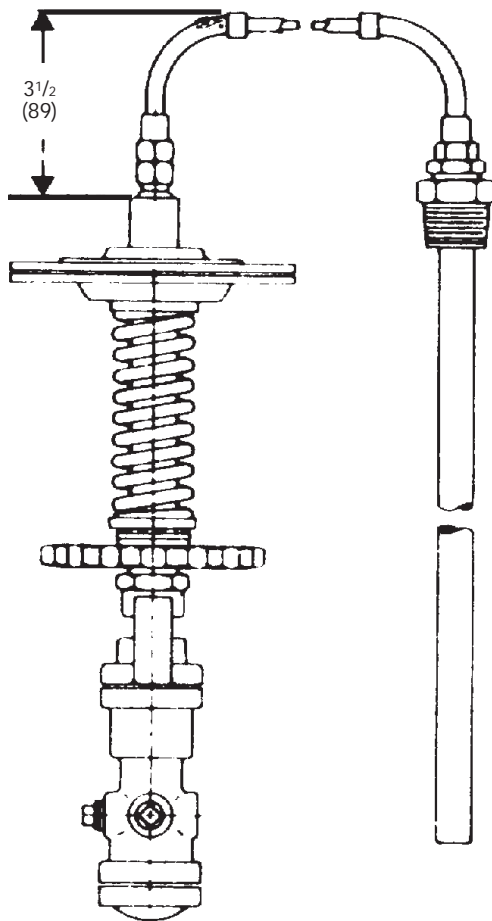
**SIZING  
INFO**

# TYPE T52 TEMPERATURE PILOT SPECIFICATION

Pilot valve is for cooling applications (reverse acting). Pilot valve shall be separate from the main valve and connected to it by unions. Pilot seats shall be protected by built-in strainer screens. Pilot shall be interchangeable on all sizes of main valves. Thermal elements shall provide a 100°F (38°C) range of temperature adjustment and shall withstand 100°F overheating without damage. Handwheel adjustment for temperature shall be standard. Unless otherwise scheduled, thermal elements shall be equipped with 10 feet of brass flexible tubing. Number 700 bronze bulb, Number 728 bronze well shall be supplied for storage tank applications. Steel wells shall be supplied for fuel oil service.

## MATERIALS OF CONSTRUCTION

Body, Bronze .....	ASTM B61-80 UNS C92200
Body, Steel .....	ASTM A108-79
Stem .....	303 St. Stl ASTM 582 Cond. A
Disc .....	440 St. Stl. ASTM 276-75 Cond. A
Seat .....	420 St. Stl ASTM 276 Cond. A
Gasket .....	Non-asbestos
Diaphragm .....	PH Bronze
Spring .....	Inconel



**TYPE T52 PILOT**  
**14 LBS. (6.4 KG)**



# TYPE T60 PNEUMATIC TEMPERATURE CONTROLLER

TEMPERATURES to 600°F

- Mercury Thermostat
- Pinpoint Accuracy
- Low Air Consumption (.1 scfm)
- Adjustable Proportional Band 2-200%
- Control Mode Proportional + Reset (PI)
- Air Supply Pressure 20-65 psig

## TYPE T60 PNEUMATIC CONTROLLER

### APPLICATION DATA

- Instantaneous Heaters
- Process Applications with wide ranging, fast changing loads
- Desuperheaters

### RATINGS (Maximum Inlet Conditions)

Supply Pressure (PSIG)	Output Range (PSIG)
20	3-15
35	3-27
35	6-30
65	12-60

### BULB LENGTH (inches) & TEMPERATURE RANGES (°F)

2¼ Bulb	-40-120
1¾ Bulb	0-200
1¾ Bulb	0-300
2¾ Bulb	30-150
1¼ Bulb	50-400
1⅛ Bulb	200-600

### OPTIONS

- P, PD or PID Control Mode

### TYPICAL CONFIGURATIONS

PRESSURE & TEMPERATURE .....EAT60

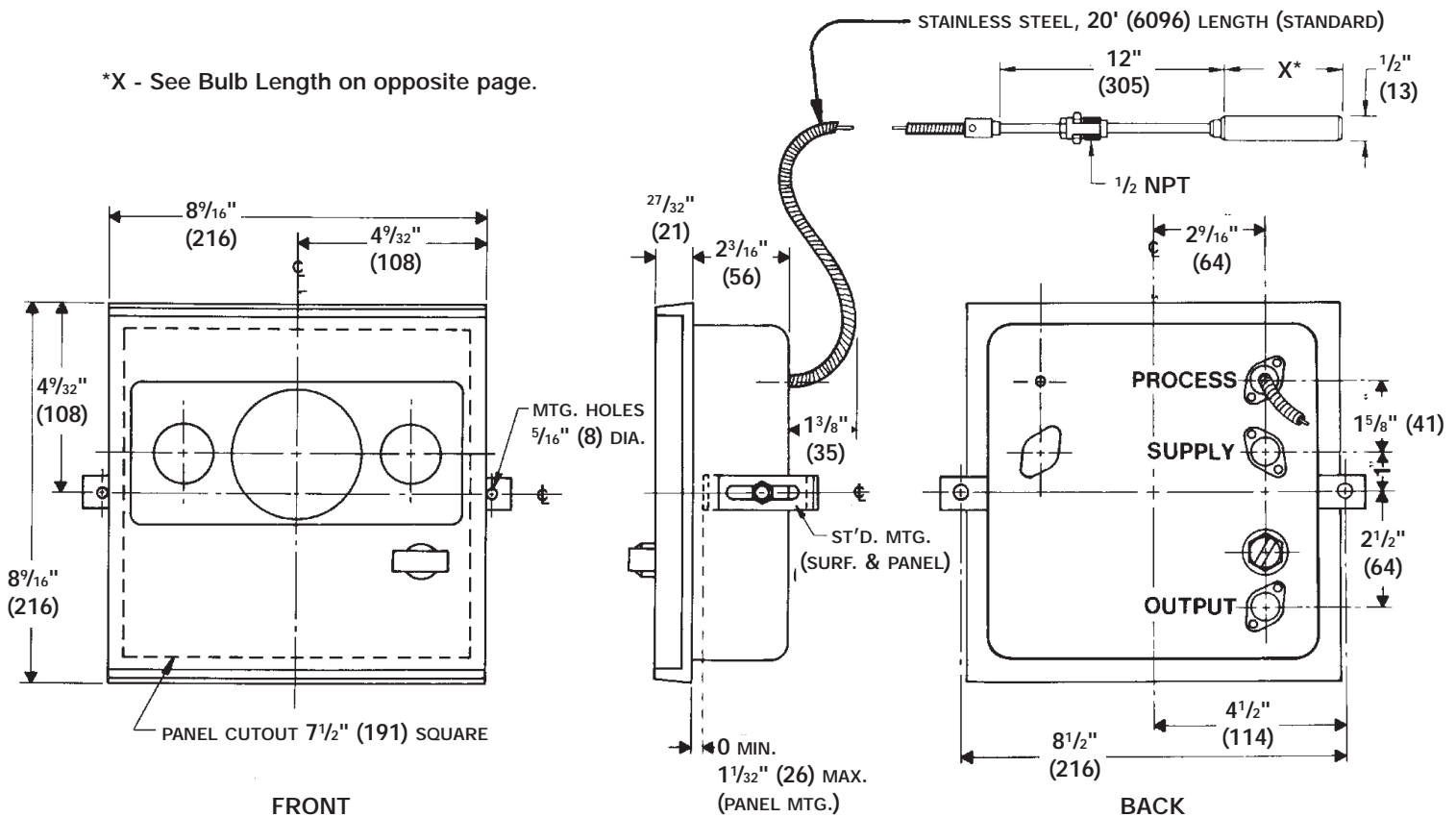
# TYPE T60 PNEUMATIC TEMPERATURE CONTROLLER SPECIFICATION

The temperature controller shall be of the indicating type. It shall be non-bleeding with high capacity, capable of fast response. It shall be equipped with 0-30 psig supply and loading gages, a 3-1/2" dial with control and set point indicators and shall have a 2-200% adjustable proportional band. The Controller shall be equipped with a stainless steel bulb and 10 feet of flexible tubing. Control point adjustments to be made by a knob inside the case.

## SPECIFICATIONS

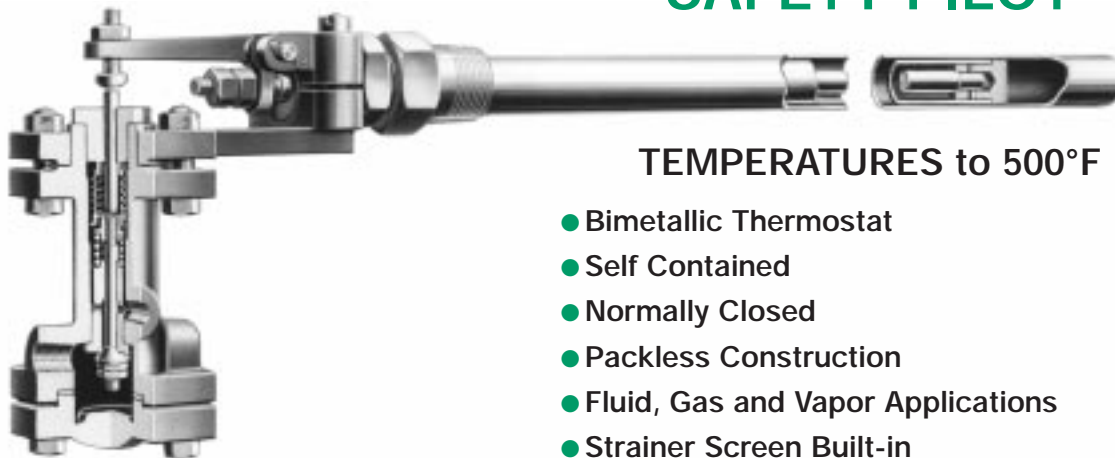
Air Connections .....1/4" FNPT  
 Air Consumption, Maximum ..... 0.2 SCFM  
 Air Consumption, Normal..... 0.1 SCFM  
 Ambient Temperature Limits -40° to 180°F (-40 to 82°C)  
 Weight .....81/2 lbs. (19 kg)  
 Proportional Band .....Adjustable, 2 - 200%  
 Control Action .....Adjustable, Reverse or Direct  
 Control Mode, Standard .....Proportional + Reset (PI)  
 Control Mode, Optional .....P, PD or PID

\*X - See Bulb Length on opposite page.





# TYPE SP/T TEMPERATURE SAFETY PILOT



TYPE SP/T TEMPERATURE SAFETY PILOT

TEMPERATURES to 500°F

- Bimetallic Thermostat
- Self Contained
- Normally Closed
- Packless Construction
- Fluid, Gas and Vapor Applications
- Strainer Screen Built-in
- Easy in-line Maintenance

## TYPICAL CONFIGURATIONS

TEMPERATURE REGULATING .....ET14SP/T

TEMPERATURE REGULATING .....ET134SP/T

## APPLICATION DATA

- Where overheating could cause personal injury or damage

## RATINGS (Maximum inlet Conditions)

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Bronze	300 (21.0)	500°F (260°C)
Cast Steel	600 (41.3)	750°F (400°C)

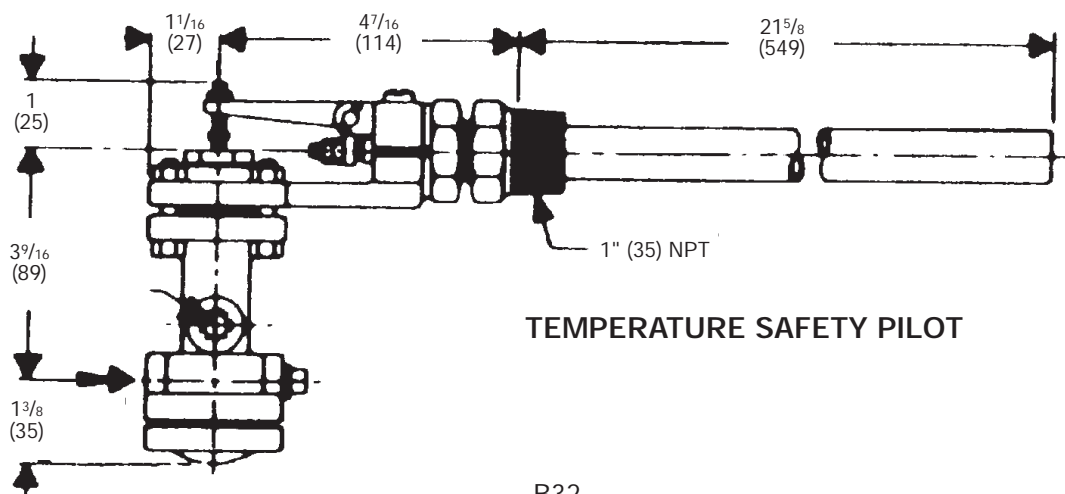
## TEMPERATURE RANGES (°F)

0-500

## MATERIALS OF CONSTRUCTION

Body .....Bronze ASTM B61-80 UNS C92200  
 Stem .....303 St. Stl. ASTM A582 Cond A  
 Disc .....440C St. Stl. ASTM A276-75 Cond A  
 Seat .....420 St. Stl. ASTM A276 Cond A  
 Gasket .....Non-asbestos  
 Bellows .....Bronze  
 Bulb .....Bronze ASTM B62-80 UNS C31400

## SIZING INFO



TEMPERATURE SAFETY PILOT

# TYPE T61, T62, T63, T64 PNEUMATIC TEMPERATURE CONTROLLER

TEMPERATURES to 350°F

- Bimetallic Thermostat for Fast Response
- Pinpoint Accuracy
- 200°F Adjustable Temperature Range
- Low Air Consumption (.25 scfm)
- Adjustable Proportional Band 1/4-2 psi per 1°F
- Overtemperature Protection
- Air Supply Pressure 20 psi

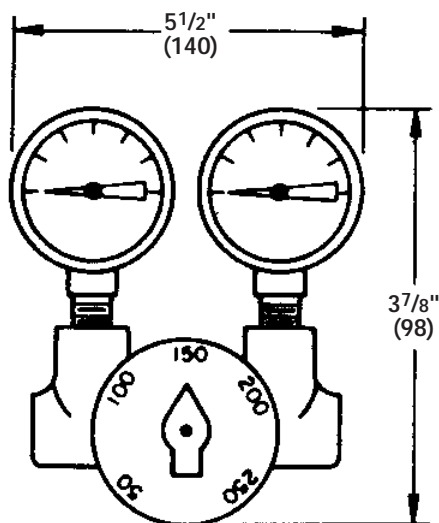
## MODELS

- **TYPE T61** for applications where air control signal decreases as process temperature increases.
- **TYPE T62** for applications where air control signal increases as process temperature increases.
- **TYPE T63** for high temperature applications where air control signal decreases as process temperature increases.
- **TYPE T64** for sanitary applications where air control signal decreases as process temperature increases. Supplied with IAMD Sanitary Cap.

## TYPICAL CONFIGURATIONS

PRESSURE & TEMPERATURE .....EA85T61

### SIZING INFO



TYPE T61, T62, T63, T64  
CONTROLLER  
1 1/2 LBS (.7 KG)



TYPE T61 PNEUMATIC  
TEMPERATURE CONTROLLER

## APPLICATION DATA

- Instantaneous Heaters
- Process Applications with wide ranging, fast changing loads

## RATINGS (Maximum Inlet Conditions)

Pressure PSIG (bar)	Temperature °F (°C)
250 (17.2)	450°F (232°C)

## TEMPERATURE RANGES (°F)

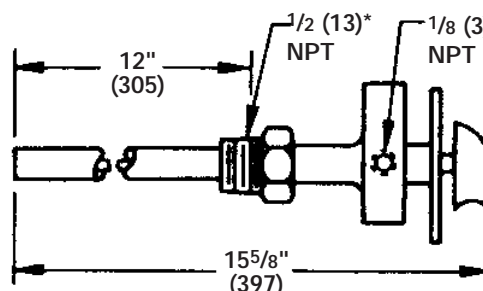
T61, T62, T64	50-250
T63	150-350

## SPECIFICATION

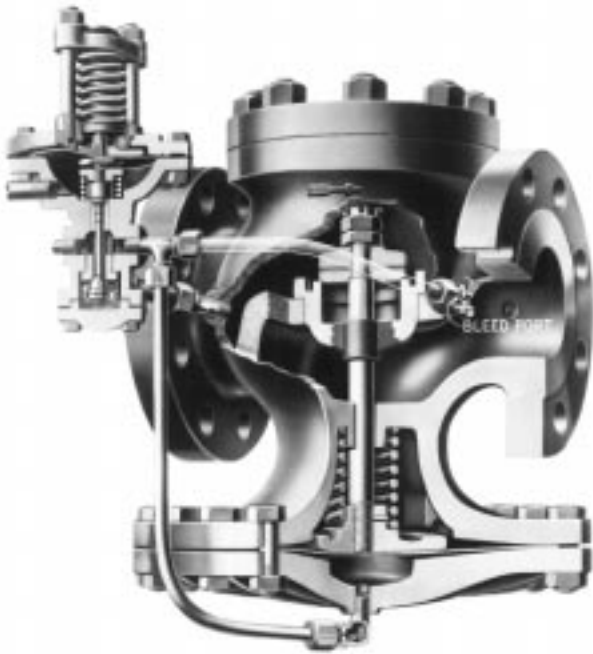
The temperature controller shall be of the non-indicating type. It shall be equipped with 0-30 psi supply and loading gages. The controller shall have 200°F adjustable range and be equipped with a bronze bulb as part of its bimetal thermostat. Control point adjustments to be made by a knob on the temperature pilot and throttling range shall be adjustable externally with a set screw wrench. A stainless steel thermostat bulb, preferable in lieu of a well, is available as an alternate to bronze.

## MATERIALS OF CONSTRUCTION

Body .....Bronze ASTM B62-80 UNS C83600  
Bulb, Bronze .....ASTM B140-80 UNS C31400  
Bulb, Steel .....316 St. Stl. ASTM A276 Cond. A  
Seals .....Viton  
Spool .....Brass ASTM B16-80 UNS 36000  
Spring .....St. Steel



\* For T64, this is IAMD Sanitary Cap.



# TYPE ED SERIES PRESSURE REGULATOR

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

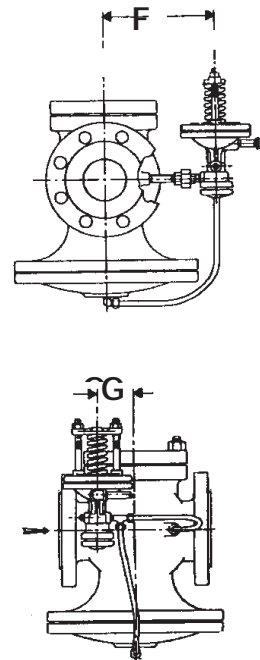
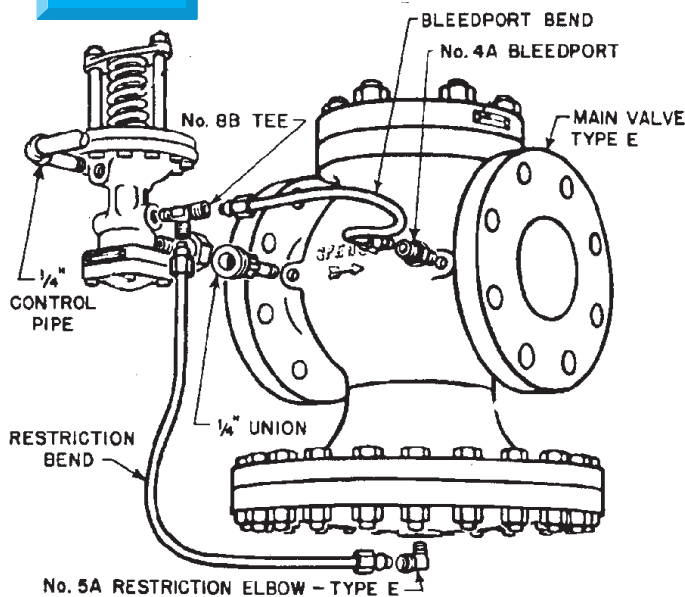
## APPLICATION DATA

- 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

### PILOT INFO



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 (12)	5 3/8 (136)	1 1/4 (32)
3/4 (19)	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 (38)	6 1/4 (159)	2 (51)
2 (51)	6 5/8 (168)	2 1/8 (54)
2 1/2 (64)	6 3/4 (171)	2 3/8 (60)
3 (76)	7 1/4 (184)	2 3/4 (70)
4 (102)	8 (203)	3 1/2 (89)
5 (127)	9 (229)	3 1/2 (89)
6 (152)	9 7/8 (251)	4 (102)
8 (203)	10 1/2 (267)	6 1/4 (159)
10 (254)	12 1/2 (318)	6 (152)
12 (305)	14 (356)	8 1/2 (216)

# TYPE E2D SERIES PRESSURE REGULATOR

CAST IRON or BRONZE  
for PRESSURES to 15 PSIG max.

## APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Single Point or Multiple use Applications
- Single Stage Reduction
- Parallel Reduction
- Low Pressure Drop to Operate Valve
- Instantaneous Hot Water Heaters with low supply pressures (with the addition of a T14 Pilot)



TYPE E2D PRESSURE REGULATOR

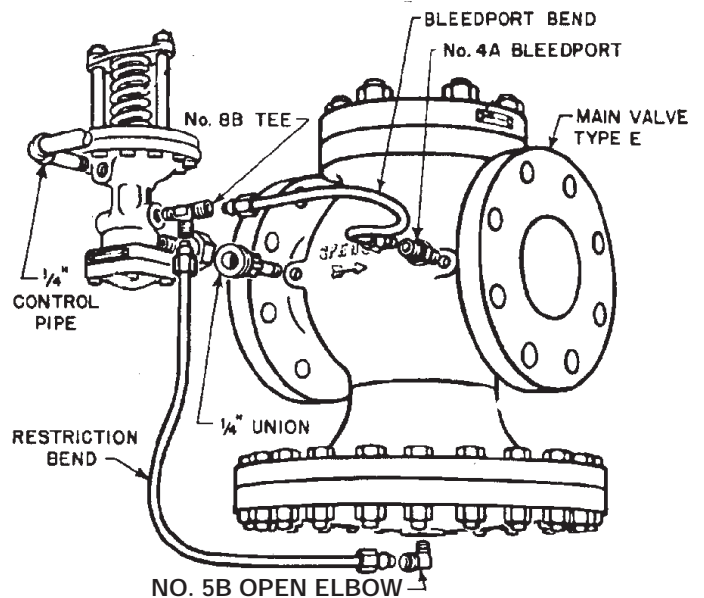
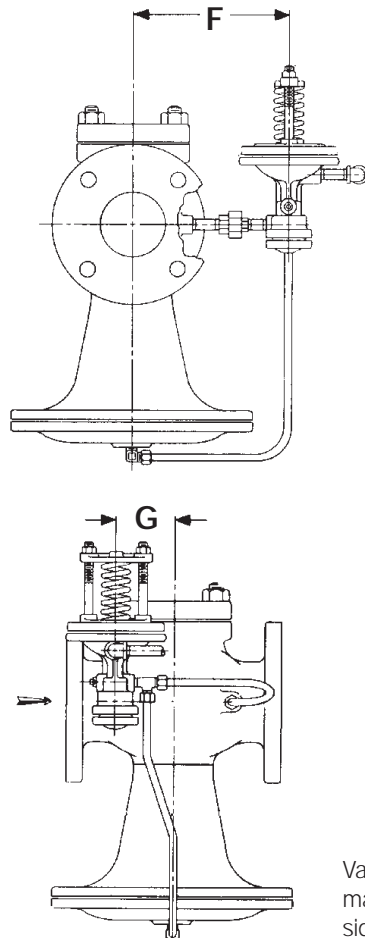
VALVE  
INFO

PILOT  
INFO

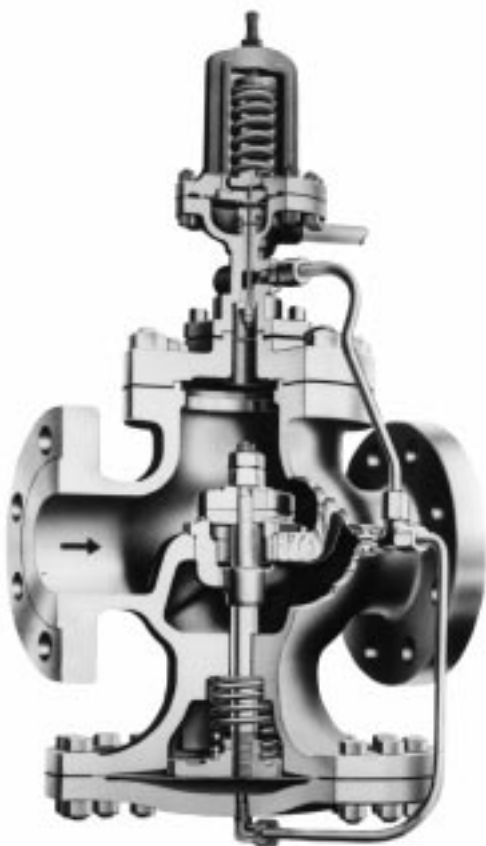
## DIMENSIONS

inches (mm)

SIZE	F	G
3/4 (19)	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 (38)	6 1/4 (159)	2 (51)
2 (51)	6 5/8 (168)	2 1/8 (54)
2 1/2 (64)	6 3/4 (171)	2 3/8 (60)
3 (76)	7 1/4 (184)	2 3/4 (70)
4 (102)	7 3/8 (187)	3 1/2 (89)
5 (127)	8 1/8 (206)	3 1/2 (89)
6 (152)	8 1/2 (216)	4 (102)
8 (203)	9 3/8 (238)	6 1/4 (159)
10 (254)	11 (279)	6 (152)
12 (305)	11 7/8 (302)	7 1/4 (184)



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



TYPE ED INTEGRAL MOUNT  
PRESSURE REGULATOR

VALVE  
INFO

PILOT  
INFO

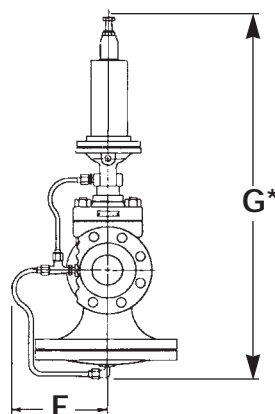
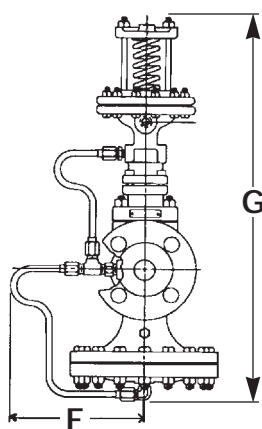
# TYPE ED & ED2 INTEGRAL MOUNT PRESSURE REGULATOR

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

## APPLICATION DATA

- Pressure Regulation for Steam Distribution where extra rigidity is required

## DIMENSIONS inches (mm)



SIZE	F	G*
3/8 (10)	5 1/4 (133)	15 3/4 (400)
1/2 (12)	5 1/4 (133)	15 3/4 (400)
3/4 (19)	5 3/8 (136)	17 (432)
1 (25)	5 1/2 (140)	18 1/2 (470)
1 1/4 (32)	5 3/4 (146)	18 1/2 (470)
1 1/2 (38)	6 (152)	19 1/2 (495)
2 (51)	6 1/2 (165)	20 5/8 (524)
2 1/2 (64)	7 (178)	21 3/4 (552)
3 (76)	7 3/8 (187)	23 1/2 (597)
4 (102)	8 7/8 (225)	27 1/4 (692)
5 (127)	10 (254)	28 5/8 (727)
6 (152)	11 3/8 (289)	31 1/2 (800)
8 (203)	12 3/4 (324)	35 5/8 (899)
10 (254)	15 1/2 (394)	43 3/4 (1111)
12 (305)	18 (457)	47 3/4 (1213)

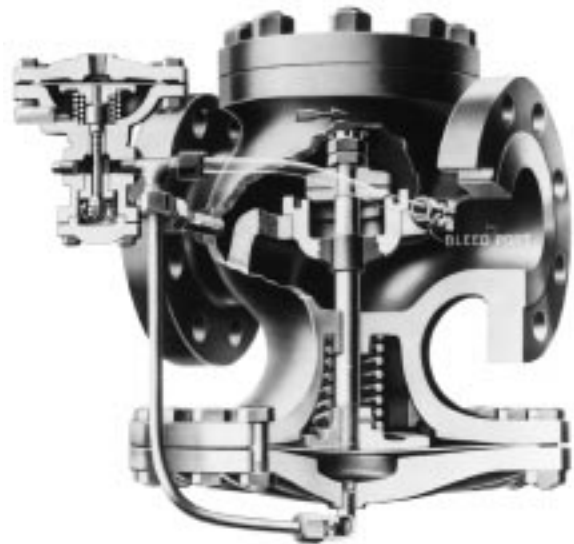
\* For D2 Pilot, add 5 1/4" (133) to this dimension.

# TYPE EA SERIES PRESSURE REGULATOR

CAST IRON, BRONZE or STEEL  
for 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
- Control from Remote Location
- Temperature Regulating (with addition of T60 Series Pneumatic Temperature Pilot)



TYPE EA SERIES  
PRESSURE REGULATOR

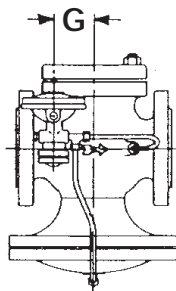
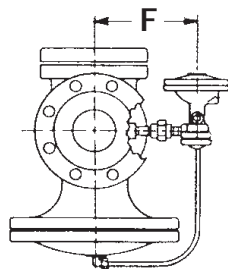
VALVE  
INFO

PILOT  
INFO

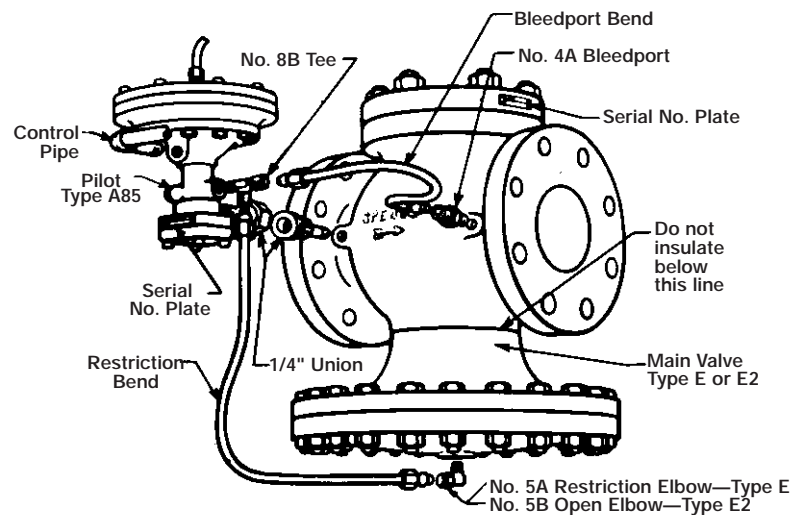
## DIMENSIONS

inches (mm)

SIZE	F	G
3/8 (10)	5 3/8 (136)	1 1/4 (32)
1/2 (12)	5 3/8 (136)	1 1/4 (32)
3/4 (19)	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 (38)	6 1/4 (159)	2 (51)
2 (51)	6 5/8 (168)	2 1/8 (54)
2 1/2 (64)	6 3/4 (171)	2 3/8 (60)
3 (76)	7 1/4 (184)	2 3/4 (70)
4 (102)	8 (203)	3 1/2 (89)
5 (127)	9 (229)	3 1/2 (89)
6 (152)	9 7/8 (251)	4 (102)
8 (203)	10 1/2 (267)	6 1/4 (159)
10 (254)	12 1/2 (318)	6 (152)
12 (305)	14 (356)	8 1/2 (216)



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





# TYPE ET14 TEMPERATURE REGULATOR

CAST IRON, BRONZE or STEEL  
CONTROLS 20 to 500°F

## APPLICATION DATA

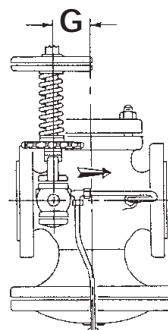
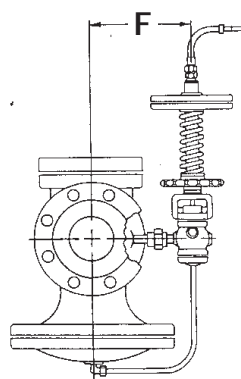
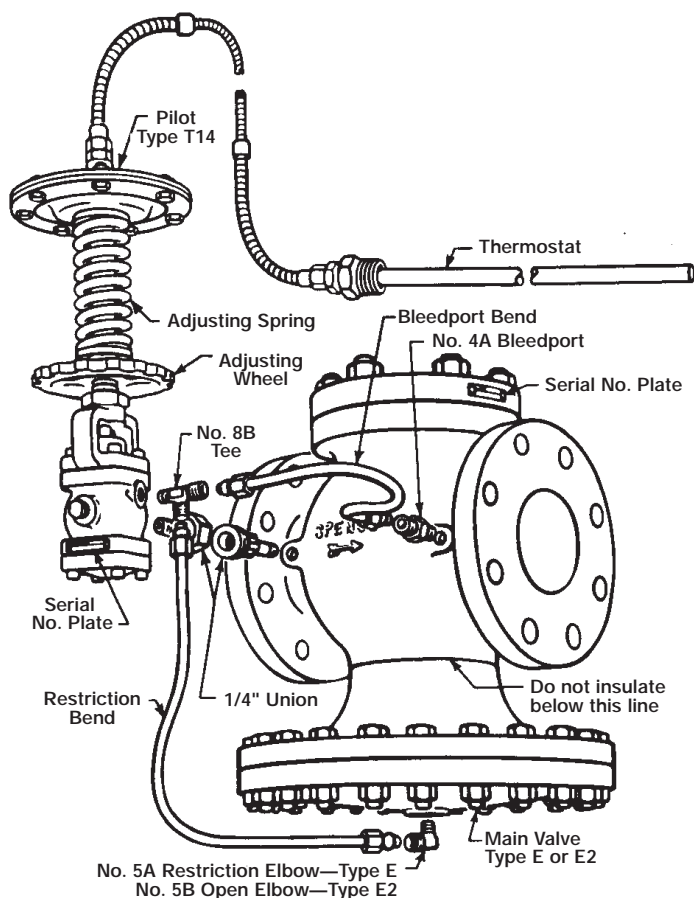
- Temperature Regulation for Batch Process
- Storage Heaters (Water, Fuel Oil or Chemical)
- Air Heating

VALVE  
INFO

PILOT  
INFO

TYPE ET14 TEMPERATURE REGULATOR

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 (12)	5 3/8 (136)	1 1/4 (32)
3/4 (19)	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 (38)	6 1/4 (159)	2 (51)
2 (51)	6 5/8 (168)	2 1/8 (54)
2 1/2 (64)	6 3/4 (171)	2 3/8 (60)
3 (76)	7 1/4 (184)	2 3/4 (70)
4 (102)	8 (203)	3 1/2 (89)
5 (127)	9 (229)	3 1/2 (89)
6 (152)	9 7/8 (251)	4 (102)
8 (203)	10 1/2 (267)	6 1/4 (159)
10 (254)	12 1/2 (318)	6 (152)
12 (305)	14 (356)	8 1/2 (216)

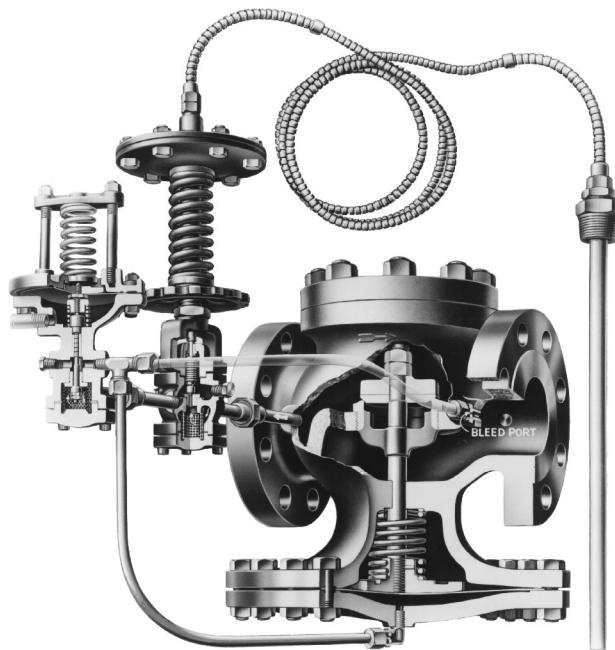


# TYPE ET14D PRESSURE LIMITING TEMPERATURE REGULATOR

CAST IRON, BRONZE or STEEL FOR  
CONTROLS 20 to 500°F

## APPLICATION DATA

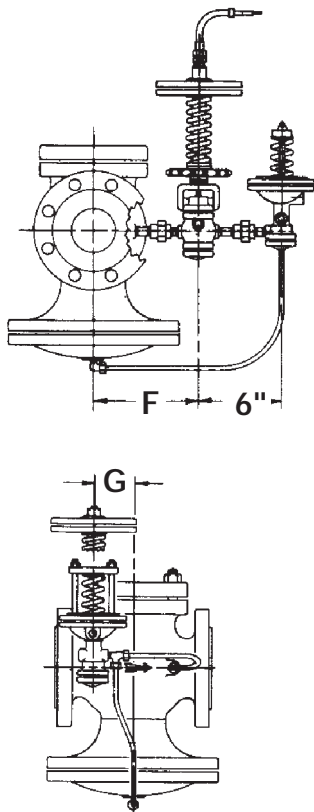
- Temperature & Pressure Regulation for large volume Heat Exchangers
- Storage Heaters
- Jacketed Kettles
- Vats



TYPE ET14D TEMPERATURE  
& PRESSURE REGULATOR

## DIMENSIONS inches (mm)

SIZE	F	G
3/8 (10)	5 3/8 (136)	1 1/4 (32)
1/2 (12)	5 3/8 (136)	1 1/4 (32)
3/4 (19)	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 (38)	6 1/4 (159)	2 (51)
2 (51)	6 5/8 (168)	2 1/8 (54)
2 1/2 (64)	6 3/4 (171)	2 3/8 (60)
3 (76)	7 1/4 (184)	2 3/4 (70)
4 (102)	8 (203)	3 1/2 (89)
5 (127)	9 (229)	3 1/2 (89)
6 (152)	9 7/8 (251)	4 (102)
8 (203)	10 1/2 (267)	6 1/4 (159)
10 (254)	12 1/2 (318)	6 (152)
12 (305)	14 (356)	8 1/2 (216)

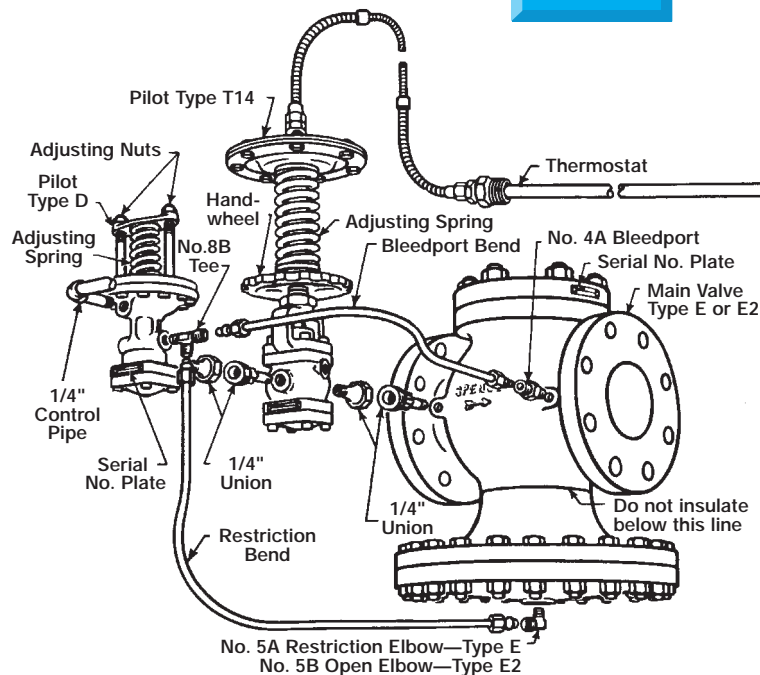


Valve is tapped so that  
Pilot may be mounted on  
either side.

VALVE  
INFO

D PILOT  
INFO

T14 PILOT  
INFO



# TYPE ET124/ET134 & E2T134 TEMPERATURE & PRESSURE REGULATOR

CAST IRON or STEEL

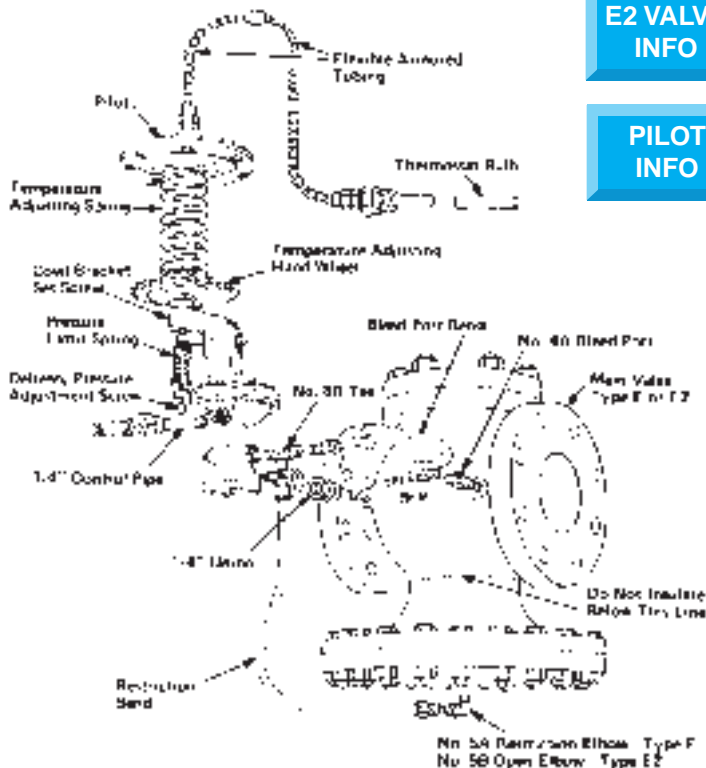


TYPE ET124 TEMPERATURE & PRESSURE REGULATOR

E VALVE  
INFO

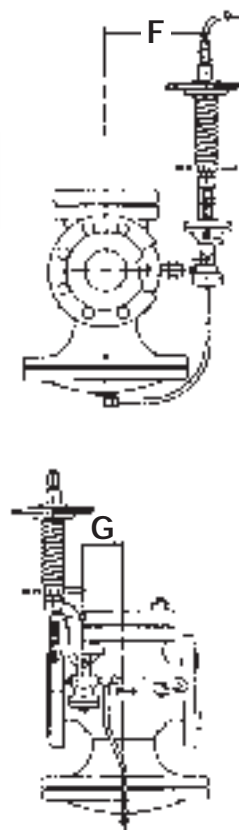
E2 VALVE  
INFO

PILOT  
INFO



DIMENSIONS  
inches (mm)

SIZE	F	G	
		E	E2
3/8 (10)	5 3/8 (136)	1 1/4 (32)	—
1/2 (12)	5 3/8 (136)	1 1/4 (32)	—
3/4 (19)	5 5/8 (143)	1 3/8 (35)	1 3/8 (35)
1 (25)	5 3/4 (146)	1 1/2 (38)	1 1/2 (38)
1 1/4 (32)	6 (152)	1 7/8 (48)	1 7/8 (48)
1 1/2 (38)	6 1/4 (159)	2 (51)	2 (51)
2 (51)	6 5/8 (168)	2 1/8 (54)	2 1/8 (54)
2 1/2 (64)	6 3/4 (171)	2 3/8 (60)	2 3/8 (60)
3 (76)	7 1/4 (184)	2 3/4 (70)	2 3/4 (70)
4 (102)	8 (203)	3 1/2 (89)	3 1/2 (89)
5 (127)	9 (229)	3 1/2 (89)	3 1/2 (89)
6 (152)	9 7/8 (251)	4 (102)	4 (102)
8 (203)	10 1/2 (267)	6 1/4 (159)	6 1/4 (159)
10 (254)	12 1/2 (318)	6 (152)	6 (152)
12 (305)	14 (356)	8 1/2 (216)	7 1/4 (184)



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

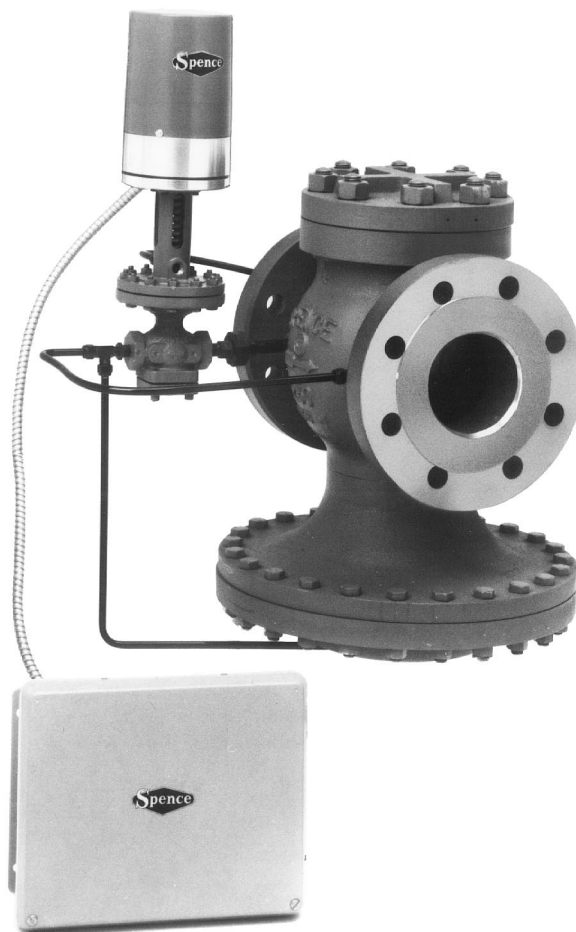
# TYPE ED210 REGULATOR

## ELECTRONIC MODULATION

### DELIVERY PRESSURES to 150 PSIG

#### APPLICATION DATA

- Main Valve adapted to 4-20 mA Signal



TYPE ED210 REGULATOR

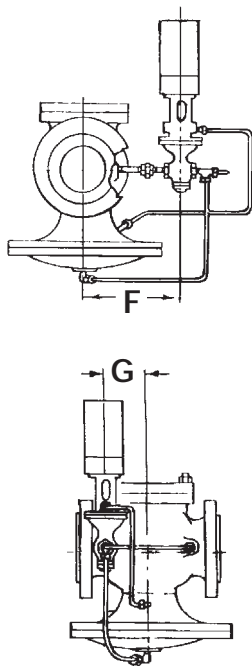
VALVE  
INFO

PILOT  
INFO

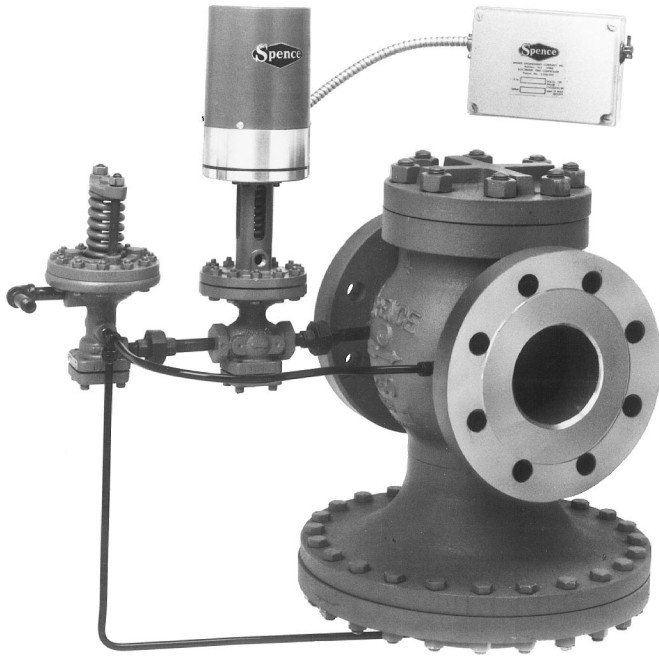
#### DIMENSIONS

inches (mm)

SIZE	F	G
$\frac{3}{8}$ (10)	$5\frac{3}{8}$ (136)	$1\frac{1}{4}$ (32)
$\frac{1}{2}$ (12)	$5\frac{3}{8}$ (136)	$1\frac{1}{4}$ (32)
$\frac{3}{4}$ (19)	$5\frac{5}{8}$ (143)	$1\frac{3}{8}$ (35)
1 (25)	$5\frac{3}{4}$ (146)	$1\frac{1}{2}$ (38)
$1\frac{1}{4}$ (32)	6 (152)	$1\frac{7}{8}$ (48)
$1\frac{1}{2}$ (38)	$6\frac{1}{4}$ (159)	2 (51)
2 (51)	$6\frac{5}{8}$ (168)	$2\frac{1}{8}$ (54)
$2\frac{1}{2}$ (64)	$6\frac{3}{4}$ (171)	$2\frac{3}{8}$ (60)
3 (76)	$7\frac{1}{4}$ (184)	$2\frac{3}{4}$ (70)
4 (102)	8 (203)	$3\frac{1}{2}$ (89)
5 (127)	9 (229)	$3\frac{1}{2}$ (89)
6 (152)	$9\frac{7}{8}$ (251)	4 (102)
8 (203)	$10\frac{1}{2}$ (267)	$6\frac{1}{4}$ (159)
10 (254)	$12\frac{1}{2}$ (318)	6 (152)
12 (305)	14 (356)	$8\frac{1}{2}$ (216)



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



# TYPE ED208D PRESSURE REGULATOR ELECTRONIC STARTUP PILOT OPERATED

DELIVERY PRESSURES to 150 PSIG

## APPLICATION DATA

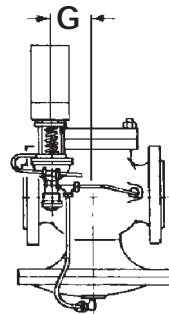
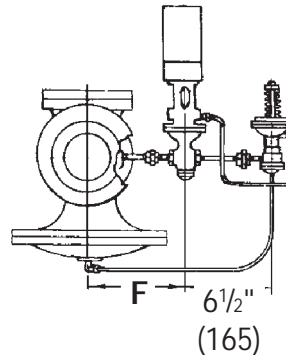
- Electronic Control of Slow Startup and/or Slow Shutdown of Pressure Regulation
- Building Heating Systems
- Can save more than 4 times it's cost in building heating in one year.

TYPE ED208D PRESSURE REGULATOR

VALVE  
INFO

D PILOT  
INFO

D208 PILOT  
INFO



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 (12)	5 3/8 (136)	1 1/4 (32)
3/4 (19)	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 (38)	6 1/4 (159)	2 (51)
2 (51)	6 5/8 (168)	2 1/8 (54)
2 1/2 (64)	6 3/4 (171)	2 3/8 (60)
3 (76)	7 1/4 (184)	2 3/4 (70)
4 (102)	8 (203)	3 1/2 (89)
5 (127)	9 (229)	3 1/2 (89)
6 (152)	9 7/8 (251)	4 (102)
8 (203)	10 1/2 (267)	6 1/4 (159)
10 (254)	12 1/2 (318)	6 (152)
12 (305)	14 (356)	8 1/2 (216)

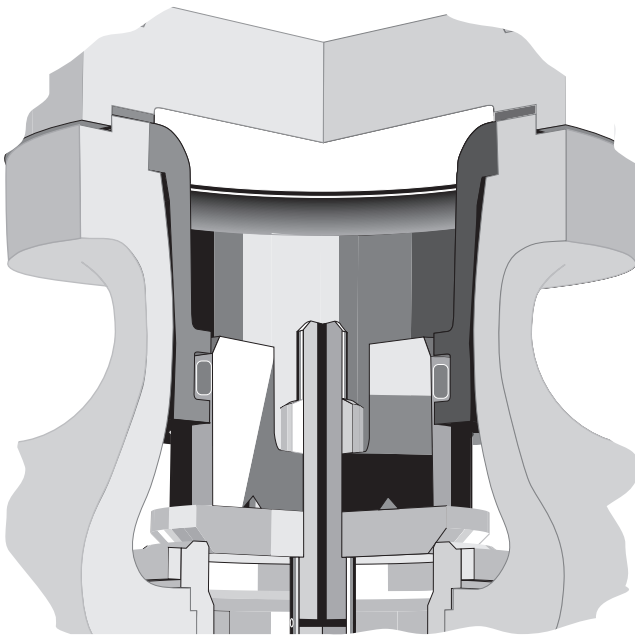
# MAIN VALVE OPTIONS

## SECOWELD

The greatest weakness in a High Pressure Valve is the threaded joint between the Seat Ring and the body. A slight leak developing at this point will gradually erode the Body metal, thus accentuating the leak and eventually ruining the body.

Various impractical schemes, such as welding the Seat Ring into the Body, have been tried to overcome this weakness. The invention SECOWELD solves this problem and, at the same time, provides an easily renewable Seat Ring.

In the SECOWELD Design, a SECO Metal Bushing is welded to and thus sealed in the Body and, in turn, is threaded to take the Main Seat Ring, which is also of SECO Metal. As SECO Metal resists wiredrawing, if slight leakage should occur, no damage can be done to the body or to the threads of either SECO Metal piece.



## BALANCED CONSTRUCTION

There are installations where it is desirable to not have the inlet pressure forcing down on the Main Valve Disc. In these instances, the E Main Valve should be internally balanced. The balance parts allow the downstream pressure to rest on top of the disc, thus allowing for finer adjustments in the Main Valve travel and a smoother operating regulator.

## CONDENSATION CHAMBER

A Condensation Chamber is standard on the Type E5 Main Valve. A Condensation Chamber is standard on the Type E Main Valve when steam temperatures exceed 600°F. Any Main Valve discharging steam into a vacuum should include a Condensation Chamber.



# MAIN VALVE OPTIONS

## COMPOSITION DISC

In a Single Seat Main Valve, the Integral (all-metal) Disc is interchangeable with the composition Disc Assembly. The composition Disc is recommended for service on air, gas and water where absolutely tight shutoff is required. Parabolic and other specially shaped Disc Washers can be furnished to meet special flow requirements.



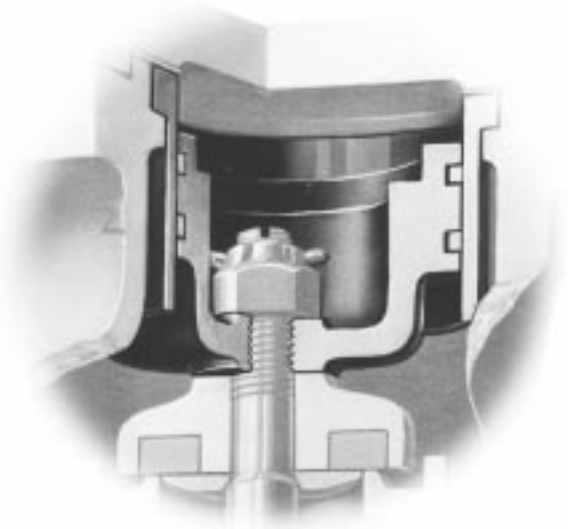
**COMPOSITION  
DISC ASSEMBLY**



**PARABOLIC  
DISC WASHER**

## DASHPOT

In order to prevent water hammer, Dashpots are required in all single seat, normally closed Main Valves used on liquid service, except Type C34. Dashpots are neither necessary nor desirable on steam, air or gas service and are not required in double seat valves or in normally open single seat valves. Illustration shows Dashpot and Composition Disc for initial pressures of 200 psig and less. For initial pressures greater than 200 psig, standard metal to metal seat and disc are used.



**DASHPOT ASSEMBLY**



**PARABOLIC DISC**

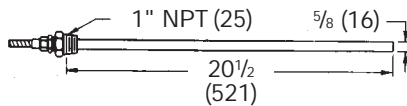
## PARABOLIC DISC

In order to meet special flow requirements, any Spence Main Valve can be equipped with a Parabolic or other specially shaped Disc. Due to the fact that the Spence Main Valve is operated by a large, balanced Diaphragm and is nearly frictionless in operation, special Discs are not required on normal installations.

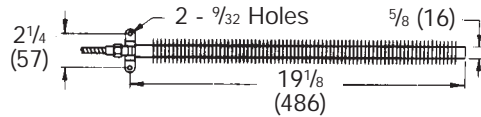


# THERMOSTAT BULBS

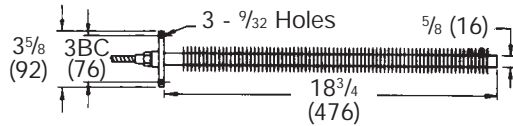
## FOR USE WITH T14, T124, T134, T52 PILOTS



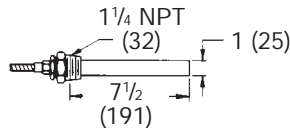
**STYLE NO. 700 AND 800**—Plain Bulb with 1" Union Connection.



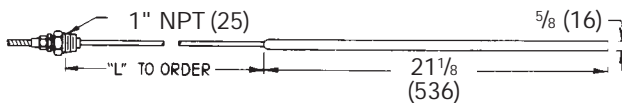
**STYLE NO. 702**—Finned Bulb with Wall Mounting Bracket. For space heating.



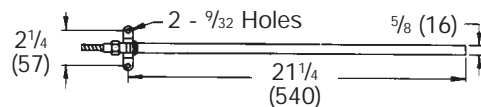
**STYLE NO. 703**—Finned Bulb with Duct Mounting Flange. For forced warm air heating.



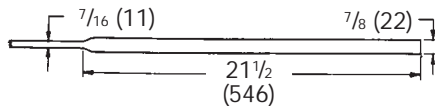
**STYLE NO. 704**—Plain Short Bulb with 1-1/4" Union Connection. For installations where depth is limited.



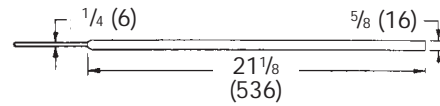
**STYLE NO. 706**—Plain Bulb with 1" Union Connection and 1/4" OD Bendable Extension. Dimension "L" must be specified.



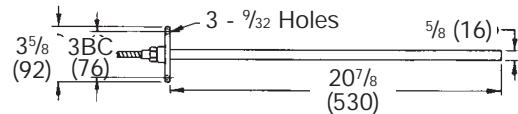
**STYLE NO. 708**—Plain Bulb with Wall Mounting Bracket. Used for space heating when dust is a problem.



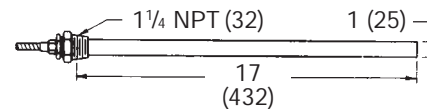
**STYLE NO. 711**—Bulb Lead Covered. Chemical lead covering homogeneously bonded to bulb and to lead sheathing on capillary.



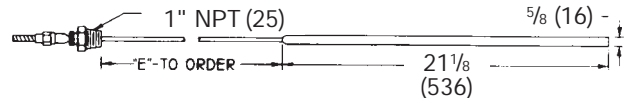
**STYLE NO. 712**—Plain Bulb with 1/4" OD Bendable Tubing Cover for Capillary. Used in open tanks or where a mounting connection is not required.



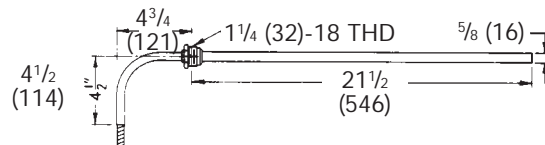
**STYLE NO. 713**—Plain Bulb with Duct Mounting Flange. For forced warm air heating when dust is a problem.



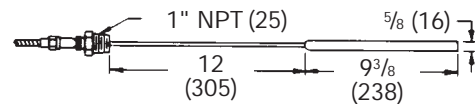
**STYLE NO. 701 AND 801**—Large Plain Bulb with 1-1/4" Union Connection. Used on pilots having more than 30 feet of flexible tubing and with dial thermometer having 20 to 120°F range.



**STYLE NO. 731**—Plain Bulb with Adjustable Extension. Used in oil storage tanks or wherever it is desirable to change position of bulb. Dimension "E" must be specified.

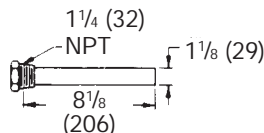


**STYLE NO. 740**—Sanitary Bulb for Milk Heaters. Threaded to fit standard No. 23A Thermometer Ferrule. Stainless Steel Bulb and Flexible Tubing.

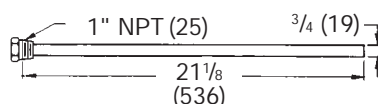


**STYLE NO. 732**—Special Bulb with 12" Adjustable Extension.

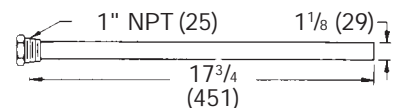
# THERMOSTAT WELLS



**727 WELL**—Used with 704 Bulb



**728 WELL**—Used with 700 and 800 Bulb



**729 WELL**—Used with 701 and 801 Bulb



# TEMPERATURE PILOT OPTIONS

## DIAL THERMOMETER

Any Spence Temperature Pilot can be equipped with a Dial Thermometer. Pilots with Dial Thermometers are available in the 20-120°F, 70-170°F, 120-220°F and 170-270°F ranges.



**DIAL THERMOMETER**



**ADJUSTMENT INDICATOR**

## ADJUSTMENT INDICATOR

An Adjustment Indicator is a definite convenience where frequent changes in set point are required. Indexed scale makes it easy to return to any previous operating point.

# DESUPERHEATERS

for PRESSURES to 600 PSIG at 750°F



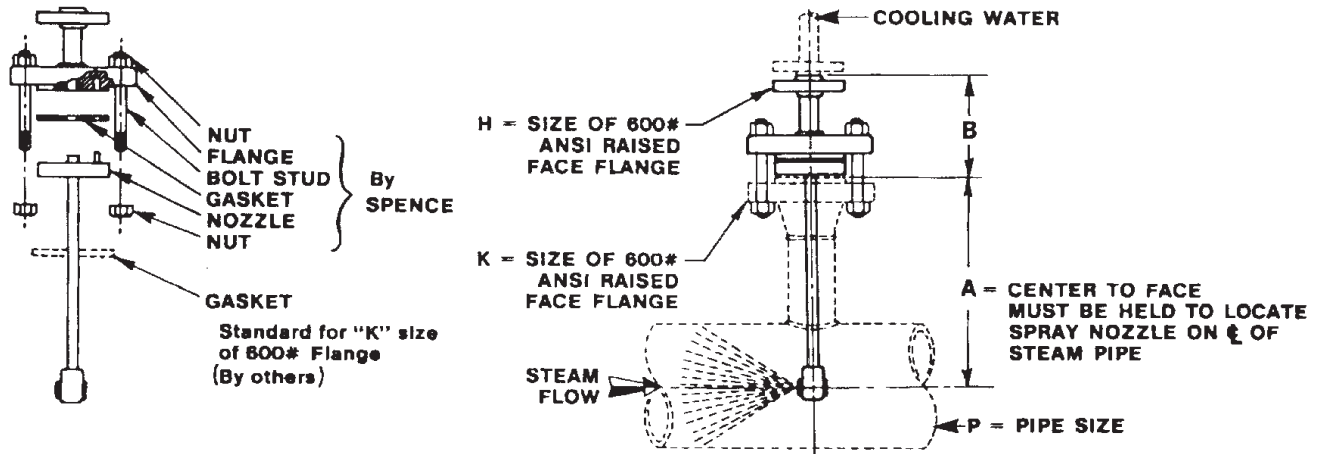
- Reduces the temperature of superheated steam by controlled direct injection of cooling water
- Mechanical atomizing 2.5:1 turndown
- Steam atomizing 20:1 turndown
- Line Sizes 3" to 24" (larger sizes available upon request)
- Velocities to 8000 feet per minute

## STEAM ATOMIZING DESUPERHEATER

### APPLICATION DATA

- Reduce Temperature of Superheated Steam

#### SIZING INFO



### MECHANICAL ATOMIZING DIMENSIONS, inches (mm) AND WEIGHTS, pounds (kg)

Size	B	H	K	A														Weight
				P = MAIN STEAM PIPE														
				3	3½	4	5	6	8	10	12	14	16	18	20	24		
#1	4½ (114)	¼ (6)	2 (51)	7 (178)	7½ (191)	8½ (216)	10 (254)	11 (280)	13 (330)	— —	— —	— —	— —	— —	— —	— —	15 (6.8)	
#3	5⅜ (136)	½ (13)	2 (51)	— —	— —	8½ (216)	10 (254)	11 (280)	13 (330)	15½ (394)	16½ (419)	— —	— —	— —	— —	— —	22 (10)	
#5	6 (152)	1 (25)	4 (102)	— —	— —	— —	— —	11 (280)	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	— —	— —	— —	40 (18)	
#6	8 (203)	1¼ (32)	4 (102)	— —	— —	— —	— —	— —	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	— —	— —	75 (34)	
#8	10 (254)	2 (51)	6 (152)	— —	— —	— —	— —	— —	— —	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	23½ (597)	27½ (699)	135 (61)	

# DESUPERHEATERS

## SPECIFICATIONS

The Desuperheater shall be air operated, consisting of atomizing injector nozzle, dual controller, air pilot and strainers. It shall be capable of handling wide load variations from full load to 5% of maximum and control within  $\pm 5^{\circ}\text{F}$ .

The injector nozzle shall be designed and installed to disperse the minute water particles and atomizing steam counter to the flow of superheated steam, enabling the fine mist to be easily evaporated.

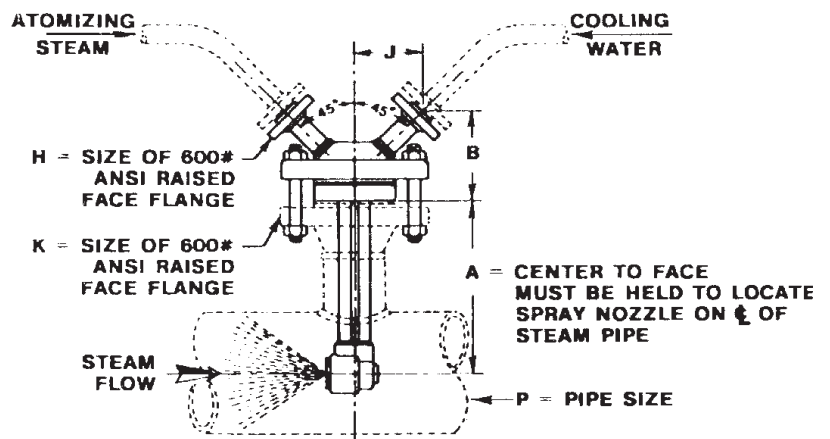
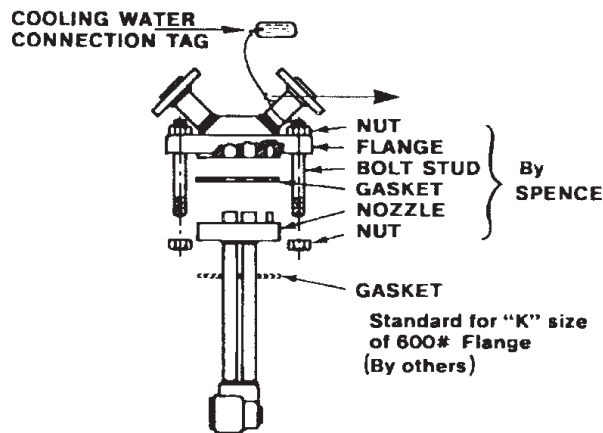
The dual controller shall be so constructed that it will maintain a balanced, modulated flow of steam and water to the injector nozzle at all times and shall be so arranged that the atomizing steam shall lead the water on opening and trail on closing, so that it is impossible for the water to reach the injector nozzle before the steam.



**DUAL CONTROL DESUPERHEATER NOZZLE**

## MATERIALS OF CONSTRUCTION

.....300 Series Stainless Steel



**STEAM ATOMIZING DIMENSIONS, inches (mm) AND WEIGHTS, pounds (kg)**

Size	B	H	J	K	A														Weight
					P = MAIN STEAM PIPE														
					3	3½	4	5	6	8	10	12	14	16	18	20	24		
#1	4½ (114)	¼ (6)	2¾ (70)	2 (51)	7 (178)	7½ (191)	8½ (216)	10 (254)	11 (280)	13 (330)	— —	— —	— —	— —	— —	— —	— —	18 (8)	
#3	5⅞ (136)	½ (13)	2¾ (70)	2½ (64)	— —	— —	8½ (216)	10 (254)	11 (280)	13 (330)	15½ (394)	16½ (419)	— —	— —	— —	— —	— —	28 (13)	
#5	6½ (165)	1 (25)	4¼ (108)	4 (102)	— —	— —	— —	— —	11 (280)	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	— —	— —	— —	68 (31)	
#6	7⅞ <sub>16</sub> (191)	1¼ (32)	6 (152)	5 (127)	— —	— —	— —	— —	— —	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	— —	— —	110 (50)	
#8	9⅓ <sub>16</sub> (250)	2 (51)	7½ (191)	8 (203)	— —	— —	— —	— —	— —	— —	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	23½ (597)	27½ (699)	270 (123)	



# NOISE SUPPRESSOR

for SERVICE to 500°F

- Standard sizes 3/8" to 8". Consult Factory for additional sizes
- Effective over a broad frequency band (up to 12,000 Hz)
- Noise attenuation up to 20 dBA
- Expansion fittings not required
- Straight through design minimizes pressure drop, permitting normal valve sizing

## NOISE SUPPRESSORS

**DIMENSIONS** inches (mm) **AND WEIGHTS** pounds (kg)  
**INLET SIZE 2½" TO 8"**

### APPLICATION DATA

- Steam Pressure Reduction Stations where Noise Reduction is Desired

### SUPPRESSOR ENDS

INLET ANSI	OUTLET ANSI
NPT .....	NPT
NPT .....	150#
NPT .....	300#
150# .....	150#
300# .....	150#
300# .....	300#

NOTE: ANSI 150# Flanges are flat faced.

It is recommended that the Noise Suppressor be insulated to reduce condensation formation in the acoustic material.

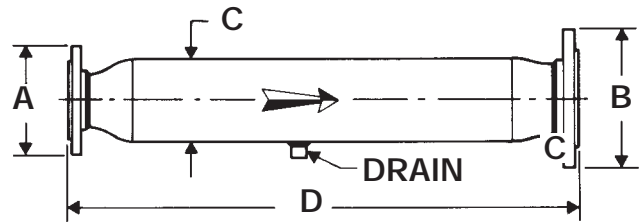
**SIZING  
INFO**

NOMINAL PIPE SIZE			D* — INSTALLED LENGTH			APPROX. WEIGHT		
A INLET	B OUTLET	C SHELL	150# X 150#	300# X 150#	300# X 300#	150# X 150#	300# X 150#	300# X 300#
2½ (64)	4 (102)	5 (127)	39¾ (1010)	40 (1016)	40¾ (1025)	73 (33)	75 (34)	85 (39)
2½ (64)	5 (127)	6 (152)	47¼ (1200)	47½ (1207)	47⅞ (1216)	105 (48)	108 (49)	123 (56)
3 (76)	4 (102)	5 (127)	39¾ (1009)	40⅞ (1019)	40½ (1028)	76 (35)	82 (37)	91 (41)
3 (76)	5 (127)	6 (152)	47¼ (1200)	47⅞ (1210)	48 (1219)	108 (49)	114 (52)	129 (59)
3 (76)	6 (152)	8 (203)	58¼ (1480)	58⅞ (1489)	59 (1499)	174 (798)	180 (82)	199 (90)
4 (102)	5 (127)	6 (152)	47½ (1206)	47⅞ (1216)	48¼ (1225)	113 (51)	123 (56)	138 (63)
4 (102)	6 (152)	8 (203)	54½ (1384)	54⅞ (1393)	55¼ (1403)	175 (80)	185 (84)	204 (93)
4 (102)	8 (203)	10 (254)	66 (1676)	66⅞ (1686)	66¾ (1695)	284 (129)	294 (134)	321 (146)
5 (127)	6 (152)	8 (203)	55 (1397)	55⅞ (1406)	55¾ (1416)	180 (82)	195 (87)	214 (97)
5 (127)	8 (203)	10 (254)	66½ (1689)	66⅞ (1698)	67¼ (1708)	289 (131)	304 (138)	331 (150)
5 (127)	10 (254)	12 (305)	89 (2261)	89⅞ (2280)	90 (2286)	455 (207)	470 (214)	516 (235)
6 (152)	8 (203)	10 (254)	66½ (1689)	66⅞ (1698)	67¼ (1708)	295 (134)	314 (143)	341 (155)
6 (152)	10 (254)	12 (305)	83½ (2121)	83⅞ (2130)	84½ (2146)	451 (205)	470 (214)	516 (235)
8 (203)	10 (254)	12 (305)	84 (2134)	84⅞ (2143)	85 (2159)	468 (213)	495 (225)	541 (246)

\* ± 1/4" for 8" Shell and under, otherwise ± 3/8".

# NOISE SUPPRESSOR SPECIFICATION

Noise Suppression equipment shall be of the dissipative reactive type. It shall have expanded outlet flange for attachment to downstream piping. Equipment shall provide a minimum of 10 dBA reduction in noise. Installation must be insulated.



## MATERIALS OF CONSTRUCTION

Pressure Shell .....Welded Steel Components  
Acoustic Material .....Stainless Steel

## MAXIMUM VELOCITY

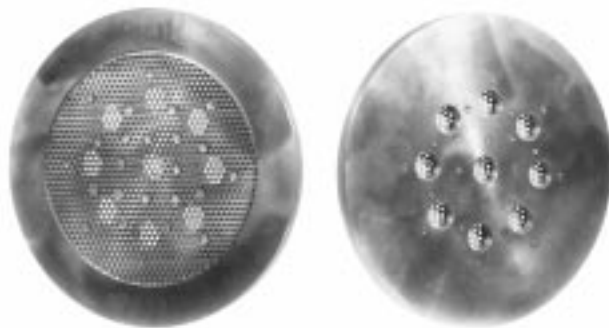
feet per minute  
(meters per minute)

NOMINAL PIPE SIZE	MAXIMUM VELOCITY
0 - 2 (0 - 51)	17,000 (5182)
2 1/2 - 8 (64 - 203)	11,000 (3353)
>8 (>203)	9,000 (2734)

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) INLET SIZES 3/8" TO 2"

NOMINAL PIPE SIZE			D* — INSTALLED LENGTH			APPROX. WEIGHT					
A INLET	B OUTLET	C SHELL	NPTxNPT NPTx300# 300#x300#	NPTx150# 300#x150#	150#x150#	NPT x NPT	NPT x 150#	NPT x 300#	150# x 150#	300# x 150#	300# x 300#
3/8 (9.5)	3/4 (19)	2 (51)	19 13/16 (502)	19 5/8 (498)	—	8 (3.6)	9 (4.1)	10 (4.5)	—	—	—
3/8 (9.5)	1 (25)	2 (51)	20 (508)	19 3/4 (502)	—	8 (3.6)	10 (4.5)	11 (5)	—	—	—
3/8 (9.5)	1 1/2 (38)	2 1/2 (64)	22 3/4 (578)	22 1/2 (572)	—	12 (5.4)	15 (6.8)	18 (8.2)	—	—	—
1/2 (13)	1 (25)	2 (51)	20 (508)	19 3/4 (502)	19 9/16 (140)	8 (3.6)	10 (4.5)	11 (5)	12 (5.4)	12 (5.4)	13 (5.9)
1/2 (13)	1 1/4 (32)	2 1/2 (64)	22 5/8 (574)	22 5/16 (565)	22 1/8 (562)	12 (5.4)	13 (5.9)	16 (7.3)	15 (6.8)	15 (6.8)	17 (7.7)
1/2 (13)	1 1/2 (38)	2 1/2 (64)	22 3/4 (578)	22 1/2 (572)	22 5/16 (565)	12 (5.45)	15 (6.8)	18 (8.2)	16 (7.3)	16 (7.3)	19 (8.6)
3/4 (19)	1 1/4 (32)	2 1/2 (64)	23 5/16 (591)	23 (584)	22 13/16 (578)	12 (5.4)	14 (6.4)	16 (7.3)	15 (6.8)	16 (7.3)	18 (8.2)
3/4 (19)	2 (51)	3 (76)	26 1/2 (673)	26 1/4 (667)	26 1/16 (664)	16 (7.3)	21 (9.5)	23 (10.4)	22 (10)	23 (10.4)	25 (11.4)
1 (25)	1 1/2 (38)	2 1/2 (64)	21 1/8 (537)	20 7/8 (530)	20 5/8 (524)	13 (5.9)	16 (7.3)	19 (8.6)	18 (8.2)	19 (8.6)	22 (10)
1 (25)	2 (51)	3 (76)	23 11/16 (603)	26 7/16 (683)	26 3/16 (666)	16 (7.3)	21 (9.5)	23 (10.4)	23 (10.4)	24 (10.9)	26 (11.8)
1 1/4 (32)	2 (51)	3 (76)	24 5/16 (616)	24 1/16 (613)	23 3/4 (603)	16 (7.3)	21 (9.5)	23 (10.4)	23 (10.4)	25 (11.4)	27 (12.3)
1 1/4 (32)	3 (76)	4 (102)	34 11/16 (882)	34 5/16 (879)	34 (864)	— (—)	40 (18)	47 (21.4)	42 (19)	45 (20.5)	51 (23)
1 1/2 (38)	3 (76)	4 (102)	31 13/16 (807)	31 7/16 (800)	31 3/16 (791)	— (—)	39 (17.7)	44 (20)	43 (19.5)	46 (21)	52 (23.6)
2 (51)	3 (76)	4 (102)	31 7/8 (810)	31 1/2 (800)	31 1/4 (794)	— (—)	40 (18)	46 (21)	45 (20.5)	47 (21.4)	53 (24)
2 (51)	4 (102)	5 (127)	40 1/8 (1019)	39 3/4 (1010)	39 1/2 (1003)	— (—)	66 (30)	76 (34.5)	72 (32.7)	74 (33.6)	84 (38.2)

\* ±1/4" for 8" Shell and under, otherwise ± 3/8".



INLET                      OUTLET  
MUFFLING ORIFICE

# MUFFLING ORIFICE

- Reduces noise by 6 dBA to 12 dBA
- Engineered for each application
- Designed to fit between ANSI flanges (DIN upon request)
- For noise reduction estimates, consult your Representative.

## MATERIALS OF CONSTRUCTION

Plate .....Steel ASTM A285-78 Gr. C.  
Disc .....St. St. 302-2B

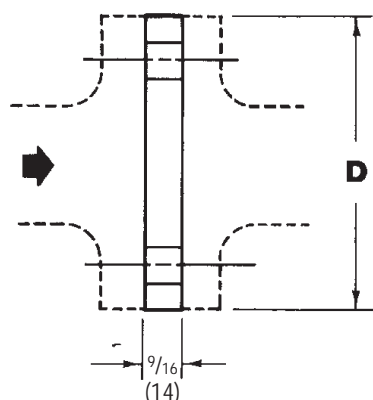
## SPECIFICATION

A Muffling Orifice Plate to be constructed of materials suitable for the installation and compatible with the piping. Generally, it is to be of steel construction with stainless steel plate welded to the primary plate. The orifices are to be on the stainless steel plate. Orifice plates are to be designed for installation between two ANSI flanges in the enlarged piping downstream of the regulator or noise suppressor. Muffling Orifice Plates are to be designed to provide between 6 to 10 dBA of noise reduction on a high flow PRV.

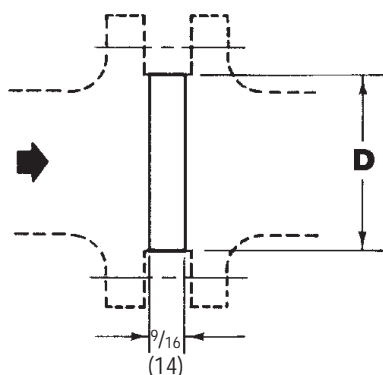
## APPLICATION DATA

- Spence Pressure Regulators or Control Valves where noise reduction is desired

### SIZING INFO



ANSI 125 & 150 FLANGED



ANSI 250, 300 & 600 FLANGED

## DIMENSIONS inches (mm)

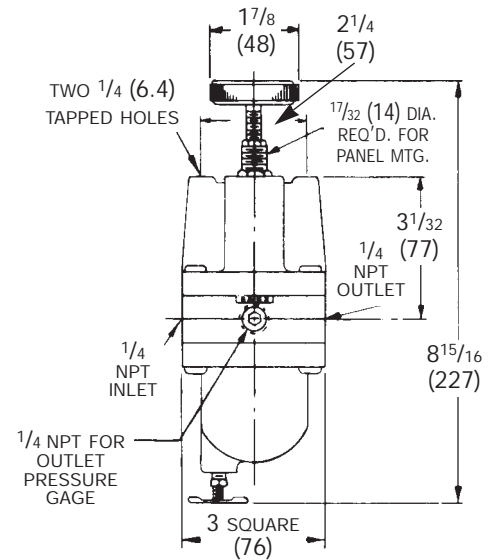
NOMINAL PIPE SIZE	DIMENSION D		
	ANSI 125 150	ANSI 250 300	ANSI 600
2 (50)	6 (152)	4 <sup>3</sup> / <sub>16</sub> (106)	3 <sup>5</sup> / <sub>8</sub> (92)
2 <sup>1</sup> / <sub>2</sub> (65)	7 (178)	4 <sup>15</sup> / <sub>16</sub> (126)	4 <sup>1</sup> / <sub>8</sub> (105)
3 (75)	7 <sup>1</sup> / <sub>2</sub> (190)	5 <sup>11</sup> / <sub>16</sub> (146)	5 (127)
4 (100)	9 (229)	6 <sup>15</sup> / <sub>16</sub> (178)	6 <sup>3</sup> / <sub>16</sub> (156)
5 (125)	10 (254)	8 <sup>5</sup> / <sub>16</sub> (210)	7 <sup>5</sup> / <sub>16</sub> (184)
6 (150)	11 (279)	9 <sup>11</sup> / <sub>16</sub> (247)	8 <sup>1</sup> / <sub>2</sub> (216)
8 (200)	13 <sup>1</sup> / <sub>2</sub> (343)	11 <sup>15</sup> / <sub>16</sub> (305)	10 <sup>5</sup> / <sub>8</sub> (270)
10 (250)	16 (406)	14 <sup>1</sup> / <sub>16</sub> (357)	12 <sup>3</sup> / <sub>4</sub> (324)
12 (300)	19 (483)	16 <sup>7</sup> / <sub>16</sub> (419)	15 (381)
14 (350)	21 (533)	18 <sup>15</sup> / <sub>16</sub> (481)	16 <sup>1</sup> / <sub>4</sub> (413)
16 (400)	23 <sup>1</sup> / <sub>2</sub> (597)	21 <sup>1</sup> / <sub>16</sub> (534)	18 <sup>1</sup> / <sub>2</sub> (470)
18 (450)	25 (635)	23 <sup>5</sup> / <sub>16</sub> (591)	21 (533)

# AIR LOADERS

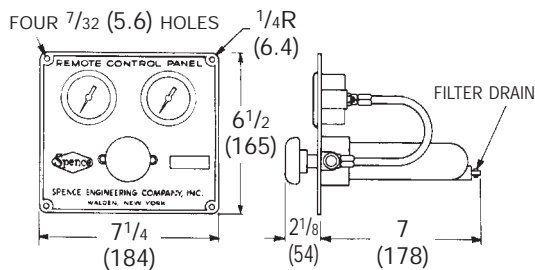
Air Loaders provide a simple, direct, low cost approach to pressure reduction by manually loading a Type E8 Valve with a static air signal. They are particularly suitable for use where poor steam conditions exist. Steam delivery pressure adjustments are made by varying Air Loader output. Air Loaders bleed only on lowering of the pressure set point.

## MODELS

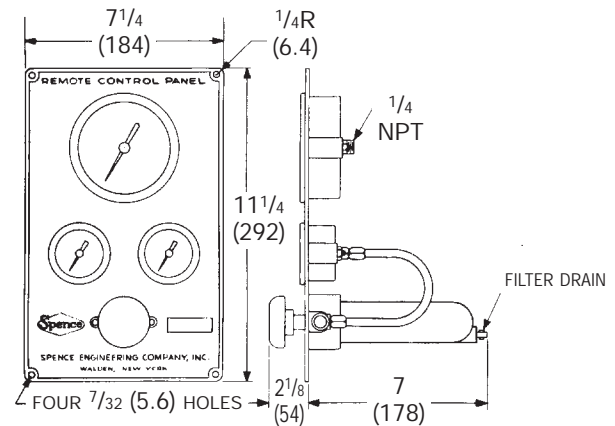
- **STANDARD AIR FILTER REGULATOR** permits a maximum 50 psi delivery pressure. Higher pressures available on request.
- **MODEL A AIR ADJUSTMENT PANEL** includes an air adjusting valve incorporating its own bleed and two gages; one for the supply air, the other to indicate the adjusting air. It comes complete and ready to be mounted directly on a control board or box.
- **MODEL B AIR ADJUSTMENT PANEL** is the same as the Model A with the exception that it has, in addition, a gage indicating the delivery pressure.



**AIR FILTER REGULATOR**



**TYPE A PANEL** cutout 5 1/4 (133) high by 6 (152) wide



**TYPE B PANEL** cutout 10 1/4 (286) high by 6 (152) wide





**TYPE 77SI CAST IRON STRAINER**

# TYPE 77SI CAST IRON STRAINERS

**SIZES 1/4" to 3"**

**PRESSURES to 250 PSIG at 406°F**

- ASTM A-126 Class B Cast Iron Body
- 304 SS ASTM A-276 Screen
- Iron Retainer Cap and Gasket
- Tapped for Closure Plug (not included)

## OPTIONS

- Other perforated screens and mesh liners.

## RATINGS

Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
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### WSP

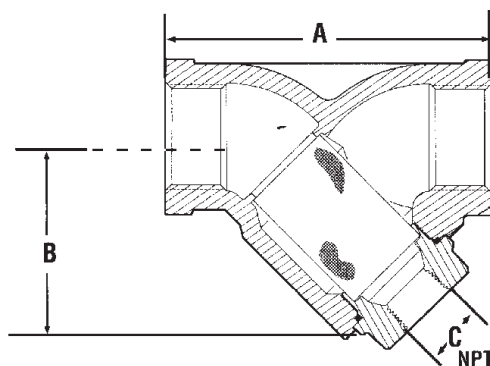
B16.4 Class 250 NPT 250 (17.2) @ 406 (207)

### WOG

B16.4 Class 250 NPT 400 (27.6) @ 100 (38)

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	WT.
1/4 (6)	3 3/16 (81)	2 (50)	1/4 (6)	1.4 (.6)
3/8 (10)	3 3/16 (81)	2 (50)	1/4 (6)	1.4 (.6)
1/2 (13)	3 3/16 (81)	2 (50)	1/4 (6)	1.8 (.8)
3/4 (19)	3 3/4 (95)	2 11/16 (68)	3/8 (10)	2.5 (1.1)
1 (25)	4 (102)	3 (76)	3/8 (10)	4.0 (1.8)
1 1/4 (32)	5 (127)	3 7/16 (87)	3/4 (19)	6.7 (3)
1 1/2 (38)	5 3/4 (146)	3 13/16 (97.3)	3/4 (19)	8.3 (3.8)
2 (50)	7 (178)	4 5/16 (117)	1 (25)	13.5 (6.1)
2 1/2 (64)	9 1/4 (235)	6 1/8 (156)	1 (25)	21.0 (9.5)
3 (76)	10 (254)	7 1/2 (191)	1 1/4 (32)	26.0 (11.8)



## SCREEN OPENINGS

SIZE	STANDARD SCREEN OPENINGS	MATERIALS
1/4" – 2"	20 mesh	Stainless
2 1/2" – 3"	3/64 Perf.	Stainless

# TYPE 77F-D FLANGED CAST IRON STRAINERS

SIZES 2" to 12"

PRESSURES to 250 PSIG at 406°F

- ASTM A-126 Class B Cast Iron Body
- 304 SS ASTM A-276 Screen
- Bolted Iron Retainer Cap and Gasket
- Tapped for Closure Plug (included)

## OPTIONS

- Other perforated screens and mesh liners.

## RATINGS

Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
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### WSP

B16.1 Class 125 Flanged 125 (8.6) @ 353 (178)

B16.1 Class 250 Flanged 250 (17.2) @ 406 (207)

### WOG

B16.1 Class 125 Flanged 200 (13.8) @ 210 (99)

B16.1 Class 250 Flanged 500 (34.5) @ 150 (66)

## SCREEN OPENINGS

SIZE	STANDARD*	MATERIALS
2" – 5"	1/16 Perf.	Stainless
6" – 8"	1/8 Perf.	Stainless
10" – 12"	3/16 Perf.	Stainless
SIZE	STEAM SERVICE	MATERIALS
2" – 10"	3/64 Perf.	Stainless
12"	1/16 Perf.	Stainless

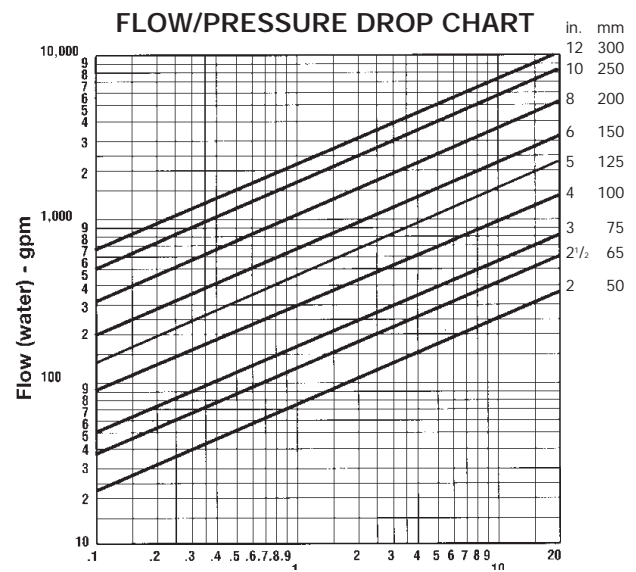
\*For Water, Oil and Gas.

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A		B		C		D		WEIGHT	
	125 lb.	250 lb.	125 lb.	250 lb.	125 lb.	250 lb.	125 lb.	250 lb.	125 lb.	250 lb.
2 (50)	7 <sup>7</sup> / <sub>8</sub> (200)	9 <sup>5</sup> / <sub>16</sub> (244)	5 <sup>1</sup> / <sub>4</sub> (133)	6 (152)	1 <sup>1</sup> / <sub>2</sub> (13)	1 <sup>1</sup> / <sub>2</sub> (13)	7 (178)	7 (178)	18 (8.2)	26 (11.3)
2½ (63)	10 (254)	11 <sup>1</sup> / <sub>16</sub> (281)	6 <sup>1</sup> / <sub>2</sub> (165)	7 <sup>1</sup> / <sub>8</sub> (181)	1 (25)	1 (25)	9 <sup>3</sup> / <sub>4</sub> (248)	9 <sup>3</sup> / <sub>4</sub> (248)	28 (12)	40 (18.2)
3 (76)	10 <sup>7</sup> / <sub>8</sub> (257)	12 <sup>5</sup> / <sub>8</sub> (321)	7 (178)	9 <sup>1</sup> / <sub>8</sub> (232)	1 (23)	1 <sup>1</sup> / <sub>4</sub> (32)	10 (254)	10 (254)	34 (15.4)	59 (26.8)
4 (102)	12 <sup>7</sup> / <sub>8</sub> (308)	15 <sup>5</sup> / <sub>8</sub> (397)	8 <sup>1</sup> / <sub>4</sub> (210)	10 <sup>7</sup> / <sub>8</sub> (276)	1½ (38)	1½ (38)	12 (305)	12 (305)	60 (27.3)	93 (42.3)
5 (127)	15 <sup>5</sup> / <sub>8</sub> (397)	18 <sup>1</sup> / <sub>4</sub> (463)	11 <sup>1</sup> / <sub>4</sub> (210)	12 <sup>15</sup> / <sub>16</sub> (329)	2 (50)	2 (50)	17 (432)	17 (432)	95 (43.7)	146 (66.4)
6 (152)	—	20 <sup>3</sup> / <sub>16</sub> (513)	—	14 <sup>1</sup> / <sub>2</sub> (368)	—	2 (50)	—	20 (508)	—	194 (88.2)
8 (203)	—	25 <sup>5</sup> / <sub>8</sub> (638)	—	16 <sup>7</sup> / <sub>16</sub> (418)	—	2 (50)	—	22 <sup>3</sup> / <sub>4</sub> (578)	—	316 (144)
10 (254)	—	29 <sup>1</sup> / <sub>8</sub> (714)	—	19 <sup>1</sup> / <sub>4</sub> (489)	—	2 (50)	—	28 (711)	—	475 (215)
12 (305)	—	33 <sup>3</sup> / <sub>4</sub> (857)	—	22 <sup>7</sup> / <sub>8</sub> (581)	—	2 (50)	—	30 (762)	—	750 (340)

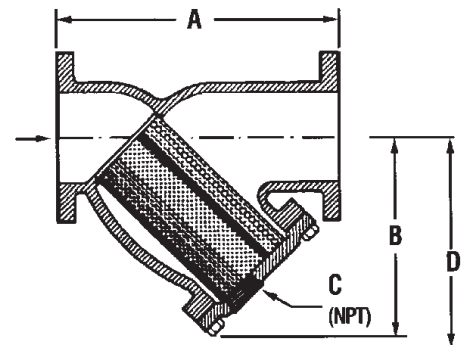


## TYPE 77F-D FLANGED CAST IRON STRAINER



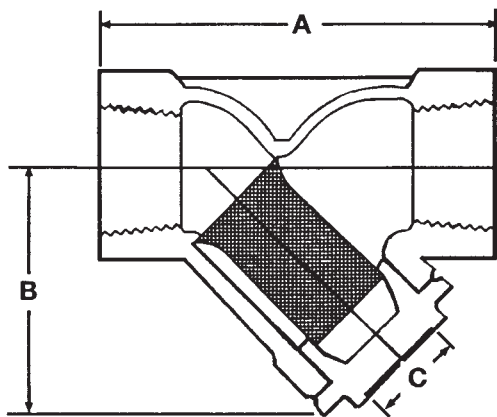
Pressure Drop - psi

\*Conversions: For gpm to lpm, multiply 3.785  
For psi to atmospheres, multiply by .068





TYPE 777SI BRONZE STRAINER



**DIMENSIONS** inches (mm)  
**AND WEIGHTS** pounds (kg)

SIZE	A	B	C	WT.
3/8 (10)	2 3/8 (60)	1 5/16 (33)	1/4 (6)	.4 (.18)
1/2 (13)	2 3/4 (70)	1 3/8 (35)	1/4 (6)	.5 (.23)
3/4 (19)	3 3/16 (81)	1 5/8 (42)	1/4 (6)	.6 (.27)
1 (25)	3 3/4 (95)	2 1/8 (54)	1/2 (13)	1.1 (.50)
1 1/4 (32)	4 7/16 (113)	2 1/2 (64)	1/2 (13)	1.9 (.86)
1 1/2 (38)	4 7/8 (124)	3 (76)	3/4 (19)	2.4 (1.09)
2 (50)	5 15/16 (151)	3 9/16 (91)	1 (25)	4.4 (2.00)
2 1/2 (64)	9 1/16 (230)	5 7/8 (149)	1/2 (13)	9.8 (4.44)
3 (76)	10 3/16 (259)	6 1/4 (159)	1/2 (13)	13.2 (5.99)

# TYPE 777SI BRONZE STRAINERS

SIZES 3/8" – 3"

PRESSURES to 125 PSIG at 353°F

- Bronze ASTM B62 Body
- Machined seat in body and tapered seat in cap for accurate screen alignment
- NPT blow-off connections (plug not provided)
- Standard 20 mesh perforated 304 Stainless Steel Screen
- Special flared screen opening on upstream end provides unrestricted flow
- PTFE Teflon Gasket

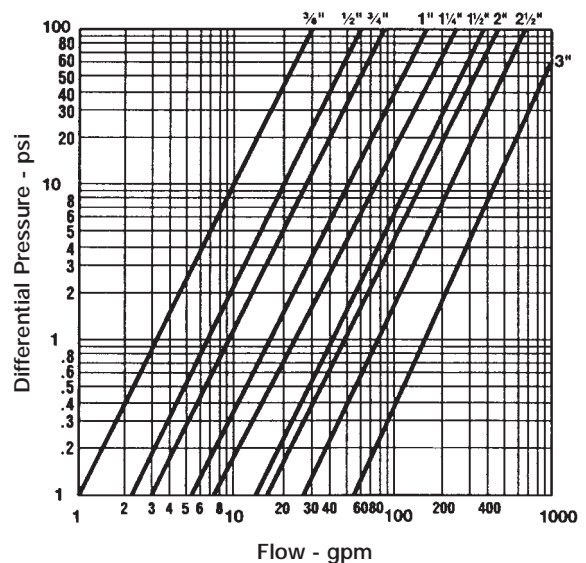
## OPTIONS

- Other perforated screens and mesh liners.

## RATINGS

Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
<b>WSP</b> B16.4 Class 125NPT	125 (8.6)	@ 353 (178)
<b>WOG</b> B16.4 Class 125NPT	400 (27.6)	@ 210 (99)

FLOW/PRESSURE DROP CHART



SCREEN OPENINGS

SIZE	STANDARD SCREEN OPENINGS	MATERIALS
3/8" – 3"	20 mesh	Stainless

# TYPE 88S STAINLESS STEEL STRAINERS

SIZES 1/4" – 2"

PRESSURES to 600 PSIG at 489°F

- Stainless Steel ASTM A-351 Grade CF8M Body
- Built for long service life in corrosive, high pressure and high temperature applications.
- Threaded cap is mated to body with straight threads and sealed off from flow.
- Cap tapped for closure plug (not provided)

## OPTIONS

- Other perforated screens and mesh liners.

## RATINGS

Ends ASME/ANSI	Pressure PSIG (bar)	Temperature °F (°C)
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### WSP

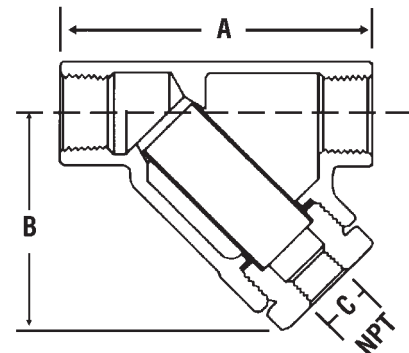
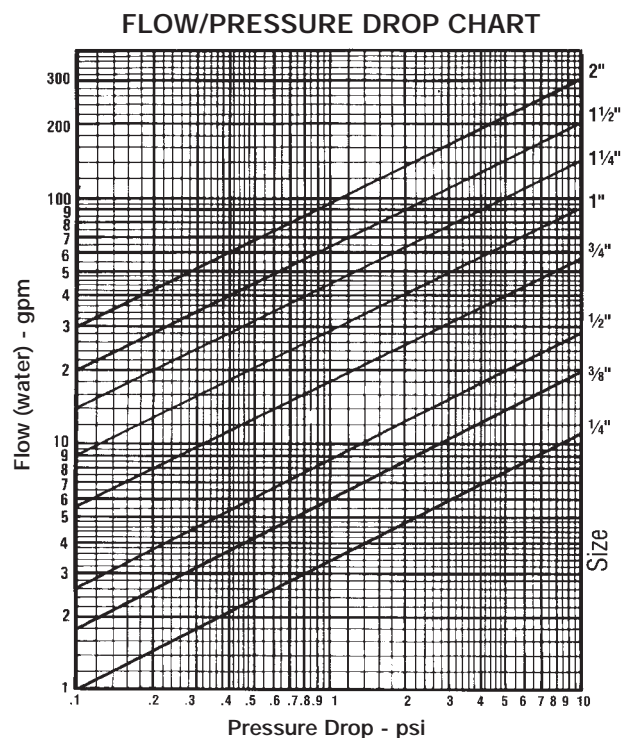
B16.34 Class 600 NPT 600 (41.4) @ 489 (254)

### WOG

B16.34 Class 600 NPT 1440 (99.3) @ 100 (38)



TYPE 88S STAINLESS STEEL STRAINER



**DIMENSIONS** inches (mm),  
**WEIGHTS** pounds (kg) **AND** Cv

Size	Dimensions			Weight	Cv Rating
	A	B	C		
1/4 (6)	3 (76)	2 1/4 (57)	1/4 (6)	1.3 (.6)	3.5
3/8 (10)	3 (76)	2 1/4 (57)	1/4 (6)	1.3 (.6)	6
1/2 (13)	3 13/16 (97)	2 5/8 (67)	1/4 (6)	2.1 (.9)	10.5
3/4 (19)	4 3/8 (136)	3 3/16 (86)	3/8 (10)	3 (1.4)	17
1 (25)	5 3/16 (137)	3 3/4 (95)	1/2 (13)	4.5 (2)	28
1 1/4 (32)	5 5/8 (143)	4 7/8 (124)	3/4 (19)	5.8 (2.6)	45
1 1/2 (38)	6 1/4 (159)	5 (127)	3/4 (19)	7 (3.2)	60
2 (50)	7 1/2 (190)	6 1/8 (156)	1 (25)	10 (4.5)	100

## SCREEN OPENINGS

SIZE	STANDARD SCREEN OPENINGS	MATERIALS
1/4" – 2"	1/16 Perf.	Stainless



**STEAM SCRUBBER FILTER**

# STEAM SCRUBBER STAINLESS STEEL FILTER

**SIZES 1/2" to 3"**

**PRESSURES to 145 PSIG at 353°F**

- 1 and 5 Micron Filters meet or exceed FDA guidelines and comply with 3A
- Electropolished and Passivated 304 Stainless Steel Housing
- Double O-ring EPDM Housing Gasket
- Inline NPT Connections
- Single Clamp Closure
- Sintered 316 Stainless Steel Filter Media
- Porosity Level greater than 50%
- Filter Media in 1, 5 or 25 Micron Absolute Ratings
- Filter Element Endcaps of 304 Stainless Steel
- Renewable Filter Media
- Single Open End Filter Media

## APPLICATION DATA

- Culinary Grade Steam
- Sterilizers
- Autoclaves
- Pharmaceutical & Biotechnology Process Equipment
- Clean Room Humidification
- Chemical Industry
- Electronic Industry
- Plastic Industry

## RATINGS (MAXIMUM INLET CONDITIONS)

Filtered	Pressure PSIG (bar)	Temperature °F (°C)
Air or Gas	145 (10)	353 (178)
Steam	125 (8.6)	353 (178)

## OPTIONS

- 316L Housing
- Silicone, Viton or Buna N Gaskets
- Flange or Welded Ends
- 4" to 8" with ANSI Flanged End

# STEAM SCRUBBER STAINLESS STEEL FILTER SPECIFICATION

Furnish and install as shown on the plans, high efficiency, inline horizontal, filter for air, steam or gas constructed with 304 or 316L stainless steel housing and single, open ended element. Filter shall have an absolute rating of 1, 5 or 25 microns and utilize double o-ring gaskets to reduce potential downstream leakage of unfiltered medium. External surface finish of filter housing shall be no less than 180 grit (25-35 Ra microinch) and joined utilizing a single clamp. Filter media shall be of sintered 316L stainless steel and be regenerable. 1 and 5 micron media shall conform to 3A sanitary standards for production of culinary steam and be USDA accepted. Connections shall be NPT, flanged ANSI 150 or welded.

## MATERIALS OF CONSTRUCTION

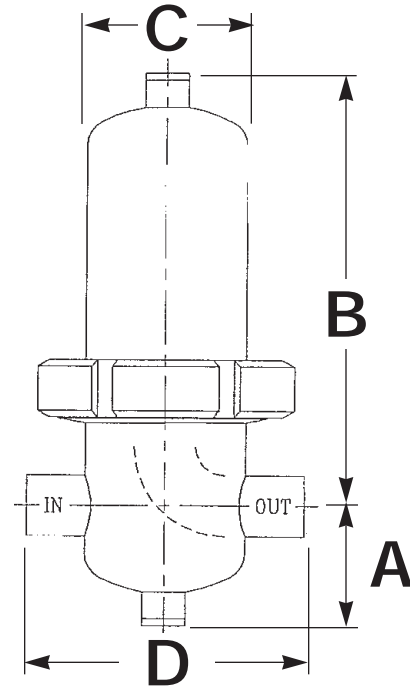
Body, Standard ..... 304 Stainless Steel  
Body, Optional ..... 316L Stainless Steel  
Clamp ..... 304 Stainless Steel  
Plug ..... 304 Stainless Steel  
Gasket, Standard ..... EPDM  
Gasket, Optional ..... Silicone  
Gasket, Optional ..... Viton  
Gasket, Optional ..... Buna N  
Filter Media ..... Sintered 316L Stainless Steel  
Filter End Caps ..... 304 Stainless Steel

## DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

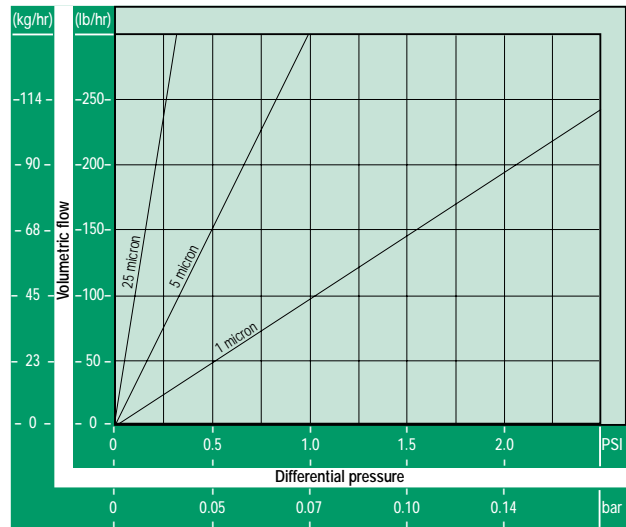
Size in.(mm)	Dimensions, Inches (mm)				Weight lbs (kg)	Conversion Factors (Cs)
	A	B	C	D		
1/2 (13)	2 1/8 (55)	7 3/8 (188)	2 3/4 (70)	4 1/8 (108)	4.2 (1.9)	0.17
3/4 (19)	2 1/8 (55)	8 3/8 (211)	2 3/4 (70)	4 7/8 (125)	4.4 (2.0)	0.25
1 (25)	2 7/8 (74)	8 5/8 (219)	3 3/8 (85)	4 7/8 (125)	5.7 (2.6)	0.39
1 1/4 (32)	2 7/8 (74)	10 5/8 (270)	3 3/8 (85)	5 1/2 (140)	6.6 (3)	0.50
1 1/2 (38)	3 3/4 (94)	11 1/2 (292)	4 1/8 (104)	6 5/8 (170)	10.1 (4.6)	0.67
2L (51)	3 3/4 (94)	14 3/8 (366)	4 1/8 (104)	6 5/8 (170)	10.6 (4.8)	1.00
2 (51)	3 3/4 (94)	19 3/8 (493)	4 1/8 (104)	6 5/8 (170)	11.7 (5.3)	1.50
2 1/2 (64)	4 1/4 (106)	24 5/8 (626)	5 1/8 (129)	8 1/2 (216)	19.8 (9)	2.00
3L (76)	4 1/4 (106)	34 5/8 (881)	5 1/8 (129)	8 1/2 (216)	23.8 (10.8)	2.70
3 (76)	4 5/8 (119)	35 3/4 (907)	6 (154)	9 3/8 (240)	35.6 (16.2)	4.00

L denotes low capacity

Steam Pressure Conversion Factors (Cp)											
Steam Pressure	PSI	0	15	30	45	60	75	90	105	120	135
	bar	0	1	2	3	4	5	6	7	8	9
Conversion factor		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0



## Saturated Steam Capacity — 2"L, 250°F, 15 PSI (Cm)\*



\*For other pressures and sizes, see conversion factors.

## SELECTION EXAMPLE

For optimum service life, the filter should have a 1 psi maximum pressure drop. Select a 5 micron filter for a flow rate of 110 lbs/hr (w) of saturated steam at 45 psi.

$$\text{Where: } Cs = \frac{w}{CmCp}$$

Designing for .75 PSI differential pressure, Cm is 225 from the capacity chart and Cp is 2.0.

$$\text{Therefore: } Cs = \frac{110}{(225)(2.0)} = .24 \text{ so } 3/4" \text{ should be used.}$$



**INSULCAP JACKET**

# INSULCAP JACKET

The Spence Insulcap Removable Insulating Jacket is an easy to install, reusable, one piece, asbestos-free insulating cover designed specifically to fit and be used on Spence [Type E](#) and [Type C Main Valves](#). In addition to providing insulation to limit heat energy losses, using the Insulcap also helps reduce noise transmission. Being a removable and reusable jacket, the Insulcap makes replacement and maintenance costs much less than those associated with rigid insulation. Simple but effective Velcro® fasteners make the Insulcap easy to install.

The Insulcap Jacket surface material is manufactured by a two step process, combining the benefits of impregnation and coating processes. It contains a well-stabilized woven glass reinforcement (result of impregnation) and an extremely durable surface membrane barrier (result of coating) wrapped around 1" thick mechanically bonded long textile glass fibers.

The Insulcap Jacket is available for valve sizes 2" screwed and 2"-6" flanged. Jackets for smaller or larger valves are available upon request. It is lightweight and will withstand temperatures to 550°F.

## OPTIONS

- Stainless Steel Mesh Lining for Temperatures above 550°F
- Lead Lining for extra noise reduction

## MATERIALS OF CONSTRUCTION

Jacketing .....Chemical resistant silicone coated fiberglass  
 Insulation .....Mechanically bound, 11# density fiberglass mat  
 Thread & Seam Closure .....Kevlar

**DIMENSIONS** inches (mm)  
**AND WEIGHTS** pounds (kg)

VALVE SIZE	DIMENSIONS IN INCHES		WEIGHT (lbs.)
	WIDTH	LENGTH	
2 Screwed (51)	14 <sup>1</sup> / <sub>2</sub> (368)	21 (533)	2.6 (1.2)
2 Flanged (51)	17 <sup>1</sup> / <sub>2</sub> (444)	26 <sup>1</sup> / <sub>2</sub> (623)	2.7 (1.2)
2 <sup>1</sup> / <sub>2</sub> (64)	18 <sup>1</sup> / <sub>2</sub> (470)	31 (787)	4.6 (2.1)
3 (76)	19 <sup>1</sup> / <sub>2</sub> (495)	35 (889)	4.65 (2.1)
4 (102)	19 <sup>1</sup> / <sub>2</sub> (495)	37 (940)	6.15 (2.7)
6 (152)	22 <sup>1</sup> / <sub>2</sub> (571)	43 (1092)	8.55 (3.9)

**Heat Energy Savings  
 Payback Period**

Regulator 50 psig	Millions of BTU's Saved Annually	Payback in Days
2" (51 kg)	24.45	157
2.5" (64 kg)	27.51	182
3" (76 kg)	30.57	168
4" (102 kg)	36.68	165
6" (152 kg)	51.96	171



# DEFINITIONS RELATING TO REGULATOR CAPACITY

The capacities contained in this bulletin are based on a specific level of performance by the regulator. The measure of performance is accuracy of regulation, also known as offset or deviation. Each table is appended with a footnote indicating the accuracy of regulation obtainable at the rated capacities listed.

Pertinent terms involved in the determination of accuracy of regulation and rated capacity are defined as follows:

\* **REGULATED VARIABLE** is the controlled condition of the fluid either (1) flowing through a regulator or (2) in a process served by a regulator. Reduced pressure, back pressure and differential pressure are the typical regulated variables to be dealt with in this instance. Other cases, such as vapor pressure produced by a steam-heated vapor generator, will be found.

\* **MINIMUM CONTROLLED FLOW** is the lowest flow at which a steady condition of fluid pressure can be maintained. Any further reduction of flow produces a noticeable deviation of the regulated pressure toward dead-end shut off. For convenience,

minimum controlled flow is often considered as being at 5% of rated capacity.

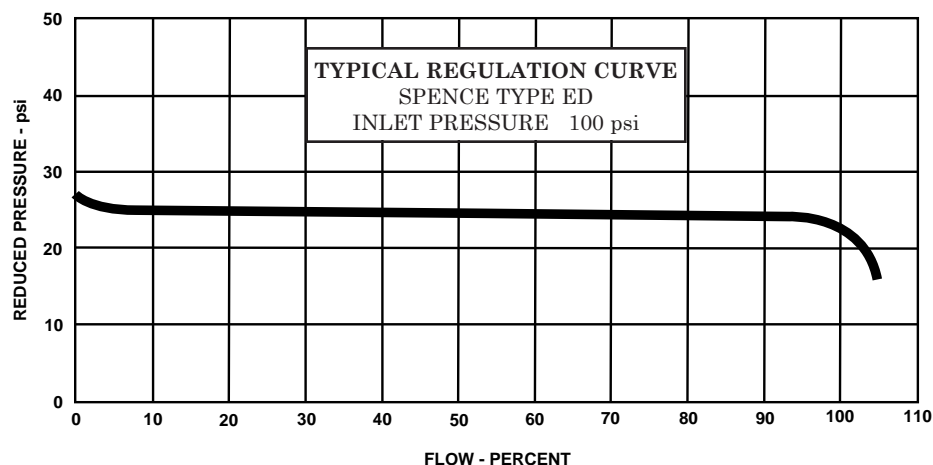
\* **SET POINT** is the value of the regulated pressure at minimum controlled flow.

\* **RATED CAPACITY** of a pressure regulator pertains to specified inlet and outlet conditions and is the rate of flow through the regulator, guaranteed by the manufacturer, when the regulated pressure deviates no more than a specified number of psi from the set pressure at minimum controlled flow.

\* **ACCURACY OF REGULATION** is the amount by which the regulated pressure deviates from set point at minimum controlled flow as the flow through the regulator is gradually increased from minimum to rated capacity.

\* **LOCK-UP** is the increase from set value due to dead end shut-off.

\* Adapted from "Definitions of Regulator Capacities", Standard No. FCI 58-1, published by Fluid Controls Institute, Inc.



## TYPICAL REGULATION CURVE

The performance characteristic of a Spence Pressure Regulator is shown above. Using this curve to illustrate several terms of reference, the following facts are evident:

REGULATED VARIABLE	REDUCED PRESSURE
Minimum Controlled Flow.....	4%
Set Point .....	25.0
Reduced Pressure at Rated (100%) Flow ...	22.5 psi
Accuracy of Regulation, psi .....	2.5 psi
Accuracy of Regulation, % of set pressure .....	10%

The slight slope of the curve establishes a definite relationship between flow and regulated pressure. Note that 1 psi accuracy of regulation is obtainable at 95% of rated flow.

For back pressure regulation, or differential where the regulator opens on increasing differential, the characteristic curve would lie opposite to that shown. It would slope upward with flow increase because a positive deviation is required to cancel valve opening.

## NOTES ON USE OF TABLES

The lowest reduced pressures are approximate critical pressures. No appreciable increase in flow can be obtained at lower pressures.

Downstream pipe size should be enlarged at regulator outlet to approximately equalize pipe velocities before and after the reduction. The Steam Capacity Tables are useful for determining steam pipe sizes and regulator size at any desired lower velocity level.

Reduced Seats—Spence Regulators are available with a choice of seat sizes called Full and Normal Ports. There is a capacity table for each port with standard plugs. The Cv Valve Coefficients shown on the back page, indicate where 75% and 50% parabolic plugs are available. For a given pressure drop, rated flows with various ports and plugs in the same size body may be compared. Thus, valve and port size may be selected to limit velocities entering and leaving the regulator. Lower velocities mean a greater proportion of the pressure drop occurs at the valve seat, where it belongs, rather than in the body outlet and connected piping.

Capacity ratings apply to Spence Regulators with Type D, N and Q Pilots which are spring loaded and have 3½ inch diaphragms. Other pilots having greater or lesser sensitivity will provide proportionally greater or less accuracy of regulation.

# 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. See Bulletin 2500 for more detailed information.
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.

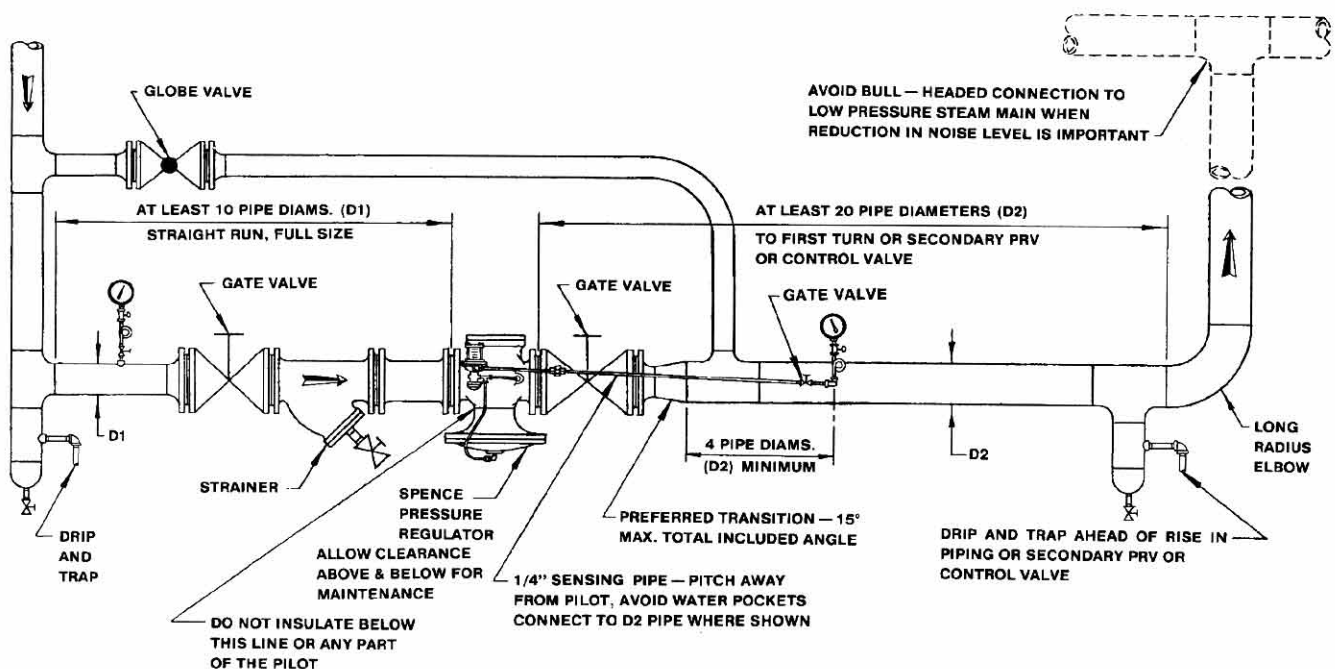


FIG. 1 — RECOMMENDED INSTALLATION OF REGULATOR WITH STRAINER

# RULES FOR MAIN VALVE SELECTION

When you select a Main Valve, your sizing can be based on one of three methods. They are:

## ECONOMICAL MAIN VALVE

Economical Main Valve Selection is choosing a regulator that has the line size and rough capacity to handle the load. No consideration is given to velocities or noise. If you are interested in an economical selection, select a regulator type for your application, then go to the Capacity Tables and select the size that will provide you with the capacity needed.

## ENGINEERED MAIN VALVE

Engineered Main Valve Selection takes into consideration the inlet and outlet velocities of the regulator. It will limit these velocities to acceptable standards. See Pressure Reducing Station Design Guidelines on the following pages for details. If you are interested in an engineered selection, select a regulator

type for your application, and then to the Capacity Tables and select the size that will provide you with the capacity needed. Verify that the velocities fall within the guidelines by consulting the Velocity Charts in this Section.

## ENGINEERED MAIN VALVE WITH NOISE SUPPRESSION

Engineered Main Valve Selection with Noise Suppression considers both velocity and noise suppression in the selection of the regulator. For this selection, it is recommended that you contact your local Spence Technical Sales Representative who can provide you with a computer generated solution.

## SELECTING A REGULATOR TYPE

The following rules should be used to help you to determine the type of regulator that you should use. You should consult the Product Pages, Velocity Tables and Capacity Tables for additional information on your selection.

## RULES FOR MAIN VALVE SELECTION—STEAM SERVICE

Together with the following rules, reference should be made to the Main Valve Specification Table or individual Product Pages for maximum initial pressures and temperatures and “minimum differentials” for the several types of Main Valve. For pressure reduction where fast response time is important, but capacity and accuracy are not critical, select **D50 DIRECT OPERATED REGULATOR**.

### EITHER DEAD-END OR CONTINUOUS FLOW SERVICE

**RULE 1.** For Initial Pressures exceeding 15 psi:

- (a) **TYPE E** – Select when the Delivery Pressure is less than 75% of Initial Pressure.
- (b) **TYPE E5** – Select when the Delivery Pressure is 75% to 96% of Initial Pressure.

**RULE 2.** For Initial Pressures less than 15 psi:

- (a) **TYPE E2** – Select when Initial Pressure is less than 15 psi.

### OPTIONAL FOR CONTINUOUS FLOW SERVICE ONLY

**RULE 3.** For Initial Pressures exceeding 20 psi:

- (a) **TYPE C20** – Select when the Delivery Pressure is less than 75% of Initial Pressure.

## RULES FOR MAIN VALVE SELECTION—AIR SERVICE

Together with the following rules, reference should be made to the Main Valve Specification Table or individual Product Pages for maximum initial pressures and temperatures and “minimum differentials” for the several types of Main Valve. For pressure reduction where fast response time is important, but capacity and accuracy are not critical, select **D50 DIRECT OPERATED REGULATOR**.

### EITHER DEAD-END OR CONTINUOUS FLOW SERVICE

**RULE 1.** For Initial Pressures exceeding 15 psi:

- (a) **TYPE E** – Select when the Delivery Pressure is less than 75% of Initial Pressure.
- (b) **TYPE E6** – Select when the Delivery Pressure is 75% to 93% of Initial Pressure.
- (c) **TYPE E5** – Select when the Delivery Pressure is 93% to 96% of Initial Pressure.

**RULE 2.** For Initial Pressures less than 15 psi:

- (a) **TYPE E2** – Select when Initial Pressure is less than 15 psi.

### OPTIONAL FOR CONTINUOUS FLOW SERVICE ONLY

**RULE 3.** For Initial Pressures exceeding 20 psi:

- (a) **TYPE C20** – Select when the Delivery Pressure is less than 75% of Initial Pressure.

## RULES FOR MAIN VALVE SELECTION—WATER SERVICE

Pilot Operated Regulators are not uniformly successful in liquid pressure reducing service unless the delivery system has unusual cushioning such as afforded by an elevated tank or large air chamber.

### WATER PRESSURE REDUCING VALVES

The **TYPE D34 DIRECT OPERATED VALVE** was developed for application on rapidly changing and intermittent flow to an inflexible system.

**RULE 1.** Select **TYPE D34 DIRECT OPERATED VALVE** for pressure reducing service.

### FOR PILOT OPERATED WATER REGULATORS

When a pilot operated regulator is required the following rules for the selection of a main valve govern:

**RULE 2.** When pressure drop across valve exceeds 10 psi:

- (a) **TYPE C34** -Select for all normal requirements.
- (b) **TYPE E6** with Dashpot-Select where high lift is desired or special flow requirements encountered.

**RULE 3.** When pressure drop across valve is between 5 and 10 psi:

- (a) **TYPE E5** - Select for pressure drops not less than 5 psi.
- (b) **TYPE E6** with Dashpot-Select if auxiliary operation is possible.

### OPTIONAL FOR CONTINUOUS FLOW SERVICE ONLY

**RULE 4.** When pressure drop across valve exceeds 20 psi:

- (a) **TYPE C20** -Select for all normal requirements not demanding dead-end.

Together with the above rules, reference should be made to the Main Valve Specification Table for maximum initial pressures and temperatures and “minimum differentials” for the

# VALVE SIZING BY COMPUTATION

## FORMULA KEY

A = Area of Pipe in (inches) <sup>2</sup>	$\Delta P_s = P_1 - P_v$ when $P_2 > P_v$
$C_v$ = Valve Coefficient	$\Delta P_s = P_1 - (.96 - .28 \sqrt{\frac{P_v}{P_c}}) P_v$ when $P_2 \leq P_v$
EDR = Equivalent Direct Radiation (Sq. Ft.)	q = Liquid Flow Rate, U.S. gpm
F = Pipe Area Factor (see Pipe Factors Table)	Q = Flow Rate, SCFH
ft = Feet	T = Absolute T (T + 460) <sup>°</sup> R
G = Specific Gravity	T <sub>SH</sub> = Steam Superheat (°F) = Total Steam Temp. – Saturated Steam Temp.
$\Delta P$ = Pressure Drop, R – P <sub>2</sub> psi	$\bar{v}$ = Specific Volume Ft <sup>3</sup> /#
P <sub>1</sub> = Inlet Pressure, psia (psi + 14.7)	V = Velocity, FPM
P <sub>2</sub> = Reduced Pressure, psia (psi + 14.7)	W = Steam Flow, #/Hr.
P <sub>C</sub> = Pressure at Thermodynamic Critical Point, psia (water = 3206 psia)	W <sub>s</sub> = Flow, #/Hr. Superheated Steam
P <sub>V</sub> = Vapor Pressure, psia	

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:

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

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

### 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**  $W = \frac{f^2 EDR}{4}$

**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:

- 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.

## Cv DATA

Valve Size	E						E2	E5,E6		C20	C34	D	D34 60%	D50	N6 50%	T3
	Normal 50%	Normal 75%	Normal	Full 50%	Full 75%	Full		Normal	Full							
1/4	—	—	—	—	—	—	—	—	—	—	—	.25	—	—	—	—
3/8	—	—	.65	—	—	1.5	—	—	—	—	—	.32	—	—	—	—
1/2	—	—	1.5	1.4	2.1	2.8	—	—	—	—	—	.32	—	2.2	—	5.3
3/4	—	—	4.8	2.7	4.0	5.4	7.6	5.7	7.6	—	—	—	—	3.3	5.3	7.0
1	—	—	7.5	4.4	6.6	8.8	11.7	10.0	11.7	7.5	5.5	—	3.3	4.9	9.2	8.7
1 1/4	—	—	10.4	7.0	10.6	14.1	18.9	13.4	18.9	14.0	12.5	—	7.5	5.0	14.3	16.0
1 1/2	—	—	14.6	9.9	14.8	19.8	27.4	19.8	27.4	20.0	17.3	—	10.4	10.1	20.8	18.5
2	—	—	17.6	15.5	23.3	31	44	25	43	30	24	—	14.4	10.8	37.5	31
2 1/2	12	18	24	22	33	44	68	35	67	47	36	—	21.6	—	60	—
3	22	33	43	37	56	74	96	59	95	69	53	—	32	—	—	—
4	39	59	78	55	82	109	143	120	159	115	86	—	52	—	—	—
5	58	87	115	85	127	169	202	176	258	186	139	—	84	—	—	—
6	76	114	151	124	186	248	255	228	350	250	196	—	118	—	—	—
8	125	187	249	222	333	444	465	366	665	436	—	—	—	—	—	—
10	189	283	377	353	530	706	748	525	1018	700	—	—	—	—	—	—
12	316	474	631	557	835	1113	1118	952	1611	1083	—	—	—	—	—	—

### 75% AND 50% REDUCED TRIM (Parabolic)

The Parabolic Discs given in the above table are designed to:

- a) Improve performance at minimum flows by improving stability over wide flow ranges.
- b) Provide easy field conversion to obtain a substantial increase or decrease in regulator Cv to meet system load requirements.
- c) Facilitate selection of smaller size safety relief valves.
- d) Size more precisely to the required Cv, thereby eliminating one of the most frequent causes of poor performance.



# SATURATED STEAM FLOW TABLE (LB/HR)

Based on Schedule 40 Pipe

SIZES 3/8" THROUGH 2"

VEL., FPM	45000	45000	45000	45000	45000	45000	45000	45000
PRESS. (PSIG)	REGULATOR or PIPE SIZE (inches)							
	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2
-10	23	43	68	120	195	337	458	755
-5	51	93	148	260	422	730	994	1638
0	73	134	213	373	605	1046	1424	2348
5	97	178	284	498	807	1396	1900	3132
10	120	220	350	613	994	1720	2342	3860
15	142	260	415	728	1179	2041	2778	4579
20	164	301	479	841	1363	2359	3210	5292
25	186	341	543	953	1545	2673	3639	5998
30	208	381	607	1065	1726	2987	4065	6700
40	251	460	732	1285	2083	3605	4906	8087
50	293	538	857	1504	2437	4217	5740	9461
60	336	616	981	1721	2789	4827	6570	10829
70	377	692	1102	1934	3134	5424	7383	12170
80	420	770	1225	2150	3485	6031	8209	13531
90	461	846	1347	2364	3831	6630	9024	14874
100	503	922	1468	2577	4176	7228	9838	16216
125	607	1113	1771	3108	5037	8718	11866	19558
150	710	1302	2072	3636	5893	10198	13881	22879
175	813	1491	2374	4166	6752	11685	15905	26216
200	916	1680	2675	4694	7608	13166	17921	29539
250	1121	2057	3274	5746	9313	16118	21938	36160
300	1336	2452	3902	6848	11099	19209	26145	43094

SIZES 2 1/2" THROUGH 12"

VEL., FPM	30000	30000	30000	30000	30000	30000	24000	24000
PRESS. (PSIG)	REGULATOR or PIPE SIZE (inches)							
	2 1/2	3	4	5	6	8	10	12
-10	718	1109	1910	3002	4335	7507	9466	13437
-5	1558	2405	4142	6509	9399	16276	20524	29134
0	2233	3448	5938	9331	13475	23334	29424	41767
5	2979	4600	7922	12449	17978	31131	39256	55723
10	3671	5669	9762	15341	22154	38362	48374	68666
15	4356	6725	11581	18200	26283	45512	57390	81464
20	5033	7772	13383	21032	30372	52594	66320	94139
25	5705	8809	15170	23839	34426	59613	75171	106703
30	6373	9841	16947	26632	38459	66596	83977	119203
40	7692	11878	20454	32143	46418	80378	101355	143871
50	9000	13896	23929	37605	54305	94036	118578	168318
60	10301	15905	27389	43042	62156	107631	135722	192653
70	11576	17874	30779	48370	69851	120955	152523	216502
80	12870	19873	34221	53779	77662	134481	169579	240713
90	14148	21846	37619	59119	85373	147834	186417	264614
100	15424	23817	41012	64452	93074	161169	203233	288484
125	18603	28725	49465	77735	112256	194385	245117	347938
150	21763	33603	57865	90936	131319	227395	286743	407024
175	24936	38503	66303	104197	150470	260557	328560	466382
200	28097	43384	74708	117405	169544	293586	370208	525501
250	34395	53108	91453	143720	207545	359389	453186	643286
300	40991	63293	108992	171283	247348	428313	540098	766655



# SATURATED STEAM FLOW TABLE (LB/HR)

Based on Schedule 40 Pipe

## SIZES 3/8" THROUGH 4"

VEL., FPM	15000	15000	15000	15000	15000	15000	15000	10000	10000	10000
PRESS. (PSIG)	REGULATOR or PIPE SIZE (inches)									
	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
-10	14	23	40	65	112	153	252	239	370	637
-5	31	49	87	141	243	331	546	519	802	1381
0	45	71	124	202	349	475	783	744	1149	1979
5	59	95	166	269	465	633	1044	993	1533	2641
10	73	117	204	331	573	781	1287	1224	1890	3254
15	87	138	243	393	680	926	1526	1452	2242	3860
20	100	160	280	454	786	1070	1764	1678	2591	4461
25	114	181	318	515	891	1213	1999	1902	2936	5057
30	127	202	355	575	996	1355	2233	2124	3280	5649
40	153	244	428	694	1202	1635	2696	2564	3959	6818
50	179	286	501	812	1406	1913	3154	3000	4632	7976
60	205	327	574	930	1609	2190	3610	3434	5302	9130
70	231	367	645	1045	1808	2461	4057	3859	5958	10260
80	257	408	717	1162	2010	2736	4510	4290	6624	11407
90	282	449	788	1277	2210	3008	4958	4716	7282	12540
100	307	489	859	1392	2409	3279	5405	5141	7939	13671
125	371	590	1036	1679	2906	3955	6519	6201	9575	16488
150	434	691	1212	1964	3399	4627	7626	7254	11201	19288
175	497	791	1389	2251	3895	5302	8739	8312	12834	22101
200	560	892	1565	2536	4389	5974	9846	9366	14461	24903
250	686	1091	1915	3104	5373	7313	12053	11465	17703	30484
300	817	1301	2283	3700	6403	8715	14365	13664	21098	36331
400	1065	1696	2976	4823	8347	11361	18725	17812	27502	47360
500	1326	2110	3703	6002	10387	14138	23303	22166	34225	58936
600	1591	2532	4444	7202	12464	16965	27963	26599	41070	70724

## SIZES 5" THROUGH 24"

VEL., FPM	10000	10000	10000	8000	8000	8000	8000	8000	8000	8000
PRESS. (PSIG)	REGULATOR or PIPE SIZE (inches)									
	5	6	8	10	12	14	16	18	20	24
-10	1001	1445	2502	3155	4479	5413	7071	8951	11122	16087
-5	2170	3133	5425	6841	9711	11737	15332	19407	24115	34878
0	3110	4492	7778	9808	13922	16826	21980	27822	34572	50002
5	4150	5993	10377	13085	18574	22448	29325	37119	46124	66710
10	5114	7385	12787	16125	22889	27662	36136	45740	56836	82204
15	6067	8761	15171	19130	27155	32818	42871	54265	67430	97526
20	7011	10124	17531	22107	31380	37924	49542	62708	77921	112700
25	7946	11475	19871	25057	35568	42986	56153	71078	88321	127741
30	8877	12820	22199	27992	39734	48021	62731	79404	98667	142706
40	10714	15473	26793	33785	47957	57959	75713	95836	119086	172238
50	12535	18102	31345	39526	56106	67808	88579	112121	139321	201505
60	14347	20719	35877	45241	64218	77611	101385	128331	159464	230638
70	16123	23284	40318	50841	72167	87219	113936	144217	179204	259189
80	17926	25887	44827	56526	80238	96972	126677	160345	199244	288174
90	19706	28458	49278	62139	88205	106601	139255	176265	219027	316787
100	21484	31025	53723	67744	96161	116217	151817	192166	238785	345363
125	25912	37419	64795	81706	115979	140168	183105	231770	287997	416540
150	30312	43773	75798	95581	135675	163972	214199	271128	336904	487276
175	34732	50157	86852	109520	155461	187884	245437	310668	386036	558337
200	39135	56151	97862	123403	175167	211700	276549	350048	434970	629112
250	47907	69182	119796	151062	214429	259150	338534	428507	532463	770120
300	57094	82449	142771	180033	255552	308850	404358	510687	634579	917814
400	74426	107479	186112	234685	333130	402609	525936	665717	827219	1196436
500	92620	133751	231607	292053	414562	501024	654498	828448	1029428	1488898
600	111143	160501	277928	350464	497474	601229	785398	994137	1235314	1786677

# SELECTING PRESSURE PILOTS

Any of the Main Valves described in the Main Valve Section can be combined with any of the Pilots listed below to produce the SPENCE Pressure Regulator. This Regulator will reduce and regulate a steady or varying initial pressure, within the range

specified, so as to maintain a constant, adjustable, predetermined delivery pressure. The table below lists the principal Pressure Pilots.

## PRESSURE REGULATOR PILOTS

Type	Service Conditions								Normal Accuracy ±	Diaphragm		Loading	Main Valve
	Cast Iron		Cast Bronze <sup>a</sup>		Cast Steel		Delivery Pressure			Diameter inches	Material		
	Maximum Initial Pressure psi	Maximum Temper-ature °F	Maximum Initial Pressure psi	Maximum Temper-ature °F	Maximum Initial Pressure psi	Maximum Temper-ature °F	Minimum psi	Maximum psi					
D	250	450	300	500	600	750	3	150	1 psi	3½	St. Stl.	Spring	E or C Series
D2	250	450	300	500	600	750	100	300	2 psi	3½	St. Stl.	Spring	E or C Series
D5	250	450	300	500	—	—	1	25	½ psi	5¾	St. Stl.	Spring	E or C Series
D120	250	450	300	500	600	750	5	150	1 psi	4½	St. Stl.	Spring	E or C Series
A73	250	450	300	500	600	750	See response curves on		½ psi	3½-7¼ <sup>b</sup>	St. Stl.	Air	E or C Series
A53	250	450	300	500	600	750			½ psi	3½-5¾ <sup>b</sup>	St. Stl.	Air	E or C Series
A	250	450	300	500	600	750			½ psi	3½	St. Stl.	Air	E or C Series
A35	250	450	300	500	—	—	A Pilot		⅛ psi	5¾-3½ <sup>b</sup>	St. Stl.	Air	E or C Series
A85	250	450	300	500	600	750			½ psi	3½-5¾ <sup>b</sup>	St. Stl.	Air	E or C Series
A84	250	450	300	500	600	750			½ psi	3½	St. Stl.	Air	E or C Series
A83	250	450	300	500	600	750	Product Page		½ psi	3½	St. Stl.	Air	E or C Series
A82	250	450	300	500	—	—			⅛ psi	5¾	St. Stl.	Air	E or C Series
A80	250	450	300	500	—	—			⅛ psi	5¾	St. Stl.	Air	E or C Series
Safety Pilot	—	—	300	500	600	750	5	175	—	3½	St. Stl.	Spring	E or C Series

<sup>a</sup>Bronze Body Pilots are recommended for water service.

<sup>b</sup>These Pilots have dual diaphragms, the first size being the control diaphragm and the second, the air loading diaphragm.

### NOTES ON SELECTION OF PILOTS

**D SERIES PILOTS** meet the requirements of the majority of all pressure regulator problems. They are spring-loaded. Other Pilots are modifications of the D Series for specific purposes.

**A SERIES PILOTS** are air-loaded. These Pilots are recommended where frequent changes in setting must be made and the Regulator is not easily accessible.

In any one Series of Pilots a larger Diaphragm will produce closer accuracy of control but with less range in delivery pressure.

Water Service Pilot operated Regulators are not uniformly satisfactory as water reducing valves unless the delivery system has the ample cushioning afforded by an elevated tank or air chamber. When the flow is intermittent to an inflexible system, the SPENCE Type D34 Direct Operated Pressure Reducing Valve is recommended.

# SIZING PRESSURE REGULATORS

## DATA REQUIRED FOR ORDERING

1. **SERVICE** Fluid flowing through Regulator.
2. **INITIAL (INLET) PRESSURE**
  - (a) Maximum/Minimum.
  - (b) Superheat, Gravity, etc.
    - (1) Steam Service—Total Temperature or Degrees Superheat, if any.
    - (2) Air, Gases, Water and Liquids—Temperature and Specific Gravity.
3. **DELIVERY (OUTLET) PRESSURE** Maximum/Minimum.
4. **CAPACITY** Maximum required flow through Regulator.
5. **END CONNECTIONS** Screwed or Flanged. (If flanged, state drilling.)

## SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A. TYPE</b> —See Selection Criteria for Steam, Air, Gases or Water and Liquids in beginning of this Section.	See Selection Criteria and Selection Charts opposite.
<b>B. SIZE</b> —See applicable Valve Capacity Tables in this Section.	
<b>C. MATERIAL</b> — See Main Valve Selection Chart in Technical Reference Section or individual Product Pages.	See Pilot Selection Chart opposite or individual Product Pages.
<b>D. ACCESSORIES</b> —See Accessories in Other Products Section.	

## EXAMPLE

Select size and type Regulator to pass 14,600 lb. steam per hour reducing from 175/150 psi saturated to 40/20 psi. Ends to be flanged, pilot spring loaded and pressure controlled within 2 psi.

1. Steam
2.
  - (a) 175/150 psi
  - (b) None (saturated, 378°F total temperature)
3. 40/20 psi
4. 14,600 lb. per hour
5. Flanged, if 2½" size or larger

## SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A.</b> Since maximum Delivery Pressure is less than 75% of minimum Initial Pressure and the least pressure drop exceeds required "minimal differential". <b>SELECT TYPE E</b>	Since maximum Initial Pressure 175 psi, Total Temperature 378°F maximum Delivery Pressure 40 psi, Pilot spring loaded and required accuracy 2 psi: <b>SELECT TYPE D</b>
<b>B.</b> For 14,600 lb. per hour and 150 psi minimum Initial Pressure Economical: <b>SELECT 3" FULL PORT</b> Engineered: <b>SELECT 4" NORMAL PORT</b>	
<b>C.</b> For 175 psi, 378°F: <b>SELECT CAST IRON, FLANGED 250 LB.</b>	For 175 psi, 378°F: <b>SELECT CAST IRON</b>
<b>D.</b> None required in this case.	None required in this case.

**ECONOMICAL SOLUTION: 3" FULL PORT SPENCE TYPE ED, CAST IRON BODY, 250 LB. FLANGED ENDS**  
**ENGINEERED SOLUTION: 4" NORMAL PORT SPENCE TYPE ED, CAST IRON BODY, 250 LB. FLANGED ENDS.**

NOTE: Pressure Regulators should always be protected by properly designed Strainers.

# SELECTING TEMPERATURE PILOTS

Any of the Main Valves described in the Main Valve Section can be combined with any of the Pilots listed below, to produce the SPENCE Temperature Regulator. This Regulator is designed to control the flow of fluid to a heating or cooling element so as to maintain a constant, adjustable, predetermined temperature. The table below lists the principal Temperature Pilots.

The Thermostats of these SPENCE Pilots are of the Vapor Tension Type. They are ruggedly constructed and will not be injured by overheating.

These SPENCE Temperature Pilots can be furnished with 150°F range of temperature adjustment on special order. It should be noted that since heavier Adjusting Springs are required for this greater range the regulation will not be quite so accurate.

## TEMPERATURE RANGES

20°F to 120°F	150°F to 300°F	Thermostats can be furnished for temperatures higher than 350°F on special order.
50°F to 150°F	170°F to 270°F	
70°F to 170°F	250°F to 350°F	
120°F to 220°F		

## TEMPERATURE REGULATOR PILOTS

Type	Service Conditions							Operating Characteristics	Main Valve
	Cast Iron		Cast Bronze <sup>a</sup>		Cast Steel		Delivery Pressure		
	Maximum Initial Pressure psi	Maximum Temperature °F	Maximum Initial Pressure psi	Maximum Temperature °F	Maximum Initial Pressure psi	Maximum Temperature °F			
							Maximum psi		
T134	250	450	300	500	600	750	20	Closes on rise in temperature—controls delivery pressure—decreases delivery pressure as temperature increases and vice versa—spring loaded pressure control.	E or C Series
T124	250	450	300	500	—	—	125		
T14	250	450	300	500	600	750	—	Closes on rise in temperature.	E or C Series
T14D	250	450	300	500	600	750	150	Closes on rise in temperature—controls delivery pressure at predetermined setting—spring loaded pressure control	E or C Series
T14D2	250	450	300	500	600	750	300		
T52	250	450	300	500	—	—	—	Opens on rise in temperature.	E or C Series
Safety Pilot	—	—	300	500	—	—	—	Prevents excessive temperature rise.	E or C Series

<sup>a</sup>Bronze Body Pilots are recommended for water service.

## AIR CONTROLLED TEMPERATURE PILOTS

SPENCE Air Control Pilots, listed below, have been developed to meet special conditions when used in conjunction with A Series Pressure Pilots. The fast bi-metal thermostats have a 200°F adjustable range and protection against damage from

over-heating. By cascading an air signal onto a pressure regulator, the EAT Series temperature control reduces steam pressure to an adjustable limit as well as regulating output temperature.

Type	Bulb Style	Bulb Material	Bulb Mounting	Range °F	Maximum Bulb Temperature °F	Control Mode	Action
T61	No. 736	Bronze	½ NPT	50-250	350	Proportional	Reverse*
	No. 737	St. Stl. <sup>1</sup>	½ NPT	50-250	350	Proportional	Reverse*
T64	No. 738	St. Stl. <sup>1</sup>	Sanitary Thermometer Bushing	50-250	350	Proportional	Reverse*
T60	No. 745	St. Stl. <sup>2</sup>	½ NPT Union Mounted	30-150 100-300***	180 350	Proportional Proportional	Reverse* Reverse*

\* Rising output pressure on falling temperature. This action applied to an EA Series Regulator increases steam flow with decreasing temperature. Direct action available for cooling control.

\*\*Rate or reset available on application

\*\*\*Other ranges on application

<sup>1</sup>Type 304

<sup>2</sup>Type 347 or optional Type 316

## NOTES ON SELECTION OF PILOTS

**HEATING CONTROL** Single Pilot Types T134 and Combination Pilot Type T14D2 reduce the steam pressure as well as regulate the output temperature. A choice should be made according to the maximum required delivery pressure, i.e., the pressure needed in the heater to carry the peak load. Pilot Types T14D and T14D2 in cast steel are designed for initial steam pressures in excess of 500°F.

Of the Air Control Pilots, the Type T61 is the general choice. The Type T60 is used for temperature indication or for remote adjustment. The required heater pressure will determine the choice of the A Series Pilot. See Product Pages.

**COOLING CONTROL** Pilot Type T52 is employed With Type E or C Series Main Valves to control temperature by regulating the flow of a cooling medium. This Pilot opens the Main Valve on rising temperature and exercises no control over the delivery pressure. The Air Control Pilots can be furnished with increasing air signal on temperature rise for use in cooling control.

**TEMPERATURE RANGES** Selection of the following ranges of temperature adjustment is recommended for the services noted:

50°F to 150°F	Room or air duct control
120°F to 220°F	Domestic or laundry hot water service.
70°F to 170°F	Fuel oil preheating.
170°F to 270°F	Fuel oil heating.

# SIZING TEMPERATURE REGULATORS

## DATA REQUIRED FOR ORDERING

### 1. SERVICE

- (a) Fluid flowing through Regulator.
- (b) Type heater to be controlled.

### 2. INITIAL (INLET) PRESSURE

- (a) Maximum/Minimum.
- (b) Superheat, Gravity, etc.
  - (1) Steam Service—Total Temperature or Degrees Superheat, if any.
  - (2) Air, Gases, Water and Liquids—Temperature and Specific Gravity.

### 3. DELIVERY (OUTLET) PRESSURE

Maximum required on heater.

### 4. CAPACITY

Maximum required flow through Regulator or the following data leading to same:

- (a) Quantity and type of fluid to be heated or cooled.
- (b) Temperature rise or drop, °F.

### 5. THERMOSTAT CHARACTERISTICS:

- (a) Controlled Temperature, °F—Maximum/Minimum.
- (b) Operation—Open or Close on temperature rise.
- (c) Thermostat Bulb—Style Number and Material.
- (d) Flexible Tubing—Length and Material.

### 6. END CONNECTIONS

Screwed or Flanged. (If flanged, state drilling)

## EXAMPLE

Select size and type Regulator for heating 120 gpm water from 50°F entering temperature to 170°F final temperature in an instantaneous heater. Steam supply at 125 psi pressure to be reduced to 30 psi maximum in heater.

1. (a) Steam
  - (b) Instantaneous
2. (a) 125 psi
  - (b) None (saturated, 353°F total temperature)
3. 30 psi
4. See Capacity Tables in this Section.
  - (a) 120 gpm water.
  - (b)  $170 - 50 = 120^\circ\text{F}$  Rise
 
$$\frac{120}{2} \times 120 = 7200\text{#/Hr.}$$
5. (a) 170°F—Select standard Temperature Range from facing page to include this final temperature.
  - (b) Close on temperature rise.
  - (c) Style No. 700 bronze. (See Options Section)
  - (d) Ten (10) feet, brass—furnished unless otherwise specified.
6. Flanged, if 2½" size or larger.

## SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A. TYPE</b> —See Selection Criteria for Steam, Air, Gases or Water and Liquids in beginning of this Section.	See Selection Criteria and Selection Charts opposite.
<b>B. SIZE</b> —See applicable Valve Capacity Tables in this Section.	
<b>C. MATERIAL</b> — See Main Valve Selection Chart in Technical Reference Section or individual Product Pages.	See Pilot Selection Chart opposite or individual Product Pages.
<b>D. ACCESSORIES</b> —See Accessories in Other Products Section.	

## SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A.</b> Since maximum Delivery Pressure is less than 75% of minimum Initial Pressure and the least pressure drop exceeds required "minimal differential". <b>SELECT TYPE E</b>	Since maximum Initial Pressure 125 psi, Total Temperature 353°F maximum Delivery Pressure 30 psi <b>SELECT TYPE T124</b>
<b>B.</b> Using Capacity Tables in this Section, for 7200#/Hr and 125 psi initial pressure <b>SELECT 2" FULL PORT</b>	
<b>C.</b> For 125 psi, 353°F: <b>SELECT CAST IRON, NPT 250</b>	For 125 psi, 353°F: <b>SELECT CAST IRON</b>
<b>D.</b> None required in this case.	None required in this case.

**ECONOMICAL SOLUTION: 3" SPENCE TYPE ET124, CAST IRON BODY, NPT 250 ENDS  
TEMPERATURE RANGE 120-220°F EQUIPPED WITH 10 FEET OF BRASS FLEXIBLE TUBING  
AND STYLE NO. 700 BRONZE THERMOSTAT BULB.**

Temperature Regulators should always be protected by properly designed Strainers.

# SELECTING DIFFERENTIAL PRESSURE PILOTS

SPENCE Differential Pressure Regulators may usually be classified in one or the other of the following groups:

1. Control of the delivery pressure at a constant, adjustable, pre-determined differential above another source of fluid pressure. This case is illustrated by the use of the SPENCE Type EN Differential Pressure Regulator on a boiler feedwater make-up line to control the delivery pressure of the feedwater at a constant differential above the boiler steam pressure. Another example is the use of the Type EN to control the steam pres-

sure on a steam atomizing oil burner at a constant differential above the oil pressure at the nozzle.

2. Control of the differential pressure or pressure drop across the Pressure Regulator itself. This case is illustrated by the use of the SPENCE Type EN24 Differential Pressure Regulator installed in parallel with a heat exchanger to maintain a constant differential across it, thereby limiting the flow rate of fluid through the heater.

The table below lists the principal Differential Pilots.

## DIFFERENTIAL PRESSURE REGULATOR PILOTS

Type	Service Conditions											Normal Accuracy	Diaphragm		Loading	Operating Characteristics	Main Valve
	Cast Iron			Cast Bronze <sup>a</sup>			Cast Steel			Differential Pressure			Diameter inches	Material			
	Max. Initial Pressure psi	Max. Temperature °F	Max. Diaph. Pressure psi	Max. Initial Pressure psi	Max. Temperature °F	Max. Diaph. Pressure psi	Max. Initial Pressure psi	Max. Temperature °F	Max. Diaph. Pressure psi	Min. psi	Max. psi						
N	250	450	240	300	500	290	600	750	300	3	150	1 psi	3½	St. Stl.	Spring	Closes on increase in differential Delivery pressure controlled at set differential above loading pressure Loading Pressure may be any fluid	E or C Series
N33	250	450	240	300	500	290	600	750	300	3	150	1 psi	3½	St. Stl.	Spring		E or C Series
N20	250	366	250	300	366	300	300	366	300	3	150	1 psi	31/2	St. Stl.	Spring	Opens on increase in differential Initial pressure controlled at set differential above loading pressure Loading pressure may be any fluid	E or C Series

<sup>a</sup>Bronze Body Pilots are recommended for water service.

### NOTES ON SELECTION OF PILOTS

**TYPE N AND N33 PILOTS** require that the delivery pressure (pressure of fluid discharged from the Regulator) be controlled at a given differential above some separate source of loading pressure.

**TYPE N** meets the requirements of most boiler feedwater make-up and steam atomizing oil burner differential control problems as described in the first group in the above table.

**TYPE N33** is a version of the Type N in which two separated diaphragms are employed to preclude the possibility of contact between the two fluids applied to the pilot.

**TYPE N20** is a differential relief pilot which causes the Main Valve to open when its initial pressure exceeds the loading pressure by a set differential.

# SIZING DIFFERENTIAL PRESSURE REGULATORS

## DATA REQUIRED FOR ORDERING

1. **SERVICE** Fluid flowing through Regulator.
2. **INITIAL (INLET) PRESSURE**
  - (a) Maximum/Minimum.
  - (b) Superheat, Gravity, etc.
    - (1) Steam Service—Total Temperature or Degrees Superheat, if any.
    - (2) Air, Gases, Water and Liquids—Temperature and Specific Gravity.
3. **LOADING PRESSURE**
  - (a) Maximum/Minimum.
  - (b) Fluid
4. **CONTROLLED PRESSURE**
  - (a) Maximum/Minimum.
  - (b) Fluid
5. **DELIVERY PRESSURE** Maximum/Minimum.
6. **CAPACITY** Maximum required flow through Regulator.
7. **END CONNECTIONS** Screwed or Flanged. (If flanged, state drilling.)

## EXAMPLE

Select size and type Regulator to control the flow of water from a Motor-Driven Centrifugal Boiler Feed Pump maintaining an Excess or Differential pressure of 50 psi between the boiler feedwater and the boiler steam pressure. The feedwater temperature is 240°F. The boiler steam pressure is 150 psi. Flow 90 gpm at 220 psi pump discharge pressure.

1. Water
2. (a) 220 psi  
(b) 240°F
3. (a) 150 psi Boiler Pressure  
(b) Steam
4. (a) 200 psi (Loading plus Excess Pressure)  
(b) Water
5. Identical with Controlled Pressure, Item 4
6. 90 gpm
7. Flanged, if 2½" size or larger

## SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A. TYPE</b> —See Selection Criteria for Steam, Air, Gases or Water and Liquids in beginning of this Section.	See Selection Criteria and Selection Charts opposite.
<b>B. SIZE</b> —See applicable Valve Capacity Tables in this Section.	
<b>C. MATERIAL</b> —See Main Valve Selection Chart in Technical Reference Section or individual Product Pages.	See Pilot Selection Chart opposite or individual Product Pages.
<b>D. ACCESSORIES</b> —See Accessories in Other Products Section.	

## SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A.</b> Since pressure drop across valve (Initial Pressure minus Delivery Pressure) is greater than 10 psi: <b>SELECT TYPE E</b>	Since Initial Pressure 220 psi, 240°F, Differential (Excess) Pressure 50 psi and the Delivery and Controlled Pressures are the same: <b>SELECT TYPE N</b>
<b>B.</b> For 90 gpm: <b>SELECT 3"</b>	
<b>C.</b> For 220 psi, 240°F: <b>SELECT CAST IRON, FLANGED 250 LB.</b>	For 220 psi, 240°F: <b>SELECT BRONZE</b>
<b>D.</b> For Water Service: Dashpot required.	None required in this case.

**ANSWER: 3" SPENCE TYPE EN, CAST IRON BODY, 250 LB FLANGED ENDS, EQUIPPED WITH BRONZE DASHPOT AND BRONZE PILOT BODY.**

NOTE: Differential Regulators should always be protected by properly designed Strainers.

## WATER CAPACITY TABLE—FLOW IN GALLONS PER MINUTE

These flow rates provide a simple method for sizing regulators or water pipes with inlet velocities in the range of 240 to 600 fpm. Spence Regulators have variable seat sizes. The factory will select the proper seat for particular flow and pressure drop. Additional capacity data is available on request.

VALVE OR PIPE SIZE															
¼	⅜	½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
Velocity, fpm															
247	251	255	262	270	277	285	300	315	330	360	390	420	480	540	600
1.3	2.5	4.0	7.3	12	22	30	52	78	127	238	405	630	1250	2210	3490



# SELECTING PUMP GOVERNOR PILOTS

SPENCE Pump Governors are classified in four groups as follows:

1. Constant Pressure Pump Governor which is illustrated by the SPENCE Type EP14 Pump Governor. This Regulator governs the steam supply to a pump, either reciprocating or turbine-driven, and maintains a constant, adjustable pump discharge pressure.
2. Excess Pressure Pump Governor which is illustrated by the SPENCE Type EN Differential Pressure Regulator. Although this Regulator is not a Pump Governor, it is recommended to govern the steam supply to boiler feed pump where it is desired to maintain the pump discharge pressure at a constant, adjustable differential pressure in excess of the boiler steam pressure.

3. Vacuum Pump Governor which is illustrated by the SPENCE Type EF46 Pump Governor. This Regulator governs the steam supply to a vacuum pump and maintains a constant, adjustable vacuum on the pump suction.
4. Differential Control for electric motor-driven centrifugal pumps which is illustrated by the SPENCE Type EN Differential Pressure Regulator. Although this Regulator is not a Pump Governor, it is recommended to maintain a constant, adjustable differential between the feedwater pressure and the boiler steam pressure; i.e., a constant pressure drop across the feedwater regulator.

The table below lists the principal Pump Governor Pilots.

## PUMP GOVERNOR PILOTS

Type	Service Conditions								Diaphragm		Main Valve	Type of Control
	Cast Iron		Cast Bronze <sup>a</sup>		Cast Steel		Pump Discharge Pressure					
	Maximum Initial Pressure psi	Maximum Temper- ature °F	Maximum Initial Pressure psi	Maximum Temper- ature °F	Maximum Initial Pressure psi	Maximum Temper- ature °F	Minimum psi	Maximum psi	Diameter inches	Material		
P13	250	450	300	500	600	750	100	300	3½	St. Stl.	E or C Series	Constant Pressure
P14	250	450	300	500	600	750	5	150	4½	St. Stl.	E or C Series	Constant Pressure
P15	250	450	300	500	600	750	3	25	5¾	St. Stl.	E or C Series	Constant Pressure
P32	250	450	300	500	600	750	200	2000	7/8 Piston	St. Stl.	E or C Series	Constant Pressure
F46	250	450	300	500	600	750	0	30" Hg vac	4½	St. Stl.	E or C Series	Vacuum
N	250	450	300	500	600	500	3 <sup>b</sup>	300 <sup>b</sup>	3½	St. Stl.	E or C Series	Differential <sup>c</sup>

<sup>a</sup>Bronze Body Pilots are recommended for water service.

<sup>b</sup>Regulator discharge pressure

<sup>c</sup>For electric motor driven centrifugal pump applications only, differential pressure range 3 to 150 psi

## NOTES ON SELECTION OF PILOTS

**P SERIES PILOTS** are used for constant pressure control. In this Series a larger Diaphragm will produce closer accuracy of control but with less range in pump discharge pressure.

**TYPE F46** is a vacuum pump governor Pilot.

**TYPE N** is a differential pressure Pilot which is applied to the discharge of a constant speed centrifugal pump to effect excess pressure control. The design of the Pilot requires that the delivery pressure (pressure of fluid discharged from Regulator) be controlled at a given differential above some separate

source of loading pressure. In typical service, boiler feedwater flows through the Regulator and is delivered at constant excess pressure above the boiler steam pressure.

**TYPE N4** has the same action as the Type N but is so designed that the higher water pressure will be kept separate from the steam passing through the valve to the pump. It finds its chief application as a differential feed pump governor. Its action is to throttle the Main Valve when the pressure being controlled rises by the set differential above some second pressure.

# SELECTING BACK PRESSURE PILOTS

Any of the Main Valves described in the Main Valve Section can be combined with any of the Pilots listed below to produce the SPENCE Back Pressure Regulator. Provided the delivery (discharge) pressure is sufficiently below the desired back pressure to operate the Regulator, it will maintain a steady back pressure regardless of fluctuations in the load. The Pilot is guaranteed to shut tight when the back pressure falls below a predetermined

setting. The table below lists the principal Back Pressure Pilots. **THE SPENCE BACK PRESSURE REGULATOR IS NOT A SAFETY VALVE AND SHOULD NEVER BE USED AS SUCH.** The discharge pressure must always be low enough in relation to the back pressure to provide the required minimum differential listed in the Main Valve Selection Chart in the Technical Reference Section.

## BACK PRESSURE REGULATOR PILOTS

Type	Service Conditions								Normal Accuracy  ±	Diaphragm		Main Valve
	Cast Iron		Cast Bronze <sup>a</sup>		Cast Steel		Delivery Pressure			Diameter inches	Material	
	Maximum Initial Pressure psi	Maximum Temper- ature °F	Maximum Initial Pressure psi	Maximum Temper- ature °F	Maximum Initial Pressure psi	Maximum Temper- ature °F	Minimum psi	Maximum psi				
Q	150	366	150	366	150	366	3	150	1 psi	3½	St. Stl.	E or C Series
Q5	25	267	25	267	—	—	1	25	½ Psi	5¾	St. Stl.	E or C Series
Q35 <sup>b</sup>	25	267	25	267	—	—	1	25	⅛ psi	5¾-3½	St. Stl.	E or C Series
Q73 <sup>b</sup>	150	366	150	366	150	366	3	150	½ psi	3½-7¼ <sup>c</sup>	St. Stl.	E or C Series

<sup>a</sup>Bronze Body Pilots are recommended for water service.

<sup>b</sup>Types Q35 and Q73 are air adjusted, all others are spring loaded.

<sup>c</sup>These Pilots have dual diaphragms, the first size being the control diaphragm and the second, the air loading diaphragm.

### NOTES ON SELECTION OF PILOTS

**TYPE Q SERIES** meet the requirements of the majority of all back pressure problems. They are packless and spring or air loaded. The Type Q Pilot can be furnished for service on refrigerants on special order.

A larger Diaphragm will produce closer accuracy of control but with less range in back pressure.

## SIZING BACK PRESSURE REGULATORS

### DATA REQUIRED FOR ORDERING

- SERVICE** Fluid flowing through Regulator.
- INITIAL (INLET) PRESSURE**
  - Maximum/Minimum.
  - Superheat, Gravity, etc.
    - Steam Service—Total Temperature or Degrees Superheat, if any.
    - Air, Gases, Water and Liquids—Temperature and Specific Gravity.
- DISCHARGE (OUTLET) PRESSURE** Maximum/Minimum.
- CAPACITY** Maximum required flow through Regulator.
- END CONNECTIONS** Screwed or Flanged. (If flanged, state drilling.)

### EXAMPLE

Select size and type Regulator to pass 9000 lb steam per hour retaining a back pressure of 5 psi and exhausting into a condenser at 6" Hg vacuum. Pilot to be packless, spring loaded and to control the pressure within ±½ psi.

- Steam
- (a) 5 psi  
(b) None (saturated, 228°F total temperature)
- 6" Hg vacuum
- 9000lb. per hour
- Flanged, if 2½" size or larger

### SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A. TYPE</b> —See Selection Criteria for Steam, Air, Gases or Water and Liquids in beginning of this Section.	See Selection Criteria and Selection Charts opposite.
<b>B. SIZE</b> —See applicable Valve Capacity Tables in this Section.	
<b>C. MATERIAL</b> — See Main Valve Selection Chart in Technical Reference Section or individual Product Pages.	See Pilot Selection Chart opposite or individual Product Pages.
<b>D. ACCESSORIES</b> —See Accessories in Other Products Section.	

### SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
<b>A.</b> Since Initial Pressure is less than 15 psi and the least pressure drop exceeds "minimum differential": <b>SELECT TYPE E2</b>	Since maximum Initial Pressure 5 psi, Total Temperature 228°F, accuracy of control ±½ psi and Pilot spring loaded: <b>SELECT TYPE Q5</b>
<b>B.</b> For 9000 lb. per hour and 5 psi Initial Pressure: <b>SELECT 8" SIZE.</b>	
<b>C.</b> For 5 psi, 228°F: <b>SELECT CAST IRON, FLANGED 125 LB.</b>	For 5 psi, 228°F: <b>SELECT CAST IRON</b>
<b>D.</b> For discharge into vacuum: Condensation Chamber required.	None required in this case.

**ANSWER: 8" SPENCE TYPE E2Q5, CAST IRON BODY, 125 LB. FLANGED ENDS, EQUIPPED WITH CONDENSATION CHAMBER.**

NOTE: Back Pressure Regulators should always be protected by properly designed Strainers.

# RATED STEAM CAPACITY TABLE

## TYPE E MAIN VALVE—FULL PORT

### Pounds of Saturated Steam per Hour

PRESSURE- <small>psig</small>		VALVE SIZE (inches)														
INLET	REDUCED	<small>3/8</small>	<small>1/2</small>	<small>3/4</small>	1	<small>1 1/4</small>	<small>1 1/2</small>	2	<small>2 1/2</small>	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	57860	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	170601	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.

75% and 50% reduced trim (Parabolic) is available 112" to 12" size only.

# RATED STEAM CAPACITY TABLE

## TYPE E MAIN VALVE—NORMAL PORT

### Pounds of Saturated Steam per Hour

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	40	90	285	445	615	865	1045	1425	2550	4630	6825	8960	14775	22370	37440
25	10	40	100	315	490	680	955	1150	1565	2805	5090	7505	9855	16250	24605	41185
	5-0	45	100	325	510	705	990	1195	1630	2920	5295	7805	10250	16905	25595	42835
30	15	45	105	335	525	730	1025	1235	1685	3015	5470	8070	10595	17470	26450	44265
	10-0	50	115	365	575	795	1115	1345	1835	3285	5960	8790	11540	19035	28815	48230
40	25	50	120	380	595	820	1155	1390	1895	3400	6165	9090	11930	19675	29790	49865
	20	60	135	425	665	925	1295	1565	2130	3820	6925	10210	13410	22110	33475	56030
	15-0	60	140	450	700	975	1365	1645	2245	4020	7295	10755	14125	23290	35265	59020
50	35	55	130	420	650	905	1270	1530	2090	3740	6785	10005	13135	21660	32795	54890
	30	65	145	470	735	1020	1435	1730	2360	4225	7660	11295	14835	24460	37035	61985
	25	70	160	515	805	1115	1565	1890	2575	4615	8370	12340	16200	26715	40445	67695
	20-0	70	165	530	830	1150	1615	1945	2655	4755	8630	12725	16705	27550	41710	69810
60	45	60	140	455	705	980	1375	1660	2265	4055	7355	10845	14240	23480	35545	59495
	40	70	160	515	800	111	1560	1880	2565	4595	8335	12285	16130	26600	40275	67410
	35	75	175	560	880	1220	1710	2060	2810	5035	9135	13470	17685	29160	44150	73895
	30-0	80	190	605	945	1305	1835	2210	3015	5405	9805	14455	18980	31295	47385	79305
75	55	75	180	570	890	1235	1730	2085	2845	5100	9250	13635	17905	29525	44700	74820
	50	85	195	625	980	1355	1905	2295	3130	5610	10175	15005	19700	32485	49185	82325
	45	90	210	675	1055	1460	2055	2475	3375	6045	10965	16170	21230	35005	53005	88710
	40-0	95	225	715	1120	1555	2180	2630	3585	6420	11645	17170	22545	37175	56285	94205
100	75	100	225	720	1125	1560	2190	2640	3605	6455	11710	17265	22670	37380	56595	94725
	60	120	275	875	1370	1900	2670	3215	4385	7860	14255	21020	27600	45515	68910	115335
	50-0	125	295	940	1470	2040	2865	3450	4705	8435	15300	22555	29615	48840	73945	123760
125	100	110	250	805	1255	1740	2445	2950	4020	7200	13065	19260	25290	41700	63140	105675
	75	145	335	1080	1685	2340	3285	3960	5400	9670	17545	25865	33960	56000	84790	141915
	65-0	155	360	1145	1790	2485	3490	4205	5735	10270	18635	27470	36070	59485	90060	150740
150	125	120	275	880	1375	1905	2675	3225	4395	7875	14290	21065	27660	45615	69065	115595
	100	160	370	1190	1860	2580	3625	4370	5955	10675	19360	28545	37480	61805	93575	156620
	80-0	185	420	1350	2110	2930	4110	4955	6760	12110	21970	32390	42525	70130	106175	177715
175	150	130	295	950	1485	2055	2885	3480	4745	8500	15420	22730	29850	49220	74520	124730
	125	175	405	1295	2020	2805	3935	4745	6470	11590	21020	30995	40695	67105	101605	170055
	100	205	475	1525	2380	3300	4635	5585	7615	13645	24750	36490	47915	79010	119625	200215
	95-0	210	485	1555	2435	3375	4735	5710	7785	13950	25300	37305	48980	80770	122295	204690
200	150	190	435	1390	2170	3010	4225	5090	6940	12435	25560	33260	43675	72020	109040	182510
	125	225	515	1645	2570	3560	5000	6025	8215	14720	26708	39375	51700	85250	129075	216035
	110-0	240	550	1760	2755	3815	5360	6460	8810	15780	28630	42210	55420	91390	138370	231595
225	175	200	460	1475	2310	3200	4495	5415	7385	13230	24000	35385	46465	76620	116005	194160
	150	240	550	1755	2745	3805	5340	6435	8775	15725	28525	42060	55225	91065	137880	230775
	125-0	265	615	1965	3070	4255	5970	7200	9815	17590	31905	47040	61765	101850	154210	258105
250	200	210	490	1560	2440	3380	4745	5720	7805	13980	25360	37390	49095	80955	122575	205155
	175	250	580	1860	2910	4030	5660	6825	9305	16670	30240	44585	58540	96530	146155	244625
	150	285	655	2090	3265	4525	6355	7660	10445	18710	33945	50045	65710	108355	164055	274585
	140-0	295	675	2165	3385	4690	6585	7940	10825	19395	35180	51870	68110	112315	170050	284615

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

75% and 50% reduced trim (Parabolic) is available 112" to 12" size only.

# RATED STEAM CAPACITY TABLE

## TYPE E2 MAIN VALVE

### Pounds of Saturated Steam per Hour

PRESSURE-psig		VALVE SIZE (inches)												
INLET	REDUCED	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12
15	12	150	230	375	545	875	1350	1905	2840	4010	5060	9230	14850	22195
	10	245	375	605	880	1415	2185	3085	4595	6490	8195	14945	24040	35930
	8	295	455	735	1070	1715	2650	3740	5570	7870	9935	18120	29145	43560
	5	345	530	860	1245	2000	3085	4360	6495	9170	11580	21110	33960	50760
	2.5	375	575	930	1345	2160	3340	4715	7025	9925	12530	22850	36755	54935
12	9	145	220	355	515	825	1275	1800	2680	3785	4780	8715	14020	20955
	7	230	355	570	830	1330	2060	2910	4330	6115	7720	14080	22650	33855
	5	280	430	690	1005	1610	2490	3515	5235	7395	9340	17030	27390	40940
	2	325	495	805	1165	1870	2890	4080	6075	8585	10835	19760	31785	47510
10	7	135	210	340	490	790	1220	1725	2570	3630	4580	8355	13440	20090
	5	220	340	550	795	1275	1970	2780	4145	5855	7390	13475	21670	32395
	2	280	435	705	1020	1635	2525	3565	5315	7505	9475	17280	27795	41545
	1" HG VAC	310	480	775	1125	1805	2795	3945	5875	8295	10475	19095	30720	45915
9	6	135	205	330	480	775	1195	1685	2510	3550	4480	8170	13140	19645
	4	215	330	535	775	1245	1925	2715	4045	5715	7215	13160	21165	31640
	2	260	400	645	935	1500	2320	3275	4880	6890	8700	15865	25515	38140
	2" HG VAC	300	460	745	1080	1730	2675	3780	5625	7950	10035	18300	29435	43995
8	5	130	200	325	470	755	1165	1645	2455	3465	4375	7980	12835	19185
	3	210	325	520	755	1215	1875	2650	3950	5575	7040	12835	20650	30865
	3.1" HG VAC	285	440	710	1035	1660	2565	3620	5390	7615	9610	17530	28195	42145
7	4	125	195	315	460	735	1140	1605	2395	3380	4270	7785	12520	18715
	2	205	315	510	735	1185	1830	2580	3845	5435	6860	12505	20120	30070
	4.3" HG VAC	275	420	680	985	1585	2450	3460	5150	7275	9185	16750	26945	40275
6	3	125	190	310	445	720	1110	1565	2330	3295	4160	7585	12200	18235
	1	200	305	495	715	1150	1780	2510	3740	5285	6675	12170	19575	29255
	5.5" HG VAC	260	405	650	945	1515	2340	3305	4925	6955	8780	16010	25755	38495
5	2	120	185	300	435	700	1080	1525	2270	3205	4045	7380	11870	17740
	0	195	295	480	695	1120	1730	2440	3635	5135	6480	11820	19010	28415
	6.7" HG VAC	250	380	615	895	1435	2215	3130	4660	6485	8310	15155	24380	36440

Based on 1 psi accuracy of regulation.

K-Factor is included in the above tabulations.

#### TYPE E2 MAIN VALVE ONLY

Used at such low pressure drops, a 1 psi deviation of reduced pressure at rated capacity is a significant portion of the total drop. It must be accounted for in calculations dealing with a subcritical flow condition.

Also, because E2 valve opening, for 1 psi accuracy of regulation, varies with the pressure drop, a regulation factor K is inserted in the formula.

$$Cv = \frac{W}{2.1 K \sqrt{\Delta P'(P_1 + P_2)'}}$$

Where K = Factor from accompanying table  
Cv = Valve coefficient

W = Flow, #/Hr. (saturated steam)

$\Delta P'$  =  $\Delta P$  nominal plus 1 psi

$P_1$  = Inlet pressure, psia (psi + 14.7)

$P_2$  = Reduced pressure, psia (psi + 14.7)

$P_2'$  =  $P_2$  nominal (set point value) minus 1 psi

$\Delta P$  = Pressure drop, psi

NOTE: When computing W for safety valve sizing, use K = 1.0

Size	E2 Cv Valve Coefficient	$\Delta P$ Nominal	K Factor
3/4	7.6		
1	11.7		
1 1/4	18.9	3	0.635
1 1/2	27.4	4	0.785
2	44	5	0.855
2 1/2	68	6	0.895
3	96	7	0.915
4	143	8	0.928
5	202	9	0.935
6	255	10	0.937
8	465	11	0.938
10	748	12	0.940
12	1118	15	0.940

# RATED STEAM CAPACITY TABLE

## TYPE E5 MAIN VALVE—FULL PORT

### Pounds of Saturated Steam per Hour

PRESSURE-psig		VALVE SIZE (Inches)												
INLET	REDUCED	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
20	10	390	600	965	1400	2200	3430	4860	8140	13205	17915	34035	52105	82455
	5-0	450	695	1120	1625	2550	3975	5635	9435	15310	20770	39460	60405	95590
25	15	420	645	1045	1515	2380	3005	5255	8795	14275	19365	36790	56320	89125
	10	495	765	1235	1790	2805	4375	6200	10380	16840	22845	43405	66445	105150
	5-0	515	795	1285	1860	2920	4550	6450	10795	17515	23760	45145	69110	109365
30	20	450	690	1120	1620	2545	3965	5620	9410	15265	20710	39350	60240	95330
	15	535	820	1325	1920	3015	4700	6665	11155	18100	24555	46650	71415	113020
	10-0	580	895	1445	2095	3285	5120	7260	12155	19720	26755	50830	77815	123140
40	30	505	775	1250	1815	2845	4435	6290	10525	17080	23175	44030	67400	106660
	25	600	925	1495	2165	3400	5295	7505	12565	20390	27660	52550	80445	127305
	20	675	1040	1680	2435	3820	5950	8435	14120	22910	31080	59050	90395	143055
	15-0	710	1095	1770	2565	4020	6265	8885	14870	24135	32740	62200	95220	150690
50	35	660	1020	1645	2385	3740	5830	8265	13830	22445	30445	57850	88560	140145
	30	745	1150	1855	2690	4225	6580	9330	15620	25345	34380	65325	100000	158250
	25	815	1255	2030	2940	4615	7190	10190	17060	27680	37550	71345	109215	172835
	20-0	840	1295	2090	3030	4755	7415	10510	17590	28545	38725	73575	112630	178235
60	45	715	1105	1780	2585	4055	6315	8960	14990	24325	33000	62705	95985	151900
	40	810	1250	2020	2925	4595	7160	10150	16985	27565	37390	71045	108755	172105
	35	890	1370	2215	3210	5035	7845	11125	18620	30215	40990	77880	119220	188665
	30-0	955	1470	2375	3445	5405	8420	11940	19985	32425	43990	83580	127945	202480
75	55	900	1385	2240	3250	5100	7945	11265	18855	30590	41500	78850	120705	191020
	50	990	1525	2465	3575	5610	8740	12395	20745	33660	45665	86765	132820	210190
	45	1070	1645	2655	3850	6045	9420	13355	22355	36270	49205	93495	143120	226490
	40-0	1135	1745	2820	4090	6420	10005	14185	23735	38515	52250	99280	151980	240510
100	75	1140	1755	2835	4115	6455	10060	14260	23870	38730	52540	99830	152820	241840
	60	1390	2140	3455	5010	7860	12245	17365	29065	47160	63975	121550	186075	294465
	50-0	1490	2295	3705	5375	8435	13140	18635	31185	50605	68650	130430	199665	315975
125	100	1275	1960	3165	4590	7200	11220	15910	26630	43210	58615	111370	170490	269800
	75	1710	2630	4250	6160	9670	15070	21365	35760	58025	78715	149560	228955	362325
	65-0	1815	2795	4515	6545	10270	16005	22695	37985	61635	83610	158860	243185	384845
150	125	1390	2145	3460	5020	7875	12275	17405	29130	47265	64120	121825	186490	295125
	100	1885	2905	4690	6800	10675	16630	23580	39465	64040	86875	165060	252675	399865
	80-0	2140	3295	5325	7715	12110	18870	26755	44780	72660	98575	187290	286705	453715
175	150	1500	2315	3735	5415	8500	13245	18780	31430	51000	69185	131450	201225	318445
	125	2050	3155	5095	7385	11590	18055	25605	42850	69530	94325	179220	274355	434170
	100	2410	3710	5995	8695	13645	21260	30145	50450	81865	111055	211005	323015	511175
	95-0	2465	3795	6130	8890	13950	21735	30815	51580	83690	113535	215715	330225	522585
200	150	2200	3385	5465	7925	12435	19380	27475	45990	74625	101235	192340	294445	465960
	125	2600	4005	6470	9380	14720	22940	32525	54435	88330	119830	227675	348535	551560
	110-0	2790	4295	6935	10055	15780	24590	34865	58355	94695	128460	244070	373630	591280
225	175	2340	3600	5815	8430	13230	20615	29230	48925	79390	107695	204625	313245	495715
	150	2780	4280	6910	10020	15725	24505	34745	58150	94355	128005	243210	372310	589185
	125-0	3110	4785	7730	11210	17590	27405	38860	65040	105535	143165	272015	416405	658965
250	200	2470	3805	6145	8910	13980	21785	30885	51695	83885	113795	216210	330980	523780
	175	2945	4535	7325	10620	16670	25975	36830	61640	100020	135685	257805	394655	624545
	150	3305	5090	8225	11925	18710	29155	41340	69190	112270	152305	289380	442995	701045
	140-0	3430	5275	8524	12360	19395	30220	42850	71720	116370	157870	299950	459175	726650

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

# RATED STEAM CAPACITY TABLE

## TYPE E5 MAIN VALVE—NORMAL PORT

### Pounds of Saturated Steam per Hour

PRESSURE-psig		VALVE SIZE (Inches)												
INLET	REDUCED	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12
20	10	290	510	685	1015	1280	1790	3020	6140	9010	11670	18730	26870	48725
	5-0	340	595	795	1175	1485	2075	3500	7120	10445	13530	21715	31150	56490
25	15	315	555	740	1095	1385	1935	3265	6640	9735	12615	20250	29045	52665
	10	370	655	875	1290	1630	2285	3850	7830	11485	14880	23890	34265	62135
	5-0	385	680	910	1345	1695	2375	4005	8145	11950	15480	24845	35640	64630
30	20	335	590	795	1170	1480	2070	3490	7100	10415	13490	21660	31065	56335
	15	400	700	940	1390	1755	2455	4140	8420	12345	15995	25675	36830	66785
	10-0	435	765	1025	1515	1910	2675	4510	9170	13455	17430	27975	40130	72770
40	30	375	660	885	1310	1655	2315	3905	7945	11655	15095	24230	34760	63030
	25	450	790	1060	1565	1975	2765	4660	9485	13910	18015	28920	41485	75230
	20	505	890	1190	1760	2220	3110	5240	10655	15630	20245	32500	46620	84535
	15-0	535	935	1255	1850	2340	3275	5520	11225	16465	21325	34235	49105	89045
50	35	495	870	1165	1720	2175	3045	5135	10440	15310	19835	31840	45670	82815
	30	560	980	1315	1945	2455	3440	5795	11790	17290	22395	35950	51570	93515
	25	610	1075	1440	2125	2680	3755	6330	12875	18880	24460	39265	56325	102135
	20-0	630	1105	1485	2190	2765	3870	6530	13275	19470	25225	40495	58085	105325
60	45	535	945	1265	1865	2355	3300	5565	11315	16595	21500	34510	49500	89765
	40	610	1070	1430	2115	2670	3740	6305	12820	18800	24360	39100	56085	101705
	35	670	1170	1570	2320	2930	4100	6910	14055	20610	26700	42865	61485	111490
	30-0	715	1255	1685	2490	3140	4400	7415	15080	22120	28655	46000	65985	119650
75	55	675	1185	1590	2350	2965	4150	6995	14230	20870	27035	43395	62250	112880
	50	745	1305	1750	2585	3260	4565	7700	15655	22965	29745	47750	68495	124210
	45	800	1405	1885	2785	3515	4920	8295	16870	24745	32055	51455	73810	133840
	40-0	850	1495	2000	2955	3730	5225	8810	17915	26275	34040	54640	78380	142125
100	75	855	1500	2010	2970	3755	5255	8855	18015	26420	34225	54945	78810	142910
	60	1040	1830	2450	3620	4570	6395	10785	21935	32170	41675	66900	95960	174010
	50-0	1120	1960	2630	3885	4905	6865	11570	23535	34520	44720	71785	102970	186720
125	100	955	1675	2245	3315	4185	5860	9880	20095	29475	38185	61295	87925	159435
	75	1280	2250	3015	4455	5625	7870	13270	26990	39585	51280	82315	118075	214110
	65-0	1360	2390	3200	4730	5970	8360	14095	28665	42045	54465	87435	125415	227420
150	125	1045	1830	2455	3625	4580	6410	10810	21985	32240	41770	67050	96175	174400
	100	1415	2480	3325	4915	6205	8685	14645	29785	43685	56590	90845	130310	236295
	80-0	1605	2815	3775	5575	7040	9855	16615	33795	49570	64215	103080	147860	268120
175	150	1125	1975	2650	3915	4940	6920	11660	23720	34790	45070	72345	103775	188180
	125	1535	2695	3610	5335	6740	9435	15900	32340	47435	61445	98640	141490	256570
	100	1810	3175	4250	6285	7935	11105	18720	38075	55845	72345	116130	166585	302070
	95-0	1850	3245	4345	6425	8110	11355	19140	38925	57090	73960	118725	170305	308815
200	150	1650	2890	3875	5725	7230	10125	17065	34710	50905	65945	105860	151850	275355
	125	1950	3425	4590	6780	8560	11985	20200	41085	60255	78060	125310	179745	325935
	110-0	2090	3670	4820	7265	9175	12845	21655	44045	64595	83680	134330	192690	349410
225	175	1755	3075	4125	6095	7695	10770	18155	36925	54155	70155	112620	161545	292935
	150	2085	3655	4900	7240	9145	12800	21580	43885	64370	83385	133855	192005	348170
	125-0	2330	4090	5480	8100	10225	14315	24135	49085	71990	93260	149710	214745	389410
250	200	1855	3250	4355	6440	8130	11380	19185	39015	57220	74130	118995	170690	309520
	175	2210	3875	5195	7675	9690	13570	22875	46520	68230	88390	141890	203530	369070
	150	2480	4350	5830	8615	1088	15230	25675	52220	76590	99215	159270	228460	414275
	140-0	2570	4510	6045	8930	11275	15785	26610	54125	79385	102840	165085	236805	429405

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



# RATED STEAM CAPACITY TABLE

## TYPE C20 MAIN VALVE

### Pounds of Saturated Steam per Hour

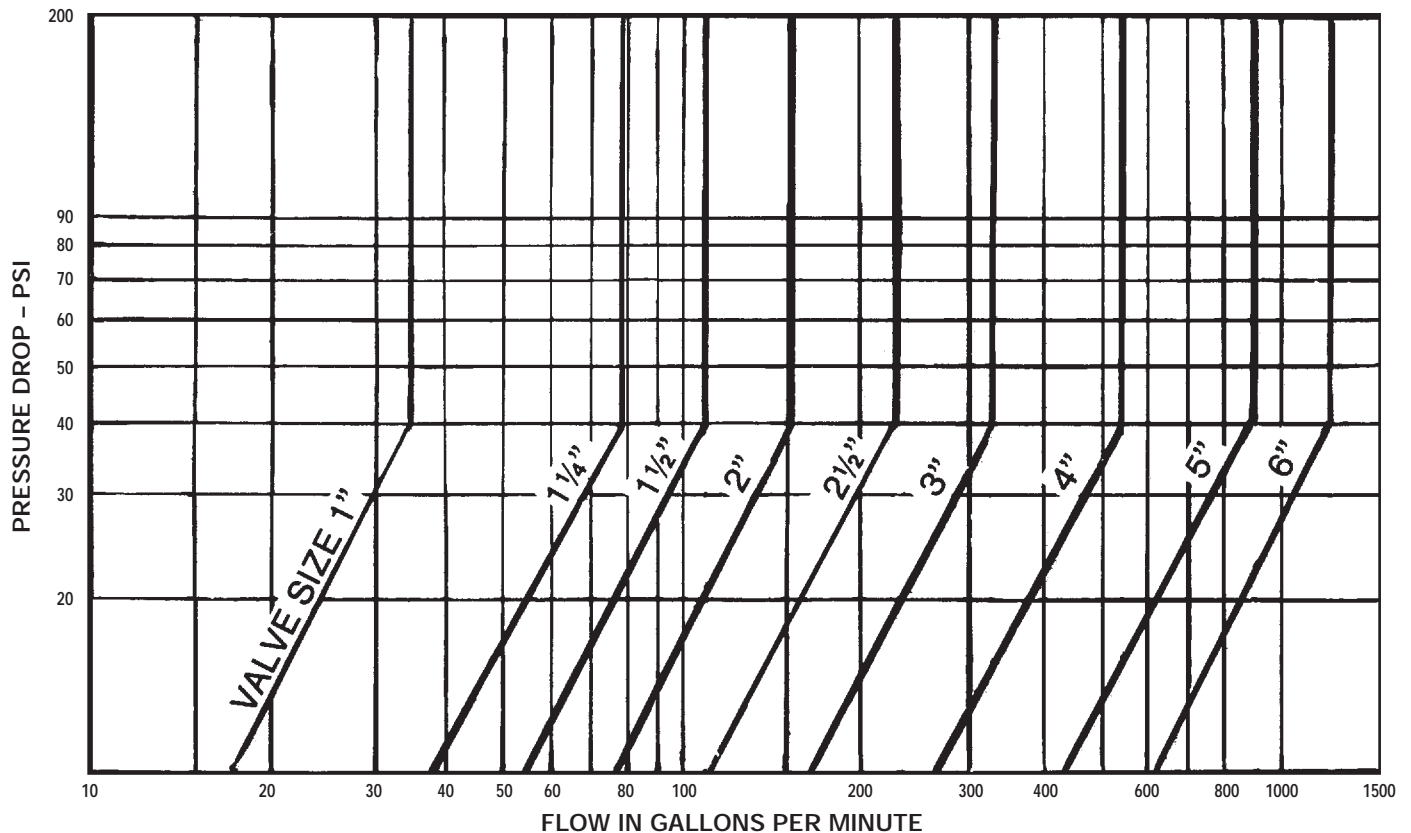
PRESSURE-psig		VALVE SIZE (inches)											
INLET	REDUCED	1	1¼	1½	2	2½	3	4	5	6	8	10	12
25	5-0	510	950	1360	2035	3190	4685	7805	12625	16970	29600	47520	73520
30	10-0	575	1070	1530	2295	3595	5275	8790	14215	19110	33325	53505	82780
40	20	665	1245	1775	2665	4175	6125	10210	16515	22200	38715	62160	96170
	15-0	700	1310	1870	2805	4395	6455	10755	17400	23385	40780	65475	101300
50	30	735	1375	1965	2945	4615	6780	11295	18270	24555	42830	68760	106385
	25	805	1500	2145	3220	5040	7405	12340	19955	26820	46775	75100	116190
	20-0	830	1550	2215	3320	5200	7635	12725	20580	27660	48240	77445	119820
60	40	800	1495	2135	3205	5020	7370	12285	19870	26710	46580	74780	115700
	35	880	1640	2340	3515	5505	8080	13470	21785	29280	51060	81980	126830
	30-0	945	1760	2515	3770	5905	8670	14455	23375	31420	54800	87980	136115
75	55	890	1660	2370	3555	5575	8180	13635	22055	29645	51695	83000	128410
	50	980	1825	2610	3915	6130	9000	15005	24270	32620	56885	91330	141300
	45	1055	1970	2810	4220	6610	9700	16170	26150	35150	61295	98415	152260
	40-0	1120	2090	2985	4480	7015	10300	17170	27770	37325	65090	104505	161685
100	75	1125	2100	3000	4505	7055	10360	17265	27920	37530	65450	105080	162575
	60	1370	2560	3655	5485	8590	12610	21020	34000	45695	79695	127950	197955
	50-0	1470	2745	3925	5885	9220	13535	22555	36480	49035	85515	137295	212415
125	100	1255	2345	3350	5025	7870	1555	19260	31150	41870	73020	117230	181375
	75	1685	3150	4500	6745	10570	15520	25865	41835	56225	98060	157435	243575
	65-0	1790	3345	4780	7165	11230	16485	27470	44435	59720	104155	167220	258715
150	125	1375	2565	3665	5495	8610	12640	21065	34075	45800	79875	128235	198400
	100	1860	3475	4965	7445	11665	17125	28545	46165	62050	108220	173745	268810
	80-0	2110	3945	5635	8450	13235	19435	32390	52385	70410	122795	197145	305015
175	150	1485	2765	3955	5930	9290	13640	22730	36765	49415	86185	138310	214075
	125	2020	3775	5390	8085	12665	18595	30995	50130	67375	117505	188655	291875
	100	2380	4440	6345	9520	14915	21895	36490	59020	79325	138345	222110	343640
	95-0	2435	4540	6490	9730	15245	22385	37305	60335	81095	141435	227070	351310
200	150	2170	4050	5785	8675	13595	19955	33260	53800	72310	126105	202465	313245
	125	2570	4795	6845	10270	16090	23625	39375	63680	85595	149275	239660	370790
	110-0	2755	5140	7340	11010	17250	25325	42210	68265	91755	160025	256920	397490
225	175	2310	4310	6155	9230	14460	21230	35385	57235	76925	134160	215395	333245
	150	2745	5120	7315	10970	17190	25235	42060	68025	91430	159455	256010	396080
	125-0	3070	5725	8180	12270	19225	28225	47040	76080	102260	178340	286330	442995
250	200	2440	4550	6505	9755	15280	22435	37390	60475	81280	141755	227590	352115
	175	2910	5425	7755	11630	18220	26750	44585	72110	96920	169025	271375	419855
	150	3265	6090	8705	13055	20455	30025	50045	80940	108790	189730	304615	471280
	140-0	3385	6315	9020	13530	21200	31125	51870	83895	112765	196660	315740	488495

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

# RATED WATER CAPACITY CHART

## TYPE C34 PILOT OPERATED MAIN VALVE

(Specific Gravity of 1)



### VALVE SIZE SELECTION

Prior to selecting valve size, the maximum required flow and the pressure drop across the valve must be determined. Enter the Capacity Chart at the maximum required flow GPM and follow vertically to the intersection of the horizontal pressure drop line. The valve size nearest to, but to the right of this intersection is the smallest valve that will satisfy the flow requirements.

The vertical portion of the curves indicate the flow at which approximately 15 feet per second velocity is reached. By selecting the next larger size valve, a lower velocity may be maintained. For general service, 8 to 10 feet per second is recommended.

### EXAMPLE

Required maximum flow is 100 GPM, Inlet Pressure is 60 psi, Delivery Pressure is 35 psi (Pressure drop is 25 psi). Enter the Capacity Chart at the 100 GPM line and follow up to 25 psi pressure drop. It falls to the right of the 1 1/2" valve size line, therefore 2" is the minimum valve size required.

# RATED CAPACITY TABLES

## TYPE T3 REGULATOR

### Steam Capacities

(Pounds per Hour of Saturated Steam)

Inlet Pressure P.S.I.G.	Outlet Pressure P.S.I.G.	Nominal Valve Size					
		1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Cv Factor		5.3	7	8.7	16	18.5	31
5	2	120	155	190	355	410	680
	0	150	193	245	450	520	870
10	8	105	140	175	320	370	620
	5	165	220	269	495	575	960
	3	190	250	315	580	665	1115
20	15	200	265	330	610	705	1180
	10	270	360	445	815	945	1580
	5	315	415	515	945	1090	1830
30	25	230	300	375	690	795	
	20	315	415	515	945	1090	
	1-10	400	535	660	1220	1405	
40	30	350	465	575			
	20	470	625	775			
	0-15	500	660	820			
50	40	390	510	635			
	30	520	685	855			
	0-25	590	780	965			
60	50	415	545	670			
	40	570	750	930			
	0-30	675	890	1105			
75	65	455	600	750			
	50	690	910	1130			
	0-35	815	1080	1340			
100	80	720	955				
	65	915	1210				
	0-50	1040	1375				
125	100	885	1170				
	80	1140	1505				
	0-60	1265	1675				
150	125	970	1280				
	100	1315	1735				
	0-75	1495	1975				
175	150	1045	1380				
	125	1430	1890				
	0-100	1725	2275				
200	175	1120	1480				
	150	1530	2025				
	0-125	1815	2395				
225	200	1190	1570				
	175	1635	2155				
	0-150	1935	2555				
250	225	1250	1655				
	200	1725	2275				
	0-175	2055	2715				

Water  
(G.P.M. —

Differential Pressure P.S.I.G.
5
10
15
20
25
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200

### Water Capacities

(G.P.M. — U.S. Gallons per Minute)

Differential Pressure P.S.I.G.	Nominal Valve Size					
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
5	12	15	20	36	41	69
10	17	22	28	50	58	98
15	21	27	34	62	72	120
20	23	31	39	72	83	138
25	27	35	44	80	93	
30	29	38	48	88	101	
40	33	44	55			
50	37	50	61			
60	41	54	67			
70	44	58	73			
80	47	63	78			
90	50	66				
100	53	70				
110	55	73				
120	58	77				
130	60	80				
140	63	83				
150	65	86				
160	67	88				
170	89	91				
180	71	94				
190	73	96				
200	75	99				
210	77	101				
220	79	104				
230	80	106				
240	82	108				
250	84	111				

#### Accuracy of Control

The T3 Regulator is intended for use on systems with a continuous load, where load fluctuations are gradual. On a well designed system, the T3 regulator should control stable loads within 2° to 5°F.

# RATED STEAM CAPACITY TABLE

## SERIES 2000 TEMPERATURE REGULATOR

VALVE SIZE		SINGLE SEATED VALVES											DOUBLE SEATED VALVES					
Inlet Pressure PSIG	Outlet Pressure PSIG	½C	½D	½E	½A	½B	½	¾	1	1¼	1½	2	½	¾	1	1¼	1½	2
		DRY SATURATED STEAM—LBS. OF STEAM/HR																
5	UP to 9"HG.VAC. 6"HG.VAC. 2	12	30	53	97	130	155	200	270	420	450	510	235	305	380	610	735	975
		11	29	52	95	125	150	195	265	415	440	500	230	300	375	600	720	960
		8	21	38	70	90	110	145	195	305	320	365	170	220	275	440	525	700
10	UP to 3"HG.VAC. 3 7	15	35	65	120	160	195	255	340	530	565	635	295	385	480	765	920	1220
		13	33	60	110	145	175	230	305	480	510	575	265	345	430	690	830	1100
		10	24	44	80	105	125	165	220	345	370	415	190	250	310	500	600	800
20	UP to 4 10 15	21	52	95	170	225	270	355	475	745	790	895	415	540	670	1070	1290	1720
		19	47	85	155	200	245	325	430	675	715	810	375	490	610	970	1170	1550
		15	37	66	120	155	190	250	335	525	555	630	290	380	470	755	910	1200
30	UP to 10 15 25	27	67	120	220	290	350	460	615	960	1020		530	695	865	1380	1660	2210
		25	63	115	210	270	330	435	580	905	960		500	660	815	1300	1570	2090
		17	42	75	140	180	220	290	385	605	640		335	440	545	870	1050	1390
40	UP to 15 20 30	33	82	150	270	350	430	560	750	1170			650	885	1060	1690	2030	2710
		32	79	140	260	340	415	540	725	1130			625	820	1020	1630	1960	2610
		25	63	115	210	270	330	435	580	905	905		505	660	820	1300	1570	2090
50	UP to 20 30 40	39	97	175	320	415	505	665	890				770	1010	1250	2000	2400	3200
		36	90	160	295	385	470	615	820				710	935	1150	1850	2220	2960
		28	70	125	230	300	365	480	640				555	730	905	1440	1740	2310
60	UP to 25 30 50	45	112	200	370	480	585	770	1020				890	1160	1440	2310	2780	3700
		44	110	198	360	470	575	755	1000				870	1140	1410	2260	2720	3620
		30	75	135	250	325	400	525	700				605	795	985	1570	1890	2520
70	UP to 30 40 60	51	127	230	420	545	665	870					1010	1320	1640	2610	3150	4190
		49	122	220	400	520	635	830					965	1260	1570	2500	3010	4010
		33	82	150	270	350	430	560					650	855	1060	1690	2030	2700
80	UP to 35 50 70	57	140	255	465	610	740	975					1120	1470	1830	2920	3520	4690
		53	130	240	435	565	690	905					1050	1370	1705	2720	3280	4360
		35	85	155	285	375	455	600					690	910	1120	1800	2160	2

# SIZING SERIES 2000 TEMPERATURE REGULATORS

## EXAMPLE FOR HEATING SERVICE

The maximum anticipated flow requirements for a regulator on heating service is 500 lbs. of steam per hour. The unit steam pressure is 50 psig and the downstream pressure is essentially zero because the steam downstream is discharged into an open drain.

ANSWER: In the chart opposite, locate 50 psi on the inlet pressure scale on the left side of the chart. Choose the outlet pressure line "up to 20" psig because the downstream pressure is essentially zero. Follow the "up to 20" outlet pressure line until you come to the value closest to 500 lbs. of steam per hour (in this case, 505). Read upward to the valve size and we see that the 1/2" single seated valve is the correct size. To size for three-way valves, use single seated capacities 1/2" through 2" size.

### NOTE: FORMULAS FOR EXACT CALCULATIONS.

If the outlet pressure is equal to or less than 53% of the absolute inlet pressure:

$$Q (\text{lbs steam/hr}) = 1.5 \times C_v \times \text{inlet pressure (psia)}$$

If the outlet pressure is greater than 53% of the absolute inlet pressure:

$$Q (\text{lbs steam/hr}) = 3 \times C_v \times \sqrt{\text{pressure drop (psi)} \times \text{outlet pressure (psia)}}$$

## STEAM FLOW REQUIREMENTS

Use the top chart on this page to determine the pounds of steam per hour required to raise the temperature in tank of known capacity to the required temperature. Determine the rise in temperature (control temp. - room temp.) on the left hand column, read the corresponding pounds of steam per hour under the corresponding gallons of water to be heated. Use the lbs. steam/hr. figure in the chart on the opposite page to determine valve size.

**Formula for converting the length, width and depth of solutions (all measured in feet) to gallons of solution: Gallons=7.48 x length x width x depth.**

## EXAMPLE FOR COOLING SERVICE

Find the correct regulator valve size that will feed a compressor intercooler that requires 100 gallons of water per minute under maximum operating conditions. The supply (inlet) pressure (P1) is 60 psi and the downstream pressure (P2) under maximum flow conditions is 20 psi. The 20 psi pressure is required to force the full flow of water through the compressor's cooling system. Inlet pressure must not exceed maximum upstream pressure, per the Series 2000 Temperature Regulator Product Pages.

ANSWER: The pressure drop permitted across the regulator is P1 minus P2 (40 psi). In the Water Capacity Table (right), locate 40 psi in the differential pressure column and read across to the required gallons per minute. Read to the highest value (in this case, 130 GPM). The chart indicates that a 1 1/4" double seated valve is required. To size 3-way valve, use single seated capacities 1/2" through 2" size.

## STEAM FLOW REQUIREMENTS SERIES 2000 TEMPERATURE REGULATOR

Temp. Rise °F	GALLONS OF WATER HEATED PER HOUR									
	25	50	75	100	150	200	300	400	500	750 1000
	LBS. OF STEAM PER HOUR									
10	2	4	6	8	12	17	25	33	42	63 83
20	4	8	12	17	25	33	50	67	83	120 167
30	6	12	19	25	37	50	70	100	120	190 250
40	9	17	25	33	50	66	100	130	170	250 330
50	11	21	31	42	63	84	125	170	210	310 420
60	13	25	37	50	75	100	150	200	250	370 500
80	17	33	50	67	100	130	200	270	330	500 670
100	21	42	63	83	120	170	250	330	420	630 830
120	25	50	75	100	150	200	300	400	500	750 1000
140	29	58	88	117	175	230	350	470	580	880 1170
160	33	66	100	133	200	270	400	530	660	1000 1330

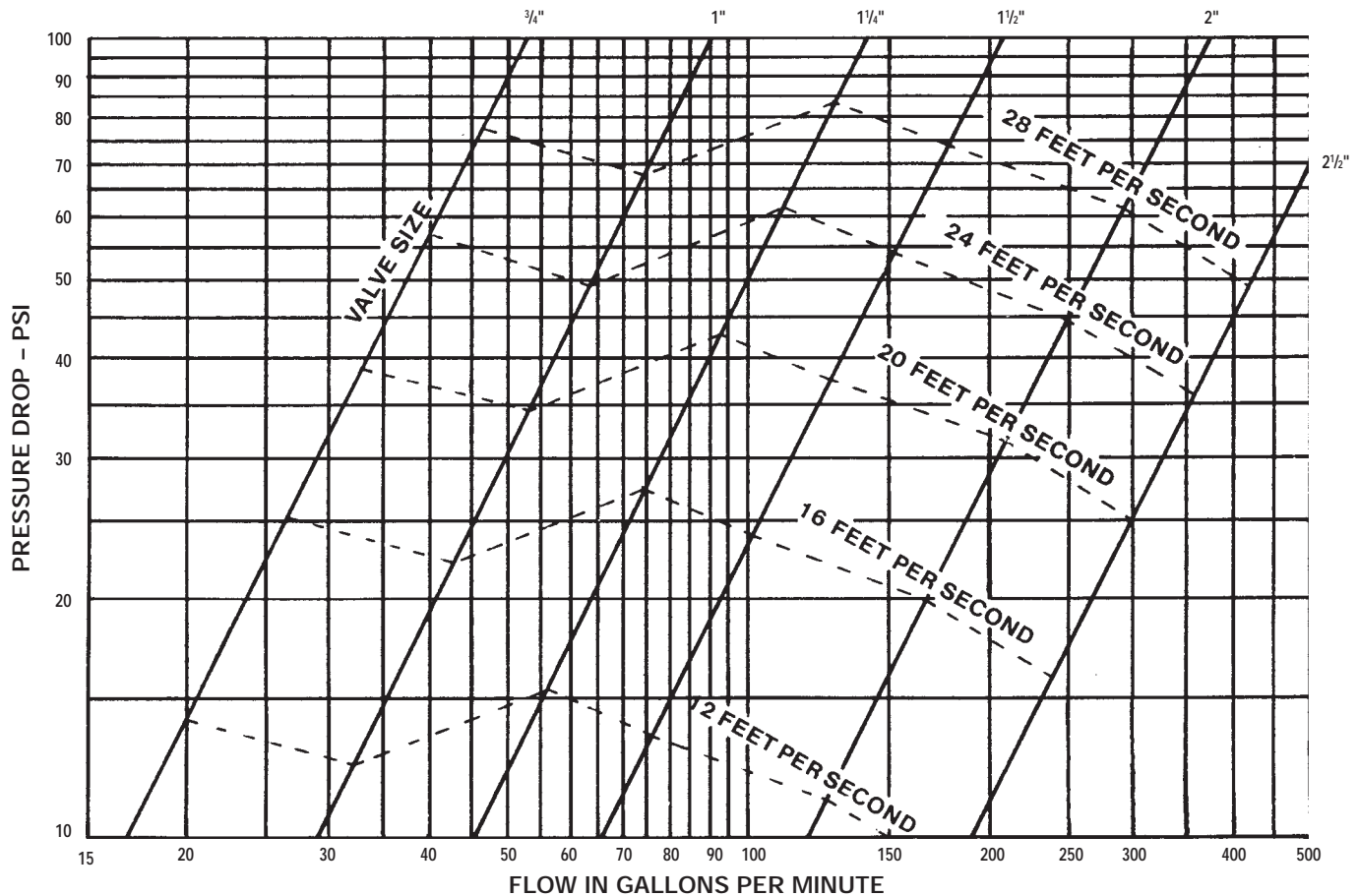
## RATED WATER CAPACITY TABLE SERIES 2000 TEMPERATURE REGULATOR

PSIG	SINGLE SEATED VALVES						DOUBLE SEATED VALVES					
	1/2	3/4	1	1 1/4	1 1/2	2	1/2	3/4	1	1 1/4	1 1/2	2
Diff. Press.	WATER FLOW-U.S. GALLONS PER MINUTE											
5	12	15	20	32	34	38	18	23	29	46	55	74
10	17	22	29	45	48	54	25	33	41	65	78	104
15	20	27	35	55	59	67	31	40	50	80	96	128
20	23	31	41	64	68	77	35	47	58	92	111	148
25	26	34	46	72	76	86	40	52	65	103	124	165
30	29	38	50	78	83		43	57	71	113	136	181
40	33	43	58	90			50	66	82	130	157	209
50	37	48	65				56	74	91	146	175	233
60	40	53	71				61	81	100	160	192	256
70	44	57					66	87	108	172	207	276
80	47	61					71	93	115	184	222	295
90	50	65					75	99	122	195	235	313
100	52						79	104	129	206	248	330
110	55						83	109	135	216	260	346
120	57						87	114	141	226	272	361
130	60						90	119	147	235	283	376
140	62						94	123	153	244	293	390
150							97	127	158	252	304	404
160							100	132	163	261	314	417
170							103	136	168	269	323	430
180							106	140	173	276	333	443
190							109	143	178	284	342	455
200							112	147	182	291	351	467
210							115	151	187	299	359	478
220							118	154	191	306	368	489
230							120	158	196	312	376	500
240							123	161	200	319	384	511
250							125	164	204	326	392	522

# RATED WATER CAPACITY CHART

## TYPE N6 DIFFERENTIAL PRESSURE VALVE

(Specific Gravity of 1)



# RATED WATER CAPACITY TABLE

## TYPE D34 VALVE

Water in GPM

PRESSURE DROP-psig	VALVE SIZE (inches)								
	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
5	7.4	17	23	32	48	71	116	188	263
10	10	24	33	45	68	101	164	266	373
15	13	29	40	55	84	124	201	325	457
20	15	33	47	64	97	143	233	376	528
30	18	41	51	79	118	175	285	460	646
50	23	53	74	102	153	226	368	594	834
75	29	65	90	125	187	277	450	727	1022
100	33	75	104	144	216	320	520	840	1180
125	37	84	116	161	241	358	581	939	1320
150	40	92	127	176	265	392	637	1029	1445
175	44	100	138	190	285	423	688	1111	1560

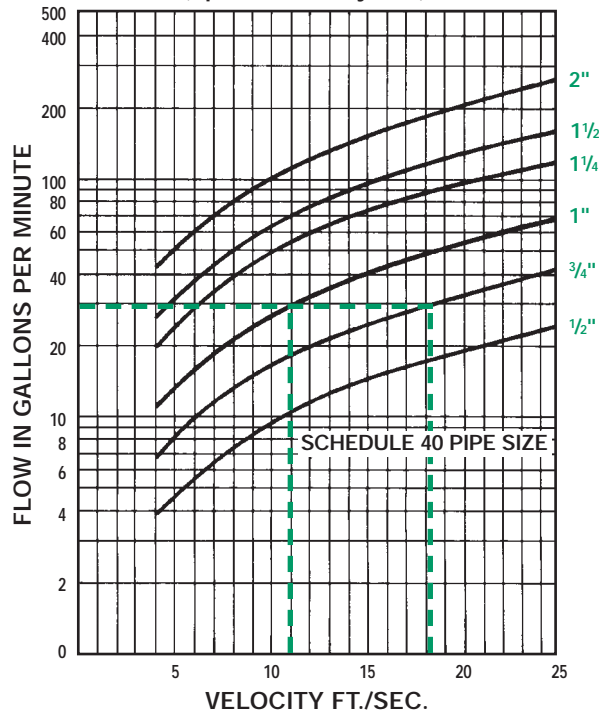
# SIZING D36 WATER PRESSURE REDUCING VALVE

## GENERAL CONSIDERATIONS

When sizing a water valve, the following points should be considered:

- The recommended velocity in the pipe (8-10 ft./sec.)
- The droop which is the fall-off pressure below the no flow pressure setting.

**FLOW VS. VELOCITY CHART**  
(Specific Gravity of 1)



## EXAMPLE

### SPECIFIED CONDITIONS

Initial Pressure	= 100 PSIG
Reduced No Flow Pressure	= 50 PSIG (lock-up pressure)
Capacity Required	= 30 GPM
Allowable Droop	= 10-15 PSIG

- Enter Capacities vs. Droop Chart, below, at 30 GPM. Move up until you intersect a curve line (possibly more than one curve). e.g. points (a), (b)...etc.

The lowest point indicates the minimum size valve required (3/4") at a droop of approximately 16 psi.

- Enter Flow vs. Velocity Chart (left) at 30 GPM and move up until you reach the 3/4" pipe size curve. Move downward and note that the velocity is approximately 18.5 ft./sec., which is unacceptably high.

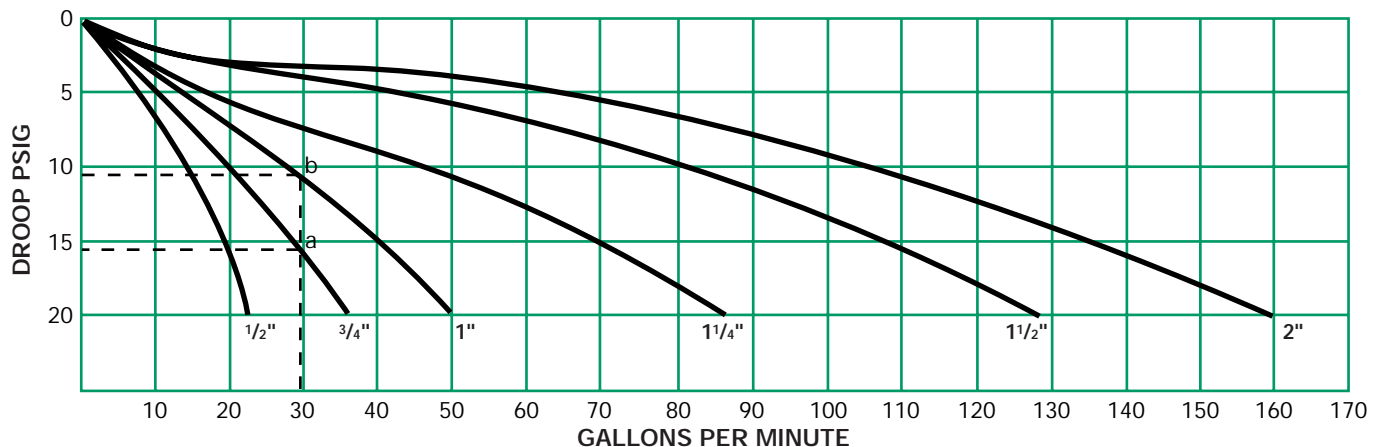
At the point of intersection of 30 GPM with the next valve curve (1"), the velocity will be approximately 11 ft./sec., which is closer to the recommended value.

Referring back to the Capacities vs. Droop Chart, you will find that the droop for a 1" valve is only 11 psig, which is also more acceptable.

### SELECT A 1" TYPE D36

NOTE: The capacities shown in the Capacities vs. Droop Chart are based on a difference of 50 psig or more between the initial pressure and the regulator lock-up pressure. Where this difference is less than 50 psig, deduct 20% from the capacity obtained.

**CAPACITIES VS. DROOP CHART**





# RATED STEAM, AIR AND WATER CAPACITY TABLE

## TYPE D50 DIRECT ACTING PRESSURE REGULATOR

VALVE SIZE		3/4"			3/4"			1"			1 1/4"			1 1/2"			2"		
PSI	Cv	2.2			3.3			4.9			5.0			10.1			10.8		
IN	OUT	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W
10	5	41	14	3	59	20	4.2	80	27	5.7	91	30	6.5	105	35	7.4	120	40	8.5
20	10	68	23	4.2	97	33	6.0	130	44	3.1	150	50	9.2	170	57	10	230	77	14
30	10	100	35	5.9	145	50	8.5	195	67	11	220	76	13	250	87	15	290	100	17
40	30	87	29	4.2	125	42	6.0	170	57	8.1	190	64	9	250	85	12	265	89	13
50		130	43	5.9	185	63	8.5	250	84	11	285	95	13	375	125	17	395	130	18
75		200	72	8.8	290	105	13	390	140	17	440	160	19	580	210	25	610	220	27
100		255	98	11	370	140	16	495	190	21	565	215	24	740	285	32	780	295	33
125		315	105	13	450	175	19	605	240	25	690	270	28	900	355	37	950	375	39
150		370	145	15	530	210	21	715	285	28	810	325	32	1065	425	42	1120	445	44
175		425	170	16	615	245	23	825	330	31	935	375	35	1230	495	46	1290	520	48
200	50	480	195	17	695	280	25	930	375	33	1060	430	38	1390	560	50	1460	590	52
250		595	240	20	855	350	28	1150	470	38	1305	535	43	1710	700	56	1800	735	60
60		115	38	4.6	165	55	6.6	250	85	10	260	87	10	355	120	14	395	130	16
75		190	63	7.2	275	92	10	420	140	16	430	145	17	585	195	23	655	220	25
85		230	77	8.5	335	110	12	510	170	19	525	175	20	715	240	27	800	270	30
100		280	96	10	410	140	15	625	215	23	645	220	23	875	300	32	1000	335	35
125		340	125	12	500	185	18	760	280	28	785	290	29	1070	390	39	1190	435	43
150	75	405	155	14	590	225	21	895	340	32	925	350	33	1260	480	45	1400	535	50
175		465	180	16	675	265	23	1030	400	36	1065	415	37	1450	565	50	1620	630	56
200		525	205	18	765	305	26	1170	460	39	1205	475	40	1640	650	55	1830	720	61
225		585	225	18	855	330	26	1300	500	39	1345	515	40	1830	705	55	2040	785	61
250		650	260	20	945	380	30	1440	580	45	1485	595	47	2020	815	65	2260	905	71
85		130	44	4.6	190	64	6.6	290	98	10	300	100	10	410	140	14	455	155	16
100		215	72	7.2	315	105	10	480	160	16	495	165	17	675	225	23	750	250	25
125	100	325	110	10	470	160	15	720	240	23	740	250	23	1010	340	32	1130	380	35
150		405	140	12	590	205	18	895	310	28	925	320	29	1260	440	39	1400	485	43
175		465	170	14	675	245	21	1030	375	32	1065	390	33	1450	530	45	1620	590	50
200		525	200	16	765	290	23	1170	440	36	1205	455	37	1640	620	50	1830	685	56
225		585	225	18	855	330	26	1300	500	39	1345	515	40	1830	705	55	2040	785	61
250		650	250	19	945	370	28	1440	560	42	1485	580	44	2020	790	60	2250	880	66
110		190	65	6	310	105	9	380	125	12	400	135	12	465	155	14	515	170	16
125	125	310	105	9	500	170	15	620	210	19	655	220	20	755	255	23	840	280	25
150		460	155	13	745	250	21	920	310	26	970	325	28	1120	375	32	1250	415	35
200		675	235	19	1095	385	30	1350	475	37	1430	500	39	1650	575	45	1830	640	50
225		755	275	21	1220	445	34	1510	550	41	1590	580	44	1840	665	50	2040	740	56
250		830	310	23	1350	505	37	1670	620	45	1760	655	48	2030	760	55	2250	840	61
135		210	70	5.9	340	115	9.5	420	140	12	440	150	12						
150		340	115	9.3	550	185	15	680	225	19	715	240	20						
175	140	500	165	13	810	270	21	995	335	26	1050	350	28						
200		635	210	16	1030	345	26	1270	425	32	1340	450	34						
225		755	255	19	1230	410	30	1510	505	37	1500	535	39						
250		830	295	21	1350	475	34	1670	585	41	1760	615	44						
160	140	315	105	8.3	510	170	13	630	210	17	665	225	17						
175		425	145	11	690	230	18	855	285	22	900	300	23						
200		580	195	14	940	315	23	1160	390	29	1220	410	30						
225		710	240	17	1150	385	28	1420	475	34	1500	505	36						
250		835	280	19	1350	455	31	1670	560	39	1760	590	41						

**S** — Steam (#/hr.)  
**A** — Air (SCFM)  
**W** — Water (GPM)

# SIZING D50 DIRECT ACTING PRESSURE REGULATOR

## EXAMPLE 1 FOR CONDITIONS WITHIN CAPACITY TABLE

Given an initial steam pressure of 100 PSIG and a required flow of 500 #/hr. at a reduced pressure of 30 PSIG, determine droop, minimum controllable flow pressure and valve size.

In the Capacity Table opposite, the droop has been fixed at 25% of the maximum range of the adjusting spring. Therefore, for a 30 PSIG delivery pressure, a 25-80 adjusting spring would be selected. Thus, the droop is (25% x 80 = 20) 20 PSI.

Minimum controllable flow pressure = Reduced Pressure + Droop = 30 + 20 = 50 PSIG

Entering the Capacity Table at a minimum controllable flow pressure (OUT) of 50 PSIG, an initial pressure (IN) of 100 PSIG, the smallest valve size capable of delivering 500 #/hr. is the 1" size.

## EXAMPLE 2 FOR CONDITIONS OUTSIDE CAPACITY TABLE

Given an initial steam pressure of 150 psig and a required flow of 900 #/hr. at a reduced pressure of 25 PSIG, determine the valve size, droop and minimum controllable flow pressure.

$$\frac{P_2}{P_1} = \frac{(25 + 14.7)}{(150 + 14.7)} = \frac{39.7}{164.7} = .24 \quad \text{thus } P_2 = .24P_1 < .58P_1$$

Therefore, use Critical Flow Cv formula:

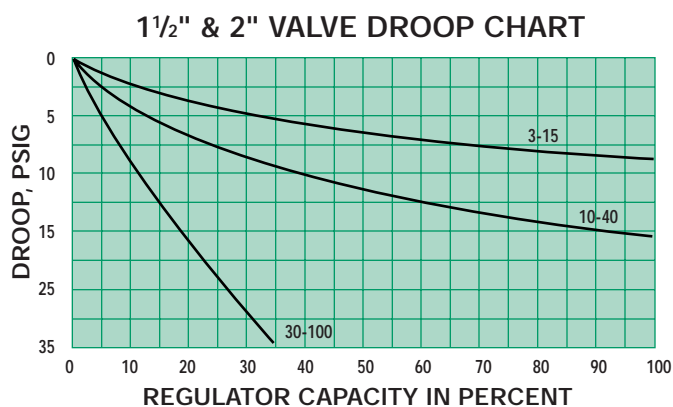
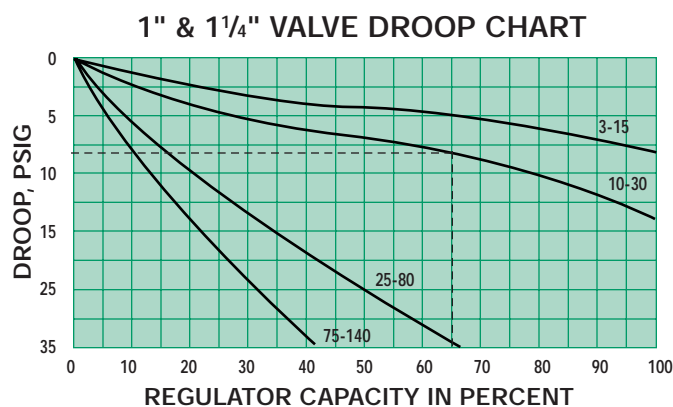
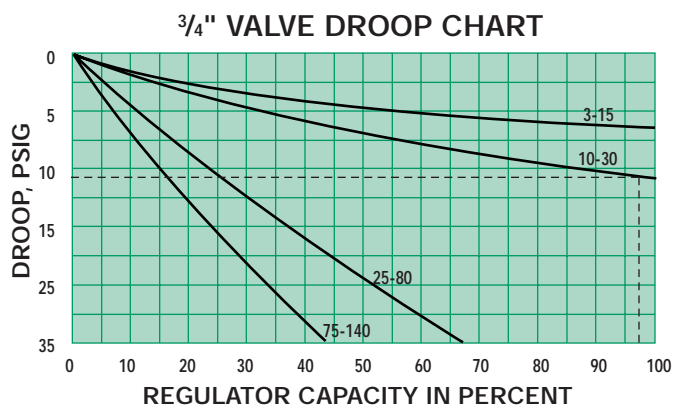
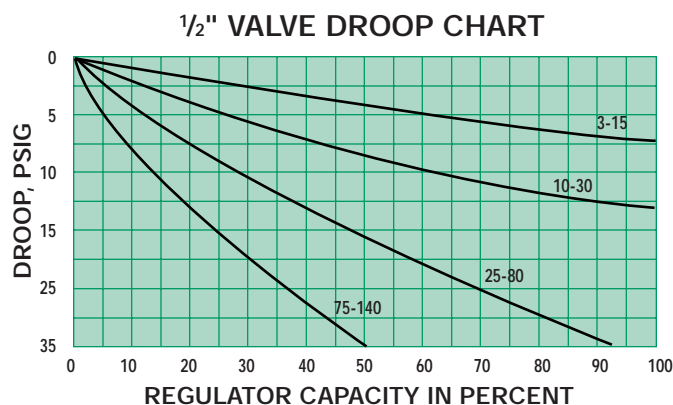
$$C_v = \frac{W}{1.71P_1} = \frac{900}{1.71(150 + 14.7)} = \frac{900}{1.71(164.7)} = 3.2$$

Referring to the  $C_v$  line of the Capacity Table opposite, the 3/4" valve size ( $C_v = 3.3$ ) is the smallest valve with the required capacity.

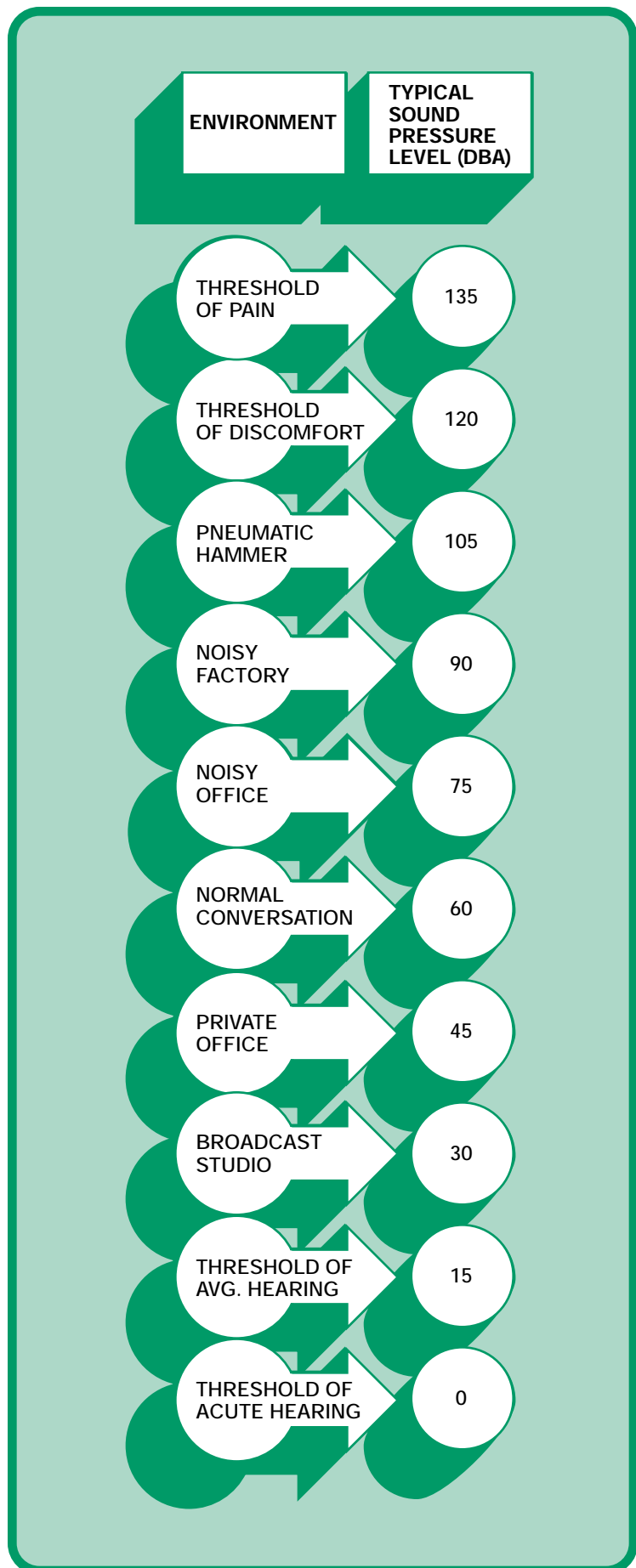
Droop is a function of valve size (3/4"), regulator capacity in percent [(3.2 ÷ 3.3) x 100 = 97%] and adjusting spring range (10-30). Enter the 3/4" Valve Droop Chart (below) at 97% and draw a line upward until you intersect the 10-30 curve. From there, draw a line left to the vertical axis. Droop in this case is 11 PSIG.

Minimum Controllable Flow Pressure = Reduced Pressure + Droop = 25 + 11 = 36 PSIG

Repeating the above procedure substituting a 1" valve size with a maximum  $C_v$  of 4.9, droop would be 8 PSIG and minimum controllable flow pressure would be 33 PSIG.



# STEAM PRESSURE REDUCING STATION NOISE REDUCTION



# INTRODUCTION TO NOISE REDUCTION

## WHY IS NOISE IMPORTANT?

Excessive noise is stressful to the human body and constitutes a serious health hazard. The Walsh-Healy Public Contracts Act and the Occupational Safety and Health Act have prompted system designers to pay careful attention to the noise generated by pressure reducing stations.

OSHA has established limits on the length of time any employee may be exposed to various sound levels. These limits are shown in Figure 1 below. For a typical eight hour working day, the limit is 90 dBA. OSHA does not provide sound level limits for periods longer than eight hours. Figure 1 extrapolates the OSHA limits to a full 24 hour day.

When daily exposure is composed of two or more at differing sound levels, their combined effect must be considered. In such cases, the sum of the ratios of actual to permissible exposure times must not exceed unity, that is:

$$\frac{t_1}{T_1} + \frac{t_2}{T_2} = \dots = \frac{t_n}{T_n} \leq 1$$

Where:

**T** = permissible time at specified noise level

**t** = actual time at specified noise level

**1, 2, ..., n** = differing noise levels

FIGURE 1: OSHA MANDATED NOISE EXPOSURE LIMITS\*

SOUND PRESSURE LEVEL (DBA)	115	110	105	100	95	90	85	82
PERMISSIBLE EXPOSURE (HOURS PER DAY)	1/4	1/2	1	2	4	8	12	24

\* Values for 12 and 24 hour per day exposure are extrapolated.

NOTE: Ear protection must be worn above 90 dBA.

## WHAT IS A DBA?

Sound results from pressure fluctuations in the air. The sound pressure level which the most sensitive listener can detect is about 20µN/m<sup>2</sup>. This level is normally taken as the reference point for the measurement of sound pressure levels.

Sound pressure level cover an enormous range of values. In order to compress this range, sound levels are usually expressed in decibels. A decibel (dB) is simply the logarithm of the ratio of two quantities. In this case, the two quantities are the sound

pressure level being measured and the reference level. The reference level is, by definition, 0 dB.

The human ear does not respond equally to all frequencies. It tends to be insensitive to very low and very high frequencies. Standard sound level meters are equipped with a scale which approximates the human ear's response. Sounds measured on this scale are expressed as A-weighted decibels (dBA). The dBA is commonly used in engineering work.

# IMPORTANT CHARACTERISTICS OF DECIBELS

## ADDING SOUND LEVELS

Since decibels express a logarithmic ratio, they cannot simply be added or subtracted. Figure 2 below provides a means of adding decibels without lengthy calculations.

To add two sound levels:

1. Determine difference between sound level
2. Find correction from Figure 2.
3. Add the correction to the **higher** sound level.

DECIBEL DIFFERENCE	0	1	2	3	4	5	6	7	8	9	10
DECIBEL CORRECTION	3.0	2.6	2.1	1.8	1.5	1.2	1.0	0.8	0.6	0.5	0.4

FIGURE 2

## SOUND LEVEL REDUCTIONS

Similarly, a 10% reduction in the decibel level does not represent a 10% reduction in absolute sound pressure level. For example, a reduction from 60 dB to 54 dB (a 10% dB reduction) produces a 50% reduction in the absolute sound pressure level. A

6 dB reduction always cuts the absolute sound pressure in half. The relationship between decibel and absolute sound pressure level reductions is summarized in Figure 3.

RELATIVE REDUCTION (dB)	1	2	3	4	5	6	10	20	40
ABSOLUTE REDUCTION (%)	11	21	29	37	44	50	68	90	99

FIGURE 3

## SOUND LEVELS DECREASE WITH DISTANCE

Sound ratings for reducing valves are conventionally established at a point three feet downstream from the valve's outlet and three feet from the outlet pipe's surface. At further distances from the pipe surface, the radiated sound drops off in intensity. Some typical values are shown below in Figure 4.

The values shown in Figure 4 assume that the valve is acoustically isolated from the surrounding structure. Sound can be transmitted throughout the structure with little attenuation if the piping system is not properly isolated or if surroundings are acoustically "hard". The piping system itself can also act as a conduit for sound.

DISTANCE FROM PIPE	3 Ft.	6 Ft.	12 Ft.	25 Ft.	50 Ft.
SOUND REDUCTION	0 dBA	3 dBA	6 dBA	9 dBA	12 dBA

FIGURE 4

# NOISE REDUCTION DESIGN GUIDELINES

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 bullhead tee connections.
6. Provide as much straight run of pipe on both sides of the 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 regulator body, piping and system components. Insulation reduces heat loss significantly and can provide moderate (3-6 dB) local noise attenuation. For greater noise reduction, use removable Spence Insulcap Jacket with lead lining on regulator body.
10. Use a Spence Noise Suppressor to reduce the propagation of noise via the downstream piping.

# SELECTING NOISE REDUCING DEVICES

## SOURCE TREATMENT

A Spence Muffling Orifice will reduce high flow pressure regulator noise by 6 to 10 dBA. Installed in the expanded down-

stream piping, the Muffling Orifice reduces the generation of noise at its source.

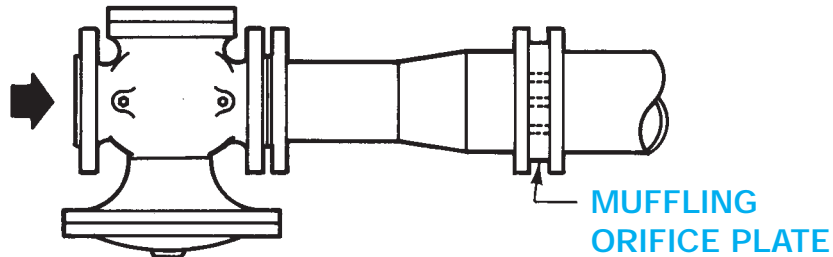


FIGURE 5A: SINGLE STAGE INSTALLATION WITH MUFFLING ORIFICE

## PATH TREATMENT

A Spence Noise Suppressor will reduce pipeline carried noise by 10 to 20 dBA. Installed at the regulator outlet, the

Suppressor absorbs noise generated by the pressure regulator and limits its propagation through the piping system.

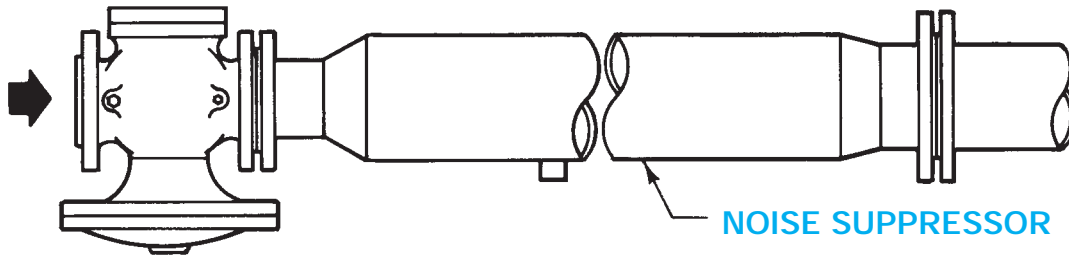


FIGURE 5B: SINGLE STAGE INSTALLATION WITH NOISE SUPPRESSOR

## SOURCE AND PATH TREATMENT

For maximum reduction of pipeline transmitted noise, the combined installation of a Spence Muffling Orifice and Spence Noise Suppressor will reduce the sound pressure level by 15 to 30 dBA.

Installation of a Spence Insulcap Jacket with lead lining on the regulator body will further reduce sound pressure levels.

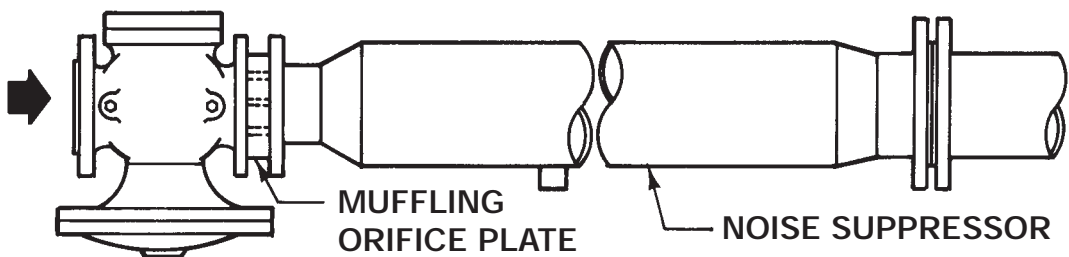


FIGURE 5C: SINGLE STAGE INSTALLATION WITH MUFFLING ORIFICE AND NOISE SUPPRESSOR

# SIZING NOISE REDUCTION COMPONENTS

## SELECTION OF SIZE AND TYPE OF COMPONENTS

### REGULATOR SIZE

1. Enter Saturated Steam Flow Table (opposite) at the specified **initial pressure**. Read across the first tabulated value which includes the specified steam flow. The regulator size at the head of this column is the minimum required to limit inlet velocity to 10,000 FPM.
2. Move up this column to the specified **reduced pressure** (chosen outlet pressure, if Muffling Orifice is used) and note the tabulated flow value. If the specified flow is more than three times the tabulated flow, the regulator's exit velocity will exceed 30,000 FPM. (Use a Spence Muffling orifice or a second stage reduction.)

### DELIVERY PIPE SIZE

Enter Saturated Steam Flow Table (opposite) at the specified reduced pressure. Read across to the first tabulated value which includes the specified steam flow. The pipe size at the head of this column is the minimum expanded pipe size to limit velocity to 10,000 FPM.

### MUFFLING ORIFICE SIZE

If a Noise Suppressor is installed, the Muffling Orifice size is the same as the regulator size. Otherwise, it is the same as the delivery pipe size.

### NOISE SUPPRESSOR SIZE

The inlet size of the Noise Suppressor is the same as the regulator size. The outlet size is the same as the delivery pipe size.

## EXAMPLE

### SPECIFIED CONDITIONS

Saturated Steam Flow = 5,000 lb/hr  
Initial Pressure = 100 PSIG  
Reduced Pressure = 15 PSIG

### REGULATOR SIZE

Entering Saturated Steam Flow Table (opposite) at 100 psig, the first tabulated value which includes 5,000 lb/hr is 5190 lb/hr. The head of this column indicates a 2½" regulator is required to limit inlet velocity to 10,000 FPM.

Moving up this column to 15 psig, the tabulated flow is 1440 lb/hr. Specified flow is 3.47 times the tabulated flow. The exit velocity for a 2½" regulator will be 34,700 FPM. The use of a Muffling Orifice is indicated.

### DELIVERY PIPE SIZE

Entering Saturated Steam Flow Table (opposite) at 15 psig, the first tabulated value which includes 5000 lb/hr is 6030 lb/hr. The delivery pipe size at the head of this column is 5". For this pipe size, flow velocity will be 8,290 FPM.

**ANSWER: 2½" SPENCE REGULATOR WITH MUFFLING ORIFICE,  
NOISE SUPPRESSOR AND 5" DELIVERY PIPE.**

NOTE: Regulators should always be protected by properly designed Strainers.

# CALCULATING VELOCITY

## VELOCITY FORMULA

The Saturated Steam Flow Tables (opposite) provide a convenient means of calculating flow velocity. The flows tabulated are based on 10,000 feet per minute (FPM) velocity. The velocities at other steam flows can be obtained by simple proportioning:

$$\text{Actual Velocity} = \frac{\text{Actual Flow}}{\text{Tabulated Flow}} \times 10,000 \text{ FPM}$$

## EXAMPLE

Pipe size = 5"  
Pressure = 15 psig  
Tabulated flow = 6,030 lb/hr  
Actual flow = 5,000 lb/hr

$$\text{Actual Velocity} = \frac{5,000}{6,030} \times 10,000 \text{ FPM} = 8,290 \text{ FPM}$$



# SATURATED STEAM FLOW TABLE

## (LB/HR) AT 10,000 FPM

### Based on Schedule 40 Pipe

#### SIZES 3/8" THROUGH 4"

PRESS. (PSIG)	TEMP (°F)	REGULATOR or PIPE SIZE (inches)									
		3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
-10	160	10	15	27	43	75	102	168	239	370	637
-5	192	21	33	58	94	162	221	364	519	802	1381
0	212	30	47	83	134	233	317	522	744	1149	1979
5	228	40	63	111	179	310	422	696	993	1533	2641
10	240	49	78	136	221	382	520	858	1224	1890	3254
15	250	58	92	162	262	454	617	1018	1452	2242	3860
20	259	67	106	187	303	524	713	1176	1678	2591	4461
25	267	76	121	212	343	594	809	1333	1902	2936	5057
30	274	85	135	237	383	664	903	1489	2124	3280	5649
40	287	102	163	286	463	801	1090	1797	2564	3959	6818
50	298	120	190	334	542	937	1276	2103	3000	4632	7976
60	308	137	218	382	620	1073	1460	2406	3434	5302	9130
70	316	154	245	430	697	1205	1641	2704	3859	5958	10260
80	324	171	272	478	774	1340	1824	3007	4290	6624	11407
90	331	188	299	525	851	1473	2005	3305	4716	7282	12540
100	338	205	326	573	928	1606	2186	3604	5141	7939	13671
125	353	247	394	691	1119	1937	2637	4346	6201	9575	16488
150	366	289	460	808	1309	2266	3085	5084	7254	11201	19288
175	378	331	528	926	1500	2597	3534	5826	8312	12834	22101
200	388	373	594	1043	1691	2926	3982	6564	9366	14461	24903
250	406	457	728	1277	2070	3582	4875	8035	11465	17703	30484
300	422	545	867	1522	2466	4269	5810	9576	13664	21098	36331
400	448	710	1130	1984	3215	5564	7574	12484	17812	27502	47360
500	470	884	1407	2469	4001	6925	9425	15535	22166	34225	58936
600	489	1061	1688	2963	4801	8310	11310	18642	26599	41070	70724

#### SIZES 5" THROUGH 24"

PRESS. (PSIG)	TEMP (°F)	REGULATOR or PIPE SIZE (inches)									
		5	6	8	10	12	14	16	18	20	24
-10	160	1001	1445	2502	3944	5599	6767	8839	11189	13903	20108
-5	192	2170	3133	5425	8552	12139	14671	19165	24258	30143	43597
0	212	3110	4492	7778	12260	17403	21033	27475	34778	43215	62503
5	228	4150	5993	10377	16357	23218	28061	36656	46398	57655	83388
10	240	5114	7385	12787	20156	28611	34578	45170	57175	71045	102755
15	250	6067	8761	15171	23913	33943	41023	53589	67831	84287	121908
20	259	7011	10124	17531	27633	39225	47406	61927	78386	97402	140876
25	267	7946	11475	19871	31321	44460	53732	70192	88847	110401	159677
30	274	8877	12820	22199	34990	49668	60027	78414	99255	123334	178382
40	287	10714	15473	26793	42231	59946	72449	94641	119795	148857	215297
50	298	12535	18102	31345	49407	70133	84760	110723	140151	174151	251881
60	308	14347	20719	35877	56551	80272	97014	126732	160414	199330	288298
70	316	16123	23284	40318	63551	90209	109024	142420	180272	224005	323986
80	324	17926	25887	44827	70658	100297	121215	158346	200431	249055	360217
90	331	19706	28458	49278	77674	110256	133251	174069	220332	273784	395983
100	338	21484	31025	53723	84680	120202	145271	189771	240207	298481	431704
125	353	25912	37419	64795	102132	144974	175210	228881	289712	359996	520675
150	366	30312	43773	75798	119476	169593	204964	267749	338910	421130	609095
175	378	34732	50157	86852	136900	194326	234855	306796	388335	482544	697921
200	388	39135	56515	97862	154253	218959	264625	345686	437560	543712	786390
250	406	47907	69182	119796	188827	268036	323938	423167	535634	665579	962649
300	422	57094	82449	142771	225041	319440	386063	504322	638359	793224	1147267
400	448	74426	107479	186112	293357	416413	503261	657420	832146	1034024	1495545
500	470	92620	133751	231607	365066	518202	626280	818123	1035560	1286785	1861122
600	489	111143	160501	277928	438079	621843	751536	981748	1242672	1544142	2233347

# NOISE REDUCTION COMPONENT FLOW COEFFICIENTS

1. Enter  $C_v$  Table below at the component's (regulator or orifice) **inlet pressure**. Read the tabulated value for  $W/C_v$  at the component's **outlet pressure**.

Note that the lowest outlet pressure listed for each inlet pressure corresponds to a critical pressure drop. An outlet pressure lower than this will not provide any further increase in flow.

2. Divide the specified steam flow by the tabulated  $W/C_v$  to obtain the regulator ( $C_{vR}$ ) or orifice ( $C_{vO}$ ) required flow coefficient.

Refer to Rated Steam Capacity Tables earlier in this Section for rated capacities and minimum pressure drops for Spence Regulators. The definition of component **inlet** and **outlet pressures** is below.

**FLOW FOR  $C_v = 1$  TABLE**  
( $W/C_v$  – LB/HR)

INLET PRESSURE (PSIG)	OUTLET PRESSURE (PSIG)	$W/C_v$	INLET PRESSURE (PSIG)	OUTLET PRESSURE (PSIG)	$W/C_v$	INLET PRESSURE (PSIG)	OUTLET PRESSURE (PSIG)	$W/C_v$	INLET PRESSURE (PSIG)	OUTLET PRESSURE (PSIG)	$W/C_v$
600	550	510	300	275	258	100	90	98.4	40	35	48.0
	500	706		250	357		80	136		33	56.2
	450	845		225	428		70	162		30	66.2
	400	953		200	483		60	183		25	79.0
	350	1040		175	527		55	191		20	88.8
	342	1050		168	538		52	196		17	93.6
550	500	488	250	225	236	90	80	93.8	30	25	43.1
	450	674		200	325		75	113		24	47.0
	400	805		175	388		70	129		22	53.6
	350	905		150	435		60	154		20	59.2
	325	947		145	433		50	173		15	70.2
	313	966		139	453		46	179		11	76.5
500	450	465	200	190	136	80	70	88.9	25	20	40.5
	400	640		175	211		60	122		19	44.1
	350	763		150	289		55	135		18	47.3
	325	812		125	342		50	145		15	55.3
	300	855		115	359		45	154		10	65.3
	284	881		110	367		40	162		8.3	67.9
450	400	440	175	165	128	70	60	83.8	20	15	37.7
	350	605		150	198		55	101		14	41.0
	325	666		125	270		50	115		13	43.9
	300	718		115	291		45	126		12	46.5
	275	763		100	317		40	136		10	51.2
	255	795		95	325		34	145		5.4	59.4
400	350	415	150	140	119	60	50	78.4	15	10	34.6
	325	500		125	183		45	94.3		9	37.6
	300	567		100	248		40	107		8	40.2
	275	623		90	267		35	117		7	42.6
	250	670		85	275		30	126		5	46.7
	226	709		81	282		29	128		2.5	50.8
350	300	387	125	115	109	50	45	52.4	10	5	31.3
	275	465		100	168		40	72.6		4	33.9
	250	527		90	194		35	87.0		3	36.2
	225	577		80	216		30	98.2		2	38.2
	200	619		75	225		25	107		0	41.7
	197	624		66	239		23	111		-0.4	42.3

## DEFINITION OF COMPONENT PRESSURE

COMPONENT	REGULATOR ONLY		REGULATOR PLUS ORIFICE	
	INLET PRESSURE	OUTLET PRESSURE	INLET PRESSURE	OUTLET PRESSURE
REGULATOR	Initial Pressure	Reduced Pressure	Initial Pressure	†
ORIFICE	N/A	N/A	†	Reduced Pressure

† Chosen regulator outlet/orifice inlet pressure. A rule of thumb is to choose this pressure so that regulator flow is barely subcritical.

# SOUND PRESSURE LEVEL (SPL) CALCULATIONS

## REGULATOR SOUND PRESSURE LEVEL

1. Enter Regulator Sound Pressure Level Chart  $L_1$  of SPLR at top of following page at the specified **initial pressure**. Move vertically to the specified **reduced pressure** (chosen outlet pressure, if Muffling Orifice is used). Read  $L_1$  to the left of this intersection.
2. Enter Regulator Sound Pressure Level Chart  $L_2$  of SPLR at bottom of following page at the required **regulator flow coefficient** ( $CV_R$ ). Move vertically to the delivery pipe size. Read  $L_2$  to the left of this intersection.
3. Regulator sound pressure level is:

$$SPLR = L_1 + L_2$$

NOTE: If SPLR exceeds specified limits, use a Muffling Orifice to reduce the regulator's pressure drop.

## MUFFLING ORIFICE SOUND PRESSURE LEVEL

1. Enter Muffling Orifice Sound Pressure Level Chart  $L_3$  of SPLO at top of following page at the chosen **orifice inlet** (regulator outlet) pressure. Move vertically to the specified **reduced pressure**. Read  $L_3$  to the left of this intersection.
2. Enter Muffling Orifice Sound Pressure Level Chart  $L_4$  of SPLO at bottom of following page at the required **orifice flow coefficient** ( $CV_O$ ). Move vertically to the orifice plate size. Read  $L_4$  to the left of this intersection.
3. Regulator sound pressure level is:

$$SPLO = L_3 + L_4$$

## COMBINED SOUND PRESSURE LEVEL

Combine **SPLO** and **SPLR** as follows:

1. Determine difference between **SPLO** and **SPLR**.
2. Find correction from dB Correction Table at right.
3. Add the correction to the **higher** SPL.

## EXAMPLE

### SPECIFIED CONDITIONS

Saturated Steam Flow = 5,000 lb/hr

Initial Pressure = 100 PSIG

Reduced Pressure = 15 PSIG

From the component sizing example on preceding pages, a 2½" regulator with a 5" Muffling Orifice is required. Choose an orifice inlet (regulator outlet) pressure of 55 PSIG (critical pressure is 52 PSIG).

Entering Flow for  $C_V=1$  Table on facing page at 100 PSIG,  $W/C_V = 191$  at 55 PSIG outlet pressure. Thus  $CVR = (5,000 \div 191) = 26.2$ .

Flow for  $C_V=1$  Table does not provide a listing for 55 PSIG inlet pressure. Using the critical pressures at both 60 PSIG and 50 PSIG, we estimate that  $W/C_V = (128 + 111) \div 2 = 120$ ; thus  $CV_O = (5,000 \div 120) = 41.7$ .

Entering  $L_1$  of SPLR Chart on following page at 100 PSIG,  $L_1 = 41$  at 55 PSIG outlet pressure. Entering  $L_2$  of SPLR Chart at  $CV_R = 26.2$ ,  $L_2 = 37$  at 5" pipe size. Thus  $SPLR = L_1 + L_2 = 78$  dBA.

Entering  $L_3$  of SPLO Chart on following page at 55 PSIG,  $L_3 = 52$  at 15 PSIG reduced pressure. Entering  $L_4$  of SPLO Chart at  $CV_O = 41.7$ ,  $L_4 = 16$  at 5" plate size. Thus  $SPLO = L_3 + L_4 = 68$  dBA.

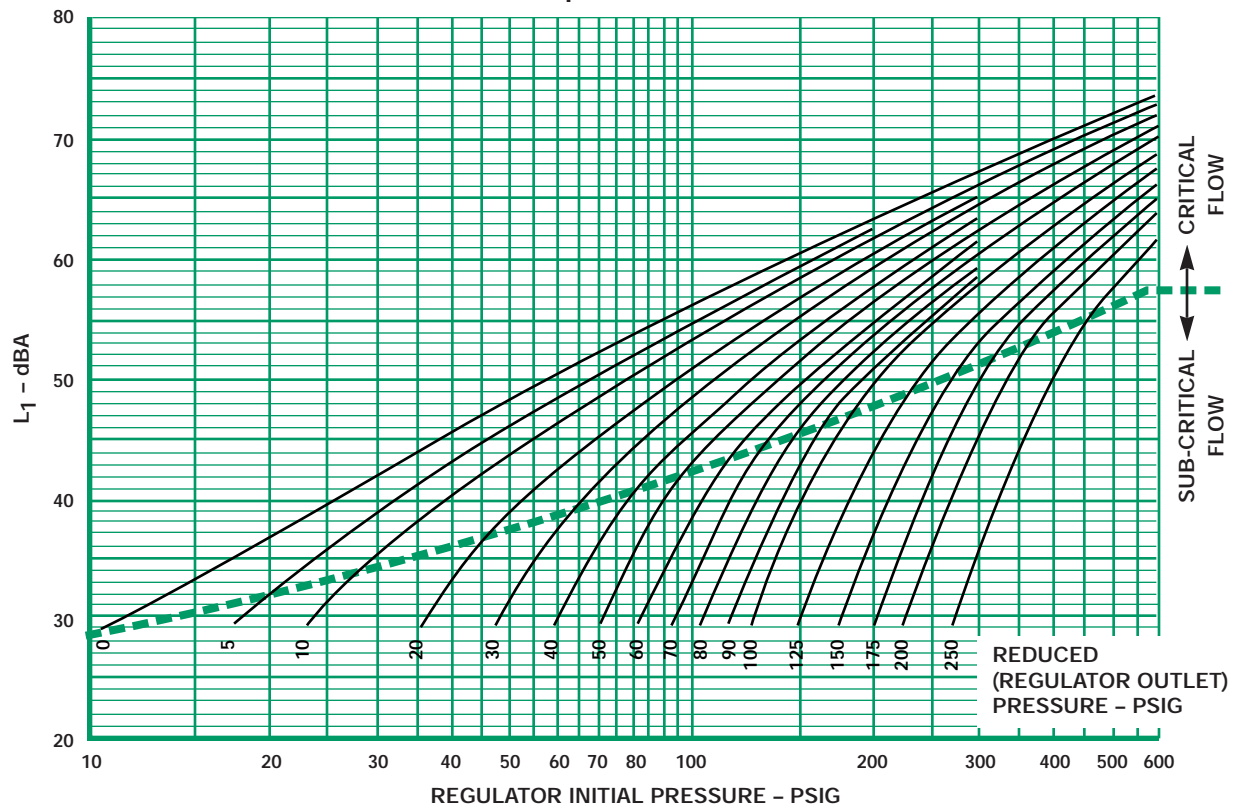
$SPLR - SPLO = 10$  dBA. From the dB Correction Table below, the decibel correction is 0.4 dB. Thus the combined SPL =  $SPLR + 0.4 = 78.4$  dBA.

**dB CORRECTION TABLE**

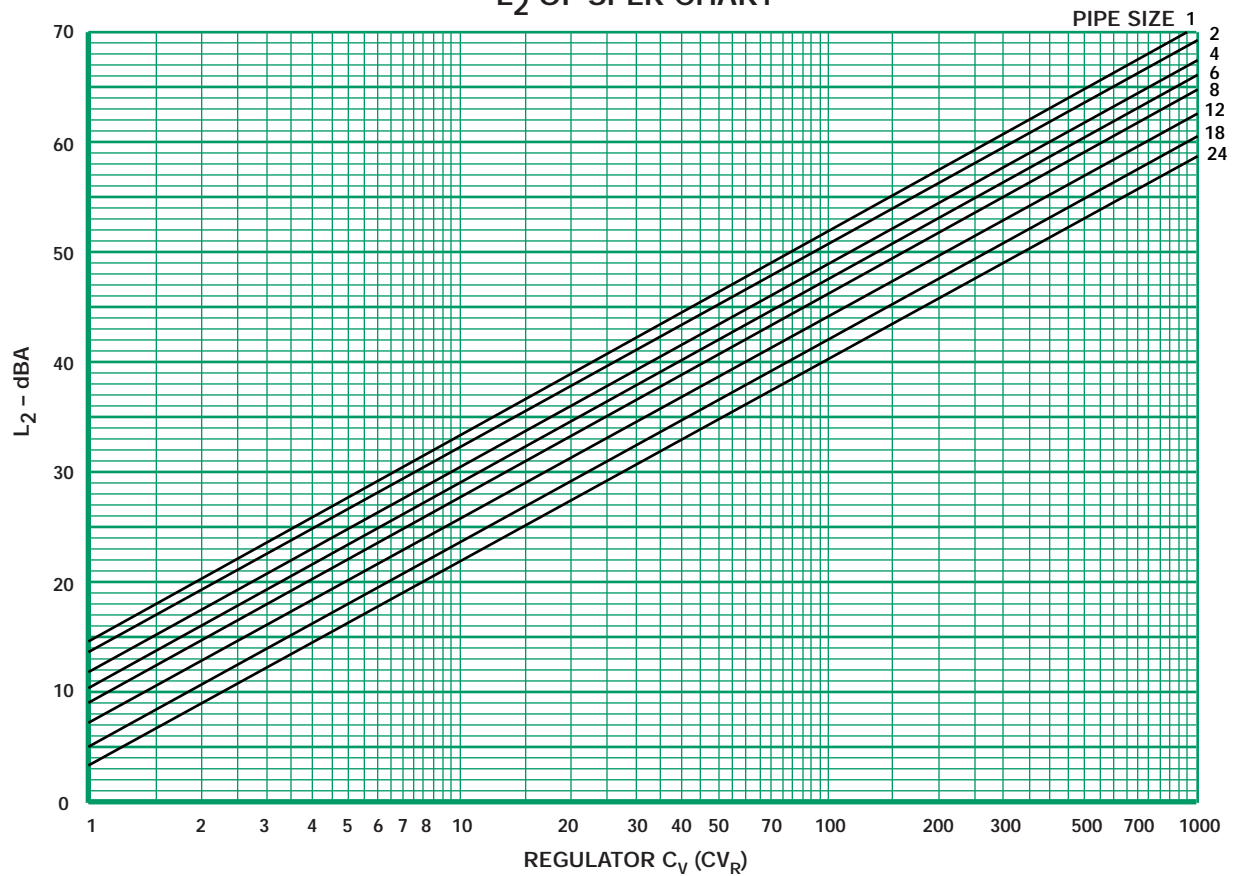
DECIBEL DIFFERENCE	DECIBEL CORRECTION
0	3.0
1	2.6
2	2.1
3	1.8
4	1.5
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4

# REGULATOR SOUND PRESSURE LEVEL CHARTS

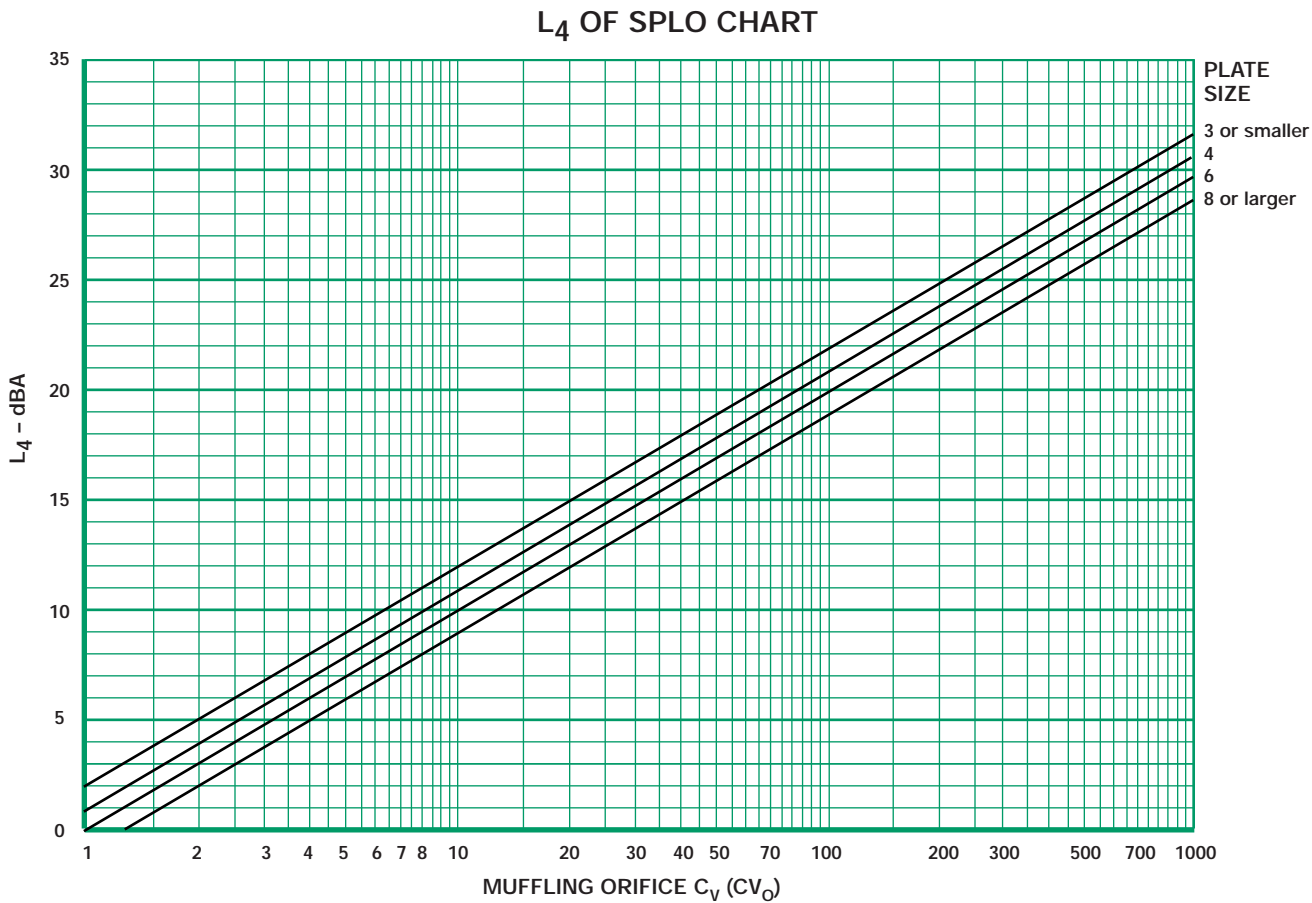
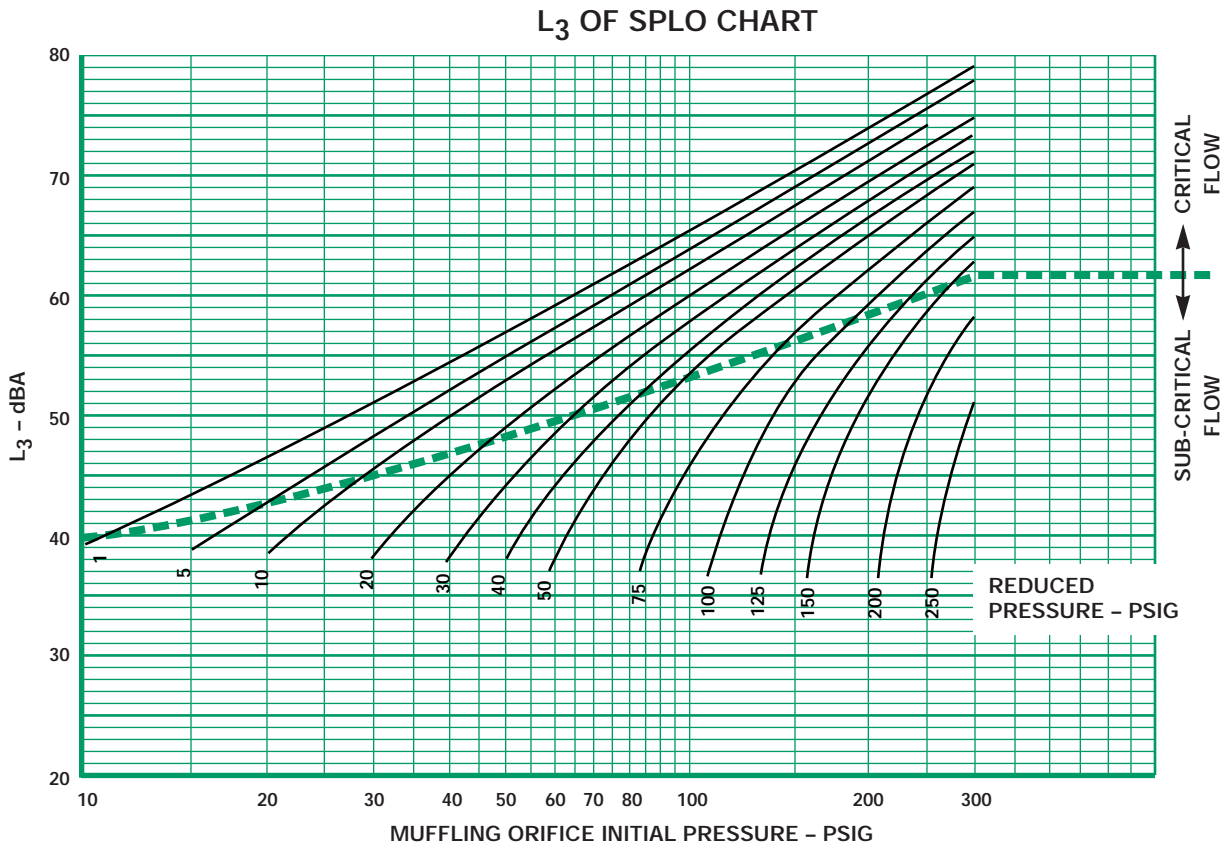
L<sub>1</sub> OF SPLR CHART



L<sub>2</sub> OF SPLR CHART



# MUFFLING ORIFICE SOUND PRESSURE LEVEL CHARTS



# RULES FOR SIZING DESUPERHEATERS

The required amount of cooling water to be injected into the superheated steam is the basis on which a Desuperheater size is determined. Since the heat gained by the injected cooling water equals the heat lost by the superheated steam, the required cooling water, G, in gallons per minute is calculated as follows:

$$G = \frac{W_S}{500} \times \frac{h_S - h_D}{h_D - (t - 32)} \text{ gpm}$$

Where:  $W_S$  = Superheated steam flow, lb per hour  
 $h_S$  = Total heat of the superheated steam, Btu per lb  
 $h_D$  = Total heat of the desuperheated steam, Btu per lb  
 $t$  = Temperature of the cooling water, °F

The values  $h_S$  and  $h_D$  may be taken from the Steam Tables on the inside back cover. Having determined the amount of cooling water, G, choice of the size unit may be made directly from the Selection table below.

Cooling water supply pressure must always be at least 75 psig higher than the pressure of the steam being desuperheated.

With Steam Atomizing Desuperheaters, the atomizing steam pressure must always be at least 50 psig higher than the pressure of the steam being desuperheated. Also, when there is more than approximately 100 psig difference between cooling water and atomizing steam pressures, a pressure reduction should be made on the higher of the two.

## SELECTION TABLE-STEAM ATOMIZING AND MECHANICAL ATOMIZING DESUPERHEATERS

	DIRECT OPERATED		PILOT OPERATED			
SIZE NUMBER	No. 1	No. 3	No. 3	No. 5	No. 6	No. 8
COOLING WATER CAPACITY, GPM	1.3	4.0	4.0	12	22	52
PIPE CONNECTIONS FOR COOLING WATER AND ATOMIZING STEAM	1/4"	1/2"	1/2"	1"	1 1/4"	2"
MINIMUM SIZE OF MAIN STEAM PIPE	3"	4"	4"	6"	8"	12"

## STEAM FOR ATOMIZATION

A source of higher pressure atomizing steam offers no problem on most desuperheater installations. Generally, the steam being desuperheated is at reduced pressure, having either been throttled by a reducing valve or extracted from an intermediate stage of a turbine.

When a pressure reduction is required in conjunction with desuperheating the steam, it is recommended that the reduction take place prior to desuperheating for the following reasons:

1. Auxiliary high pressure steam for atomization is immediately available.

2. The Pressure Regulator is not subject to a damaging accumulation of soluble salts precipitated by evaporation from the cooling water.
3. Elimination of resuperheating when the pressure reduction is after the point of superheat control.

If higher pressure steam is not available, a Mechanical Atomizing Desuperheater must be employed. The Injector Nozzle is identical with the Steam Atomizing Nozzle except that it does not have the advantage of secondary atomization into mist by the action of the steam.

# SPENCE MAIN VALVE SPECIFICATION TABLE

TYPES		SIZES, BODY MATERIAL <sup>a</sup> AND FACINGS								OTHER MATERIALS <sup>a</sup>						
		CAST IRON			CAST BRONZE	CAST STEEL				Diaphragm	SEAT RINGS		DISCS		Stem	Main Spring
		Screwed Ends	Flanged ANSI 125	Flanged ANSI 250	Screwed Ends	Screwed Ends	Flanged ANSI 150	Flanged ANSI 300	Flanged ANSI 600		Steam Service	Water, Oil, Air or Gas Service	Steam Service	Water, Oil, Air or Gas Service		
E	SIZES-INCHES	¾-2	1-12	1-12	¾-2	¾-2	1-12	1-12	½-8	Stainless Steel	316/420 <sup>d</sup>	316/420	304/420	Hycar	Stainless Steel or 17-4PH <sup>e</sup>	Carbon or Inconel <sup>f</sup>
	Max. Initial Pressure-psi	250	125	250	250	300	150	300	600							
	Max. Initial Temperature-°F	450	450	450	450	750	500	750	750							
	Min. Differential <sup>c</sup> -psi <sup>h</sup>	10/20	10/20	10/20	10/20	10/20	10/20	10/20	20							
E2	SIZES-INCHES	¾-2	1-12	—	¾-2	—	—	—	—	Hycar	316	—	304/420	—	Stainless Steel	Carbon Steel
	Max. Initial Pressure-psi	15	15	—	15	—	—	—	—							
	Max. Initial Temperature-°F	250	250	—	250	—	—	—	—							
	Min. Differential <sup>c</sup> -psi	3	3	—	3	—	—	—	—							
E5	SIZES-INCHES	¾-2	1-12	1-12	¾-2	¾-2	1-12	1-12	—	Hycar	316/420	316/420	304/420	304/420	Stainless Steel	Carbon Steel
	Max. Initial Pressure-psi	250	125	250	250	300	150	300	—							
	Max. Initial Temperature-°F	450	450	450	450	600	500	600	—							
	Min. Differential <sup>c</sup> -psi	5	5	5	5	5	5	5	—							
E6	SIZES-INCHES	¾-2	1-12	¾-2	—	—	—	—	—	Hycar	—	316/420	—	Hycar	Stainless Steel	Carbon Steel
	Max. Initial Pressure-psi	250	125	250	250	—	—	—	—							
	Max. Initial Temperature-°F	200	200	200	200	—	—	—	—							
	Min. Differential <sup>c</sup> -psi	10	10	10	10	—	—	—	—							
C20	SIZES-INCHES	1-2	2-12	2-12	—	—	—	—	—	Stainless Steel	303/304	303/304	303/304	303/304	Stainless Steel or 17-4PH <sup>e</sup>	Carbon or Inconel <sup>f</sup>
	Max. Initial Pressure-psi	250	125	250	—	—	—	—	—							
	Max. Initial Temperature-°F	450	450	450	—	—	—	—	—							
	Min. Differential <sup>c</sup> -psi	20	20	20	—	—	—	—	—							
C34	SIZES-INCHES	1-2	2-6	2-6	—	—	—	—	—	Hycar	—	303/304	—	Hycar	Stainless Steel	Carbon Steel
	Max. Initial Pressure-psi	200	165	200	—	—	—	—	—							
	Max. Initial Temperature-°F	200	200	200	—	—	—	—	—							
	Min. Differential <sup>c</sup> -psi	10	10	10	—	—	—	—	—							

<sup>a</sup> Main Valves for corrosive fluids or costly gases require special materials.

<sup>b</sup> Bronze body and blind flange only.

<sup>d</sup> Secoweld seat construction described in Options Section is regularly furnished for service pressures 400 psi and higher.

<sup>e</sup> 17-4 PH stems are furnished for service temperatures exceeding 600°F.

<sup>f</sup> Inconel springs are furnished for service pressures exceeding 400 psi and/or temperatures exceeding 600°F.

<sup>h</sup> Standard spring requires 20# minimum differential. Optional spring for 10# minimum differential.



# MATERIAL SPECIFICATIONS FOR MAIN VALVES & PILOTS

## MAIN VALVE & PILOT BODIES

Cast Iron.....	ASTM A126	Class B
Cast Carbon Steel.....	ASTM A216	WCB
Cast Bronze .....	ASTM B61	C92200

## STEEL PLATE FLANGES & HOODS-FLANGE QUALITY

.....	ASTM A285	Grade C
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## NUTS

Steel Valves .....	ASTM A194-79	Grade 2H
Cast Iron Valves.....	SAE J995	Grade 2

## STUDS

Steel Valves .....	ASTM A193-79a	Grade 2H
Cast Iron Valves.....	AISI 12L14	Ledloy

## CAP SCREWS

Cast Iron Valves.....	SAE J429	Grade 5
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MATERIAL	COMPONENT PARTS	COMPONENT USAGE		
St. Steel C304	Seat Rings	6" C20-up	ASTM A743-79	Grade CF-8
St. Steel C316	Seat Rings	6"-12" E	ASTM A743-79	Grade CF-8
St. Steel C420	Seat Rings	Up to 5" E	ASTM A743-79	Grade CA-40
St. Steel	Seat Rings	C20, C34, D34	ASTM A276-79a	AISI 303 & 304
St. Steel	Discs	Pilot	ASTM A276-79a	AISI 440C
St. Steel	Discs	6" & Up, includes parabolic	ASTM A276-79a	AISI303 & 304
St. Steel	Discs	Up to 5"	ASTMA582-79	AISI 420F
St. Steel	Stems	All Valves & Pilots	ASTM A276-79a	AISI 303
St. Steel	Stems	750°F E, Bot. GU. VAL. C20	ASTM A564-79	AISI 630 (17-4)
St. Steel	Diaphragms	All E's & Pilots	ASTM A167	AISI 301

## PRESSURE PILOT DIAPHRAGMS

PART NO.	MATERIAL	SIZE	USED ON PILOT TYPE
4-01621-0	Brz.	3½"	W, A88, D2
4-01623-0	St. Stl.	3½"	D, N, Q, A43, A53
4-07890-0	Brz.	3½"	A35, A, A81, SP/P
4-01626-0	St. St.	3½"	P13, N4, F13, N24
4-01627-0	Brz.	4½"	A43, A84, A86, A93
4-01629-1	St. Stl.	4½"	P14, P110, Q43, F14
4-01630-0	Brz.	5¾"	A53, A5, P95, A85
4-01632-0	St. Stl.	5¾"	A92, P15, A54, F15
4-10721-0	Brz.	5¾"	D5, Q5, A35
4-03927-0	St. Stl.	5¾"	Q35, A81, A82
4-01633-0	Brz.	7¼"	A73, A70, A75, A87
4-01635-0	St. Stl.	7¼"	A73
4-09685-0	Brz.	4½"	D120, A92, D234
4-01659-0	St. Stl.	4½"	A54, F46

## TYPE E MAIN VALVE DIAPHRAGMS

VALVE SIZE	PART NO.		DIA.
	ST. STL.	BRZ.	
⅜ & ½	4-01629-1	4-01627-0	4½
¾	4-01662-0	4-01660-0	5⅛
1	4-01632-0	4-01630-0	5¾
1¼	4-01664-0	4-09678-0	6½
1½	4-01635-0	4-01633-0	7¼
2	4-01638-0	4-09679-0	8⅛
2½	4-01641-0	4-09680-0	9
3	5-02038-0	4-09681-0	10
4	5-01647-0	4-09682-0	13
5	5-01649-0	4-09683-0	15
6	5-01651-0	5-09684-0	17½
8	5-01653-0	—	20
10	4-02096-0	—	25
12	5-01656-0	—	30

## PRESSURE PILOT SPRINGS

PART NO.	DELIVERY PRESSURE	SPRING COLOR	WIRE DIAMETER	USED ON PILOT TYPE
5-05007-0	1 - 10	Aluminum	3/16"	D5, Q5
5-05007-0	3 - 20	Aluminum	3/16"	D, N, N33, Q, N20
5-05003-0	5 - 25	Orange	1/4"	D5, Q5
5-05016-0	5 - 25	Uncolored	7/32"	D120
5-05003-0	5 - 50	Orange	1/4"	D, N, N33, Q,
5-05028-0	10-75	Uncolored	5/16"	D120
5-05005-0	10 - 100	Green	5/16"	D, N, N33, Q, N20
5-05012-0	20 -150	Black	11/32"	D, N, N33, Q, N20
5-04990-0	100-300	Uncolored	7/16"	D2, N2, Q2
5-05030-0	40 - 150	Uncolored	3/8"	D120

The number of E Main Valve Diaphragms per set is as follows:

Initial Pressure	# per Set
10 - 250	2
250 - 400	3
400 - 600	4

The Number of Diaphragms per set for Pilots varies with the type and delivery pressure. Consult factory.

# AUXILIARY FITTINGS

## BLEEDPORTS

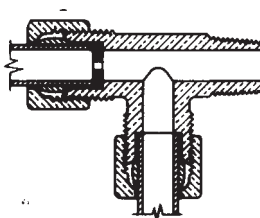
For steam, air and gas service, a 3/32" bleedport orifice is used for main valve sizes up to 8". For 10" and 12" main valve sizes, a 1/8" bleedport orifice is used. If the initial pressure or pressure drop is less than 15 psig, the orifice is reduced to 1/16". For liquids: fuel oil utilizes a 3/32" bleedport and all other fluids utilize a 1/16" bleedport regardless of pressure conditions. For main valve sizes up to 8" on long pressure drops, the orifice is sometimes increased to 1/8" to eliminate hunting or to make the valve close faster and open slower.



4A BLEEDPORT



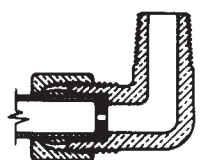
1A UNION  
BLEEDPORT



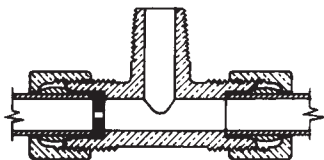
8A BLEEDPORT  
TEE

## RESTRICTIONS

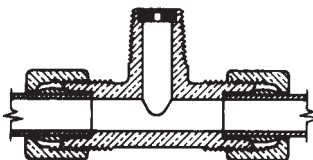
Spare restriction fittings can be supplied blank and drilled for a particular main valve according to the table. If the initial pressure or pressure drop is less than 15 psi, an open fitting is used. All back pressure valves employ an open fitting. For liquid services (except back pressure) the restriction orifice is 1/16" for all sizes of main valves.



5A RESTRICTION  
ELBOW



7A SAFETY PILOT  
RESTRICTION TEE



7C ANTI-FREEZE  
RESTRICTION TEE

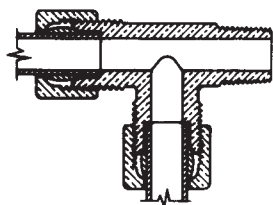
## RESTRICTION ORIFICES\*

MAIN VALVE SIZE	ORIFICE DRILL SIZE	DECIMAL EQUIVA- LENT
3/8	60	.0400
1/2	60	.0400
3/4	60	.0400
1	60	.0400
1 1/4	58	.0420
1 1/2	58	.0420
2	56	.0465
2 1/2	56	.0465
3	53	.0595
4	51	.0670
5	47	.0785
6	45	.0820
8	42	.0935
10	17	.1730
12	7	.2010

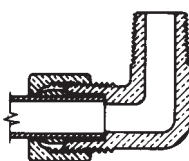
\* Steam, Air & Gas.

If the initial pressure or pressure drop is less than 15 psi, a No. 5A elbow with orifice removed is used

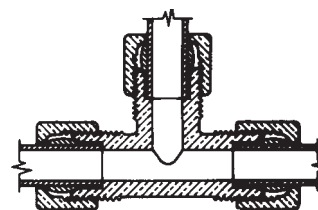
## OPEN FITTINGS



8B TEE



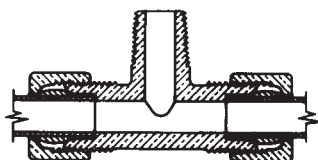
5B ELBOW



9B TUBING TEE



4B COUPLING



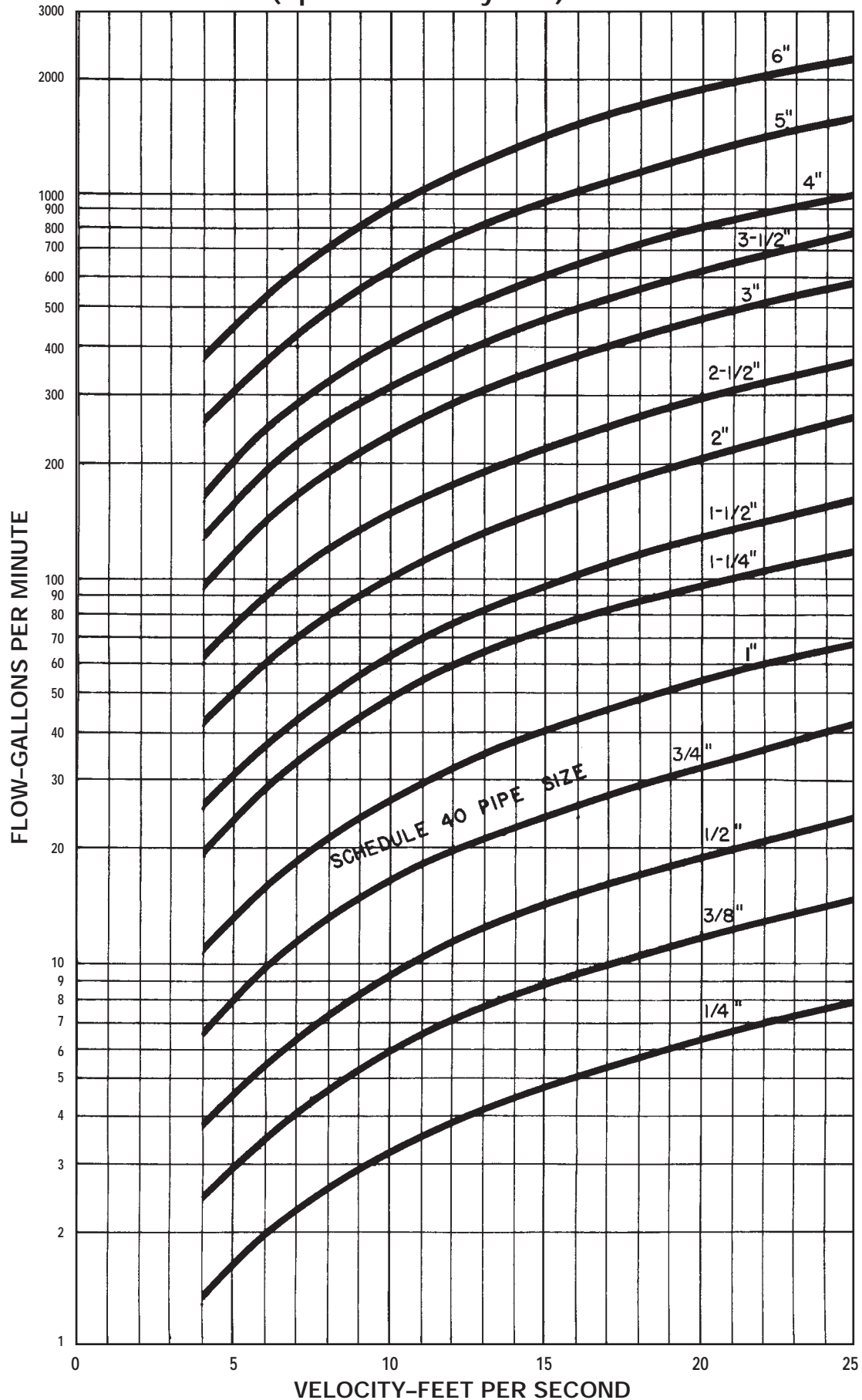
7B TEE



1B UNION

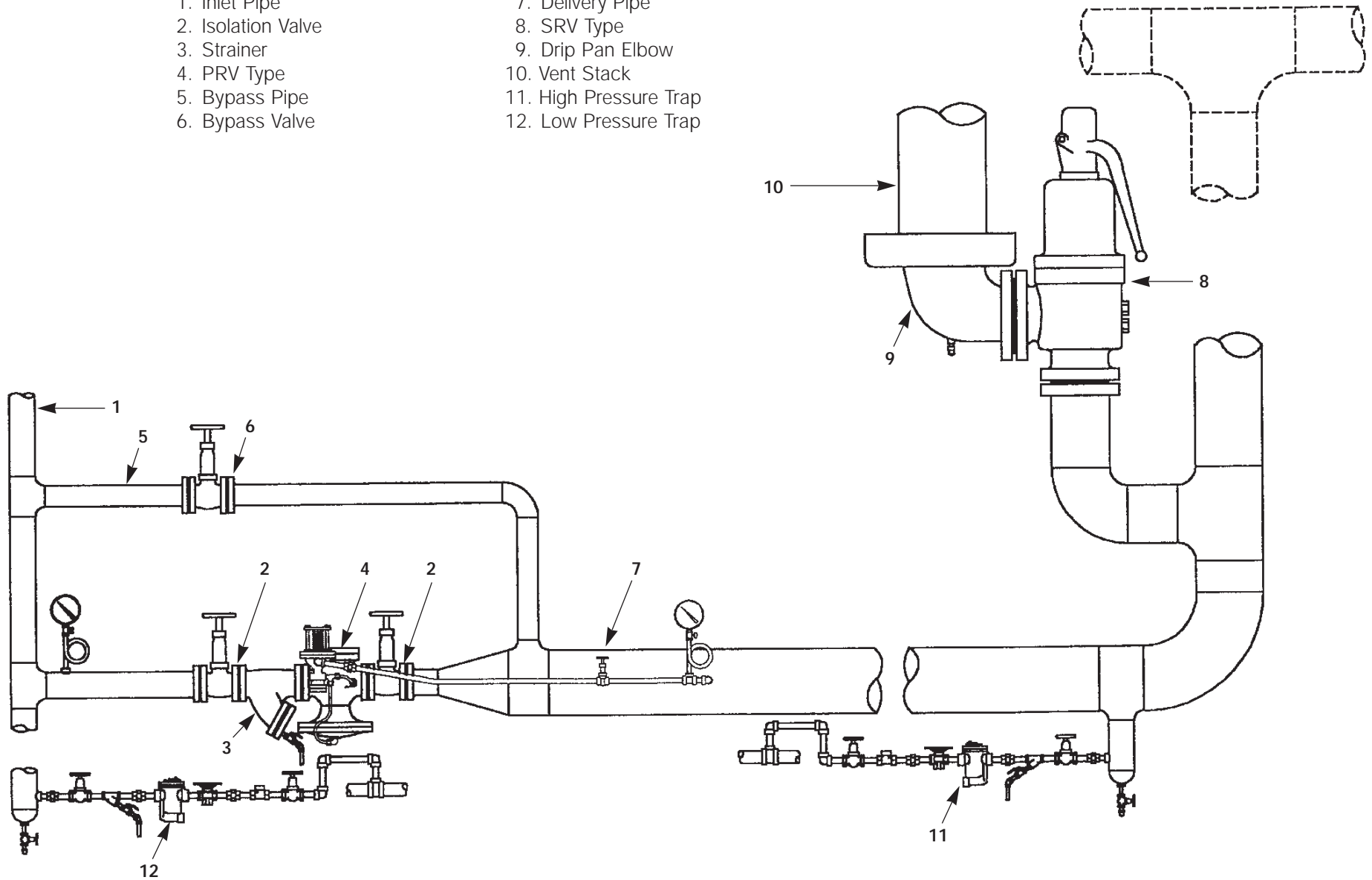
# FLOW VS. VELOCITY CHART

(Specific Gravity of 1)



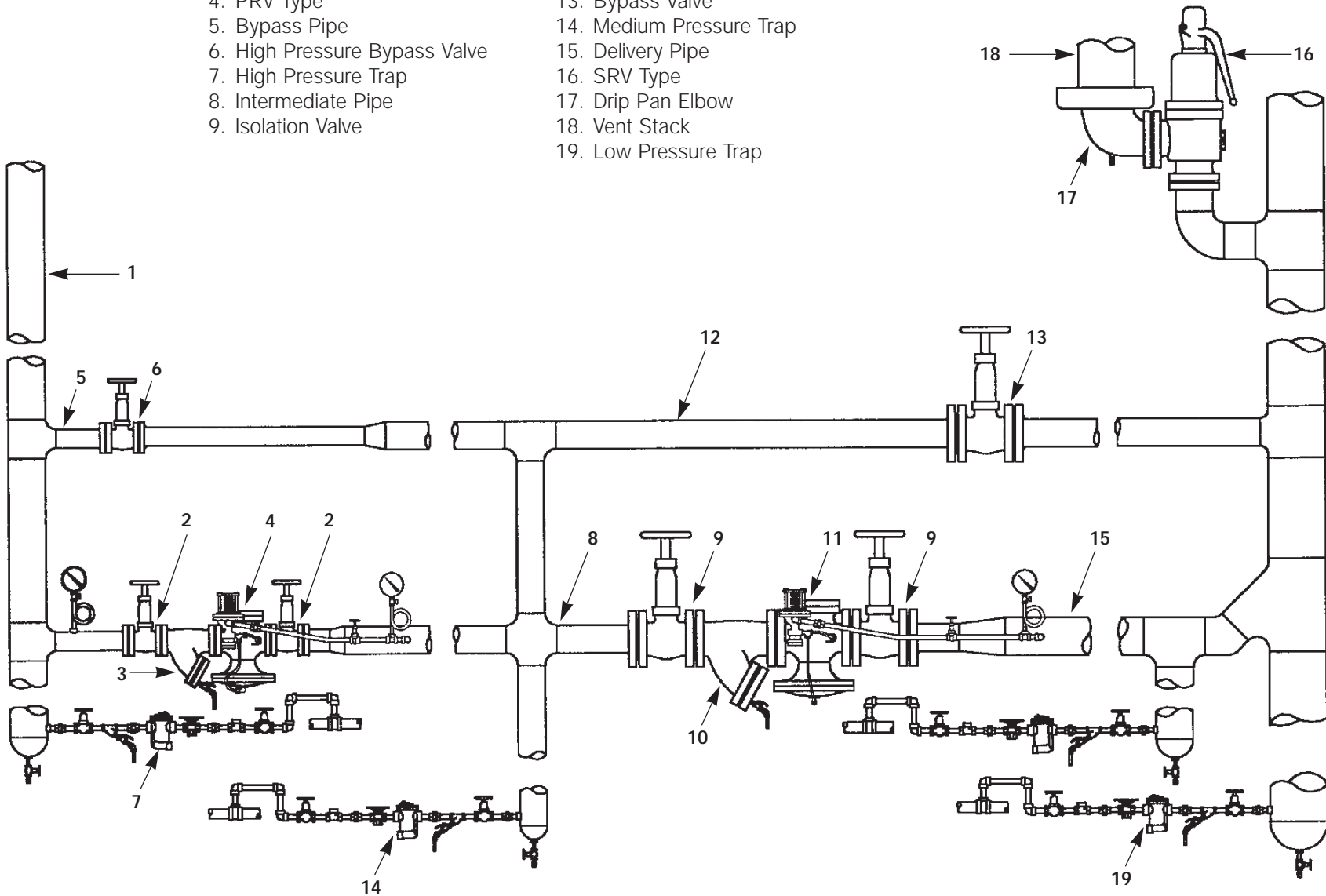
# SPENCE SINGLE STAGE PRESSURE REDUCING STATION

- |                    |                        |
|--------------------|------------------------|
| 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. High Pressure Trap |
| 6. Bypass Valve    | 12. Low Pressure Trap  |



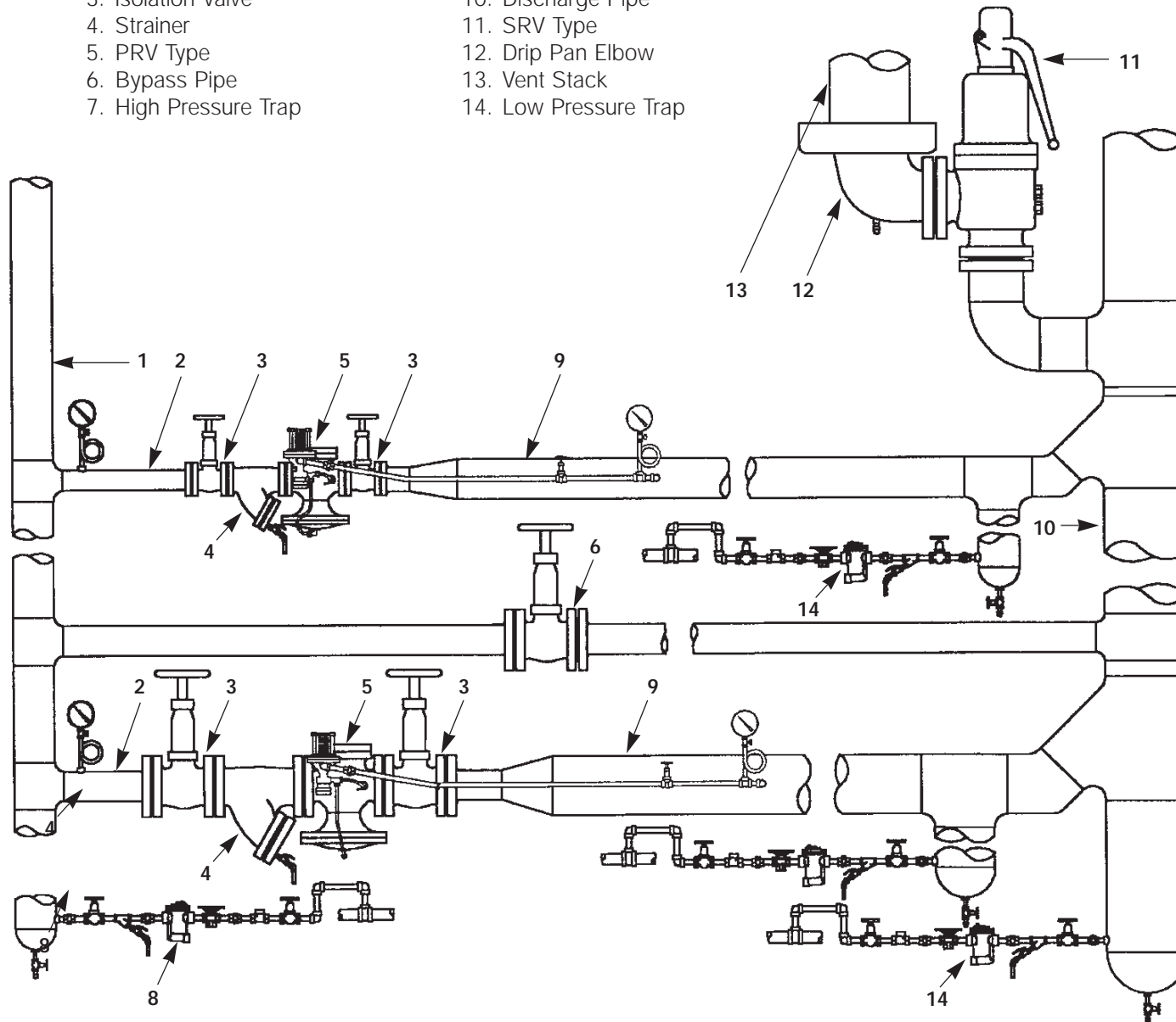
# SPENCE TWO STAGE PRESSURE REDUCING STATION

- |                               |                          |
|-------------------------------|--------------------------|
| 1. Inlet Pipe                 | 10. Strainer             |
| 2. Isolation Valve            | 11. PRV Type             |
| 3. Strainer                   | 12. Bypass Pipe          |
| 4. PRV Type                   | 13. Bypass Valve         |
| 5. Bypass Pipe                | 14. Medium Pressure Trap |
| 6. High Pressure Bypass Valve | 15. Delivery Pipe        |
| 7. High Pressure Trap         | 16. SRV Type             |
| 8. Intermediate Pipe          | 17. Drip Pan Elbow       |
| 9. Isolation Valve            | 18. Vent Stack           |
|                               | 19. Low Pressure Trap    |



# SPENCE SINGLE STAGE PARALLEL PRESSURE REDUCING STATION

- |                       |                       |
|-----------------------|-----------------------|
| 1. Supply Pipe        | 8. Intermediate Pipe  |
| 2. Inlet Pipe         | 9. Delivery Pipe      |
| 3. Isolation Valve    | 10. Discharge Pipe    |
| 4. Strainer           | 11. SRV Type          |
| 5. PRV Type           | 12. Drip Pan Elbow    |
| 6. Bypass Pipe        | 13. Vent Stack        |
| 7. High Pressure Trap | 14. Low Pressure Trap |

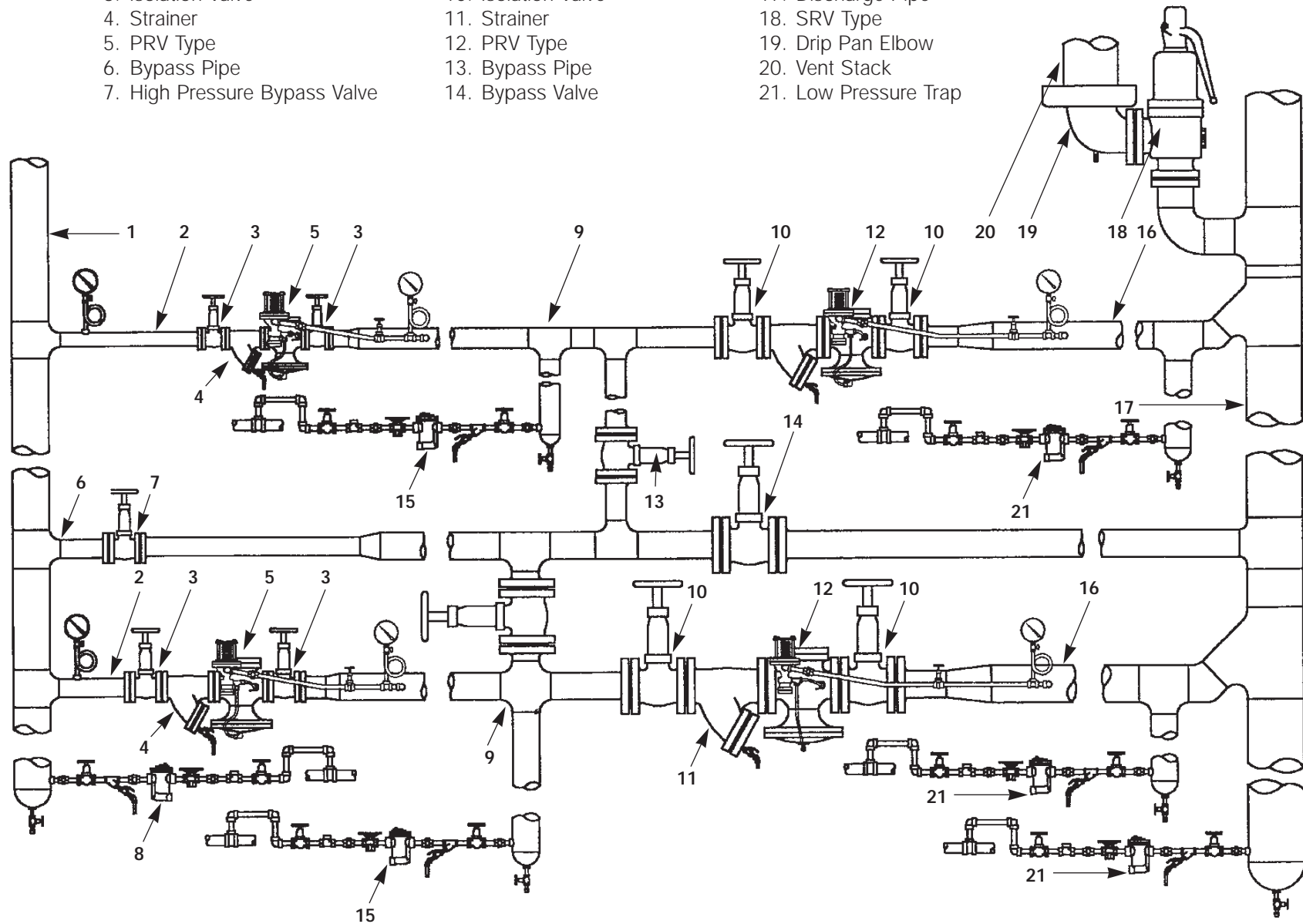


# SPENCE TWO STAGE PARALLEL PRESSURE REDUCING STATION

1. Supply Pipe
2. Inlet Pipe
3. Isolation Valve
4. Strainer
5. PRV Type
6. Bypass Pipe
7. High Pressure Bypass Valve

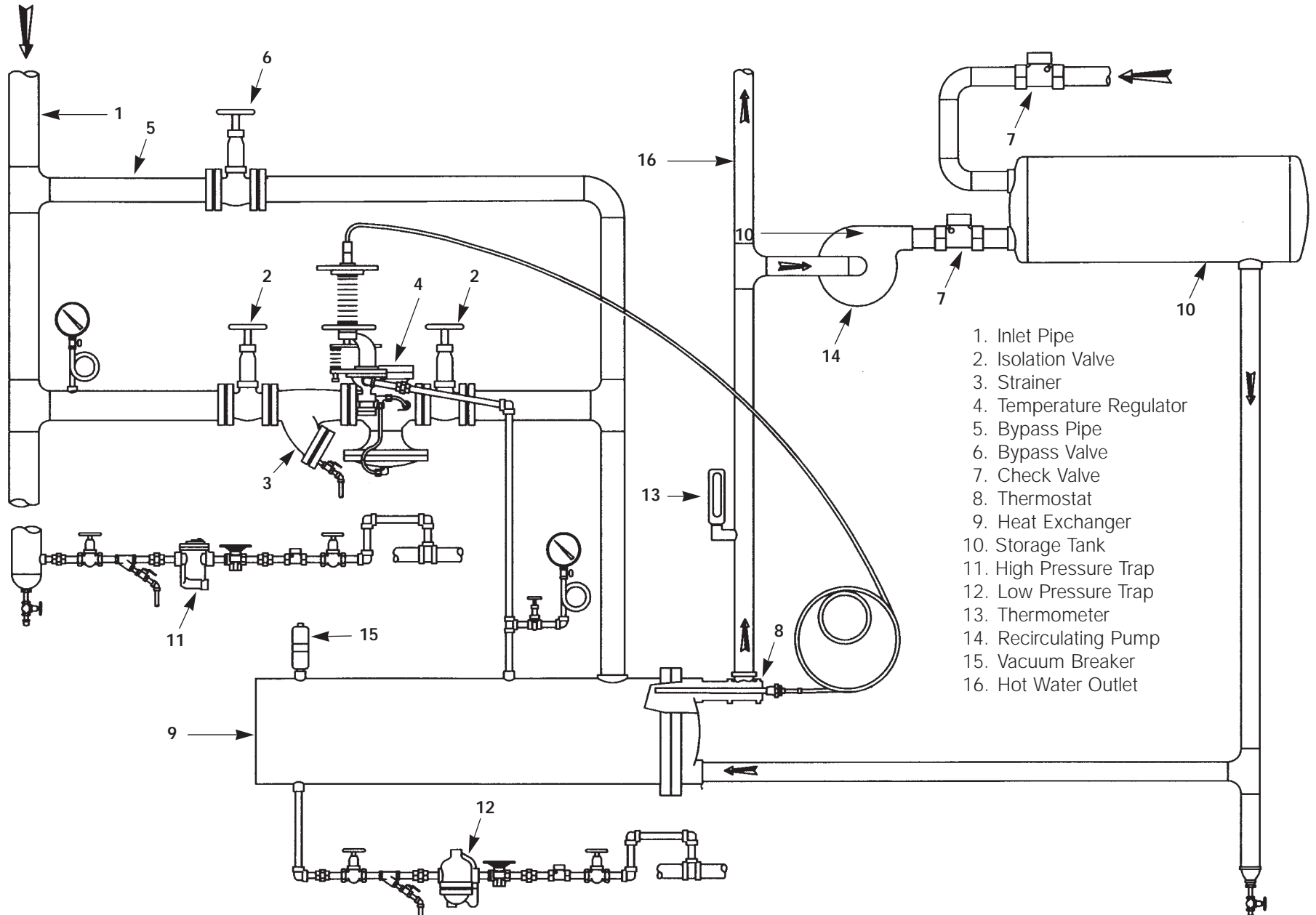
8. High Pressure Trap
9. Intermediate Pipe
10. Isolation Valve
11. Strainer
12. PRV Type
13. Bypass Pipe
14. Bypass Valve

15. Medium Pressure Trap
16. Delivery Pipe
17. Discharge Pipe
18. SRV Type
19. Drip Pan Elbow
20. Vent Stack
21. Low Pressure Trap





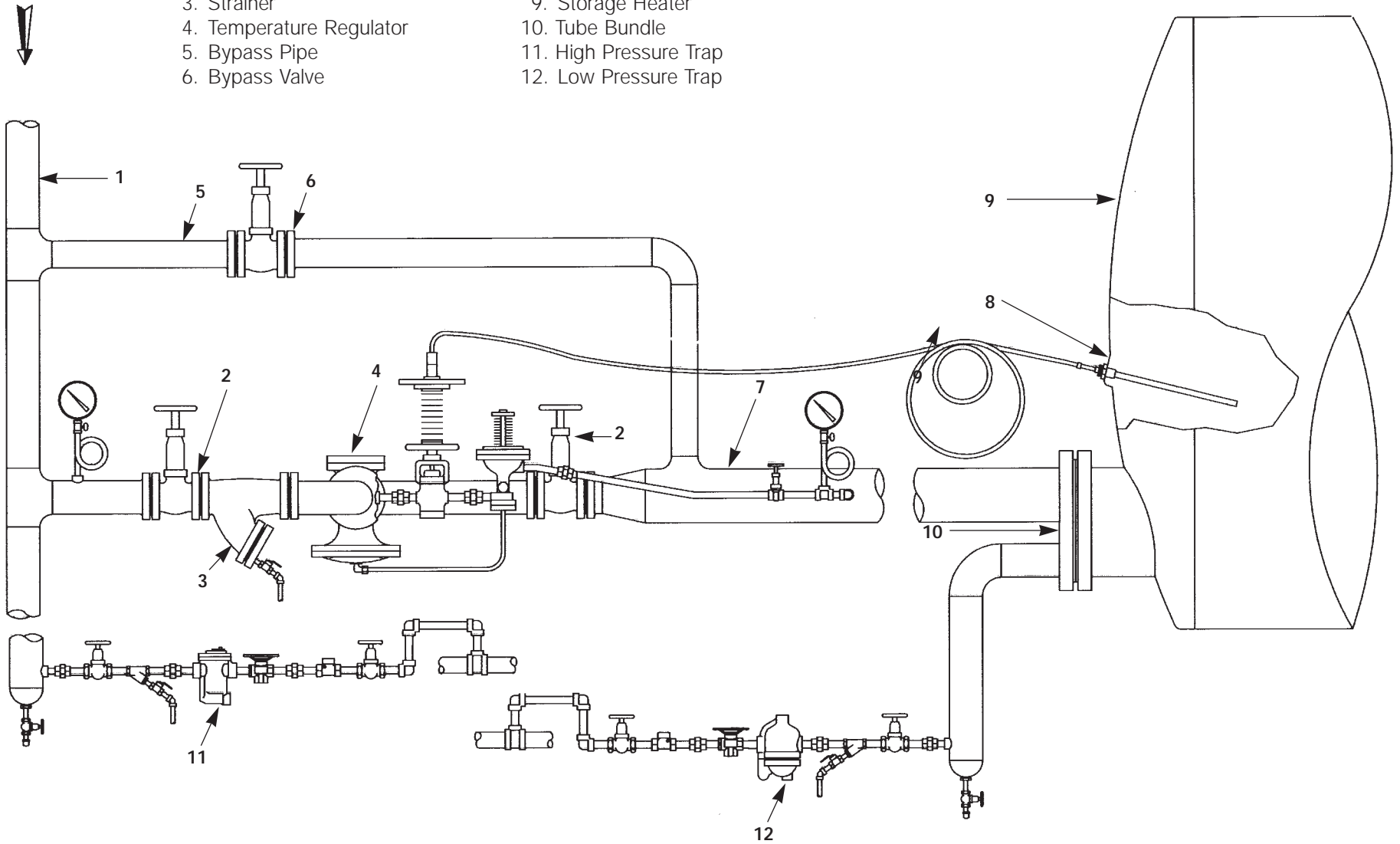
# SPENCE TYPICAL INSTALLATION FOR INSTANTANEOUS HEATER



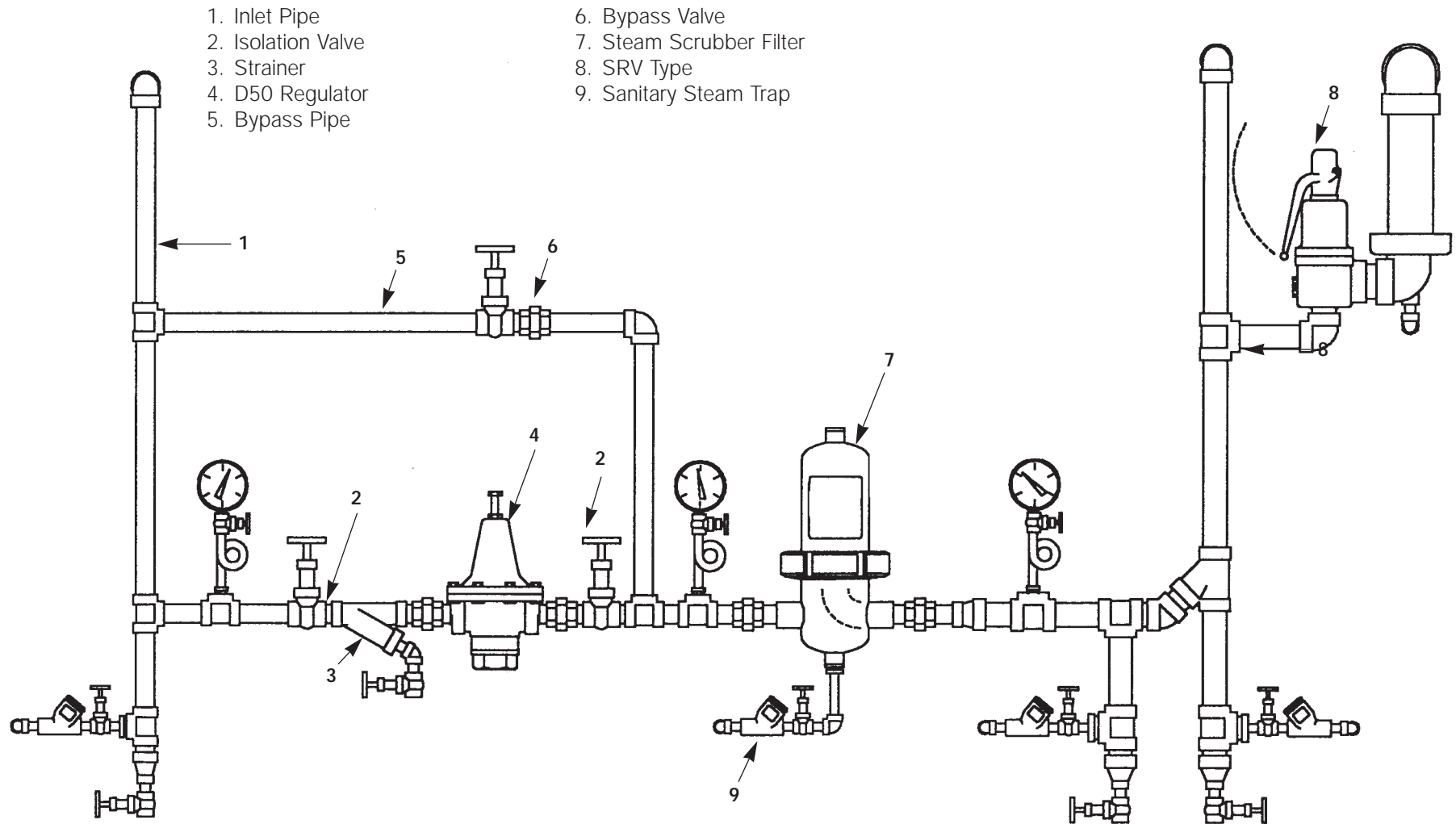
# SPENCE TYPICAL INSTALLATION FOR STORAGE HEATER

1. Inlet Pipe
2. Isolation Valve
3. Strainer
4. Temperature Regulator
5. Bypass Pipe
6. Bypass Valve

7. Delivery Pipe
8. Thermostat
9. Storage Heater
10. Tube Bundle
11. High Pressure Trap
12. Low Pressure Trap



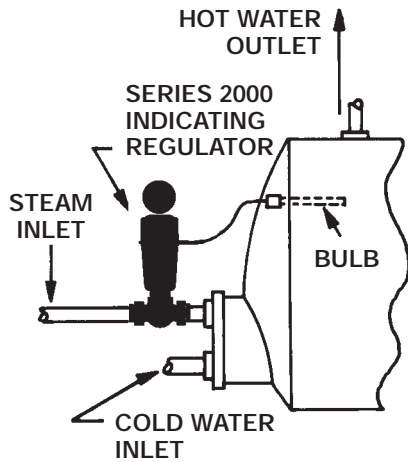
# SPENCE TYPICAL INSTALLATION FOR SANITARY STEAM SYSTEM



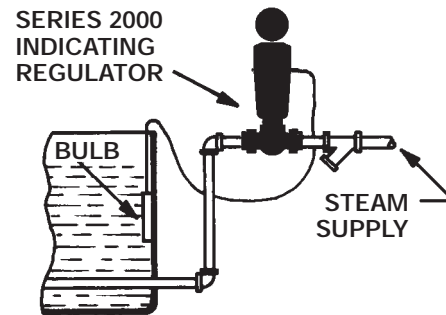
# SPENCE SERIES 2000 TEMPERATURE REGULATOR

## TYPICAL APPLICATIONS

### Direct Acting

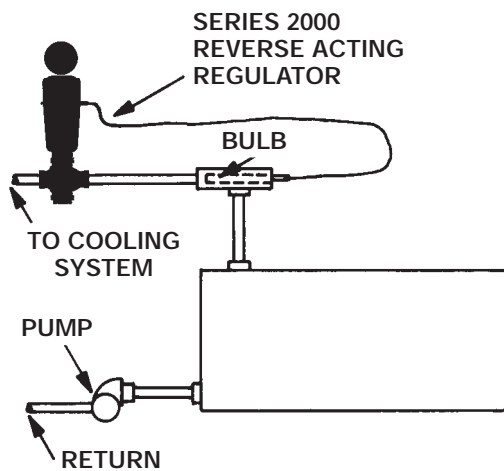


**WATER HEATER**

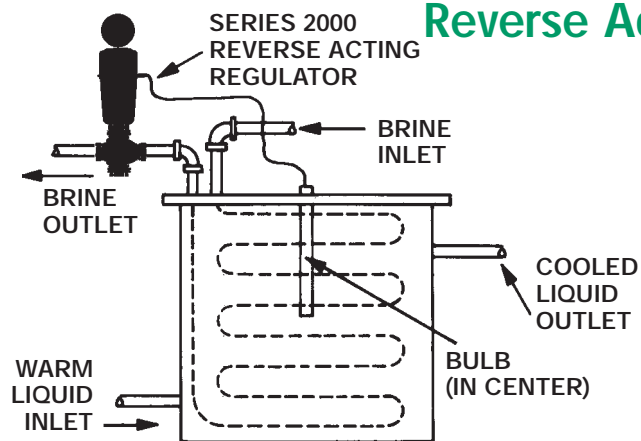


**PLATING TANK**

### Reverse Acting

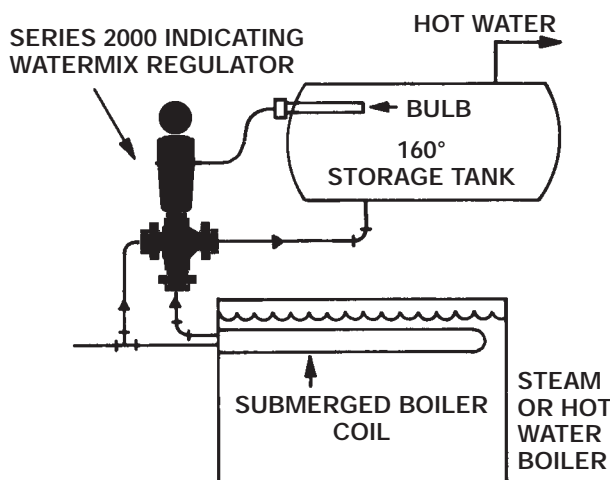


**ENGINE JACKET COOLING**

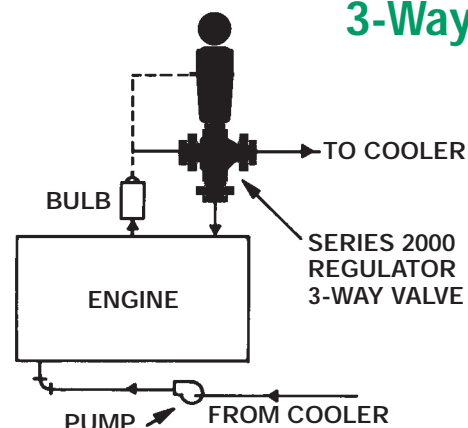


**LIQUID COOLER**

### 3-Way Mixing



**FIRE TUBE BOILER**



**INTERNAL COMBUSTION ENGINE**

# STEAM TABLE\*

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

Pres- sure psi (gage)	Temper- ature F° (sat.)		Satur- ated Liquid	Satur- ated Vapor	TOTAL TEMPERATURE, °F												
					220	240	260	280	300	320	340	360	380	400	420	440	460
0	212	h v	180.1 0.0167	1150.4 26.80	1154.4 27.15	1164.2 28.00	1173.8 28.85	1183.3 29.70	1192.8 30.53	1202.3 31.37	1211.7 32.20	1221.1 33.03	1230.5 33.85	1239.9 34.68	1249.3 35.50	1258.8 36.32	1268.2 37.14
5	228	h v	196.2 0.0168	1156.3 20.089		1162.3 20.48	1172.2 21.11	1182.0 21.74	1191.6 22.36	1201.2 22.98	1210.8 23.60	1220.3 24.21	1229.7 24.82	1239.2 25.43	1248.7 26.04	1258.2 26.65	1267.6 27.25
10	240	h v	208.4 0.0169	1160.6 16.303			1170.7 16.819	1180.6 17.330	1190.5 17.836	1200.2 18.337	1209.8 18.834	1219.4 19.329	1229.0 19.821	1238.5 20.31	1248.1 20.80	1257.6 21.29	1267.1 21.77
15	250	h v	218.8 0.0170	1164.1 13.746			1169.1 13.957	1179.3 14.390	1189.3 14.816	1199.1 15.238	1208.9 15.657	1218.6 16.072	1228.3 16.485	1237.9 16.897	1247.5 17.306	1257.0 17.714	1266.6 18.121
20	259	h v	227.9 0.0171	1167.1 11.898			1167.5 11.911	1177.9 12.288	1188.1 12.659	1198.1 13.025	1208.0 13.387	1217.8 13.746	1227.5 14.103	1237.2 14.457	1246.8 14.810	1256A 15.162	1266.1 15.512
25	267	h v	236.0 0.0171	1169.7 10.498				1176.5 10.711	1186.8 11.040	1197.0 11.364	1207.0 11.684	1216.9 12.001	1226.7 12.315	1236.5 12.628	1246.2 12.938	1255.9 13.247	1265.5 13.555
30	274	h v	243.4 0.0172	1172.0 9.401				1175.0 9.484	1185.6 9.781	1195.9 10.072	1206.0 10.359	1216.0 10.643	1225.9 10.925	1235.8 11.204	1245.6 11.482	1255.3 11.758	1265.0 120033
40	287	h v	256.3 0.0173	1175.9 7.787					1183.0 7.947	1193.6 8.192	1204.0 8.432	1214.3 8.668	1224.4 8.902	1234.3 9.134	1244.3 9.364	1254.1 9.592	1263.9 9.819
50	298	h v	267.5 0.0174	1179.1 6.655					1180.3 6.676	1191.3 6.889	1202.0 7.096	1212.5 7.300	1222.7 7.501	1232.9 7.700	1242.9 7.896	1252.9 8.091	1262.8 8.285
60	308	h v	277.4 0.0175	1181.9 5.816						1188.9 5.9321	1199.9 6.116	1210.6 6.296	1221.1 6.473	1231.4 6.648	1241.6 6.820	1251.7 6.991	1261.7 7.161
70	316	h v	286.4 0.0176	1184.2 5.168						1186.4 5.200	1197.7 5.366	1208.7 5.528	1219.4 5.687	1229.9 5.843	1240.2 5.997	1250.4 6.150	1260.6 6.301
80	324	h v	294.6 0.0177	1186.2 4.652							1195.5 4.773	1206.7 4.921	1217.7 5.065	1228.3 5.207	1238.8 5.347	1249.2 5.485	1259.4 5.621
90	331	h v	302.1 0.0178	1188.1 4.232							1193.2 4.292	1204.7 4.429	1215.9 4.562	1226.7 4.693	1237.4 4.821	1247.9 4.947	1258.2 5.071
100	338	h v	309.1 0.0178	1189.7 3.882							1190.8 3.895	1202.7 4.022	1214.1 4.146	1225.2 4.267	1236.0 4.385	1246.6 4.502	1257.1 4.617
125	353	h v	324.8 0.0180	1193.0 3.220								1197.3 3.258	1209.4 3.365	1211.1 3.468	1232.3 3.569	1243.3 3.667	1254.1 3.764
150	366	h v	338.5 0.0182	1195.6 2.752									1204.5 2.818	1216.7 2.910	1228.4 2.998	1239.8 3.085	1251.0 3.169
175	378	h v	350.8 0.0183	1197.6 2.404									1199.3 2.414	1212.2 2.498	1224.5 2.577	1236.3 2.655	1247.8 2.730
200	388	h v	361.9 0.0185	1199.3 2.134										1207.4 2.180	1220.3 2.253	1232.6 2.324	1244.5 2.393
225	397	h v	372.1 0.0186	1200.6 1.9183										1202.5 1.9276	1216.0 1.9964	1228.8 2.062	1241.1 2.126
250	406	h v	381.6 0.0187	1201.7 1.7422											1211.5 1.7870	1224.9 1.8488	1237.6 1.9081
275	414	h v	390.5 0.0188	1202.6 1.5954											1206.8 1.6130	1220.8 1.6717	1234.0 1.7277
300	422	h v	398.8 0.0190	1203.2 1.4711												1216.5 1.5222	1230.3 1.5755
350	436	h v	414.1 0.0192	1204.1 1.2720												1207.5 1.2831	1222.4 1.3326
400	448	h v	428.1 0.0194	1204.6 1.1194													1214.0 1.1468
450	460	h v	440.9 0.0196	1204.6 0.9985													
500	470	h v	452.9 0.0198	1204.2 0.9004													
550	480	h v	464.1 0.0200	1203.7 0.8191													
600	489	h v	474.7 0.0202	1203.0 0.7503													

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

# STEAM TABLE\*

h = Total heat of steam, Btu per pound

v = Specific volume, cubic feet per pound

TOTAL TEMPERATURE, °F															Temp- erature °F (sat.)	Pres- sure psi (gage)	
480	500	520	540	560	580	600	620	640	660	680	700	720	740	750			
1277.6 37.96	1287.1 38.78	1296.6 39.60	1306.2 40.41	1315.7 41.23	1325.3 42.04	1334.8 42.86	1344.5 43.68	1354.2 44.49	1363.8 45.31	1373.5 46.12	1383.2 46.94	1393.0 47.75	1402.8 48.56	1407.7 48.97	h v	212	0
1277.1 27.86	1286.6 28.46	1296.2 29.06	1305.7 29.67	1315.3 30.27	1324.8 30.87	1334.4 31.47	1344.1 32.07	1353.8 32.67	1363.5 33.27	1373.2 33.87	1382.9 34.47	1392.7 35.07	1402.6 35.67	1407.5 35.96	h v	228	5
1276.6 22.26	1286.2 22.74	1295.8 23.22	1305.3 23.71	1314.9 24.19	1324.5 24.68	1334.1 25.16	1343.8 25.64	1353.5 26.12	1363.2 26.60	1372.9 27.08	1382.6 27.56	1392.5 28.04	1402.3 28.52	1407.2 28.76	h v	240	10
1276.2 18.528	1285.7 18.933	1295.3 19.337	1304.9 19.741	1314.5 20.144	1324.2 20.547	1333.8 20.95	1343.5 21.35	1353.2 21.75	1362.9 22.15	1372.6 22.56	1382.4 22.96	1392.3 23.36	1402.1 23.76	1407.0 23.96	h v	250	15
1275.7 15.862	1285.3 16.210	1294.9 16.558	1304.5 16.905	1314.1 17.251	1323.8 17.597	1333.5 17.943	1343.2 18.288	1352.9 18.633	1362.6 18.977	1372.3 19.322	1382.1 19.666	1391.9 20.01	1401.8 20.35	1406.7 20.52	h v	259	20
1275.2 13.862	1284.8 14.168	1294.5 14.473	1304.1 14.778	1313.8 15.082	1323.4 15.385	1333.1 15.688	1342.8 15.990	1352.5 16.293	1362.3 16.595	1372.1 16.896	1381.9 17.198	1391.7 17.499	1401.6 17.8001	1406.5 7.951	h v	267	25
1274.7 12.307	1284.4 12.580	1294.0 12.852	1303.7 13.123	1313.4 13.394	1323.1 13.665	1332.8 13.935	1342.5 14.204	1352.2 14.473	1362.0 14.742	1371.8 15.011	1381.6 15.279	1391.5 15.547	1401.4 15.815	1406.3 15.949	h v	274	30
1273.7 10.044	1283.4 10.269	1293.2 10.493	1302.9 10.717	1312.6 10.940	1322.4 11.162	1332.1 11.384	1341.9 11.605	1351.7 11.826	1361.5 12.047	1371.3 12.268	1381.1 12.488	1391.0 12.708	1400.9 12.927	1405.8 13.037	h v	287	40
1272.7 8.478	1282.5 8.670	1292.3 8.861	1302.1 9.051	1311.9 9.240	1321.7 9.429	1331.5 9.618	1341.3 9.806	1351.1 9.993	1360.9 10.181	1370.8 10.368	1380.6 10.555	1390.5 10.741	1400.4 10.928	1405.4 11.021	h v	298	50
1271.6 7.329	1281.5 7.496	1291.4 7.663	1301.3 7.829	1311.1 7.994	1321.0 8.159	1330.8 8.323	1340.6 8.486	1350.5 8.649	1360.3 8.812	1370.2 8.975	1380.1 9.138	1390.0 9.300	1399.9 9.462	1404.9 9.543	h v	308	60
1270.6 6.450	1280.6 6.599	1290.5 6.747	1300.5 6.894	1310.4 7.041	1320.2 7.187	1330.1 7.332	1340.0 7.477	1349.9 7.622	1359.8 7.766	1369.7 7.910	1379.6 8.054	1389.6 8.198	1399.5 8.341	1404.5 8.413	h v	316	70
1269.5 5.756	1279.6 5.891	1289.6 6.024	1299.6 6.156	1309.6 6.288	1319.5 6.419	1329.4 6.550	1339.4 6.680	1349.3 6.810	1359.3 6.940	1369.2 7.069	1379.1 7.199	1389.1 7.327	1399.0 7.456	1404.0 7.520	h v	324	80
1268.5 5.195	1278.6 5.317	1288.7 5.439	1298.8 5.559	1308.8 5.679	1318.8 5.799	1328.7 5.918	1338.7 6.036	1348.7 6.154	1358.6 6.272	1368.6 6.389	1378.5 6.506	1388.5 6.623	1398.5 6.740	1403.5 6.798	h v	331	90
1267.4 4.730	1277.7 4.843	1287.8 4.955	1297.9 5.066	1308.0 5.176	1318.0 5.285	1328.1 5.394	1338.1 5.503	1348.0 5.611	1358.0 5.719	1368.0 5.827	1378.0 5.934	1388.1 6.041	1398.1 6.148	1403.1 6.201	h v	338	100
1264.7 3.860	1275.2 3.954	1285.5 4.047	1295.8 4.140	1306.0 4.232	1316.2 4.323	1326.4 4.413	1336.5 4.503	1346.6 4.593	1356.6 4.683	1366.7 4.772	1376.8 4.861	1386.9 4.949	1397.0 5.038	1402.0 5.082	h v	353	125
1261.9 3.252	1272.6 3.334	1283.2 3.414	1293.6 3.494	1304.0 3.573	1314.3 3.652	1324.6 3.730	1334.8 3.807	1345.0 3.884	1355.2 3.960	1365.3 4.037	1375.4 4.113	1385.6 4.188	1395.8 4.264	1400.8 4.301	h v	366	150
1259.0 2.804	1270.0 2.877	1280.8 2.948	1291.4 3.019	1302.0 3.089	1312.4 3.157	1322.8 3.226	1333.2 3.294	1343.5 3.361	1353.7 3.429	1363.9 3.495	1374.2 3.562	1384.4 3.628	1394.6 3.694	1399.7 3.727	h v	378	175
1256.0 2.460	1267.3 2.525	1278.3 2.590	1289.2 2.653	1299.9 2.716	1310.5 2.777	1321.0 2.839	1331.4 2.900	1341.8 2.960	1352.2 3.019	1362.5 3.079	1372.8 3.139	1383.1 3.198	1393.3 3.256	1398.5 3.286	h v	388	200
1253.0 2.187	1264.5 2.247	1275.8 2.306	1286.9 2.364	1297.8 2.421	1308.5 2.477	1319.2 2.533	1329.8 2.587	1340.3 2.642	1350.7 2.696	1361.1 2.750	1371.5 2.804	1381.9 2.857	1392.2 2.910	1397.3 2.936	h v	397	225
1249.9 1.9654	1261.7 2.021	1273.2 2.076	1284.5 2.129	1295.6 2.181	1306.5 2.233	1317.3 2.284	1328.0 2.334	1338.7 2.384	1349.2 2.434	1359.7 2.483	1370.2 2.532	1380.6 2.580	1391.0 2.629	1396.2 2.653	h v	406	250
1246.6 1.7816	1258.8 1.8338	1270.6 1.8846	1282.1 1.9342	1293.4 1.9829	1304.5 2.031	1315.5 2.078	1326.3 2.125	1337.0 2.171	1347.7 2.217	1358.3 2.262	1368.8 2.307	1379.3 2.352	1389.8 2.396	1395.0 2.418	h v	414	275
1243.3 1.6266	1255.8 1.6759	1267.9 1.7237	1279.7 1.7703	1291.2 1.8159	1302.5 1.8607	1313.6 1.9048	1324.5 1.9483	1335.4 1.9912	1346.1 2.034	1356.8 2.076	1367.4 2.118	1378.0 2.159	1388.6 2.200	1393.8 2.220	h v	422	300
1236.4 1.3795	1249.6 1.4243	1262.4 1.4675	1274.7 1.5094	1286.6 1.5501	1298.2 1.5900	1309.7 1.6291	1320.9 1.6676	1332.0 1.7056	1343.0 1.7430	1353.9 1.7801	1364.7 1.8168	1375.4 1.8531	1386.1 1.8892	1391.4 1.9071	h v	436	350
1229.0 1.1908	1243.2 1.2325	1256.6 1.2724	1269.4 1.3108	1281.8 1.3480	1293.9 1.3842	1305.7 1.4196	1317.2 1.4544	1328.6 1.4885	1339.8 1.5222	1350.9 1.5554	1361.9 1.5883	1372.8 1.6207	1383.6 1.6529	1389.0 1.6689	h v	448	400
1221.2 1.0416	1236.3 1.0811	1250.5 1.1186	1264.0 1.1544	1276.9 1.1889	1289.4 1.2224	1301.6 1.2550	1313.5 1.2868	1325.1 1.3180	1336.5 1.3488	1347.8 1.3789	1359.0 1.4088	1370.1 1.4382	1381.1 1.4675	1386.5 1.4819	h v	460	450
1212.8 0.9204	1229.0 0.9584	1244.0 0.9941	1258.3 1.0280	1271.8 1.0604	1284.8 1.0917	1297.3 1.1221	1309.6 1.1516	1321.5 1.1805	1333.2 1.2088	1344.7 1.2367	1356.1 1.2641	1367.3 1.2913	1378.4 1.3180	1384.0 1.3313	h v	470	500
	1221.4 0.8565	1237.4 0.8909	1252.4 0.9234	1266.5 0.9542	1280.0 0.9838	1293.0 1.0124	1305.6 1.0401	1317.8 1.0671	1329.8 1.0935	1341.6 1.1195	1353.2 1.1449	1364.6 1.1700	1375.8 1.1947	1381.4 1.2070	h v	480	550
	1213.2 0.7703	1230.3 0.8040	1246.1 0.8353	1261.0 0.8649	1275.1 0.8931	1288.5 0.9203	1301.5 0.9465	1314.1 0.9720	1326.3 0.9968	1338.3 1.0211	1350.2 1.0450	1361.8 1.0684	1373.2 1.0916	1378.9 1.1030	h v	489	600

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

# GLOSSARY OF TERMS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**DROOP**—See accuracy of regulation.



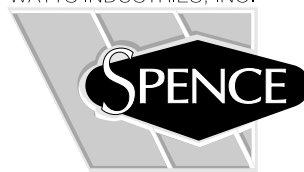
# Safety Relief Valves

## Quick Selection

VALVE SERIES	SET PRESSURES*	INLET SIZES	CONNECTIONS		FLUID				ASME SECTION <sup>†</sup>
			NPT	FLANGED	STEAM	AIR	GAS	LIQUID	
<a href="#">FIG 10</a>	5–15	3/4–3	X		X				IV
<a href="#">FIG 15C/15A</a>	5–15	3/4–3	X			X	X		VIII
<a href="#">FIG 15V</a>	1–30"HG	1–3	X			Vacuum			None
<a href="#">FIG 25</a>	30–300	1/2–1	X					X	None
<a href="#">FIG 31</a>	5–300	1/2–6	X	X	X				I & VIII
<a href="#">FIG 41</a>	5–300	1/2–6	X	X	X				I & VIII
<a href="#">FIG 41A</a>	5–300	1/2–6	X	X		X	X		I & VIII
<a href="#">FIG 41A-A</a>	5–300	1/2	X			X	X		VIII
<a href="#">FIG 41A-T</a>	5–300	1/2–2	X			X	X		VIII
<a href="#">FIG 50</a>	10–30	2	X			X	X		VIII

\*Pressure and temperature ranges may vary, depending upon valve material. Please consult the appropriate product bulletin for specific data.

<sup>†</sup>ASME does not certify valves set below 15 PSIG.



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## Figure 31, 41 & 41A and 32, 42 & 42A Cast Bronze Safety Valves

### Figure 31

Figure 31 is a safety valve for over pressure protection of steam boilers operating up to 250 psi. It is rated up to 250 psi and 406°F saturated steam. Figure 31 safety valves meet ASME code, Section I.

### Figure 32

Figure 32 is a safety valve with stainless steel trim for over pressure protection of steam boilers operating up to 300 psi. It is rated up to 300 psi and 422°F saturated steam. Figure 32 safety valves meet ASME code, Section I.

### Figure 41

Figure 41 is a safety relief valve for steam service on unfired pressure vessels. It is also used on accumulators, cleaners, and distillers. Figure 41 safety relief valves are rated up to 250 psi and 406°F of saturated steam and meet ASME code, Section VIII.

### Figure 42

Figure 42 is a safety relief valve with stainless steel trim for steam service on unfired pressure vessels. It is also used on accumulators, cleaners, and distillers. Figure 42 safety relief valves are rated up to 300 psi and 422°F of saturated steam and meet ASME code, Section VIII.

### Figure 41A

Figure 41A is a safety relief valve for air, gas and vapors. It is used on compressors, receivers, burners, dryers and other piping systems. Figure 41A safety relief valves are rated up to 250 psi and 406°F and meet ASME code, Section VIII.

### Figure 42A

Figure 42A is a safety relief valve with stainless steel trim for air, gas and vapors. It is used on compressors, receivers, burners, dryers and other piping systems. Figure 42A safety relief valves are rated up to 300 psi and 422°F and meet ASME code, Section VIII.

### Features

These safety valves are top guided, full nozzle and high capacity. Their unitized bonnet/base design and two ring control make them extremely dependable in terms of pop action, seat tightness and repeatability. The single cap and lifting lever permits manual valve opening (testing) with little force required.

Figure 31, 41, 41A, 32, 42 and 42A safety valves are approved and registered in every Province in Canada in accordance with C.S.A. B-51 under C.R.N.#0G1893.5C.



### Size/Orifice

1/2" x 3/4" through 2 1/2" x 2 1/2" with orifices from D through J.

Valves have male (NPT) inlet x female (NPT) outlet.

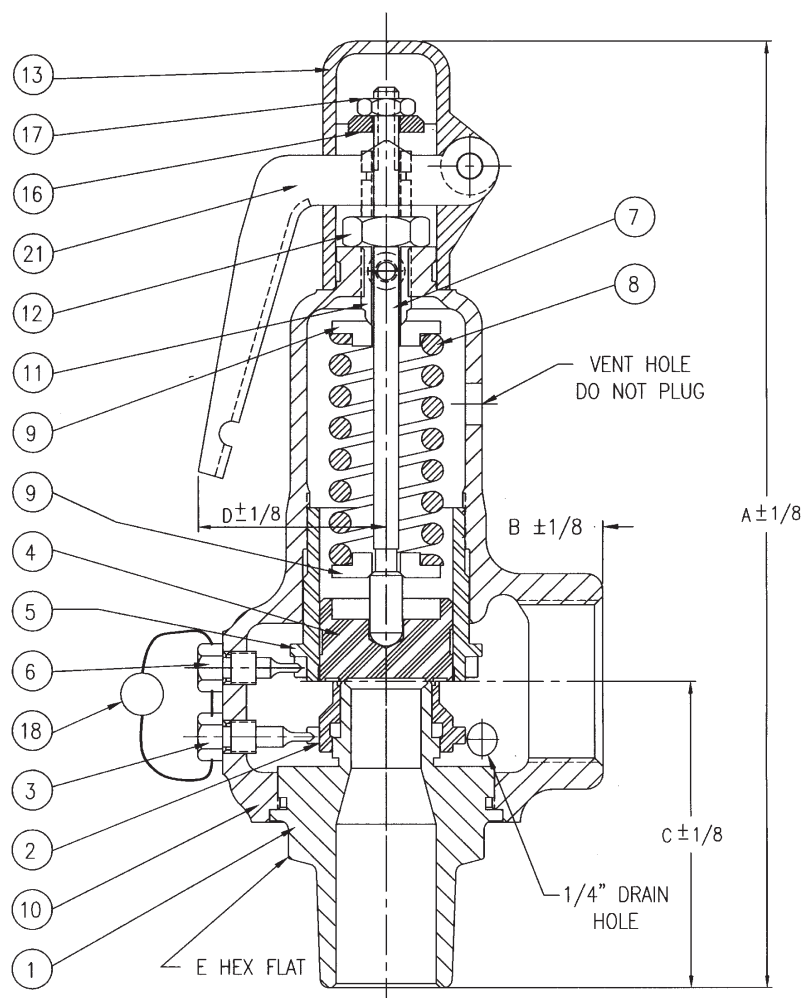
### Ordering information

Please furnish the following information to assure fast and accurate processing of valve orders:

- Quantity of valves
- Nominal pipe size - Inlet x Outlet Valve
- Figure (model) number (31, 41, 41A, 32, 42 or 42A)
- Trim material
- Orifice size
- Set pressure - psig
- Saturated steam temperature
- Required relieving capacity
- Code requirements
- Special testing or instructions

## Materials

Ref. No	Part Name	Material
1	Base	Brass, Bronze or SS
2	Base Ring	Brass or Bronze
3	Base Ring Set Screw	Brass
4	Disc	Brass, Bronze or SS
5	Guide and Ring	Brass or Bronze
6	Guide Ring Set Screw	Brass
7	Spindle	Steel
8	Spring	Plated Steel
9	Spring Washer	Steel
10	Bonnet	Cast Bronze
11	Adjusting Bolt	Brass
12	Adjusting Bolt Locknut	Plated Steel
13	Lifting Cap	Zinc Alloy/Steel
14	Lifting Cap Pin	Steel
15	Lifting Cap Lockscrew	Plated Steel
16	Spindle Nut	Steel
17	Spindle Nut Locknut	Plated Steel
18	Seal and Wire	Lead & Stainless Steel
19	Nameplate	Stainless Steel
20	Drive Screw	Stainless Steel
21	Lever	Plated Steel

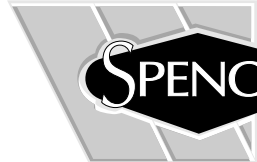


## Dimensions—Inches

Valve Size Inlet x Outlet inches	Orifice Size	A	B	C	D*	E	Weight (lb.)
1/2 X 3/4	D	6 <sup>9</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>1</sup> / <sub>8</sub>	2
3/4 X 3/4	D	6 <sup>9</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>1</sup> / <sub>4</sub>	2.25
3/4 X 1	E	7 <sup>1</sup> / <sub>8</sub>	1 <sup>5</sup> / <sub>8</sub>	2 <sup>5</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>1</sup> / <sub>4</sub>	2.5
1 X 1	E	7 <sup>1</sup> / <sub>8</sub>	1 <sup>5</sup> / <sub>8</sub>	2 <sup>5</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>1</sup> / <sub>2</sub>	2.75
1 X 1 1/4	F	9	1 <sup>7</sup> / <sub>8</sub>	2 <sup>13</sup> / <sub>16</sub>	1 <sup>13</sup> / <sub>16</sub>	1 <sup>1</sup> / <sub>2</sub>	4
1 1/4 X 1 1/4	F	9	1 <sup>7</sup> / <sub>8</sub>	2 <sup>13</sup> / <sub>16</sub>	1 <sup>13</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>4</sub>	4.25
1 1/4 X 1 1/2	G	9 <sup>11</sup> / <sub>16</sub>	2 <sup>1</sup> / <sub>8</sub>	3	1 <sup>13</sup> / <sub>16</sub>	1 <sup>7</sup> / <sub>8</sub>	7
1 1/2 X 1 1/2	G	9 <sup>11</sup> / <sub>16</sub>	2 <sup>1</sup> / <sub>8</sub>	3	1 <sup>13</sup> / <sub>16</sub>	2 <sup>1</sup> / <sub>16</sub>	7.25
1 1/2 X 2	H	12 <sup>1</sup> / <sub>8</sub>	2 <sup>9</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>2</sub>	2 <sup>3</sup> / <sub>4</sub>	2 <sup>1</sup> / <sub>4</sub>	13.5
2 X 2	H	12 <sup>1</sup> / <sub>8</sub>	2 <sup>9</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>2</sub>	2 <sup>3</sup> / <sub>4</sub>	2 <sup>9</sup> / <sub>16</sub>	13.75
2 X 2 1/2	J	13 <sup>5</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>3</sup> / <sub>4</sub>	2 <sup>3</sup> / <sub>4</sub>	2 <sup>3</sup> / <sub>4</sub>	17.5
2 1/2 X 2 1/2	J	13 <sup>5</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>3</sup> / <sub>4</sub>	2 <sup>3</sup> / <sub>4</sub>	3	17.75

\* Add 1/2" to D dimension when lever is pulled out to manually operate the valve.

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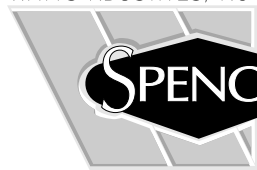


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## Figure 31, 41 & 41A Flanged Cast Iron Safety Valves

### Figure 31

Figure 31 is a safety valve for over pressure protection of steam boilers operating up to 250 psi. It is rated up to 250 psi and 450°F saturated steam. Figure 31 safety valves meet ASME code, Section I.

### Figure 41

Figure 41 is a safety relief valve for steam service on unfired pressure vessels. It is also used on accumulators, cleaners and distillers. Figure 41 safety relief valves are rated up to 250 psi and 450°F saturated steam and meet ASME code, Section VIII.

### Figure 41A

Figure 41A is a safety relief valve for air, gas and vapors. It is used on compressors, receivers, burners, dryers and other piping systems. Figure 41A safety relief valves are rated up to 300 psi and 450°F and meet ASME code, Section VIII.

### Features

Figure 31, 41 and 41A safety valves have two piece bodies and enclosed springs. Their rugged construction and two ring control make them extremely dependable in terms of pop action, seat tightness and repeatability. The lifting lever permits manual valve opening (testing) with little force required on the lever when system pressure is at 75% of the valve's set pressure or higher.

Figure 31, 41 and 41A safety valves are approved and registered in every Province in Canada in accordance with C.S.A. B-51 under C.R.N.#0G1893.5C.

### Size/Orifice

Threaded x threaded connections  
1 1/2" x 2 1/2" (J), 2" x 3" (K), 3" x 4" (M)

Flanged (250#) x threaded connection  
1 1/2" x 2 1/2" (J), 2" x 3" (J,K), 2 1/2" x 3" (K), 2 1/2" x 4" (L), 3" x 3" (K), 3" x 4" (L,M)

Flanged (250#) x flanged (125#)  
4" x 6" (N,P), 6" x 8" (Q,R)

Note: Other sizes available, 1/2" through 2", male NPT inlet, Cast Bronze or Cast Iron bodies

### Options

All Figure 31, 41 and 41A safety valves are Cast Iron with Bronze Trim. 125# flange and nipple are available on outlet of threaded units.



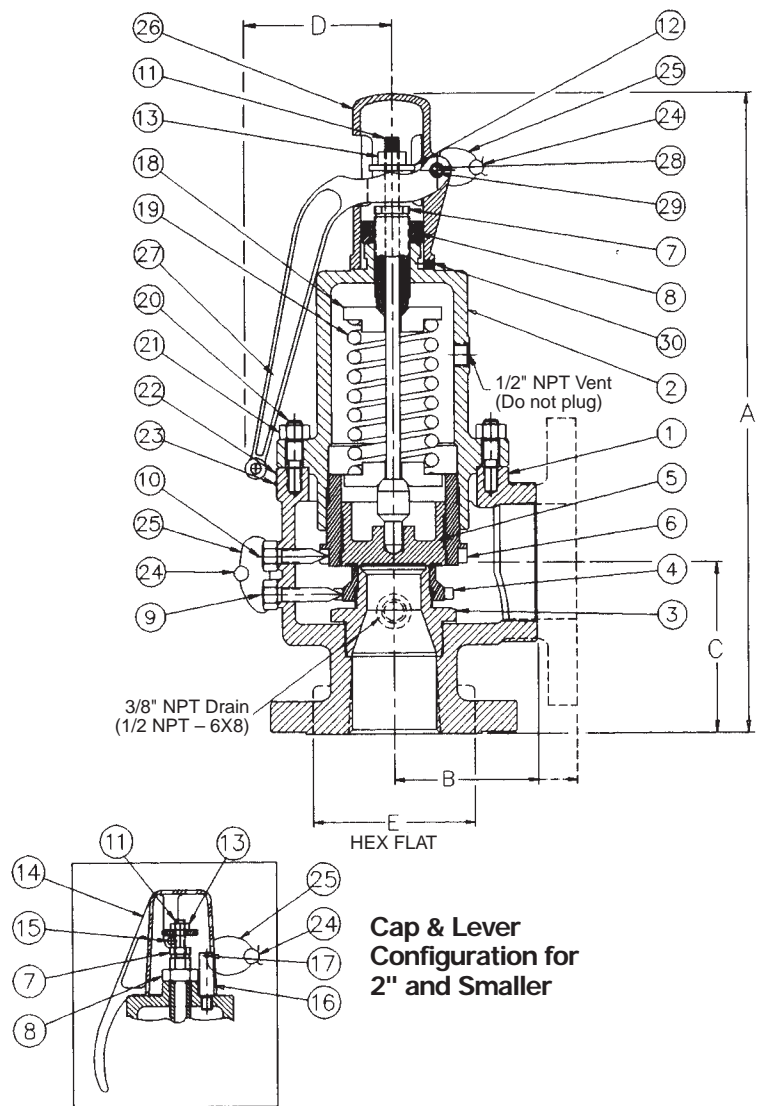
### Ordering information

Please furnish the following information to assure fast and accurate processing of valve orders:

- Quantity of valves
- Size - Inlet x outlet and connection configuration
- Figure (model) number (31, 41, or 41A)
- Set pressure - psig
- Saturated steam temperature
- Required relieving capacity
- Code requirements
- Special testing or instructions

## Materials

Ref. No	Part Name	Material Spec.
1	Body	ASTM A126-B (Grey Iron)
2	Bonnet	ASTM A126-B (Grey Iron)
3	Nozzle	ASTM B62 (Bronze)
4	Nozzle Ring	ASTM B584-844 (Bronze)
5	Disc	ASTM B62 (Bronze)
6	Guide Ring	ASTM B584-844 (Bronze)
7	Adjusting Bolt	ASTM B16 (Brass)
8	Adjusting Bolt Locknut	Steel (ZN Plate)
9	Nozzle Ring Set Screw	Brass
10	Guide Ring Set Screw	Brass
11	Spindle	ASTM A108 Grade 1212
12	Spindle Nut	ASTM A108 Grade 1212
13	Spindle Nut Lock Nut	Steel AISI (ZN Plate)
14	Lifting Cap	Zinc Alloy
15	Lifting Cap Pins	Steel 1020 (ZN Plate)
16	Pivot Post	Steel AISI
17	Post Pin	Steel AISI 1070 (ZN Plate)
18	Spring Washer	Steel AISI 1212
19	Spring	Steel (ZN Plate)
20	Stud	Steel ASTM A193 B7
21	Stud Nut	Steel ASTM A194 2H
22	Name Plate	SST AISI 304
23	Name Plate Screws	SST 18-8
24	Lead Seal	Lead Commercial
25	Seal Wire	SST AISI 304
26	Lifting Cap	A126-B Cast Iron
27	Lifting Lever	A126-B Cast Iron
28	Clevis Pin	Steel (Zn)
29	Cotter Pin	Steel
30	Liftcap Lockscrew	Steel

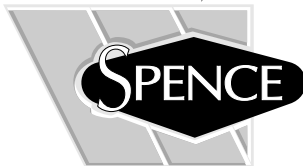


FPT outlets can be converted to a 125 lb. flange by the use of close nipple and threaded flange.

## Dimensions and Weights

Valve Size Inlet x Outlet (inches)	Orifice Designation	Dimensions (inches)					Weight (lb.) Cast Iron
		A	B	C	D	E	
1 1/2-250# X 2 1/2 FPT	J	15	3 1/4	4 1/4	3	—	24
1 1/2 FPT X 2 1/2 FPT	J	14 1/2	3 1/4	4 1/4	3	2 3/4	20
2-250# X 3 FPT	J,K	15 3/4	4	4 5/8	3 1/2	—	42
2 FPT X 3 FPT	K	15 3/4	4	4 5/8	3 1/2	3 5/8	36
2 1/2-250# X 3 FPT	K	15 3/4	4	4 3/4	3 1/2	—	45
2 1/2-250# X 4 FPT	L	23	5 1/8	5 1/2	6	—	105
2 1/2 FPT X 4 FPT	L	23	5 1/8	5 1/2	6	4 1/2	97
3-250# X 3 FPT	K	15 3/4	4	5	3 1/2	—	48
3-250# X 4 FPT	L,M	23	5 1/8	5 1/2	6	—	107
3 FPT X 4 FPT	M	23 1/8	5 1/8	5 5/8	6	4 1/2	99
4-250# X 6-125#	N,P	28 1/2	7 1/4	6 3/4	6	—	212
6-250# X 8-125#	Q,R	45 5/16	10	9 1/4	10 1/2	—	675

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# Figure 31 – Safety Valve

## Saturated Steam Capacity – Power Boiler Code ● Capacity (lb/hr) – 90% Rating at 3% Over Pressure

Meets requirements of ASME Boiler and Pressure Vessel Code, Section I.

Certified by National Board of Boiler and Pressure Vessel Inspectors

ORIFICE AREA (In <sup>2</sup> )	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479	J 1.391	K 1.892	L 2.935	M 3.715	N 4.468	P 6.564	Q 11.365	R 16.475
SET PRESS. PSIG													
15	170	303	475	776	1213	1991	2708	4200	5318	6394	9394	16265	23579
20	197	351	550	899	1405	2305	3135	4863	6157	7403	10876	18831	27298
25	224	398	625	1021	1596	2619	3562	5526	6996	8412	12358	21396	31017
30	250	446	700	1144	1788	2933	3989	6188	7835	9420	13839	23962	34736
35	277	494	774	1266	1979	3247	4416	6851	8674	10429	15321	26527	38455
40	304	542	849	1388	2171	3561	4843	7513	9512	11437	16803	29093	42174
45	331	589	924	1511	2362	3875	5270	8176	10351	12446	18285	31658	45893
50	358	637	999	1633	2553	4189	5697	8838	11190	13455	19766	34224	49612
55	385	685	1074	1756	2745	4503	6125	9501	12029	14463	21248	36789	53331
60	411	733	1149	1878	2936	4817	6552	10163	12868	15472	22730	39355	57050
65	438	780	1224	2001	3128	5131	6979	10826	13707	16480	24212	41920	60769
70	466	829	1300	2126	3323	5451	7414	11502	14562	17509	25723	44537	64562
75	493	878	1377	2252	3520	5774	7854	12184	15426	18548	27249	47180	68393
80	521	928	1455	2378	3717	6098	8294	12866	16290	19587	28775	49822	72223
85	548	977	1532	2504	3914	6421	8734	13549	17154	20626	30302	52464	76054
90	576	1026	1609	2630	4111	6745	9174	14231	18018	21665	31828	55107	79884
95	604	1075	1686	2756	4308	7068	9614	14914	18882	22703	33354	57749	83715
100	631	1124	1763	2882	4506	7392	10054	15596	19746	23742	34880	60392	87546
105	659	1174	1840	3008	4703	7715	10494	16279	20610	24781	36406	63034	91376
110	687	1223	1917	3134	4900	8038	10934	16961	21474	25820	37932	65677	95207
115	714	1272	1995	3261	5097	8362	11374	17643	22338	26859	39459	68319	99037
120	742	1321	2072	3387	5294	8685	11813	18326	23202	27898	40985	70962	102868
125	769	1370	2149	3513	5491	9009	12253	19008	24066	28937	42511	73604	106699
130	797	1420	2226	3639	5688	9332	12693	19691	24930	29975	44037	76247	110529
135	825	1469	2303	3765	5886	9655	13133	20373	25794	31014	45563	78889	114360
140	852	1518	2380	3891	6083	9979	13573	21055	26658	32053	47090	81532	118190
145	880	1567	2457	4017	6280	10302	14013	21738	27522	33092	48616	84174	122021
150	908	1616	2535	4143	6477	10626	14453	22420	28386	34131	50142	86817	125851
155	935	1666	2612	4269	6674	10949	14893	23103	29250	35170	51668	89459	129682
160	963	1715	2689	4396	6871	11273	15333	23785	30114	36208	53194	92101	133513
165	990	1764	2766	4522	7068	11596	15773	24468	30978	37247	54721	94744	137343
170	1018	1813	2843	4648	7266	11919	16212	25150	31842	38286	56247	97386	141174
175	1046	1862	2920	4774	7463	12243	16652	25832	32706	39325	57773	100029	145004
180	1073	1912	2997	4900	7660	12566	17092	26515	33570	40364	59299	102671	148835
185	1101	1961	3075	5026	7857	12890	17532	27197	34434	41403	60825	105314	152666
190	1128	2010	3152	5152	8054	13213	17972	27880	35298	42442	62351	107956	156496
195	1156	2059	3229	5278	8251	13537	18412	28562	36162	43480	63878	110599	160327
200	1184	2108	3306	5404	8448	13860	18852	29244	37026	44519	65404	113241	164157
205	1211	2158	3383	5531	8646	14183	19292	29927	37890	45558	66930	115884	167988
210	1239	2207	3460	5657	8843	14507	19732	30609	38754	46597	68456	118526	171818
215	1267	2256	3538	5783	9040	14830	20172	31292	39618	47636	69982	121169	175649
220	1294	2305	3615	5909	9237	15154	20612	31974	40482	48675	71509	123811	179480
225	1322	2354	3692	6035	9434	15477	21051	32656	41346	49714	73035	126453	183310
230	1349	2404	3769	6161	9631	15800	21491	33339	42210	50752	74561	129096	187141
235	1377	2453	3846	6287	9829	16124	21931	34021	43074	51791	76087	131738	190971
240	1405	2502	3923	6413	10026	16447	22371	34704	43938	52830	77613	134381	194802
245	1432	2551	4000	6540	10223	16771	22811	35386	44802	53869	79140	137023	198633
250	1460	2600	4078	6666	10420	17094	23251	36069	45666	54908	80666	139666	202463
255	1488	2650	4155	6792	10617	17418							
260	1515	2699	4232	6918	10814	17741							
265	1543	2748	4309	7044	11011	18064							
270	1570	2797	4386	7170	11209	18388							
275	1598	2846	4463	7296	11406	18711							
280	1626	2896	4540	7422	11603	19035							
285	1653	2945	4618	7548	11800	19358							
290	1681	2994	4695	7675	11997	19682							
295	1709	3043	4772	7801	12194	20005							
300	1736	3092	4849	7927	12391	20328							



# Figure 41 – Safety Relief Valve

**Saturated Steam Capacity – Pressure Vessel Code ● Capacity (lb/hr) – 90% Rating at 10% Over Pressure**

Meets requirements of ASME Boiler and Pressure Vessel Code, Section VIII.

Certified by National Board of Boiler and Pressure Vessel Inspectors

ORIFICE AREA (In <sup>2</sup> )	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479	J 1.391	K 1.892	L 2.935	M 3.715	N 4.468	P 6.564	Q 11.365	R 16.475
SET PRESS. PSIG													
15	176	313	491	802	1254	2057	2798	4340	5494	6606	9706	16804	24360
20	203	361	566	925	1445	2371	3225	5003	6335	7617	11190	19374	28085
25	229	409	641	1047	1637	2686	3653	5667	7175	8627	12674	21943	31809
30	256	456	716	1170	1829	3000	4081	6330	8015	9637	14158	24513	35534
35	286	509	798	1305	2040	3346	4551	7060	8939	10748	15790	27339	39631
40	315	562	881	1440	2251	3692	5022	7790	9863	11859	17422	30165	43729
45	345	614	963	1575	2461	4038	5492	8520	10787	12970	19055	32992	47826
50	374	667	1046	1709	2672	4384	5963	9250	11711	14081	20687	35818	51923
55	404	720	1128	1844	2883	4730	6433	9980	12636	15193	22320	38645	56020
60	434	772	1211	1979	3094	5076	6904	10710	13560	16304	23952	41471	60117
65	463	825	1293	2114	3305	5422	7374	11440	14484	17415	25585	44297	64215
70	493	877	1376	2249	3516	5768	7845	12170	15408	18526	27217	47124	68312
75	522	930	1458	2384	3727	6114	8316	12900	16332	19637	28849	49950	72409
80	552	983	1541	2519	3937	6460	8786	13630	17256	20748	30482	52777	76506
85	581	1035	1623	2654	4148	6805	9257	14359	18180	21860	32114	55603	80604
90	611	1088	1706	2789	4359	7151	9727	15089	19105	22971	33747	58429	84701
95	640	1140	1788	2923	4570	7497	10198	15819	20029	24082	35379	61256	88798
100	670	1193	1871	3058	4781	7843	10668	16549	20953	25193	37012	64082	92895
105	699	1246	1953	3193	4992	8189	11139	17279	21877	26304	38644	66909	96992
110	729	1298	2036	3328	5203	8535	11609	18009	22801	27415	40276	69735	101090
115	758	1351	2118	3463	5414	8881	12080	18739	23725	28527	41909	72561	105187
120	788	1404	2201	3598	5624	9227	12550	19469	24649	29638	43541	75388	109284
125	818	1456	2283	3733	5835	9573	13021	20199	25574	30749	45174	78214	113381
130	847	1509	2366	3868	6046	9919	13491	20929	26498	31860	46806	81041	117479
135	877	1561	2448	4003	6257	10265	13962	21659	27422	32971	48438	83867	121576
140	906	1614	2531	4137	6468	10611	14432	22388	28346	34082	50071	86693	125673
145	936	1667	2614	4272	6679	10957	14903	23118	29270	35194	51703	89520	129770
150	965	1719	2696	4407	6890	11303	15373	23848	30194	36305	53336	92346	133868
155	995	1772	2779	4542	7100	11648	15844	24578	31118	37416	54968	95173	137965
160	1024	1825	2861	4677	7311	11994	16314	25308	32043	38527	56601	97999	142062
165	1054	1877	2944	4812	7522	12340	16785	26038	32967	39638	58233	100825	146159
170	1083	1930	3026	4947	7733	12686	17256	26768	33891	40749	59865	103652	150256
175	1113	1982	3109	5082	7944	13032	17726	27498	34815	41861	61498	106478	154354
180	1143	2035	3191	5217	8155	13378	18197	28228	35739	42972	63130	109305	158451
185	1172	2088	3274	5352	8366	13724	18667	28958	36663	44083	64763	112131	162548
190	1202	2140	3356	5486	8577	14070	19138	29688	37587	45194	66395	114957	166645
195	1231	2193	3439	5621	8787	14416	19608	30418	38512	46305	68028	117784	170743
200	1261	2246	3521	5756	8998	14762	20079	31147	39436	47416	69660	120610	174840
205	1290	2298	3604	5891	9209	15108	20549	31877	40360	48527	71292	123437	178937
210	1320	2351	3686	6026	9420	15454	21020	32607	41284	49639	72925	126263	183034
215	1349	2403	3769	6161	9631	15800	21490	33337	42208	50750	74557	129089	187131
220	1379	2456	3851	6296	9842	16146	21961	34067	43132	51861	76190	131916	191229
225	1408	2509	3934	6431	10053	16492	22431	34797	44057	52972	77822	134742	195326
230	1438	2561	4016	6566	10263	16837	22902	35527	44981	54083	79455	137569	199423
235	1468	2614	4099	6700	10474	17183	23372	36257	45905	55194	81087	140395	203520
240	1497	2667	4181	6835	10685	17529	23843	36987	46829	56306	82719	143221	207618
245	1527	2719	4264	6970	10896	17875	24313	37717	47753	57417	84352	146048	211715
250	1556	2772	4346	7105	11107	18221	24784	38447	48677	58528	85984	148874	215812
255	1586	2824	4429	7240	11318	18567							
260	1615	2877	4511	7375	11529	18913							
265	1645	2930	4594	7510	11740	19259							
270	1674	2982	4676	7645	11950	19605							
275	1704	3035	4759	7780	12161	19951							
280	1733	3088	4841	7914	12372	20297							
285	1763	3140	4924	8049	12583	20643							
290	1793	3193	5007	8184	12794	20989							
295	1822	3245	5089	8319	13005	21335							
300	1852	3298	5172	8454	13216	21681							



# Figure 41A – Safety Relief Valve

**Air Capacity – Pressure Vessel Code ● Standard Cubic Feet/minute – 90% Rating at 10% Over Pressure**

Meets requirements of ASME Boiler and Pressure Vessel Code, Section VIII.

Certified by National Board of Boiler and Pressure Vessel Inspectors

ORIFICE AREA (In <sup>2</sup> )	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479	J 1.391	K 1.892	L 2.935	M 3.715	N 4.468	P 6.564	Q 11.365	R 16.475
SET PRESS. PSIG													
15	63	111	175	285	446	732	996	1545	1956	2351	3455	5981	8671
20	72	128	201	329	514	844	1148	1781	2255	2711	3983	6896	9996
25	82	145	228	373	583	956	1300	2017	2554	3071	4511	7810	11322
30	91	162	255	416	651	1068	1453	2253	2853	3430	5039	8725	12648
35	102	181	284	464	726	1191	1620	2513	3182	3826	5620	9731	14106
40	112	200	313	512	801	1314	1787	2773	3511	4221	6201	10737	15565
45	123	219	343	560	876	1437	1955	3033	3840	4617	6782	11743	17023
50	133	237	372	608	951	1560	2122	3292	4169	5012	7363	12749	18482
55	144	256	402	656	1026	1684	2290	3552	4498	5408	7945	13755	19940
60	154	275	431	704	1101	1807	2457	3812	4826	5803	8526	14761	21398
65	165	294	460	753	1176	1930	2625	4072	5155	6199	9107	15767	22857
70	175	312	490	801	1251	2053	2792	4332	5484	6594	9688	16773	24315
75	186	331	519	849	1326	2176	2960	4592	5813	6990	10269	17779	25773
80	196	350	548	897	1402	2299	3127	4851	6142	7385	10850	18785	27232
85	207	368	578	945	1477	2422	3295	5111	6471	7781	11431	19791	28690
90	217	387	607	993	1552	2545	3462	5371	6800	8176	12012	20797	30149
95	228	406	637	1041	1627	2669	3630	5631	7129	8572	12593	21804	31607
100	238	425	666	1089	1702	2792	3797	5891	7458	8967	13174	22810	33065
105	249	443	695	1137	1777	2915	3965	6150	7787	9363	13755	23816	34524
110	259	462	725	1185	1852	3038	4132	6410	8116	9758	14336	24822	35982
115	270	481	754	1233	1927	3161	4300	6670	8445	10154	14917	25828	37440
120	280	500	783	1281	2002	3284	4467	6930	8774	10549	15498	26834	38899
125	291	518	813	1329	2077	3407	4635	7190	9103	10945	16079	27840	40357
130	302	537	842	1377	2152	3531	4802	7449	9432	11340	16660	28846	41816
135	312	556	872	1425	2227	3654	4970	7709	9761	11736	17241	29852	43274
140	323	575	901	1473	2302	3777	5137	7969	10090	12131	17822	30858	44732
145	333	593	930	1521	2377	3900	5305	8229	10418	12527	18403	31864	46191
150	344	612	960	1569	2452	4023	5472	8489	10747	12922	18984	32870	47649
155	354	631	989	1617	2527	4146	5640	8748	11076	13318	19565	33876	49107
160	365	649	1018	1665	2602	4269	5807	9008	11405	13713	20147	34882	50566
165	375	668	1048	1713	2677	4392	5974	9268	11734	14109	20728	35888	52024
170	386	687	1077	1761	2753	4516	6142	9528	12063	14504	21309	36894	53483
175	396	706	1106	1809	2828	4639	6309	9788	12392	14900	21890	37900	54941
180	407	724	1136	1857	2903	4762	6477	10047	12721	15295	22471	38906	56399
185	417	743	1165	1905	2978	4885	6644	10307	13050	15691	23052	39912	57858
190	428	762	1195	1953	3053	5008	6812	10567	13379	16086	23633	40918	59316
195	438	781	1224	2001	3128	5131	6979	10827	13708	16482	24214	41924	60774
200	449	799	1253	2049	3203	5254	7147	11087	14037	16877	24795	42930	62233
205	459	818	1283	2097	3278	5378	7314	11346	14366	17273	25376	43936	63691
210	470	837	1312	2145	3353	5501	7482	11606	14695	17668	25957	44942	65150
215	480	855	1341	2193	3428	5624	7649	11866	15024	18064	26538	45948	66608
220	491	874	1371	2241	3503	5747	7817	12126	15353	18459	27119	46954	68066
225	501	893	1400	2289	3578	5870	7984	12386	15682	18855	27700	47960	69525
230	512	912	1430	2337	3653	5993	8152	12646	16010	19251	28281	48966	70983
235	522	930	1459	2385	3728	6116	8319	12905	16339	19646	28862	49972	72441
240	533	949	1488	2433	3803	6239	8487	13165	16668	20042	29443	50979	73900
245	543	968	1518	2481	3878	6363	8654	13425	16997	20437	30024	51985	75358
250	554	987	1547	2529	3953	6486	8822	13685	17326	20833	30605	52991	76817
255	564	1005	1576	2577	4028	6609							
260	575	1024	1606	2625	4104	6732							
265	585	1043	1635	2673	4179	6855							
270	596	1062	1665	2721	4254	6978							
275	606	1080	1694	2769	4329	7101							
280	617	1099	1723	2817	4404	7224							
285	628	1118	1753	2865	4479	7348							
290	638	1136	1782	2913	4554	7471							
295	649	1155	1811	2961	4629	7594							
300	659	1174	1841	3009	4704	7717							



**SPENCE** SPENCE ENGINEERING COMPANY, INC.

## Figure 41A-A Cast Bronze Safety Relief Valve; ASME Section VIII service to 300 PSI NON-VENTING BONNET FOR FUGITIVE EMISSION CONTAINMENT OF HAZARDOUS AIR, GAS OR VAPORS

### Applications

Figure 41A-A valves are heavy duty, high capacity cast bronze bonnet/body safety relief valves for compressed gases, gas sterilizers, toxic or carcinogenic gases or vapors to 300 PSI with temperatures to 450°F.

### Features

The unitized cast bronze bonnet/body, bronze or stainless base design, rugged construction and 2-ring control make the 41A-A Safety Relief Valve extremely dependable in terms of pop action, seat tightness and repeatability. The threaded cap design and all threaded connections are sealed to prevent any body leakage.

### Sizes/Ratings

Available in 1/2" inlet x 3/4" outlet, connections are male (NPT) by female (NPT). Other sizes are available on application. Consult Factory. Rated to 300 PSI with bronze nozzle and disc at temperatures to 450°F.

### Applicable codes

The Figure 41A-A Safety Relief Valves meet all requirements of the ASME Boiler and Pressure Vessel Code, Section VIII and capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors. It is approved and registered in every Province in Canada in accordance with C.S.A. B-51 under C.R.N.#OG1893.5C.

Note: Oxygen service cleaning available.

### Ordering information

Please furnish the following information to assure fast and accurate processing of orders:

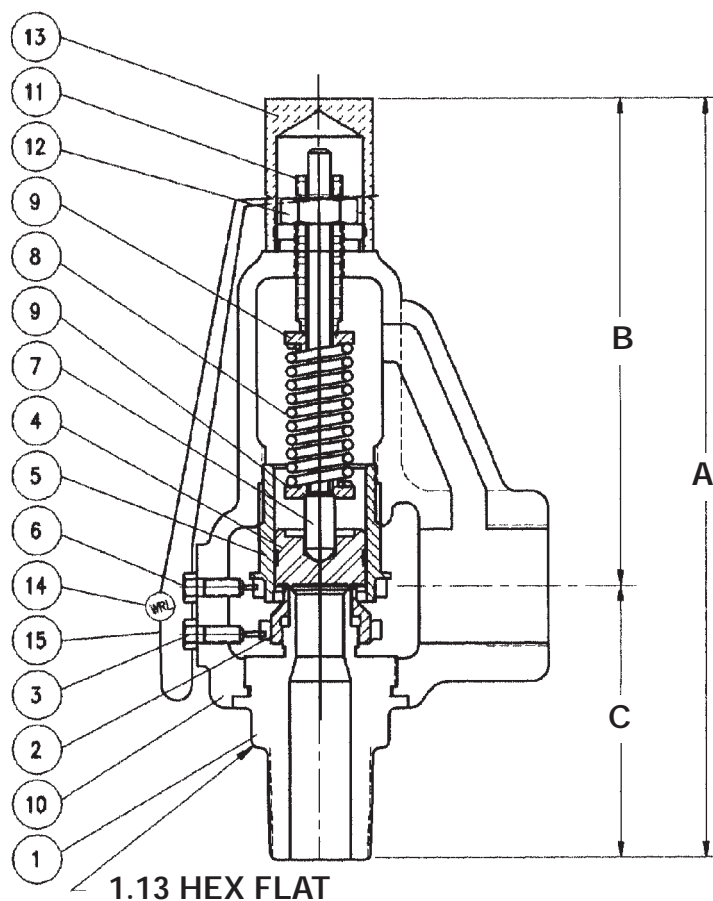
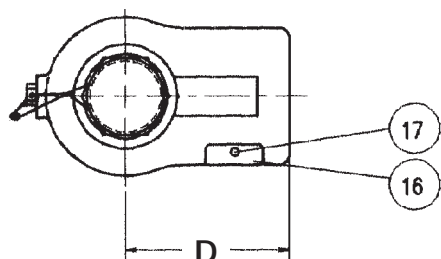
- Quantity of valves
- Nominal pipe size - inlet x outlet
- Figure (model) number (41A-A)
- Set pressure - psig
- Service fluid (air, gas, vapor)
- Required relieving capacity
- Code requirements
- Special testing or cleaning instructions



### Air Capacity – SCFM (90% rating) at 10% overpressure

SIZE	SET PRESSURES (50 PSI INCREMENTS)					
	50	100	150	200	250	300
1/2"	133	238	343	448	553	659

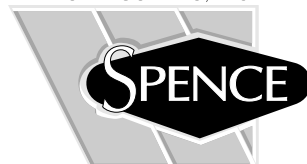
Materials		
Ref. No	Part Name	Material Spec.
1	Base	ASTM B283 Brass
2	Base Ring	ASTM B283 Brass
3	Base Ring Set Screw	ASTM B16 Brass
4	Disc	ASTM B16 Brass
5	Guide & Ring	ASTM B283 Brass
6	Guide Ring Set Screw	ASTM B16 Brass
7	Spindle	ASTM A580 Type 302
8	Spring	Commercial SS
9	Spring Washer	Commercial SS
10	Bonnet	ASTM B62 Bronze
11	Adjusting Bolt	ASTM B16 Brass
12	Adjusting Bolt Locknut	Commercial SS
13	Cap	ASTM B16 Brass
14	Seal	Lead
15	Wire	Commercial SS
16	Nameplate	Commercial SS
17	Drive Screw	Commercial SS



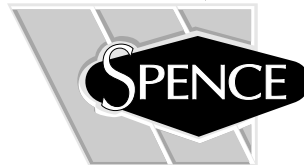
## Dimensions—Inches

Valve Size (inches)	A	B	C	D	Weight (lbs)
1/2" X 3/4"	6 <sup>1</sup> / <sub>4</sub>	4	2 <sup>1</sup> / <sub>4</sub>	1 <sup>7</sup> / <sub>8</sub>	2.5

WATTS INDUSTRIES, INC.



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SPENCE ENGINEERING COMPANY, INC.

## Figure 41A-T Cast Bronze Top Outlet Safety Relief Valve; ASME Section VIII service to 300 PSI FOR AIR, GAS OR VAPORS

### Applications

Figure 41A - T, top outlet valves are heavy duty, high capacity, cast bronze safety relief valves for compressors intercoolers, aftercoolers and receivers, air make-up units, pneumatic conveying/elevating equipment, dryers and other pressure vessels and piping handling air or non-hazardous gases. In addition, valves can be used for protection of the discharge or low pressure side of air, gas & vapor pressure reducing valve installations to 300 psig.

### Features

Unitized cast bronze bonnet/bronze base (nozzle) design with optional stainless steel trim available, rugged construction and 2-ring control make the 41A-T safety relief valve extremely dependable in terms of pop action, blowdown, seat tightness and repeatability. The heavy duty lifting lever design allows for manual valve opening (testing) with low required force on the lever.

### Sizes/Ratings

Available in six inlet sizes from 1/2" through to 2" male inlet connections. Rating is 300 psig. at 406°F maximum. Cast Iron Bodies (bonnet) not available for top outlet valves. Stainless nozzle & disc (optional) 300 psig. @422°F.

### Applicable Codes

Figure 41A - T safety valve meets all requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, and capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors, (capacities shown are 90% of actual test capacities). It is approved and registered in every Province in Canada in accordance with C.S.A. B-51 under C.R.N.#0G1893.5C.

### Ordering Information

Please furnish the following information to assure fast and accurate processing of orders.

- Quantity of valves
- Nominal pipe size - Inlet
- Valve Figure (model) number (41A-T)
- Set pressure - PSIG
- Fluid temperature (normal & maximum)
- Service
- Required relieving capacity
- Code requirements, if any
- Special testing or instructions
- Stainless nozzle & disc (optional)

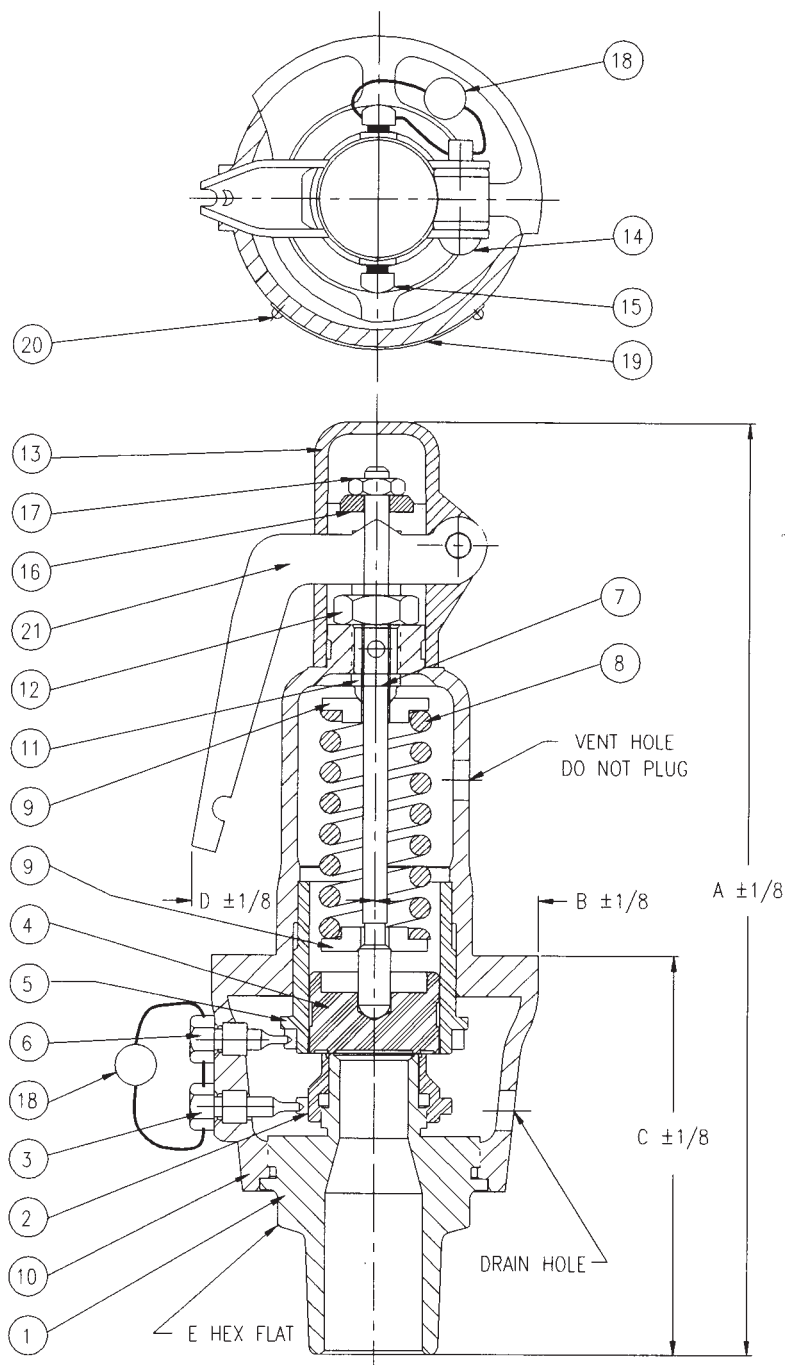


### Air Capacity – SCFM (90% rating) at 10% overpressure

Set Press. PSIG	Valve Orifice Size						Set Press. PSIG	Valve Orifice Size					
	D	E	F	G	H	J		D	E	F	G	H	J
*5	37	65	102	167	261	428	125	291	518	812	1328	2076	3407
*10	50	89	140	228	356	585	150	343	611	959	1568	2452	4022
15	63	111	175	285	446	732	175	396	705	1106	1808	2827	4638
20	72	128	201	329	514	844	200	448	799	1253	2048	3202	5254
25	82	145	228	373	583	956	225	501	892	1400	2288	3578	5869
30	91	162	255	416	651	1068	250	553	986	1547	2528	3953	6435
50	133	237	372	608	951	1550	275	606	1080	1693	2769	4328	7101
75	185	331	519	848	1326	2176	300	659	1173	1840	3009	4703	7716
100	238	424	665	1088	1701	2791							

\* Capacities for 5 & 10 PSI not certified by ASME National Board.

Materials		
Ref. No	Part Name	Material Spec.
1	Base	Brass or Bronze ASTM B283 or B62
2	Base Ring	Brass or Bronze ASTM B283 or B62
3	Base Ring Set Screw	Brass ASTM B16
4	Disc	Brass or Bronze ASTM B283 or B62
5	Guide and Ring	Brass or Bronze ASTM B283 or B62
6	Guide Ring Set Screw	Brass ASTM B16
7	Spindle	Steel ASTM A108
8	Spring	Plated Steel
9	Spring Washer	Steel ASTM A108
10	Bonnet	Cast Bronze ASTM B62
11	Adjusting Bolt	Brass ASTM B16
12	Adjusting Bolt Locknut	Plated Steel
13	Cap	Zinc Alloy
14	Lifting Cap Pin	Plated Steel
15	Lifting Cap Lockscrew	Plated Steel
16	Spindle Nut	Steel
17	Spindle Nut Locknut	Plated Steel
18	Seal and Wire	Lead & Stainless Steel
19	Nameplate	Stainless Steel
20	Drive screw	Stainless Steel
21	Lever	Plated Steel

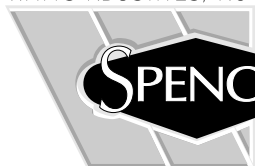


## Dimensions—Inches

Valve Inlet Size (inches)	Orifice	A	B	C	D*	E Hex	Weight (lbs)
1/2	D	6 9/16	1 1/16	2 7/8	1 3/8	1 1/8	2.00
3/4	E	7 1/8	1 1/4	3 1/16	1 3/8	1 1/4	2.50
1	F	9	1 7/16	3 1/2	1 13/16	1 1/2	4.00
1 1/4	G	9 11/16	1 11/16	3 3/4	1 13/16	1 7/8	6.00
1 1/2	H	12 1/8	2 1/16	4 11/16	2 3/4	2 1/4	10.50
2	J	13 5/16	2 1/2	5	2 3/4	2 3/4	15.50

\*Add 1/4" to D dimension to allow lift.

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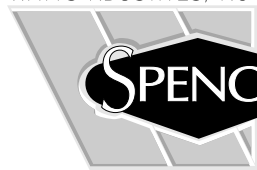


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## Figure 10 cast iron safety valve for steam heating boilers with operating pressures to 15 PSIG — ASME Section IV

### Applications

Figure 10 valves are ASME Code Section IV safety valves designed for industrial and commercial low pressure steam heating boilers and associated equipment. Standard pressure settings for saturated steam service are 5 thru 15 psig.

### Features

The Figure 10 valve features tight shutoff, sharp popping and closing action and a high degree of repeatability. The valve inlet and body are one integral casting assuring proper alignment of disc, seat and spindle for smooth action. The disc is located by a disc guide which in turn is held in place by a zinc plated wave spring. The entire assembly is contained by a combination bonnet/compression screw. The simplicity of the design means dependability and low cost.

### Sizes/Ratings

Available in seven sizes ranging from  $\frac{3}{4}$ " x 1" to 3" x 3", connections are male NPT screwed inlet and female NPT screwed outlet. The cast iron body is rated at 15 psig at saturated steam temperature (250°F).

### Applicable codes

Figure 10 safety valve steam capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors, Columbus, Ohio (capacities shown are 90% of actual test capacities). Built in accordance with requirements of the ASME Section IV Heating Boiler Code, this valve is also approved and registered in every Province in Canada in accordance with C.S.A. B-51 under Canadian Registration No. 02635.1-0.

### Ordering information

Please furnish the following information to assure fast and accurate processing of valve orders:

- Quantity of valves
- Nominal pipe size - Inlet x Outlet
- Valve Figure (Model) number (10)
- Set pressure - psig
- Saturated steam temperature
- Required relieving capacity
- Code requirements
- Special testing or instructions



### Saturated Steam Capacities—Pounds per hour (90% rating) at 33 $\frac{1}{3}$ % overpressure

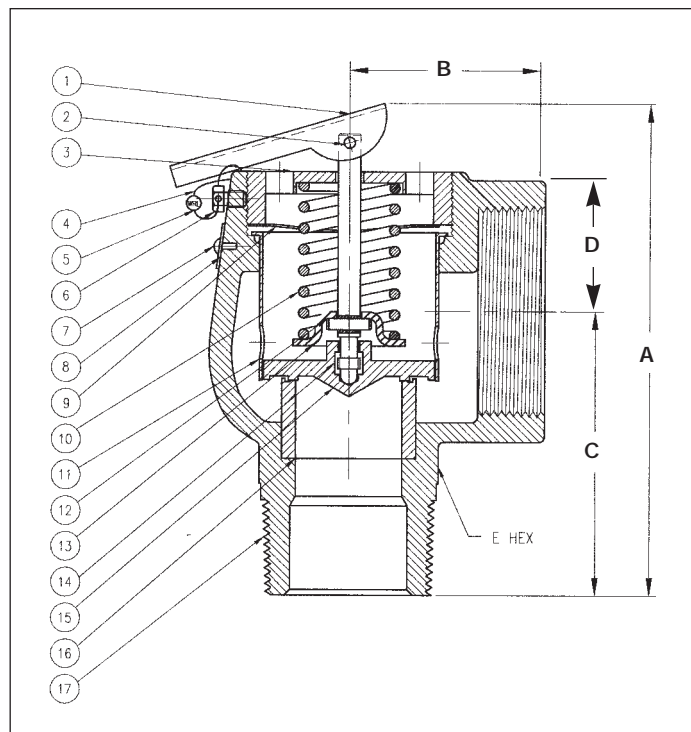
Set Pressure PSIG	Valve Size Inlet x Outlet—Inches						
	$\frac{3}{4}$ x 1	1 x 1 $\frac{1}{4}$	1 $\frac{1}{4}$ x 1 $\frac{1}{2}$	1 $\frac{1}{2}$ x 2	2 x 2 $\frac{1}{2}$	2 $\frac{1}{2}$ x 2 $\frac{1}{2}$	3 x 3
* 5	230	409	639	924	1637	2557	3698
* 10	318	565	882	1276	2260	3530	5106
15	394	700	1093	1581	2801	4375	6328

\*Capacities for 5 and 10 PSI are not certified by ASME National Board.



## Materials

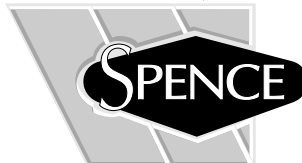
Ref. No	Part Name	Material Spec.
1	Lever	Steel-Zinc Plated
2	Lever Pin	Steel- Zinc Plated
3	Compression Screw	Cast Iron/Steel
4	Seal Wire	Stainless Steel
5	Seal	Lead
6	Lock Screw	Brass
7	Drive Screw	Stainless Steel
8	Name Plate	Stainless Steel
9	Wave Washer	Carbon Steel-Zinc Plated
10	Spring	Carbon Steel-Zinc Plated
11	Disc Guide	Brass or Bronze
12	Spindle Pin	Steel-Zinc Plated
13	Spring Washer	Steel-Zinc Plated
14	Spindle	Steel
15	Disc	Brass or Bronze
16	Seat	Brass or Bronze
17	Body	Cast Iron



## Dimensions and Weights

Valve Size Inlet x Outlet Male NPT x Female NPT	Dimensions (inches)					Weight (lb.)
	A	B	C	D	E	
3/4 x 1	3 <sup>5</sup> / <sub>16</sub>	1 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>16</sub>	1 <sup>1</sup> / <sub>4</sub>	1
1 x 1 <sup>1</sup> / <sub>4</sub>	4	2	2 <sup>5</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	1 <sup>1</sup> / <sub>2</sub>	2
1 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>2</sub>	5	2 <sup>1</sup> / <sub>8</sub>	3	2	1 <sup>7</sup> / <sub>8</sub>	3
1 <sup>1</sup> / <sub>2</sub> x 2	5 <sup>1</sup> / <sub>8</sub>	2 <sup>3</sup> / <sub>16</sub>	3 <sup>3</sup> / <sub>16</sub>	1 <sup>15</sup> / <sub>16</sub>	2	4
2 x 2 <sup>1</sup> / <sub>2</sub>	6 <sup>11</sup> / <sub>16</sub>	2 <sup>7</sup> / <sub>8</sub>	4	2 <sup>11</sup> / <sub>16</sub>	3	8
2 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub>	8 <sup>3</sup> / <sub>8</sub>	3 <sup>5</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	4	3 <sup>1</sup> / <sub>4</sub>	14
3 x 3	9 <sup>1</sup> / <sub>2</sub>	3 <sup>7</sup> / <sub>8</sub>	5 <sup>1</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	4	22

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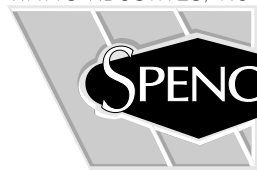
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## Figure 15 cast iron safety valve for overpressure protection of low pressure/ high volume air and gas systems

### Applications

Figure 15 valves are high capacity safety relief valves for over-pressure protection of low to medium pressure, high volume blowers and compressors, bulk hauling trailers, pneumatic conveying equipment, air pollution control equipment, dryers, dust collectors and similar pneumatic equipment.

### Features

The Figure 15 valve features tight shutoff, sharp popping and closing action and a high degree of repeatability. The valve inlet and body are one integral casting assuring proper alignment of disc, seat and spindle for smooth action. The bronze disc is guided by a brass guide which in turn is held in place by a zinc plated wave spring. The entire assembly is contained by a combination bonnet/compression screw. The simplicity of the design means dependability and low cost. Standard Figure 15C valves are equipped with lifting levers (required by ASME Code, Section VIII for air service) or screwed cap (Figure 15A and 15V).

### Sizes/Ratings\*

Available in seven sizes ranging from  $\frac{3}{4}$ " x 1" to 3" x 3", connections are male NPT screwed inlet and female NPT screwed outlet. The cast iron body is rated at 60 psig at 400°F. Figure 15C and 15A set pressures range from 5 to 15 psig. For setting over 15 psi, please check factory. Figure 15V set pressures range from 6"Hg to 30"Hg. Check with factory for vacuum capacities.

### Applicable codes

Figure 15 safety relief valves are non-ASME Code valves in all sizes except 2" x 2½". The 2" x 2½" Figure 15 safety relief valve meets the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII. Capacities for the 2" x 2½" valve are certified by the National Board of Boiler and Pressure Vessel Inspectors for set pressures 15 psig and above. All Figure 15 valves are approved and registered in every Province in Canada in accordance with C.S.A. B-51 under Canadian Registration No. 02636.1 thru 0.

### Ordering information

Please furnish the following information to assure fast and accurate processing of valve orders:

- Quantity of valves
- Nominal pipe size - Inlet x Outlet
- Valve Figure (Model) number (15C, 15A, 15V)
- Set pressure - psig
- Fluid temperature (normal and maximum)
- Service fluid (air, gas)
- Specific gravity, if gas
- Required relieving capacity
- Code/requirements
- Special testing or instructions

\* Vacuum valves (Figure 15V) are mounted in reverse direction.



Figure 15C



Figure 15A and 15V

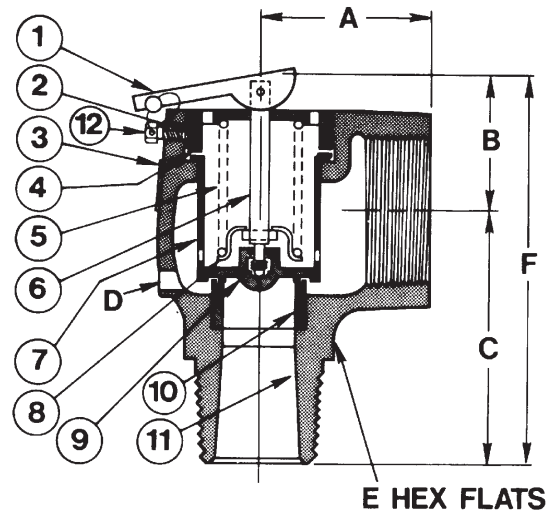
### Air capacity — SCFM at 10% overpressure

Set Pressure PSIG	Valve Size Inlet x Outlet — inches						
	$\frac{3}{4}$ x 1	1 x 1¼	1¼ x 1½	1½ x 2	2 x 2½	2½ x 2½	3 x 3
5	69	122	191	276	487	763	1103
10	94	167	260	377	666	1043	1508
15	118	209	326	472	834	1305	1888

**NOTE:** For inlet temperatures other than 60°F., multiply above air capacities by correction factor  $K_t$  found on back page.  
For gases of specific gravity other than 1.0 (Air = 1.0), multiply above air capacities by correction factor  $K_{sg}$  found on back page.

## Materials

Ref. No.	Part Name	Material
1	Lever	Steel Plated
2	Compression Screw	Cast Iron
3	Name Plate	Aluminum/Stainless Steel
4	Wave Spring	Steel Plated
5	Valve Spring	Steel lated
6	Spindle	Steel Plated
7	Disc Guide	Brass
8	Spring Washer	Steel Plated
9	Disc	Brass or Bronze
10	Seat	Brass or Bronze
11	Body	Cast Iron
12	Lock Screw	Brass



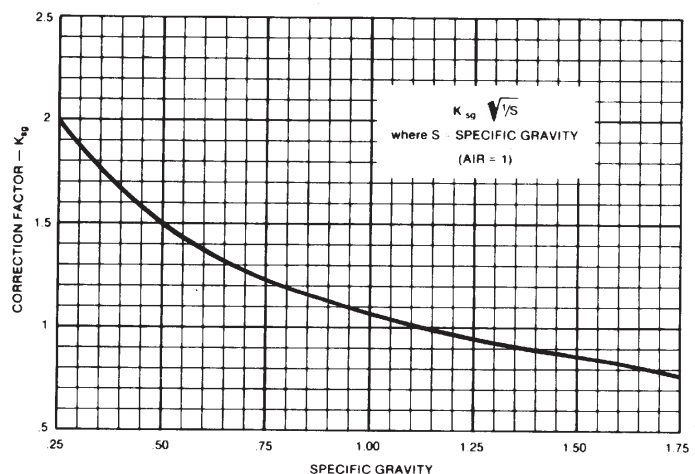
## Dimensions-Inches

Valve Size Inlet x Outlet Male NPT x Female NPT	A	B	C	D	E	F	Weight (lb.)
3/4 x 1	1 1/2	1 3/16	2 1/8	1/4	1 1/4	3 5/16	1
1 x 1 1/4	2	1 3/8	2 5/8	1/4	1 1/2	4	2
1 1/4 x 1 1/2	2 1/8	2	3	1/4	1 7/8	5	3
1 1/2 x 2	2 3/16	2 3/8	3 3/16	1/4	2	5 1/8	4
2 x 2 1/2	2 7/8	2 11/16	4	1/4	3	6 11/16	8
2 1/2 x 2 1/2	3 5/8	4	4 3/8	3/8 NPT	3 1/4	8 3/8	14
3 x 3	3 7/8	4 3/8	5 1/8	3/8 NPT	4	9 1/2	22

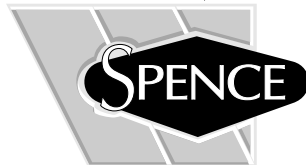
## Correction Factors-Temperature Correction Factor $K_t$ Applying to Air Capacities

Fluid Temp. °F	$K_t$	Fluid Temp. °F	$K_t$	Fluid Temp. °F	$K_t$
0	1.063	120	0.9469	240	0.8619
10	1.052	130	0.9388	250	0.8558
20	1.041	140	0.9310	260	0.8499
30	1.031	150	0.9233	270	0.8440
40	1.020	160	0.9158	280	0.8383
50	1.010	170	0.9085	300	0.8272
60	1.000	180	0.9014	320	0.8155
70	0.9905	190	0.8944	340	0.8062
80	0.9813	200	0.8876	360	0.7964
90	0.9723	210	0.8811	380	0.7863
100	0.9636	220	0.8746	400	0.7776
110	0.9552	230	0.8682		

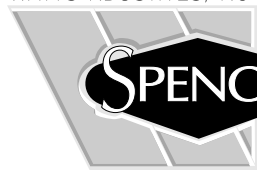
## Specific Gravity Correction Factor $K_{sg}$ Applying to Gas Capacities



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## Figure 15LC & 15LA Aluminum safety valve for overpressure protection of low pressure/ high volume air and gas systems

### Applications

Figure 15LC valves are high capacity safety relief valves for over-pressure protection of low to medium pressure, high volume blowers and compressors, bulk hauling trailers, railroad tank cars, pneumatic conveying equipment, air pollution control equipment, dryers, dust collectors and similar pneumatic equipment.

### Features

The Figure 15LC valve features tight shutoff, sharp popping and closing action and a high degree of repeatability. The valve inlet and body are one integral casting assuring proper alignment of disc, seat and spindle for smooth action. The bronze disc is guided by a brass guide which in turn is held in place by a zinc plated wave spring. The entire assembly is contained by a combination bonnet/compression screw. The simplicity of the design means dependability and low cost. Figure 15LC valves are equipped with lifting levers (required by ASME Code, Section VIII for air service). Figure 15LA valves are equipped with a screwed cap and no lifting lever.

### Sizes/Ratings

Available in 2 x 2 1/2 size only. Connections are male NPT screwed inlet and female NPT screwed outlet. Set pressures range from 5 to 15 psig. For setting over 15 psi, please check factory.

### Applicable codes

The 2" x 2 1/2" Figure 15LC safety relief valve meets the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII. Capacities for the 2" x 2 1/2" valve are certified by the National Board of Boiler and Pressure Vessel Inspectors for set pressures 15 psig and above. All Figure 15 valves are approved and registered in every Province in Canada in accordance with C.S.A. B-51 under Canadian Registration No. 02636.1 thru 0.

### Ordering information

Please furnish the following information to assure fast and accurate processing of valve orders:

- Quantity of valves
- Nominal pipe size - Inlet x Outlet
- Valve Figure (Model) number (15LC)
- Set pressure - psig
- Fluid temperature (normal and maximum)
- Service fluid (air, gas)
- Specific gravity, if gas
- Required relieving capacity
- Code/requirements
- Special testing or instructions

### Air capacity — Inches

#### SCFM at 10% overpressure

Set Pressure PSIG	Size Inlet x Outlet 2 x 2 1/2
5	487
10	666
15	834

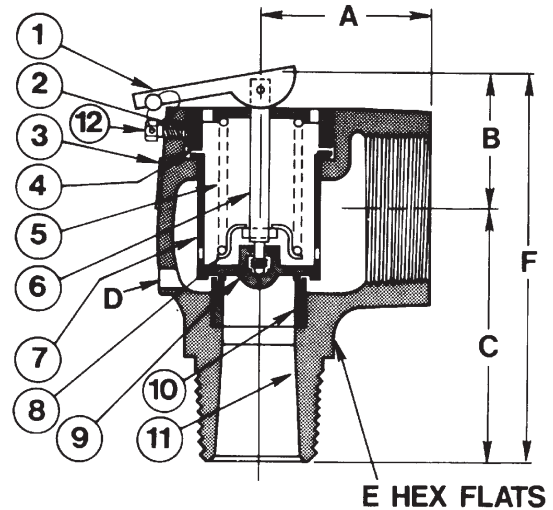


Figure 15LC

**NOTE:** For inlet temperatures other than 60°F., multiply above air capacities by correction factor  $K_t$  found on back page.  
For gases of specific gravity other than 1.0 (Air = 1.0), multiply above air capacities by correction factor  $K_{sg}$  found on back page.

## Materials

Ref. No.	Part Name	Material
1	Lever	Steel Plated
2	Compression Screw	Cast Iron or Steel
3	Name Plate	Aluminum/Stainless Steel
4	Wave Spring	Steel Plated
5	Valve Spring	Steel lated
6	Spindle	Steel Plated
7	Disc Guide	Brass
8	Spring Washer	Steel Plated
9	Disc	Brass or Bronze
10	Seat	Brass or Bronze
11	Body	Aluminum
12	Lock Screw	Brass



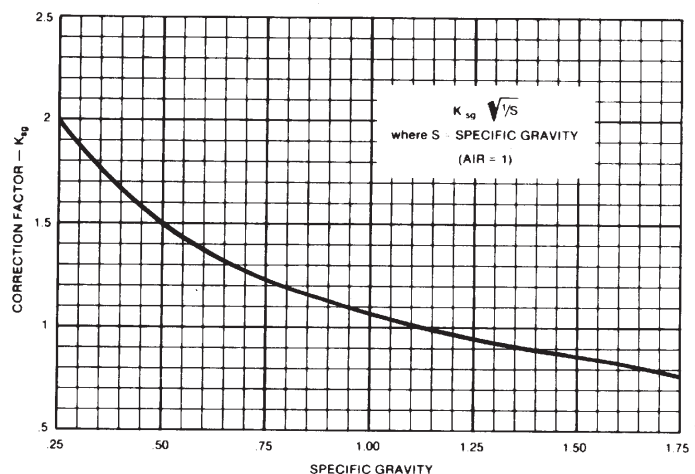
## Dimensions-Inches

Valve Size Inlet x Outlet Male NPT x Female NPT	A	B	C	D	E	F	Weight (lb.)
2 x 2½	2⅞	2⅞	4	¼	3	6⅞	4

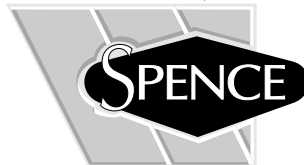
## Correction Factors—Temperature Correction Factor $K_t$ Applying to Air Capacities

Fluid Temp. °F	$K_t$	Fluid Temp. °F	$K_t$	Fluid Temp. °F	$K_t$
0	1.063	120	0.9469	240	0.8619
10	1.052	130	0.9388	250	0.8558
20	1.041	140	0.9310	260	0.8499
30	1.031	150	0.9233	270	0.8440
40	1.020	160	0.9158	280	0.8383
50	1.010	170	0.9085	300	0.8272
60	1.000	180	0.9014	320	0.8155
70	0.9905	190	0.8944	340	0.8062
80	0.9813	200	0.8876	360	0.7964
90	0.9723	210	0.8811	380	0.7863
100	0.9636	220	0.8746	400	0.7776
110	0.9552	230	0.8682		

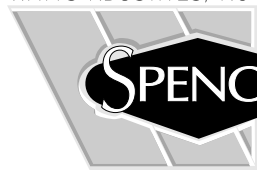
## Specific Gravity Correction Factor $K_{sg}$ Applying to Gas Capacities



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## Figure 25 Bronze Relief Valve with Soft Seat or Metal Trim for Liquid Service

### Applications

The Figure 25 valves are completely sealed bronze relief valves for thermal relief, low capacity pumps and similar applications on water, oil and other liquids.

### Features

These unusually rugged valves feature a top guided disc, flat seats and single unit cast body. The compression screw is also the disc guide and is sealed against the body with a Viton O-ring. The top guided, contoured disc assures rapid opening at set pressure with stable operation. Two trim types are offered to handle many industrial and marine applications: bronze disc and seat with Viton O-ring seal (standard) or metal-to-metal bronze seats (optional).

### Sizes/Ratings

Figure 25 valves are available in sizes 1/2" x 3/4", 3/4" x 3/4" and 1" x 1". Connections are male NPT inlet and female NPT outlet. Maximum pressure rating is 300 PSIG. Maximum temperature rating for all sizes is 150°F. Set pressure range is 30 to 300 PSIG.

### Applicable codes

Figure 25 relief valves are non-code valves. Capacities are certified by Watts through laboratory test. They are approved and registered in every Province in Canada in accordance with C.S.A. B-51 under C.R.N.#02723.1 through 0.

### Ordering information

Please furnish the following information to assure fast and accurate processing of valve orders:

- Quantity of valves
- Nominal pipe size - Inlet x Outlet
- Figure (model) number (25)
- Set pressure - psig
- Service liquid (water, oil, etc.)
- Service liquid specific gravity
- Required relieving capacity
- Code/requirements, if any
- Special testing or instructions
- Back pressure conditions must be advised



### Water Capacity – GPM @ 25% overpressure\*

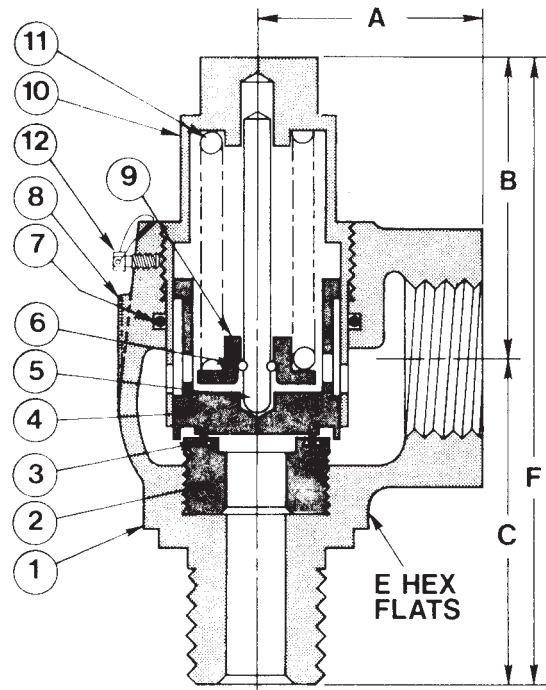
Set Pressure PSIG	Valve Size Inlet x Outlet - Inches			Set Pressure PSIG	Valve Size Inlet x Outlet - Inches		
	1/2 x 3/4	3/4 x 3/4	1 x 1		1/2 x 3/4	3/4 x 3/4	1 x 1
30	3	12	12	100	8.5	26	26
40	4	15	15	120	9	28.5	28.5
50	5	17	17	140	9.5	31	31
60	6	19	19	160	10	32.5	32.5
70	7	21	21	180	10	33.5	33.5
80	7.5	23	23	200-300	10	34	34
90	8	25	25				

\*For liquids of specific gravity other than 1.0 (Water = 1), multiply above capacities by correction factor  $K_{sg}$  found on back page.

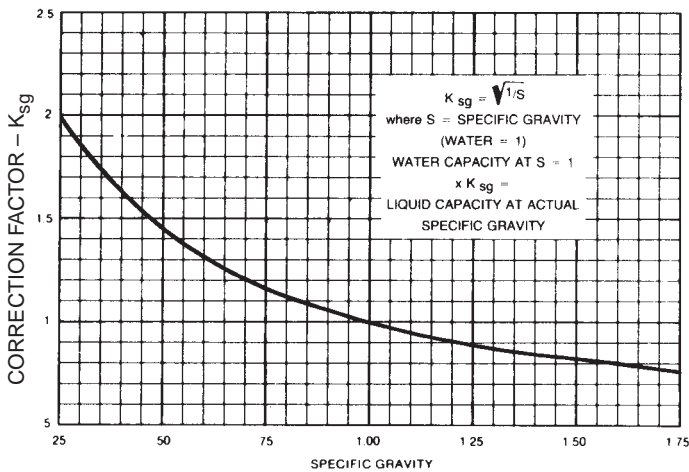
\*Where back pressure exists, use instead of set pressure, the difference between set pressure and the back pressure.

## Materials

Ref. No	Part Name	Material Spec.
1	Body	SB-62 Bronze
2	Seat	B-16 Brass
3	Seat Seal	Viton O-ring
4	Disc	B-16 Brass
5	Spindle	Type 316 St. St.
6	Snap Ring	Type 302 St. St.
7	Compression Screw Seal	Viton O-ring
8	Name Plate	
9	Spring Washer	Type 316 St. St.
10	Compression Screw	B-16/SB-62
11	Valve Spring	Carbon Steel-Zinc Plated
12	Lock Screw	Brass



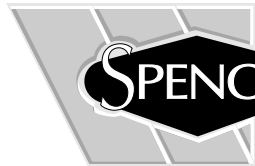
## Specific Gravity Correction Factor $K_{sg}$ Applying to Liquid Capacities



## Dimensions—Inches

Valve Size Inlet x Outlet (inches)	A	B	C	E	F	Weight (lb.)
1/2 x 3/4 3/4 x 3/4 1 x 1	17/16	2	2 1/8	—	4 1/8	1.5

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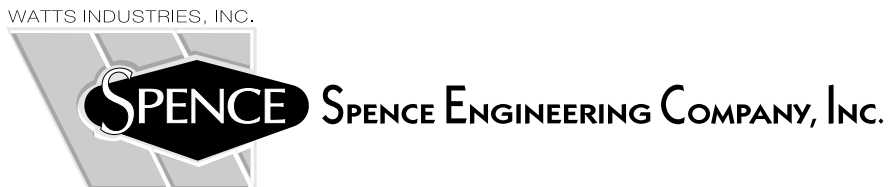
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## Figure 50 bronze or aluminum safety relief valve for air, gas, vapors and powdered solids ASME Section VIII

### Applications

The Figure 50 is a compact bronze and/or aluminum safety relief valve for pressure relief of low pressure air, gas, vapors and powdered solids to atmosphere. It provides dependable overpressure protection of pneumatic conveyor systems as well as bulk haul trailers, railroad tank cars and storage vessels containing powdered solids such as potash, flour, cement, etc. that are loaded or unloaded by compressed air.

### Features

Special features of the Figure 50 include a tamper proof spring setting that cannot be altered, weatherproofed construction and a diaphragm that completely seals the spring chamber from the process fluid. The diaphragm seal with multiple vent design assures high capacity relief without clogging. An O-ring seat seal provides tight shut-off until the set pressure is reached. A lifting lever is available as required.

### Sizes/Ratings

The Figure 50 safety relief valve is available in size 2" female NPT screwed connection only. Set pressure range is 10-30 PSIG, maximum temperature is 225°F. Higher temperature, consult factory.

### Applicable codes

The Figure 50 safety relief valve meets all requirements of the ASME Boiler and Pressure Vessel Code, Section VIII and capacities are certified by the National Board of Boiler and Pressure Vessel Inspectors. The Figure 50 is also approved and registered in every Province in Canada in accordance with C.S.A. B-51 under C.R.N. #02635.1 thru 0.

### Ordering information

Please furnish the following information to assure fast and accurate processing of valve orders:

- Quantity of valves
- Valve Figure (Model) number (50)
- Set pressure - psig
- Fluid temperature (normal and maximum)
- Service fluid (air, gas, vapor)
- Molecular weight, if vapor
- Specific gravity, if gas
- Required relieving capacity
- Code/regulatory requirements
- Special testing or instructions
- Material - Aluminum or Bronze
- Lifting lever (if req'd)



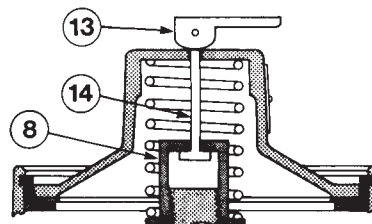
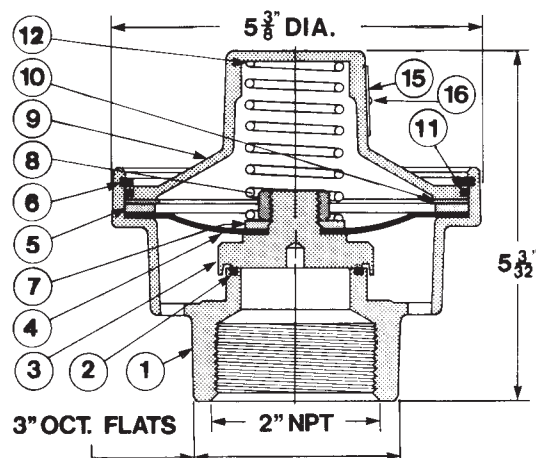
### Air capacity — SCFM at 3 PSI overpressure

Set Pressure — psig					Weights	
10	15	20	25	30	Al.	Bronze
637	752	867	982	1097	3 lbs.	7 lbs.

Note: For inlet temperatures other than 60°F, multiply above capacities by factor  $K_t$  found on back page.  
For gases of specific gravity other than 1.0 (Air = 1), multiply above capacities by correction factor  $K_{sg}$  found on back page.  
Consult Spence for vapor sizing.



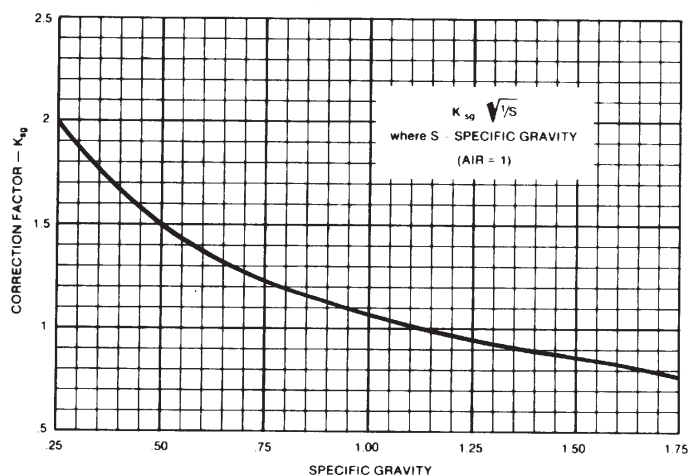
Ref. No.	Part Name	Material
1	Body	Bronze or Aluminum
2	Seat Seal	Viton or Buna-N
3	Disc	Brass
4	Diaphragm	Buna-N
5	Washer	Steel-Zinc Plated
6	Retaining Ring	Steel-Zinc Plated
7	Disc Washer	Steel-Zinc Plated
8	Disc Nut	Steel-Zinc Plated
9	Cover	Bronze or Aluminum
10	Wave Spring	Carbon Steel-Plated
11	Weather Seal	Viton
12	Spring	Carbon Steel-Zinc Plated
13	Lifting Lever	Steel-Zinc Plated
14	Spindle	Steel-Zinc Plated
15	Nameplate	Stainless Steel or Alum.
16	Drive Screw	Stainless Steel



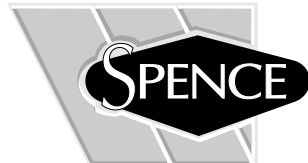
## Correction Factors

Fluid Temp. °F	K <sub>t</sub>	Fluid Temp. °F	K <sub>t</sub>	Fluid Temp. °F	K <sub>t</sub>
0	1.063	120	0.9469	240	0.8619
10	1.052	130	0.9388	250	0.8558
20	1.041	140	0.9310	260	0.8499
30	1.031	150	0.9233	270	0.8440
40	1.020	160	0.9158	280	0.8383
50	1.010	170	0.9085	300	0.8272
60	1.000	180	0.9014	320	0.8155
70	0.9905	190	0.8944	340	0.8062
80	0.9813	200	0.8876	360	0.7964
90	0.9723	210	0.8811	380	0.7863
100	0.9636	220	0.8746	400	0.7776
110	0.9552	230	0.8682		

## Specific Gravity Correction Factor K<sub>sg</sub> Applying to Gas Capacities



WATTS INDUSTRIES, INC.



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## SAFETY VALVE (MODEL DPE) DRIP PAN ELBOWS

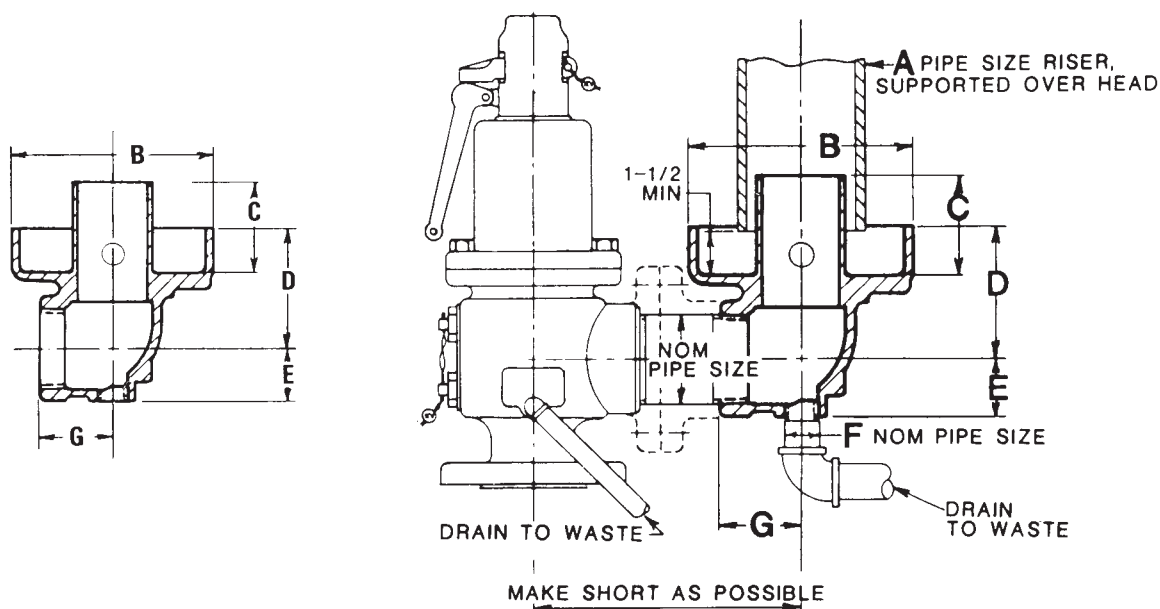


Safety Valve (Model DPE) Drip Pan Elbows

The **Spence** Safety Valve (Model DPE) Drip Pan Elbows are recommended for installation on outlet/discharge pipes for equivalent safety valves used on steam service. They are easily installed on female NPT or flanged outlets with the appropriate companion flange and are compatible with all Spence ASME Safety Valves.

Safety Valve (Model DPE) Drip Pan Elbows will fit safety valve outlet sizes  $\frac{3}{4}$ ", 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ ", 2",  $2\frac{1}{2}$ ", 3", 4", 6" and 8".

Spence Safety Valve (Model DPE) Drip Pan Elbows offer users consistent high quality workmanship and materials. They are a safe and practical complement to Spence Figure 31 and 41 Safety Valves.



### DIMENSIONS AND WEIGHTS

DPE No.	Valve Outlet Size	Dimensions							Wt. Lbs.
		A	B	C	D	E	F	G	
.75	$\frac{3}{4}$ "	$1\frac{1}{2}$	$3\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{3}{4}$	$1\frac{1}{32}$	$\frac{1}{4}$	$1\frac{1}{2}$	2
1	1"	$1\frac{1}{2}$	$3\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{3}{4}$	$1\frac{1}{32}$	$\frac{1}{4}$	$1\frac{1}{2}$	2
1.25	$1\frac{1}{4}$ "	2	$5\frac{1}{2}$	$2\frac{15}{32}$	$4\frac{1}{8}$	$1\frac{7}{16}$	$\frac{3}{8}$	$2\frac{1}{8}$	5
1.5	$1\frac{1}{2}$ "	2	$5\frac{1}{2}$	$2\frac{15}{32}$	$4\frac{1}{8}$	$1\frac{7}{16}$	$\frac{3}{8}$	$2\frac{1}{8}$	5
2	2"	3	$6\frac{1}{4}$	$2\frac{3}{8}$	$3\frac{5}{8}$	$1\frac{5}{8}$	$\frac{1}{2}$	$2\frac{1}{4}$	$6\frac{1}{2}$
2.5	$2\frac{1}{2}$ "	$3\frac{3}{4}$	$7\frac{3}{8}$	3	$4\frac{5}{16}$	$1\frac{15}{16}$	$\frac{3}{4}$	$2\frac{11}{16}$	11
3	3"	4	8	$3\frac{1}{2}$	$4\frac{7}{8}$	$2\frac{5}{16}$	$\frac{3}{4}$	$3\frac{1}{8}$	$14\frac{1}{2}$
4	4"	6	$9\frac{5}{8}$	$4\frac{1}{2}$	$5\frac{3}{4}$	$2\frac{7}{8}$	$\frac{3}{4}$	$3\frac{3}{4}$	27
6	6"	8	$12\frac{3}{4}$	$6\frac{5}{8}$	$7\frac{9}{16}$	$4\frac{3}{16}$	$\frac{3}{4}$	8	75
8	8"	10	$16\frac{1}{2}$	$7\frac{1}{2}$	$9\frac{9}{16}$	$5\frac{3}{8}$	1	$10\frac{3}{4}$	102

6" and 8" elbows have integral 125 lb. ANSI flange, smaller sizes  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ " available on request.



SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## CONDENSATE COMMANDER PUMP

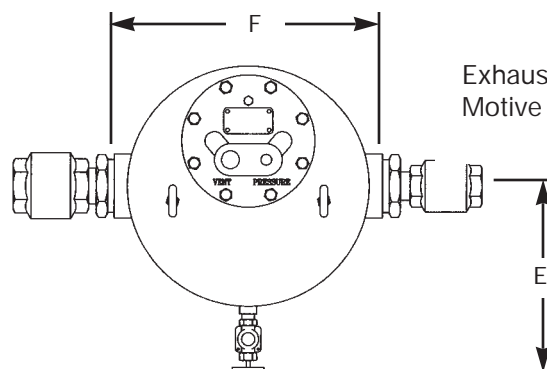
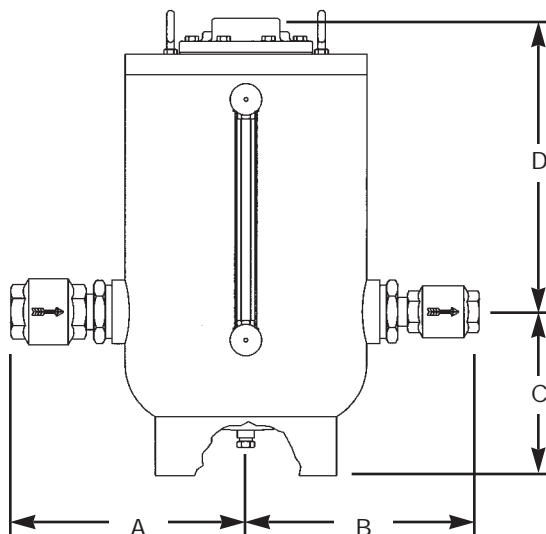


Condensate Commander Pump

Dimensions							Weight Lbs.
Size	A	B	C	D†	E*	F	
1"x 1"	13 <sup>3</sup> / <sub>8</sub>	13 <sup>3</sup> / <sub>8</sub>	11	21 <sup>3</sup> / <sub>4</sub>	9	17 <sup>3</sup> / <sub>4</sub>	168
1 1/2"x 1 1/2"	14 <sup>3</sup> / <sub>4</sub>	14 <sup>3</sup> / <sub>4</sub>	11	21 <sup>3</sup> / <sub>4</sub>	9	17 <sup>3</sup> / <sub>4</sub>	170
2"x 2"	15	15	11	21 <sup>3</sup> / <sub>4</sub>	9	17 <sup>3</sup> / <sub>4</sub>	173
3"x 2"	16 <sup>1</sup> / <sub>2</sub>	15	11	21 <sup>3</sup> / <sub>4</sub>	9	17 <sup>3</sup> / <sub>4</sub>	185

\*Add 5" for Water Gage.

† Allow additional 21" clearance for maintenance.



Exhaust outlet: 1" NPT  
Motive inlet: 1/2" NPT

The Spence Condensate Commander Pump is driven by pressurized gas or steam. Operation without electrical connections makes it the preferred choice for remote or hazardous locations. Required suction head is negligible as optimal performance is achieved at only 12 inches. The stainless steel snap acting mechanism in continuous compression is unaffected by turbulence and the single spring assures long service life without adjustment or maintenance. The head assembly is available to retrofit other manufacturer's tanks. Self centering supply and exhaust valves provide reliable performance and are lapped for tight shutoff.

The Spence Condensate Commander Pump will remove condensate as well as acids and other process fluids that may be incompatible with conventional pumps. It performs well with high back pressure, low pressure and vacuum systems and can be used in a sump or other submerged application. An ASME code stamped fabricated steel tank is standard.

### RATINGS (Maximum Inlet Conditions)

PMO: Max. Operating Pressure	200 psi
TMO: Max. Operating Temperature	400°F
PMA: Max. Allowable Pressure	200 psi
TMA: Max. Allowable Temperature	650°F

### Options

- Glass Water Gage
- Cycle Counter
- Check Valves
- Insulating Jacket
- Skid Mount
- Supply Pressure Regulator
- Drain Line for Freeze Protection

### Applications

- Remote Locations
- Hazardous Locations
- Vacuum Systems
- Low Pressure Systems
- High Back Pressure Systems
- Heat Exchangers
- Process Steam Equipment
- Sumps or Submerged Areas
- Hazardous Process Fluids

# FEATURES & BENEFITS



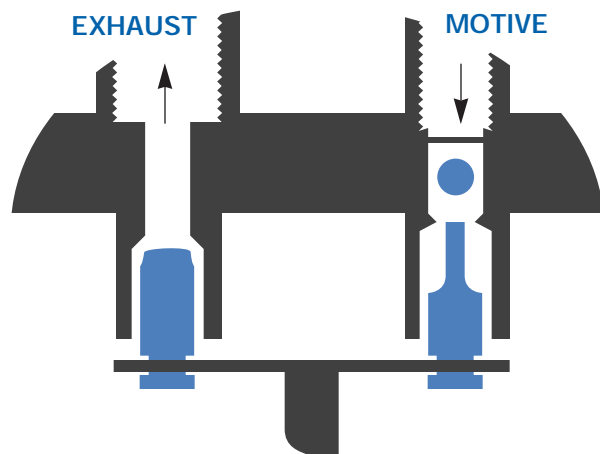
## Lifetime Spring Warranty

Patented single spring mechanism design eliminates pump breakdown due to spring failure. The snap acting mechanism uses this unique single spring technology to actuate the valves with the spring in compression. The dependability of the rugged stainless steel mechanism offers the maximum in reliability and service life.

## Superior Valve Technology

The inlet supply and vent valves feature lapped valves and seats for tight shutoff. The stainless steel construction resists corrosion. Unique floating ball design and hardened sealing surface of the supply valve provide long service life. The floating ball has an infinite number of potential seating surfaces.

The spring assisted stainless steel lift check valves provide high quality and reliable performance. The floating disc also has infinite seating surfaces. The all stainless steel valve is corrosion resistant.



## APPLICATIONS

### Collection of Condensate

- Remote Locations such as tank farms
- Low pressure and vacuum systems
- Condensate systems with high backpressure
- High capacity process applications such as heat exchangers

### Electrical Service is Unavailable or Prohibited

- Remote locations
- Hazardous locations

### Submerged Areas

- Sumps or low lying areas
- Manholes

### Hazardous Fluids

- Process fluids that may be difficult for conventional electric pump technology to handle

# SELECTION GUIDELINES

To correctly select a Condensate Commander Pump that meets the requirements of the application, some specific data is needed.

1. Condensate load in lbs/hr. \*
2. Motive pressure available (air or steam).
3. Total lift in feet (hydraulic head).
4. Pressure in return piping.
5. Filling head available in inches (recommended minimum of 12 inches).

EXAMPLE 1, Steam motive:

1. Condensate Load: 4,000 lb/hr.
2. Steam pressure available: 50 psig
3. Total vertical lift: 20 ft.
4. Pressure in return piping: 10 psig
5. Filling head available: 12 inches  
For filling head other than 12 inches, multiply capacity by correction factor found in Table 3.

SOLUTION:

1. Calculate total back pressure. Back pressure is the total head in feet multiplied by 0.433 plus the pressure in the return piping.  
 $(20 \text{ ft.} \times .433) + 10 \text{ psig} = 19$
2. Select from the Pump Capacity Table a pump with 50 psig motive pressure and greater than 19 (25) psig total back pressure: a 1½" x 1½" Condensate Pump.

EXAMPLE 2, Air motive:

(conditions same as Example 1)

1. To determine correction factor for air, divide total back pressure from Example 1 by motive pressure available (BP÷MP).

$$19 \div 50 = 38\%$$

Correction factor from Table 2 is 1.10

2. Divide required condensate load by correction factor.

$$4000 \div 1.10 = 3636$$

Select from the Pump Capacity Table (Table 1) a 1½" x 1½" Condensate Pump.

\*CONVERSIONS:

GPM to lbs/hr.: GPM x 500

Lbs/hr to GPM: Lbs/hr. x .002

Lbs/hr to KG/hr: Lbs/hr. x .454

Capacity Correction Factors for Motive Gas Supply other than Steam								
% Back Pressure vs. Motive Pressure (BP ÷ MP)								
10%	20%	30%	40%	50%	60%	70%	80%	90%
1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28

TABLE 2

Pump Capacity Table—(lbs/hr)						
Operating Pressure Inlet (psig)	Total Backpressure (psig)	Stainless Steel Check Valves				
		1"x1"	1½"x1½"	2"x2"	3"x2"	3"x2" Duplex
5	2	1900	3100	4800	6300	12,600
10	5	2100	3400	5900	7700	15,400
	2	2200	3800	8900	11,800	23,600
25	15	2300	3900	6600	8800	17,600
	10	2400	4500	8600	11,400	22,800
	5	2600	4900	10,600	14,100	28,200
50	40	2300	3700	5500	6100	12,700
	25	2600	<b>4300</b>	8100	10,800	21,600
	10	2700	4600	10,700	14,200	28,400
75	60	2300	3900	4800	6900	13,800
	40	2700	4400	8000	10,500	21,000
	15	2900	4800	11,400	15,200	30,400
100	80	2300	3700	5500	7400	14,800
	60	2500	4200	6700	9000	18,000
	40	2700	4800	9000	12,000	24,000
	15	3100	5300	11,600	15,400	30,800
125	115	2100	3600	4300	5600	11,200
	100	2200	3800	5200	6900	13,800
	80	2400	4200	6600	8800	17,600
	60	2600	4500	8600	11,400	22,800
	40	3000	5200	10,100	13,400	26,800
	15	3100	5500	12,200	16,000	32,000
150	120	2200	3800	5800	9900	19,800
	100	2400	4100	6300	10,700	21,400
	80	2600	4500	6800	11,600	23,200
	60	2800	4900	7600	13,100	26,200
	40	3200	5700	8000	13,500	27,000
	15	3400	6000	8400	17,500	35,000

TABLE 1

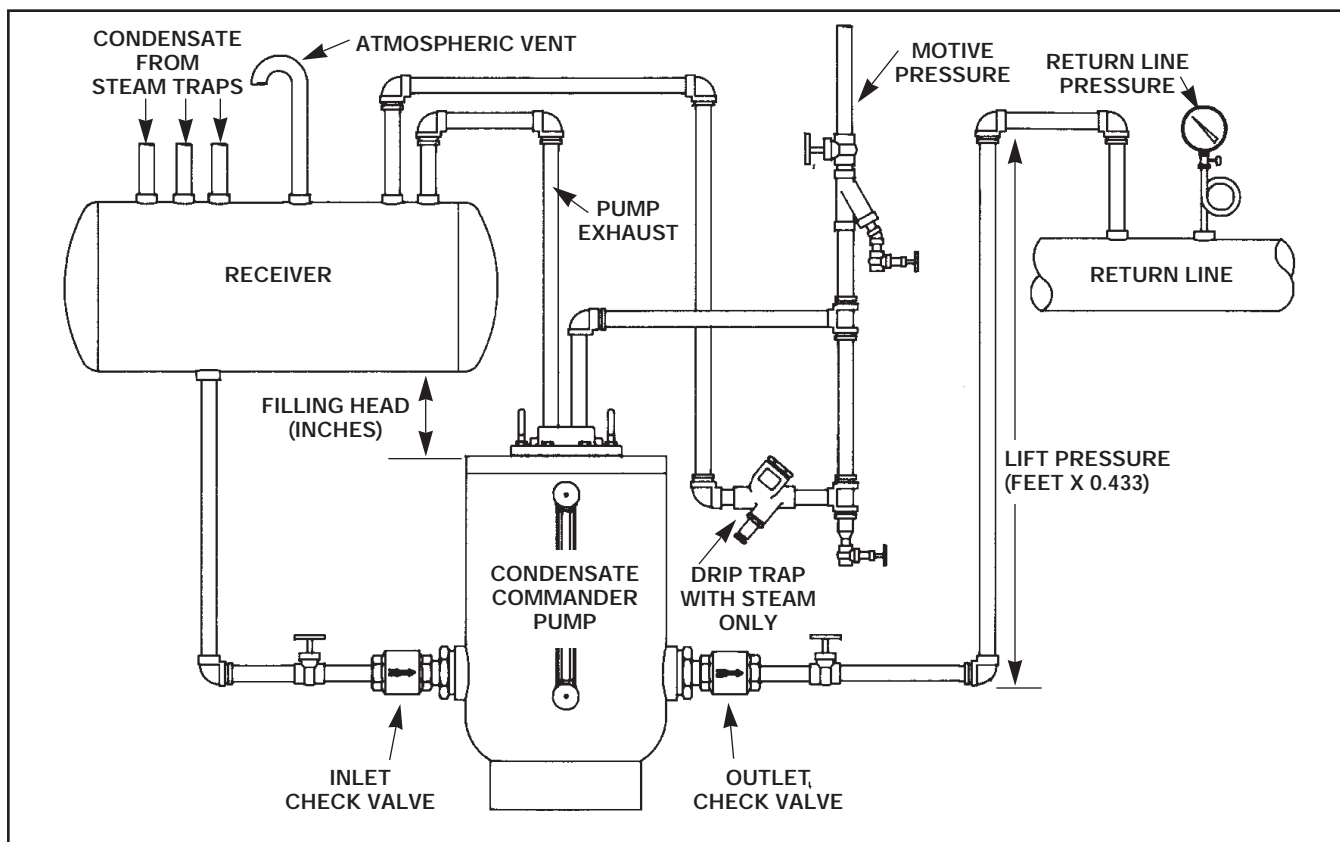
Capacity Correction Factor for Filling Head Variation				
Filling Head (inches)	Check Valve and Piping Size Inches			
	1"	1½"	2"	3" x 2"
6	0.70	0.70	0.70	0.84
12	1.00	1.00	1.00	1.0
24	1.20	1.20	1.20	1.08
36	1.35	1.35	1.35	1.20

TABLE 3

# APPLICATIONS

## Vented Receiver

To efficiently drain condensate from an open system, the vented receiver should be horizontally located a minimum of twelve inches above the pump. To allow for sufficient volume of condensate and flash vapor, the receiver must be sized adequately to permit the complete separation of flash vapor from condensate. The receiver may be either an ASME coded tank or a length of large diameter pipe.



### Typical Installation of a Condensate Commander Pump with a Vented Receiver

Condensate is being pumped from a vented receiver to an overhead elevated condensate return line that may contain pressure. For safety, the pump exhaust and receiver should be vented to atmosphere if steam is used for the motive pressure.

**Vented Receiver Sizing Table**

Receiver size based on 36" OAL

Flash Vapor (lbs/hr)	Pipe Diameter (inches)	Vent Line Size (inches)
75	4	1½
150	6	2
300	8	3
600	10	4
900	12	6
1200	16	6
2000	20	8

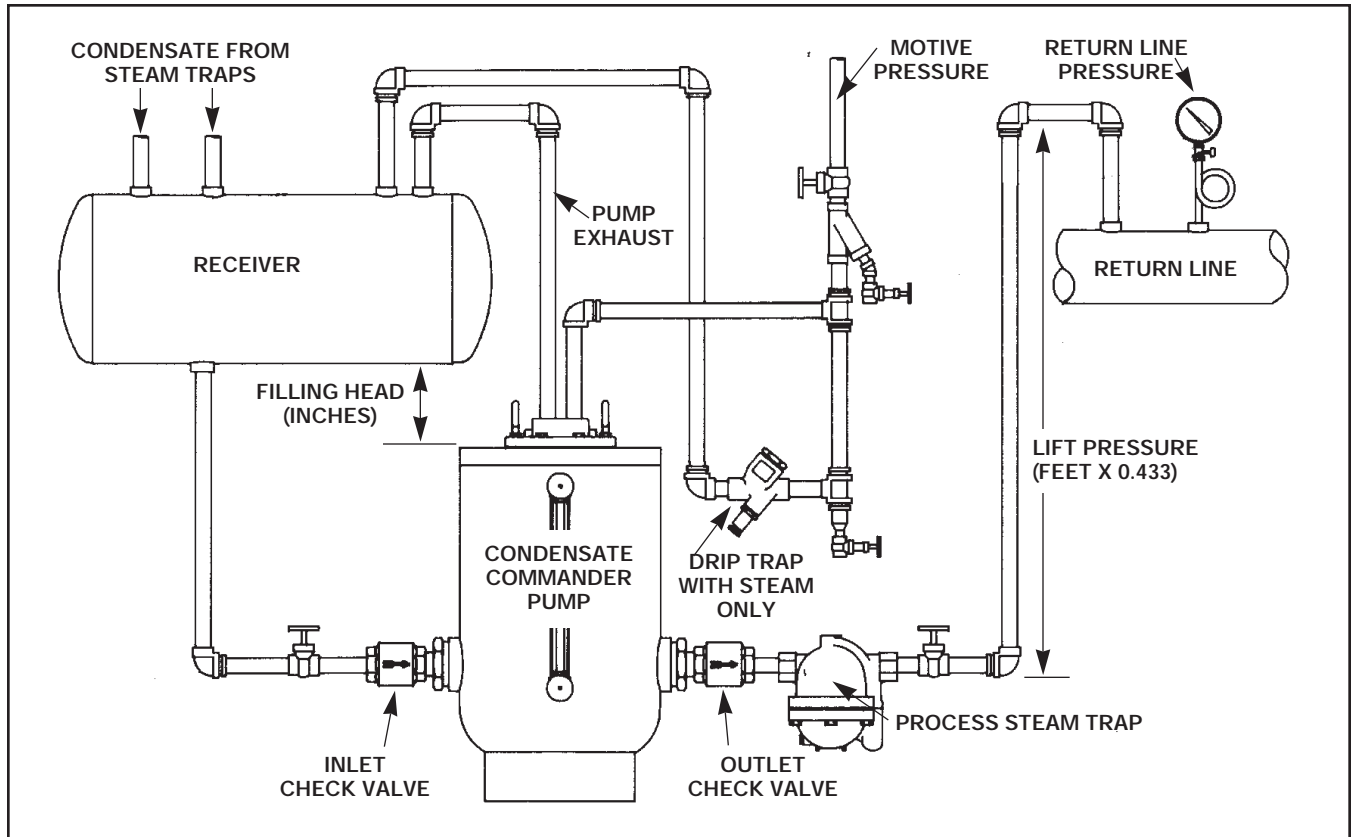
**Percent of Flash Steam Formed**

Initial Steam Pressure psig	Sat. Temp. °F	Receiver Tank Pressure, psig							
		0	5	10	20	30	40	50	75
10	239	3.0	2.0	0	0	0	0	0	0
25	267	5.7	4.1	3.0	1.0	0	0	0	0
50	298	9.0	7.4	6.2	4.3	2.6	1.0	0	0
75	320	11.3	10.8	8.6	6.7	5.0	3.7	2.5	0
100	338	13.3	11.7	10.6	8.7	7.0	5.7	4.6	2.2
125	353	14.8	13.4	12.2	10.3	8.7	7.4	6.3	3.8

# APPLICATIONS

## Inlet Receiver

To efficiently drain condensate in a closed system, the receiver should be horizontally located a minimum of twelve inches above the pump to allow for sufficient condensate collection. The receiver must be sized to provide the minimum condensate capacity required to prevent equipment flooding. The receiver may be either an ASME coded tank or a length of large diameter pipe. A safety relief valve may be required.



### Typical Installation of a Condensate Commander Pump in a Closed System

Condensate is flowing from a pressurized system to another pressurized system with greater pressure. Both the inlet and return line may be elevated. This installation will also service a high capacity process installation using a pressurized receiver.

**Inlet Receiver Sizing Table**

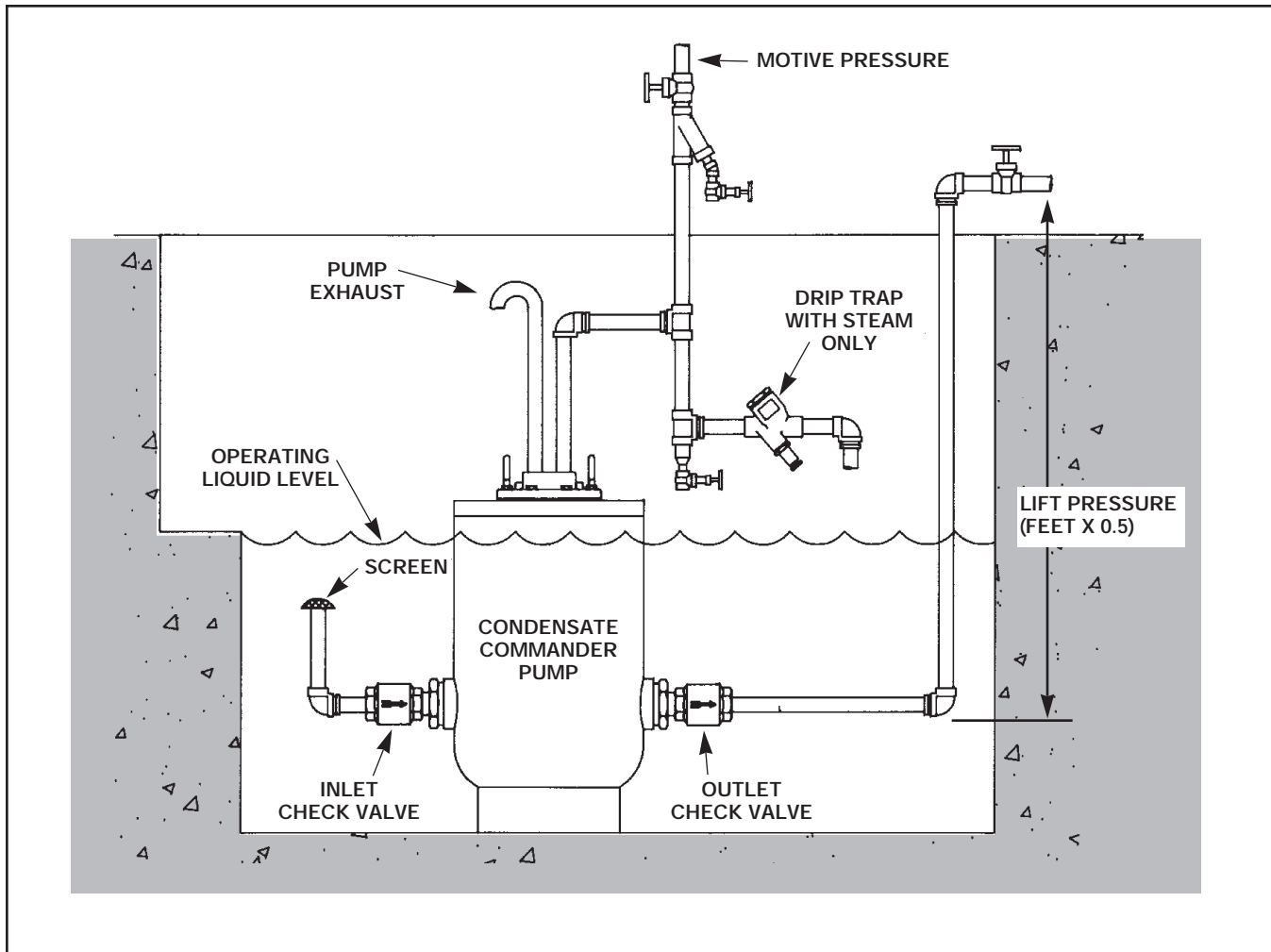
Liquid (lb/hr)	Receiver Pipe Size (feet)				
	3"	4"	6"	8"	10"
>500	2	—	—	—	—
1000	2	—	—	—	—
1500	3	2	—	—	—
2000	3.5	2	1	—	—
3000	—	3	2	—	—
4000	—	4	2	1	—
5000	—	6	3	2	—
6000	—	—	3	2	—
7000	—	—	3	2	—
8000	—	—	4	2	—
9000	—	—	4.5	3	2
10,000	—	—	5	3	2
11,000	—	—	5	3	2



# APPLICATIONS

## Submerged Pump

Condensate Commander Pumps can pump liquids from low lying areas such as manholes, steam pits or any area that may collect liquid or flood. The non-electric feature makes it a good choice if steam or any other gas is readily available for use as the driving force.



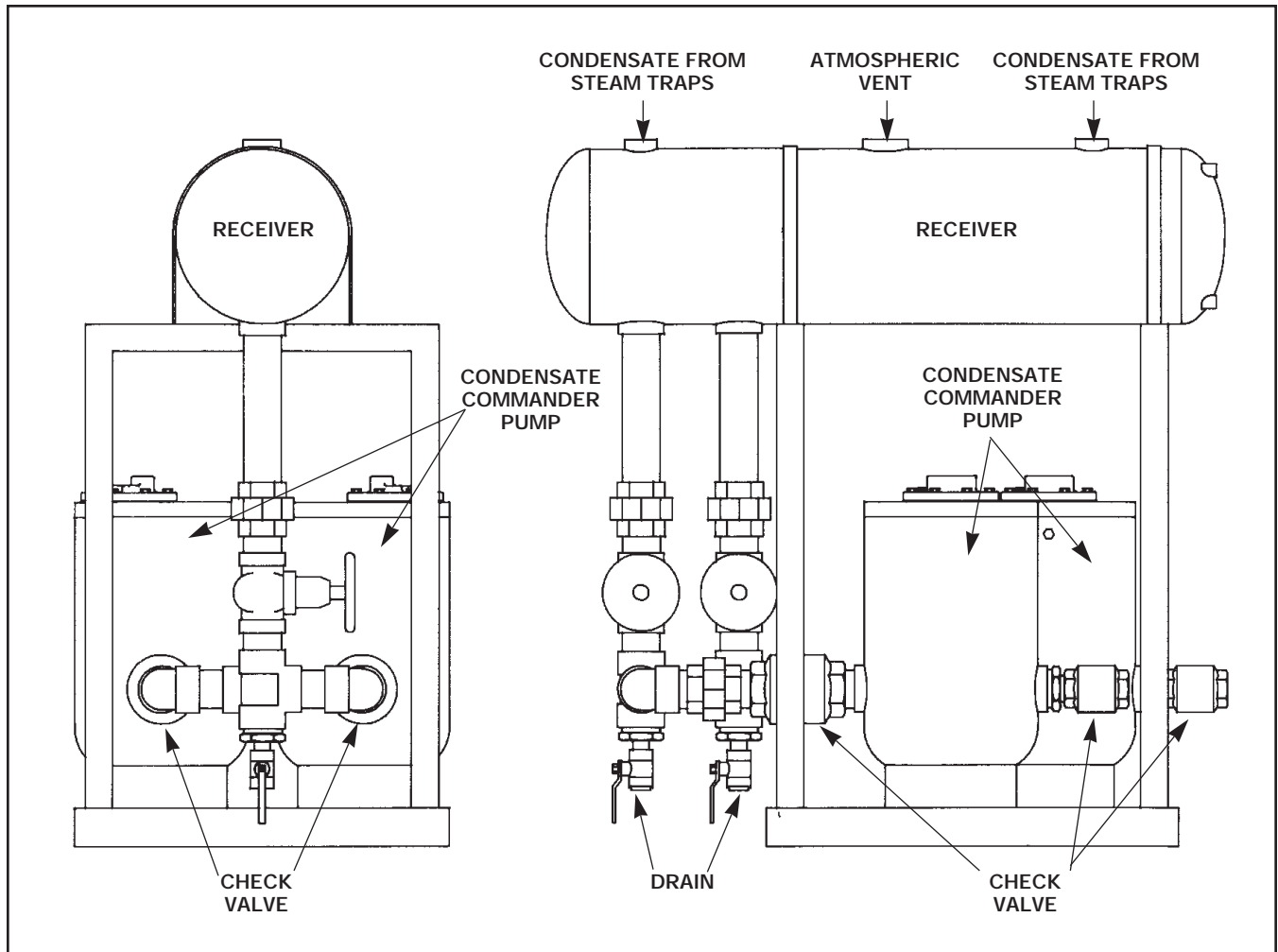
### Typical Installation of a Condensate Commander Pump in a Submerged Application

Liquid is pumped from a sump, manhole or other low-lying area where it may accumulate. For back pressure applications, multiply the total vertical lift by .5 plus any back pressure in the return line.

# OPTIONS

## Skid Mounted System

Where the condensate load exceeds the capacity of one Condensate Commander Pump, multiple pumps may be used in tandem. Skid mounted units may be simplex (one pump), duplex (two pumps), triplex (three pumps) or quadruplex (four pumps). The units are equipped with a receiver, Condensate Commander Pump(s) and all necessary piping fully connected and ready for use.



### Typical Duplex Condensate Commander Pump Skid Mount System

The skid mount systems are designed to provide a complete condensate collection and condensate pump unit ready to pipe. All necessary connections are in place. The filling head dimension has already been determined.

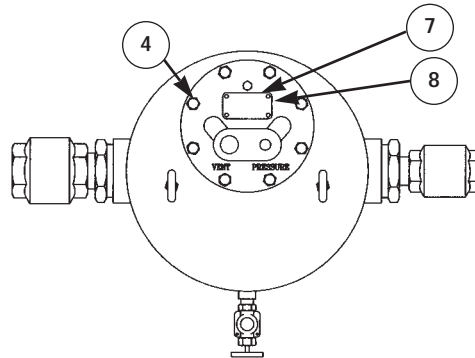
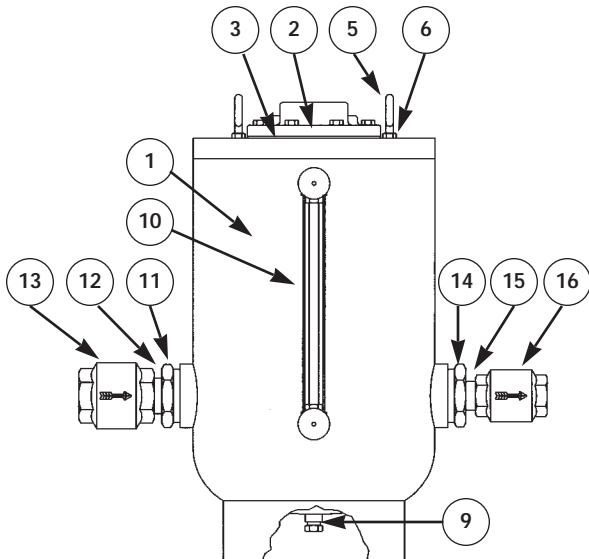
## OPERATING PRINCIPLE

The vent valve is open, the pressure supply valve is closed and the float is positioned in the lower part of the tank as the condensate or other liquid enters the tank through the inlet check valve. As the tank fills with liquid, the float rises to the point where the spring mechanism snaps past the center position. The compressed spring instantly closes the vent valve and opens the pressure supply. This allows pressure into the tank which forces the liquid through the outlet check valve.

As the liquid level falls, the float lowers to the point where the spring mechanism snaps past the center position which immediately closes the pressure supply valve and opens the vent valve. The pressure in the tank decreases, allowing liquid to flow through the inlet check valve, repeating the cycle.

### Parts List

Item No.	Description	Material	1" x 1"	1 1/2" x 1 1/2"	2" x 2"	3" x 2"
1	Tank Weldment	Steel	0014164	0014164	0014164	0014164
2	Trip Mechanism w/Flange	DI/Stl/SS	0014161	0014161	0014161	0014161
3	Gasket	Non-asbestos	0621155	0621155	0621155	0621155
4	Bolt, Hex Head	Steel	0046626	0046626	0046626	0046626
5	Eye Bolt	Steel	0030396	0030396	0030396	0030396
6	Nut	Steel	05-02856-00	05-02856-00	05-02856-00	05-02856-00
7	Nameplate	Aluminum	0028249	0028249	0028249	0028249
8	Drive Screw	Steel	0028250	0028250	0028250	0028250
9	Pipe Plug, 1/2" NPT	Steel	05-03775-00	05-03775-00	05-03775-00	05-03775-00
10	Water Level Gage	Bronze	0018125	0018125	0018125	0018125
11	Inlet Reducer	M. Iron	05-15043-00	05-15042-00	05-15123-00	—
12	Inlet Nipple	Steel	05-02807-00	05-15404-00	05-15121-00	05-15416-00
13	Inlet Check Valve	Stainless Steel	0016294	0016295	0016292	0016293
14	Outlet Reducer	M. Iron	05-15043-00	05-15042-00	05-15123-00	05-15123-00
15	Outlet Nipple	Steel	05-02807-00	05-15404-00	05-15121-00	05-15121-00
16	Outlet Check Valve	Stainless Steel	0016294	0016295	0016292	0016292
	Condensate Pump Sub-assembly	Steel	0014163	0014163	0014163	0014163
	Cycle Counter		0016296	0016296	0016296	0016296
	Insulating Jacket		0014162	0014162	0014162	0014162



**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035



**Dura-Flo Horizontal**



**Dura-Flo Vertical**

## DURA-FLO INVERTED BUCKET STEAM TRAPS

The Spence Dura-Flo Inverted Bucket Steam Traps are designed for reliable condensate removal on virtually all types of steam using equipment including pressing machines, cookers, vats, etc. The design makes servicing quick and easy. Just remove the bolts on the top of the trap and all working parts lift right out and are "workbench ready". Parts can be replaced and cleaned in a matter of minutes with virtually no interruption of trap operation.

### RATINGS (Maximum Inlet Conditions)

Model	Pressure	Temperature
Dura-Flo	250 PSIG	450°F

### CONSTRUCTION FEATURES

- In-line Connections mean simplified installation
- Hardened stainless steel valve and seat provide long life and maximum corrosion resistance.
- Stainless Steel Bucket is rugged and naturally resists water hammer.
- Low initial cost and low maintenance cost.
- All working parts lift out of top of trap. Horizontal traps can be serviced in-line without disturbing system piping.
- Unique reusable Teflon® cover gasket can be reinstalled numerous times.

### MATERIALS OF CONSTRUCTION

- Body and Cover: Cast Iron ASTM-A-126/A48
- Bucket & Linkage: Stainless Steel
- Valve & Seat: Hardened Stainless Steel
- Standpipe: Steel Pipe
- Cover Gasket: Teflon®

### APPLICATIONS

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drums

### SPECIFICATION

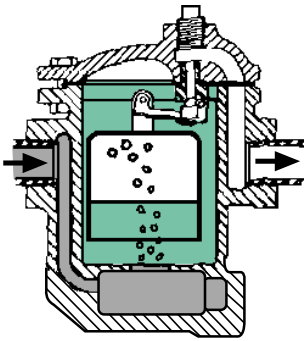
Furnish and install as shown on the plans, inverted bucket traps capable of discharging condensate, air and other non-condensable gases without loss of steam. These traps shall have a heavy cast iron body, hardened stainless steel valve and seat, all stainless steel linkage and bucket, and reusable Teflon® body gasket.

### Maximum Capacity—lbs/hr 10°F Below Saturation

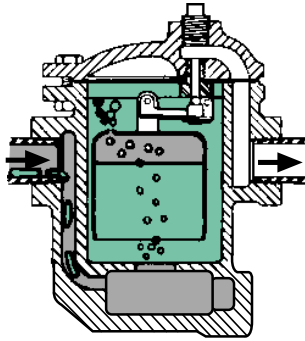
MODEL	ORIFICE	PSIG														
		1	5	10	15	20	30	40	50	80	100	125	130	150	200	250
SBTH80S	20	270	450	560	640	690										
	80	110	200	300	360	420	500	540	580	690						
	#38	40	70	110	150	200	270	310	340	440	480	540	545	570		
SBTH81S, SBTV21	30	300	540	670	770	880	1000									
	125	130	220	340	390	460	560	610	650	800	860	950				
	#38	60	100	150	190	240	290	340	380	470	520	575	585	620	700	760
SBTH82S, SBTV22	30	500	950	1380	1630	1800	2050									
	125	300	560	680	800	900	1070	1220	1320	1650	1800	2000				
	250	130	240	340	370	420	520	590	650	810	900	1010	1020	1100	1230	1300
SBTH83S, SBTV23	30	1400	2300	2700	3300	3500	4000									
	125	600	1100	1300	1600	1800	2000	2350	2600	3300	3600	3900				
	250	400	700	950	1100	1300	1700	1800	1900	2300	2500	2600	2700	2800	3200	3500
SBTH85, SBTV25	30	2900	5200	6400	7700	8500	9800									
	130	1500	2600	3200	3900	4500	5400	6200	6900	8500	9600	10900	11000			
	250	700	1200	1500	1900	2100	2600	3200	3600	4100	4600	5100	5150	5500	6350	7000
SBTV26	40	4500	8200	10600	12800	15000	18000	20000								
	125	2600	5000	6400	7800	8900	10500	12000	13000	16300	18000	20000				
	250	1800	3400	4500	5400	6100	7500	8500	9200	11500	12800	14200	14300	15600	17500	19000

Models with "S" suffix are equipped with integral stainless steel strainers.

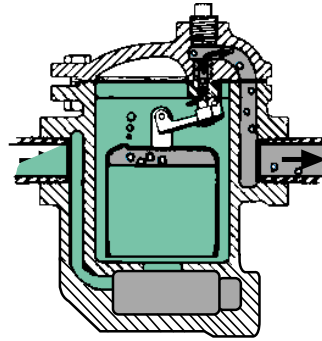
## OPERATING PRINCIPLE



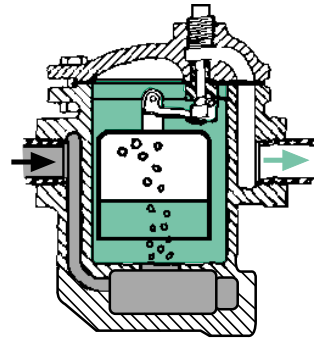
**Trap Closed** – After trap is installed and primed, steam entering the trap collects in the top of the bucket, floating the bucket and forcing the valve into its seat.



**Trap Begins to Open** – As condensate begins to flow into the trap, steam and air are forced from the bucket. This causes the bucket to begin losing buoyancy, tending to pull the valve from its seat.



**Trap Discharges** – When enough condensate has entered the trap, displacing the steam and air, the bucket drops, pulling the valve from the seat and allowing condensate and air to discharge.



**Trap Closes** – As the flow of condensate stops, steam enters the trap and refloats the bucket, forcing the valve into its seat. The cycle then repeats as more condensate reaches the trap.

## INSTALLATION

### PLANNING

Traps should be installed in an accessible position and location for easy servicing. The maximum differential pressure ( $\Delta P$ ) stamped on product name plate must be greater than the maximum pressure differential across the trap. The trap must be installed with the body upright so that the bucket is rising and falling vertically. The inlet and outlet connections should be in a horizontal plane for horizontal traps and a vertical plane with inlet on the bottom for vertical traps. The trap should be installed below the drain point, so that a water seal can be maintained around the open end of the bucket.

Install below and close to equipment being drained. Avoid long lengths of horizontal piping ahead of trap. Allow vertical clearance for maintenance. Pitch all horizontal inlet lines toward the steam trap to help eliminate potential water hammer problems. All models should have a strainer installed ahead of trap.

Union fittings and shut off valves should be installed on both sides of trap for ease of servicing and trap testing. A test and pressure relief valve should be installed to assure relief of internal pressure prior to servicing and as a visual indication of trap operation. A check valve should be installed on return piping if there will be a pressurized return line or the trap drains to an overhead return line (Fig. 2)

### PRIMING

Inverted bucket traps may need to be primed before being placed into service. Either of the following methods can be

used. Remove pipe plug from trap cover. Pour water into trap until full and replace pipe plug. Keep return piping valve closed until trap fills with condensate, then slowly open valve.

### MAINTENANCE

The trap mechanism should be inspected periodically and all dirt removed from working parts. ***Worn parts must be replaced.***

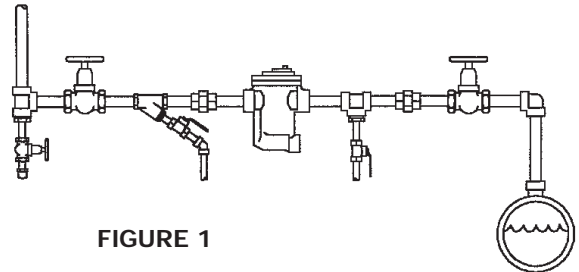


FIGURE 1

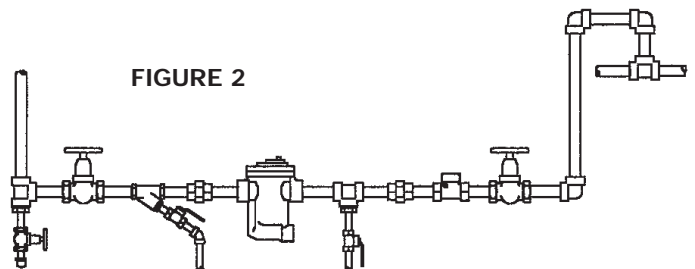
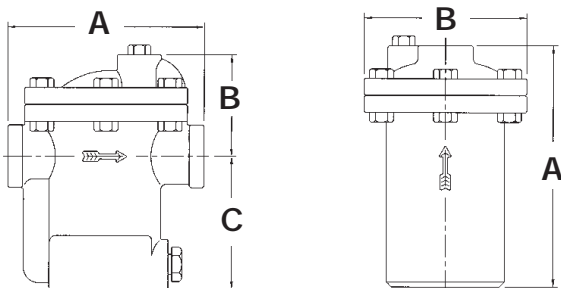


FIGURE 2



Dimensions					
Model	NPT Size	Inches			Weight Lbs.
		A	B	C	
SBTH80S	1/2, 3/4	5 1/16	2 5/8	3 7/16	7
SBTH81S	1/2, 3/4	5	2 5/8	4 7/16	8
SBTH82S	1/2, 3/4	7	3 5/8	5 3/4	22
SBTH83S	3/4, 1	8 1/8	5	7 3/8	32
SBTH85	1 1/2, 2	10 1/4	8 3/16	8 1/16	74
SBTV21	1/2	6 3/8	4 1/4	—	6.5
SBTV22	1/2, 3/4	8	5 5/8	—	16
SBTV23	3/4, 1	10 1/2	6 7/8	—	28
SBTV25	1, 1 1/2	14 3/8	9 1/16	—	60
SBTV26	1 1/2, 2	16 11/16	10 1/4	—	90



**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035



**TDS600 Steam Trap**

## TDS600 SERIES THERMODYNAMIC STEAM TRAPS

The TDS600 Series Thermodynamic Steam Traps feature a compact design in which a hardened stainless steel disc is the only moving part. The low initial cost makes it more economical than repairable traps. Installation is simplified because it works in any position.

The TDS600 handles water hammer and superheat and the blast discharge helps to eliminate dirt buildup while providing tight shutoff. The all stainless steel construction resists both internal and external corrosion and self draining design resists freezing. The audible discharge cycle simplifies checking operation.

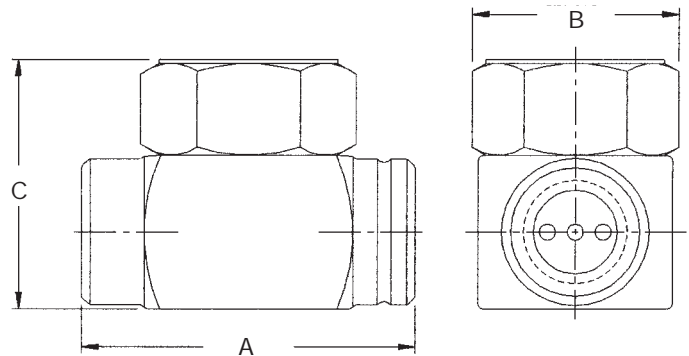
### Applications

- Steam Mains
- Multi-platen Presses
- Marine Applications
- Tracing Lines
- Bulk Storage Tanks
- Laundry Equipment

### RATINGS (Maximum Inlet Conditions)

PMO: Max. Operating Pressure	600 psi
TMO: Max. Operating Temperature	800°F
PMA: Max. Allowable Pressure	600 psi
TMA: Max. Allowable Temperature	800°F

Dimensions in inches				Weight in Lbs.
Size	A	B	C	
3/8"	2	1 3/4	1 3/4	.8
1/2"	2 11/16	1 3/4	2	1.2
3/4"	2 13/16	2 5/16	2 7/16	1.85
1"	3 5/16	2 1/2	2 7/8	3.1



### Maximum Capacity—lbs/hr 10°F Below Saturation

NPT Connection	PSIG (bar)													
	3.5 (0.24)	5 (0.34)	10 (0.7)	20 (1.4)	30 (2.1)	50 (3.4)	75 (5.2)	100 (6.9)	150 (10.3)	200 (13.8)	300 (20.7)	400 (27.6)	500 (34.5)	600 (41.3)
3/8"	180	185	190	200	215	245	305	370	500	610	790	960	1100	1250
1/2"	300	310	345	410	465	575	700	810	1000	1140	1410	1630	1830	2000
3/4"	405	420	470	560	640	810	1000	1160	1450	1670	2100	2430	2750	3050
1"	640	670	725	865	980	1200	1470	1750	2200	2600	3250	3780	4250	4700

For Kg/Hr Multiply by .454

The TDS600 steam trap works efficiently at all line pressures between 2 and 600 psi and back pressures to 80% of line pressure.

### Effect of back pressure on trap capacity

Back pressure as percent of Inlet pressure	10	20	25	30	40	50	60	70	80
Percent reduction of trap capacity	0	0	0	2	5	12	20	30	40

## OPERATING PRINCIPLE

Incoming air and condensate flow through the trap body and into the control chamber. Line pressure raises the disc off the seat allowing complete discharge. When flashing condensate enters the cartridge, flow velocity increases, creating low pressure underneath the disc. Flashing condensate at high velocity strikes the inside wall of the disc chamber and is deflected to the top of the disc causing a pressure buildup.

The disc is forced down onto the seat by this pressure imbalance. The trap remains closed as flashed vapor in the control chamber keeps the disc seated. Pressure inside the cap is not lowered until the trapped flash vapor condenses due to body radiation. Condensing steam lowers the pressure above the disc. Disc is then lifted and the cycle repeated.

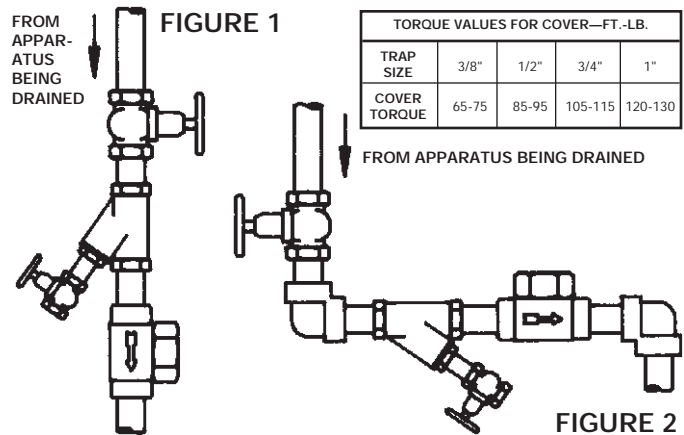
## INSTALLATION

Before installing trap, blow all dirt and scale from apparatus and piping. Install trap (with arrow on body in flow line) as close as possible to apparatus with strainer (20 mesh) and valve upstream of trap as shown in Figures 1 and 2. Pitch all drain lines toward trap. Approved practice is to install separate traps on each piece of apparatus to be drained. Steam supplied to inlets of several units may be of uniform pressure, but invariably there is a differential at the outlets. Although this differential may be small, unit discharging highest pressure will control the action of trap, while other units become airborne and waterlogged.

Piping upstream and downstream of trap should be at least equal to or one size larger than trap connection. Trap installation as shown in Figure 1 is freeze-proof.

Locate trap for maintenance accessibility.

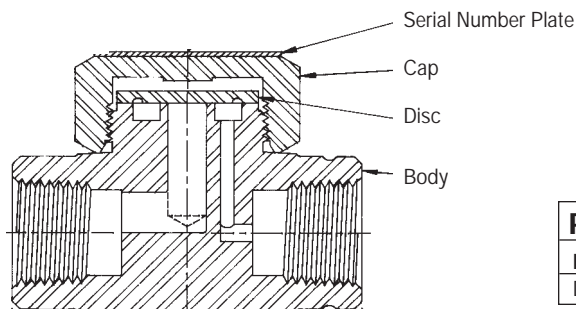
## RECOMMENDED INSTALLATION



## MAINTENANCE

We strongly recommend blow-off of accumulations in strainer a day or two after the system has been installed. A periodic blow-off or cleaning of strainer should be instituted. Dirt or sediment on disc or body seating will cause abnormal operation. Cleaning of these parts should be done with a soft cloth and solvent. DO

NOT WIRE BRUSH OR USE ANY ROUGH IMPLEMENT. Reassemble unit with groove in disc down. Apply anti-seize compound on cover threads. Avoid getting compound on disc or body seating surfaces. See Table for torque values.



### Parts List

Description	Material	3/8"	1/2"	3/4"	1"
Disc	420FH	422931	422932	422933	422934

\*Spare discs are available in packs of three.



SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035



FTS 3/4"-1 1/4"



FTS 1 1/2" and 2"

## TYPE FTS SERIES FLOAT & THERMOSTATIC STEAM TRAPS

The Spence FTS Series Steam Traps are built with a universal four-port design which allows four possible hookup combinations. The "H" pattern body and piping dimensions similar to other major manufacturers allow maximum installation flexibility for easy replacement of other traps. The inlet and outlet taps on larger sized traps are located in the cover to permit larger capacities.

### RATINGS (Maximum Inlet Conditions)

Connection	Pressure	Temperature
ANSI, NPT	250 PSIG	450°F

### CONSTRUCTION FEATURES

- All Stainless Steel Internal Components
  - Hardened valves and seats
  - Extra long life and dependable service.
  - Resists water hammer.
  - Protects against erosion and corrosion.
- Balanced Pressure Thermostatic Element allows venting of non-condensables while operating at design pressure.
- Rugged Welded Stainless Steel Element increases service life.
- Differential Pressures of 15, 30, 75 and 125 psig provide wide selection for many applications.
- Can be serviced in-line without disturbing system piping.
- Made in USA

### MATERIALS OF CONSTRUCTION

- Body and Cover: Cast Iron
- All Internal Parts: Stainless Steel
- Air Vent: Balanced Pressure, Stainless Steel

### APPLICATIONS

- Unit heaters and other space heating equipment
- Heat exchangers/reboilers
- Air heating coils
- Steam main drips
- Process equipment

### HOT CONDENSATE CAPACITIES (lbs/hr)

Type	Size NPT	PSIG Orifice	DIFFERENTIAL PRESSURE (PSI)														
			1/4	1/2	1	2	5	10	15	20	25	30	40	50	75	100	125
FTS-15	3/4"	.218	279	369	489	650	785	1000	1075								
FTS-15	1"	.218	279	369	489	650	785	1000	1075								
FTS-15	1 1/4"	.312	600	770	980	1240	1640	2000	2340								
FTS-15	1 1/2"	.500	1100	1700	2400	3300	5000	6600	7600								
FTS-15	2"	.625	2300	2800	3600	4650	6900	9000	10900								
FTS-30	3/4"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
FTS-30	1"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
FTS-30	1 1/4"	.228	375	500	690	910	1200	1500	1680	1800	1900	2000					
FTS-30	1 1/2"	.390	1000	1300	1700	2300	3400	4600	5500	6000	6600	7000					
FTS-30	2"	.500	1300	1800	2500	3400	5200	6800	7800	8600	9300	10000					
FTS-75	3/4"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
FTS-75	1"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
FTS-75	1 1/4"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
FTS-75	1 1/2"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
FTS-75	2"	.421	850	1100	1500	2000	3100	4150	4750	5200	5500	5800	6400	6800	7700		
FTS-125	3/4"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
FTS-125	1"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
FTS-125	1 1/4"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
FTS-125	1 1/2"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
FTS-125	2"	.332	550	675	880	1225	1950	2600	3000	3250	3500	3800	4200	4600	5500	6100	6600

## OPERATING PRINCIPLE

Air entering trap is immediately discharged through the high capacity integral air vent. The thermostatic vent will close just prior to saturation temperature. The balanced design will allow venting of non-condensables that collect in the float chamber when operating at design pressure. When steam enters the trap, the thermostatic air vent closes to prevent steam loss. When steam gives up it's latent heat, it becomes condensate. This

"condensate" enters the trap and causes the stainless steel ball float to rise. Raising of the float opens the discharge valve, allowing condensate to be continuously discharged as it enters the trap. The condensate level in the trap body is maintained above the discharge seat, providing a positive seal against the loss of steam.

## INSTALLATION

### PLANNING

Traps should be installed in an accessible position and location for easy servicing. The maximum differential pressure ( $\Delta P$ ) stamped on product name plate must be greater than the maximum pressure differential across the trap. Be sure to install trap straight, plumb and in a level position to insure proper operation.

Install below and close to equipment being drained. Avoid long lengths of horizontal piping ahead of trap. Pitch all horizontal inlet lines toward the steam trap to help eliminate potential water hammer problems. Pipe plugs (included separately) must

be placed in the two unused connections on all 3/4", 1" and 1 1/4" FTS-15 and FTS-30 traps (see Figure 2).

A dirt pocket and strainer with blowdown should always be provided ahead of trap. Union fittings and shutoff valves should be installed on both sides of trap for ease of servicing and trap testing.

### MAINTENANCE

Accumulated dirt and sludge can be removed by blowing down through the drain in the bottom of the trap. The trap mechanism should be inspected periodically and all dirt removed from working parts. Worn parts must be replaced.

## RECOMMENDED INSTALLATION

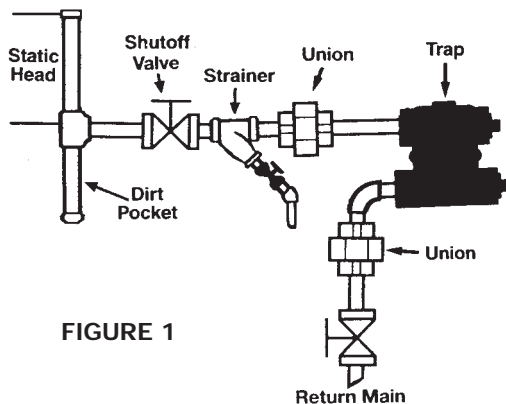
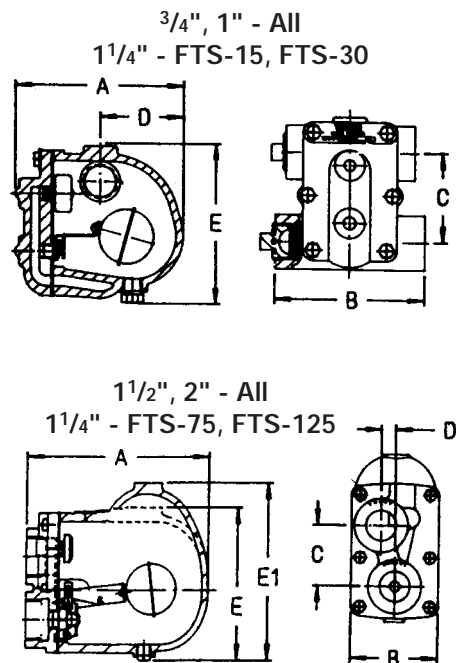


FIGURE 1



## PIPING COMBINATIONS

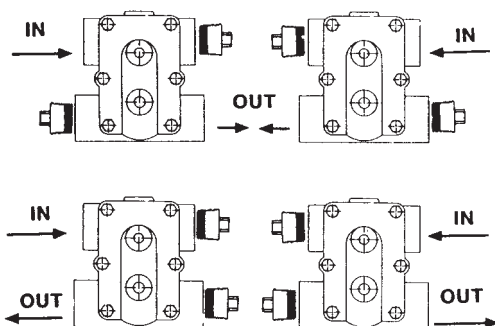


FIGURE 2

### Dimensions

Model No.	Size	Inches						Weight lbs.
		A	B	C	D	E	E1	
FTS-15, FTS-30	3/4	6.25	5.50	3.31	3.00	5.75	—	9
	1	6.25	5.50	3.31	3.00	5.75	—	9
	1 1/4	6.25	5.75	3.00	3.81	5.75	—	9 1/2
	1 1/2	8.50	4.25	3.00	0.70	—	8.40	18
	2	9.81	4.94	4.94	0.12	9.12	—	26
FTS-75, FTS-125	3/4	6.25	5.50	3.31	3.00	5.75	—	9
	1	6.25	5.50	3.31	3.00	5.75	—	9
	1 1/4	8.50	4.25	3.00	0.70	—	8.40	18
	1 1/2	8.50	4.25	3.00	0.70	—	8.40	18
	2	9.81	4.94	4.94	0.12	9.12	—	26



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Walden, NY 12586-2035

## **TYPE T & B TEST and BLOCKING STEAM VALVE**

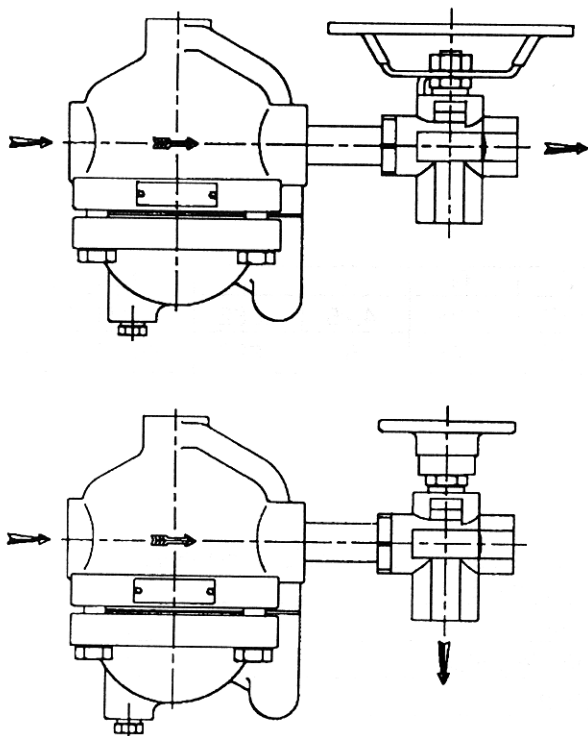
**PRESSURES TO 250 PSIG (17 BAR)**  
**TEMPERATURES TO 406°F (208°C)**



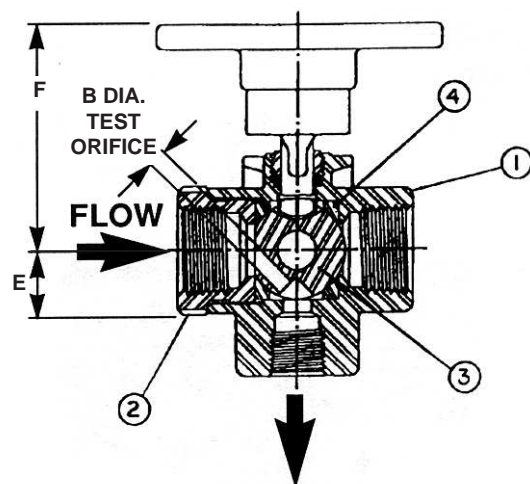
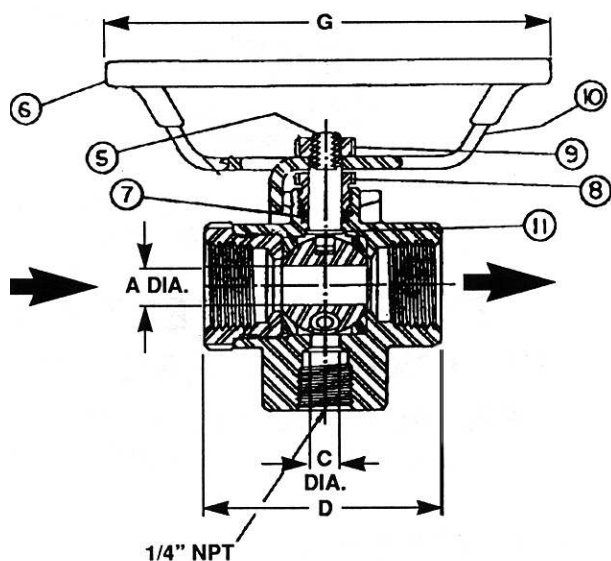
**Type T & B Test and Blocking Valve**

The Spence T & B replaces multiple valves and fittings. There is no need for separate blocking and test valves as this specially designed ball valve provides both functions in one body. Installation of the T & B eliminates the need for several fittings, thereby reducing labor costs and possible connection leaks. The T & B can also be used to sample fluids or gasses from process lines.

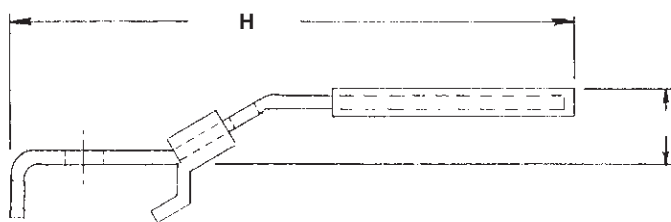
The T & B valve is installed on the downstream side of the steam trap. During operation, it is in the open position with unrestricted flow thru trap into the return system. One quarter turn (90°) blocks flow from return and vents trap discharge to the atmosphere.



- Provides for quick visual examination of steam trap discharge.
- Small size facilitates installation and operation in tight spaces.
- Stainless steel internals provide long service life and protection against corrosion.
- All parts are easily replaceable.
- Vent passage in ball is large enough to provide true determination of trap discharge.
- Bottom loaded, pressure retaining stem and packing nut threaded to body provides extra margin of safety.
- Locking lever handle available as option.



**VALVE CLOSED - TEST**



**OPTIONAL LOCKING LEVER HANDLE**

## DIMENSIONS

Size	A	B	C	D	E	F	G	H	I	Thread Size
1/2"	.375	.156	.281	2.26	1.20	2.17	4.25	4.25	.562	1/2" NPT
3/4"	.531	.218	.281	2.83	1.49	2.45	4.25	5	.687	3/4" NPT

## PARTS

NUMBER	DESCRIPTION	MATERIAL
1	Body	ASTM A216 WCB Carbon Steel (Blk oxide & oil coat)
2	Adapter	#12L14C.R.S. (Blk oxide & oil coat)
3	Ball	#316 Stainless Steel
4	Seat	25% Mineral Fill Virgin Teflon
5	Stem	#316 Stainless Steel
6	Insulator	Plastisol (Vinyl grip)
7	Packing Gland	Carbon Reinforced Teflon
8	Packing Nut	#12L14 C.R.S. (Blk oxide & oil coat)
9	Handle Nut	Steel (Zinc plated)
10	Handle (Std.)	#11 Ga. C.R.S. (Zinc plated)
	Handle (Opt.)	
11	Thrust Washer	Glass Reinforced Teflon
12	Body Seal	Virgin Teflon
13	Labels	Aluminum (not shown)



# Application Guide

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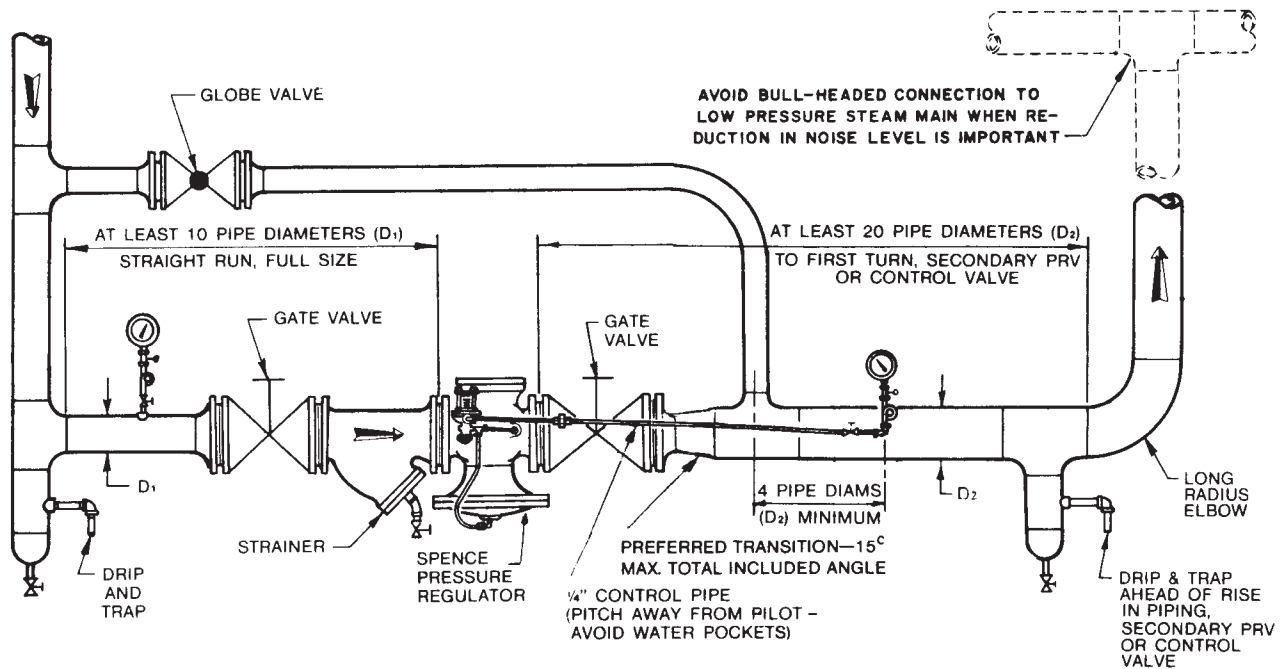
## SPENCE TYPE ED SINGLE STAGE PRESSURE REDUCING VALVE

### APPLICATION:

To reduce a steady or varying Inlet pressure to a constant adjustable delivery pressure.

### OPERATION:

Valve is operated by incoming pressure. As delivery pressure nears spring setting on pilot, valve starts to modulate and maintain set pressure.



RECOMMENDED INSTALLATION OF REGULATOR WITH STRAINER

### ADVANTAGES:

- Accurate, sensitive control.
- Packless construction.
- High capacity.
- Inexpensive.



# Application Guide

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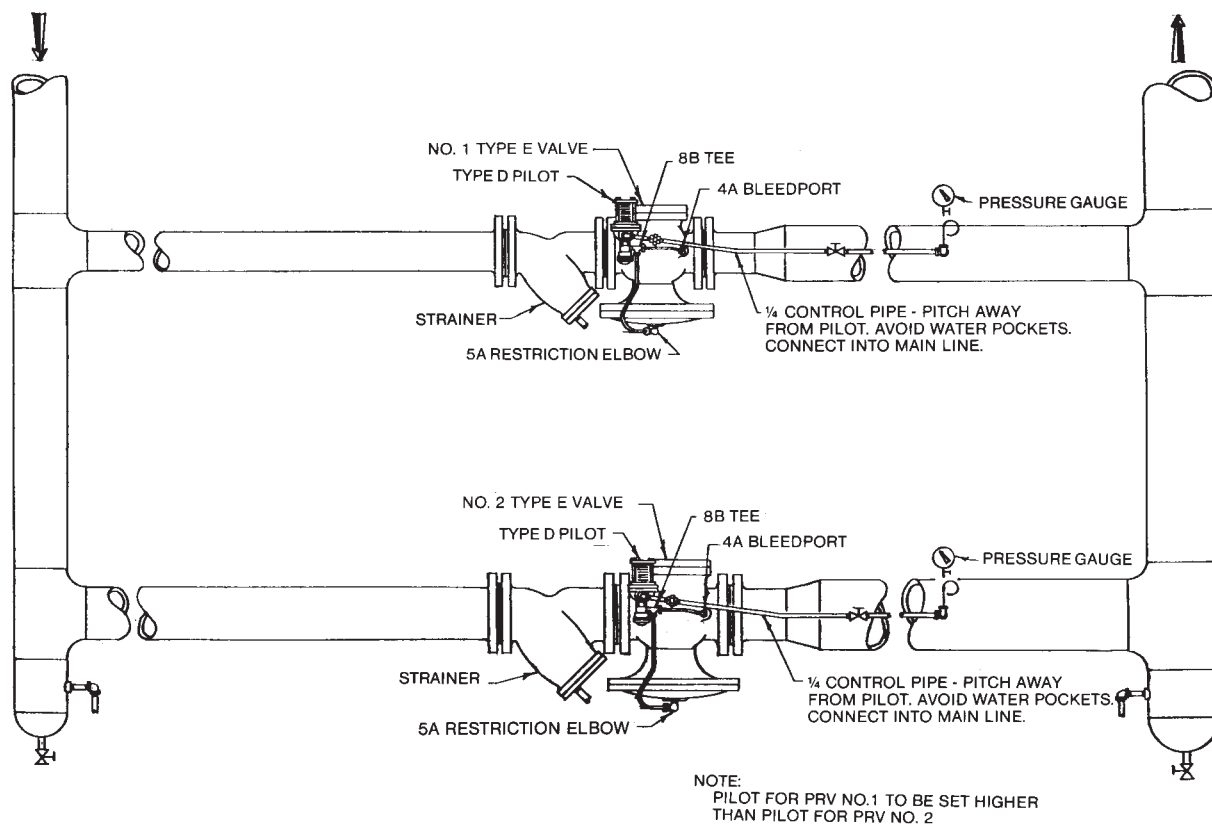
## SPENCE TYPE ED PARALLEL (ADDITIVE) PRESSURE REDUCING STATION

### APPLICATION:

Used on widely varying flow conditions

### OPERATION:

Load is typically split 1/3 - 2/3. Small valve is sized for 1/3 of load and is lead valve set for desired delivery pressure. Large valve is lag valve set 2 - 3 psig lower than delivery pressure of small valve. On low flow demand, small valve only will be flowing; as flow increases and small valve cannot handle flow, the delivery pressure drops and large valve opens.



### ADVANTAGES:

Better rangeability.  
Accurate control.



# Application Guide

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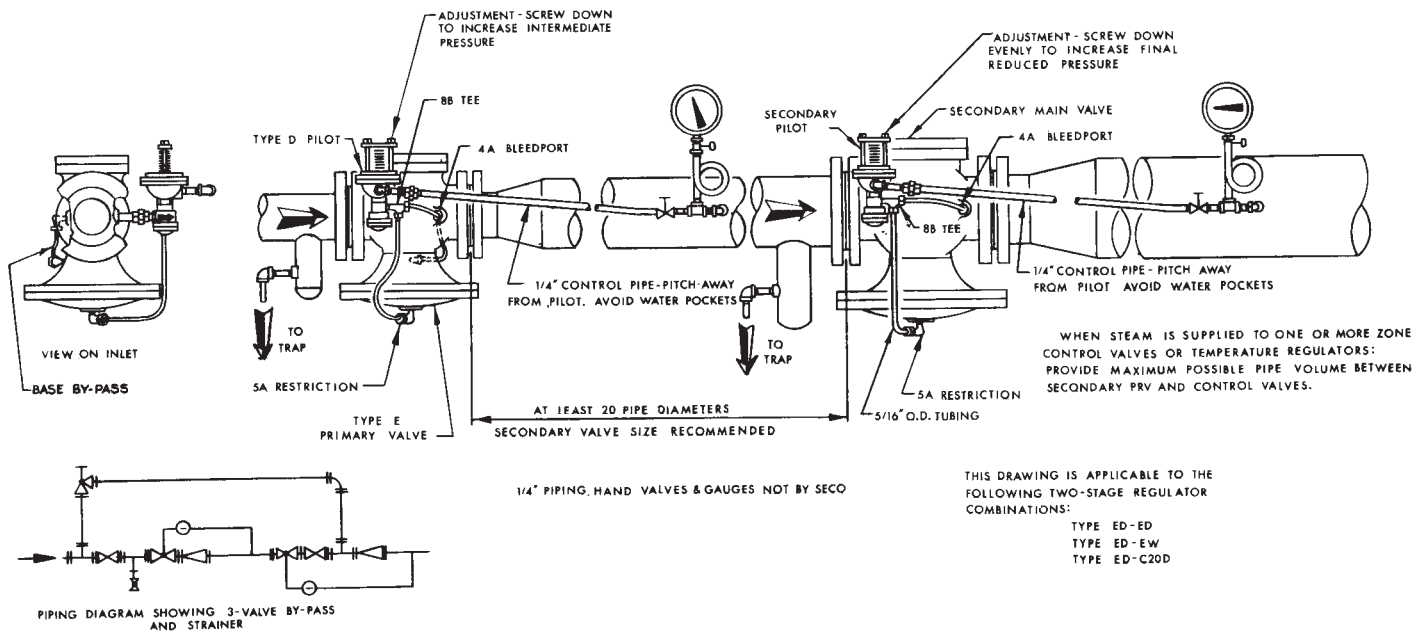
## SPENCE TYPE ED TWO-STAGE PRESSURE REDUCING STATION

### APPLICATION:

Used when reducing from high inlet pressure to low delivery pressure.

### OPERATION:

Same as single stage reduction. When delivery pressure approaches spring setting on pilot, main valve throttles to maintain setting.



### ADVANTAGES:

- Less velocity noise.
- Less maintenance costs.
- Safety is increased.





# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

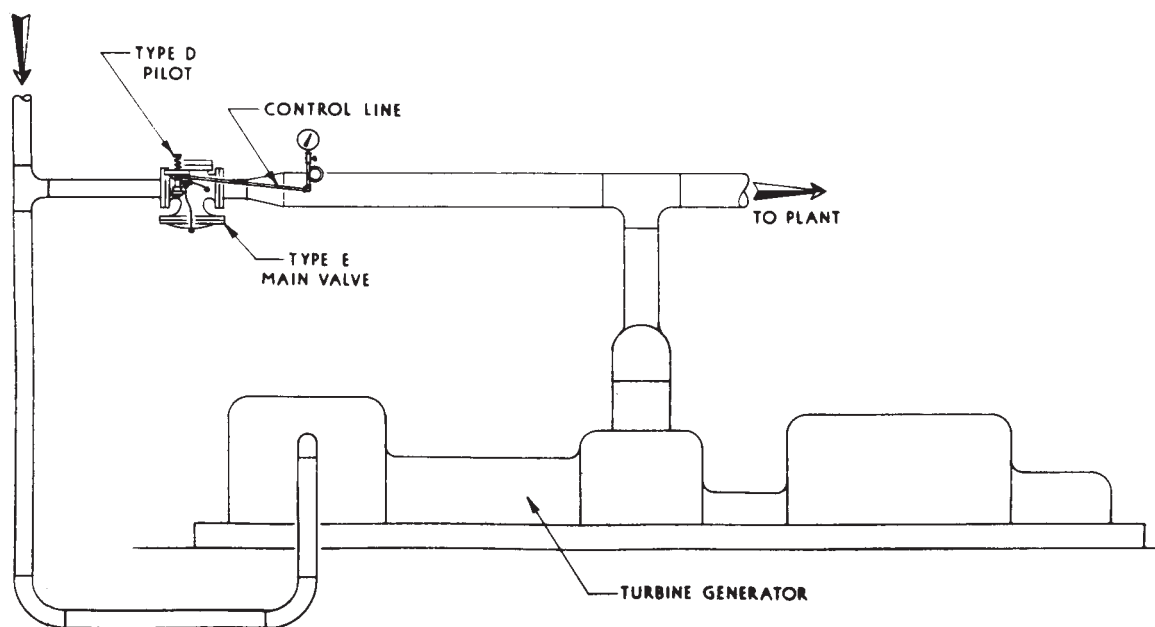
## SPENCE TYPE ED TURBINE EXHAUST MAKE-UP VALVE

### APPLICATION:

To provide additional (make-up) steam to turbine exhaust main.

### OPERATION:

When turbine load decreases and turbine exhaust is insufficient for steam load, very slight drop in exhaust pressure causes pressure regulator to feed correct amount of steam to meet demand.



### ADVANTAGES:

- Pilot operated accuracy avoids undue pressure drop before makeup starts.
- Constant accurate supply to user.
- Ease of operation - "set & forget".



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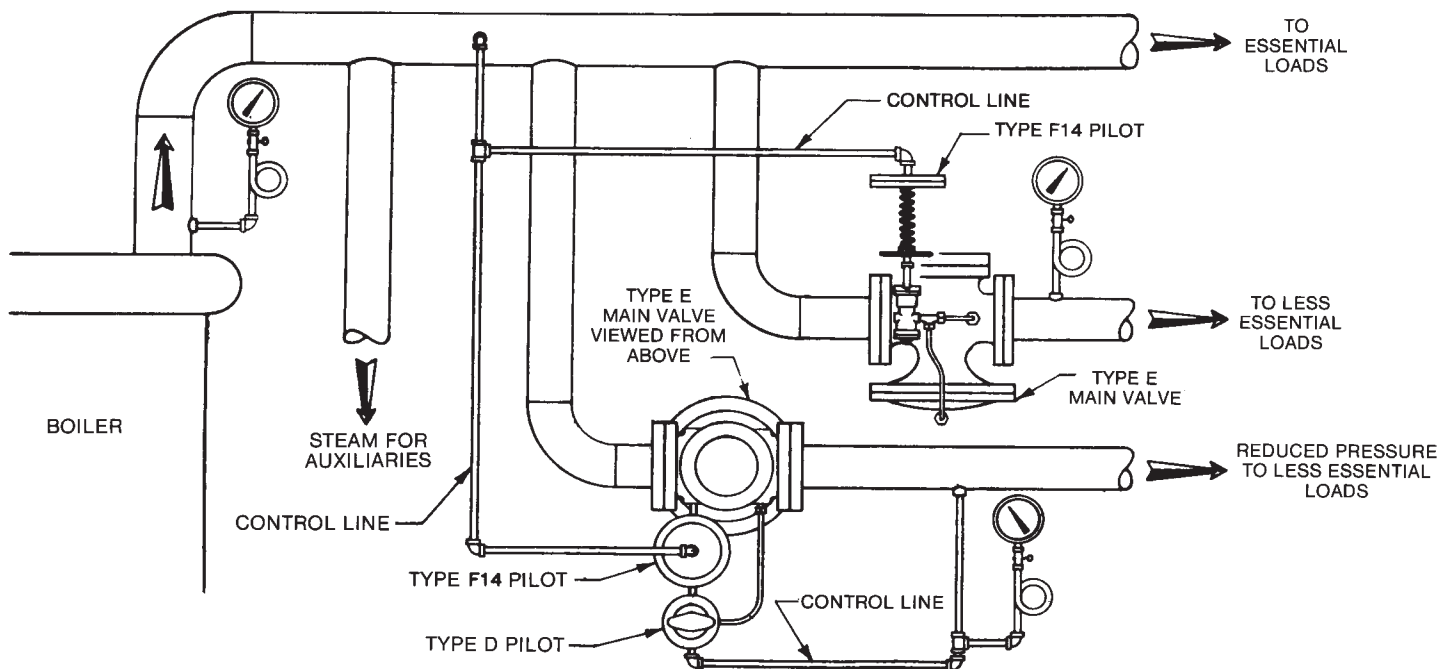
## SPENCE TYPE EF14 AND EF14D STEAM ALLOCATING VALVES

### APPLICATION:

To provide for distribution of steam from an occasionally overloaded boiler to most essential services first.

### OPERATION:

With boiler operating within rated load and at rated pressure, F14 pilots (set slightly lower) are wide open and main valves are either wide open or under control of alternate pilots and delivering all the steam each line requires. Then, when load increases beyond boiler capacity and boiler pressure drops, the F14 pilots will throttle the main valves, restricting the flow to the less vital processes and permitting the others to function at rating.



### ADVANTAGES:

Less expensive than separate back pressure valve (when combined with pressure, temperature or other regulating valves).

Can frequently postpone necessity of buying larger boiler.

Provides assurance against loss of steam to boiler auxiliaries.



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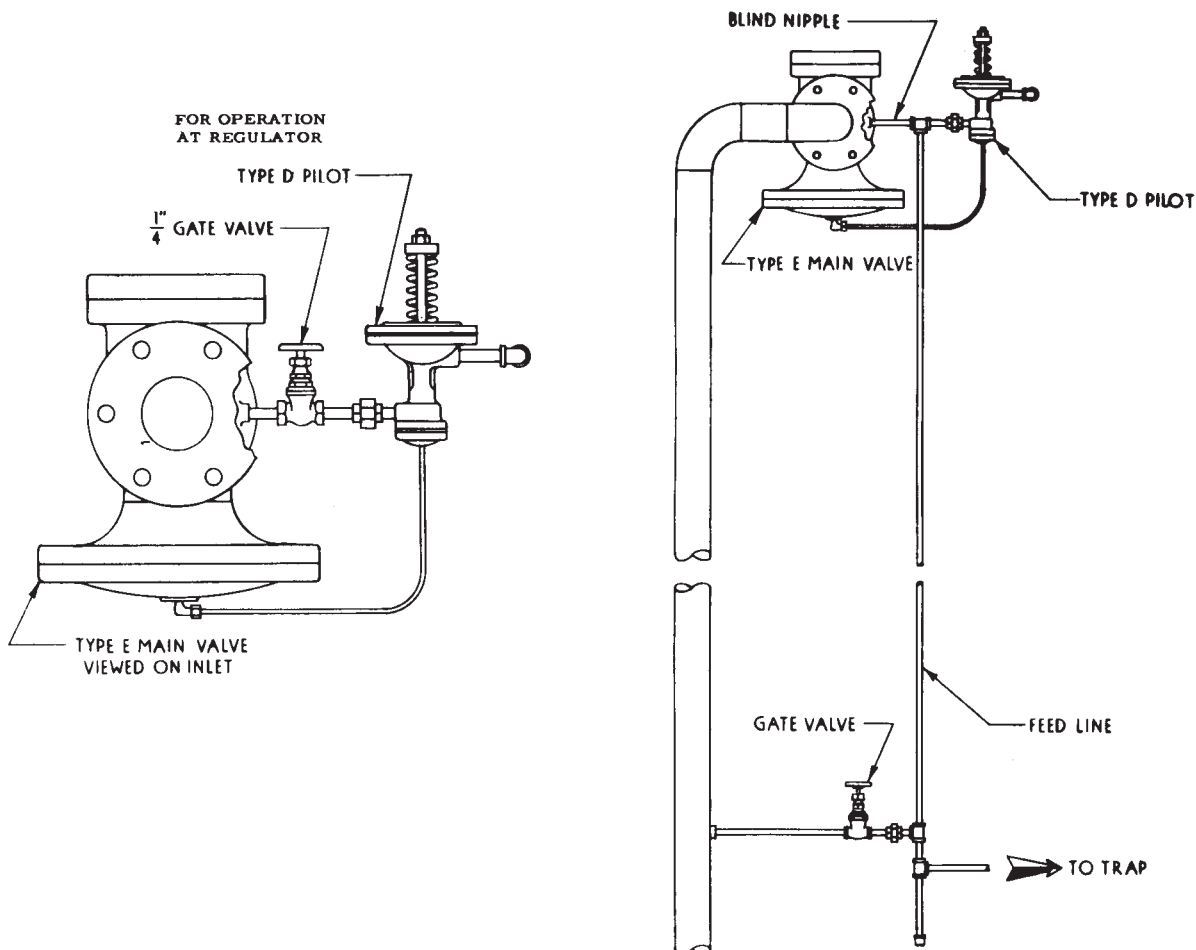
## SPENCE TYPE ED REMOTE SHUT OFF

### APPLICATION:

Provides easy shut-down on a process where frequent shut-down is required.

### OPERATION:

Same as standard ED, except, closing 1/4" gate valve denies steam to the pilot and shuts main valve.



### ADVANTAGES:

- Easier and much faster than opening and closing the larger gate valve in main.
- Reduces maintenance on the gate valve in the main line.
- Self contained.



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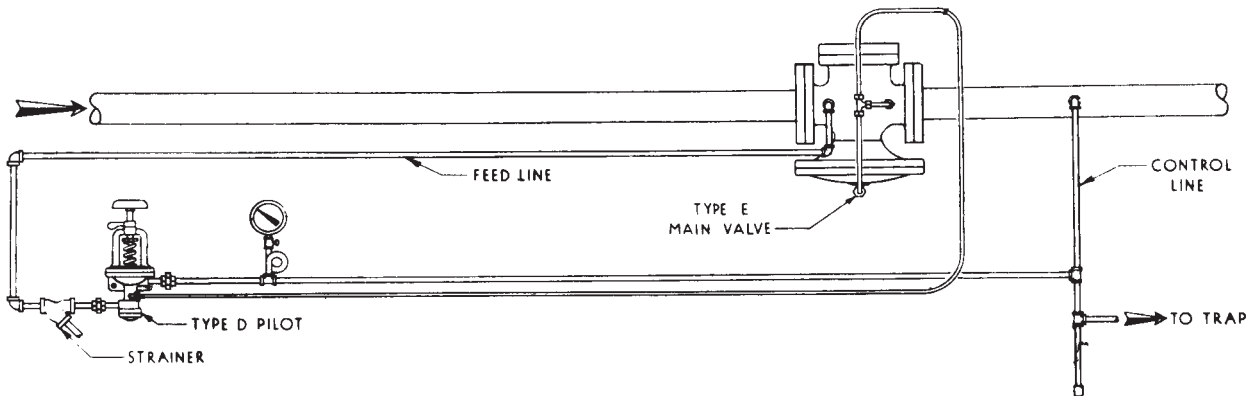
## SPENCE TYPE ED REMOTE MOUNTED PILOT

### APPLICATION:

Provides remote location of pilot to area where pressure can be easily adjusted.

### OPERATION:

Standard ED operation.



### ADVANTAGES:

Least expensive of remote-adjusting arrangements (less than special extra equipment or re-routing main piping).

Maintenance personnel, who understand operation of standard mounted regulator, have nothing new to learn.

Can be applied to existing regulators by merely extending connections.

Can be furnished with panel board and gages.



# Application Guide

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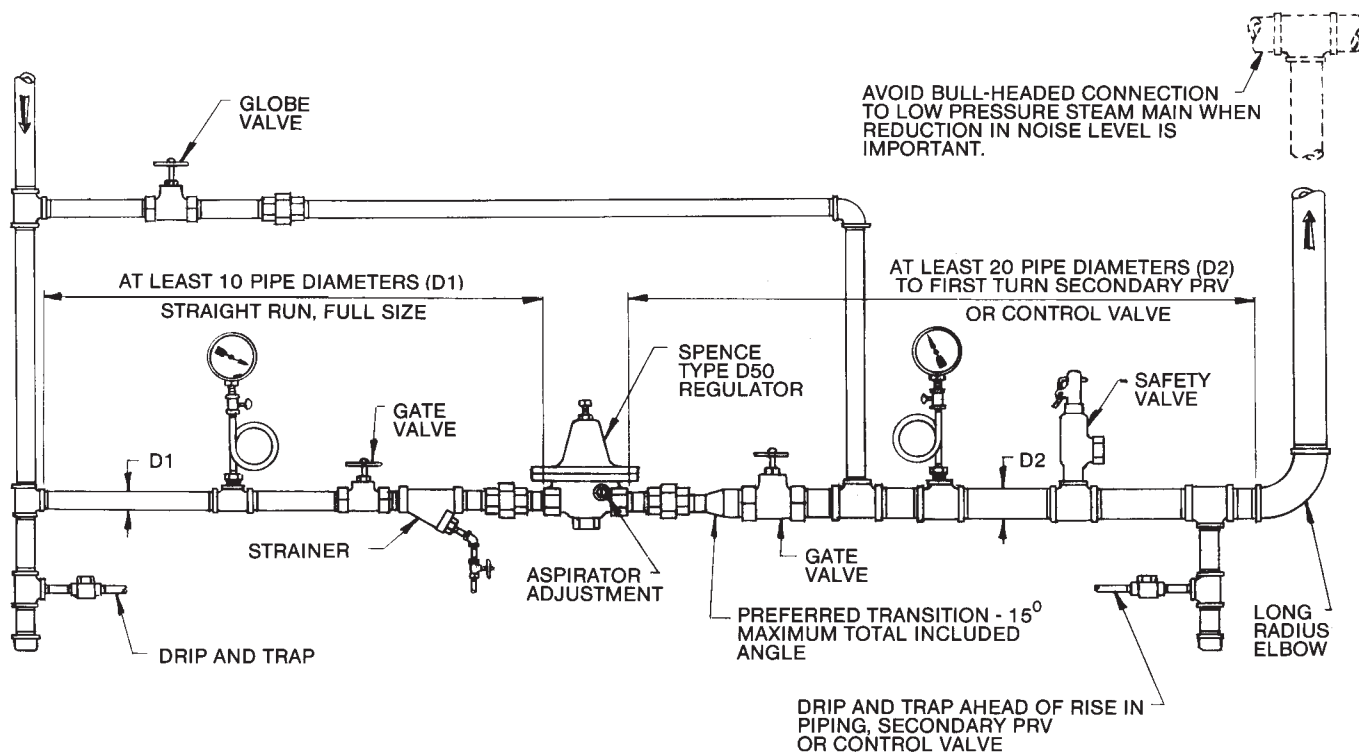
## SPENCE TYPE D50 DIRECT OPERATED PRESSURE REDUCING VALVE

### APPLICATION:

To reduce a steady or varying inlet pressure to a constant adjustable delivery pressure. Ideal for small flows such as unit heaters and sterilizers.

### OPERATION:

Valve is operated by incoming pressure. As delivery pressure nears spring setting on pilot, valve starts to modulate and maintain set pressure.



### ADVANTAGES:

- Accurate control.
- Available in Cast Iron, Bronze and Stainless Steel.
- Aspirator adjustment for greater sensitivity.



# Application Guide

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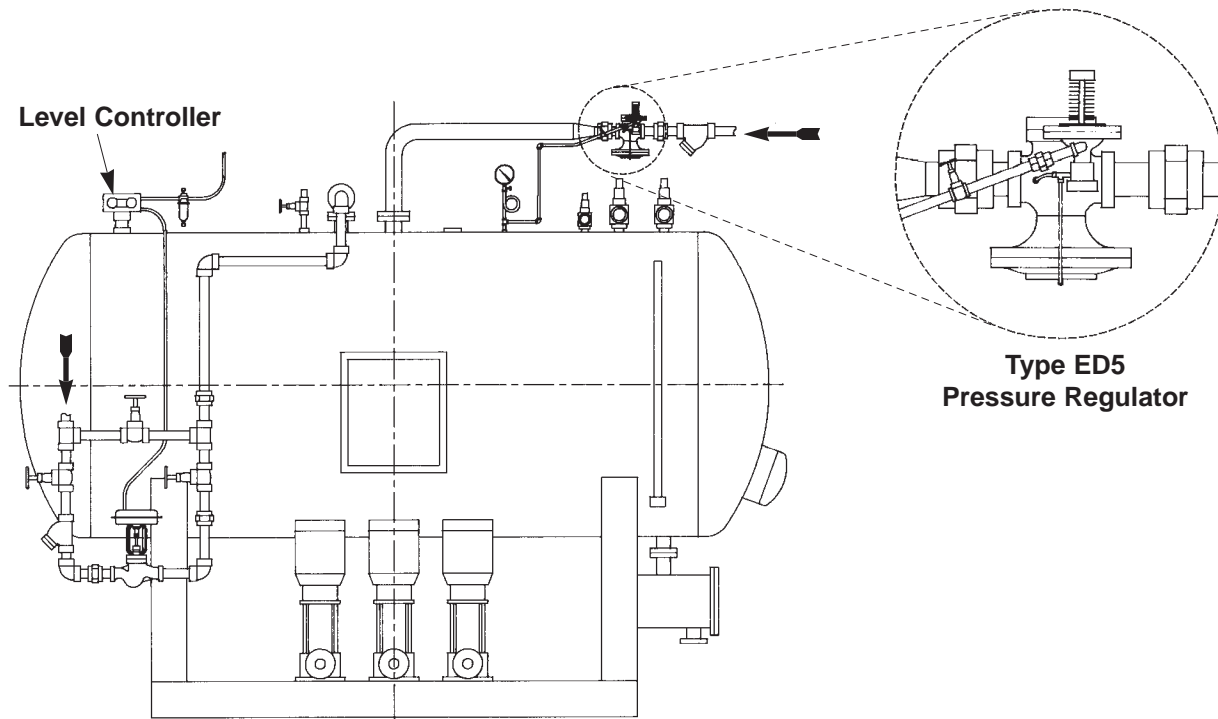
## SPENCE TYPE ED5 PRESSURE REGULATOR for ACCURATE CONTROL of a DEAERATOR

### APPLICATION:

To enhance the deaeration of boiler feedwater by accurately controlling the steam pressure and temperature in a deaerator.

### OPERATION:

The Type ED5 Pressure Regulator is connected to the Deaerator as shown, *with the Type D5 Pilot's Sensing Line connected to the Deaerator*. Operation is identical to the Type ED except delivery pressure is sensed in the Deaerator, not the steam piping. The larger, more sensitive diaphragm of the Type D5 Pilot (1 to 25 psig delivery pressure) has twice the accuracy ( $\pm 1/2$  psig) of the Type D Pilot ( $\pm 1$  psig). With the Type D5 Pilot typically set at 5 psig, temperature variation inside the Deaerator is held to  $\pm 1^\circ\text{F}$ .



### ADVANTAGES:

Self-contained, packless regulator

Increased accuracy for better deaeration

Type E2 substituted if initial steam pressure is between 9 and 15 psig



# Application Guide

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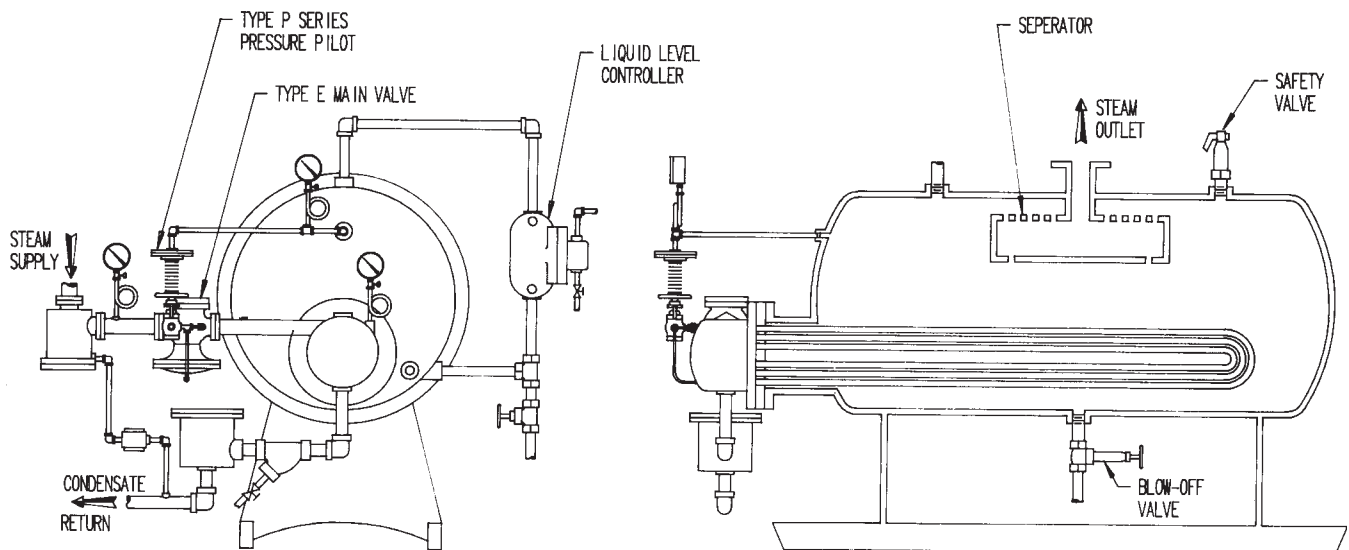
## SPENCE TYPE EP PRESSURE REGULATOR FOR SELF-CONTAINED CONTROL OF AN UNFIRED STEAM GENERATOR

### APPLICATION:

To provide self-contained control of an Unfired Steam Generator.

### OPERATION:

The Spence Type EP Pressure Regulator controls the steam or high-temperature water supply to the Unfired Steam Generator and maintains a constant, average, adjustable steam outlet pressure of the Unfired Steam Generator regardless of changes in load.



### ADVANTAGES:

Can eliminate the need for a Pneumatic Control Valve, Positioner and Pressure Controller.

When additionally equipped with a Type D Pressure Pilot, making a Spence Type EPD Pressure Regulator, the need for a separate Pressure Reducing Valve may be eliminated.





# Application Guide

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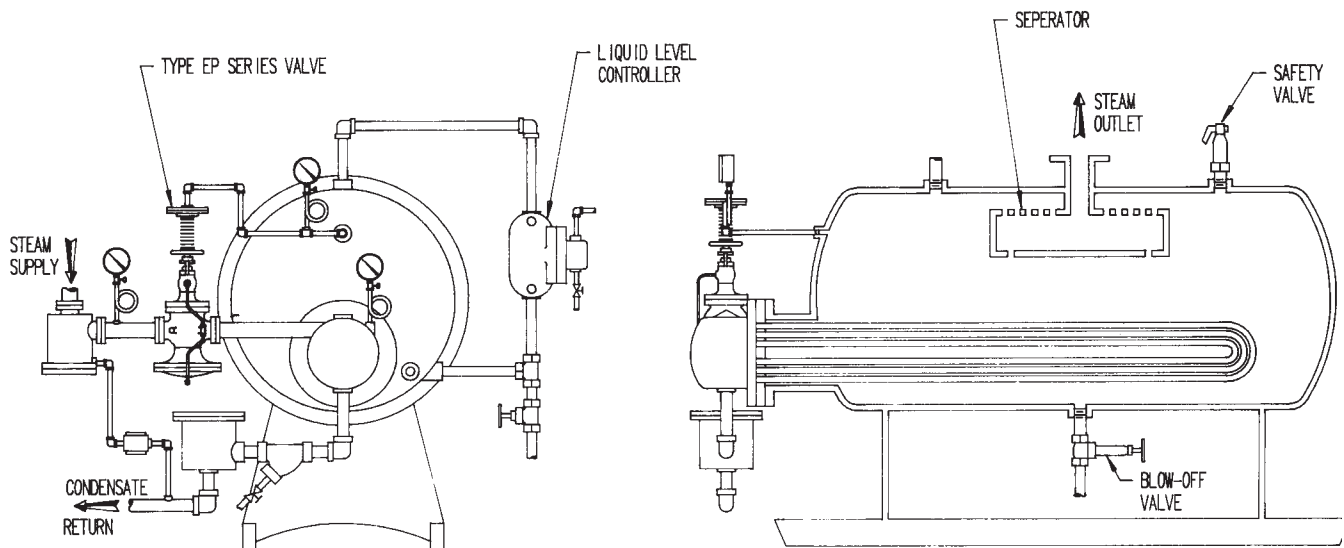
## SPENCE TYPE EP PRESSURE REGULATOR INTEGRALLY MOUNTED FOR SELF-CONTAINED CONTROL OF AN UNFIRED STEAM GENERATOR

### APPLICATION:

To provide self-contained control of an Unfired Steam Generator with Integrally Mounted Pilot option for increased rigidity.

### OPERATION:

The Spence Type EP Pressure Regulator controls the steam or high-temperature water supply to the Unfired Steam Generator and maintains a constant, average, adjustable steam outlet pressure of the Unfired Steam Generator regardless of changes in load.



### ADVANTAGES:

Can eliminate the need for a Pneumatic Control Valve, Positioner and Pressure Controller.

Integrally Mounted Pilot option increases the rigidity of the Pilot for O.E.M. installation on skid mounted equipment.



# Application Guide

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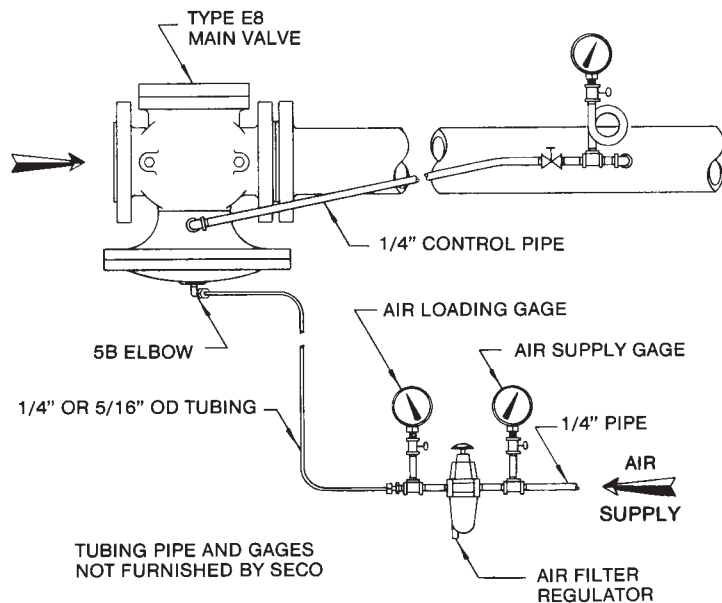
## SPENCE TYPE E8 AIR ADJUSTED PRESSURE REDUCING VALVE

### APPLICATION:

To reduce high pressure to constant adjustable delivery pressure. Ideal for regulation when poor steam conditions exist.

### OPERATION:

Valve is normally closed and is opened by air pressure under the diaphragm. The downstream pressure is on top of the diaphragm, and the required delivery pressure is obtained by adjusting the air pressure.



### ADVANTAGES:

- No pilot required.
- No orifices to plug up.
- Economy and performance of E valve.



# Application Guide

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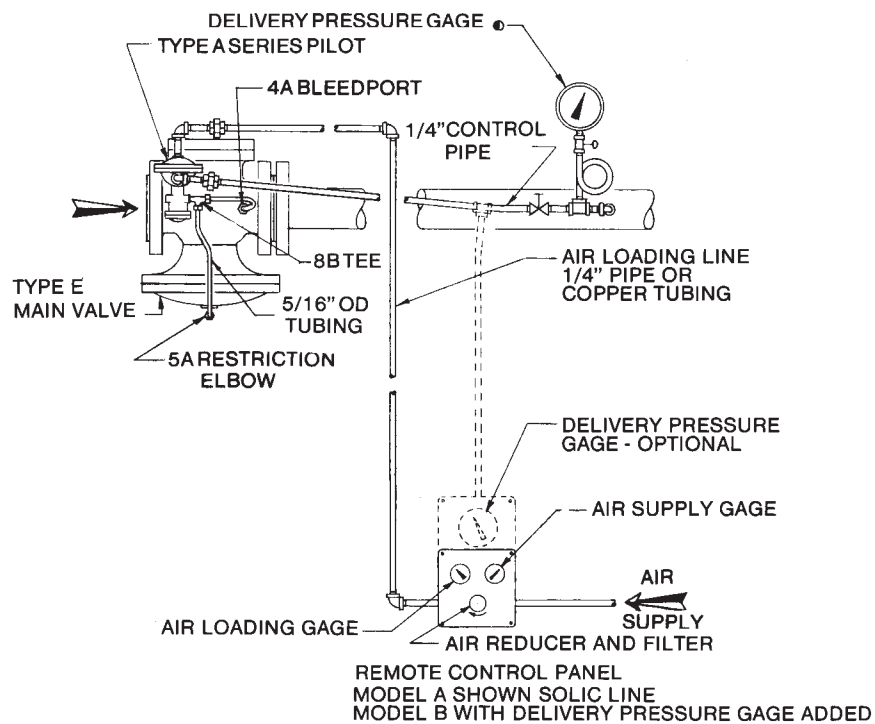
## SPENCE EA SERIES AIR ADJUSTED PRESSURE REGULATOR

### APPLICATION:

To provide simple accurate control when varying delivery pressures are required. Ideal for tire moulding, laminate presses and drum dryers.

### OPERATION:

Delivery pressure is remotely adjusted by changing air pressure to pilots.



### ADVANTAGES:

- Ease of adjustment.
- Operator control.
- Many air adjusted Pilots available.



# Application Guide

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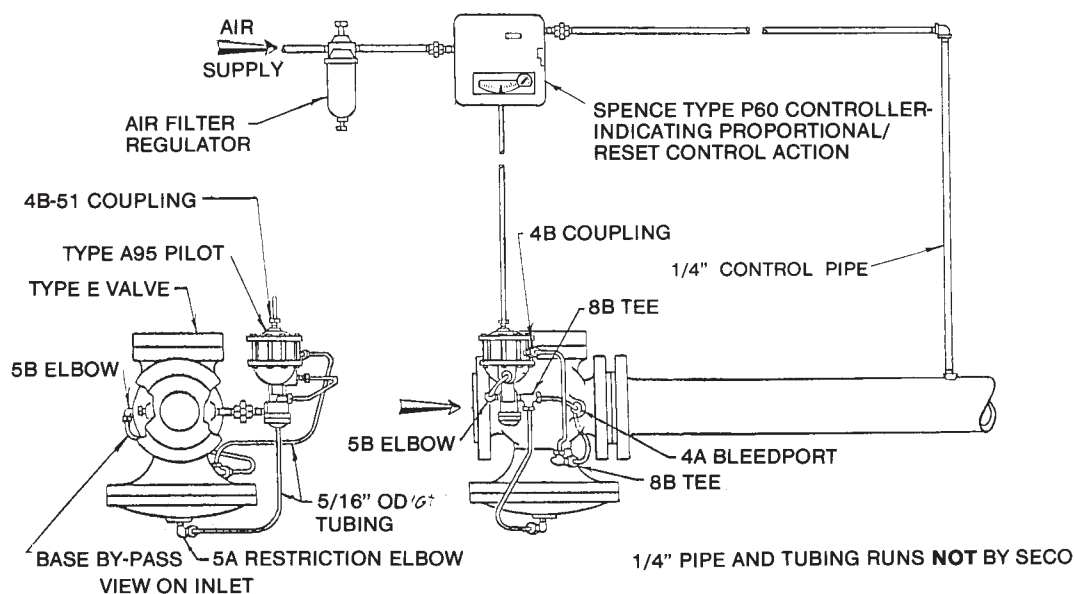
## SPENCE EA95P60 PNEUMATICALLY CONTROLLED PRESSURE REGULATOR

### APPLICATION:

Provides control valve accuracy on jobs demanding close regulation. Ideal for process applications requiring fast load changes and varying outlet pressures.

### OPERATION:

A controller out-put air signal, covering a span of 12 psig, will fully stroke the main valve. An out-put signal of 3 psig will start the main valve opening and at 15 psig main valve is fully open.



### ADVANTAGES:

- Packless Construction.
- Parabolic Disc available for greater rangeability.
- Valve closes on loss of air.



# Application Guide

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## SPENCE EA93 AUTOMATIC TRANSFER PRESSURE REDUCING STATION

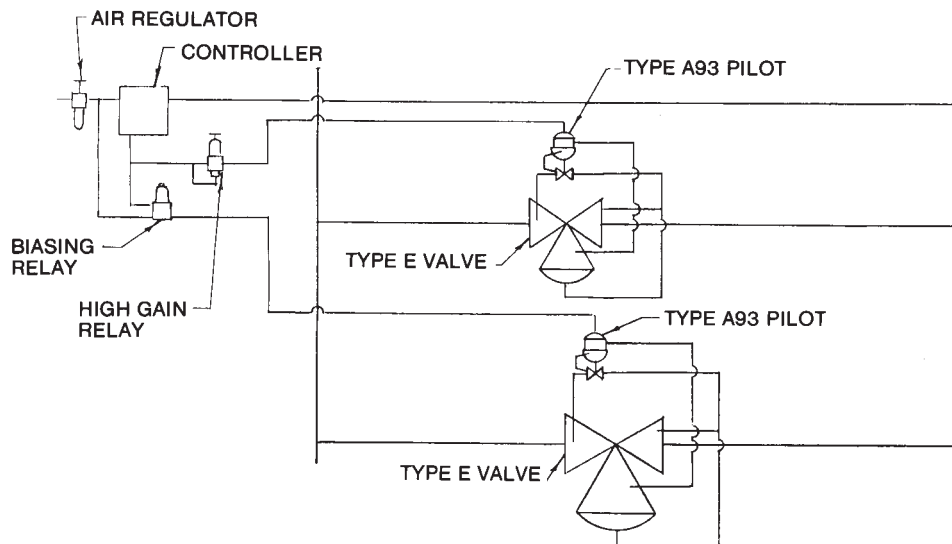
### APPLICATION:

The Spence Type EA93 Automatic Transfer Station is designed to provide accurate and stable control of reduced pressure throughout an exceptionally wide range of flow conditions. This design maximizes the rangeability of the station, while minimizing the extreme throttling encountered in single valve stations operating under the identical conditions. Balanced construction insures stability of regulator.

### OPERATION:

The Type EA93 Automatic Transfer Station consists of two pressure reducing valves installed in parallel. The larger of these valves is sized for 100% of the required load. The smaller valve is sized for a fraction (typically 15% to 25%) of the required load. Both valves are operated in a predetermined sequence by a pneumatic controller. An interlocking system of pneumatic relays provided the logic to sequence the operation of the station.

Under low flow conditions, the smaller valve will handle the demands on the station; the larger valve will be shut. As demand increases, the smaller valve will gradually open until it reaches the full open position. Upon further increases in demand, the larger valve will open and, simultaneously, the smaller valve will shut. The larger valve will then carry the higher loads on its own. Should demand drop, this sequence reverses: control of the flow is transferred back to the smaller valve and, simultaneously, the larger valve closes.



### ADVANTAGES:

Greater rangeability than single valve.

Pressure switches can be adapted to system for additional safety.

**A2-4** Standard stock valves can be used.



# Application Guide

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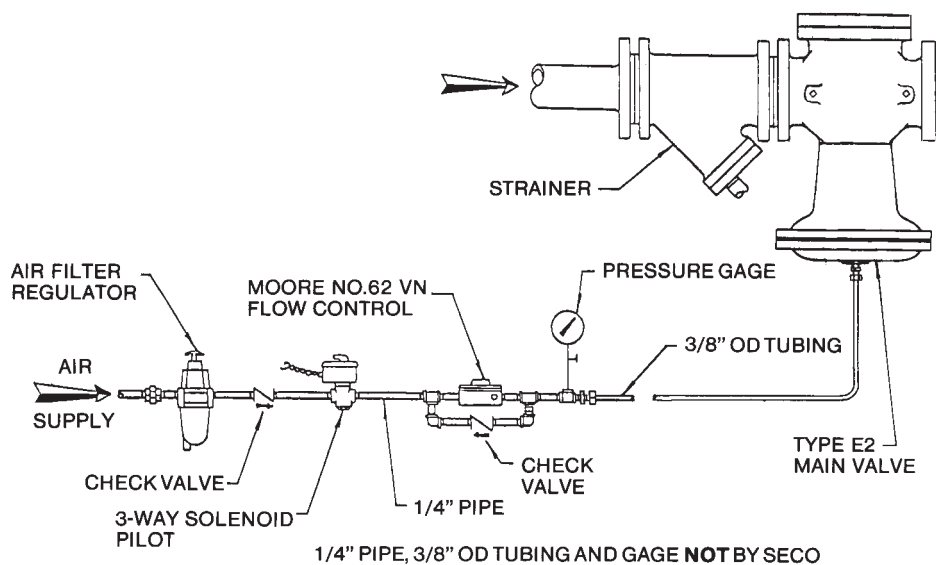
## SPENCE TYPE E2 SLOW OPENING VALVE

### APPLICATION:

When slow opening is required on a low pressure steam system, the E2 can be slowly opened by using a low volume flow control valve.

### OPERATION:

System is turned on by activating solenoid, and supplying air to flow control, which sends air loading pressure to diaphragm of E2 valve. Opening time is regulated by adjusting needle valve on flow control. When solenoid is shut off, it bleeds loading air from diaphragm of the E2 valve allowing it to close.



### ADVANTAGES:

- Low cost.
- Closes on loss of air.
- Remote controlled.



# Application Guide

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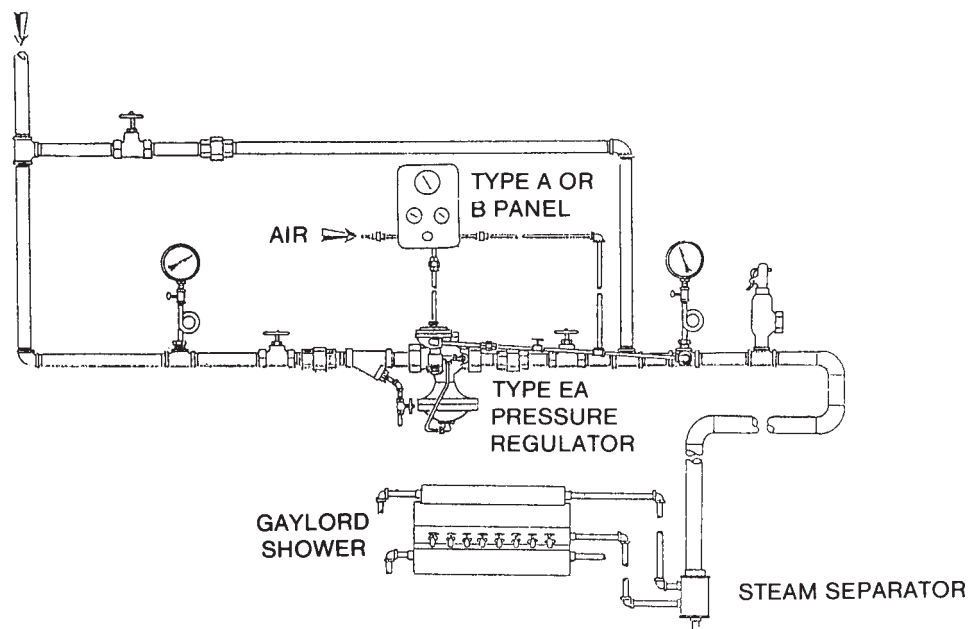
## SPENCE TYPE EA PRESSURE REGULATOR WITH TYPE B PANEL FOR GAYLORD SHOWER CONTROL

### APPLICATION:

To improve paper conditioning and reduce steam consumption by utilizing reduced pressure saturated steam instead of high pressure dry steam at the Gaylord Shower.

### OPERATION:

A Spence Type EA Pressure Regulator supplied by a Type B Panel is installed in the steam supply line to the Gaylord Shower and Steamer Pipe (if used) to reduce the steam pressure used. When high pressure saturated steam is reduced in a single step to 0 psi, the quality of the steam may be so enhanced as to introduce a certain degree of superheat. By comparison to low pressure saturated steam, low pressure superheated steam is a rather inefficient transmitter of heat and moisture to paper.



### ADVANTAGES:

- Reduced steam consumption.
- Improved paper conditioning.
- Self-contained, packless construction.
- Reduced pressure relatively unaffected by varying supply pressures.
- B Panel may be remotely located.

**A2-6A**





# Application Guide

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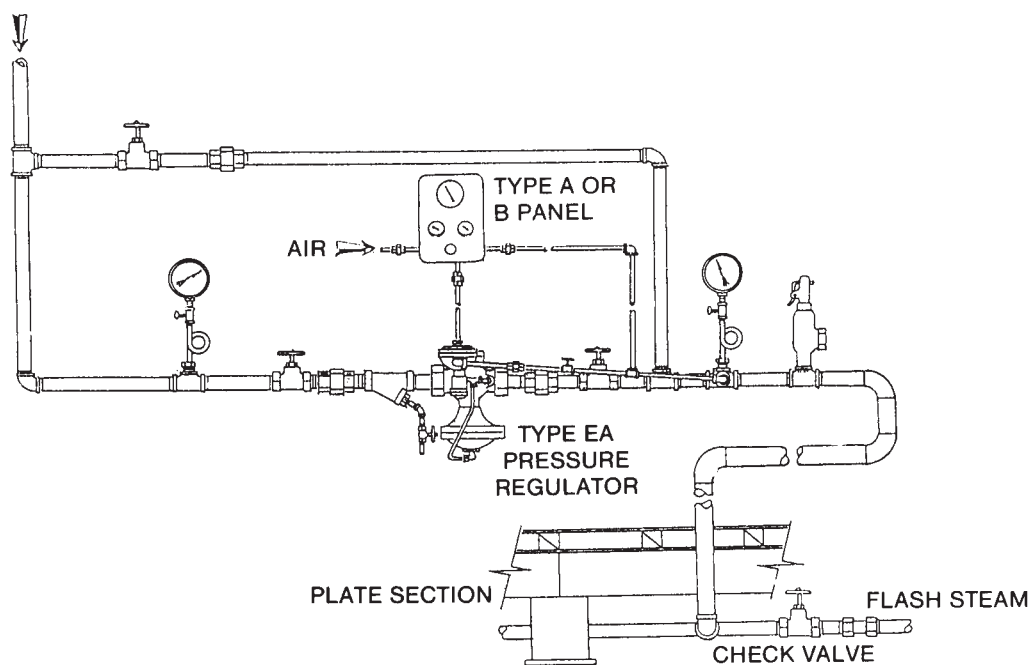
## SPENCE TYPE EA PRESSURE REGULATOR WITH TYPE B PANEL FOR CONTROL OF THE PLATE SECTIONS OF A CORRUGATOR

### APPLICATION:

When corrugator process speed is increased to the point that the flash steam available to the plate sections is insufficient, high pressure steam is admitted to the plate sections to permit increased process speed.

### OPERATION:

A spence Type EA Pressure Regulator is installed between a high pressure steam main and the flash steam supplied to the plate section. The Type B Panel is used to supply the air loading pressure to the Type A Pilot to establish the minimum steam pressure in the plate section. When insufficient flash steam is available to maintain the pressure desired, the Type EA opens and admits sufficient steam to maintain the set pressure.



### ADVANTAGES:

- Increased process speed may be possible.
- Self-contained, packless construction.
- B Panel may be remotely located.
- Fast response to process variables.



# Application Guide

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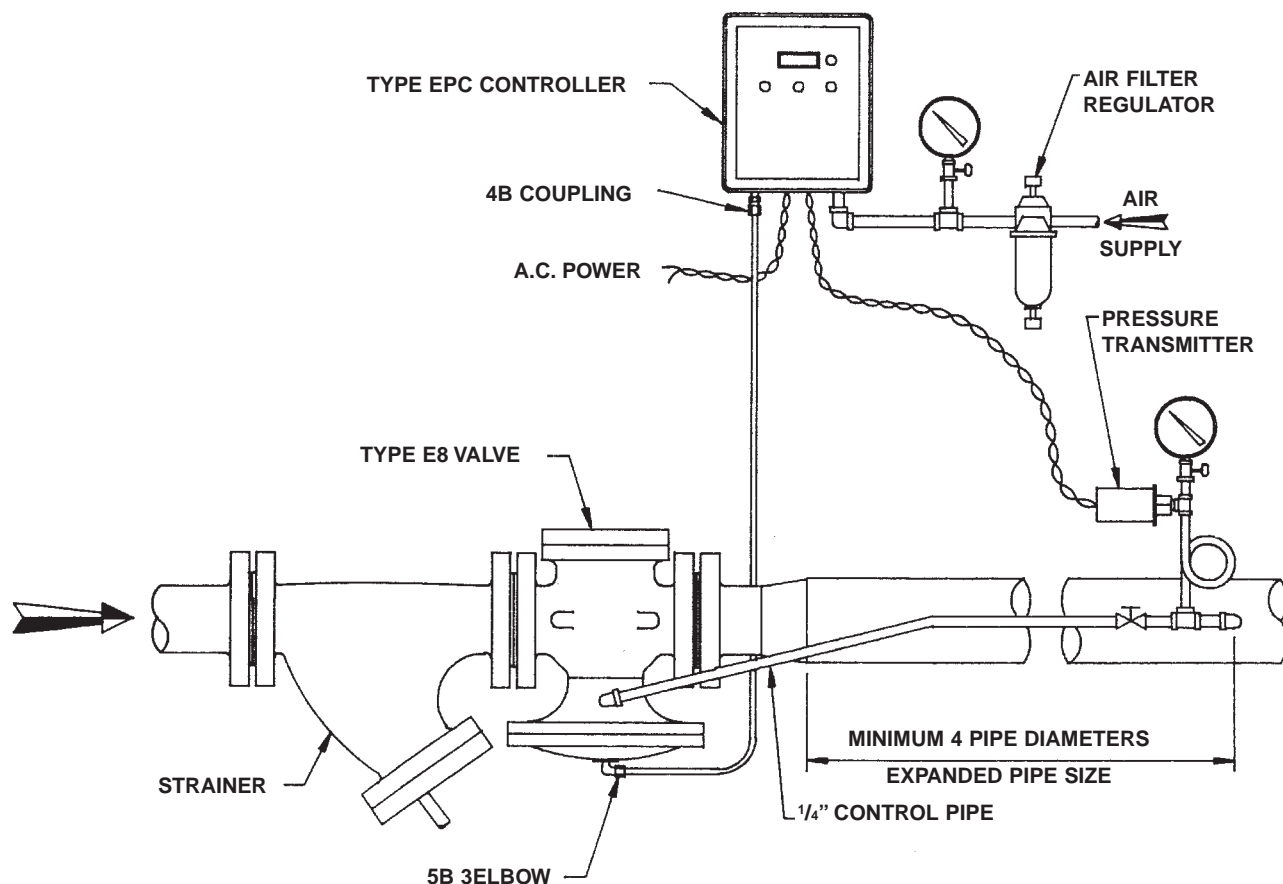
## SPENCE TYPE E8 EPC ELECTRO-PNEUMATICALLY CONTROLLED PRESSURE REDUCING VALVE

### APPLICATION:

To reduce a high pressure to a constant, adjustable delivery pressure. Ideally suited for accurate control when poor steam conditions exist.

### OPERATION:

The Type E8 Main Valve is normally closed. The Type EPC Electro-Pneumatic Controller provides 24VDC power to a pressure transmitter installed in the E8's control pipe. The EPC compares the 4-20mA pressure transmitter's signal to the setpoint. Using a series of short pneumatic pulses to the E8's diaphragm, the EPC either opens or closes the E8 to maintain the desired pressure.



### ADVANTAGES:

Utilizes standard plant air up to 100 psig.

Easy to install, operate and maintain.



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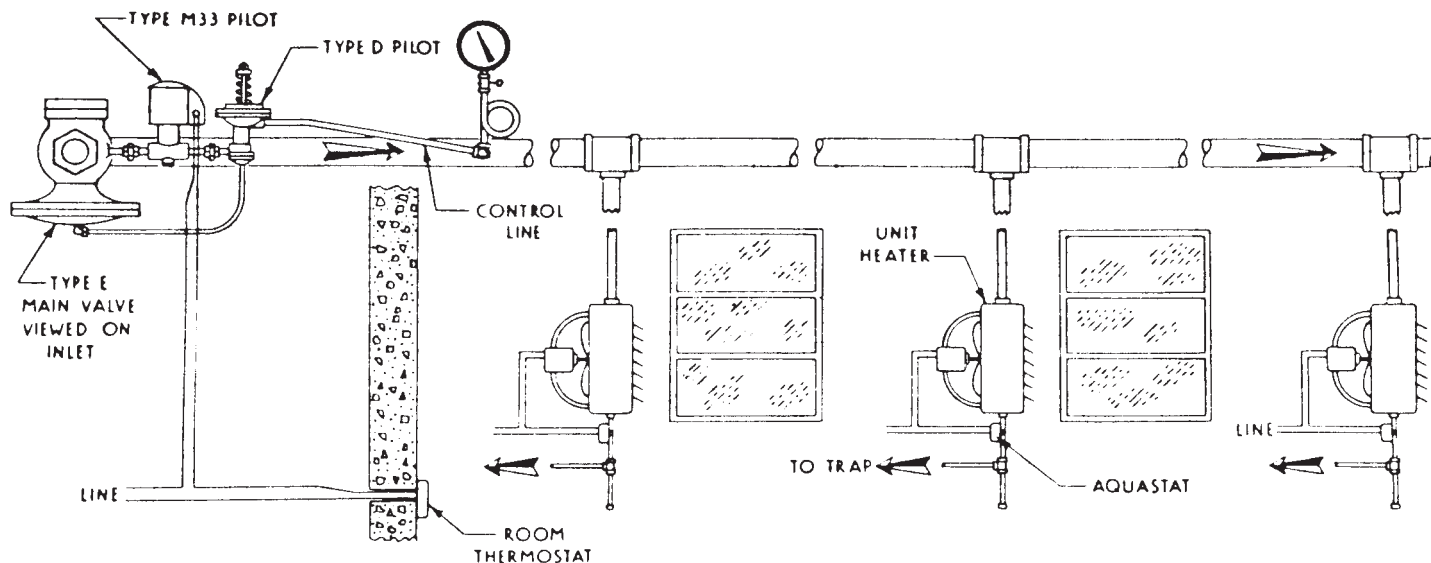
## SPENCE TYPE EM33D ELECTRICALLY OPERATED REDUCING VALVE

### APPLICATION:

To provide control of unit heater coil pressure and room temperature.

### OPERATION:

When the thermostat closes the circuit and opens the Type M33 solenoid pilot, the D pilot operates the Type E main valve to control header pressure. Then, as unit heaters warm up, the aquastats close the individual fan circuits, starting the fans.



### ADVANTAGES:

Reduced pressure can prevent "hot-blast".

Reduced pressure reduces trap wear.

Steam shut-off and pressure controlled by same valve.

Aquastat operation prevents cold drafts.

Seasonal pressure adjustment partially balances output to load and reduces cycling on room temperature.



# Application Guide

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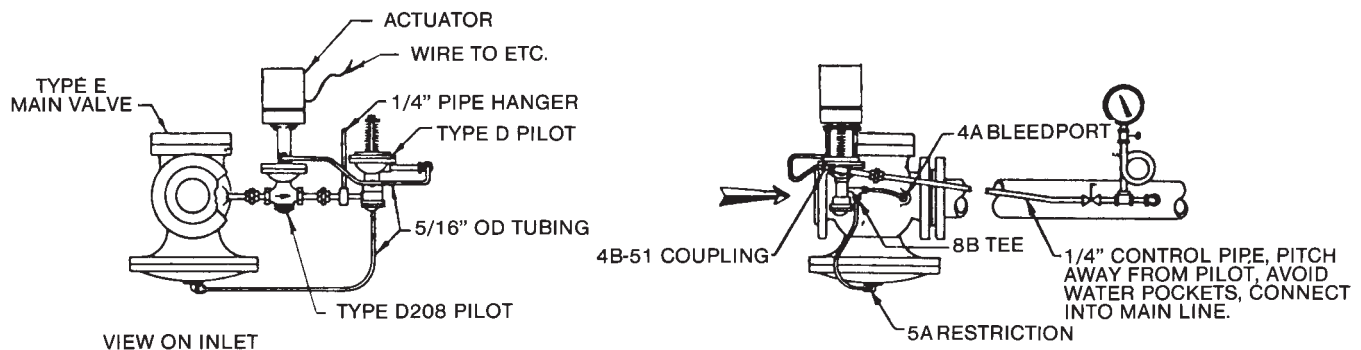
## THE SPENCE TYPE ED208D ELECTRONIC START-UP CONTROL IN CONJUNCTION WITH A TIME PROPORTIONING OUTDOOR RESET CONTROLLER

### APPLICATION:

Effect energy savings by adapting a Time Proportioning Reset Controller to a building's steam heating system. A Time Proportioning Outdoor Reset Controller regulates a building's heating system based on the actual heat loss for a given outdoor temperature by computing and varying the required "on/off" cycle with changing outdoor conditions.

### OPERATION:

When the Time Proportioning Outdoor Reset Controller calls for an "on" cycle, it activates the D208's Electronic Time Controller. The ED208D then follows its pre-programmed start-up cycle, which gradually heats up and pressurizes the building's steam heating system until the downstream pressure reaches the setting of the D pilot, which then assumes normal control. When the Time Proportioning Outdoor Reset Controller signals an "off" cycle, the D208's Electronic Time Controller is deactivated and the ED208D closes in approximately one minute.



### ADVANTAGES:

Substantial fuel savings since the steam heating system is energized only when required and in the amount necessary.

Substantial man-hour savings when frequent start-ups are necessary.

Reduces start-up load effect on boilers by controlling the rate at which the steam heating load is applied.

Minimizes the possibility of water hammer by gradually heating lines and enabling the traps to discharge condensate.



# Application Guide

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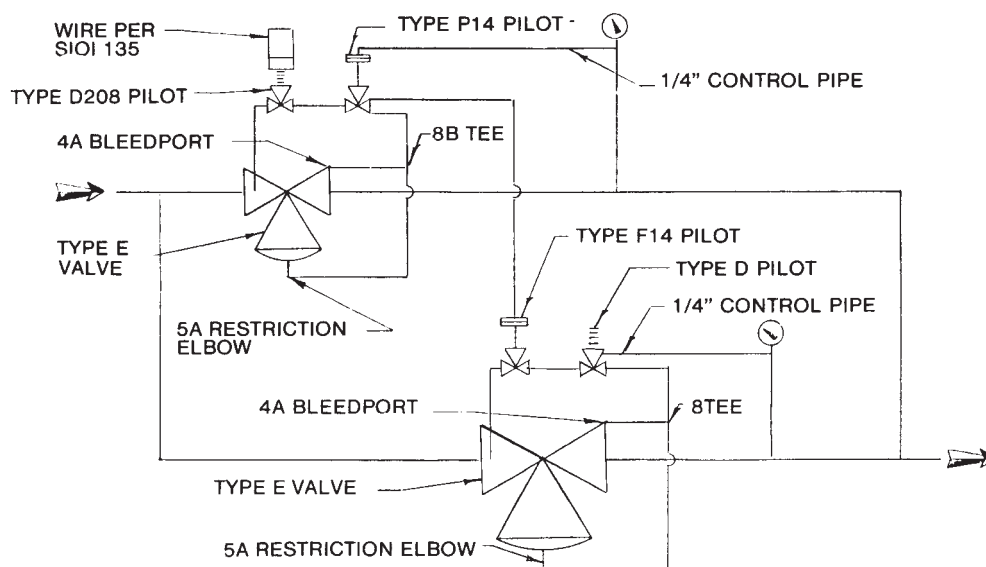
## THE SPENCE TYPE ED208P14-EF14D ELECTRONIC SLOW START-UP CONTROL FOR PARALLEL OPERATION

### APPLICATION:

To gradually heat up and pressurize a parallel installation.

### OPERATION:

When activated, the D208 Electronic Slow Start-up Control on the lead valve follows its pre-programmed start-up cycle, which gradually heats up and pressurizes the system until the delivery pressure reaches the setting of the P14 pilot, which then assumes control. The output of the lead station's P14 pilot is also connected to the trailing station's F14 pilot. This F14 pilot is set approximately 20 psi higher than the delivery pressure. Arranged in this manner, the trailing station is prohibited from normal parallel operation until the lead station has been fully activated and its capacity exceeded.



### FEATURES:

May be started from manual switch, thermostat or time clock. May be readily added to most existing Spence Parallel Operated Pressure Reducing Stations.

### ADVANTAGES:

Substantial fuel savings when used to turn on steam heating mains only when required by outdoor thermostat control.

Substantial man-hour savings when frequent start-ups are necessary.

Reduces start-up load effect on boilers by controlling the speed with which the load is applied.

Minimizes the possibility of water hammer by gradually heating lines and enabling the traps to discharge condensate.



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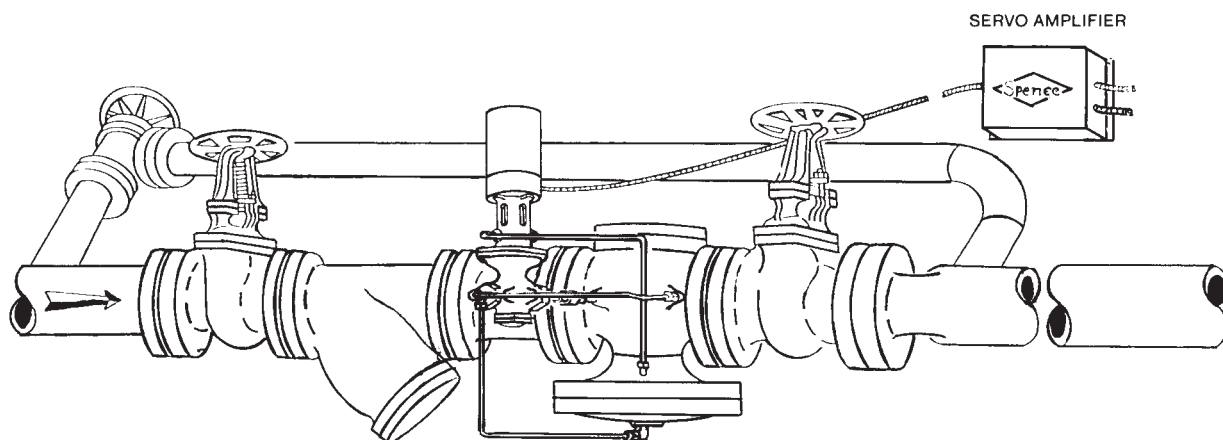
## THE SPENCE TYPE ED210 ELECTRONIC MODULATING REGULATOR

### APPLICATION:

To electronically modulate a Main Valve to control pressure or temperature.

### OPERATION:

The D210 pilot will modulate a process variable in relation to a proportional control input signal. There is a continuous signal between the system's input, the Servo-Amplifier and the pilot actuator. This constant signal gives the D210 pilot the ability to react immediately to a command from the input and modulate the Main Valve.



**Typical Installation of the Type ED210  
Pressure Regulator protected by a Strainer**

### ADVANTAGES:

Back-up power supply available.

Optional input signals:-

1 - 5 ma

4 - 20 ma

10 - 50 ma

Selectable from 0 to 24 VDC

Can be used on standard Spence valve.

Adaptable to energy management systems.



# Application Guide

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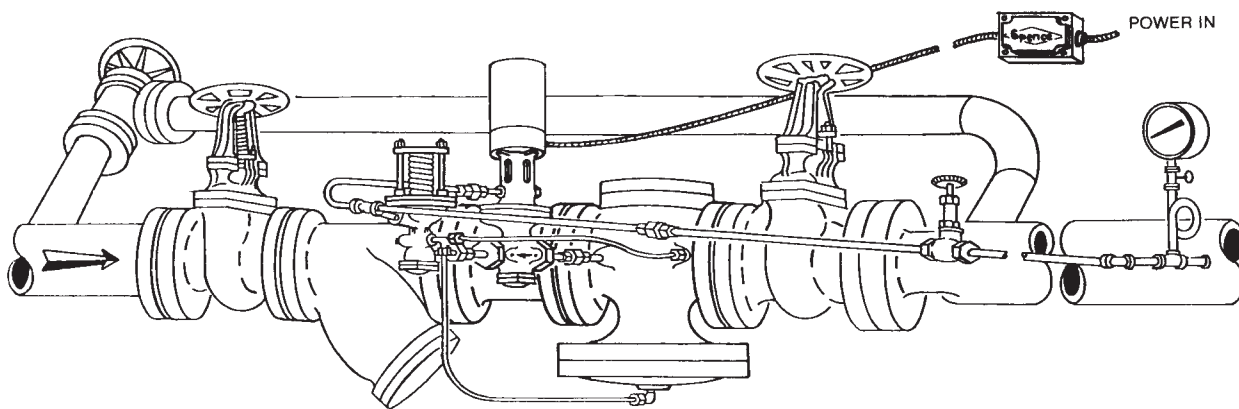
## THE SPENCE TYPE ED208D ELECTRONIC START-UP CONTROL

### APPLICATION:

To gradually heat up and pressurize a steam distribution line.

### OPERATION:

The D208 Pilot is controlled by a pre-programmed Electronic Time Controller (E.T.C.). When activated by the customer supplied "switch", the Pilot slowly opens the Main Valve over the 6 - 96 minute time period selected. When deactivated, the Main Valve closes in 1 minute.



**Typical Installation of the Type ED208D  
Pressure Regulator protected by a Strainer**

### ADVANTAGES:

May be started from manual switch, thermostat or time clock. May be readily added to most existing Spence ED pressure reducing stations.

Substantial fuel savings when used to turn steam into heating mains only when required by outdoor thermostat control.

More even temperature is maintained in a comfort control system.

Substantial man-hour savings when frequent start-ups are necessary.

Reduces start-up load effect on boilers by controlling the speed with which the load is applied.

Minimizes the possibility of a water hammer by gradually heating lines and enabling the traps to discharge condensate.

Back up power supply available.





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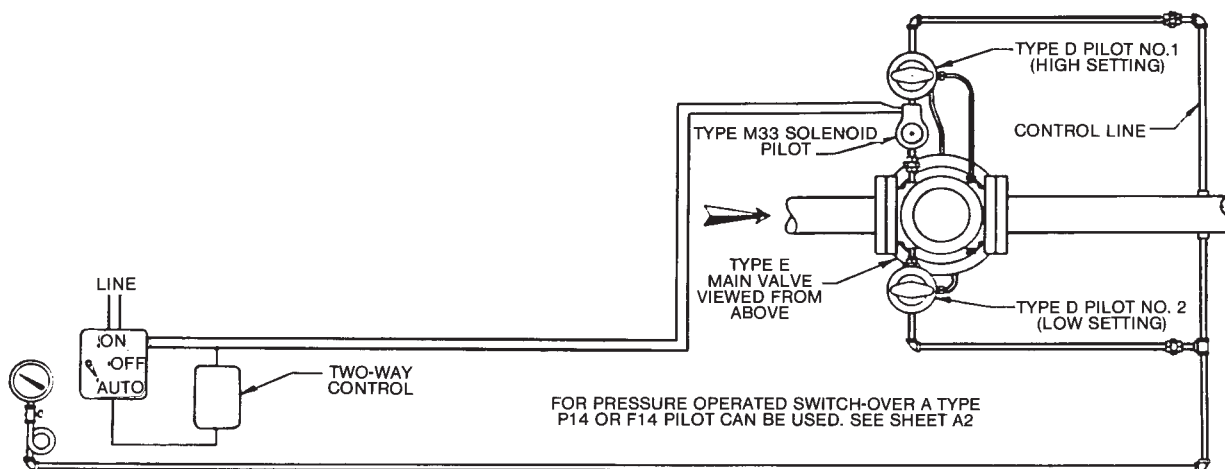
## SPENCE TYPE EDM33D PRESSURE REDUCING VALVE WITH TWO SET-POINT CONTROL

### APPLICATION:

To provide simple, economical and rapid means for alternating between a high and low control point, when two control settings are repeatedly used.

### OPERATION:

Standard ED operation with one pilot set higher than other. Pilot No. 1 has the higher setting and is controlled by the M33 solenoid. When solenoid is closed, pilot No. 2 is in control at the lower setting. When higher setting is required, solenoid is opened and pilot No. 1 is in control.



### ADVANTAGES:

- Consists of standard equipment.
- Less expensive than two separate regulators.
- Can be applied to existing regulator.
- Can be tied to automatic control system (as illustrated).
- Essentially no limit on location of station.



# Application Guide

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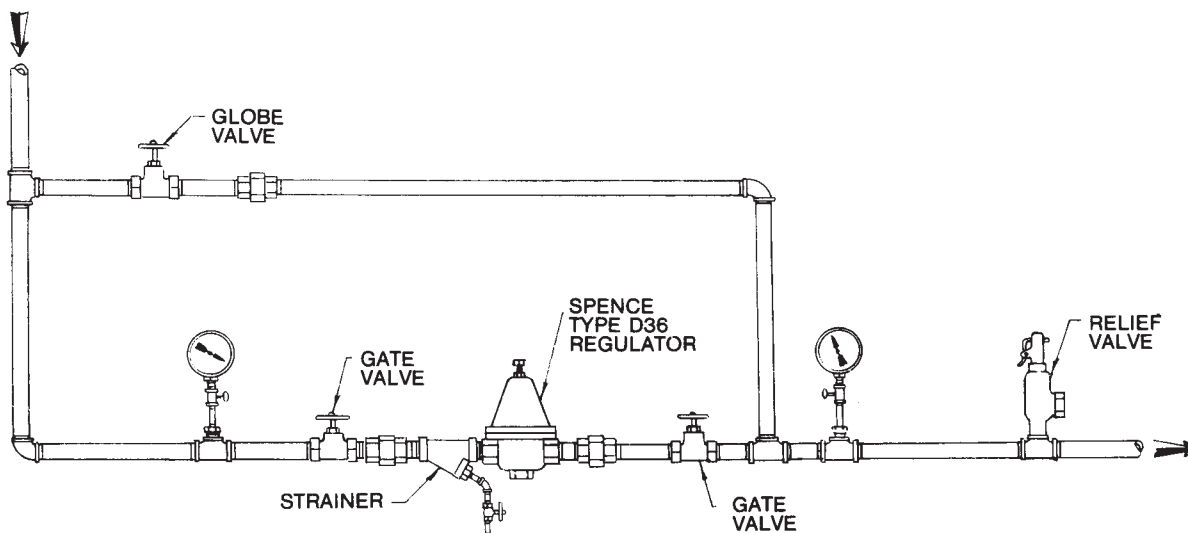
## SPENCE D36 WATER PRESSURE REDUCING VALVE

### APPLICATION:

Designed for liquid pressure reduction, where very fast reaction to intermittent flows or rapid changes are a system requirement.

### OPERATION:

Valve is opened by compressing adjusting spring. Downstream pressure acts against adjusting spring, and pressure is set by increasing or decreasing spring pressure.



### ADVANTAGES:

High capacity.

Large sensitive diaphragm.

Meets requirements of:

A.S.S.E Standard 1003.

Southern Standard Plumbing Code.

MIL Standard MILV-18146A, Type I.

I.A.P.M.O.

City of Los Angeles.

W.P.O.A. Uniform Plumbing Code.



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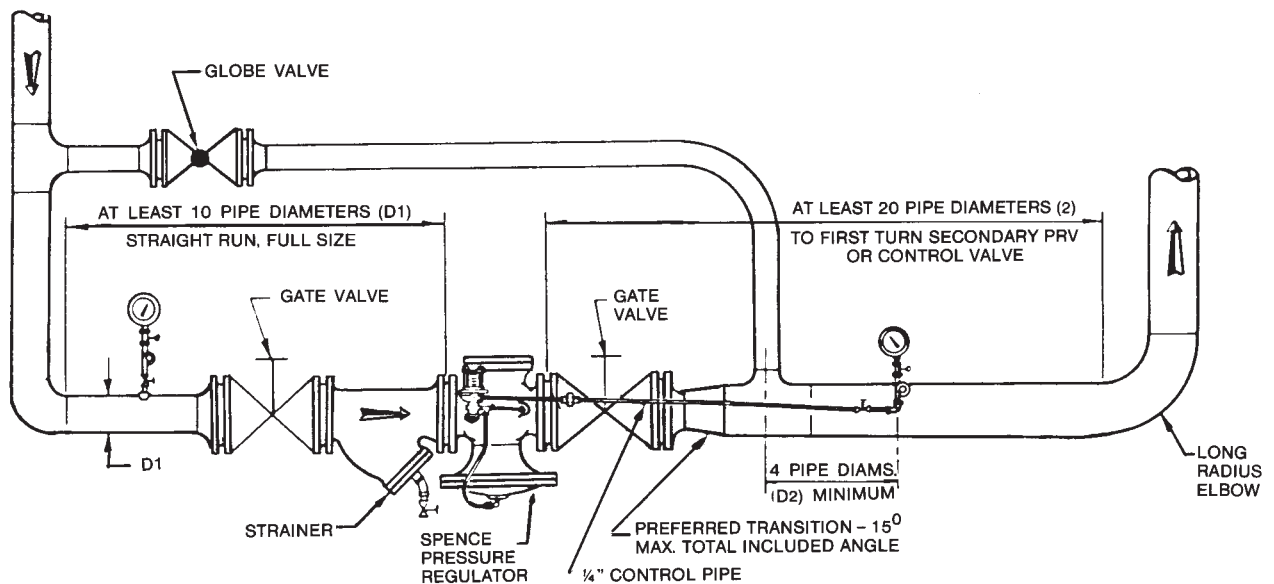
## SPENCE C34D PILOT OPERATED PRESSURE REDUCING VALVE

### APPLICATION:

Designed to reduce a steady or varying inlet pressure to a constant, adjustable delivery pressure. Recommended for applications needing high accuracy of regulation, but with load changes not too violent for pilot operated valve.

### OPERATION:

Delivery pressure, acting on pilot diaphragm, throttles main valve to maintain set pressure.



### ADVANTAGES:

- Self Operated.
- Packless.
- High Capacity.



# Application Guide

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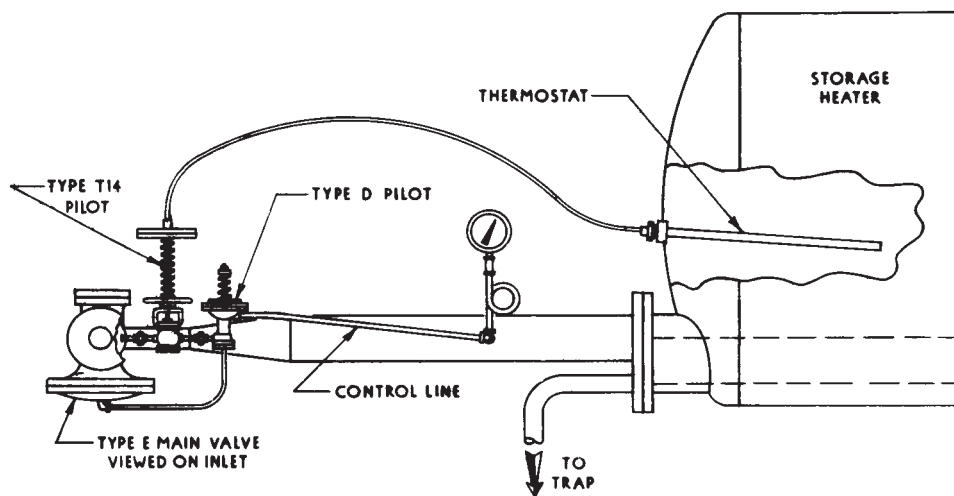
## SPENCE ET14 & ET14D TEMPERATURE REGULATOR

### APPLICATION:

To provide temperature control in a storage water heater.

### OPERATION:

Steam flowing through the main valve is controlled by the T14 pilot. Variations in temperature at the thermostat opens and closes T14 pilot, which operates the valve. If pressure control is needed to protect heater coils, the D pilot is used.



### ADVANTAGES:

- Pilot operated accuracy.
- No separate PRV required.
- Many temperature ranges available.
- All packless construction.



# Application Guide

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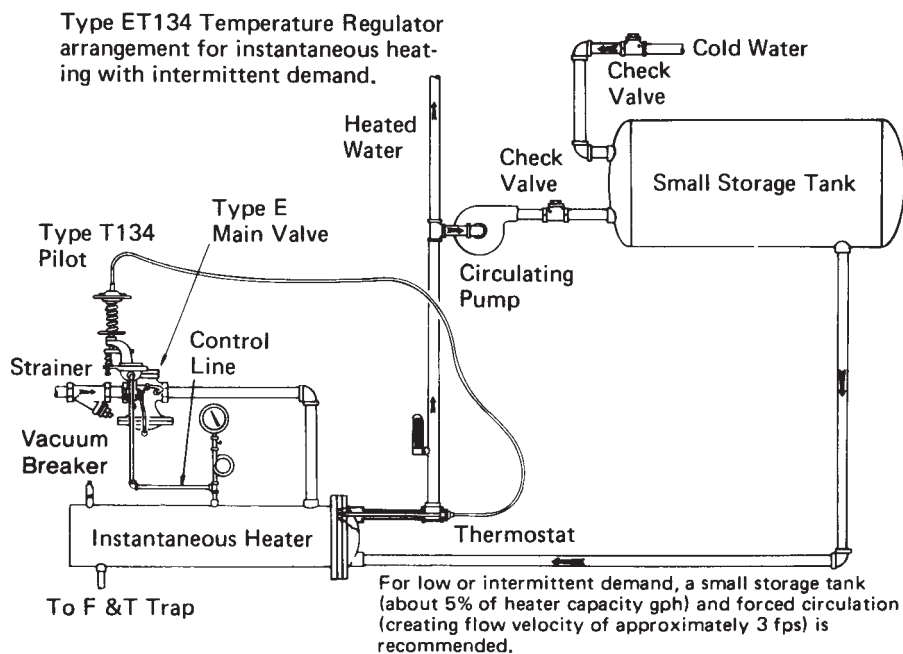
## SPENCE ET124 & ET134 TEMPERATURE REGULATOR

### APPLICATION:

To provide temperature control in a converter or instantaneous heater.

### OPERATION:

Steam flowing through the main valve is controlled by T124 or T134 pilot. Steam pressure in the heater is modulated in proportion to temperature and load variations.



### ADVANTAGES:

No separate PRV required.

Pressure sensing anticipates load changes before thermostat sees temperature change.

Standard stock valves.



# Application Guide

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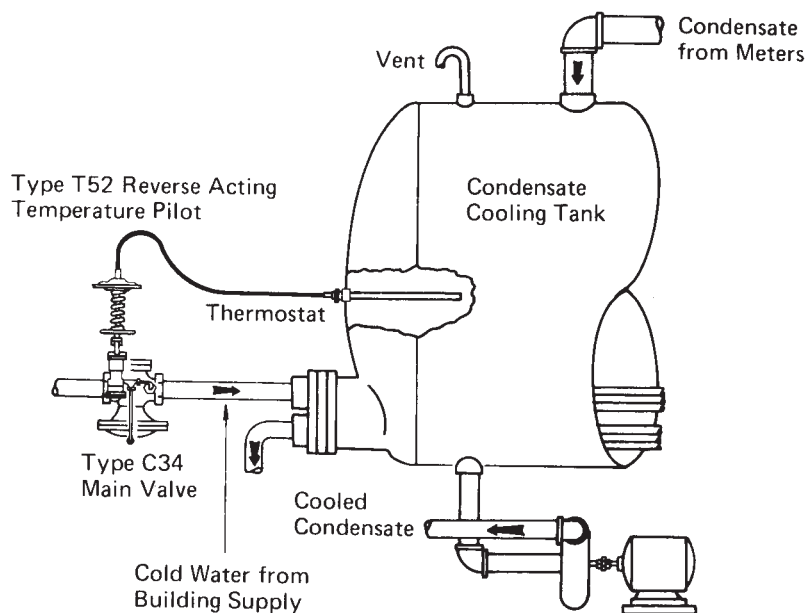
## SPENCE C34T52 COOLING REGULATOR

### APPLICATION:

To provide temperature control for refrigeration condensers, lube oil coolers, process coolers and water cooled heat exchangers.

### OPERATION:

The main valve and pilot are normally closed. When the temperature at the thermostat bulb increases above its set point, the valve opens and flows cooling water to maintain temperature setting.



### ADVANTAGES:

- Self contained.
- Balanced construction for greater stability.
- Can be furnished with pressure limit pilot.
- Tight shut-off.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

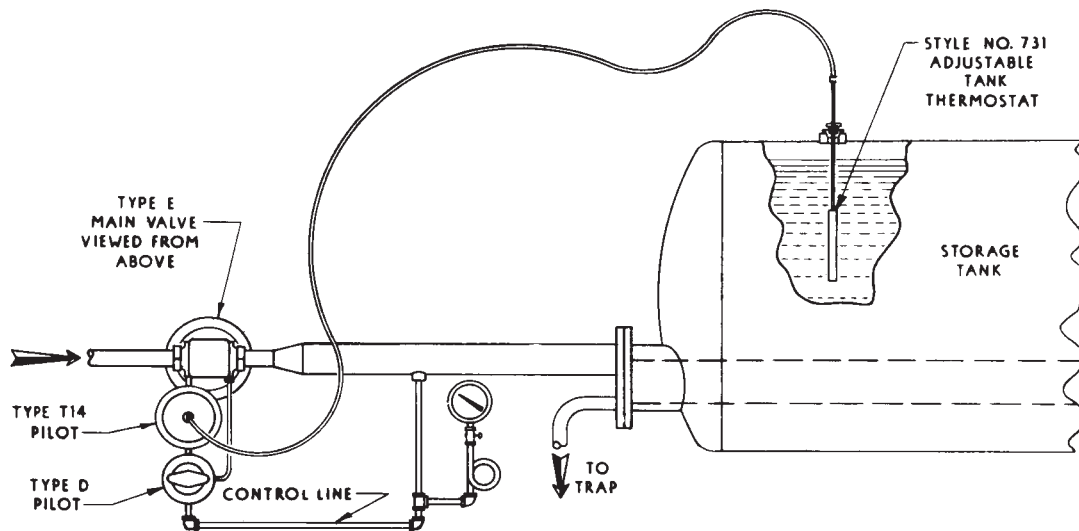
## SPENCE ET14D TEMPERATURE REGULATOR

### APPLICATION:

To control fuel oil temperature in a storage tank.

### OPERATION:

The T14 pilot opens and closes the main valve with slight variations in stored-oil temperature. The D pilot “takes over” to control coil pressure when the T14 pilot opens wide. The thermostat bulb can be raised or lowered by loosening the packing nut and sliding the bulb extension through the packing.



### ADVANTAGES:

- Permits top-insertion. Bulb can be removed even when tank is full.
- Permits adjusting bulb location for best efficiency, as tank level varies.
- Minimizes oil carbonation through pressure control.
- Combining pressure and temperature regulation in same valve reduces maintenance.
- Smaller high pressure line can be used for steam transmission to tank.





# Application Guide

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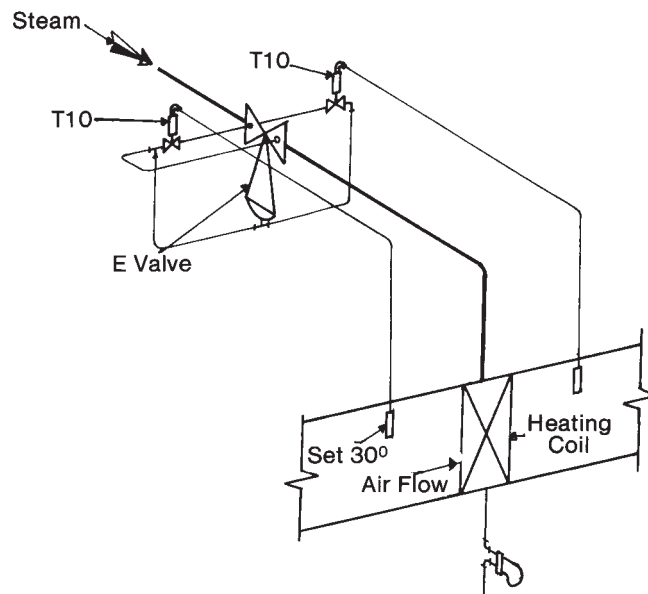
## SPENCE ET10T10 TEMPERATURE REGULATOR

### APPLICATION:

To provide temperature control of heating coils and prevent freeze-up, if outside temperature drops below freezing.

### OPERATION:

When outside temperature is above freezing, the pilot sensing that temperature is off and the valve is controlled by the pilot sensing inside temperature. If outside temperature drops below freezing, the pilot sensing outside temperature will open the valve regardless of inside temperature.



### ADVANTAGES:

- One pilot will over-ride other.
- Pilot operated accuracy.
- Self contained.



# Application Guide

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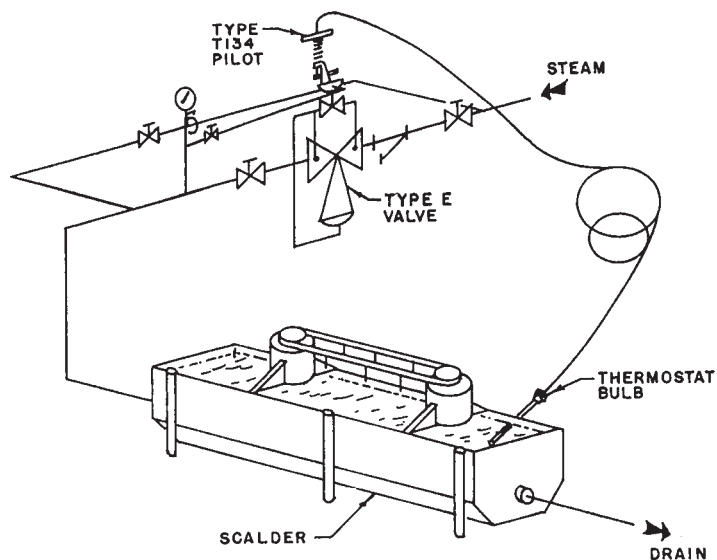
## POULTRY SCALDER SPENCE TYPE ET134 TEMPERATURE REGULATOR

### APPLICATION:

To provide self-contained pressure reduction, temperature and pressure control to a Poultry Scalding.

### OPERATION:

A Poultry Scalding is essentially an open tapped multi-nozzle steam injection heater custom fabricated to suit the customer's requirements. Steam flowing through the Type E Main Valve is controlled by the Type T134 Pilot. Steam pressure to the injection nozzles is modulated, within the pre-set range of the T134's pressure limit spring, in proportion to temperature, typically 140°F., and process variations.



### ADVANTAGES:

Self-contained, packless construction.

Provides pressure reduction, temperature and pressure control in a single unit.

Adaptable to existing scalders utilizing Pneumatic Temperature Controllers by substituting the appropriate Type T134 Pilot in place of the Type A Pilot.



# Application Guide

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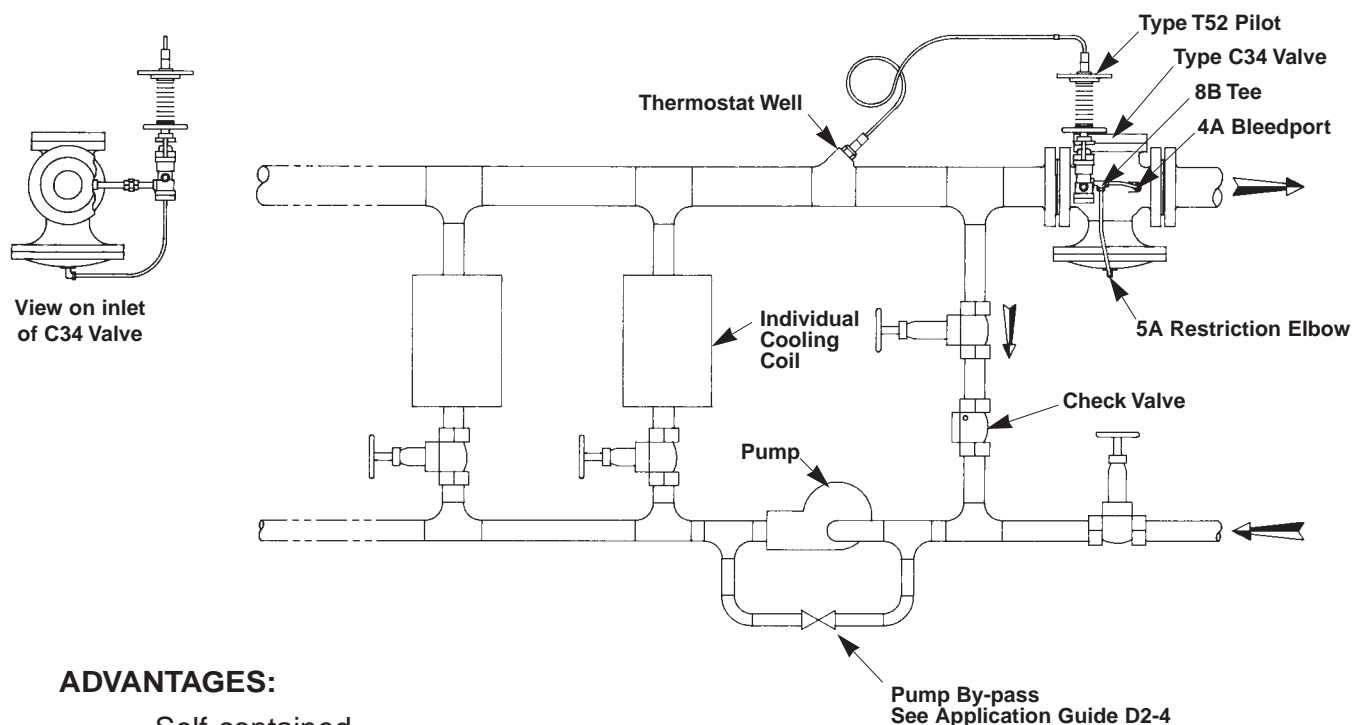
## SPENCE TYPE C34T52 TEMPERATURE REGULATOR FOR CHILLED WATER SYSTEM

### APPLICATION:

To provide self-contained temperature control of a chilled water system.

### OPERATION:

The Spence Type C34T52 Temperature Regulator controls the chilled water return by not allowing water to return to its source until the set point of the T52 pilot has been reached.



### ADVANTAGES:

- Self-contained.
- Tight shut-off.
- Pilot operated accurate temperature control.
- Economical, chilled water only returned when set point temperature is reached.
- System stability is maintained with variations in chilled water supply temperature.

### NOTES:

1. For large high-rise buildings, a desired head pressure may need to be maintained. To accomplish this, an appropriate F Series pilot may be added to the C34T52.
2. If the chilled water return must not exceed a desired pressure, an appropriate D pilot may be added to the C34T52.



# Application Guide

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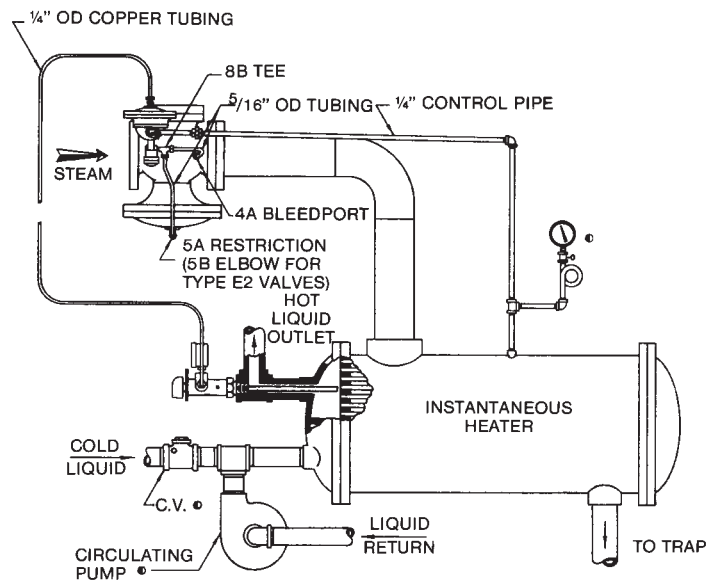
## SPENCE EAT61 AIR CONTROLLED TEMPERATURE REGULATOR

### APPLICATION:

To provide fast accurate control on instantaneous heaters and difficult process applications.

### OPERATION:

Temperature variations at thermostat bulb of T61 pilot changes its output air signal going to A series pilot. The changing air signal positions the A pilot and main valve to maintain temperature setting.



### ADVANTAGES:

T61 and A pilot combine for cascade type control.

Accurate sensitive bi-metallic thermostat.

Low air consumption.



# Application Guide

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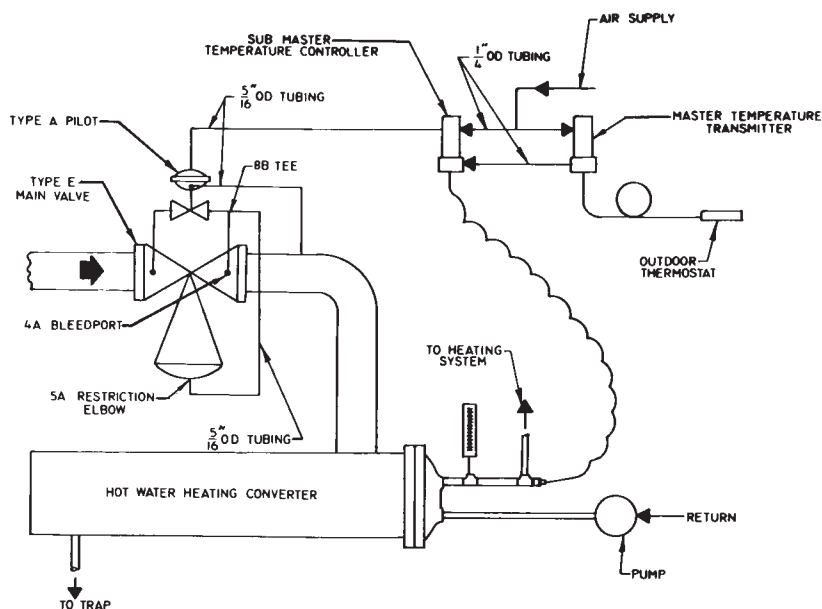
## SPENCE EA TEMPERATURE REGULATOR REMOTE THERMOSTAT CONTROL

### APPLICATION:

To provide indoor-outdoor temperature control of hot water temperatures in a heating system.

### OPERATION:

The remote bulb thermostat on the master controller provides a pneumatic feed-back based on outside air temperature. The pneumatic feed-back from the master controller raises or lowers the set point of the sub-master controller, which puts out a varying signal to the Spence EA regulator to maintain proper water temperature.



### ADVANTAGES:

- Accurate temperature control.
- Economical, water heated only when needed.
- Standard valve and pilot.



# Application Guide

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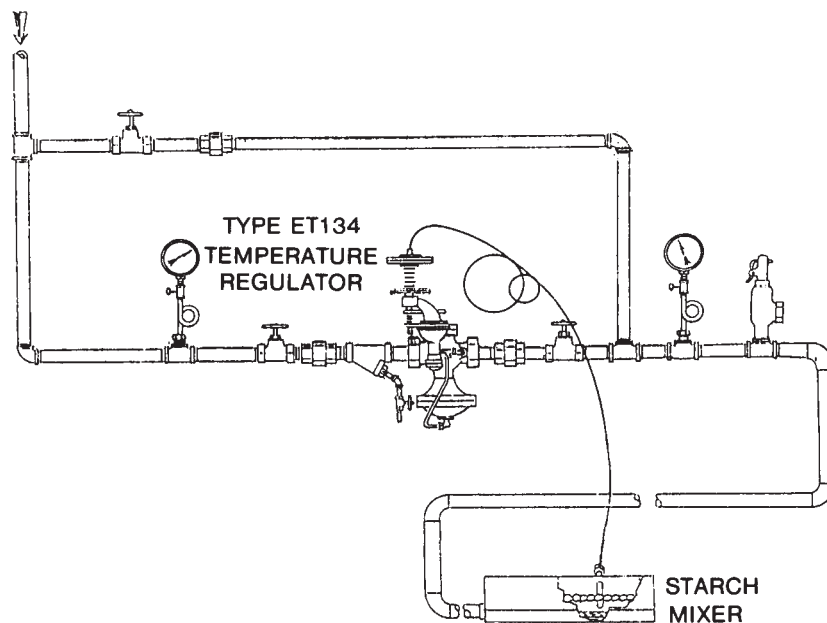
## SPENCE TYPE ET134 SELF-CONTAINED TEMPERATURE REGULATOR FOR STARCH MIXER

### APPLICATION:

To provide accurate temperature control with pressure limitation in a Starch Mixer for corrugated adhesive usage.

### OPERATION:

A Starch Mixer is essentially an open topped, agitated sparge tube storage heater, in which the adhesive is prepared before being placed in storage. The temperature probe of a Type T134 Temperature Pilot is placed in an active area of the Starch Mixer. Once activated, the ET134 flows steam to the heater until either the proper temperature or pressure limit is reached, then the ET134 closes, opens or throttles to maintain its preset temperature or pressure limit.



### ADVANTAGES:

- Self-contained packless construction.

- If electronic activation of a remotely located regulator is needed, a Type M Pilot can be added, making an EMT134

- No separate PRV needed



# Application Guide

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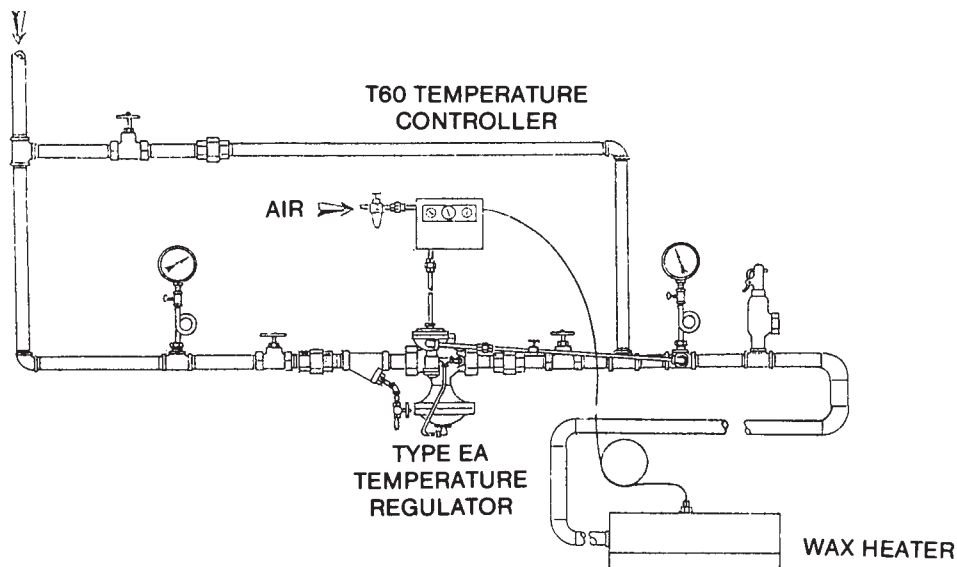
## SPENCE TYPE EAT60 TEMPERATURE REGULATOR FOR WAX APPLICATION CONTROL

### APPLICATION:

To provide fast accurate control of the wax temperature in order to assure the proper coating of the product.

### OPERATION:

The Spence Type EAT60 utilizes cascade control, whereby a pneumatic Temperature Controller, sensing wax temperature, is used to reset a pneumatically adjusted pressure regulator sensing the steam pressure in the heater. Any change in demand on the heater causes a change in the steam pressure in the heater, and the EA Pressure Regulator responds to it immediately, maintaining a given pressure in the heater. When a change in wax temperature is sensed by the T60 Temperature Controller, it resets the EA Pressure Regulator to a new pressure, thus maintaining a fixed wax temperature.



### ADVANTAGES:

- Fast accurate control of wax temperature
- Packless construction
- Pressure sensing anticipates load changes before thermostat sees temperature change (cascade control).
- No separate PRV needed.



# Application Guide

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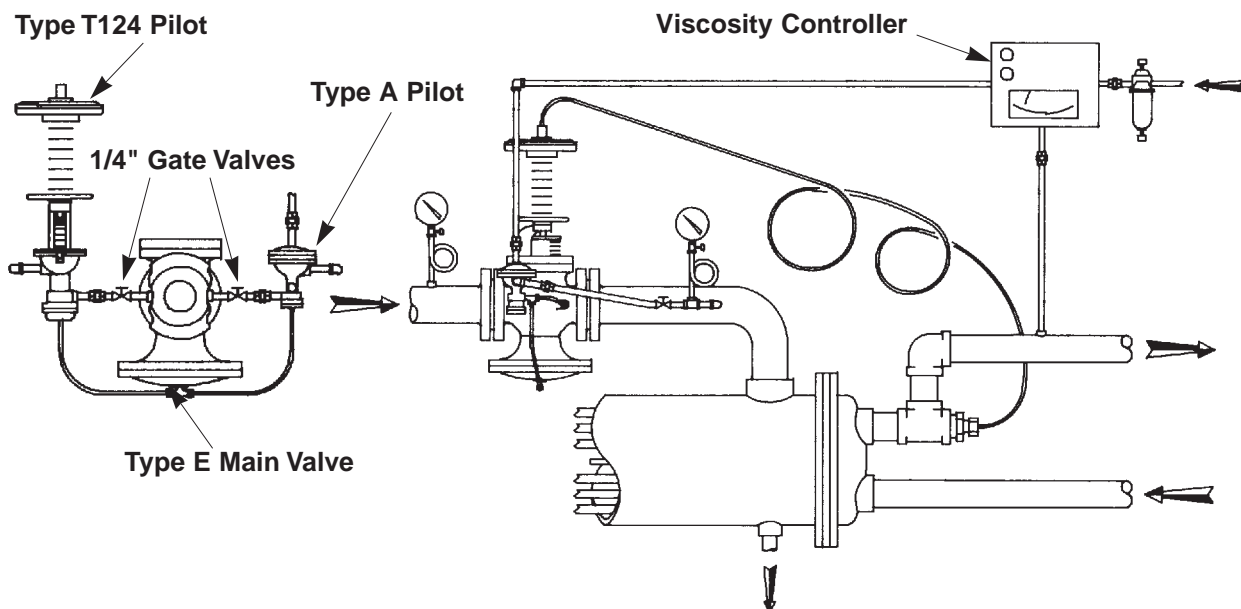
## SPENCE TYPE ET124A VISCOSITY/TEMPERATURE REGULATOR

### APPLICATION:

To provide increased economy by controlling the viscosity of the fuel oil to a burner unit while, at the same time, retaining conventional self-contained temperature regulation for emergency use in the event of pneumatic system failure.

### OPERATION:

In normal operation the 1/4" gate valve supplying the Type T124 Pilot is closed, the 1/4" gate valve supplying the Type A Pilot is open. The Norcross Viscosity Meter samples the viscosity of the fuel oil discharge of the fuel oil heater and adjusts the 3 to 15 psi air loading signal to the Type EA Regulator. The correct steam pressure and flow is supplied to the fuel oil heater to optimize fuel oil viscosity for burner unit efficiency. In the event of a pneumatic system failure, closing the 1/4" gate valve supplying the Type A Pilot and opening the 1/4" gate valve supplying the Type T124 Pilot provides conventional temperature control by a Type ET124 Temperature Regulator. (see Application Guide C1-2)



### ADVANTAGES:

- Increased fuel oil economy
- Self-contained Temperature Regulator available for stand-by service





# Application Guide

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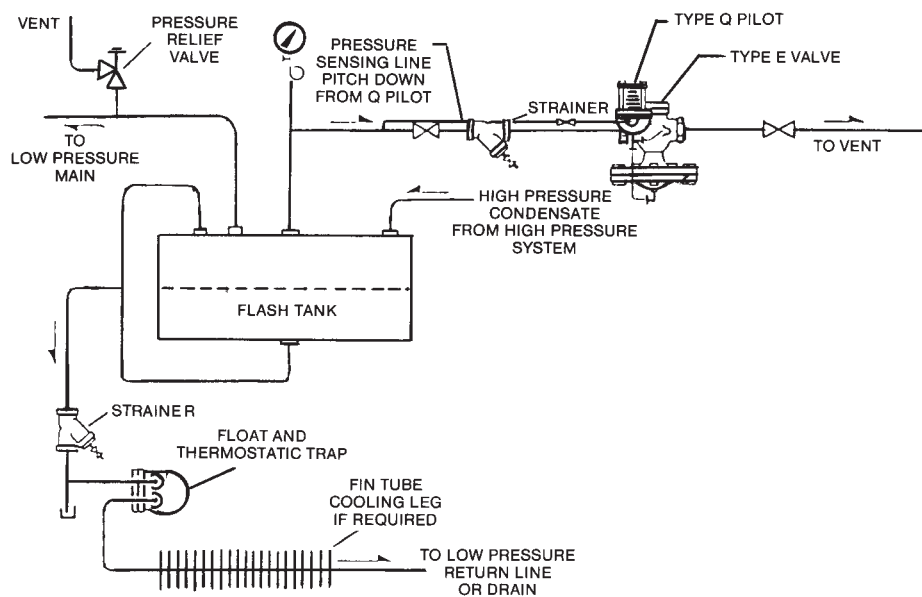
## SPENCE EQ BACK PRESSURE REGULATOR

### APPLICATION:

To maintain pressure in a flash tank so that steam can be used in low pressure main.

### OPERATION:

When steam pressure in the flash tank increases above the Q pilot setting, the E valve will open and vent the excess to maintain correct pressure.



### ADVANTAGES:

- Accurate control.
- Saves money by using flash steam.



# Application Guide

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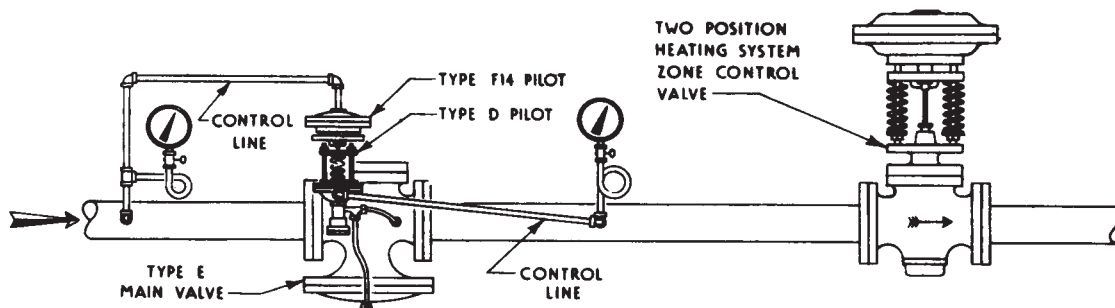
## SPENCE EF14D PRESSURE REDUCING VALVE WITH BACK PRESSURE CONTROL

### APPLICATION:

To retard flow of steam to a rate that can be handled by the boiler.

### OPERATION:

Frequently, large automatic on-off control valves, or inexperienced equipment operators, impose load pick-ups on a steam system that the boilers cannot follow. An F14 pilot added to the pressure regulator feeding such loads can be set to throttle, when the boiler pressure sags, as it does on such a quick load surge. Then, when the boiler has increased its steam rate, the F pilot will re-open and permit full load to be handled.



### ADVANTAGES:

- Only slight additional cost over pressure regulator alone.
- Operates on small differential - does not allow large drop in boiler pressure.
- Prevents "upsetting" boiler controls.
- All standard equipment.



# Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## SPENCE EQ BACK PRESSURE VALVE WITH FLOW CONTROL ORIFICE

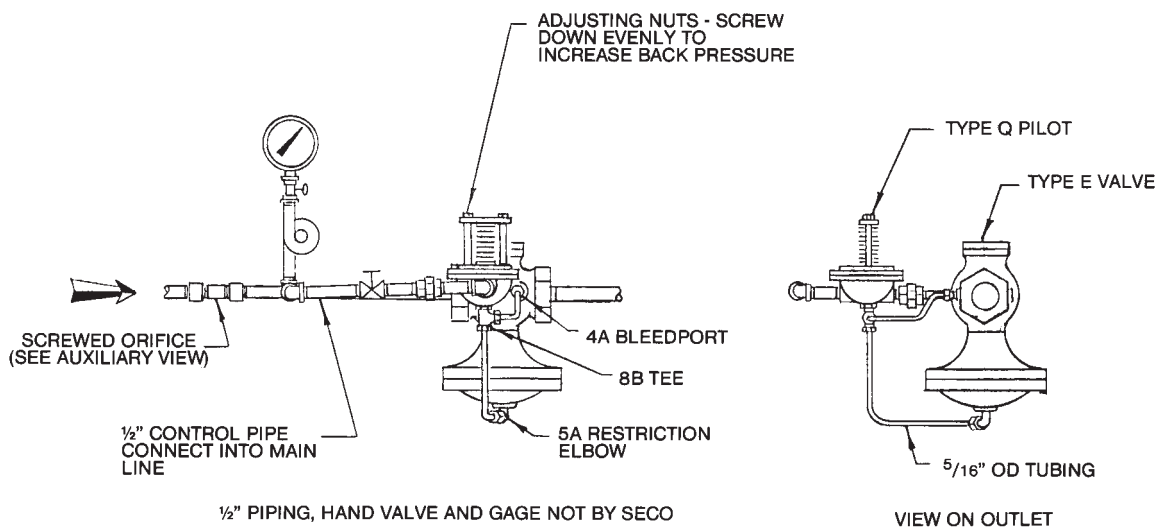
### APPLICATION:

To provide a valve that will limit flow and provide steam at a constant pressure.

### OPERATION:

An orifice is sized for a known flow at a given pressure drop and is fitted in the upstream piping of the Back Pressure Valve. The Q pilot is set for the pressure required at the outlet of the orifice. If the pressure at the outlet of the orifice drops, the valve will start to close to maintain the pressure and flow.

### ADVANTAGES:



Standard Spence Valves.  
Easily adjustable.



# Application Guide

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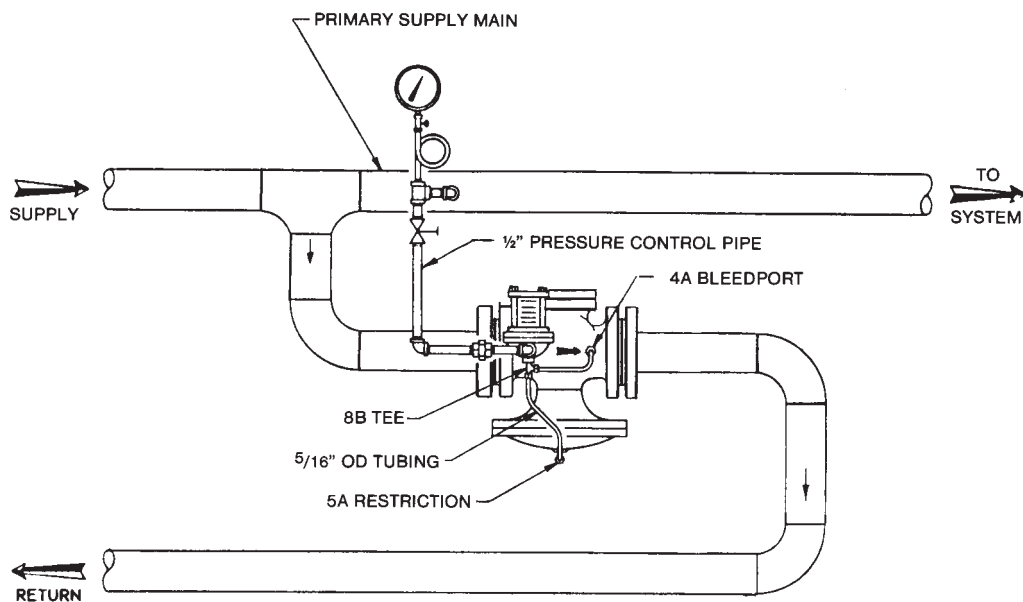
## SPENCE C34Q BACK PRESSURE PUMP BY-PASS CONTROL

### APPLICATION:

To maintain pump discharge pressure and insure constant circulation of water through pump.

### OPERATION:

The Q pilot is set to open when pump discharge pressure raises, due to decreased need for water in system. The C34 will discharge excess water to return line.



### ADVANTAGES:

- Self operated.
- Balanced construction.
- High capacity.



# Application Guide

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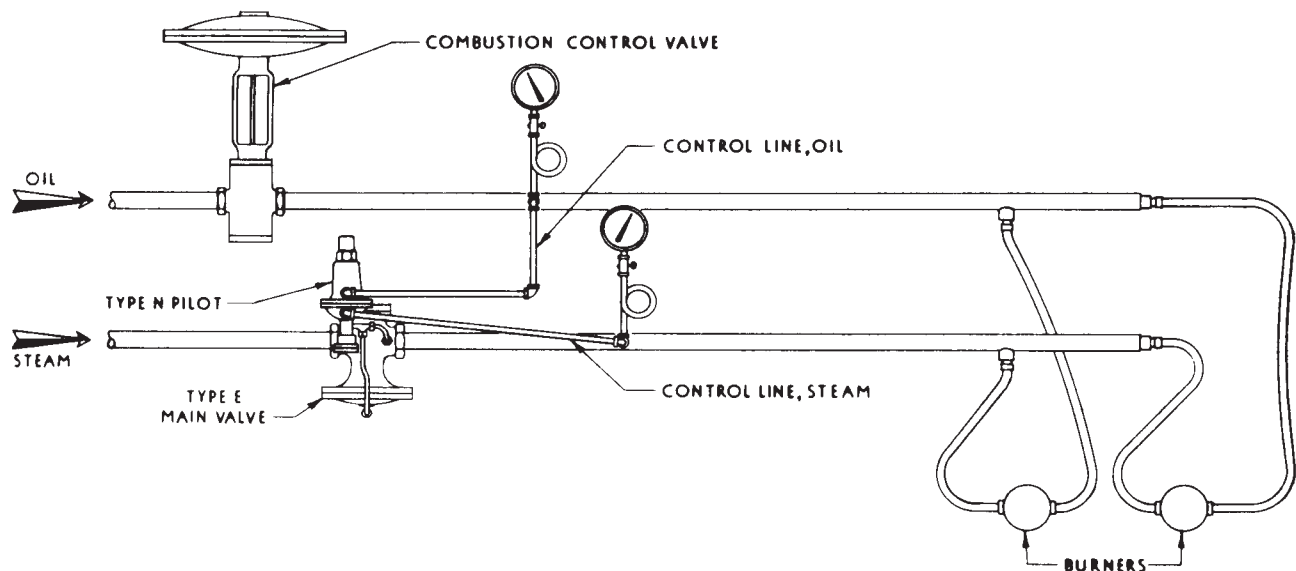
## SPENCE EN DIFFERENTIAL REGULATOR

### APPLICATION:

To regulate the atomizing steam pressure to an oil burner by pre-setting that amount higher than the oil pressure.

### OPERATION:

The steam pressure under the diaphragm of the Type N Pilot is balanced by the oil pressure and the adjusting spring on top. Once set, the adjusting spring force is constant. Therefore, as the combustion control valve raises the oil pressure, the regulator raises the steam pressure until the pilot diaphragm is again in balance.



### ADVANTAGES:

- Accurate pilot control.
- Valve can be balanced for greater rangeability.
- Self contained.



# Application Guide

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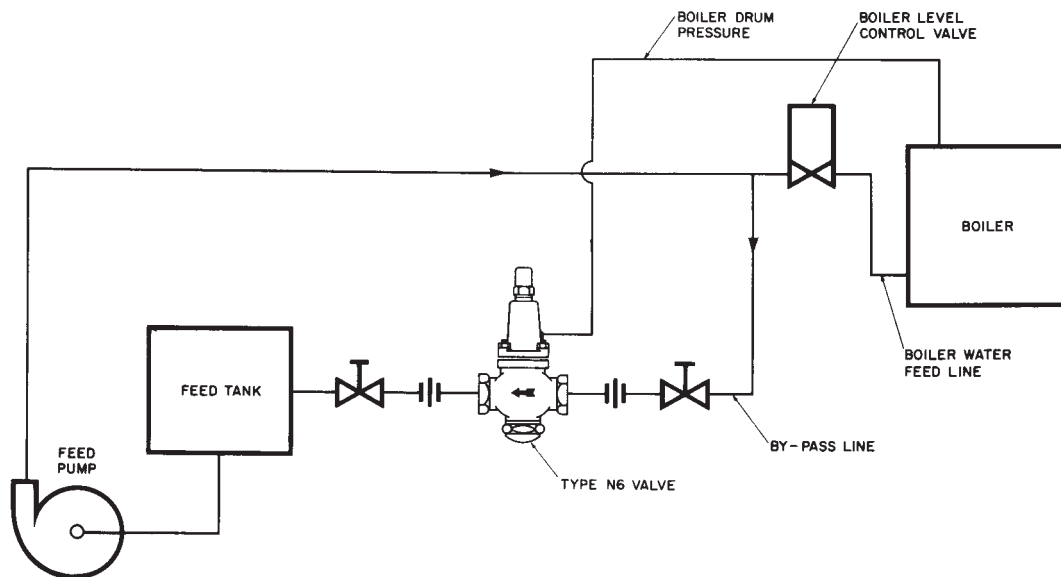
## SPENCE N6 DIFFERENTIAL PRESSURE VALVE

### APPLICATION:

To maintain pump discharge pressure at a constant differential above boiler steam pressure.

### OPERATION:

The desired differential is made by the adjusting spring. The boiler feed pressure will then be maintained by the N6 at a constant pressure above the steam drum pressure by modulating the quantity of water by-passed to pump suction.



### ADVANTAGES:

- Self contained.
- Easily adjustable.
- Stainless steel trim.



# Application Guide

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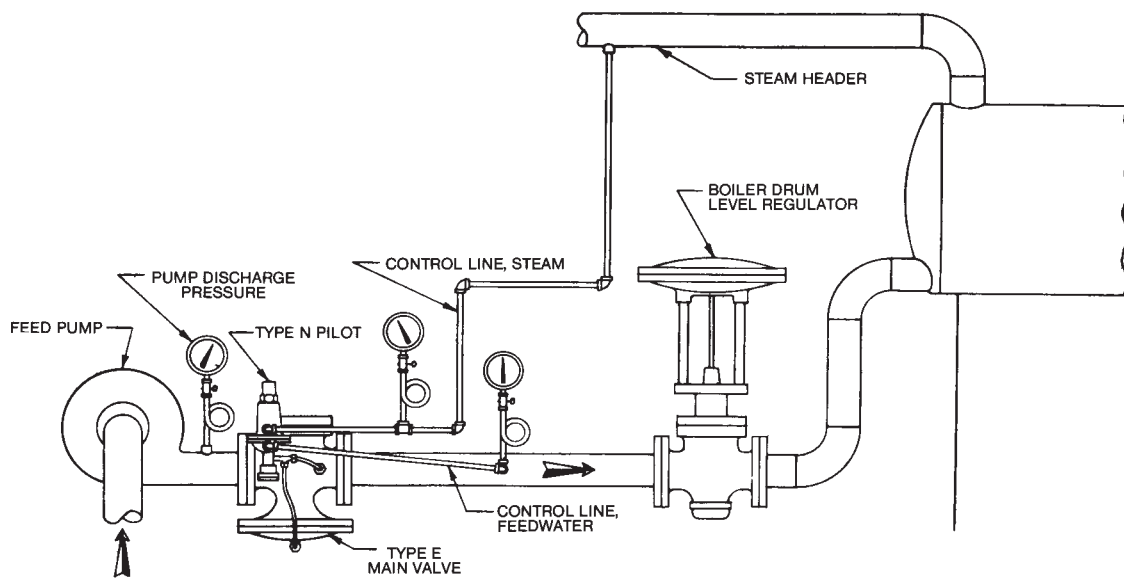
## SPENCE C34N DIFFERENTIAL PRESSURE REGULATOR

### APPLICATION:

To provide control of pressure drop across the boiler level regulator, when boiler is supplied by a motor driven centrifugal pump.

### OPERATION:

As the demand for feedwater decreases and the level regulator throttles, the C34N also throttles, offsetting the increased pump discharge pressure and maintaining the inlet pressure to the level regulator at a constant differential over the boiler pressure. For high temperature water over 200°F., use E main valve instead of C34.



### ADVANTAGES:

- Reduces maintenance on level regulator.
- Self operated.
- Accuracy of pilot operation.



# Application Guide

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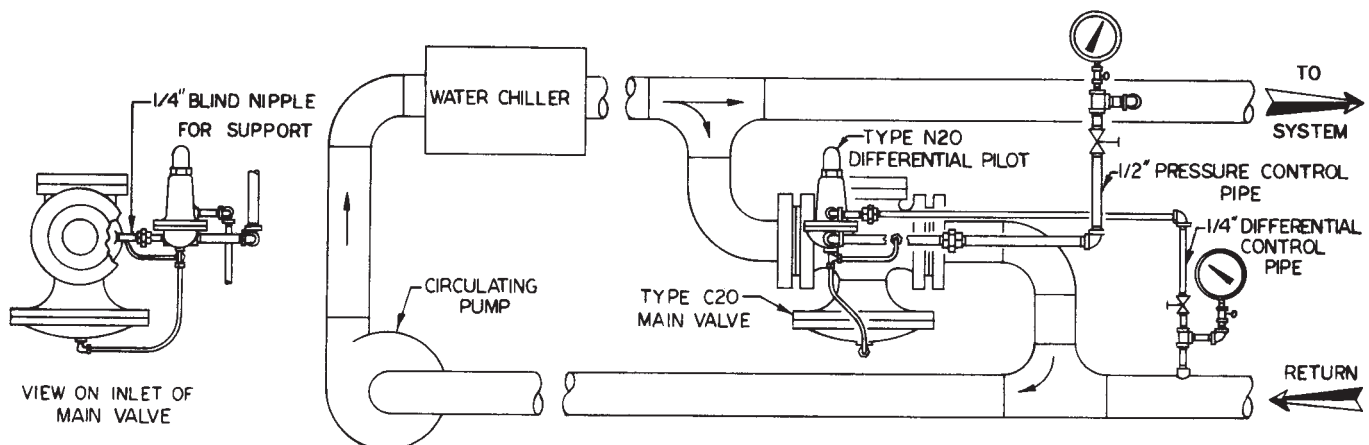
## SPENCE C20N20 DIFFERENTIAL REGULATOR

### APPLICATION:

To maintain a constant pressure differential across the terminal units of a chilled water system.

### OPERATION:

The differential pressure across the system is adjusted by increasing or decreasing the spring compression on the N20 pilot. This spring force, plus the return line pressure, is balanced by the supply line pressure. A change in flow through the terminal units will be compensated by the C20 valve, with the result that the pressure drop across the system will be held at a constant value.



### ADVANTAGES:

- Optimizes performance of terminal units and circulating pump.
- Prevents chiller freeze-up by maintaining continuous flow.
- Permits use of two-way rather than three-way valves at terminal units.
- Economical, self-contained unit.
- C34 or E valve may be used instead of C20.





# Application Guide

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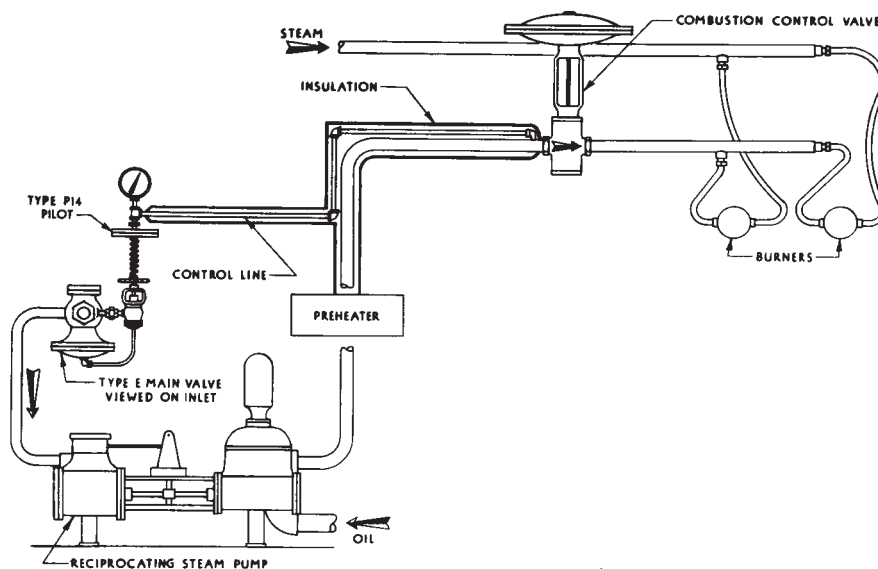
## SPENCE EP14 PUMP GOVERNOR

### APPLICATION:

To provide control of a steam pump discharge pressure feeding burners.

### OPERATION:

Increase or decrease in pump discharge pressure throttles or opens the pilot, which in turn operates the main valve. Controlling the steam going to the cylinder keeps a constant oil pressure ahead of the combustion control valve for optimum performance.



### ADVANTAGES:

Pilot operation give close control through wide load range.

Pressure control at combustion control permits best performance of it.

Pressure pilot (Type D) can be added to make a Type EP14D regulator that puts a positive limit on chest pressure.



# Application Guide

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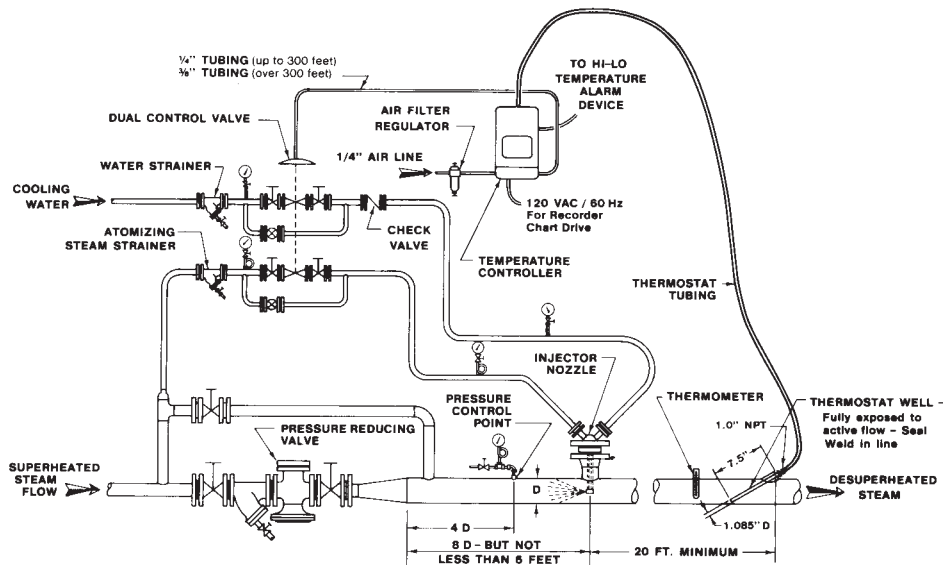
## SPENCE STEAM ATOMIZING AIR OPERATED DESUPERHEATER

### APPLICATION:

Spence steam atomizing desuperheaters are designed to reduce and control the temperatures of superheated steam by the controlled injection of a cooling water mist.

### OPERATION:

Water and steam are injected into a superheated steam line through the injector nozzle. The nozzle is designed to break the water into a fine mist to be easily absorbed by the oncoming steam. The flow through the nozzle is controlled by the dual control valve, and a pneumatic temperature controller.



### ADVANTAGES:

- Unique Dual Control Valve.
- Complete package by Spence.
- Spence Pressure Reducing Valve available.
- Many sizes available.



# Application Guide

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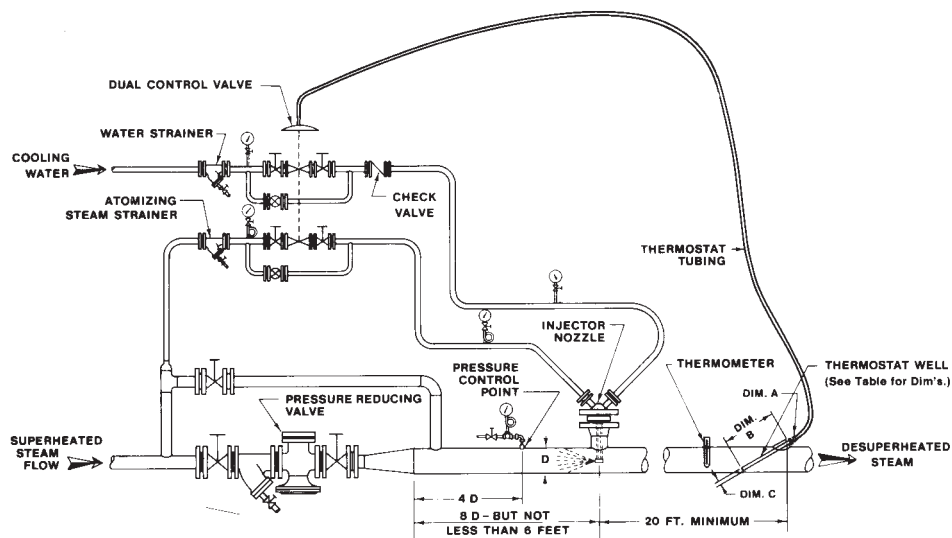
## SPENCE STEAM ATOMIZING DIRECT OPERATED DESUPERHEATER

### APPLICATION:

Spence steam atomizing desuperheaters are designed to reduce and control the temperature of superheated steam by the controlled injection of a cooling water spray.

### OPERATION:

Water and steam are injected into a superheated steam line through the injector nozzle. The nozzle is designed to break the water into a fine mist to be easily absorbed by the oncoming steam. The flow through the nozzle is controlled by the dual control valve, and a vapor tension type thermostat.



### ADVANTAGES:

- Unique Dual Control Valve.
- Self contained - no air or electricity needed.
- Complete package by Spence.
- Many sizes available.



# Application Guide

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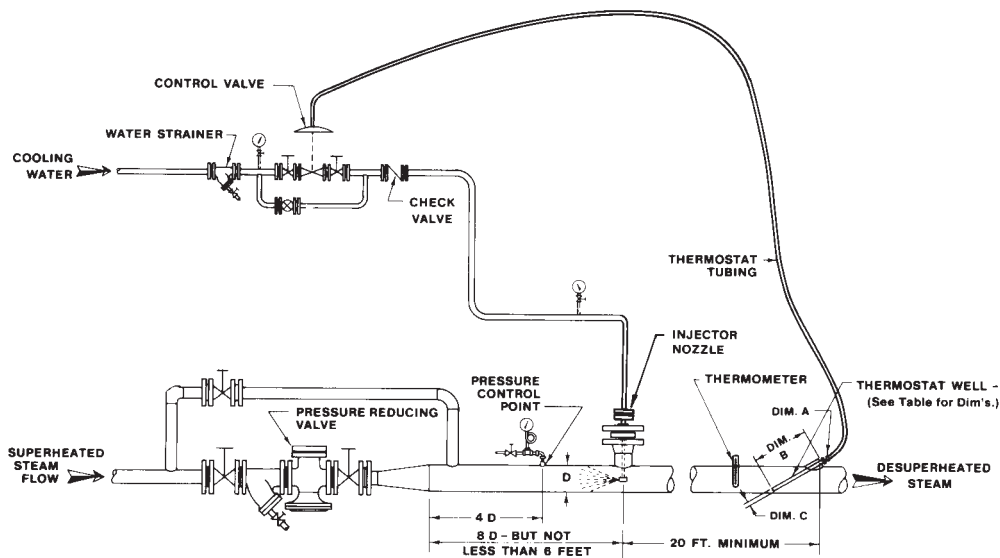
## SPENCE MECHANICAL ATOMIZING DIRECT OPERATED DESUPERHEATER

### APPLICATION:

Spence mechanical atomizing desuperheaters are designed to reduce and control the temperature of superheated steam by the controlled injection of a finely dispersed spray of cooling water.

### OPERATION:

Water is injected into a superheated steam line through the injector nozzle. The nozzle is designed to break the water into a fine mist to be easily absorbed by the oncoming steam. The flow through the nozzle is controlled by the water control valve, and a vapor tension type thermostat.



THERMOSTAT WELL DIMENSIONS

DIM.	728 WELL (700 T-STAT)	729 WELL (701 T-STAT)
A	1"	1 1/4"
B	21 1/8"	17 3/4"
C	3/4"	1 1/8"

### ADVANTAGES:

- Self contained.
- Ease of operation.
- Complete package by Spence.



# Application Guide

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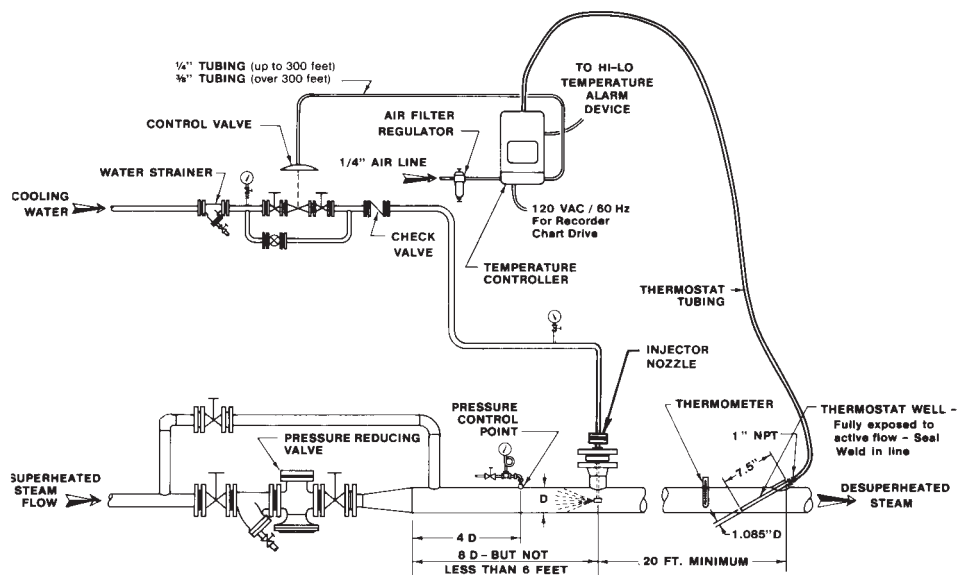
## SPENCE MECHANICAL ATOMIZING AIR OPERATED DESUPERHEATER

### APPLICATION:

Spence mechanical atomizing desuperheaters are designed to reduce and control the temperature of superheated steam by the controlled injection of a finely dispersed spray of cooling water.

### OPERATION:

Water is injected into a superheated steam line through the injector nozzle. The nozzle is designed to break the water into a fine mist to be easily absorbed by the oncoming steam. The flow through the nozzle is controlled by the dual control valve, and a pneumatic temperature controller.



### ADVANTAGES:

- Complete package by Spence.
- Spence Pressure Reducing Valve available.
- Many sizes available.



# Application Guide

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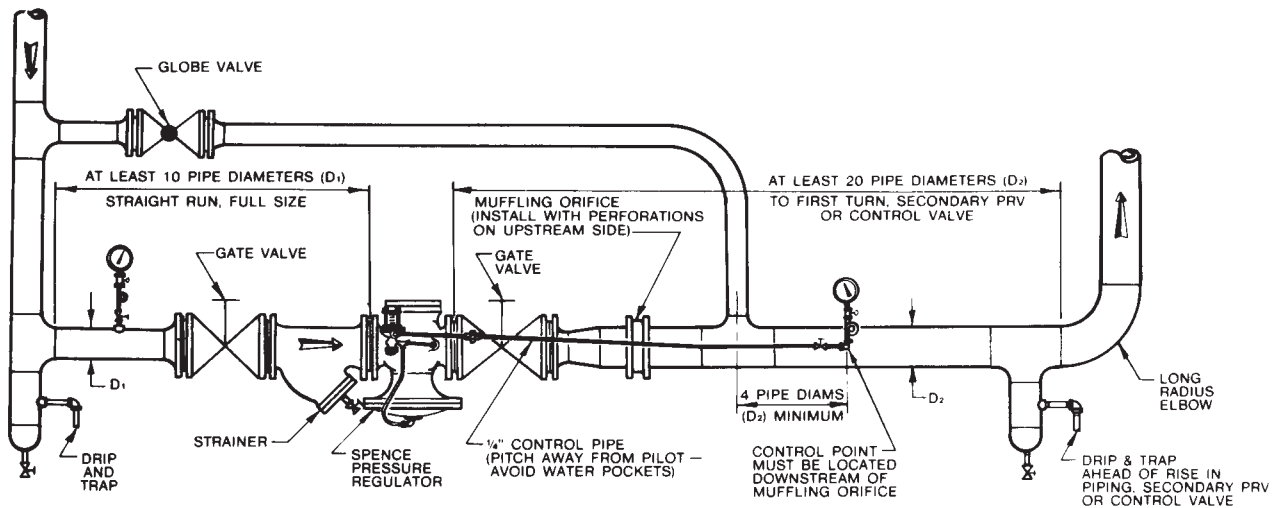
## SPENCE PRESSURE REGULATOR WITH MUFFLING ORIFICE

### APPLICATION:

The Spence muffling orifice reduces the generation of pressure regulator noise at its source. It provides an economical means of attenuating high flow PRV noises by 6 - 20 dba.

### OPERATION:

The muffling orifice consists of a steel plate with primary orifices, to which is welded a stainless steel plate with secondary orifices. The plate is installed in the expanded downstream piping, and creates the desired back pressure on the PRV for maximum attenuation.



### ADVANTAGES:

- Inexpensive.
- Maintenance free.
- Capacity of valve not reduced.
- Ease of installation.



# Application Guide

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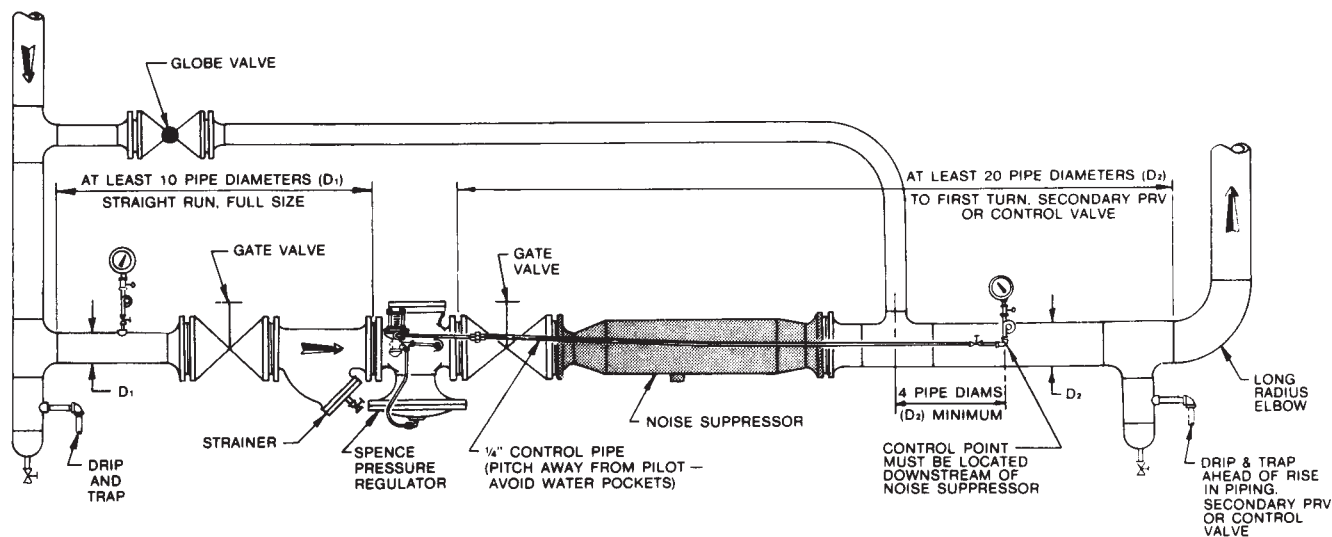
## SPENCE PRESSURE REGULATOR WITH NOISE SUPPRESSOR

### APPLICATION:

The Spence Noise Suppressor is designed to attenuate the noise generated by a pressure reducing station. These devices are particularly effective in limiting the propagation of valve-generated noise into the downstream piping. Being of the dissipative reactive type, they are effective over a broad frequency band (up to 12,000 Hz). Depending upon flow and piping configuration, noise attenuation of up to 20 decibels is obtainable.

### OPERATION:

Installed at the reducing valve outlet, the required pipeline expansion takes place within the noise suppressor. This expanded outlet feature eliminates the expense and noise often associated with separate expansion fittings. A reflector assembly improves performance by increasing the interaction of flow and acoustic material. The straight through design minimizes pressure drop, permitting normal valve sizing.



### ADVANTAGES:

- Maintenance free.
- Standard Spence valves used.
- Capacity of valve not reduced.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

## **SPENCE TYPE SFT FREE FLOAT STEAM TRAP for FAST START-UP in CORRUGATION PLANTS**

**APPLICATION:** Hot Plates and Cylinder Dryers

**PLANTS:** Corrugator Plants

**EXAMPLES:** Green Bay Packaging  
Menasha Corporation  
Packaging Corporation of America  
Georgia Pacific  
International Paper

### **PROBLEM:**

The existing systems were always designed to eliminate the problems with a standard inverted bucket steam trap. This is due to the on/off operation of inverted bucket and the inability for an inverted bucket to vent air fast for start-up purposes. The plants will typically group-trap the cylinders and hot plates and this will cause temperature fluctuation and production problems.

### **SOLUTION:** Free Float Trap

Use a free-flow design steam trap which gives them the ability to vent air for a fast start-up. Also, the continuous flow operation allows for even temperature on the hot plate and cylinder dryer. The cylinder dryer will have a siphoning joint on the unit and a continuous flow design steam trap will always ensure condensate being evacuated from the cylinder

In some cases, our preference is to discharge the steam trap into a high back-pressured condensate return system and return this condensate directly back to the de-aerator, thus capturing all the flash steam and energy.

Acknowledgement and thanks are credited to Kelly Equipment Inc., Wisconsin.





# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## **SPENCE TYPE SFT FREE FLOAT STEAM TRAP to PREVENT FREEZING in STEAM COILS**

### **APPLICATION:**

Steam Coils are used for process heating and HVAC purposes in industrial and commercial plants, universities, hospitals, etc.

### **PROBLEM:**

The maintenance staff usually have a lot of problems with steam coils freezing during winter operation. This is caused by steam traps being the wrong design and also sizing problems. Steam Coils will have a modulating control valve on the inlet of the coil to modulate the steam flow to the coil, depending on outlet temperature. When there is just a small requirement for heating and the outside air temperature is between 28 and 38 degrees Fahrenheit, which is cold enough, if condensate backs up in the coil it will freeze the coil. The steam trap should be sized for a very low differential at the full condensate load rate. Also, there is a need to review the condensate return system to ensure there is no unnecessary back pressure on the steam traps.

### **SOLUTION:** Free Float Steam Trap

The free float design steam trap is continuous flow, which is the best operational design for steam coil applications. The steam trap can operate at a half or one PSI differential and remove the condensate without any problem. If the steam coils are properly piped, trapped, there should not be any problem with coils freezing. Typically when you approach a customer, do not ask them if they have any problems with steam coils but how many steam coils did they freeze the previous year in operation. Now you have the solution.

Acknowledgement and thanks are credited to Kelly Equipment Inc., Wisconsin.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## **SPENCE TYPE SFT FREE FLOAT STEAM TRAP to PREVENT FREEZING of OUTSIDE AIR HEATING COILS**

### **APPLICATION:**

Air pre-heat coils must be constantly drained or they will freeze. If flow stops, the bottom of the coil will freeze, even when there is steam in the top of the coil. Maintenance people become expert at cutting and soldering split tubes. If traps are failed open or a throttled, open, by-pass valve is used, freezing will not occur, but this results in considerable steam loss. The solution is to use a continuous discharge type trap (Variable orifice free float trap).

### **SELECTION:**

The trap must be sized for a high load at a low pressure differential. This is because the coils use modulating control valves which reduce the pressure from time to time, even though air temperature is below freezing. A coil of 2 feet by 6 feet (a very common size) will require a SFT 252 with a #20 or #100 orifice, depending on the maximum inlet pressure.

### **INSTALLATION:**

Piping must gravity drain the trap. A 1-1/2" pipe is recommended. High back pressure in the condensate return cannot be tolerated. In some cases, discharge to a vented receiver is required. A vacuum breaker on the coil is recommended, particularly on low steam pressure (15 psig).

### **ADVANTAGES:**

True continuous condensate discharge of the SFT trap provides flow through the coil at all times. No minimum operating pressure. Condensate drainage continues as long as any differential exists, no matter how small.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## SPENCE TYPE SFT FREE FLOAT STEAM TRAP

### APPLICATION: REBOILERS

The most common process heat exchanger is a shell and tube vessel. Heat exchange occurs through the tube surface with the product in the tubes or in the shell surrounding the tubes. The steam, of course, is in the opposite space. In chemical plants or refineries, many shell and tube heat exchangers are referred to as Reboilers. The steam is normally in the shell side, with the product being heated in the tubes. The product is a petroleum base or other chemical that can be subject to damage from overheating (known as charring). In order to maintain the highest efficiency, it is necessary to control the temperature as close to this char temperature as possible. If the heat exchange surface contacting the product reaches the char temperature, charring occurs. This creates a hot spot that accelerates charring, necessitating a cleaning (Hydro-blast) of the tubes. These reboilers are furnished in pairs, so that one will be operating when the other is being cleaned (a lengthy and expensive operation).

### SELECTION:

The trap for a reboiler must be sized. However, it is relatively simple, as reboilers are usually fully instrumented and the customer can tell you the exact load and pressure. In 75% of the applications, the capacity required will be in the range of the SFT 253. If the reboiler does not have a steam flow meter, revert to the drawing (always available) for design criteria.

### ADVANTAGES OF THE SFT FREE FLOAT TRAP:

The continuous low velocity discharge of condensate allows for extremely good temperature control.

The trap reacts immediately to control valve changes.

There is never a high velocity impingement of steam on the tubes. This does occur with cycling traps that have static periods followed by high velocity flow. The impingement on tubes increases heat transfer in a small area creating a hot spot and charring occurs.

Even flow, due to continuous discharge of condensate, prevents charring.

The simple construction provides long, maintenance-free life as opposed to traps with hinges, pins, levers and fasteners.



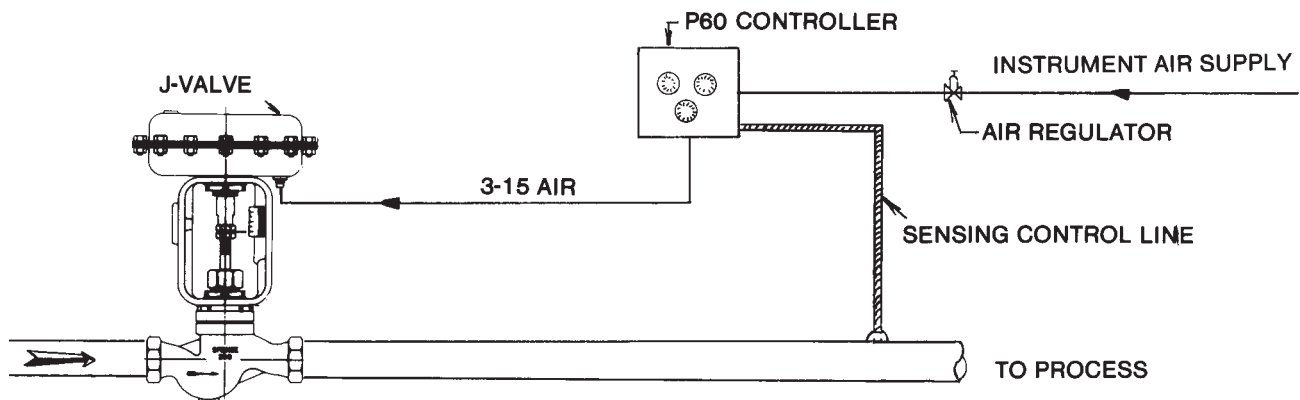
# Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

## SPENCE J CONTROL VALVE AND P60 PRESSURE CONTROLLER

### APPLICATION:

To provide accurate regulation to a process requiring fast load changes and varying outlet pressures.



### SELECT VALVE:

Flow .....1200-2100#/hr.  
Inlet.....100 psig Saturated Steam  
Delivery .....20 psig  
Fail closed, air to open

**See Page 8, Bulletin No. 3501.**

a 1" J Valve with a 7/8" port will flow 2275#/hr.

**See Page 17, Bulletin No. 3501.**

A 7/8" port at 100 psig will require an Actuator A 36-in<sup>2</sup> and 3-15 air signal.



# Application Guide

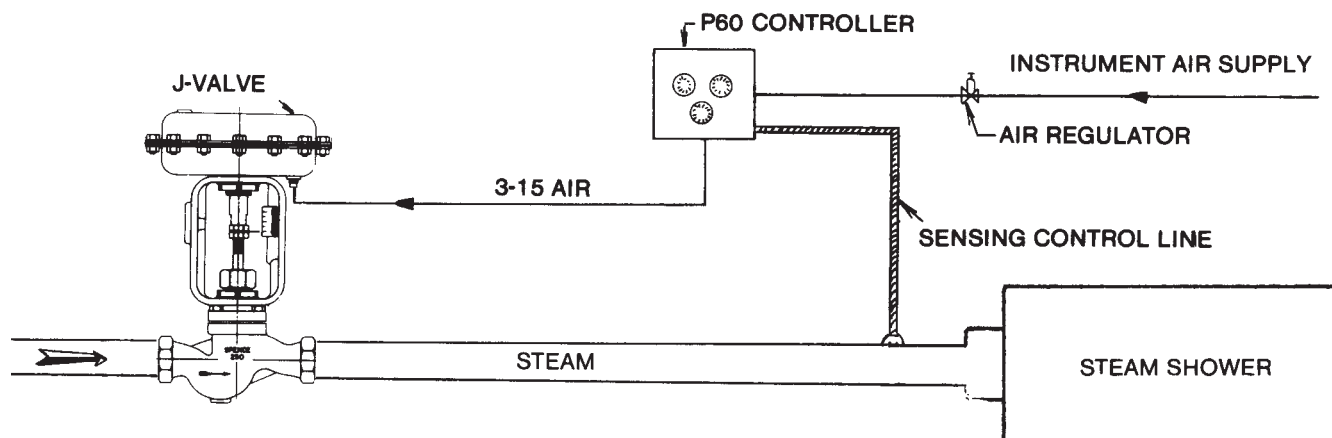
SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## SPENCE J CONTROL VALVES AND P60 PRESSURE CONTROLLER

**INDUSTRY:** Paper

**APPLICATION:**

Providing accurate pressure regulation to steam showers to hasten paper drying process.



**SELECT VALVE:**

Flow .....830 #/hr.  
Inlet .....75 psig Saturated Steam  
Delivery .....10 psig

**See Page 8, Bulletin No. 3501.**

a 1" J Valve with a 5/8" port will flow 920 #/hr.

**See Page 17, Bulletin No. 3501.**

A 5/8" port at 75 psig will require an Actuator A 36-in<sup>2</sup> and 3-15 air signal.

Compliments of Crane Paper Co.



# Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## SPENCE J CONTROL VALVES AND LIQUID LEVEL CONTROLLER

### APPLICATION:

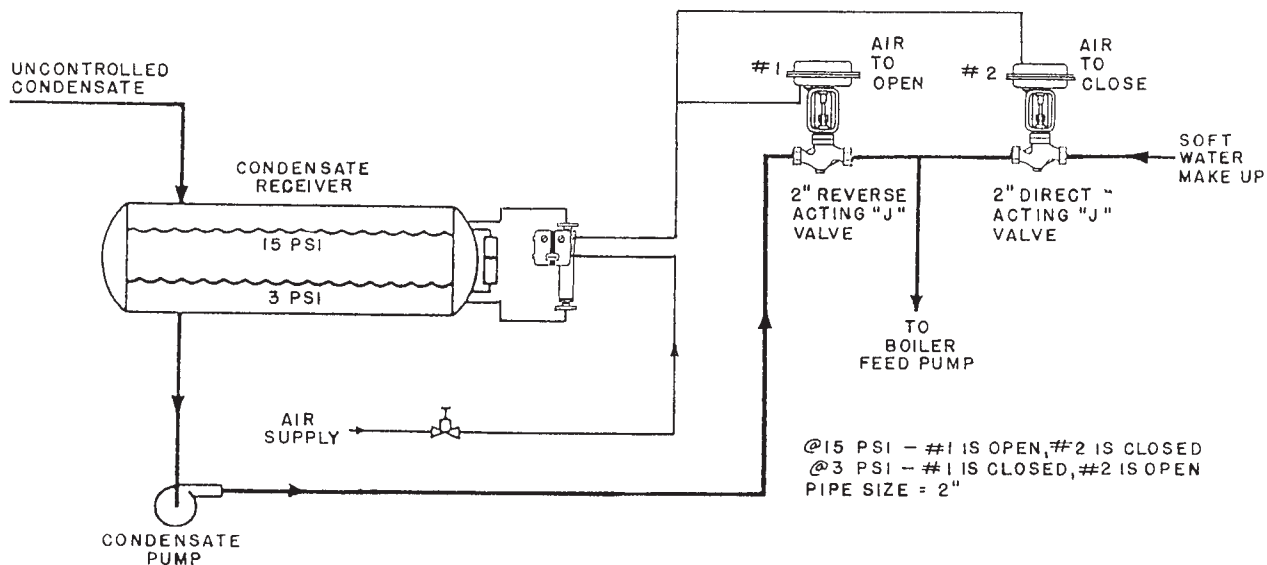
To provide water to a boiler at all times, even if water in condensate tank falls too low.

### OPERATION:

As the level in the condensate receiver increases, an output signal from the pilot controller causes the number one J control valve to open and the number two control valve (make-up) to close.

As the level continues to increase, valve number one fully opens, admitting water from the condensate receiver to the boiler feed pump, valve two simultaneously closes, cutting off the soft water make-up supply.

Should the level in the condensate receiver decrease, reverse action of the above occurs and, at low level, all water to the boiler feed pump is obtained from the soft water make-up supply.





# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

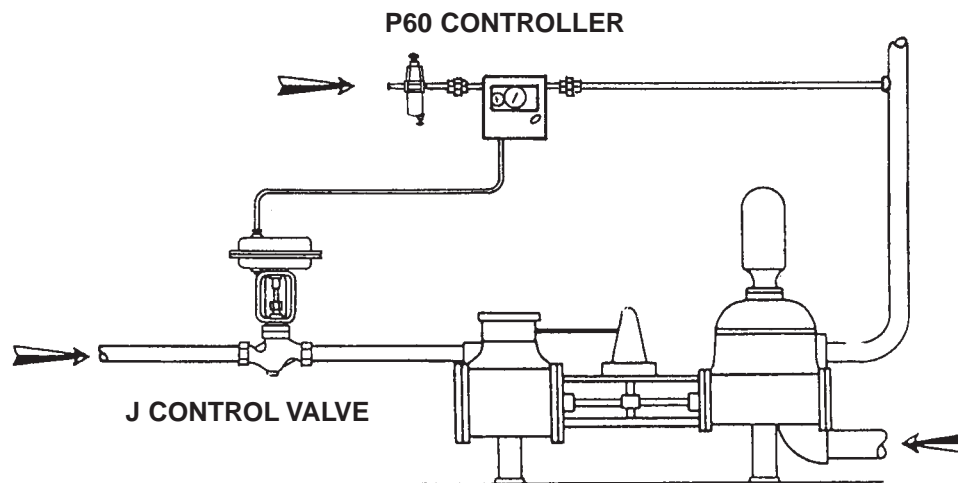
## SPENCE JP60 PUMP GOVERNOR

### APPLICATION:

To provide control of the pump discharge pressure of a steam driven pump.

### OPERATION:

The Type P60 Controller monitors the pump discharge pressure, while the J Control Valve controls the steam supply to turbine or piston engine driving the pump. As the pump's discharge pressure fluctuates with demand, the P60 sends a corrective signal to the control valve. The J Valve responds by supplying either more or less steam to the turbine or piston engine, as necessary to maintain the desired pump discharge pressure.



### ADVANTAGES:

Precise control of pump discharge pressure.

The standard modified equal percent plug contour provides superior throttling action.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

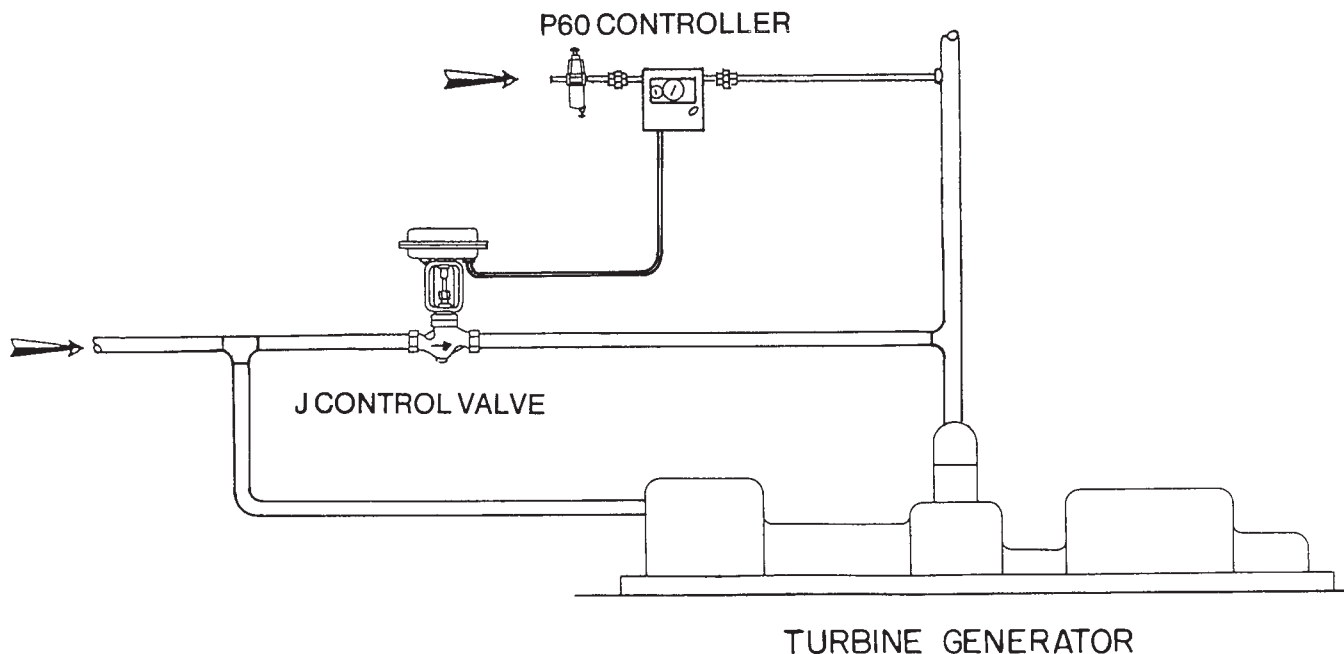
## SPENCE TYPE J CONTROL VALVE WITH P60 CONTROLLER TURBINE EXHAUST MAKE-UP VALVE

### APPLICATION:

To provide additional (make-up) steam to a generating turbine's exhaust in order to maintain a minimum exhaust pressure and flow for secondary usage.

### OPERATION:

When the generating load on the turbine is insufficient to maintain the desired pressure and flow for the secondary steam demand, the P60 controller senses the sagging turbine exhaust pressure and signals the Type J Control Valve to open the by-pass line to the extent necessary to maintain the desired operating conditions.



P = 140 psig

P<sup>1</sup> = 17 psig

W<sup>2</sup> = 8000 lbs/hr

2" J Valve, 1 3/4" Port

0-30 psig P60

For Pilot-operated equivalent, see Application Guide No. A1-4





# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

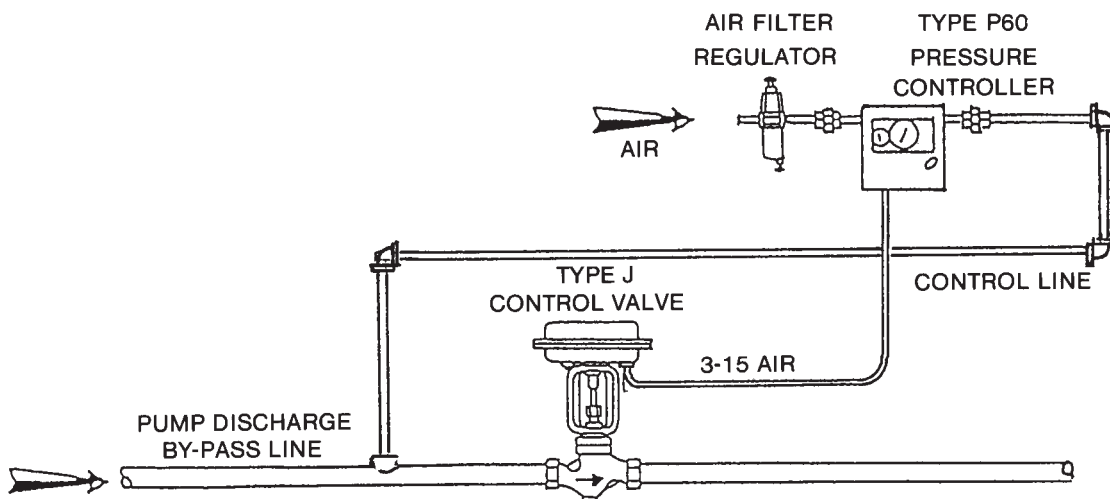
## SPENCE TYPE J CONTROL VALVE AND P60 BACK PRESSURE CONTROLLER

### APPLICATION:

To provide accurate regulation of pump discharge pressure. Excess pressure is by-passed to return line.

### OPERATION:

When used on a glycol system, the P60 controller is set to open the J valve at a pressure less than the safety valve setting. If system pressure increases to setting of control valve, it opens and discharges to the return line and liquid is not lost through safety valve.



Courtesy of: Martin Engineering Co., Boston, MA



# Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

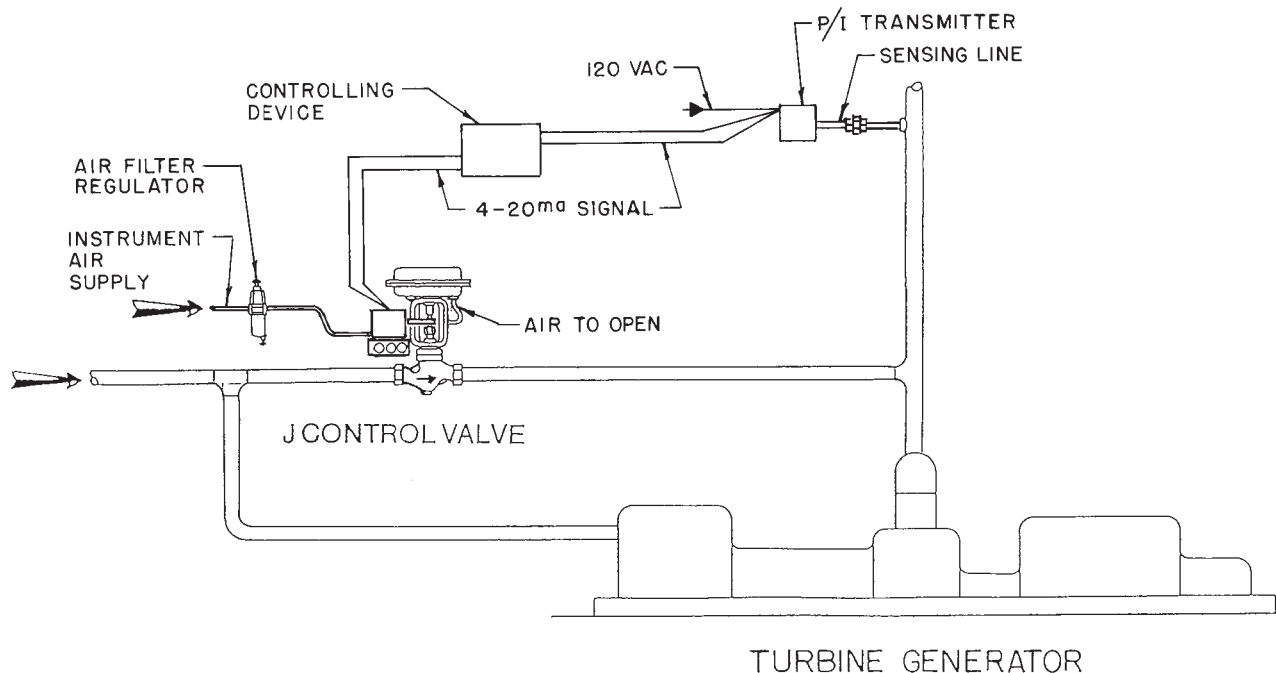
## SPENCE TYPE J CONTROL VALVE WITH ELECTRO-PNEUMATIC POSITIONER COMPUTERIZED COGENERATION CONTROL

### APPLICATION:

To interface either a computerized cogeneration control, or electronic controller, to a turbine exhaust make-up valve in order to control the generating turbine's exhaust pressure and flow for secondary steam usage.

### OPERATION:

A pre-programmed computer, or electronic controller receiving a 4-20 MA signal from a P/I Transmitter, is used as the controlling device for a Type J Control Valve with an electro-pneumatic positioner opening the by-pass line to the extent necessary to maintain the desired operating conditions.



P = 140 psig

P<sup>1</sup> = 17 psig

W<sup>2</sup> = 8000 lbs/hr

2" J Valve, 1 3/4" Port



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

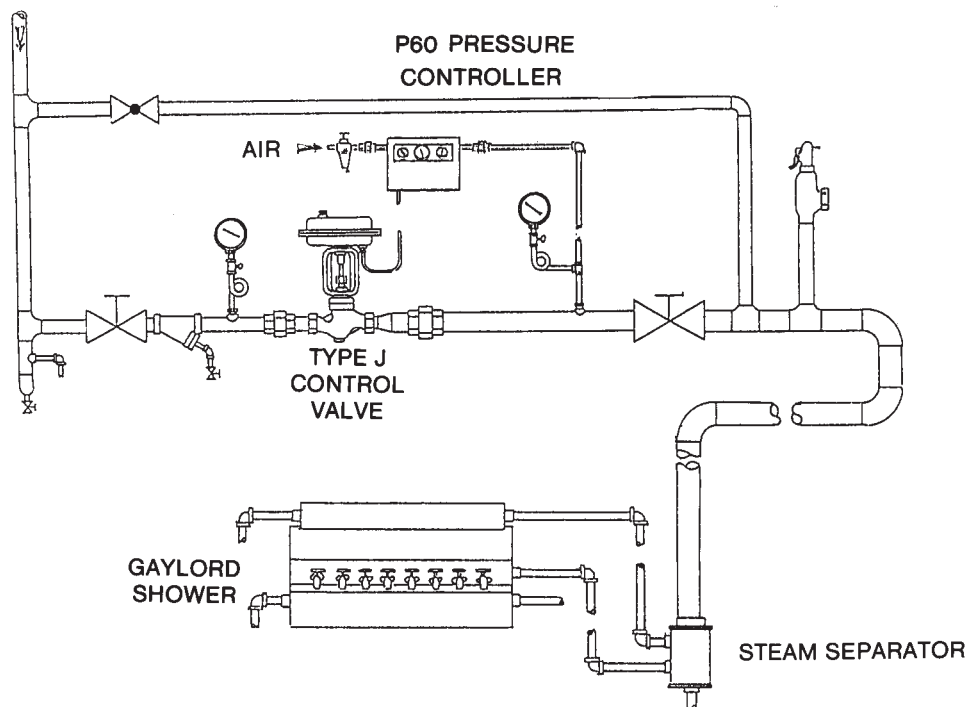
## SPENCE TYPE J CONTROL VALVE WITH TYPE P60 CONTROLLER FOR GAYLORD SHOWER CONTROL

### APPLICATION:

To improve paper conditioning and reduce steam consumption by utilizing reduced pressure saturated steam instead of high pressure dry steam at the Gaylord Shower.

### OPERATION:

A Spence Type J Control Valve with positioner and Type P60 Pressure Controller are installed in the steam supply line to the Gaylord Shower and Steamer Pipe (if used) to reduce the steam pressure used. When high pressure saturated steam is reduced in a single step to 0 psi, the quality of the steam may be so enhanced as to introduce a certain degree of superheat. In comparison to low pressure saturated steam, low pressure superheated steam is a rather inefficient transmitter of heat and moisture to the paper.



### ADVANTAGES:

- Improved control of paper conditioning.
- Reduced steam consumption.
- Repeatable, remote adjustment control.
- Precise control of low flows.
- Compact size permits easy installation.



# Application Guide

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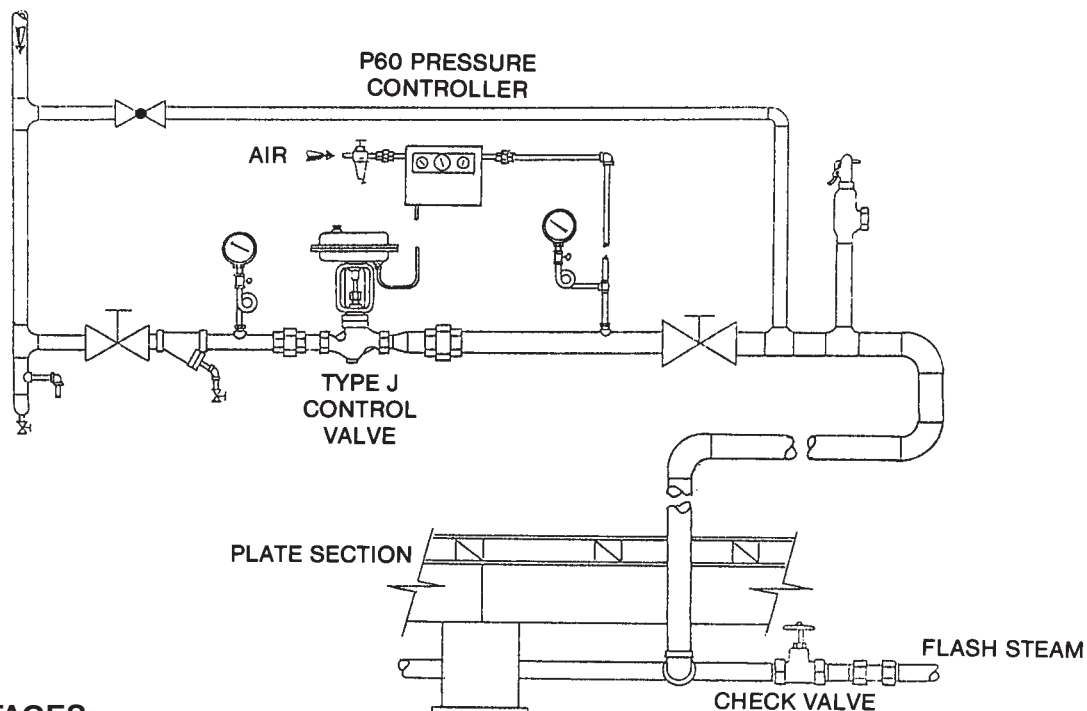
## SPENCE TYPE J CONTROL VALVE WITH TYPE P60 PRESSURE CONTROLLER FOR CONTROL OF PLATE SECTIONS OF A CORRUGATOR

### APPLICATION:

When corrugator process speed is increased to the point that the flash steam available to the plate sections is insufficient, high pressure steam is admitted to the plate sections to permit increased process speed.

### OPERATION:

A Type P60 Pressure Controller is connected to the flash steam supply of a plate section. A Type J Control Valve is connected between a high pressure steam main and the flash steam supply of the plate section. The prescribed pressure for the product and process speed is the P60's set point. When insufficient flash steam is available to maintain the set pressure, the Type J Control Valve will open and admit sufficient steam to maintain the set pressure.



### ADVANTAGES:

- Process speed can be increased.
- Controller can be remotely located.
- Maximizes capacity at minimal pressure differentials.
- Compact size permits easy installation.
- Able to maintain control at low flow rates.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

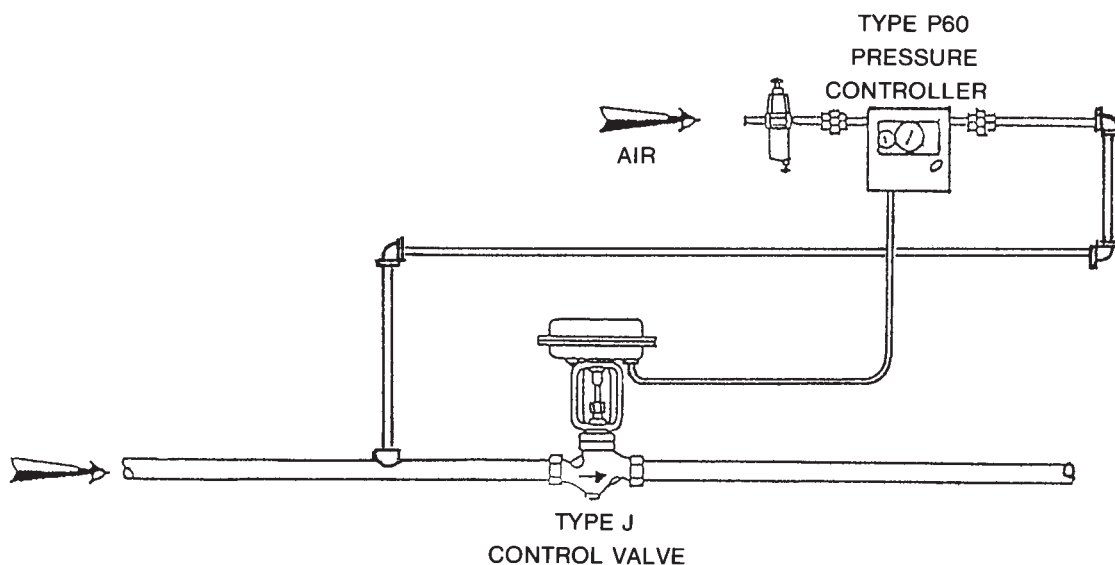
## SPENCE TYPE J CONTROL VALVE WITH TYPE P60 CONTROLLER FOR BACK PRESSURE CONTROL OF A DEAERATOR

### APPLICATION:

When the pressure in a Deaerator increases to the set pressure of the Controller, the Control Valve opens and exhausts the amount of steam necessary to maintain the set pressure.

### OPERATION:

A Spence Type J Control Valve is installed between the Deaerator Tank and the exhaust vent, usually to the roof. A Type P60 Pressure Controller is installed to sense either the pressure in the Deaerator Tank or the supply pressure to the Type J Control Valve. When the pressure in the Deaerator Tank reaches the set pressure of the Type P60 Controller, the Type P60 Controller sends a proportional 3 to 15 psig pneumatic signal to the Actuator of the Type J Control Valve. The Type J Control Valve opens, closes or throttles in response to the Type P60 Controller's pneumatic signal, enabling the set pressure to be maintained in the Deaerator.



### ADVANTAGES:

- Controller can be remotely located.
- Maximizes capacity at minimal pressure differentials.
- Compact size permits easy installation.
- Able to maintain control at low flow rates.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

## SPENCE TYPE J CONTROL VALVE WITH TYPE P60 FOR CONTROL OF UNFIRED STEAM GENERATOR

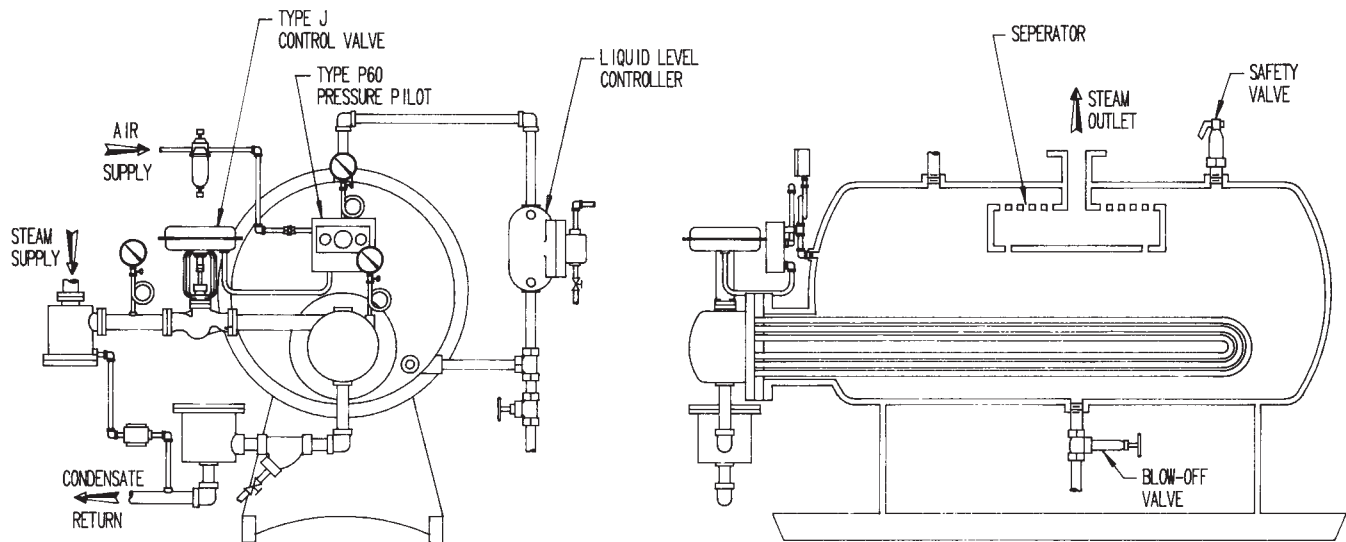
### APPLICATION:

To provide pneumatic control for an Unfired Steam Generator.

### OPERATION:

The Spence Type P60 Pneumatic Pressure Controller senses the boiler's operating pressure and sends a proportional 3 to 15 psig air signal to the Spence Type J Pneumatic Control Valve. The Spence Type J Pneumatic Control Valve then opens, closes or throttles the supply of heating medium, either steam or high-temperature water, in order to maintain the boiler's operating pressure set point.

### ADVANTAGES:



Can utilize a sophisticated PID controller for exceptionally accurate control.

Permits lower operating differential pressures across the control valve than a self-contained regulator.



# Application Guide

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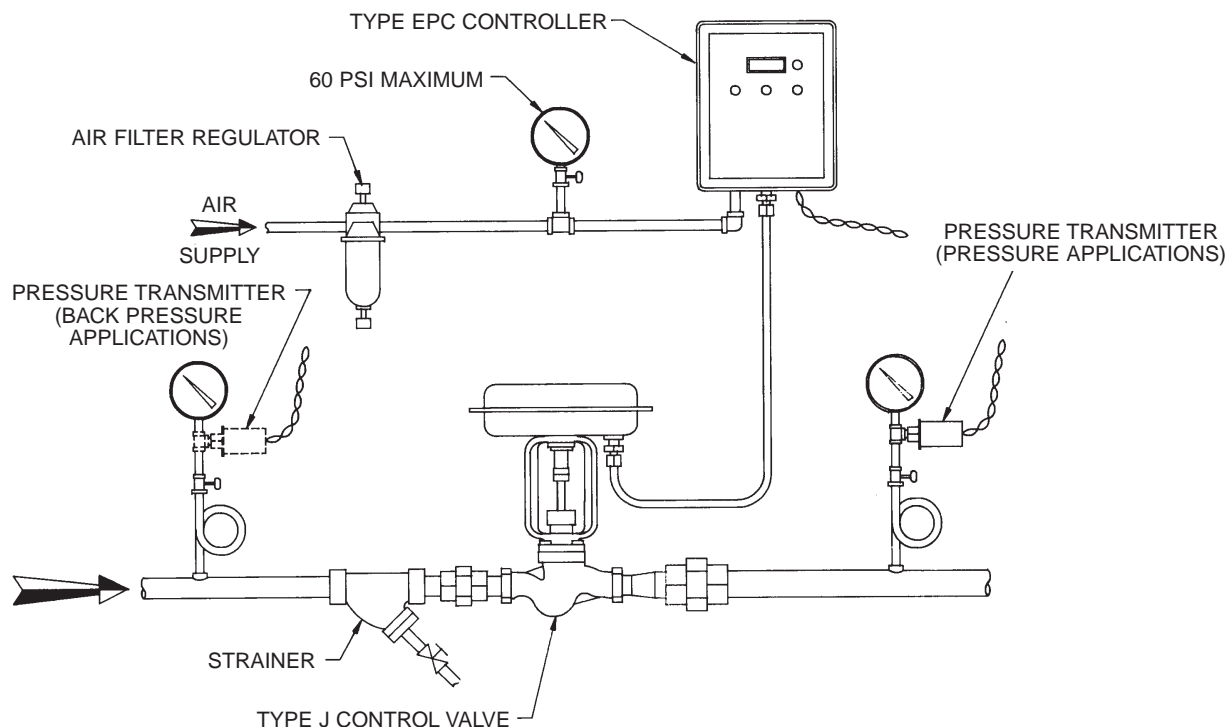
## SPENCE TYPE EPC ELECTRO-PNEUMATIC CONTROLLER as a PRESSURE OR BACK PRESSURE CONTROLLER

### APPLICATION:

To provide a modulating pneumatic signal of up to 60 psig to a Type J Control Valve utilized in pressure or back pressure control.

### OPERATION:

An appropriate pressure transmitter is connected to the EPC's transmitter input terminals. The EPC provides the 24 VDC power to the transmitter and compares the returned 4-20 mA signal to the EPC's setpoint. Using a series of short pneumatic pulses, the EPC either increases or decreases the pneumatic signal to the control valve to maintain the desired pressure control.



### ADVANTAGES:

Control action can be set for either direct or reverse action.

Utilizes standard plant air up to 60 psig maximum.

Use of a Valve Positioner can be eliminated with sufficient supply air pressure.

Easy to install and operate.



# Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

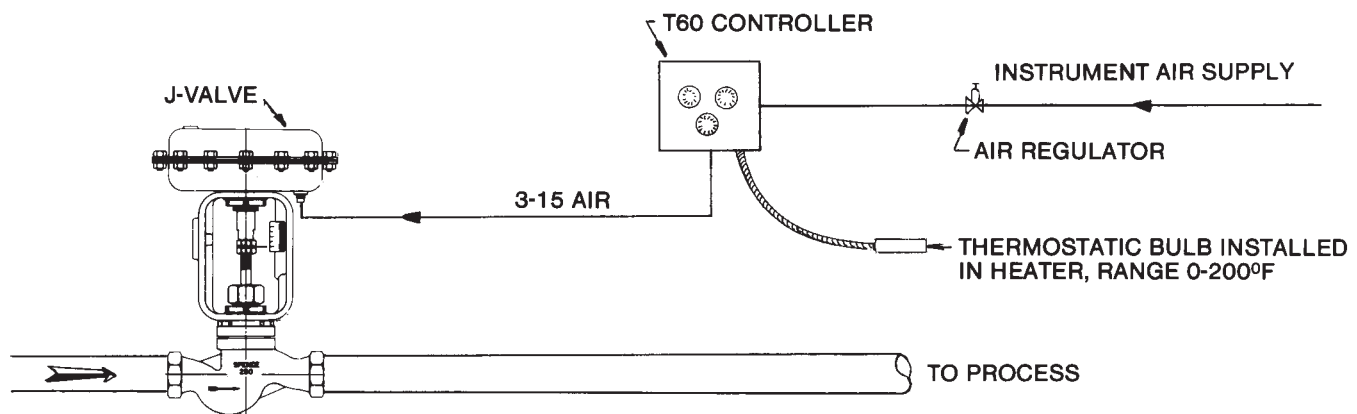
## SPENCE TYPE J CONTROL VALVE AND T60 TEMPERATURE CONTROLLER

### APPLICATION:

To provide fast, accurate control on instantaneous heaters and difficult process applications.

### OPERATION:

Temperature variations at thermostat bulb of the T60 changes output air signal going to the J valve. The changing air signal positions the control valve to maintain temperature setting.



### SELECT VALVE:

Flow ..... 1400#/hr.

Inlet Pressure ..... 15 psig

Heater Pressure ..... 5 psig

Temperature Setting ..... 140°F.

Fail closed, air to open

**See Page 8, Bulletin No. 3501.**

a 2" J Valve with a 1 3/4" port will flow 1655#/hr.

**See Page 17, Bulletin No. 3501.**

With 15 psig inlet pressure, a 36 square inch Actuator can be used. A T60 with a 0-200° temperature range and a 3-15 psig air signal is required.





# Application Guide

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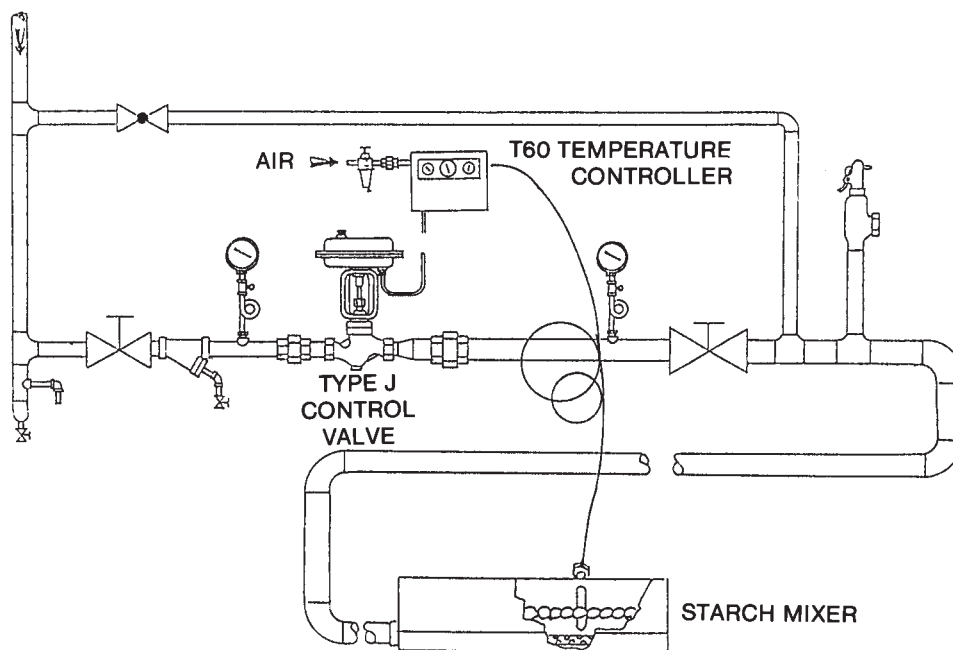
## SPENCE TYPE J CONTROL VALVE WITH TYPE T60 TEMPERATURE CONTROLLER FOR STARCH MIXER

### APPLICATION:

To provide accurate temperature control in a Starch Mixer for corrugated adhesive usage.

### OPERATION:

A Starch Mixer is essentially an open topped, agitated sparge tube storage heater, in which the adhesive is prepared before being placed in storage. The temperature probe of a Type T60 Temperature Controller is placed in an active area of the Starch Mixer. Once activated, the Type J Control Valve flows steam to the heater until the T60 senses that the proper temperature has been reached. Then the T60 varies its 3 to 15 psi pneumatic signal to the J Control Valve to close, open or throttle, as necessary, to maintain a preset temperature.



### ADVANTAGES:

- Use of the T60 Controller permits remote setting and read out of starch temperature.
- Permits highly accurate temperature control.
- Precise control of low flows.
- Minimum pressure differential across the J Valve permissible.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

## SPENCE TYPE J CONTROL VALVE WITH TYPE T60 TEMPERATURE CONTROLLER FOR WAX APPLICATION CONTROL

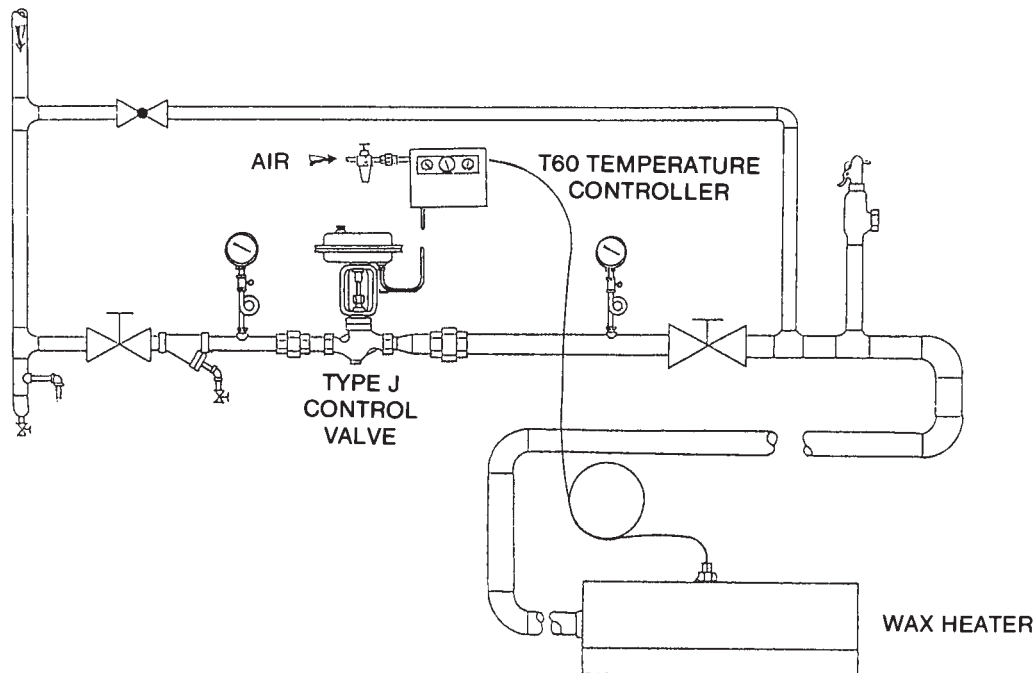
### APPLICATION:

To provide accurate control of the wax temperature in order to assure the proper coating of the product.

### OPERATION:

The temperature probe of the Type T60 Temperature Controller is placed into the wax at the point of application. The T60 compares the wax temperature to its temperature setting and sends a 3 to 15 psi pneumatic signal to the Type J Control Valve, which opens, closes or throttles to maintain the desired wax temperature.

### ADVANTAGES:



Improved control of wax temperature.

Capable of maintaining precise control down to very low flow rates.

Maximum valve capacity at low differential pressures.



# Application Guide

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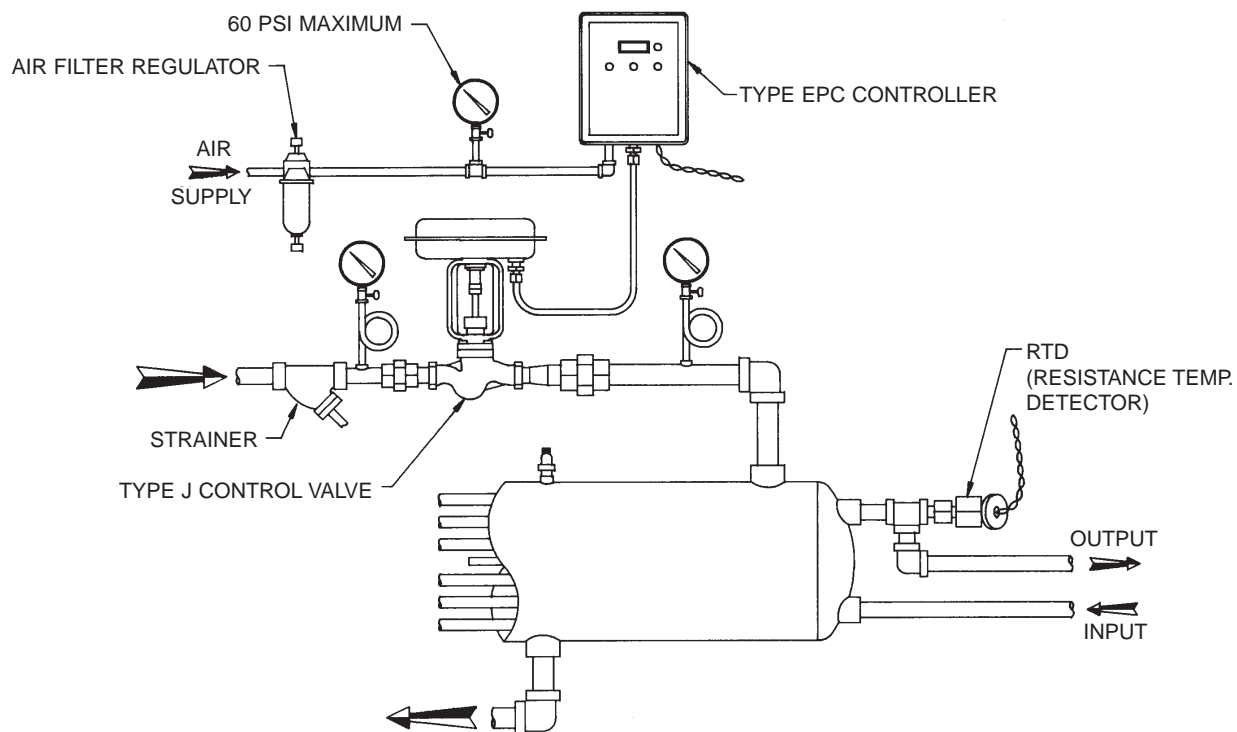
## SPENCE TYPE EPC ELECTRO-PNEUMATIC CONTROLLER as a TEMPERATURE CONTROLLER

### APPLICATION:

To provide a modulating pneumatic signal of up to 60 psig to a Type J Control Valve utilized in temperature control.

### OPERATION:

An appropriate RTD (Resistance Temperature Detector) is connected to the EPC's RTD input terminals. The EPC compares the RTD's output to the EPC's setpoint. Using a series of short pneumatic pulses, the EPC either increases or decreases the pneumatic signal to the control valve to obtain the desired temperature control.



### ADVANTAGES:

Control action can be set for either direct or reverse action.

Utilizes standard plant air up to 60 psig maximum.

Use of a Valve Positioner can be eliminated with sufficient supply air pressure.

Easy to install and operate.



# Application Guide

**SPENCE ENGINEERING COMPANY, INC.** 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

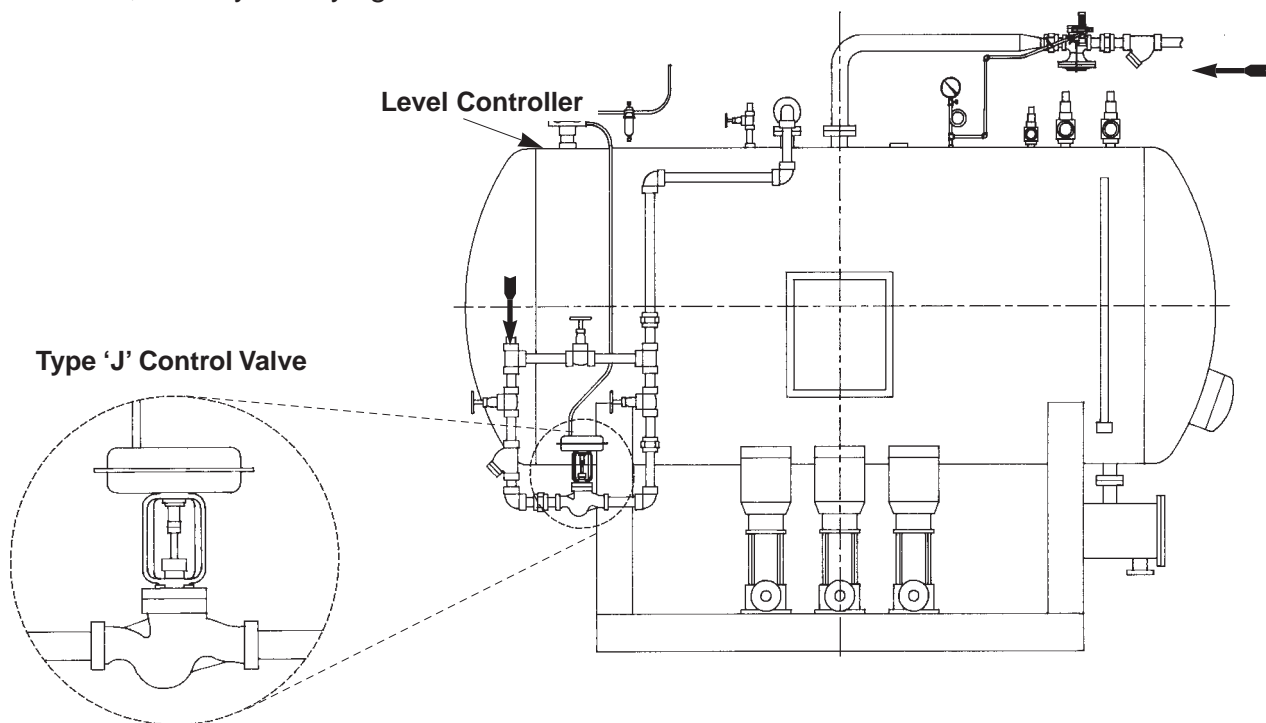
## SPENCE TYPE 'J' CONTROL VALVE LEVEL/MAKE-UP CONTROL VALVE on a DEAERATOR

### APPLICATION:

When insufficient condensate to meet the demand for boiler feedwater is returned to the deaerator, the make-up water control valve is opened to satisfy this requirement.

### OPERATION:

When the Deaerator's Pneumatic Level Controller senses low water level, it sends a proportional 3 to 15 psia pneumatic signal to the Type 'J' Control Valve. The Type 'J' Control Valve responds by opening, closing or modulating the flow of raw make-up water into the Deaerator, thereby satisfying the demand for boiler feedwater.



### ADVANTAGES:

Precise control of make-up water

The standard modified equal percent plug contour provides superior throttling action



# Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

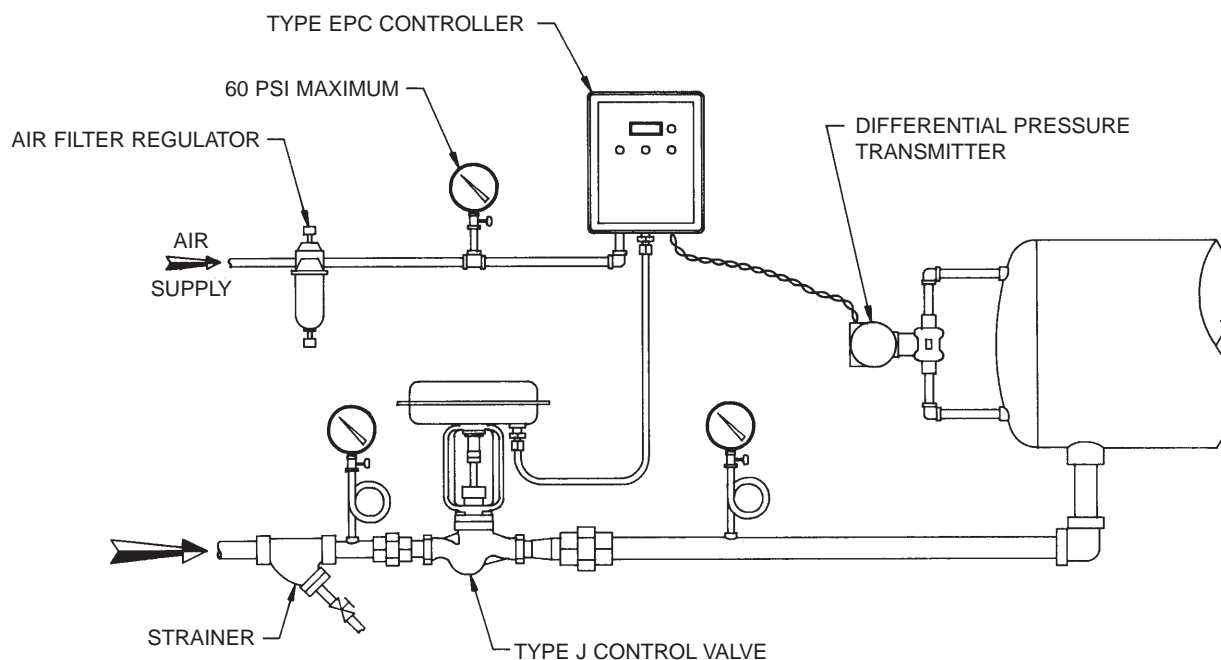
## SPENCE TYPE EPC ELECTRO-PNEUMATIC CONTROLLER as a DIFFERENTIAL (LEVEL) CONTROLLER

### APPLICATION:

To provide a modulating pneumatic signal of up to 60 psig to a Type J Control Valve unitized as a Differential Pressure Valve.

### OPERATION:

An appropriate Differential Pressure Transmitter is connected to the EPC's transmitter input terminals. The EPC provides the 24 VDC power to the transmitter and compares the returned 4-20 mA signal to the EPC's setpoint. Using a series of pneumatic pulses, the EPC either increases or decreases the pneumatic signal to the control valve to maintain the desired differential pressure (level).



### ADVANTAGES:

Control action can be set for either direct or reverse action.

Utilizes standard plant air up to 60 psig maximum.

Use of a Valve Positioner can be eliminated with sufficient supply air pressure.

Easy to install and operate.










## SPENCE ENGINEERING COMPANY, INC

PRESSURE AND  
TEMPERATURE  
CONTROLS &  
STEAM SPECIALTIES

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