

SPENCE STEAM & FLUID CONTROL DESIGNER'S GUIDE

- Regulators •
- Control Valves •
- Safety Relief Valves •
- Condensate Pumps •
- Steam Traps •
- Strainers •
- Desuperheaters •
- Noise Treatment •



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It is the philosophy of the
Spence Engineering Company that,
to win and be deserving of the trust of
our customers, we must be ever mindful
of and totally dedicated to quality; in
all that we do; at every level
of our operation.

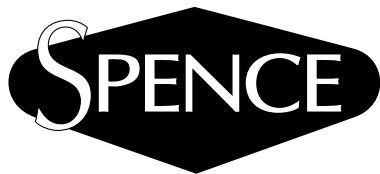


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SPENCE

STEAM & FLUID CONTROL DESIGNER'S GUIDE

CONDENSATE PUMPS	DESUPERHEATERS & NOISE REDUCTION	SAFETY RELIEF VALVES	CONTROL VALVES	REGULATORS
REFERENCE	APPLICATION GUIDE	STRAINERS	UNIFLEX COUPLINGS & GENERAL USE VALVES	TRAPS & SPECIALTIES

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.

Watts Industries, Inc. split in 1999 and Spence Engineering Company became a division of the newly formed corporation, CIRCOR International.

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 or reach us via e-mail at sales@spenceengineering.com



THE SPENCE ADVANTAGE IS SERVICE

LOCAL TECHNICAL SUPPORT

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

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

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.

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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.

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It is solely the responsibility of the system designer and the user to select products suitable for their specific application requirements and to ensure proper installation, operation, and maintenance of these products. Assistance shall be afforded with the selection of the materials based on the technical information supplied to Spence Engineering Company, Inc. Applicable codes, material compatibility, product ratings and application details should be considered in the selection and application. Improper selection, application or use of the products described herein can cause personal injury or property damage. If the product is intended for an application or use other than originally specified, the system designer and or user must reconfirm that the selection is suitable for the new operating conditions.

SECTION I

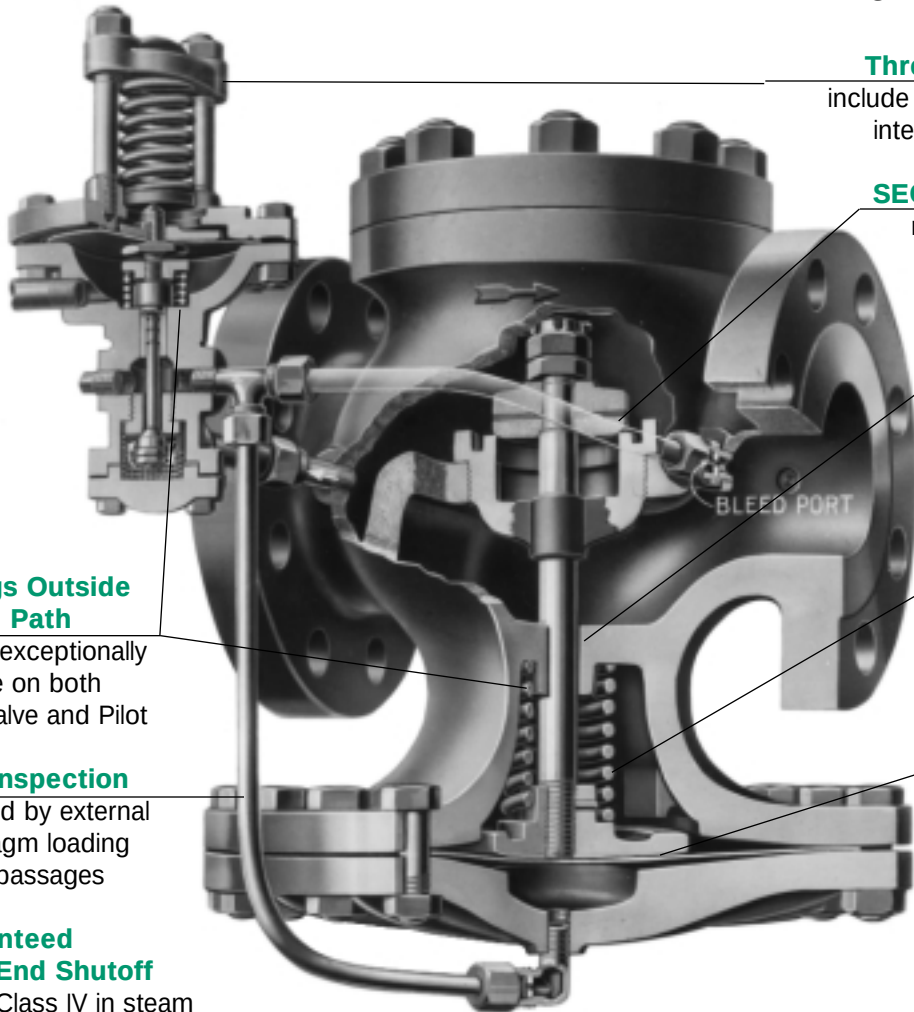
REGULATORS

Applications

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

Iron Horse ED Series Pressure Regulator

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



Three Pilot Mounting Options

include standard side mount (shown), integral mount and remote mount

SECO Metal Seats and Discs

resist wiredraw - not one case of SECO Metal being cut by steam in 75 years

Packless Construction

eliminates leakage and greatly reduces friction and stem wear

Two Main

Spring Options

for superior regulation over a wide range of applications

Large, Protected Metal Diaphragm

bathed in condensate, sealed away from steam seldom needs replacement

No Closely Fitted Parts

to stick or bind due to uneven expansion or foreign matter

Few Moving Parts

mean long service life

Springs Outside Steam Path

assure exceptionally long life on both Main Valve and Pilot

Easy Inspection

provided by external diaphragm loading steam passages

Guaranteed Dead End Shutoff

meets Class IV in steam service, even on large sizes

Patented SECOWELD Option

allows easy repair of seat ring threads damaged by high pressure applications

HOW TO CHOOSE A REGULATOR

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 Combination Regulators Chapter. Detailed product information on materials, ratings, dimensions, weights and applications are found in the Products Chapters. All sizing information is contained in the Regulator Sizing Chapter.

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 each Product Page. 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 Direct Operated Valves Chapter to determine which best fits your specific needs. Then, consult the appropriate pages in the Regulator Sizing Chapter to select the exact size you need.

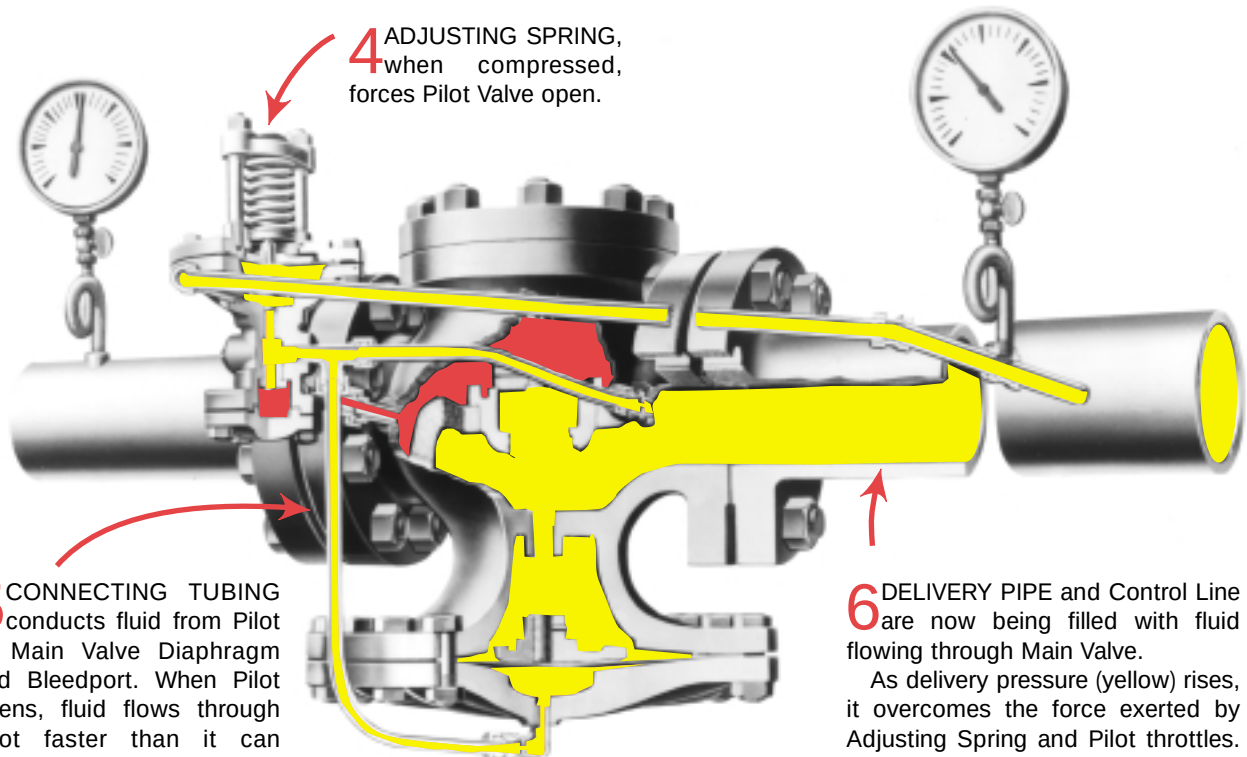
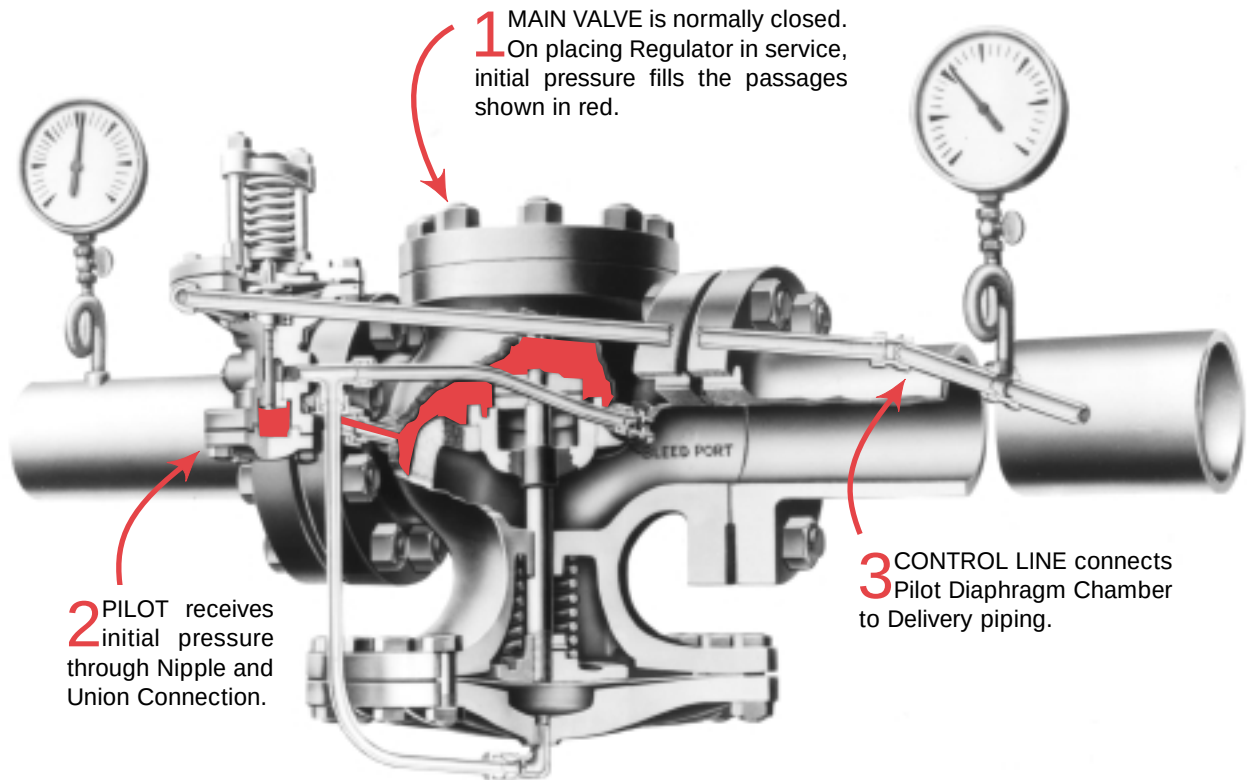
If a Pilot Operated Regulator is required, go to Page 14 (for Pressure Regulators) or Page 15 (for Temperature Regulators). These selection charts will help you to quickly determine the type of product that you need. The Pilot can be self contained, pneumatically or electronically actuated. Consult the appropriate pages in the Regulator Sizing Chapter to select the exact size Regulator and Pilot you need. Overall dimensions of the most popular combinations are provided in the Combination Regulators Chapter.

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 50 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 Noise Reduction Chapter.

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.



KEY

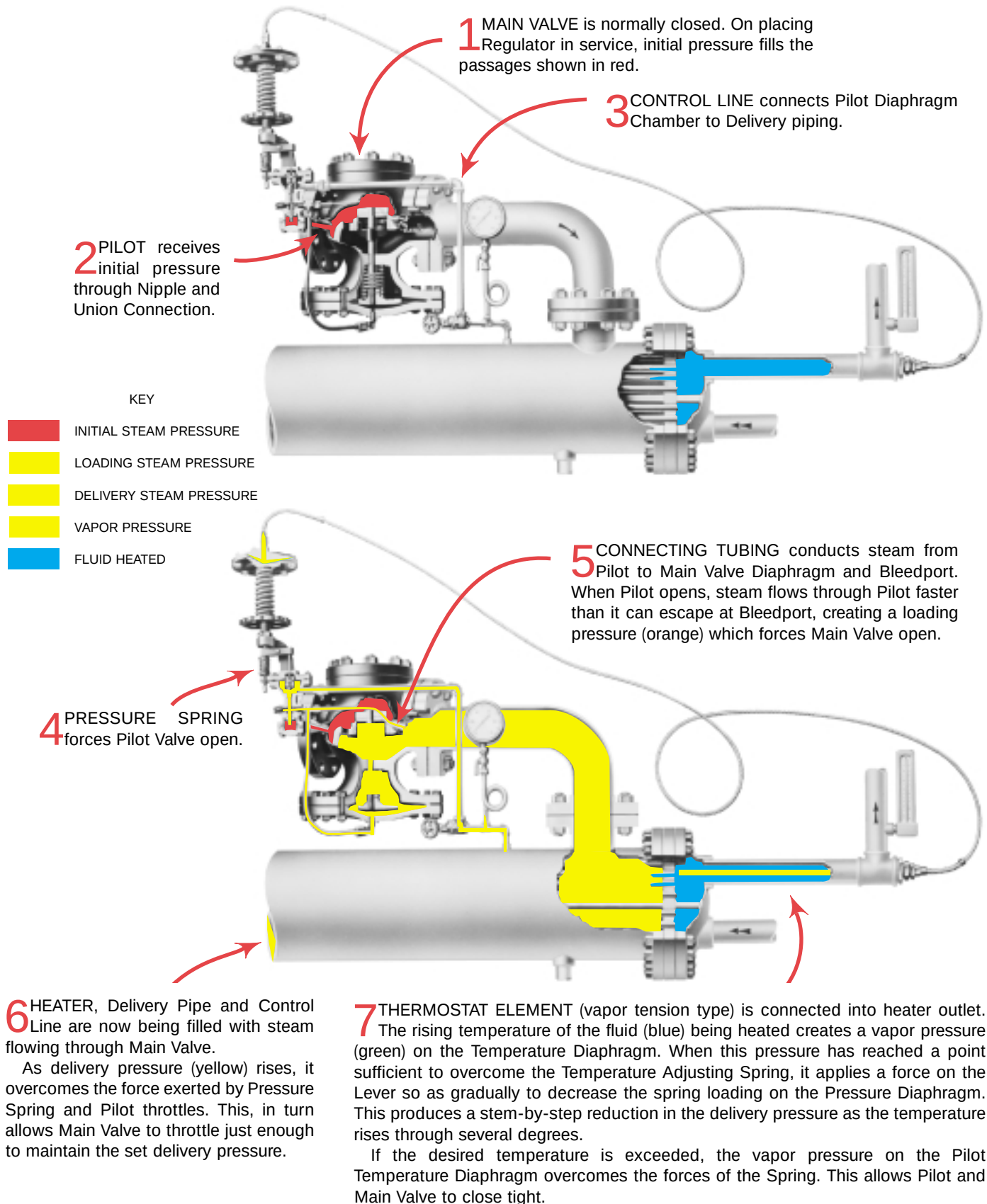


As delivery pressure (yellow) rises, it overcomes the force exerted by Adjusting Spring and Pilot throttles. This, in turn, allows Main Valve to throttle just enough to maintain the set delivery pressure.

If the demand ceases, Pilot closes, allowing the Main Valve to close – effecting a DEAD-END SHUTOFF.

THE OPERATING CYCLE OF A SPENCE TEMPERATURE REGULATOR

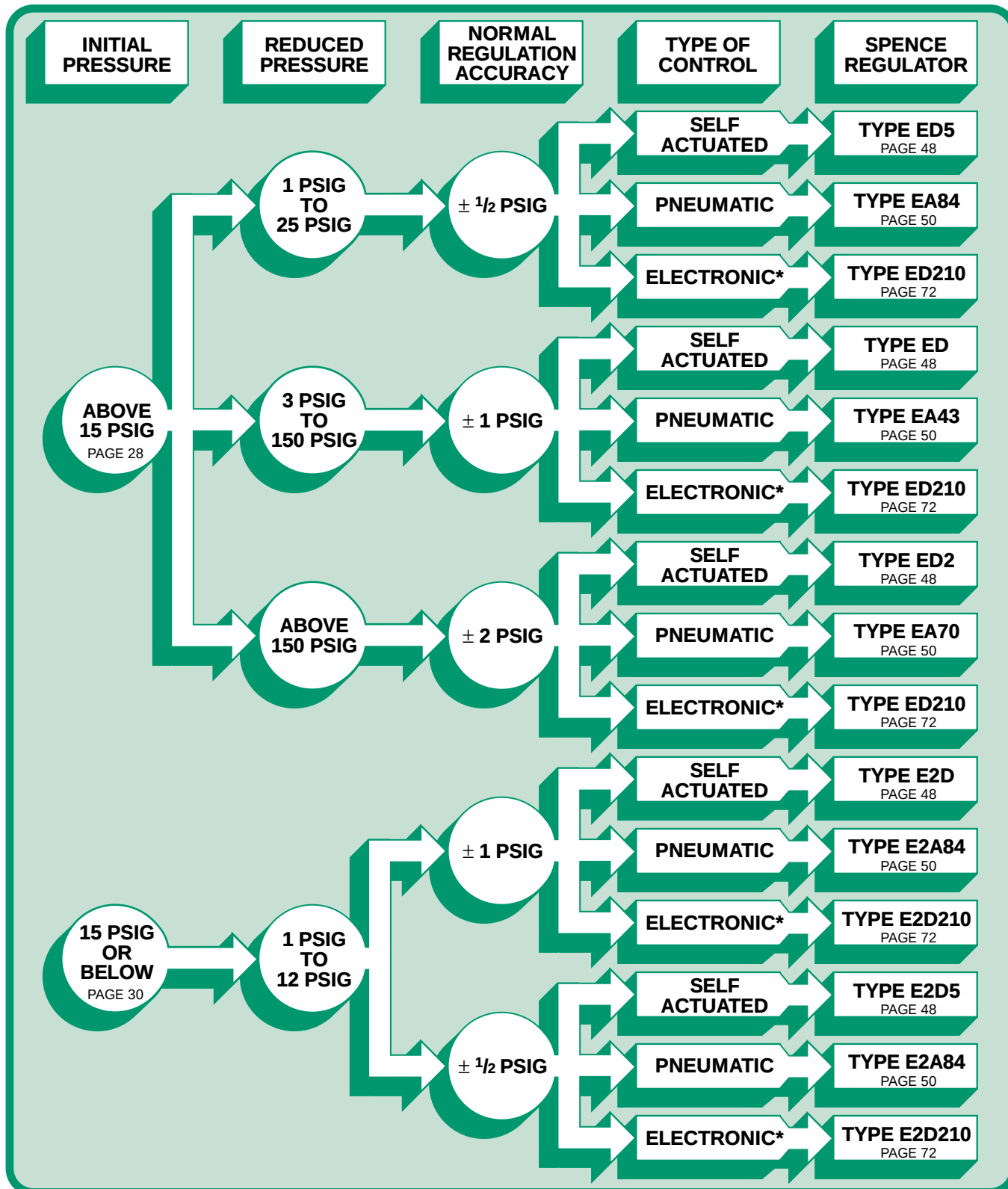
The Type ET134 has been selected to illustrate the operation of a SPENCE Pilot Operated Temperature Regulator. This presentation describes the successive steps in the mechanical cycle of the Regulator.



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.

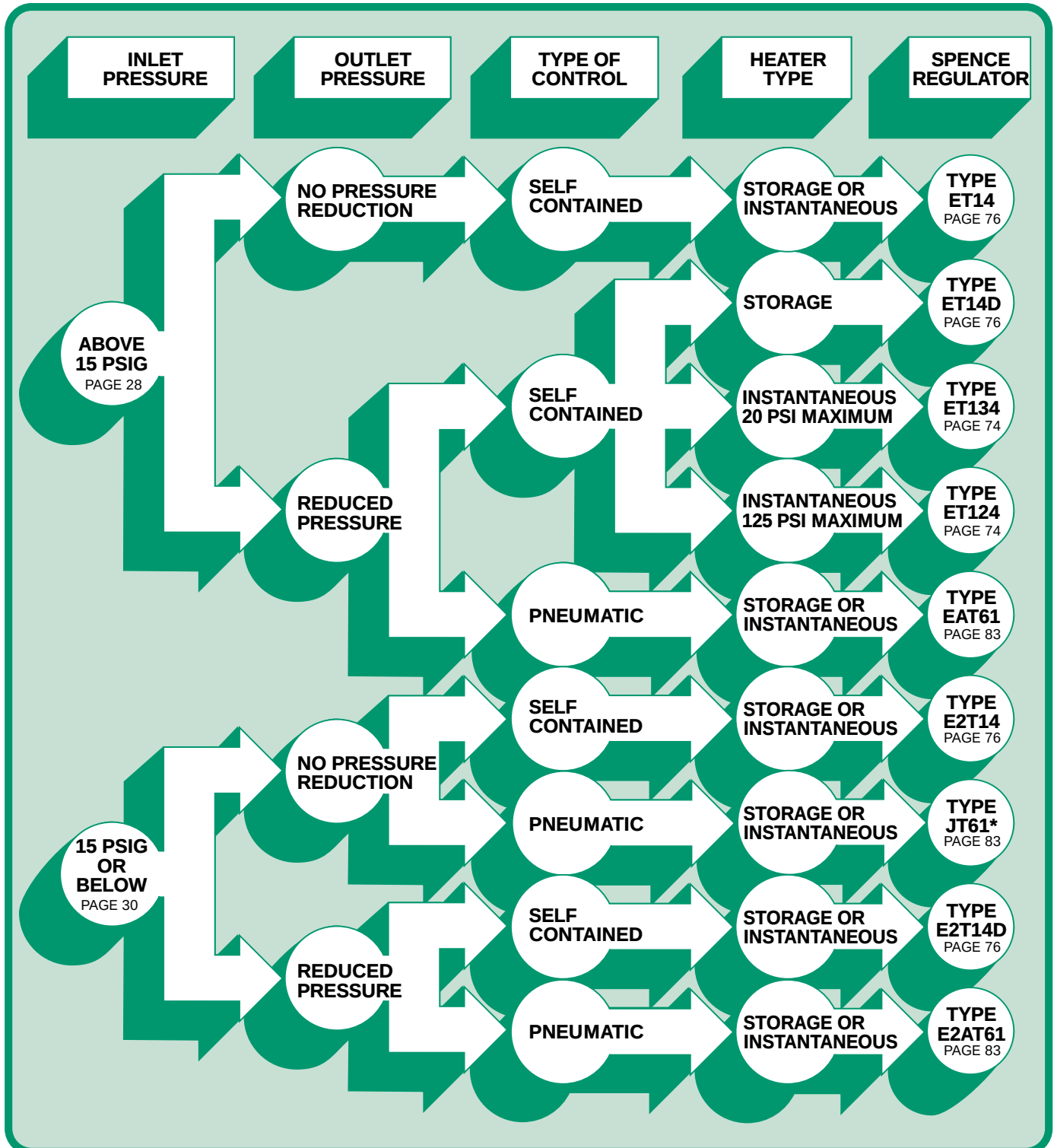


* Electronic Pilot accuracy is a function of controller accuracy.

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 Section, Page 150

SPENCE MAIN VALVE SPECIFICATION TABLE

TYPES		SIZES, BODY MATERIAL ^a AND FACINGS										OTHER MATERIALS ^a							
		CAST IRON			CAST BRONZE		CAST STEEL					Diaphragm	SEAT RINGS			DISCS		Stem	Main Spring
		Screwed Ends	Flanged ANSI 125	Flanged ANSI 250	Screwed Ends	Flanged ANSI 150	Flanged ANSI 300	Flanged ANSI 600	Steam Service	Water, Oil, Air or Gas Service	304/420		316/420	304/420	Water, Oil, Air or Gas Service				
E	SIZES-INCHES	3/8-2	1-12	1-12	3/8-2	3/8-2	1-12	1-12	1-12	1/2-8									
	Max. Initial Pressure-psi	250	125	250	250	300	150	300	600										
	Max. Initial Temperature-°F	450	450	450	400	750	500	750	750										
	Min. Differential ^k -psi ^b	10/30/50	10/30/50/10/30/50																

^a Main Valves for corrosive fluids or costly gases require special materials.

^b Bronze body and blind flange only.

^c Minimum Differential is the smallest permissible difference between initial pressure (measured at the inlet) and the delivery pressure (measured at the outlet) of the main valve.

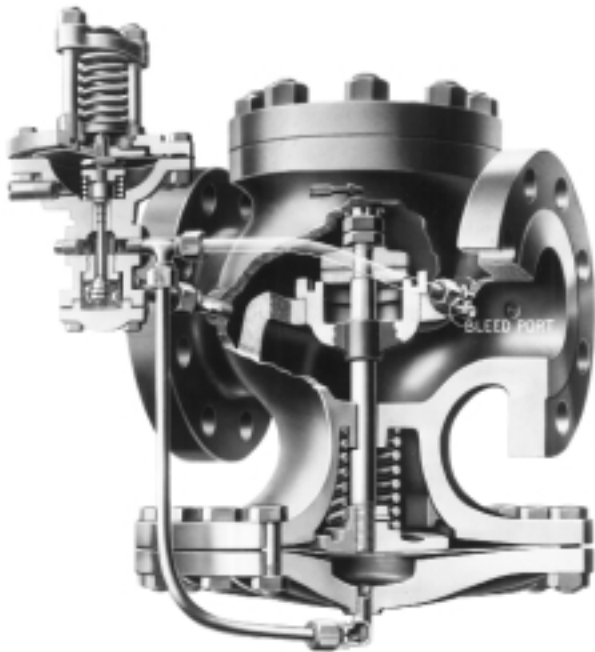
^d Secoweld seat construction described in Options Section is regularly furnished for service pressures 400 psi and higher.

^e 17-4 PH stems are furnished for service temperatures exceeding 600°F.

^f Inconel springs are furnished for service pressures exceeding 400 psi and/or temperatures exceeding 600°F.

^h Standard spring (HP) requires minimum 30 PSI differential. 50 PSI is recommended minimum differential. Use optional Low ΔP (LP) main spring for 15 psi minimum differential. 10 psi minimum differential is attainable by adding base bypass and 3/8" bleedport.

COMBINATION REGULATORS



TYPE ED SERIES PRESSURE REGULATOR

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

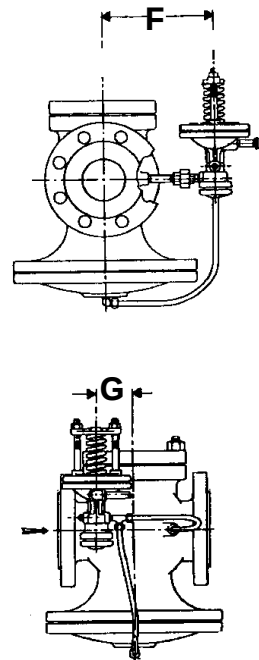
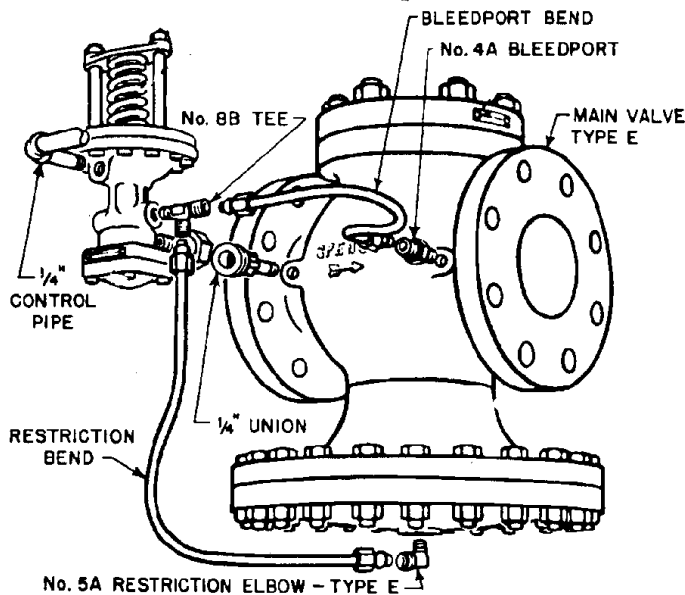
APPLICATION DATA

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

TYPE ED PRESSURE REGULATOR

VALVE INFO
PAGE 28

PILOT INFO
PAGE 48



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

DIMENSIONS inches (mm)

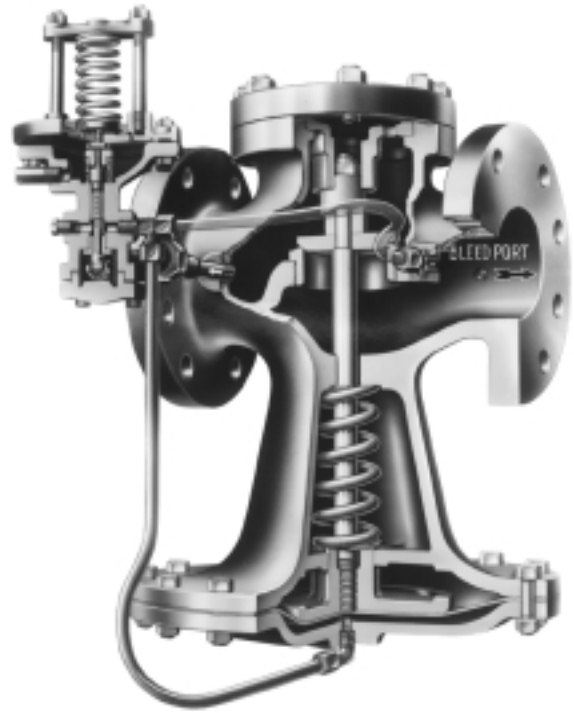
SIZE	F	G
3/8 (10)	5 3/8 (136)	1 1/4 (32)
1/2 (15)	5 3/8 (136)	1 1/4 (32)
3/4 (20)	5 3/8 (136)	1 3/8 (35)
1 (25)	5 3/4 (146)	1 1/2 (38)
1 1/4 (32)	6 (152)	1 7/8 (48)
1 1/2 (40)	6 1/4 (159)	2 (51)
2 (60)	6 5/8 (168)	2 1/8 (54)
2 1/2 (65)	6 3/4 (171)	2 3/8 (60)
3 (80)	7 1/4 (184)	2 3/4 (70)
4 (100)	8 (203)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

TYPE E2D SERIES PRESSURE REGULATOR

CAST IRON
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

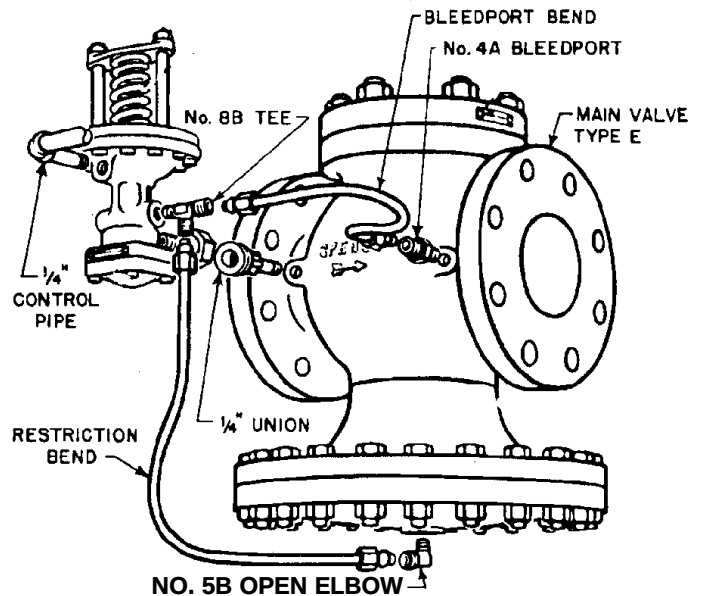
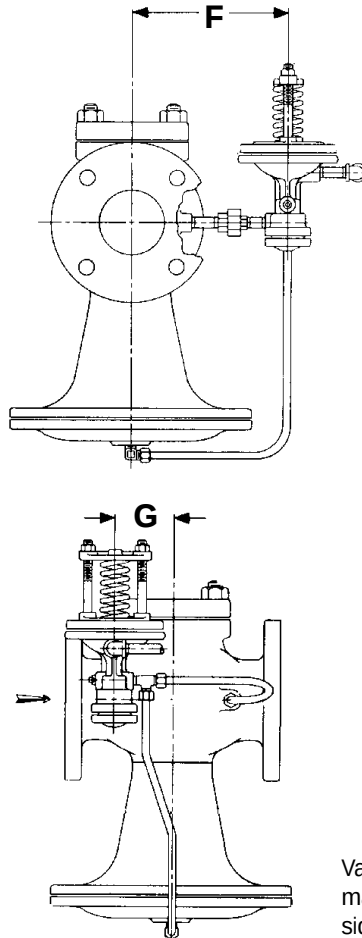
TYPE E2D PRESSURE REGULATOR

VALVE INFO
PAGE 30

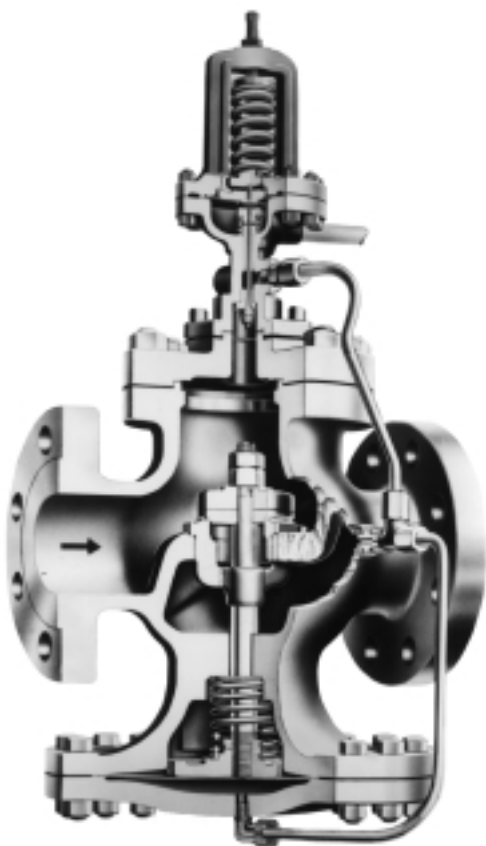
PILOT INFO
PAGE 48

DIMENSIONS inches (mm)

SIZE	F	G
3/4 (20)	5 5/8 (143)	1 3/8 (35)
1 (25)	5 3/4 (146)	1 1/2 (38)
1 1/4 (32)	6 (152)	1 7/8 (48)
1 1/2 (40)	6 1/4 (159)	2 (51)
2 (50)	6 5/8 (168)	2 1/8 (54)
2 1/2 (65)	6 3/4 (171)	2 3/8 (60)
3 (80)	7 1/4 (184)	2 3/4 (70)
4 (100)	7 3/8 (187)	3 1/2 (89)
5 (125)	8 1/8 (206)	3 1/2 (89)
6 (150)	8 1/2 (216)	4 (102)
8 (200)	9 3/8 (238)	6 1/4 (159)
10 (250)	11 (279)	6 (152)
12 (300)	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
PAGE 28

PILOT INFO
PAGE 48

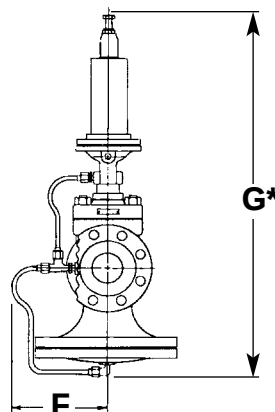
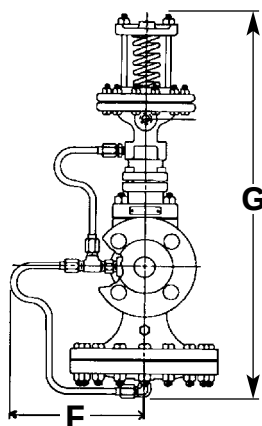
TYPE ED & ED2 INTEGRAL MOUND PRESSURE REGULATOR

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

APPLICATION DATA

- Pressure Regulation for Steam Distribution where space is limited

DIMENSIONS inches (mm)



SIZE	F	G*
3/8 (10)	5 1/4 (133)	15 3/4 (400)
1/2 (15)	5 1/4 (133)	15 3/4 (400)
3/4 (20)	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 (40)	6 (152)	19 1/2 (495)
2 (50)	6 1/2 (165)	20 5/8 (524)
2 1/2 (65)	7 (178)	21 3/4 (552)
3 (80)	7 3/8 (187)	23 1/2 (597)
4 (100)	8 7/8 (225)	27 1/4 (692)
5 (125)	10 (254)	28 5/8 (727)
6 (150)	11 3/8 (289)	31 1/2 (800)
8 (200)	12 3/4 (324)	35 3/8 (899)
10 (250)	15 1/2 (394)	43 3/4 (1111)
12 (300)	18 (457)	47 3/4 (1213)

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

TYPE EA SERIES PRESSURE REGULATOR

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

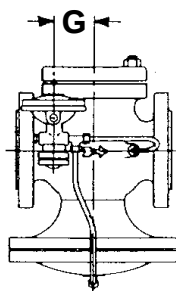
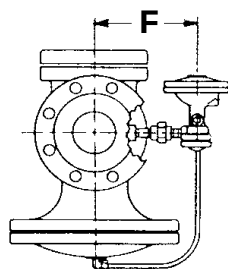
APPLICATION DATA

- 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)

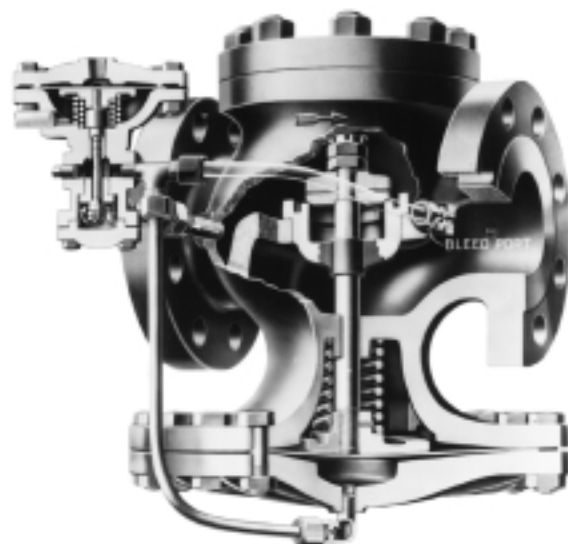
DIMENSIONS

inches (mm)

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



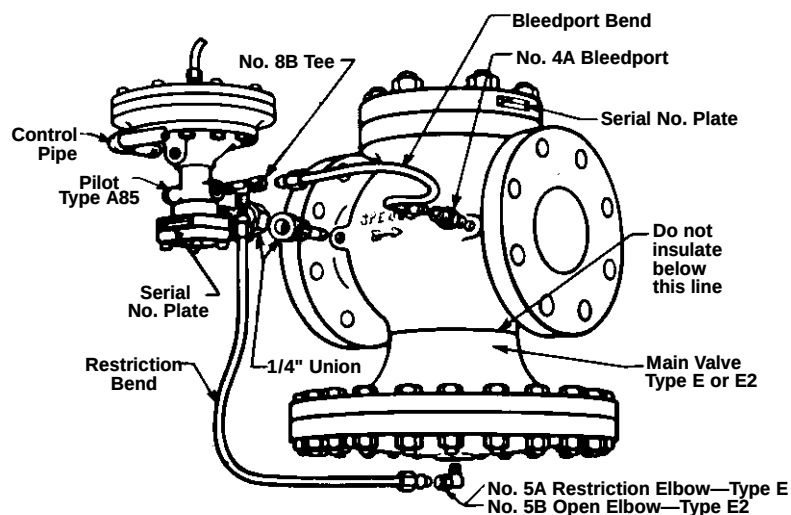
Valve is tapped so that
Pilot may be mounted
on either side.

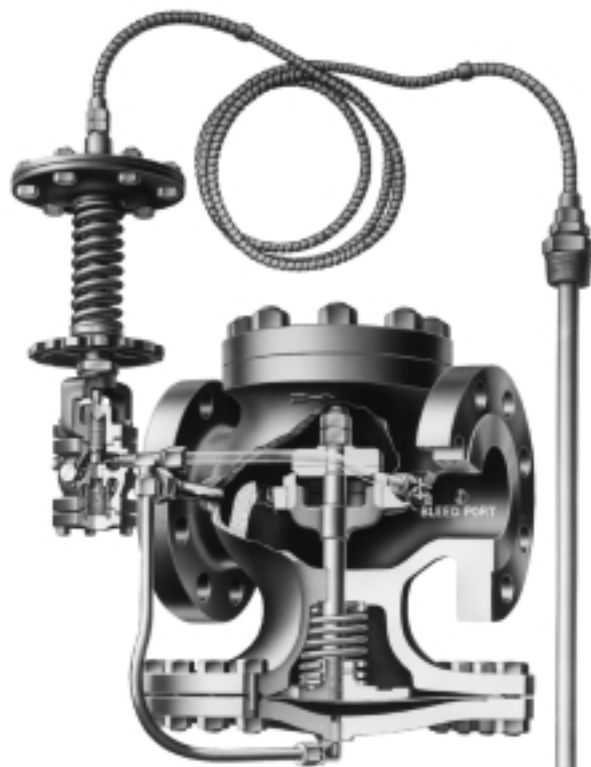


TYPE EA SERIES
PRESSURE REGULATOR

VALVE INFO
PAGE 28

PILOT INFO
PAGE 50

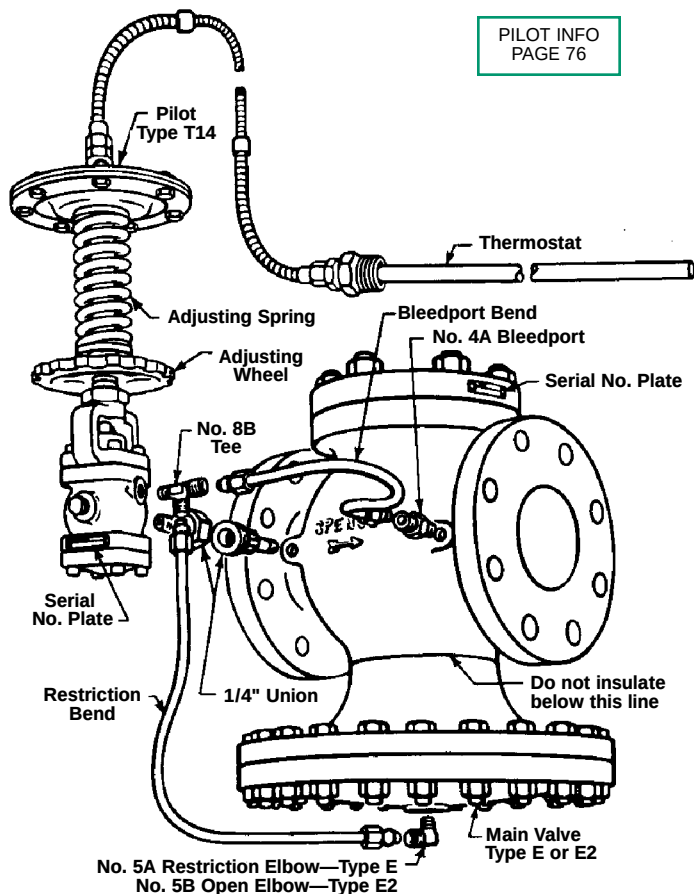




TYPE ET14 TEMPERATURE REGULATOR

VALVE INFO
PAGE 28

PILOT INFO
PAGE 76



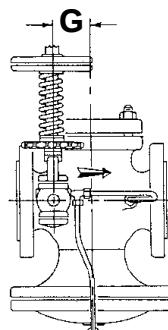
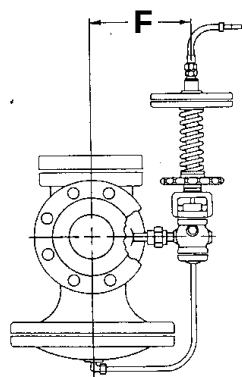
TYPE ET14 TEMPERATURE REGULATOR

CAST IRON or STEEL
CONTROLS 20 to 500°F

APPLICATION DATA

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

DIMENSIONS inches (mm)



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

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

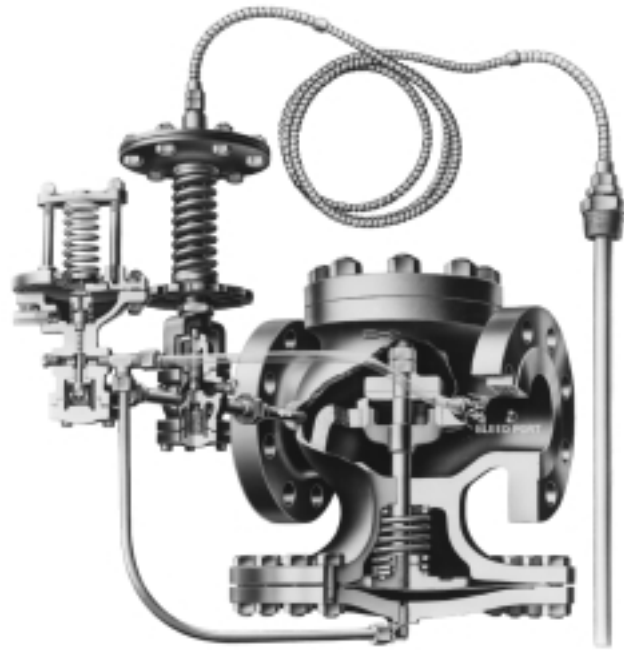
TYPE ET14D

PRESSURE LIMITING TEMPERATURE REGULATOR

CAST IRON or STEEL
CONTROLS 20 to 500°F

APPLICATION DATA

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



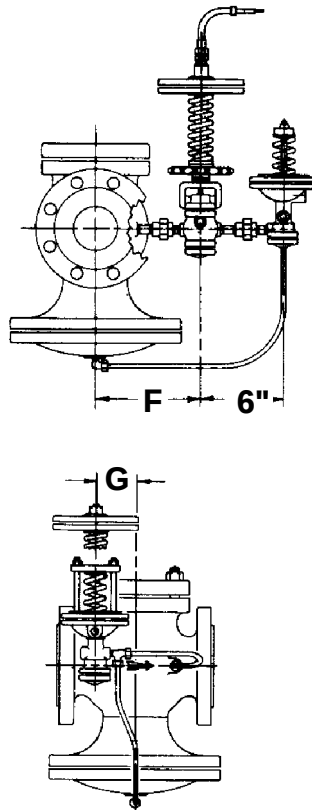
TYPE ET14D
TEMP. REGULATOR

TYPE ET14D TEMPERATURE
& PRESSURE REGULATOR

DIMENSIONS

inches (mm)

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

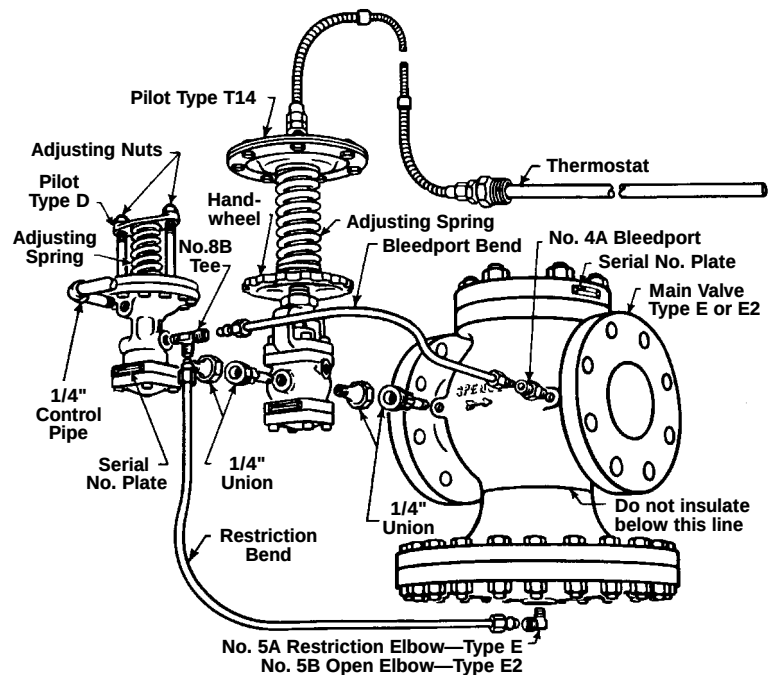


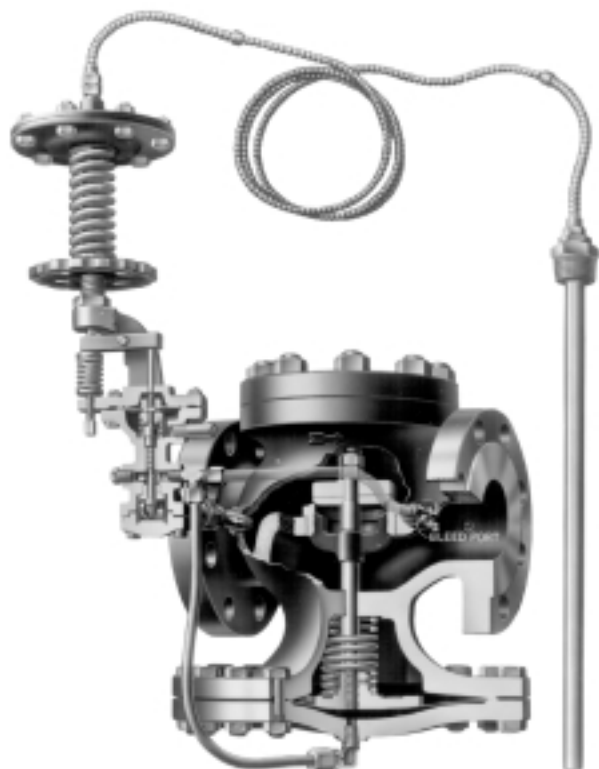
Valve is tapped so that
Pilot may be mounted on
either side.

VALVE INFO
PAGE 28

D PILOT INFO
PAGE 48

T14 PILOT INFO
PAGE 76





TYPE ET124/ET134 & E2T134

TEMPERATURE & PRESSURE REGULATOR

CAST IRON or STEEL

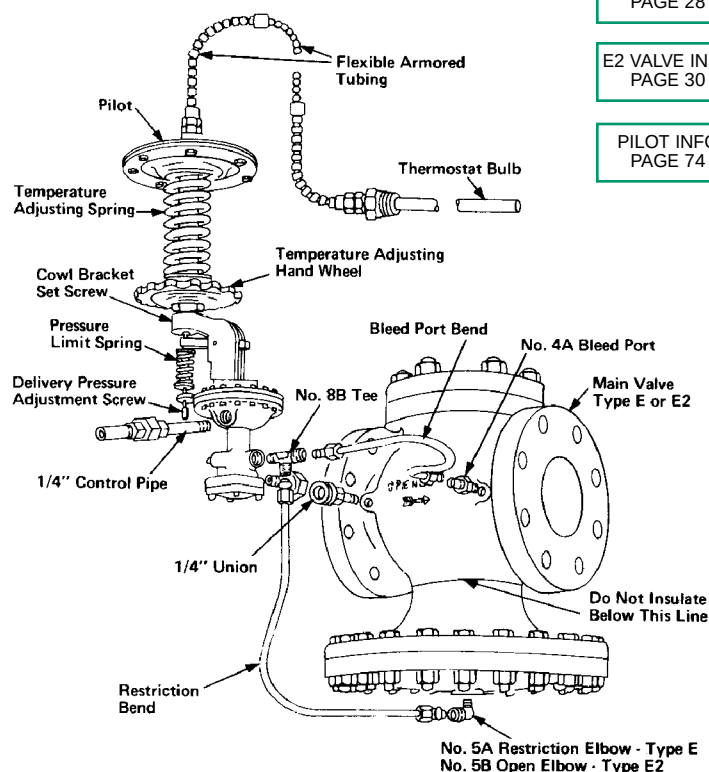
APPLICATION DATA

- Instantaneous Heaters
- Jacketed Kettles
- Storage Heaters
- Oil Heaters
- Batch Heating
- Process Heaters
- Vats
- Driers
- Ovens

MODELS

- **ET124** for heater operating pressures between 20 and 125 psi.
- **ET134** for heater operating pressures up to 20 psi.
- **E2T134** for heater operating pressures up to 15 psi.

TYPE ET124 TEMPERATURE & PRESSURE REGULATOR



E VALVE INFO
PAGE 28

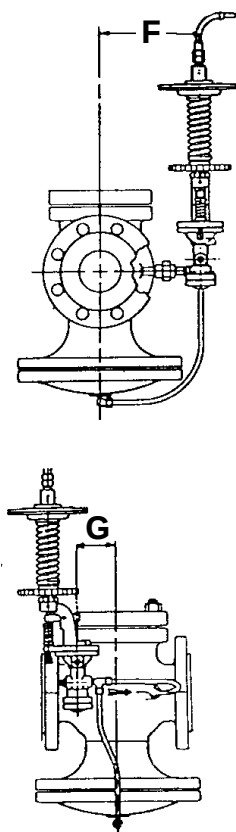
E2 VALVE INFO
PAGE 30

PILOT INFO
PAGE 74

DIMENSIONS

inches (mm)

SIZE	F	G	
		E	E2
3/8 (10)	5 3/8 (136)	1 1/4 (32)	—
1/2 (15)	5 3/8 (136)	1 1/4 (32)	—
3/4 (20)	5 5/8 (143)	1 3/8 (35)	1 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 (40)	6 1/4 (159)	2 (51)	2 (51)
2 (50)	6 5/8 (168)	2 1/8 (54)	2 1/8 (54)
2 1/2 (65)	6 3/4 (171)	2 3/8 (60)	2 3/8 (60)
3 (80)	7 1/4 (184)	2 3/4 (70)	2 3/4 (70)
4 (100)	8 (203)	3 1/2 (89)	3 1/2 (89)
5 (125)	9 (229)	3 1/2 (89)	3 1/2 (89)
6 (150)	9 7/8 (251)	4 (102)	4 (102)
8 (200)	10 1/2 (267)	6 1/4 (159)	6 1/4 (159)
10 (250)	12 1/2 (318)	6 (152)	6 (152)
12 (300)	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

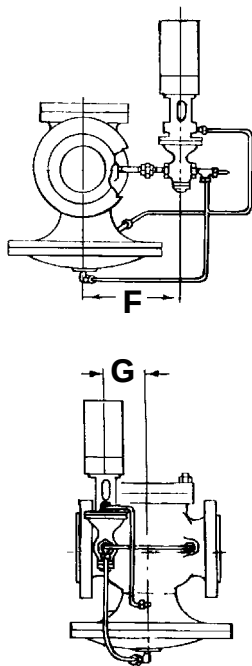
DELIVERY PRESSURES to 150 PSIG

APPLICATION DATA

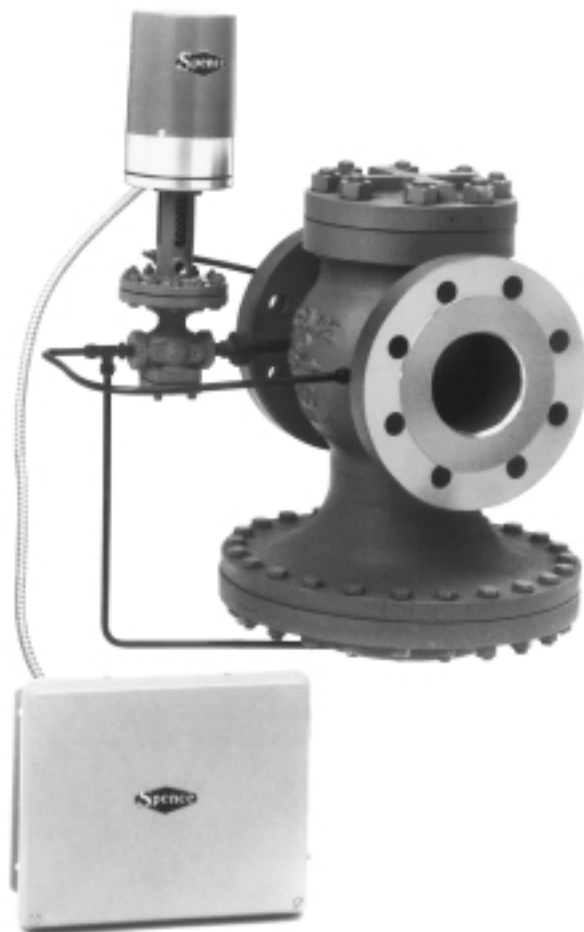
- Main Valve adapted to 4-20 mA Signal
- Requires balanced Main Valve

DIMENSIONS inches (mm)

SIZE	F	G
$\frac{3}{8}$ (10)	$5\frac{3}{8}$ (136)	$1\frac{1}{4}$ (32)
$\frac{1}{2}$ (15)	$5\frac{3}{8}$ (136)	$1\frac{1}{4}$ (32)
$\frac{3}{4}$ (20)	$5\frac{5}{8}$ (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)
$1\frac{1}{2}$ (40)	$6\frac{1}{4}$ (159)	2 (51)
2 (50)	$6\frac{5}{8}$ (168)	$2\frac{1}{8}$ (54)
$2\frac{1}{2}$ (654)	$6\frac{3}{4}$ (171)	$2\frac{3}{8}$ (60)
3 (80)	$7\frac{1}{4}$ (184)	$2\frac{3}{4}$ (70)
4 (100)	8 (203)	$3\frac{1}{2}$ (89)
5 (125)	9 (229)	$3\frac{1}{2}$ (89)
6 (150)	$9\frac{7}{8}$ (251)	4 (102)
8 (200)	$10\frac{1}{2}$ (267)	$6\frac{1}{4}$ (159)
10 (250)	$12\frac{1}{2}$ (318)	6 (152)
12 (300)	14 (356)	$8\frac{1}{2}$ (216)



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



TYPE ED210 REGULATOR

VALVE INFO
PAGE 28

PILOT INFO
PAGE 72

TYPE ED210 ELECTRONIC
MODULATING REGULATOR



TYPE ED208D

PRESSURE REGULATOR

ELECTRONIC STARTUP PILOT OPERATED

DELIVERY PRESSURES to 150 PSIG

APPLICATION DATA

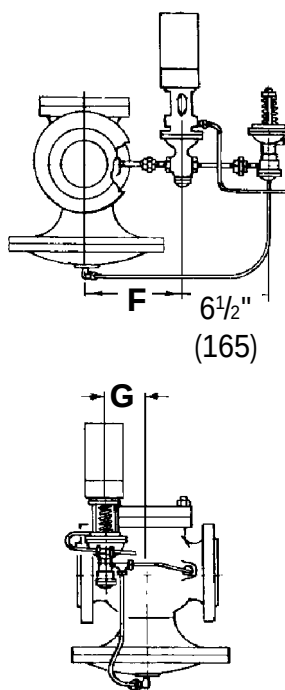
- Electronic Control of Slow Startup and/or Slow Shutdown of Pressure Regulation
- Building Heating Systems
- Can save more than 4 times it's cost in building heating in one year.
- Requires balanced Main Valve

TYPE ED208D PRESSURE REGULATOR

VALVE INFO
PAGE 28

D PILOT INFO
PAGE 48

D208 PILOT
INFO
PAGE 70



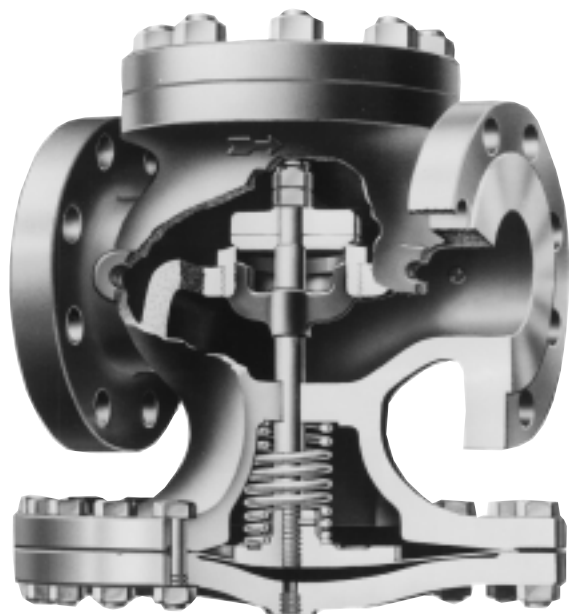
Valve is tapped so that Pilot may be mounted on either side.

DIMENSIONS

inches (mm)

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

MAIN VALVES



TYPE E 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

SIZING INFO
PAGE 108

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 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.
Canadian Registration # OC 0591.9C

Installation Tip: Add EZ Connections for ease of maintenance
SEE PAGE 42

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
- Multiple Trims for Precise Sizing
- 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 ΔP 10 psi (.7 bar)
- Lifetime Warranty against Wire Drawing of Seat & Disc*

OPTIONS

- Composition Disc
- Balanced Construction
- Insulcap Insulating Jacket
- High Temperature Construction
- Low ΔP (LP) Main Spring
- Parabolic Disc
- Integral Mount Pilot
- Secoweld
- Dashpot
- EZ Connections

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

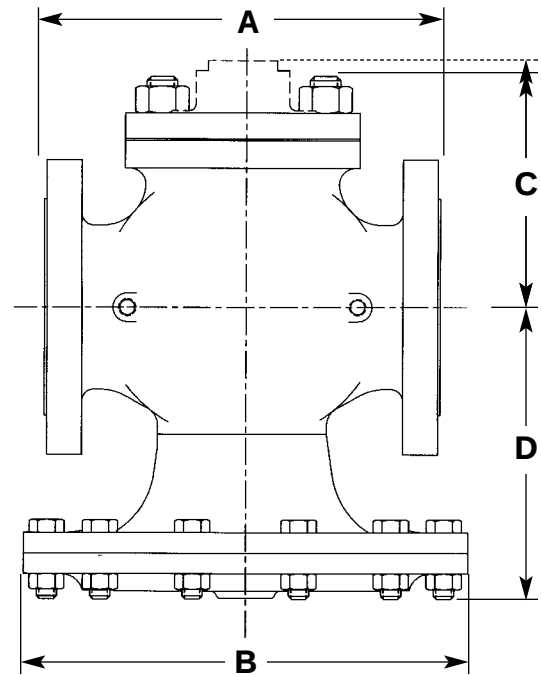
TYPE E MAIN VALVE

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



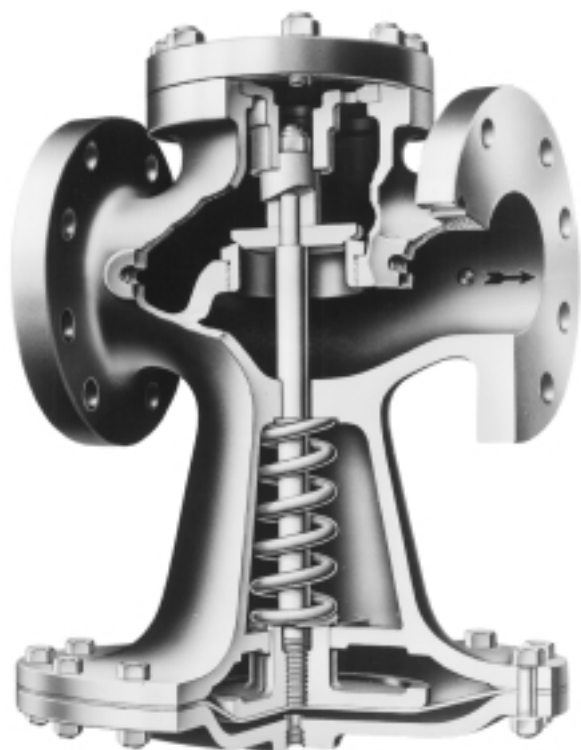
TYPE E MAIN VALVE

FITTINGS ON
PAGE 46

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

CAST IRON

B16.4 Class 250 NPT	15 (1.03)	250°F (121°C)
B16.1 Class 125 Flanged	15 (1.03)	250°F (121°C)

Canadian Registration # OC 0591.9C

Installation Tip: Add EZ Connections for ease of maintenance
SEE PAGE 42

SIZING INFO
PAGE 108

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 ΔP 3 psi (.2 bar)
- Lifetime Warranty against Wire Drawing of Seat & Disc *

OPTIONS See page 42

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

TYPICAL CONFIGURATIONS

PRESSURE REDUCING TYPE E2D
AIR ADJUSTED TYPE E2A SERIES
BACK PRESSURE TYPE E2Q
LOAD ALLOCATING TYPE E2FD
AIR CONTROLLED TYPE E2AP60
ELECTRONIC SLOW START TYPE E2D208D
SOLENOID CONTROLLED TYPE E2MD
SOLENOID ACTUATED TYPE E2M
DIFFERENTIAL TYPE E2N
TEMPERATURE CONTROL TYPE E2T14
TEMP. & PRESSURE CONTROL TYPE E2T134

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
70%-75%	—	8.8	13.2	19.2	30.8	47.6	67.2	100	141	178	—	—	—
45%	—	—	—	12.3	—	30.6	—	64.4	—	11.4	—	336	—

* When installed according to factory specifications.

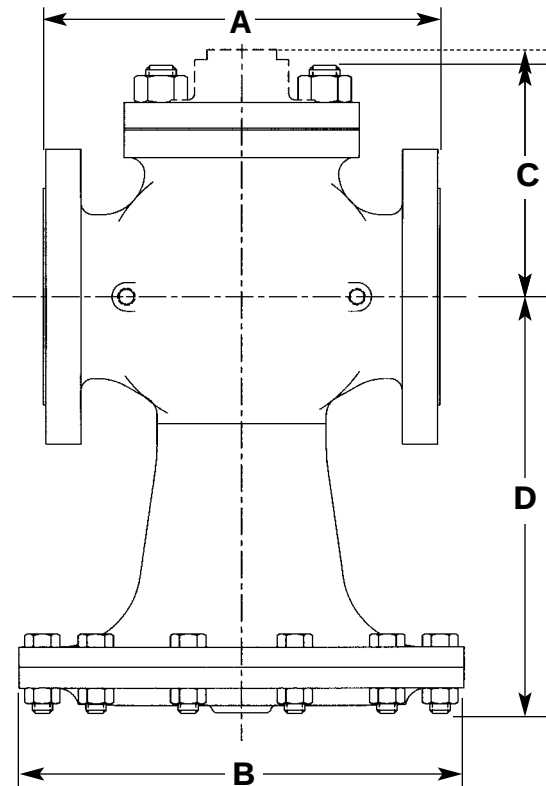
TYPE E2 MAIN VALVE

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 ON
PAGE 46

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

SIZE	A		OTHER DIMENSIONS				APPROX. WT.	
	Cl, BRZ ANSI NPT	CI ANSI 125	B	C		D*	Cl, 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

SIZING INFO
PAGE 108

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 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.

Canadian Registration # OC 0591.9C

Installation Tip: Add EZ Connections for ease of maintenance
SEE PAGE 42

TYPE E5 MAIN VALVE

HIGH PRESSURE-HIGH LIFT LOW DIFFERENTIAL

SIZES 3/4" – 12"

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
- Lifetime Warranty against Wiredrawing of Seat & Disc *

OPTIONS See page 42

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

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												
	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	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

* When installed according to factory specifications.

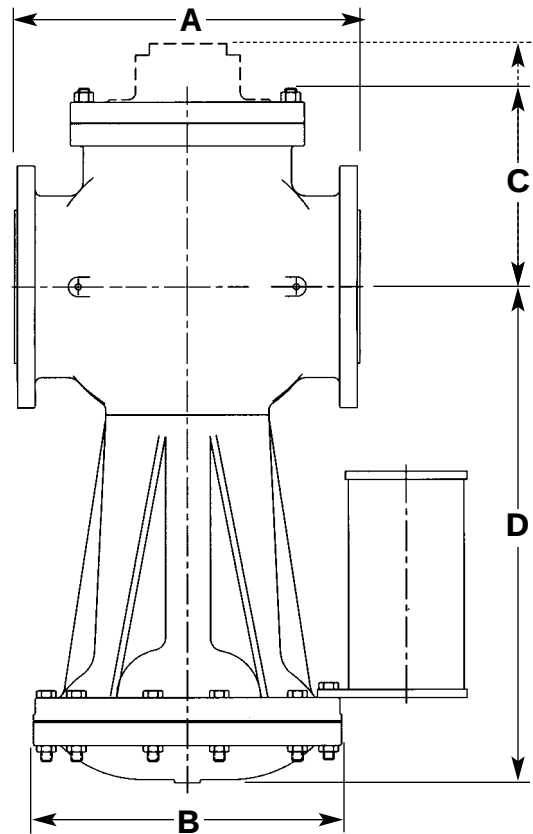
TYPE E5 MAIN VALVE

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 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

TYPE E5 MAIN VALVE

FITTINGS ON
PAGE 46

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A			B	C			D*		APPROX.WT				
	ANSI NPT	ANSI 125	ANSI 250		Std. Mount	Integral Mount				Iron,Brz. Stl.ANSI NPT	Iron		Steel	
						Cl	Stl.	ANSI 125	SCR 250		ANSI 125	ANSI 250	ANSI 150	ANSI 300
¾ (19)	4¾ (111)	— —	— —	6⅞ (175)	2⅞ (73)	3⅝ (92)	3½ (89)	11¼ (286)	11¼ (286)	23 (10)	— —	— —	— —	— —
1 (25)	5⅜ (137)	5½ (140)	6 (152)	6⅞ (175)	3⅝ (92)	4⅜ (111)	4⅜ (111)	11⅝ (295)	11⅝ (295)	24 (11)	30 (14)	33 (15)	35 (16)	39 (18)
1¼ (32)	6½ (165)	6¾ (171)	7¼ (184)	9⅞ (232)	4⅞ (105)	4 (102)	4⅝ (117)	13½ (343)	13½ (343)	49 (22)	46 (21)	49 (22)	58 (26)	63 (29)
1½ (38)	7¼ (184)	6⅞ (175)	7⅜ (187)	9⅞ (232)	4⅜ (111)	4½ (114)	5 (127)	13⅝ (346)	13⅝ (346)	53 (24)	58 (26)	68 (31)	67 (30)	74 (34)
2 (51)	7½ (191)	8½ (216)	9 (229)	11⅞ (283)	5¼ (133)	5 (127)	5⅝ (143)	16¼ (413)	16¼ (413)	84 (38)	90 (41)	97 (44)	113 (51)	120 (55)
2½ (64)	— —	9⅜ (238)	10 (254)	11⅞ (283)	5¾ (146)	5⅜ (137)	6 (152)	16½ (419)	16½ (419)	— —	97 (44)	112 (51)	130 (59)	135 (61)
3 (76)	— —	10 (254)	10¾ (273)	13½ (343)	6⅞ (168)	6⅜ (162)	7 (178)	19¼ (489)	19¼ (489)	— —	148 (67)	170 (77)	210 (95)	226 (103)
4 (102)	— —	11⅞ (302)	12½ (318)	13½ (343)	7⅞ (194)	6⅝ (168)	8 (203)	18⅜ (467)	23⅜ (594)	— —	208 (95)	293 (133)	307 (139)	330 (150)
5 (127)	— —	13⅝ (346)	14½ (368)	13½ (343)	8½ (216)	7⅜ (187)	8¾ (222)	18¾ (476)	23¾ (603)	— —	240 (109)	333 (151)	335 (152)	366 (166)
6 (152)	— —	15⅞ (384)	16 (406)	16¾ (425)	10 (254)	7 (178)	— —	23½ (597)	27⅜ (695)	— —	348 (158)	616 (280)	560 (254)	503 (274)
8 (203)	— —	19 (483)	20 (508)	16¾ (425)	11½ (292)	9¼ (235)	— —	23¾ (603)	29⅝ (752)	— —	650 (295)	814 (370)	795 (361)	862 (392)
10 (254)	— —	23⅝ (600)	25 (635)	20 (508)	13¾ (349)	— —	— —	30¾ (781)	35⅜ (899)	— —	910 (414)	1130 (513)	1345 (611)	1420 (645)
12 (305)	— —	26½ (673)	28 (711)	24¾ (629)	15⅞ (403)	— —	— —	39¾ (1010)	39¾ (1010)	— —	1580 (718)	1920 (872)	1990 (904)	2160 (982)



TYPE E6 MAIN VALVE

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)

Other pressure/temperature ratings available; consult factory.

Canadian Registration # OC 0591.9C

Installation Tip: Add EZ Connections for ease of maintenance
SEE PAGE 42

SIZING INFO
PAGE 108

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

OPTIONS *See page 42*

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

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

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	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

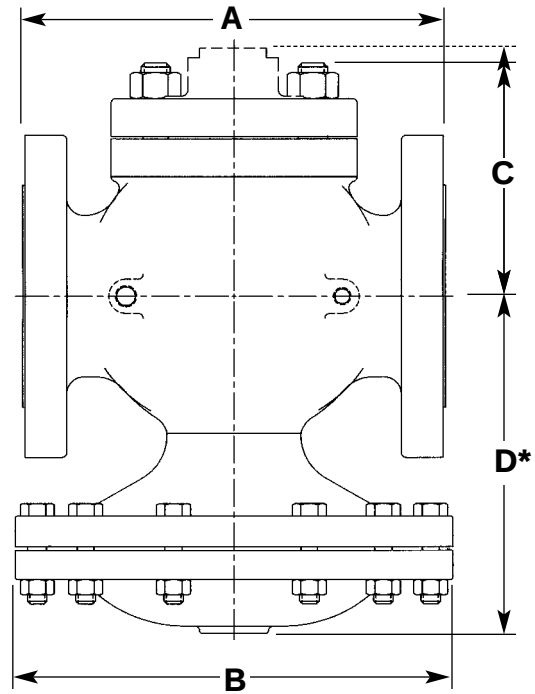
TYPE E6 MAIN VALVE

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



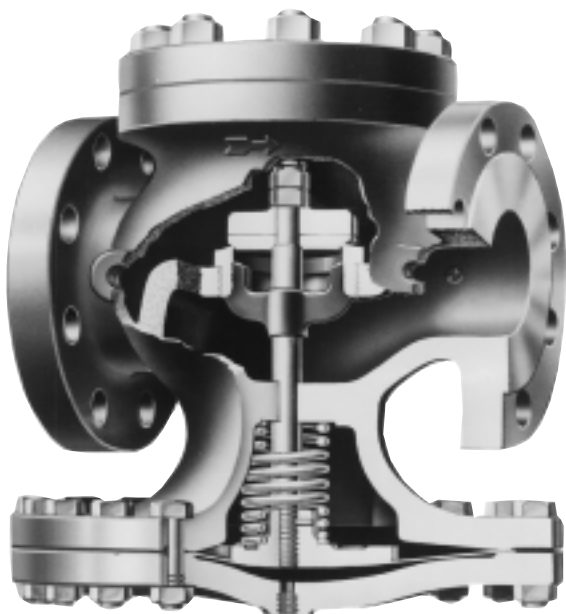
TYPE E6 MAIN VALVE

FITTINGS ON
PAGE 46

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 E8 MAIN VALVE

APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Regulating for Process Control (Temperature or Pressure)
- Maintain Back Pressure or Differential Pressure
- To use Air Load Pressure to Control Delivery Pressure
- Single Point or Multiple Use Applications
- Slow Start-up or Shutdown
- Use where "Dirty Steam" Conditions Exist

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)

Canadian Registration # OC 0591.9C

Installation Tip: Add EZ Connections for ease of maintenance
SEE PAGE 42

SIZING INFO
PAGE 108

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 E8 MAIN VALVE AIR LOADED

SIZES 3/8" – 12"

PRESSURES to 250 PSIG at 406°F

- Normally Closed
- Single Seat
- Balanced Metal Diaphragms
- ANSI/FCI 70-2 Class IV Shutoff
- No Minimum Operating Differential Pressure
- Packless Construction
- No Pilot Needed
- Maximum 50 PSI Air Delivery Pressure
- Permits Remote Operation and Control
- Economical Alternative to Control Valve

OPTIONS See page 42

- Composition Disc
- Parabolic Disc
- Balanced Construction
- Dashpot
- Insulcap Insulating Jacket
- EZ Connections

TYPICAL CONFIGURATIONS

PRESSURE REDUCING TYPE E8 65A

PRESSURE REDUCING TYPE E8 A PANEL

PRESSURE REDUCING TYPE E8 B PANEL

PRESSURE REDUCING TYPE E8EPC

TEMPERATURE CONTROL TYPE E8T61

TEMPERATURE CONTROL TYPE E8EPC

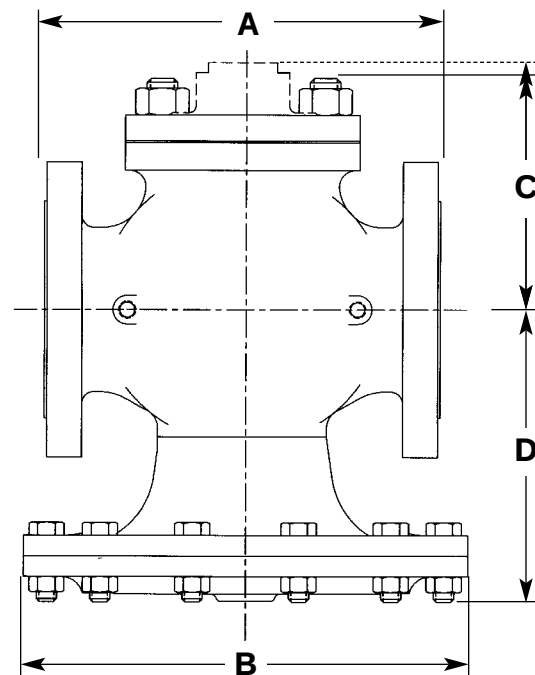
TYPE E8 MAIN VALVE

SPECIFICATION

The valve shall be air operated, 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
 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

TYPE E8
MAIN VALVE

FITTINGS ON
PAGE 46

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

SIZE	FACE TO FACE DIMENSIONS					OTHER DIMENSIONS					APPROX. WT.					
	A					B	C		D	E						
	ANSI NPT	ANSI 125,150	ANSI 250	ANSI 300	ANSI 600			ANSI 600			ANSI NPT	ANSI 125	ANSI 150	ANSI 250	ANSI 300	ANSI 600
3/8 (10)	4 3/8 (111)	—	—	—	—	5 7/8 (149)	2 3/4 (70)	—	5 1/4 (133)	7 3/8 (187)	14 (31)	—	—	—	—	—
1/2 (12)	4 3/8 (111)	—	—	—	6 (152)	5 7/8 (149)	2 3/4 (70)	2 3/4 (70)	5 1/4 (133)	7 3/8 (187)	14 (31)	—	—	—	—	20 (44)
3/4 (19)	4 3/8 (111)	—	—	—	6 3/8 (162)	6 1/2 (165)	2 7/8 (73)	3 7/8 (98)	5 1/2 (140)	7 7/8 (200)	18 (40)	—	—	—	—	28 (62)
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)	6 1/4 (159)	8 7/8 (225)	23 (51)	24 (53)	26 (57)	27 (59)	31 (68)	32 (70)
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)	6 1/2 (165)	9 1/8 (232)	33 (73)	36 (79)	37 (81)	40 (88)	41 (90)	45 (99)
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)	7 1/8 (181)	9 3/4 (248)	43 (95)	45 (99)	47 (103)	51 (112)	55 (121)	58 (128)
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)	7 5/8 (194)	11 1/4 (286)	62 (136)	67 (147)	73 (161)	72 (158)	78 (172)	83 (183)
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)	8 3/8 (213)	12 1/8 (308)	—	82 (180)	95 (209)	100 (220)	100 (220)	130 (286)
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)	9 1/4 (235)	14 5/8 (371)	—	110 (242)	125 (275)	130 (286)	140 (308)	175 (385)
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 7/8 (270)	11 7/8 (302)	18 1/4 (464)	—	200 (440)	210 (462)	235 (517)	230 (506)	310 (682)
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)	12 1/2 (318)	20 1/8 (511)	—	280 (616)	295 (649)	315 (693)	310 (682)	490 (1078)
6 (152)	—	15 1/8 (384)	16 (406)	16 (406)	17 3/8 (441)	19 3/4 (502)	10 (254)	13 3/4 (349)	14 1/8 (359)	22 3/8 (568)	—	385 (847)	420 (924)	455 (1001)	470 (1034)	655 (1441)
8 (203)	—	19 (483)	20 (508)	20 (508)	21 5/8 (549)	22 1/2 (572)	11 1/2 (292)	15 5/8 (391)	17 1/4 (438)	27 3/4 (705)	—	657 (1445)	700 (1540)	735 (1617)	710 (1562)	1070 (2354)
10 (254)	—	23 5/8 (600)	25 (635)	25 (635)	—	28 (711)	13 3/4 (349)	—	23 3/8 (594)	36 1/4 (921)	—	1260 (2772)	1240 (2728)	1430 (3146)	1300 (2860)	—
12 (305)	—	26 1/2 (673)	28 (711)	28 (711)	—	33 (838)	15 7/8 (403)	—	25 1/4 (641)	41 1/2 (1054)	—	2070 (4554)	2060 (4532)	2145 (4719)	2140 (4708)	—



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)

Canadian Registration # OC 0591.9C

Installation Tip: Add EZ Connections for ease of maintenance
SEE PAGE 42

SIZING INFO
PAGE 108

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

OPTIONS See page 42

- EZ Connections

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

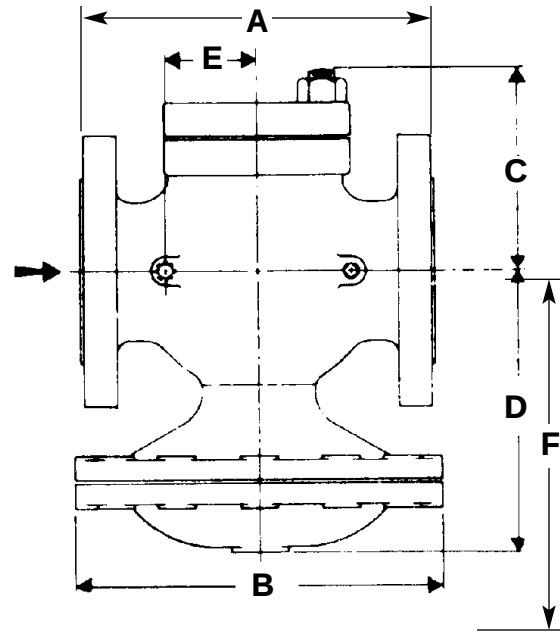
TYPE C34 MAIN VALVE

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 ON
PAGE 46

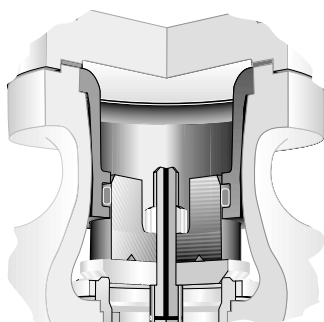
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	FACE TO FACE			OTHER DIMENSIONS						APPROX. WT.		
	ANSI NPT	ANSI 125	ANSI 250	B	C	D	E	F	G	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 3/8 (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)

NOTES:

MAIN VALVE ACCESSORIES

MAIN VALVE OPTIONS



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.

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.



EZ CONNECTIONS

Provides the performance of a flanged connection with the simplicity of a union connection. Unlike conventional unions, EZ Connections do not require matched sets or springing pipe to clear cone tolerances and do not leak after just a few disassembly/reassembly cycles. Uniform end to end dimensions simplify rough-in schematics. Available on ½" through 2" threaded main valves in NPT, socketweld and threaded by socketweld connections.

See Uniflex Couplings on page 374

CONDENSATION CHAMBER

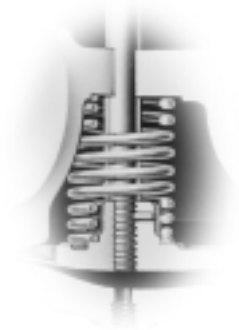
A Condensation Chamber is standard on the Type E5 Main Valve. A Condensation Chamber is standard on the Type E Main Valve when steam temperatures exceed 600°F. Any Main Valve discharging steam into a vacuum should include a Condensation Chamber.



MAIN VALVE OPTIONS

LOW DIFFERENTIAL PRESSURE (LP) MAIN SPRING

The E Series Main Valves provide superior regulation in a broad range of applications by utilizing a specialized Main Spring. When differential pressures between 10-50 psi are desired, E Main Valves should be equipped with the optional LP Main Spring. The LP Main Spring alone will achieve differential pressures to 15 psi. In order to attain differential pressures to 10 psi, optional 5B Open Elbow and $\frac{1}{8}$ " 4A Bleedport are required.

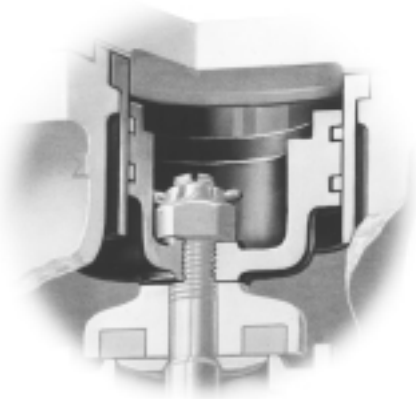
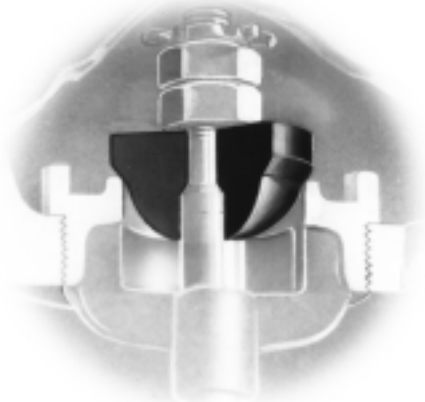


COMPOSITION DISC

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 and is available on Full and Normal seats and Parabolic valve plugs. The Composition Disc is suitable for pressures to 200 psi and temperatures to 200°F.

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.



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.



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 (50)	14 ¹ / ₂ (368)	21 (533)	2.6 (1.2)
2 Flanged (50)	17 ¹ / ₂ (444)	26 ¹ / ₂ (623)	2.7 (1.2)
2 ¹ / ₂ (65)	18 ¹ / ₂ (470)	31 (787)	4.6 (2.1)
3 (80)	19 ¹ / ₂ (495)	35 (889)	4.65 (2.1)
4 (100)	19 ¹ / ₂ (495)	37 (940)	6.15 (2.7)
6 (150)	22 ¹ / ₂ (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" (50)	24.45	157
2.5" (65)	27.51	182
3" (80)	30.57	168
4" (100)	36.68	165
6" (150)	51.96	171

TYPES A & B PANELS

- Gauges indicate Air Loading, Air Supply and/or Delivery Pressures
- Integral Filter Conditions Dirty Shop Air
- 50 PSI Delivery Pressure
- Accurate Delivery Pressure over Wide Range of Flow

OPTIONS

- HIGH DELIVERY PRESSURE

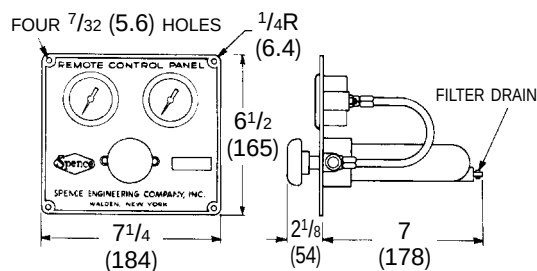
MODELS

- **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.

TYPICAL CONFIGURATIONS

For use with:

- EA
- Positioners
- Any Controller Requiring Conditioned Pneumatic Signal
- E8
- EPC



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



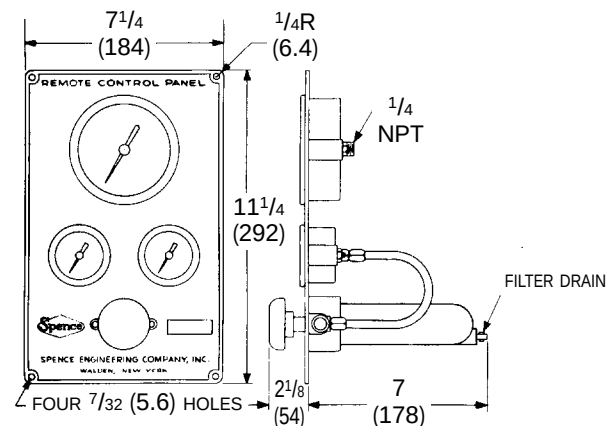
TYPE B PANEL

APPLICATION DATA

- To display Air Loading, Air Supply and/or Delivery Pressure
- To Remotely Adjust Air Pilots
- To Reduce Plant Air Pressure to Instrument Air Pressure for Signaling Regulators and Control Valves
- To Filter Plant Air to Instrument Air Quality

SPECIFICATION

Air Adjustment Panel shall provide remote control for air actuated regulators and control valves. It shall convert plant air to instrument quality air and provide 0 to 50 psi delivery pressure. The Panel shall have a flow capacity of 22 scfm. Panel shall have gauges indicating air load pressure and air supply pressure with option of process delivery pressure gauge.



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

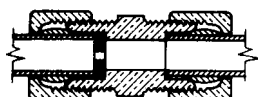
AUXILIARY FITTINGS

BLEEDPORTS

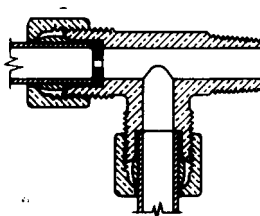
For steam, air and gas service, a 3/32" bleedport orifice is used for main valve sizes up to 8". For 10" and 12" main valve sizes, a 1/8" bleedport orifice is used. If the initial pressure or pressure drop is less than 15 psig, the orifice is reduced to 1/16". For liquids: fuel oil utilizes a 3/32" bleedport 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



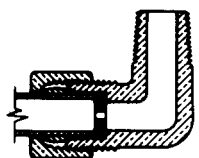
1A UNION
BLEEDPORT



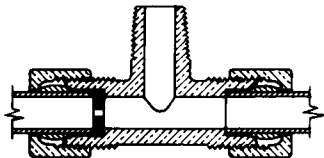
8A BLEEDPORT
TEE

RESTRICTIONS

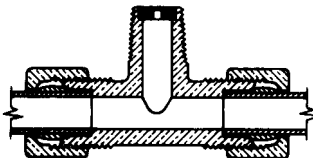
Spare restriction fittings can be supplied blank and drilled for a particular main valve according to the table. If the initial pressure or pressure drop is less than 15 psi, an open fitting is used. All back pressure valves employ an open fitting. For liquid services (except back pressure) the restriction orifice is 1/16" for all sizes of main valves.



5A RESTRICTION
ELBOW



7A SAFETY PILOT
RESTRICTION TEE



7C ANTI-FREEZE
RESTRICTION TEE

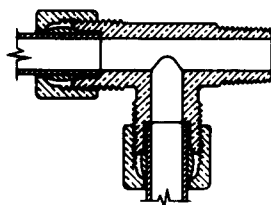
E MAIN VALVE RESTRICTION ORIFICES*

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

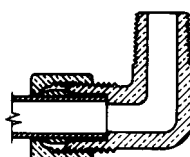
* Steam, Air & Gas.

If the initial pressure or pressure drop is less than 15 psi, a No. 5A elbow with orifice removed is used

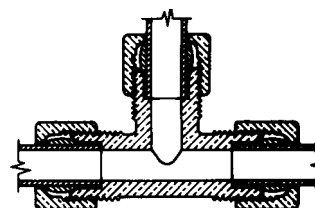
OPEN FITTINGS



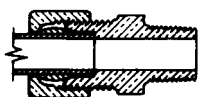
8B TEE



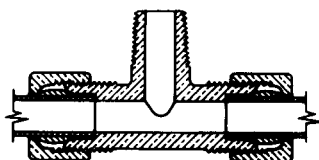
5B ELBOW



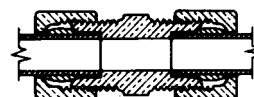
9B TUBING TEE



4B COUPLING

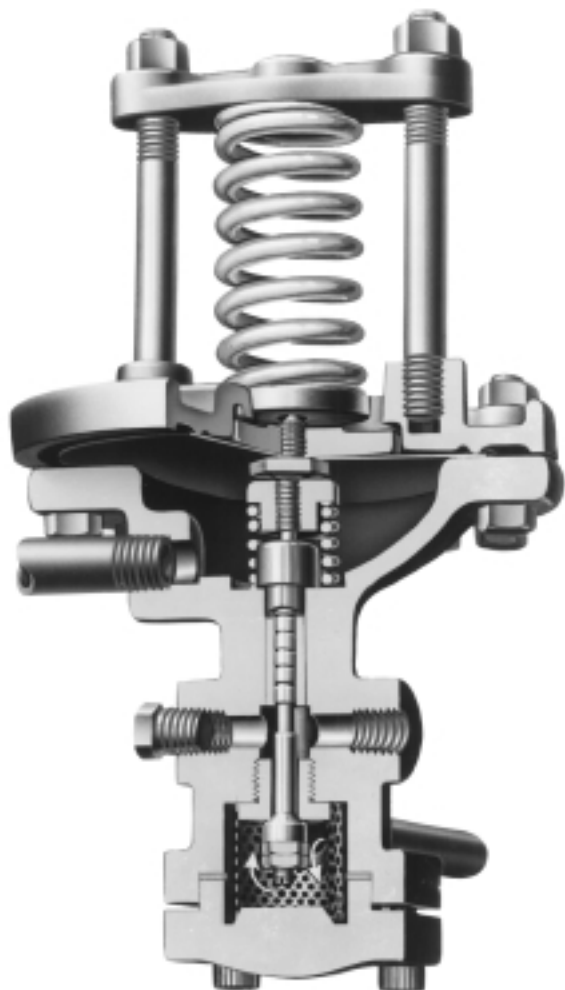


7B TEE



1B UNION

PILOTS



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

SIZING INFO
PAGE 117

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)

TYPE D	TYPE D2	TYPE D5	TYPE D120
3-20 [†]	100-300	1-10	5-25
5-50 [†]		5-25	10-75
10-100			40-150
20-150			

[†]With Vacuum Spring Assembly, minimum range is 30 inches Hg; maximum is reduced by 15 PSIG.

Canadian Registration # OC 0591.9C

TYPE D PRESSURE REDUCING PILOT

CONTROLS 3 to 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 ± 1 psi control of delivery pressures between 3 and 150 psi.
- **TYPE D2** for 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
- Composition Disc
- Vacuum Spring Assembly
- Adjusting Handwheel
- Integral Mount Body

TYPICAL CONFIGURATIONS

PRESSURE REDUCING TYPE ED

PRESSURE REDUCING TYPE E2D

PRESSURE REDUCING TYPE E5D

PRESSURE REDUCING TYPE E6D

WATER PRESSURE REDUCING.....TYPE C34D

TEMPERATURE & PRESSURE TYPE ET14D

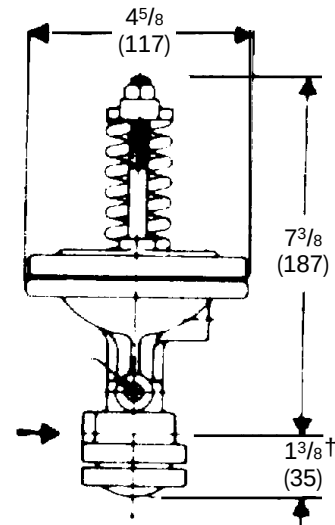
TYPE D PRESSURE REDUCING PILOT

SPECIFICATION

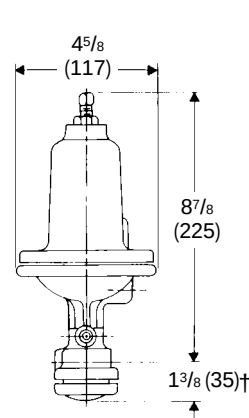
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves.

MATERIALS OF CONSTRUCTION

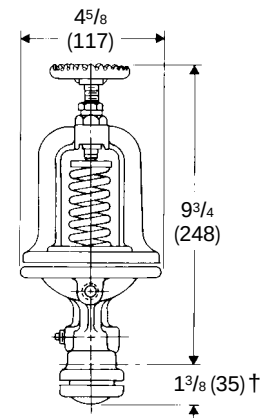
Body, Cast Iron	ASTM A126 CI B
Body, Cast Steel	ASTM A216 GR. WCB
Stem	303 St. Stl. ASTM A582 COND A
Disc	440 St. Stl. ASTM A276-75 COND A
Seat	420 St. Stl. ASTM A276 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Inconel



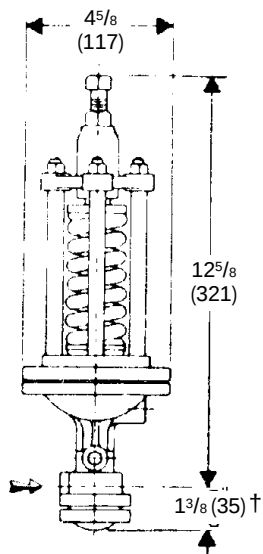
STANDARD D PILOT
7 LBS.
(3.2 KG)



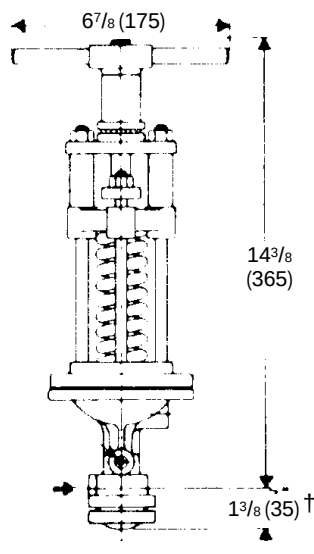
D SPRING CHAMBER
8 LBS. (3.6 KG)



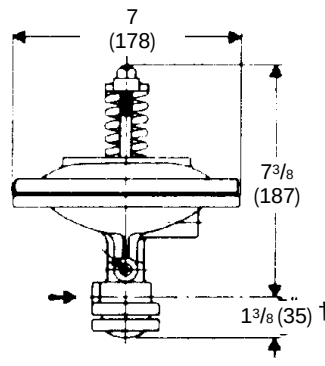
**D ADJUSTING
HANDWHEEL**
9 LBS. (4.1 KG)



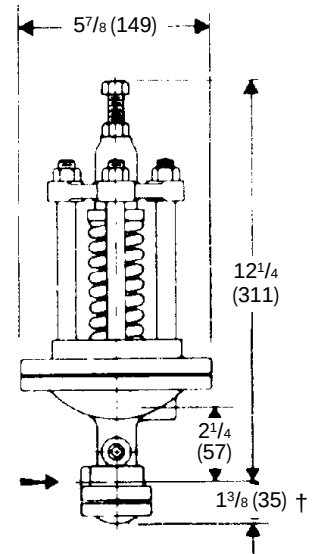
TYPE D2
10 LBS.
(4.5 KG)



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

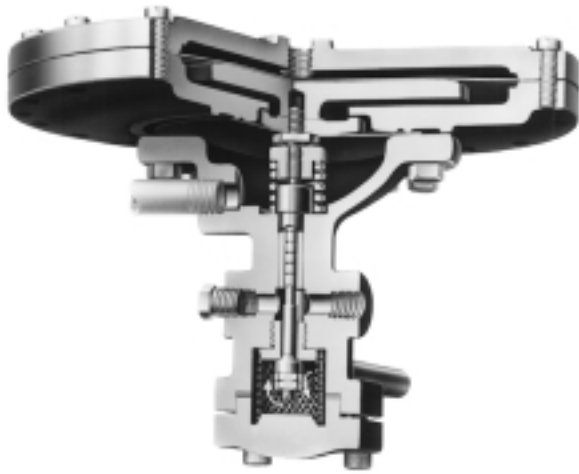


TYPE D5
14 LBS.
(6.4 KG)

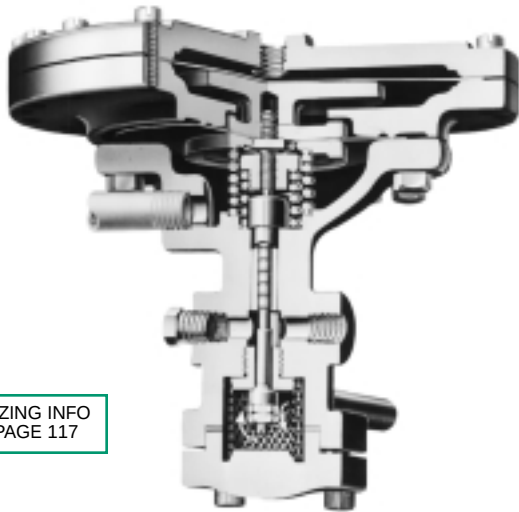


TYPE D120
16 LBS.
(7.3 KG)

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



TYPE A73 AIR ADJUSTED PILOT



SIZING INFO
PAGE 117

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 Steel	600 (41.4) @	750 (400)

TYPICAL CONFIGURATIONS

PRESSURE REDUCING TYPE EA
PRESSURE REDUCING TYPE E2A
PRESSURE REDUCING TYPE E5A
PRESSURE REDUCING TYPE E6A
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 ± 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
- Air Filter Regulator/Gauges

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 1/2 to 1 psi.
- **TYPE A43 & A54** for pressure control at medium to high pressures. Delivery to loading pressure is 2% to 1 psi.
- **TYPE A53** for pressure control at medium pressures. Delivery to loading pressure is 4 to 1 psi.
- **TYPE A70 & A73** for pressure control at high delivery pressures when available loading air is at low pressure. Delivery to loading pressures are 15 and 6% (respectively) 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 3% to 1 psi.
- **TYPE A86** for pressure control at low pressures. Delivery to loading pressure is 1 to 1 1/6 psi.
- **TYPE A87** Vacuum for temperature, pressure and vacuum control. Delivery to loading pressure is 8% to 1 psi.

Canadian Registration # OC 0591.9C

*Ranges are approximate.

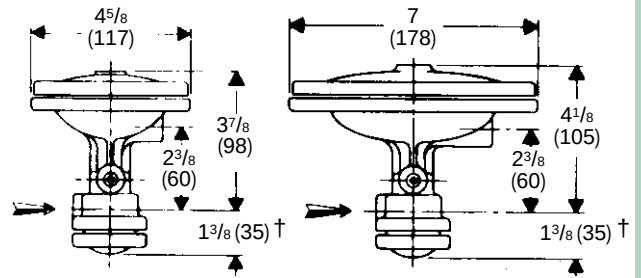
TYPE A AIR ADJUSTED PILOT

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.

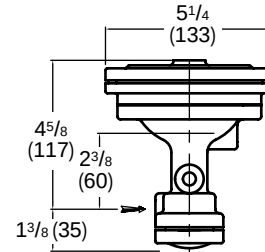
MATERIALS OF CONSTRUCTION

Body, Cast Iron		ASTM A126 CI B
Body, Cast 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

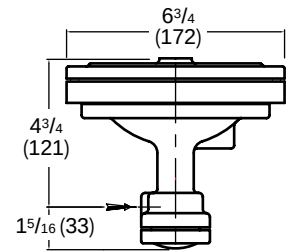


Type A or A83
6 lbs (2.7 kg)

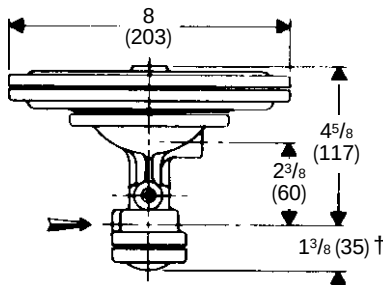
Type A82
11 lbs (5 kg)



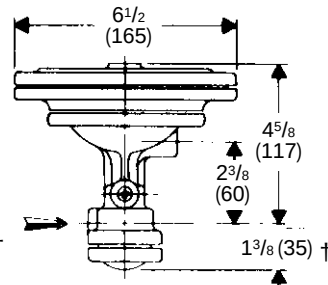
Type A43
11 lbs (5 kg)



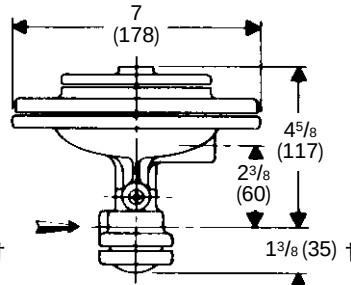
Type A54
19 lbs (8.6 kg)



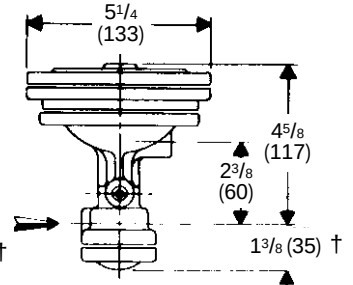
Type A73 or A70
15 lbs (6.8 kg)



Type A53 or A 85
12 lbs (5.5 kg)



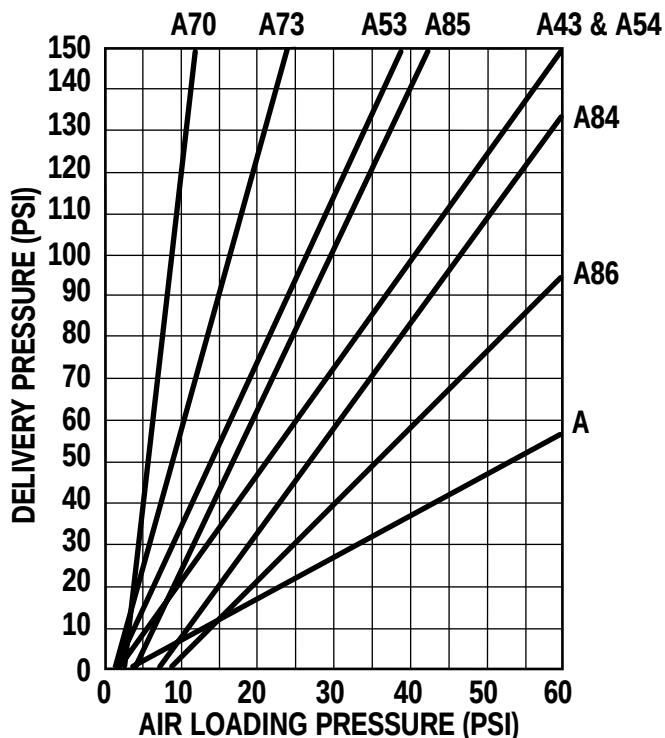
Type A35
14 lbs (6.4 kg)



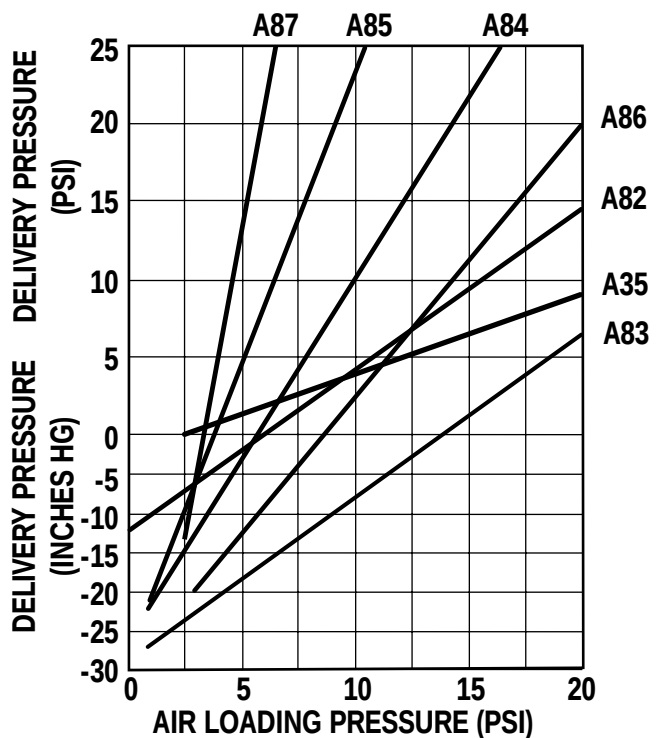
Type A84 or A86
11 lbs (5 kg)

†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

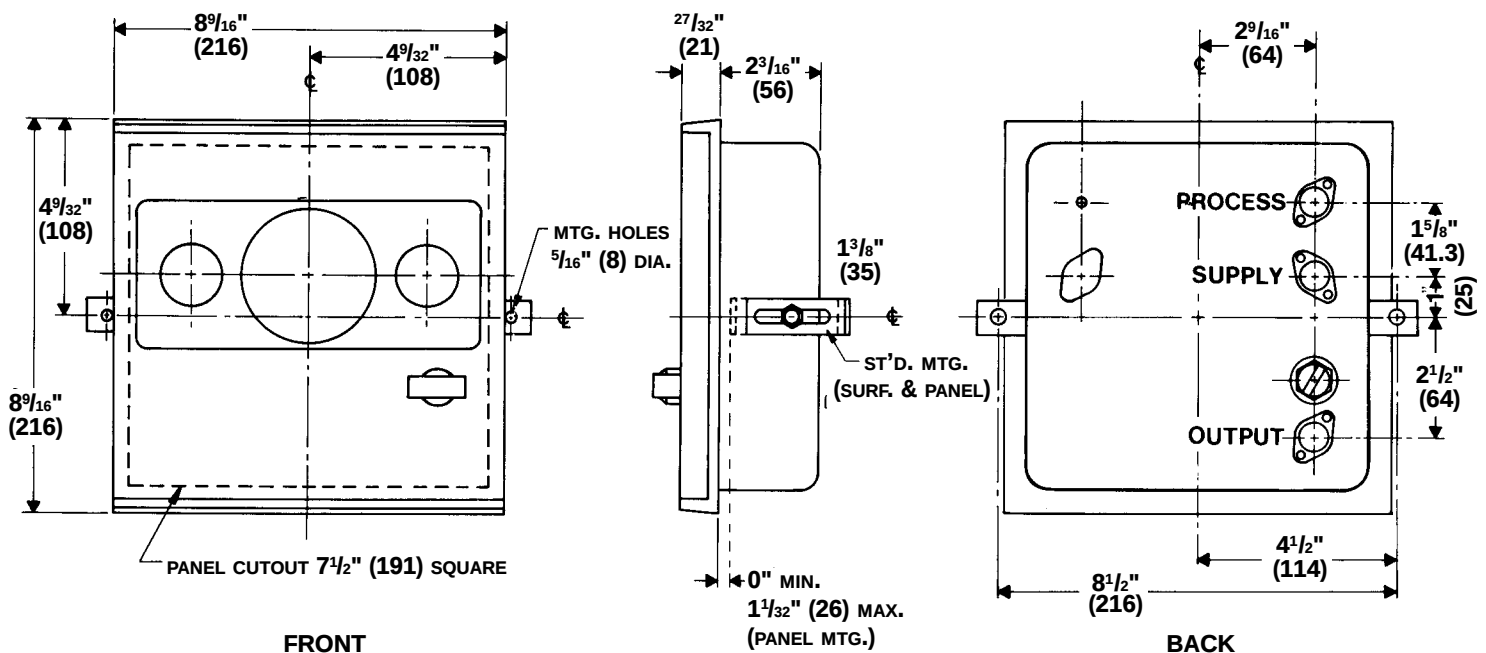
SPECIFICATION

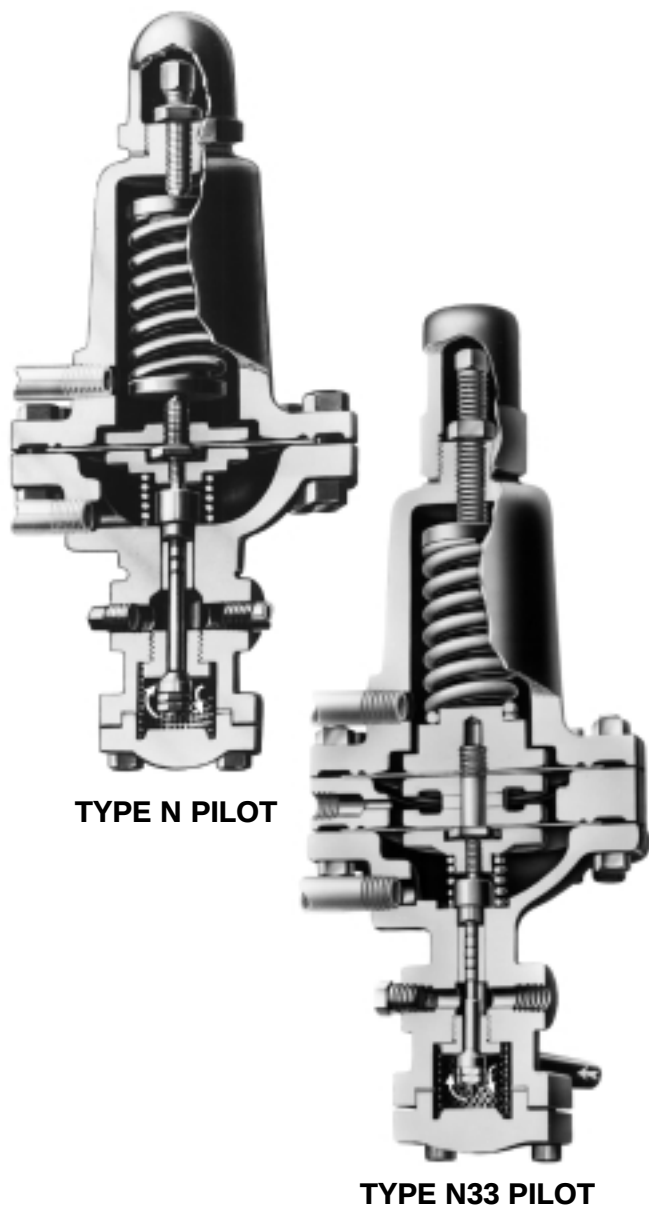
The pressure controller shall be of the indicating type. It shall be non-bleeding with high capacity, capable of fast response. It shall be equipped with 0-30 psig supply and loading gages, a 3-1/2" dial with control and set point indicators and shall have a 2-200% adjustable proportional band. Control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

TYPE P60
CONTROLLER





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 Steel	600 (41.4) @	750 (400)

SPRING PRESSURE RANGES (PSIG)

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

Canadian Registration # OC 0591.9C

SIZING INFO
PAGE 121

TYPE N DIFFERENTIAL PRESSURE PILOT

CONTROLS 3 to 150 PSIG

- Self Contained
- Spring Operated
- Normally Closed
- Packless Construction
- Accurate to ± 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

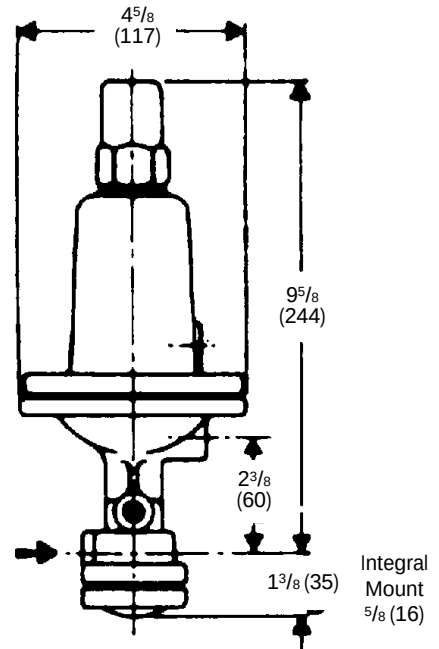
TYPE N DIFFERENTIAL PRESSURE PILOT

SPECIFICATION

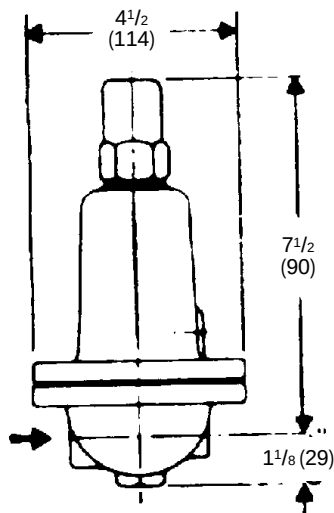
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall have packless construction. The Pilot shall be interchangeable on all sizes of main valves.

MATERIALS OF CONSTRUCTION

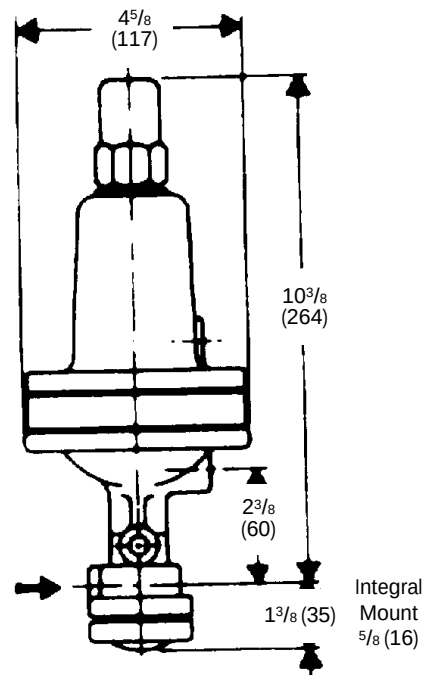
Body, Cast Iron	ASTM A126 CI B
Body, Cast Steel	ASTM A216 GR. WCB
Stem	303 St. Stl. ASTM A582 COND A
Disc	440 St. Stl. ASTM A276 COND A
Seat	420 St. Stl. ASTM A276 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Inconel



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

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 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

Canadian Registration # OC 0591.9C

SIZING INFO
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TYPE P PUMP GOVERNOR PILOT

CONTROLS 3 to 2000 PSIG

- Self Contained
- Spring Operated
- Normally Open
- ANSI/FCI 70-2 Class IV Shutoff
- Packless Construction
- Accurate to ± 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

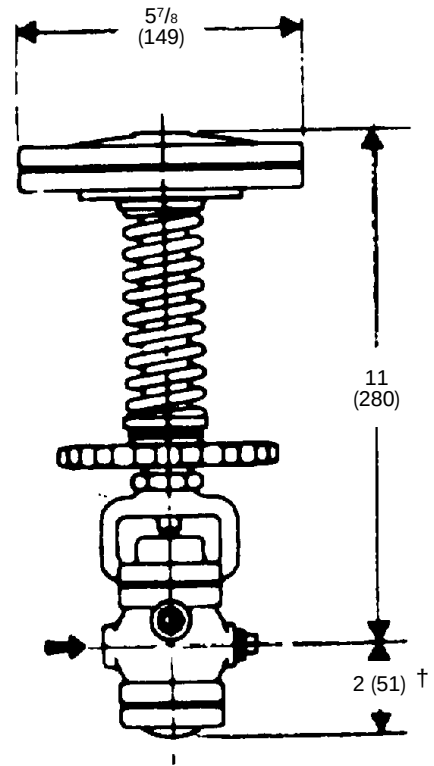
TYPE P PUMP GOVERNOR PILOT

SPECIFICATION

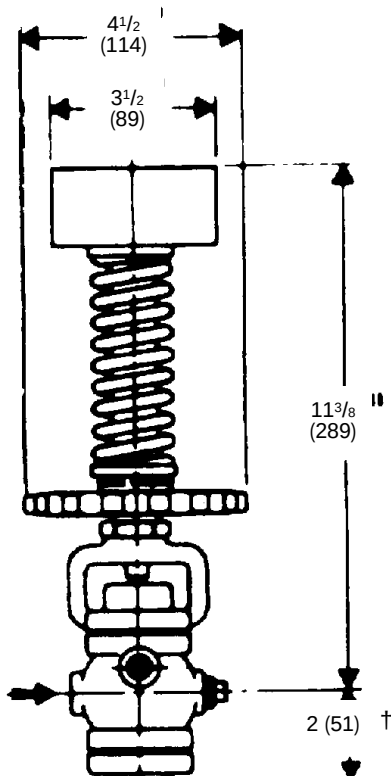
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves. The pilot shall automatically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

MATERIALS OF CONSTRUCTION

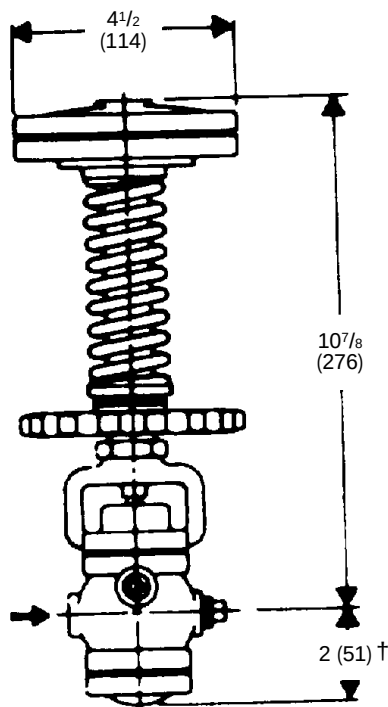
Body, Cast Iron	ASTM A126 CI B
Body, Cast Bronze	ASTM B61 UNS C92200
Body, Cast Steel	ASTM A216 GR. WCB
Stem	2024-T4 ASTM B211-75
Disc	440 St. St. ASTM A276-75 COND A
Seat	420 St. Stl ASTM A276 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Steel ASTM A231



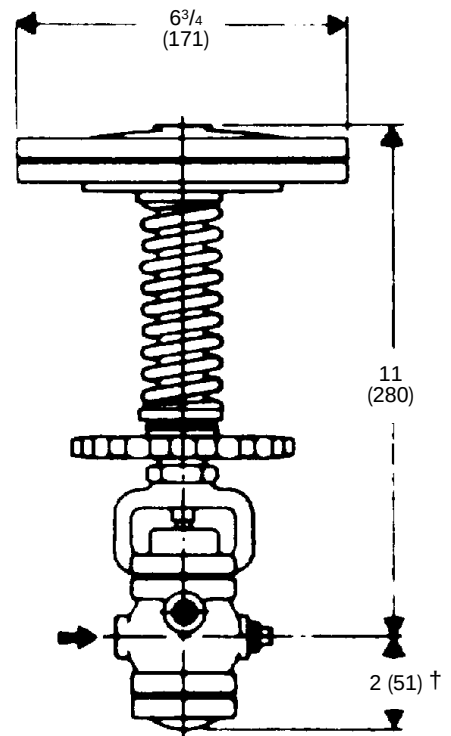
TYPE P14 PILOT
13 LBS.
(5.9 KG)



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 PILOT

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

Canadian Registration # OC 0591.9C

SIZING INFO
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TYPE F46 VACUUM PUMP GOVERNOR PILOT

CONTROLS to -30" Hg

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

OPTIONS

- Adjustment Indicator
- Integral Mount

TYPICAL CONFIGURATIONS

VACUUM PUMP CONTROL TYPE EF
VACUUM PUMP CONTROL TYPE E2F
VACUUM PUMP CONTROL TYPE E5F

TYPE F46

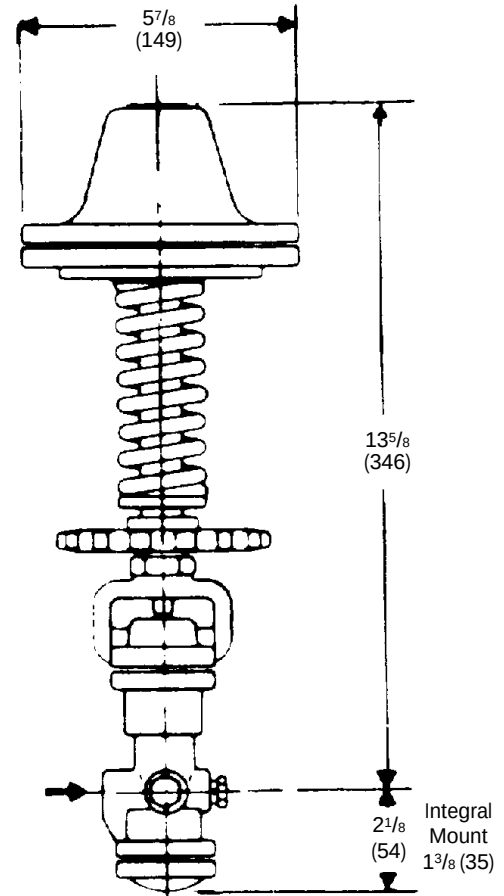
VACUUM PUMP GOVERNOR PILOT

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.

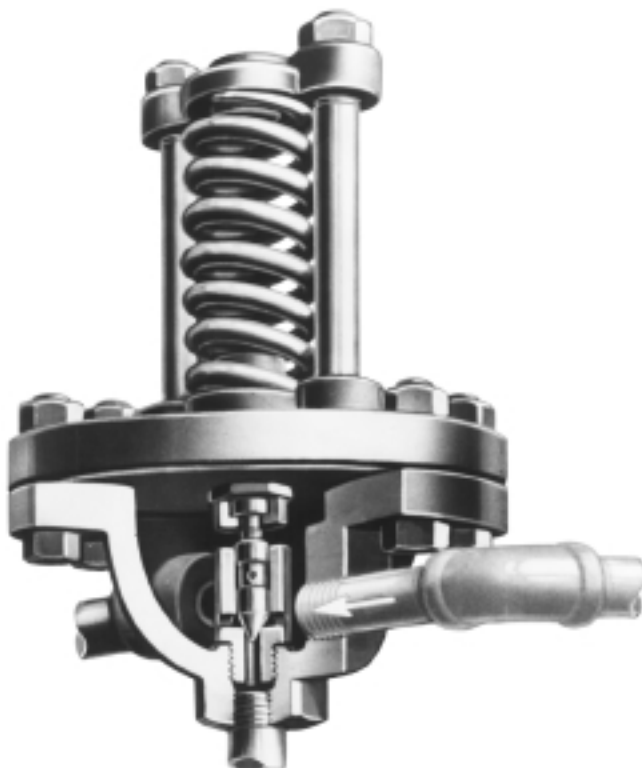
MATERIALS OF CONSTRUCTION

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. Stl ASTM A276 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Inconel



TYPE F46 PILOT
15 LBS.
(6.8 KG)

TYPE F46 VACUUM
PUMP GOVERNOR PILOT



TYPE Q 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 Steel	600 (41.4) @	750 (400)

SPRING PRESSURE RANGES (PSIG)

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

Canadian Registration # OC 0591.9C

TYPE Q BACK PRESSURE PILOT

CONTROLS 3 to 300 PSIG

- 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
- High Pressure

MODELS

- **TYPE Q** for ± 1 psig accuracy controlling back pressures between 3 and 150 psig.
- **TYPE Q2** for ± 2 psig accuracy controlling back pressures between 100 and 300 psig.
- **TYPE Q73** air adjusted for ± 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

SIZING INFO
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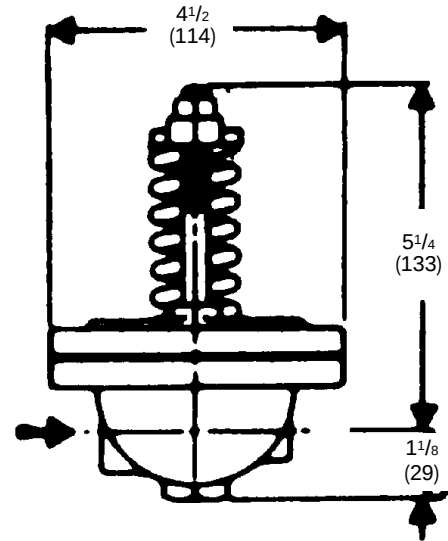
TYPE Q BACK PRESSURE PILOT

SPECIFICATION

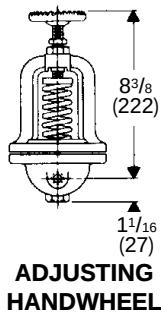
The Pilot shall be separate from the main valve and connected to it with a male union. The Pilot shall be normally closed design with packless construction. A strainer screen shall be built into the Pilot inlet. The Pilot shall be interchangeable on all sizes of main valves.

MATERIALS OF CONSTRUCTION

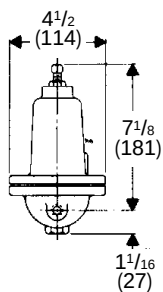
Body, Cast Iron	ASTM A126 CI B
Body, Cast Steel	ASTM A216 GR. WCB
Disc	440 St. St. ASTM A276-75 COND A
Seat	440 St. St. ASTM A276-75 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Steel



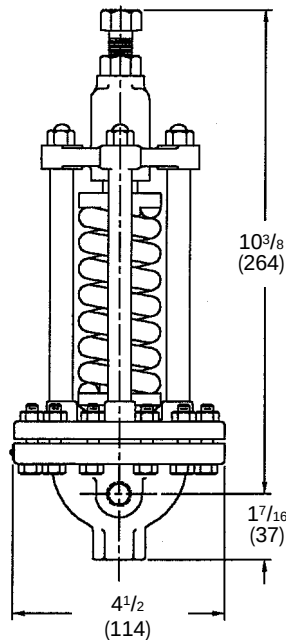
TYPE Q PILOT
7 LBS.
(3.2 KG)



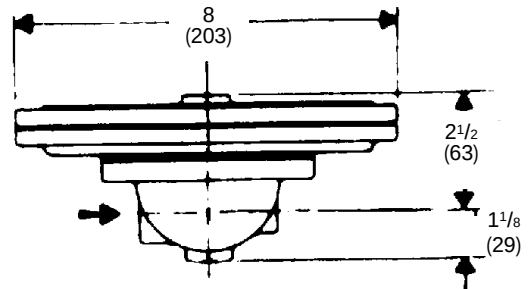
**ADJUSTING
HANDWHEEL**



SPRING CHAMBER



TYPE Q2 PILOT
10 LBS.
(4.5 KG)



TYPE Q73 PILOT
15 LBS.
(6.8 KG)



TYPE F32 PILOT

APPLICATION DATA

- Steam Backpressure Control
- Steam Backpressure Control with long control pipes
- Backpressure controlled by change in pressure of secondary fluid
- Backpressure control where a water leg on the pilot diaphragm cannot be avoided*

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)

TYPE F13	TYPE F14	TYPE F15	TYPE F32
100-300	3-30	2-10	200-450
	20-100	5-25	400-1200
	40-150		1000-2000

Canadian Registration # OC 0591.9C

TYPE F BACK PRESSURE PILOT

CONTROLS 2 to 2000 PSIG

- Self Contained
- Spring Operated
- Normally Closed
- ANSI/FCI 70-2 Class IV Shutoff
- Packless Construction
- Four Adjustable Spring Ranges
- Operates on remote/local pressure source
- Not Affected by Static Head
- Accurate Regulation Unaffected by Service Conditions

MODELS

- **TYPE F13** for ± 1 psi control of back pressure between 100 and 300 psi.
- **TYPE F14** for ± 2 psi control of back pressure between 100 and 300 psi.
- **TYPE F15** for $\pm 1/2$ psi control of back pressure between 2 and 25 psi.
- **TYPE F32** for ± 10 psi control of back pressure between 200 and 2000 psi.

OPTIONS

- Adjustment Indicator
- Integral Mount

TYPICAL CONFIGURATIONS

BACK PRESSURE CONTROL TYPE EF
 BACK PRESSURE CONTROL TYPE EF14D
 BACK PRESSURE CONTROL TYPE E2F
 BACK PRESSURE CONTROL TYPE E5F

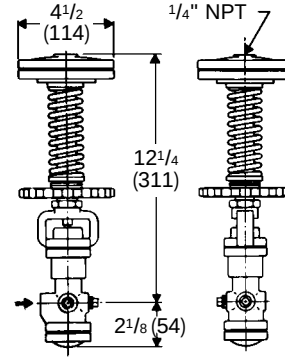
TYPE F BACK PRESSURE PILOT

SPECIFICATION

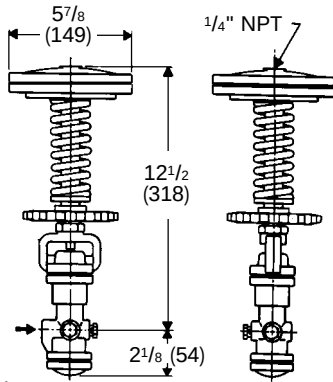
Pilot shall be separate from the main valve and connected to it with a male union. The pilot shall be normally closed design with packless construction. A strainer screen shall be built into the pilot inlet. The pilot shall be interchangeable on all sizes of main valves.

MATERIALS OF CONSTRUCTION

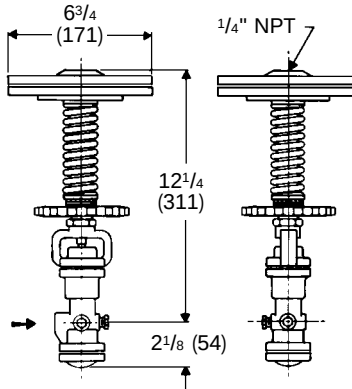
Body, Cast Iron	ASTM A126 CI B
Body, Cast Steel	ASTM A216 GR. WCB
Stem	2024-T4 ASTM B211-75
Disc	440 St. St. ASTM A276-75 COND A
Seat	420 St. Stl ASTM A276 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Steel ASTM A231



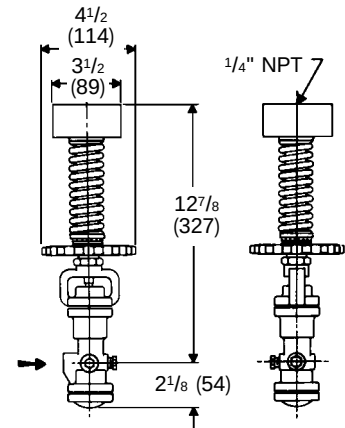
TYPE F13 PILOT
12 LBS. (5.5 KG)



TYPE F14 PILOT
14 LBS. (6.4 KG)



TYPE F15 PILOT
15 LBS. (6.8 KG)



TYPE F32 PILOT
12 LBS. (5.5 KG)



TYPE P125 TRIP STOP PILOT

TYPE P125 TRIP STOP PILOT

SHUTOFF 5 to 175 PSI

- Self Contained
- Spring Operated
- Normally Closed
- Packless Construction
- Easy In-line Maintenance
- Quickly shuts off steam flow in the event of an over pressure condition
- Factory preset and tested for desired trip set point
- Trip setting unaffected by service conditions
- Manual reset feature keeps system safely shut down until control is regained

APPLICATION DATA

- Safety Shutoff For Over Pressure Conditions
- May Be Used When Conditions Disallow Use of SRV

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

5-25	10-50
40-150	150-175

Canadian Registration # OC 0591.9C

TYPICAL CONFIGURATIONS

OVER PRESSURE SHUTDOWN	EP125
OVER PRESSURE SHUTDOWN	ESP125
OVER PRESSURE SHUTDOWN	E2P125

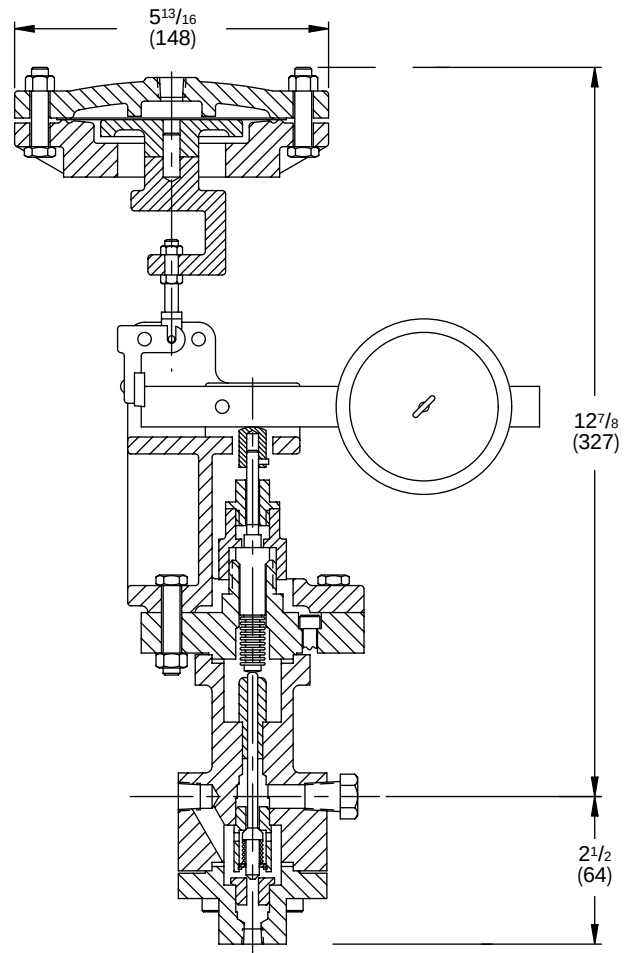
TYPE P125 TRIP STOP PILOT

SPECIFICATION

The Trip Stop 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 trip stop pilot shall maintain a Spence main valve in the open position while system pressure remains below set pressure. The pilot shall trip in the event of system overpressure, shutting main valve. Pilot shall be manually resettable and maintain safe shut off until reset.

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	304 St. Stl. ASTM 276 Cond. A
Gasket	Non-asbestos



TYPE P125 PILOT

TYPE P125 TRIP STOP PILOT
CAST IRON 26 LBS. (12 KG)
CAST STEEL 28 LBS. (13 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 EDSP/T

PRESSURE REDUCING TYPE E5DSP/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) @	400 (204)
Cast Steel	600 (41.4) @	750 (400)

SPRING PRESSURE RANGES (PSIG)

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

Canadian Registration # OC 0591.9C

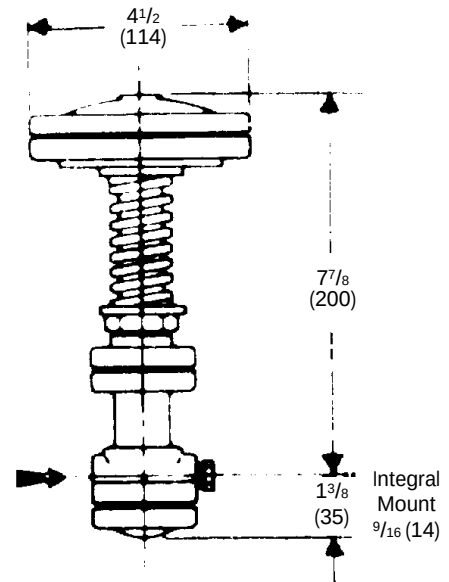
TYPE SP/P PRESSURE SAFETY PILOT

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 SP/P PRESSURE
SAFETY PILOT**



TYPE M SOLENOID PILOT

APPLICATION DATA

- Remote Electronic Shutoff of Regulators

RATINGS (Maximum Inlet Conditions)

Model	Pressure PSIG (bar)	Temperature °F (°C)
M24, M25	250 (17.2) @	200 (93)
M26, M27	125 (8.6) @	180 (82)
M32LP, M33, M34LP, M35LP	125 (8.6) @	363 (178)
M32HP, M33HP, M34HP, M35HP	250 (17.2) @	406 (208)

Canadian Registration # OC 0591.9C

TYPE M SOLENOID PILOT

CONTROLS to 250 PSI

- **Fast Acting for Quick Response**
- **Available Normally Open or Normally Closed**

MODELS*

- **TYPE M24** 3-way normally open for cold fluids in straight solenoid valve applications
- **TYPE M25** 3-way normally closed for cold fluids in straight solenoid valve applications
- **TYPE M26** 2-way normally open for cold fluids in multiple pilot arrangements
- **TYPE M27** 2-way normally closed for cold fluids in multiple pilot arrangements
- **TYPE M32** 2-way normally open for steam or other hot fluid services in multiple pilot arrangements
- **TYPE M33** 2-way normally closed for steam or other hot fluid services in multiple pilot arrangements
- **TYPE M34** 3-way normally open for steam or other hot fluid services in straight solenoid valve applications
- **TYPE M35** 3-way normally closed for steam or other hot fluid services in straight solenoid valve applications

* For M32, M33, M34, M35 Pilots, add LP suffix for low pressure and HP suffix for high pressure

TYPICAL CONFIGURATIONS

PRESSURE REDUCING EMD
TEMPERATURE REGULATING EMT14
TEMPERATURE & PRESSURE EMT134
TEMPERATURE & PRESSURE EMT14D
DIFFERENTIAL PRESSURE REDUCING ...E5M33N33

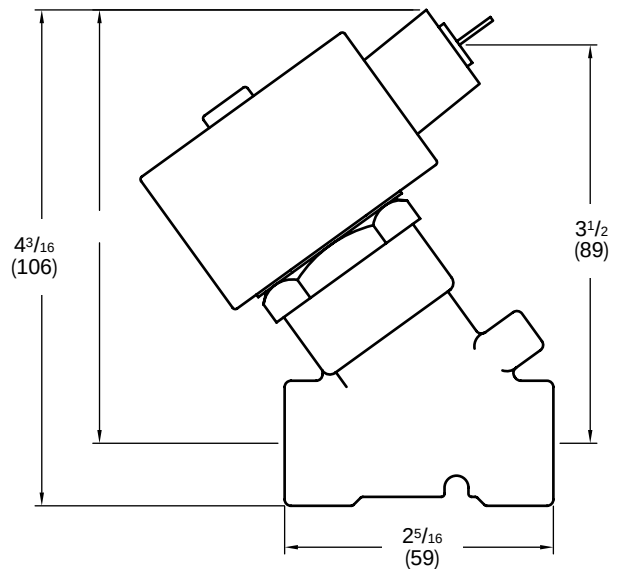
TYPE M SOLENOID PILOT

SPECIFICATION

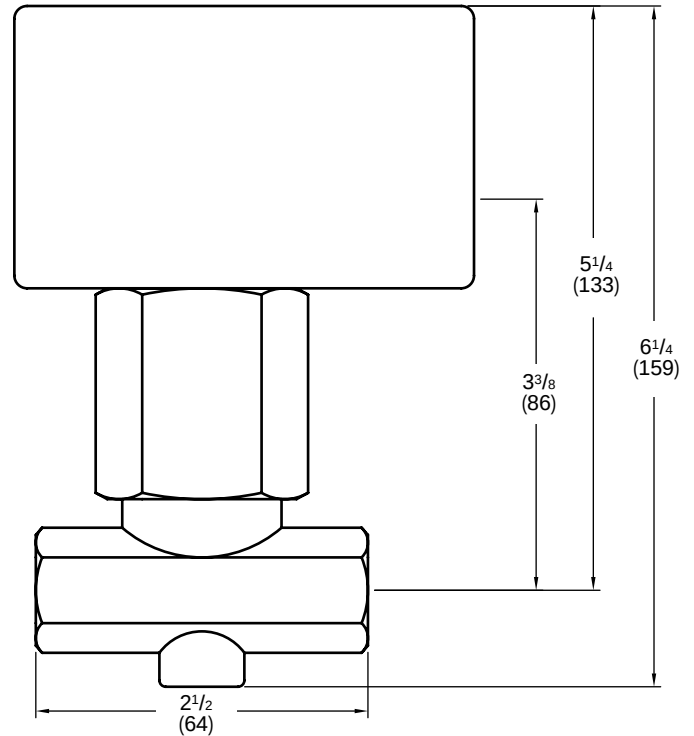
The actuator pilot shall open or close the controlled system via an external control signal. Actuator pilot shall be available in both fail open or fail closed upon loss of signal. Actuator pilot shall mount outside the main valve and provide remote on/off operation for a wide range of control variables.

MATERIALS OF CONSTRUCTION

Head	Epoxy Coated aluminum (NEMA1)
.....	Polypropylene (NEMA 4)
Body	Brass
Internal Core Assembly	Ferrous & Brass
Bonnet Gasket	EPDM



TYPE M33 SOLENOID PILOT 125#
3 LBS. (1.4 KG)



TYPE M33 SOLENOID PILOT 250#
6 LBS. (2.7 KG)

TYPE M PILOT



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 only

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

Canadian Registration # OC 0591.9C

*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

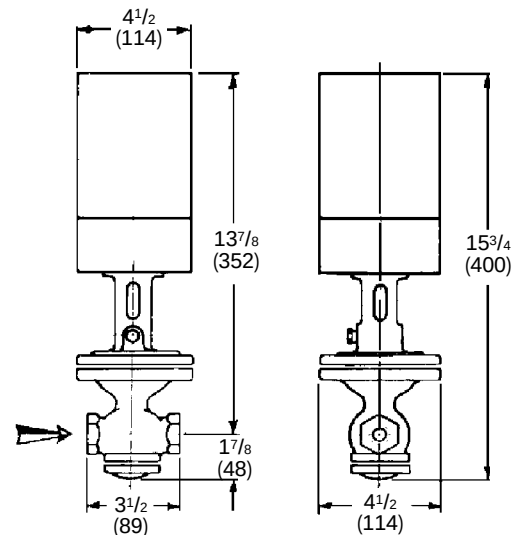
SPECIFICATION

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.

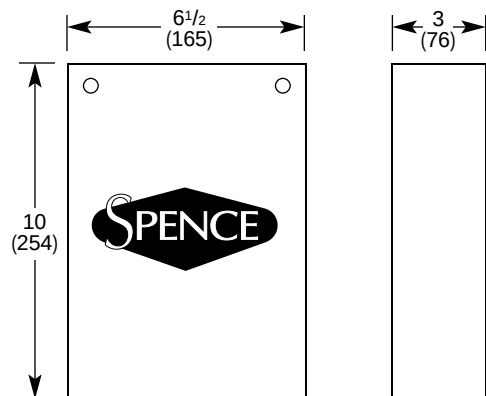
The Actuator Pilot shall be controlled by a totally solid state Electronic Time Controller which shall incrementally open and/or close the Actuator Pilot with 320 pulses in periods from 1-1/2, 2-1/2, 3, 6 - 96 minutes and shall be field adjustable in multiples of 6 minutes.

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 D208
ACTUATOR PILOT



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)
- For use with Balanced Main Valve only

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.

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

Canadian Registration # OC 0591.9C

TYPE D210

ELECTRONIC ACTUATOR PILOT WITH MODULATING SERVO-AMPLIFIER

SPECIFICATION

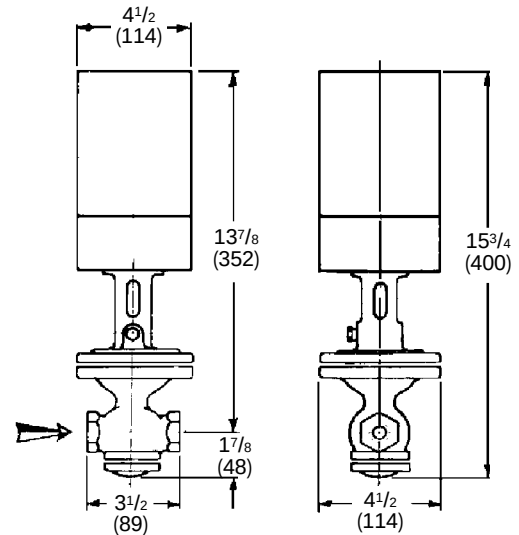
The Actuator Pilot shall maintain a system and modulate that system as requirements dictate. A continuous signal (1-5mA, 4-20mA, 10-50mA or 0-24 VCD) is transmitted by the system control to the Servo-Amplifier which positions the Actuator Pilot.

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.

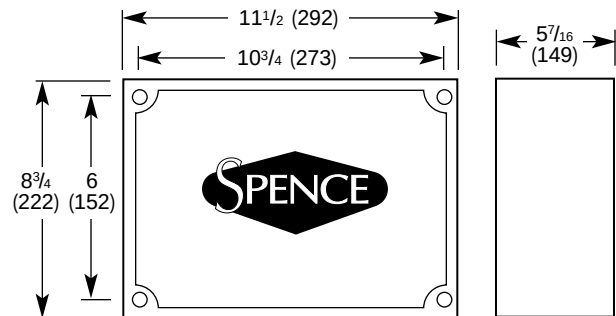
In the event of signal failure, the Actuator Pilot shall close unless a Fail-Safe Device is specified in the Servo-Amplifier which will be factory set to stroke the Actuator Pilot half open or full open.

MATERIALS OF CONSTRUCTION

Body, Cast Iron	ASTM 126 Cl. B
Body, 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 D210
ACTUATOR PILOT



TYPE T124/134 TEMPERATURE/ PRESSURE PILOT

CONTROLS 20 to 500°F

- Precise, Rapid Response
- 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 T134** for heater operating pressures up to 20 psi.

OPTIONS *See page 87*

- Stainless Steel Flexible Tubing
- Thermostat Well
- Stainless Steel Capillary Tubing
- Dial Thermometer
- Tubing longer than 10'
- Integral Mount
- Thermostat other than #700 (see Options Section)

TYPE T134 TEMPERATURE/PRESSURE PILOT

APPLICATION DATA

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

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)

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	

Canadian Registration # OC 0591.9C

SIZING INFO
PAGE 118

*Cast Steel available in T134 only.

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

TYPE T124/134

TEMPERATURE/ PRESSURE PILOT

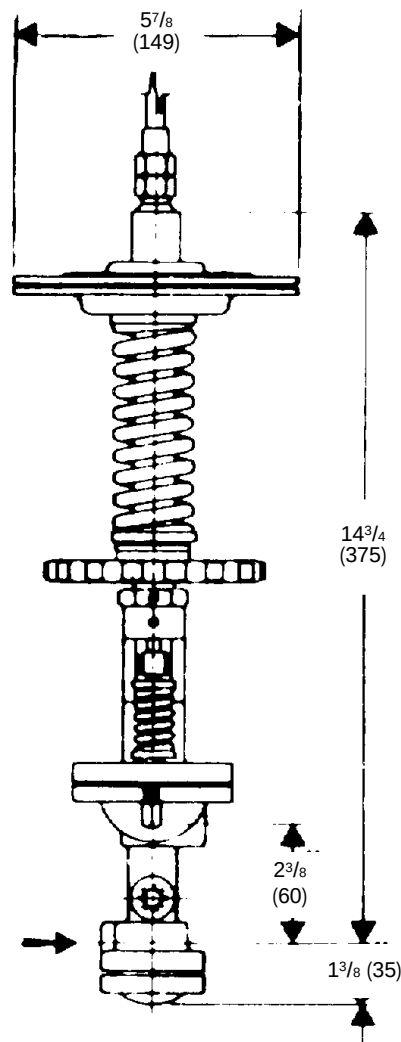
SPECIFICATION

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.

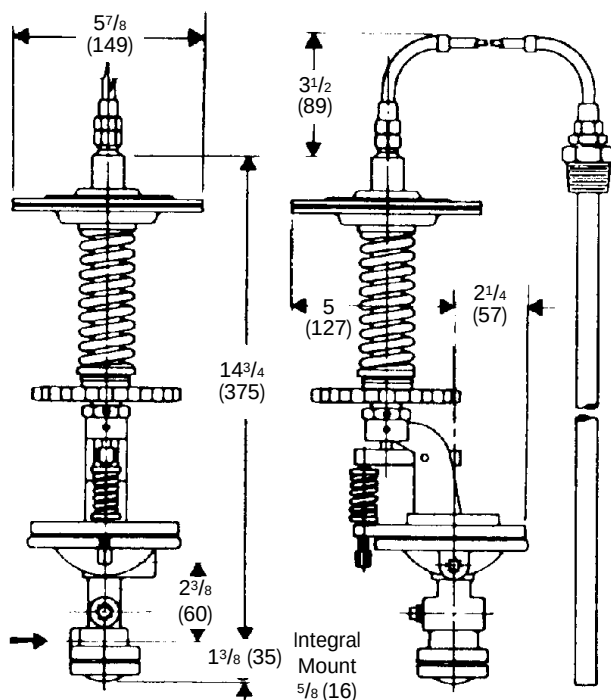
MATERIALS OF CONSTRUCTION

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

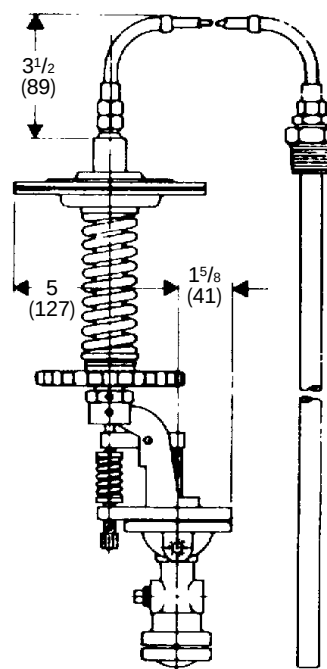
TYPE T124/134 TEMP/
PRESSURE PILOT



TYPE T124 PILOT
16 LBS. (7.3 KG)



TYPE T134 PILOT
18 LBS. (8.2 KG)





TYPE T14 TEMPERATURE PILOT

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 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	

Canadian Registration # OC 0591.9C

SIZING INFO
PAGE 118

TYPE T14 VAPOR TENSION TEMPERATURE PILOT

CONTROLS 20 to 500°F

- Precise, Rapid Response
- Spring Operated
- Self Contained
- Normally Open, Direct Operation (Heating)
- Packless Construction
- Fluid, Gas and Vapor Applications
- Strainer Screen Built-in
- Easy in-line Maintenance

OPTIONS See page 87

- Stainless Steel Flexible Tubing
- Stainless Steel Capillary Tubing
- Tubing longer than 10'
- Thermostat Well
- Dial Thermometer
- Integral Mount
- Thermostat other than #700 (see Options Section)

THERMOSTATS See page 86

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

TYPICAL CONFIGURATIONS

TEMPERATURE REGULATING	ET14
TEMPERATURE & PRESSURE	ET14D
TEMPERATURE REGULATING	E2T14
TEMPERATURE & PRESSURE	E2T14D
TEMPERATURE REGULATING	E5T14
TEMPERATURE & PRESSURE	E5T14D

TYPE T14

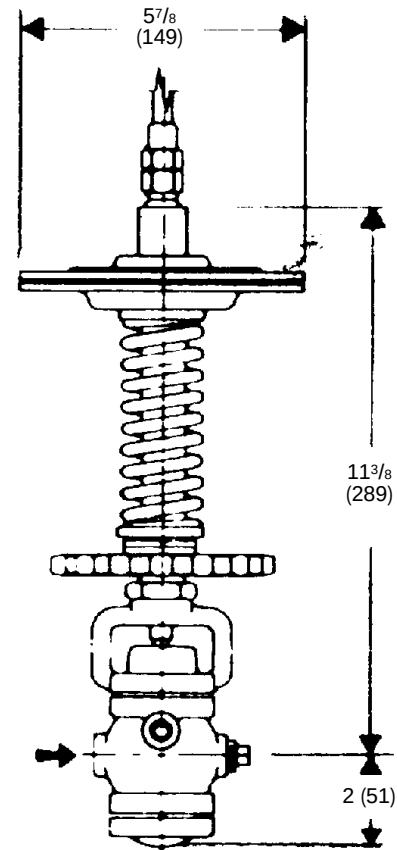
VAPOR TENSION TEMPERATURE PILOT

SPECIFICATION

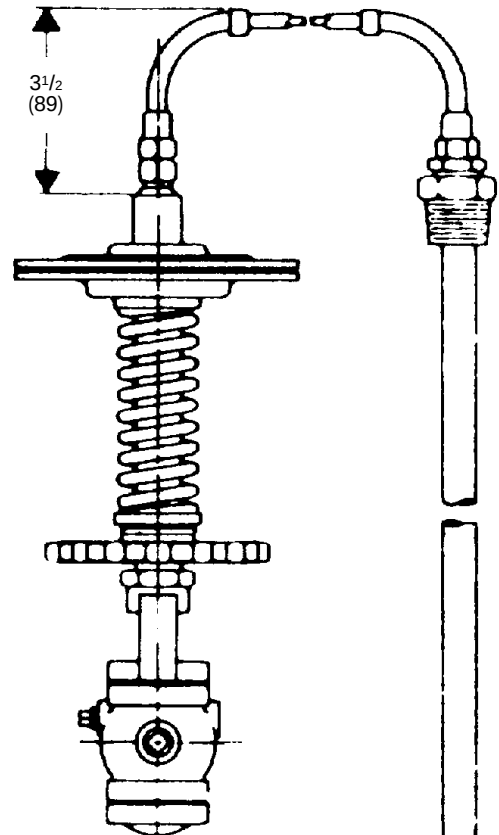
Pilot valve shall be separate from the main valve and connected to it by unions. Pilot seats shall be protected by built-in strainer screens. Pilot shall be interchangeable on all sizes of main valves. Thermal elements shall provide a 100°F (38°C) range of temperature adjustment and shall withstand 100°F 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 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	Graphite
Diaphragm	Bronze ASTM B103-77 UNS C51000
Spring	Steel



TYPE T14 TEMPERATURE PILOT
13 LBS. (6 KG)



TYPE T14
TEMPERATURE PILOT



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 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	

Canadian Registration # OC 0591.9C

SIZING INFO
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TYPE T52 TEMPERATURE PILOT

CONTROLS 20 to 500°F

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

OPTIONS See page 87

- Stainless Steel Flexible Tubing
- Stainless Steel Capillary Tubing
- Tubing longer than 10'
- Thermostat Well
- Dial Thermometer
- Integral Mount
- Thermostat other than #700 (see Options Section)

THERMOSTATS See page 86

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

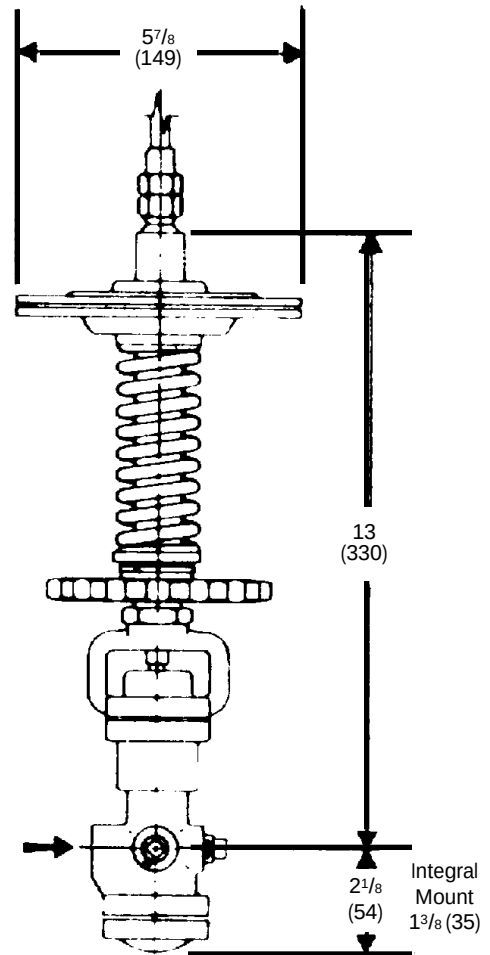
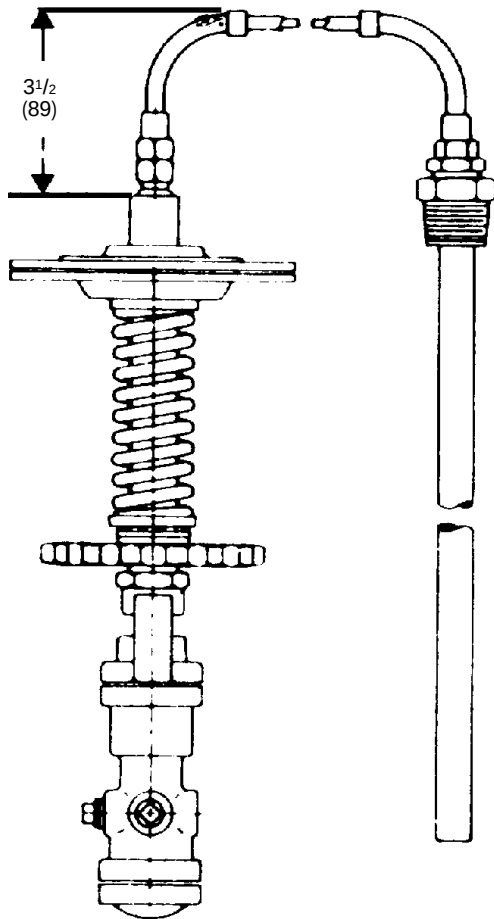
TYPE T52 TEMPERATURE PILOT

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, Cast Iron	ASTM A126 C53
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	Graphite
Diaphragm	PH Bronze
Spring	Inconel



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

TYPE T52
TEMPERATURE PILOT



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)

2 ¹ / ₄ Bulb	-40-120
1 ³ / ₄ Bulb	0-200
1 ³ / ₈ Bulb	0-300
2 ³ / ₄ Bulb	30-150
1 ¹ / ₄ Bulb	50-400
1 ¹ / ₈ Bulb	200-600

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

OPTIONS

- P, PD or PID Control Mode

TYPICAL CONFIGURATIONS

PRESSURE & TEMPERATURE EAT60

TYPE T60

PNEUMATIC TEMPERATURE CONTROLLER

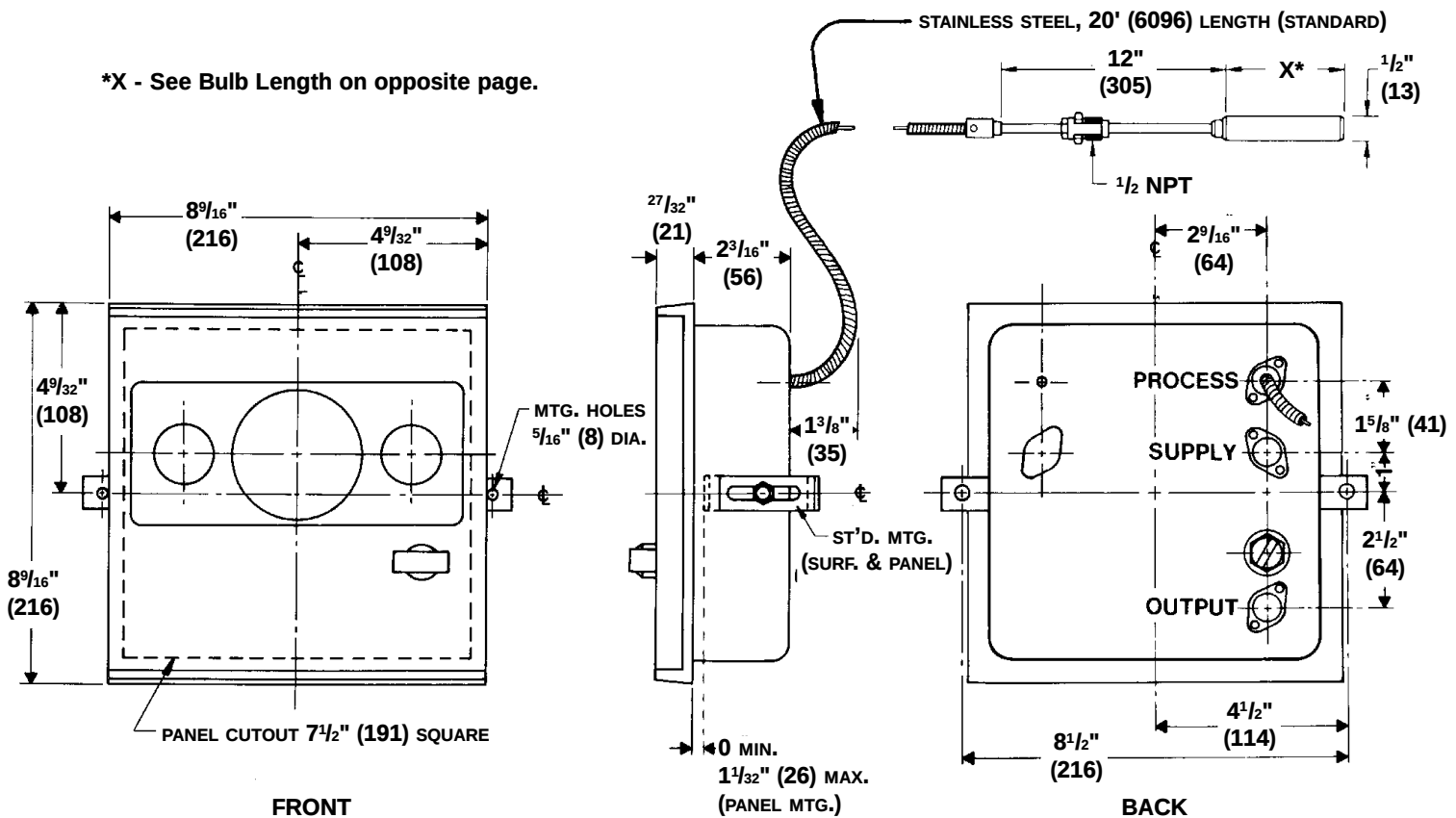
SPECIFICATION

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

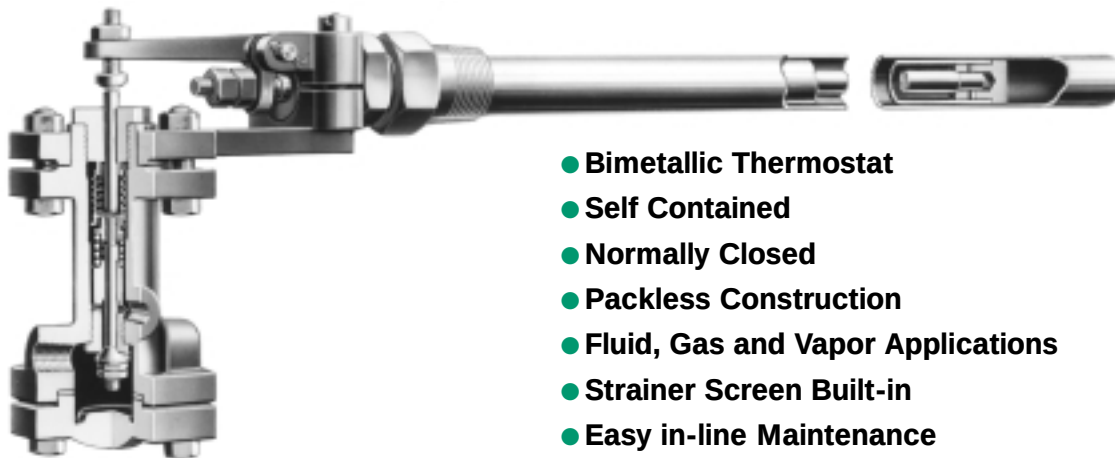
Air Connections	1/4" FNPT
Air Consumption, Maximum	0.2 SCFM
Air Consumption, Normal.....	0.1 SCFM
Ambient Temperature Limits	-40° to 180°F (-40 to 82°C)
Weight	81/2 lbs. (19 kg)
Proportional Band	Adjustable, 2 - 200%
Control Action	Adjustable, Reverse or Direct
Control Mode, Standard	Proportional + Reset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

*X - See Bulb Length on opposite page.



TYPE SP/T TEMPERATURE SAFETY PILOT

TEMPERATURES to 500°F



TYPE SP/T TEMPERATURE SAFETY PILOT

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)

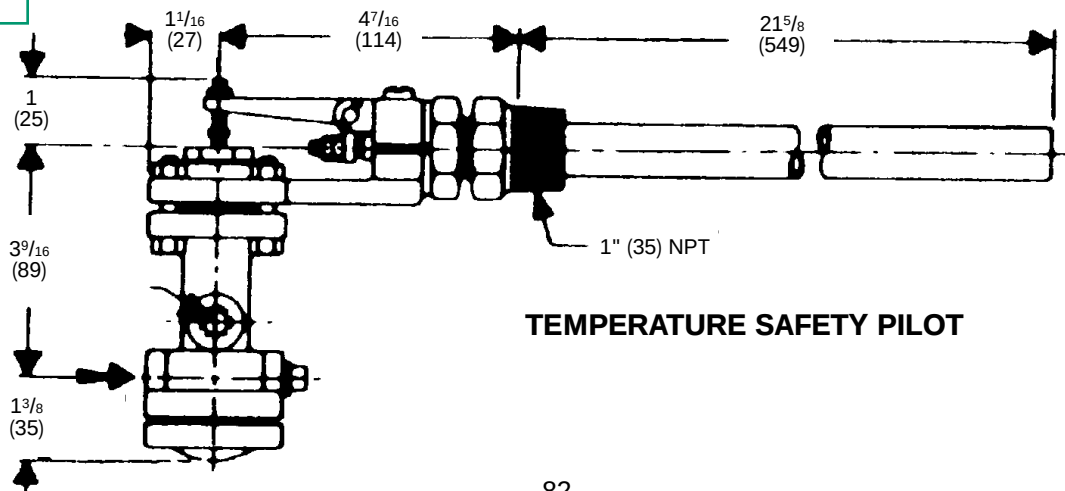
TEMPERATURE RANGES (°F)

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
PAGE 116



TEMPERATURE SAFETY PILOT

- 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

SPECIFICATION

Pilot to be used to insure that pressure regulator will not fail open. Pilot to be bronze, with stainless steel trim. Pilot to be normally closed and to employ a bimetallic element that will ensure that the pilot will fail open. Pilot to be of packless construction to provide for long service life. Pilot to have a built in strainer for protection.

Canadian Registration # OC 0591.9C

TYPE T61, T62, T63, T64

PNEUMATIC TEMPERATURE CONTROLLER

TEMPERATURES to 350°F

- Bimetallic Thermostat for Fast Response
- Pinpoint Accuracy
- 200°F Adjustable Temperature Range
- Air Consumption - Average .25, Maximum .7
- Adjustable Proportional Band $\frac{1}{4}$ -2 psi per 1°F
- Overtemperature Protection
- Air Supply Pressure 30 psi

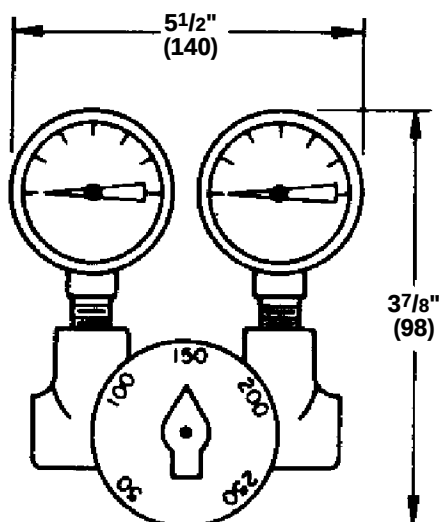
MODELS

- **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
PAGE 118



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



TYPE T61 PNEUMATIC
TEMPERATURE CONTROLLER

TYPE T61, 62, 63, T64
TEMPERATURE PILOT

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)	400 (204)

TEMPERATURE RANGES (°F)

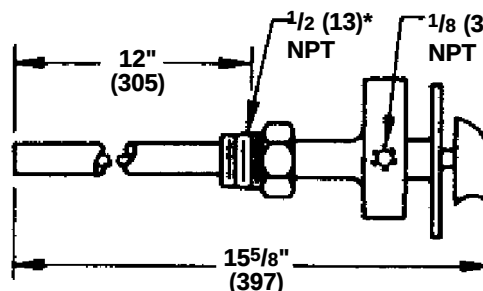
T61, T62, T64	50-250
T63	150-350

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.

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

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

MATERIAL	COMPONENT PARTS	COMPONENT USAGE		
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	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.	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, 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
5-05007-0	3 - 20	Aluminum	3/16"	D, N, N33, Q, N20
5-05003-0	5 - 25	Orange	1/4"	D5
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:

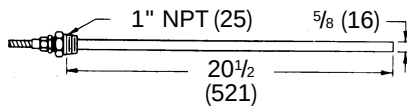
Initial Pressure	# per Set
10 - 250	2
250 - 400	3
400 - 600	4

The Number of Diaphragms per set for Pilots varies with the type and delivery pressure. Consult factory.

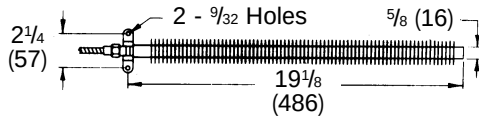
PILOT ACCESSORIES

THERMOSTAT BULBS

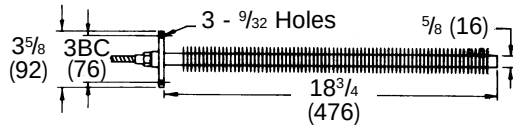
FOR USE WITH T14, T124, T134, T52 PILOTS



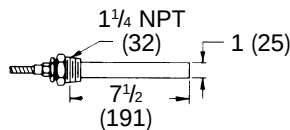
STYLE NO. 700—Plain Bulb with 1" Union Connection.



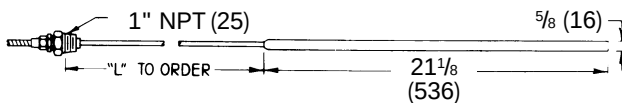
STYLE NO. 702—Finned Bulb with Wall Mounting Bracket. For space heating.



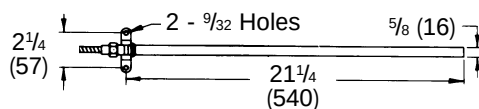
STYLE NO. 703—Finned Bulb with Duct Mounting Flange. For forced warm air heating.



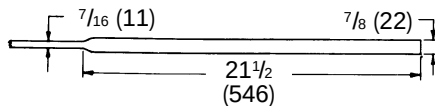
STYLE NO. 704—Plain Short Bulb with 1-1/4" Union Connection. For installations where depth is limited.



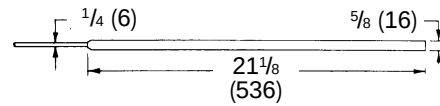
STYLE NO. 706—Plain Bulb with 1" Union Connection and 1/4" OD Bendable Extension. Dimension "L" must be specified.



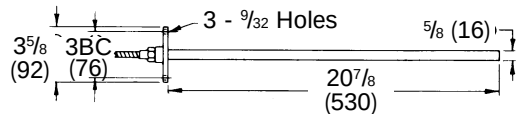
STYLE NO. 708—Plain Bulb with Wall Mounting Bracket. Used for space heating when dust is a problem.



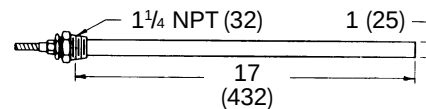
STYLE NO. 711—Bulb Lead Covered. Chemical lead covering homogeneously bonded to bulb and to lead sheathing on capillary.



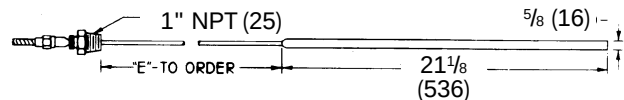
STYLE NO. 712—Plain Bulb with 1/4" OD Bendable Tubing Cover for Capillary. Used in open tanks or where a mounting connection is not required.



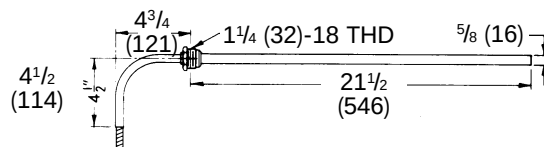
STYLE NO. 713—Plain Bulb with Duct Mounting Flange. For forced warm air heating when dust is a problem.



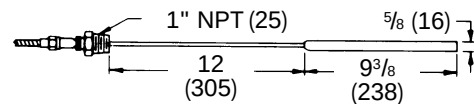
STYLE NO. 701—Large Plain Bulb with 1-1/4" Union Connection. Used on pilots having more than 30 feet of flexible tubing and with dial thermometer having 20 to 120°F range.



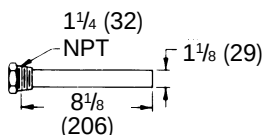
STYLE NO. 731—Plain Bulb with Adjustable Extension. Used in oil storage tanks or wherever it is desirable to change position of bulb. Dimension "E" must be specified.



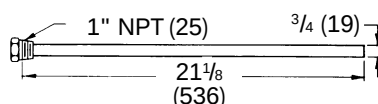
STYLE NO. 740—Sanitary Bulb for Milk Heaters. Threaded to fit standard No. 23A Thermometer Ferrule. Stainless Steel Bulb and Flexible Tubing.



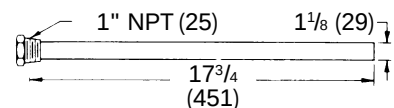
STYLE NO. 732—Special Bulb with 12" Adjustable Extension.



727 WELL—Used with 704 Bulb



728 WELL—Used with 700 and 800 Bulb



729 WELL—Used with 701 and 801 Bulb

THERMOSTAT WELLS

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.

SPRING CHAMBER

Spence Pressure Pilots can be provided with an enclosed spring chamber.



Applications

Direct Acting

- Bottle Washers
- Steam Tables
- Plating Tanks
- Heating Ducts
- Sterilizers
- Fuel Oil Heaters
- Cooking Vats
- Water Heaters
- Heat Exchangers
- Parts Washers

Reverse Acting

- Induction Furnaces
- Industrial Compressors
- Engine Jacket Cooling
- Cooling Ducts
- Liquid Chillers
- Fuel Oil Heaters

Three Way Acting

- Fire Tube Boilers
- Internal Combustion Engine
- Coolers
- Filters

Series 2000 Temperature Regulator

**Pressures To 250 PSIG
Temperatures to 406°F**

Positionable Temperature Indicator

(indicating regulators only) may be turned in direction of easiest reading. Highly accurate with stainless steel case and bayonet lock ring.

Overtemperature Protection

prevents damage to regulator from inadvertent overheating.

Thermal System

is heavy duty bronze bellows with bronze spiral armored copper capillary, copper bulb and epoxy coated bellows housing. Other line and bulb materials available.

Extra Long Adjustment Spring

permits adjustment over a wide range of temperatures.

Packing Assembly

with spring loaded self adjusting chevron type teflon packing eliminates the human factor of improper adjustment.

Epoxy Coated Compact Single Piece Channel Frame

permits installation in tight locations.

Full Scale Adjustment

makes repeat settings easy and accurate.

Double Guided Stainless Steel Monolithic Disc Assembly

maintains proper alignment of all moving parts.

Stainless Steel Seat Rings

are threaded and bonded to eliminate any possibility of leakage through seat ring threads.

Stainless Steel Disc

is self aligning to assure accurate seating, long wear and tight closure.

Adjusting Key

is conveniently located and always there when settings have to be changed.

Galvanized Iron Union Ends

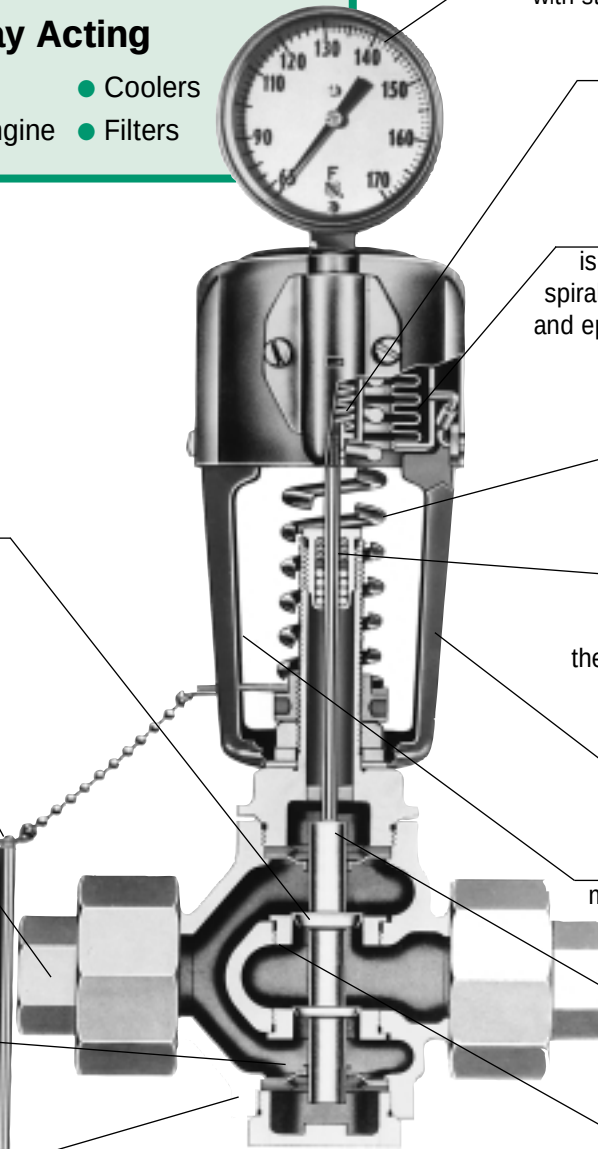
for sturdiness and ease of installation.

Full Ported and Full Flow Bronze Valve Body

provides maximum capacity for each valve size.

Heavy Section Valve Body

is tough, solid, durable and will withstand severe piping strains for pressures to 250 psig at 406°F.



DIRECT OPERATED VALVES



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)	400 (204)

Canadian Registration # OC 0591.9C

SERIES 2000 TEMPERATURE REGULATOR

SIZES 1/2" – 2"
CONTROLS -25 to 400°F

- 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 Bulb
- Stainless Steel Armored Capillary
- Capillary lengths greater than 8'
- Extra Large Bulb
- Union Bushings & Wells

SERIES 2000

TEMPERATURE REGULATOR

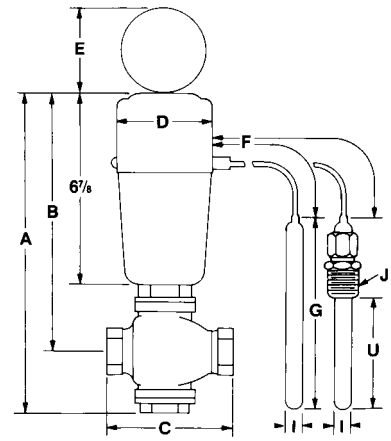
SPECIFICATION

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 400°F. Body materials shall be bronze.

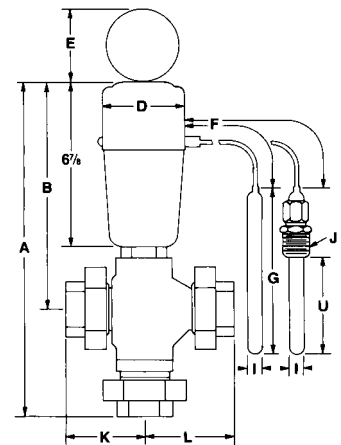
MODEL 2060 FOR GAS SERVICE ONLY: The valve shall be self-operated, requiring no external energy source and designed to control process temperature by regulating gas flow. It shall be normally open and close with increased temperature. "Bubble tight" dead end shutoff shall be provided by Buna-N vulcanized 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	Steel	Steel
Cap	Aluminum	Aluminum
Bellows	Bronze	Bronze
Spring	Steel	Steel
Capillary	Copper	Copper
Bulb	Copper	Copper
Armor	Bronze	—
Stem	304 Stainless Steel	304 Stainless Steel
Disc	304 Stainless Steel	Buna-N
Seat.....	303 Stainless Steel	—



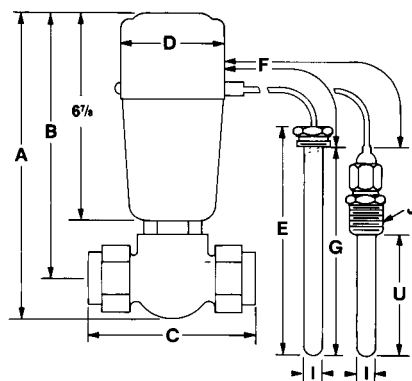
TYPE 2010-2040 DIRECT & REVERSE ACTING



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) 1/2, 3/4	2010	9 3/4	8 1/2	5 1/2	3 1/2	2 13/16	8 Ft.	10 (4.5)
	2020	(248)	(216)	(140)	(89)	(71)		
1/2" 3/4"	2030	12 7/16	9 3/4	7 3/16	3 1/2	2 13/16	8 Ft.	13 (5.9)
	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" 1 1/2" 2"	2030	12 7/8	9 31/32	8 15/16	3 1/2	2 13/16	8 Ft.	20 (9.1)
	2030	(327)	(253)	(227)	(89)	(71)		25 (11)
	2040							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"						

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

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)	

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 _v	Max. Upstream Pressure	Type Number		Flow Coefficient C _v	Max. Upstream Pressure	Type Number	Flow Coefficient C _v	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)	2030	2040	250 (17.2)	2050	5.22	140 (9.7)	
1/2"T			5.22	140 (9.7)							
3/4"T			6.85	90 (6.2)							10.4
1"T			9.15	65 (4.5)							12.9
1 1/4"T			14.3	40 (2.8)							20.6
1 1/2"T			15.1	30 (2.1)							24.8
2"T			17.2	20 (1.4)							33.0

SIZING INFO
PAGE 95

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: 65/140°F.

Line length: 15'

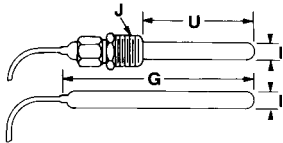
SOLUTION:

Bulb size: extra large – G = 15 5/8"

RANGES, BULB SIZES & MAXIMUM LINE LENGTHS

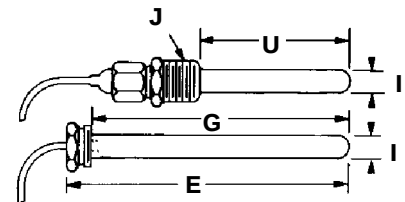
Short Ranges (Gold Spring)		Long Ranges (Silver Spring)		Bulb Size	†Max. Line Length	Maximum Over-Temperature	
°F	°C	°F	°C			°F	°C
-15 to 50	-26 to 10	-15 to 75	-26 to 24	X Large	40 Ft.	450	232
45 to 115	7.2 to 46	45 to 145	7.2 to 63	X Large	40 Ft.	450	232
65 to 140	18 to 60	65 to 170	18 to 77	Large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

†Standard line lengths are 25' and 40'.



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

CODE SELECTION CHART

Model				Orifice Size	Inlet Size	Line & Bulb Style	Mat'l	Range °F
2	0	1	0	T	C	- G	Q	K
1	2	3	4	5	6	7	8	9

Model -

Position 1, 2, 3 & 4
 2010 = Single Seat,
 Direct Acting
 2020 = Single Seat,
 Reverse Acting
 2030 = Double Seat,
 Direct Acting
 2040 = Double Seat,
 Reverse Acting
 2050 = Three Way

Orifice -

Position 5
 A
 B
 C
 D
 E
 T = Standard

Inlet Size -

Position 6
 C = 1/2
 D = 3/4
 E = 1
 F = 1 1/4
 G = 1 1/2
 H = 2

Line & Bulb Style -

Position 7
 G = Indicating
 N = Non-indicating

Material† -

Position 8
 Q = Copper Bz Armor 8'
 R = Copper Bz Armor 15'
 N = Copper Bz Armor 25'
 P = Copper Bz Armor 40'
 T = SS Unarmored 8'
 V = SS Unarmored 15'
 W = SS Unarmored 25'
 X = SS Unarmored 40'
 Z = Other

Range °F -

Position 9
 A = 15/50
 B = 15/75
 C = 45/115
 D = 45/145
 E = 65/140
 F = 65/170
 J = 120/200
 K = 120/230
 L = 240/310
 M = 240/340
 N = 280/375
 P = 280/415
 Z = Other

† For SS Armored Thermal Assembly Material, add (-TV) at the end of the code (ex.: 2010TC-NTH-TV)

† Small bulb standard for J-1 range and higher.

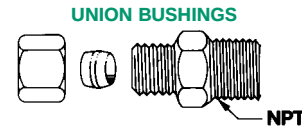
Extra large bulb standard for D range and lower.

Large bulb standard for E and F range



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)		
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)	
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 (25)	1
98F	L & X	St. St.		1

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

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			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	2880
90	UP to 41 60 90	65	155	285	515	675	820	1070					1240	1630	2020	3230	3890	5180
		57	140	255	465	610	740	975					1120	1470	1830	2790	3520	4680
		35	90	165	305	395	480	630					730	960	1190	1900	2290	3040
100	UP to 46 60 90	70	170	310	565	740	900						1360	1790	2220	3540	4260	5680
		65	165	295	540	705	855						1300	1700	2110	3380	4060	5410
		40	95	175	320	415	505						770	1010	1250	2000	2400	3200
110	UP to 52 70 90	75	185	335	615	800	975						1480	1940	2410	3850	4640	6170
		70	175	315	575	750	910						1380	1810	2250	3590	4330	5760
		55	135	245	450	590	715						1090	1430	1770	2830	3400	4530
120	UP to 57 80 100	80	200	365	665	865	1050						1600	2100	2600	4160	5010	6670
		75	185	330	605	790	965						1460	1920	2380	3800	4580	6090
		55	145	260	475	615	750						1140	1490	1850	2960	3560	4740
130	UP to 62 80 110	85	215	390	715	930	1130						1720	2250	2800	4470	5380	7160
		80	205	370	680	885	1080						1630	2140	2660	4250	5120	6810
		60	150	270	495	645	780						1190	1560	1930	3080	3710	4940
140	UP to 68 90 120	95	230	420	765	995	1215						1840	2410	2990	4780	5750	7660
		85	215	390	715	930	1130						1720	2250	2800	4470	5380	7160
		60	155	280	510	670	815						1230	1620	2010	3210	3860	5140
150	UP to 72 90 120	100	245	445	815	1060							1960	2570	3180	5090	6120	8150
		95	240	430	780	1020							1880	2470	3060	4900	5890	7840
		75	190	345	625	820							1510	1980	2460	3930	4730	6290
160	UP to 78 100 140	105	260	470	860	1120							2080	2720	3380	5400	6500	8650
		100	250	450	820	1070							1970	2590	3210	5120	6170	8210
		65	165	300	550	715							1320	1730	2150	3440	4140	5500
170	UP to 83 100 140	110	275	500	810	1190							2190	2880	3570	5700	6870	9140
		105	270	485	885	1150							2130	2790	3470	5540	6660	8870
		80	205	370	670	875							1620	2120	2630	4210	5070	6740
180	UP to 89 120 160	115	290	525	960	1250							2310	3030	3760	6010	7240	9640
		110	270	485	890	1150							2140	2800	3480	5550	6690	8900
		70	175	320	585	760							1400	1840	2290	3650	4400	5850
190	UP to 95 120 160	125	305	555	1010	1310							2430	3190	3960	6320	7610	10100
		115	290	525	960	1250							2310	3030	3760	6000	7220	9610
		85	215	390	715	930							1720	2260	2800	4470	5380	7160
200	UP to 100 120 180	130	320	580	1060	1380							2550	3350	4150	6630	7980	10600
		125	310	560	1020	1330							2470	3240	4010	6410	7720	10300
		75	185	335	615	805							1480	1940	2410	3850	4640	6180
210	UP to 105 120 180	135	335	605	1110								2670	3500	4350	6940	8360	11100
		130	330	595	1080								2620	3430	4260	6800	8190	10900
		90	230	415	755								1820	2380	2960	4720	5680	7560
220	UP to 110 140 200	140	350	635	1160								2790	3660	4540	7250	8730	11600
		135	335	600	1100								2640	3470	4300	6870	8270	11000
		80	195	355	645								1560	2040	2530	4050	4870	6480
230	UP to 115 140 200	145	365	660	1210								2910	3810	4730	7560	9100	12100
		140	355	635	1160								2800	3680	4560	7290	8780	11700
		95	240	435	790								1910	2500	3100	4960	5970	7940
240	UP to 120 160 200	155	380	690	1250								3030	3970	4930	7870	9470	12600
		140	355	640	1160								2810	3690	4570	7300	8790	11700
		110	280	500	915								2200	2890	3580	5720	6890	9170
250	UP to 126 160 220	160	395	715	1300								3150	4130	5120	8180	9840	13100
		150	375	675	1240								2980	3910	4850	7750	9330	12400
		100	250	455	830								1990	2620	3240	5180	6240	8300

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: Locate 50 psi on the inlet pressure scale on the left side of the Series 2000 Capacity 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.

PERFORMANCE VARIABLE

30°F span from fully open to fully closed
Oversized valve can provide narrower spans—Consult Factory

CAPACITY CHART SEE PAGE 94

STEAM FLOW REQUIREMENTS

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

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



**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**
- **Four Spring Ranges**
- **Integral Stainless Steel Strainer**
- **ANSI/FCI 70-2 Class IV Shutoff**

OPTIONS

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

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 374

APPLICATION DATA

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

VALVE RATINGS

Body Material	Pressure PSIG (bar)	Temperature °F (°C)
WITH ST. STL. DISC		
Cast Iron	200 (13.8)	@ 400 (204.4)
Bronze	300 (21.0)	@ 430 (215.6)
Stainless Steel	300 (21.0)	@ 420 (215.6)
WITH TEFLON® DISC		
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"
10-50	1/2-1 1/4"	30-100	1 1/2-2"
25-80	1/2-1 1/4"	10-40	1 1/2-2"

Canadian Registration # OC 0591.9C

SIZING INFO
PAGE 135

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

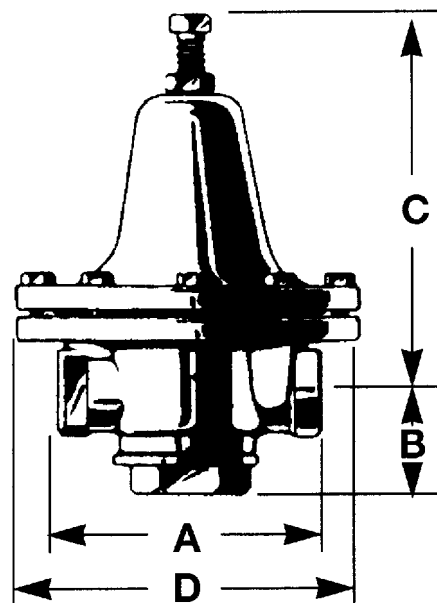
TYPE D50 PRESSURE REDUCING VALVE

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.

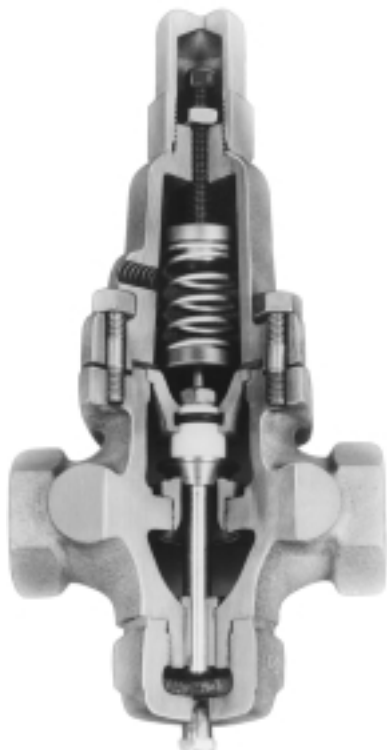


**TYPE D50 DIRECT ACTING
PRESSURE REDUCING VALVE**

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 7/16 (191)	22 (10)

**D50 PRESSURE
REDUCING VALVE**



TYPE N6 DIFFERENTIAL PRESSURE VALVE

SIZES 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

RATED FLOW COEFFICIENTS (Cv)

VALVE SIZE					
3/4	1	1 1/4	1 1/2	2	2 1/2
5.3	9.2	14.3	20.8	37.5	60

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	

Canadian Registration # OC 0591.9C

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 374

SIZING INFO
PAGE 108

TYPE N6

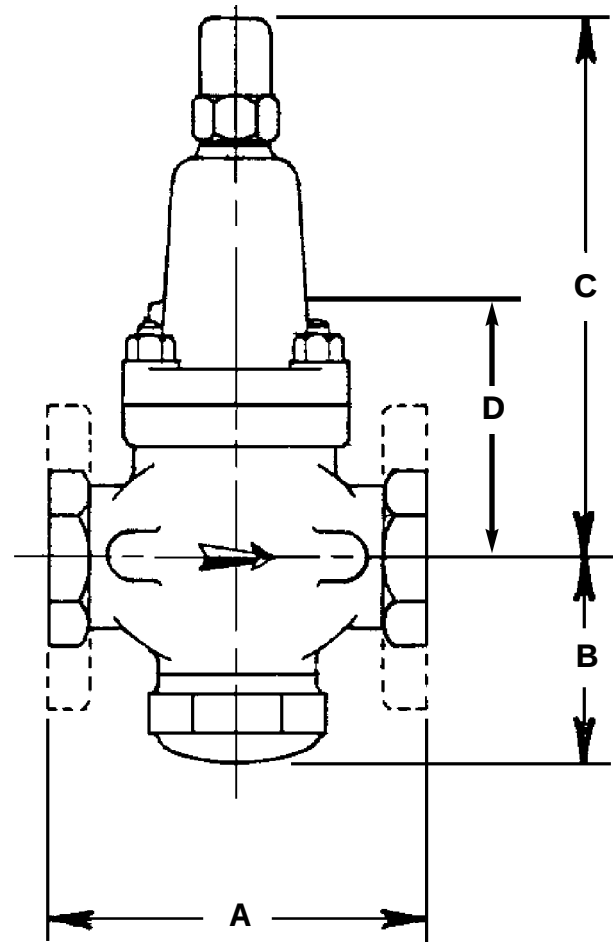
DIFFERENTIAL PRESSURE VALVE

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 Graphite
 Spring St. Stl. 17-4



N6 DIFFERENTIAL
PRESSURE VALVE

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 D & D2 DIFFERENTIAL PRESSURE VALVE

SIZES 1/4" – 1/2"
PRESSURES to 600 PSIG at 750°F

- **Self-contained**
- **Direct Operated**
- **Normally Open**
- **Packless Construction**
- **Accurate Regulation Unaffected by Service Conditions**
- **Easy In-line Maintenance**
- **Five Spring Ranges for Improved Control**
- **Utilizes Many Standard D/D2 Pilot Components**

APPLICATION DATA

- Pressure Regulating for Steam Distribution
- Regulating for Fluid, Gas and Vapor Process Control
- Processes with Small, Relatively Steady Flow Rates

VALVE RATINGS

Construction	Pressure PSIG (bar)	Temperature °F (°C)
Cast Iron	250 (17.2) @	400 (204)
Cast Steel	600 (41.4) @	750 (400)

SPRING PRESSURE RANGES (PSIG)

TYPE D	TYPE D2
3-20	100-300
5-50	
10-100	
20-150	

Canadian Registration # OC 0591.9C

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 374

MODELS

- **TYPE D VALVE** — ±1 PSI control of delivery pressure between 3 and 150 PSI
- **TYPE D2 VALVE** — ±2 PSI control of delivery pressure between 100 and 300 PSI

OPTIONS

- Enclosed Spring Chamber
- Adjusting Handwheel
- Composition Disc
- Locking Device
- Wall Bracket

TYPICAL CONFIGURATIONS

PRESSURE REDUCING TYPE D VALVE

PRESSURE REDUCING TYPE D2 VALVE

TYPE D & D2

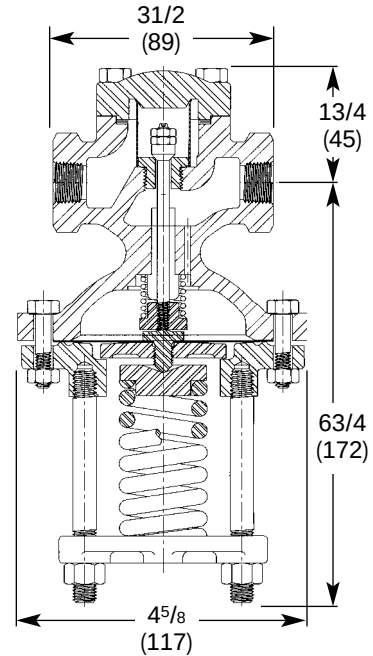
DIFFERENTIAL PRESSURE VALVE

SPECIFICATION

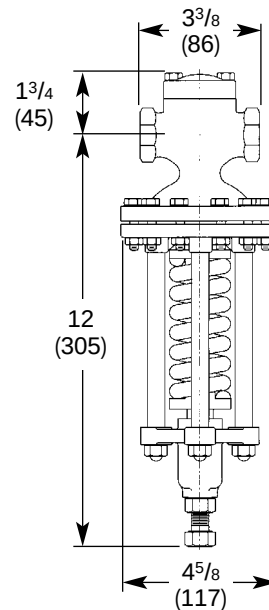
The Valve shall be of normally open design with packless construction. A strainer Screen shall be built into the valve inlet. The valve shall be single- seated, spring loaded and diaphragm actuated.

MATERIALS OF CONSTRUCTION

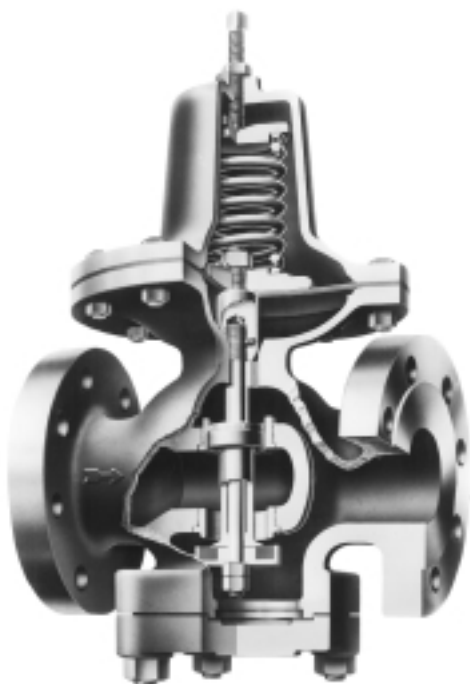
Body, Cast Iron	ASTM A126 CI B
Body, Cast Steel	ASTM A216 GR. WCB
Stem	303 St. Stl. ASTM A582 COND A
Disc	440 St. St. ASTM A276-75 COND A
Seat	420 St. Stl ASTM A276 COND A
Gasket	Non-Asbestos
Diaphragm	301 St. Stl. MIL-5-5059C
Spring	Inconel



D VALVE
7.3 LBS.
(3.3 KG)



D2 VALVE
10.6 LBS.
(4.8 KG)



TYPE D34
WATER PRESSURE REDUCING VALVE

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

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

Canadian Registration # OC 0591.9C

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 374

SIZING INFO
PAGE 108

RATED FLOW COEFFICIENTS (Cv)

	VALVE SIZE								
	1	1 1/4	1 1/2	2	2 1/2	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

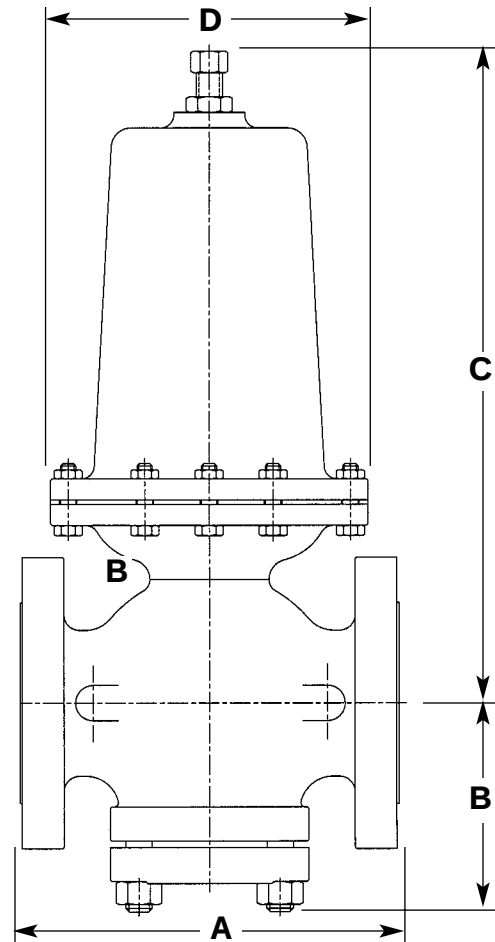
SPECIFICATION

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

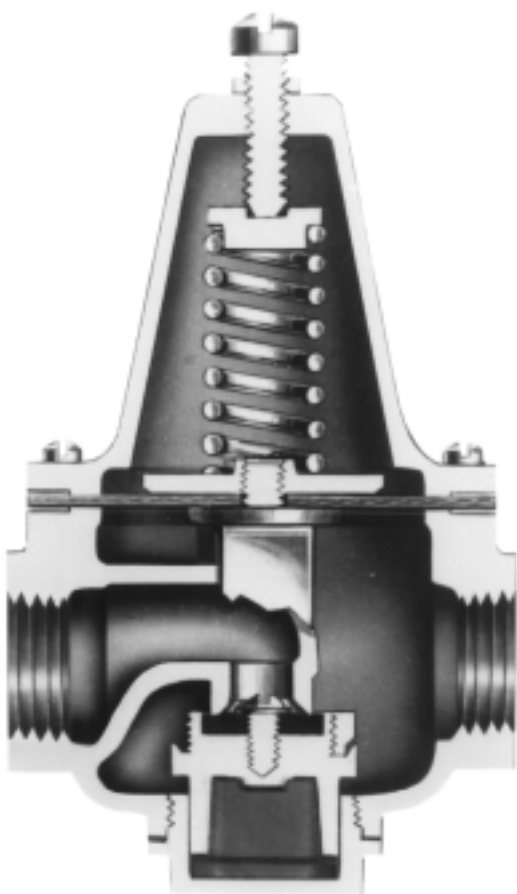
Body Cast Iron ASTM 126 Cl. B
 Stem 303 St. Stl. ASTM 582 Cond. A
 Disc.....304 St. Stl. ASTM 276 Cond. A
 Seat 304 St. Stl. ASTM 276 Cond. A
 Gasket Non-asbestos
 Diaphragm Hycar
 Spring Steel



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



**TYPE D36
WATER PRESSURE REDUCING VALVE**

TYPE D36 WATER PRESSURE REDUCING VALVE

SIZES 1/2" – 2"

PRESSURES to 300 PSIG at 160°F

- **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	

Canadian Registration # OC 0591.9C

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 374

SIZING INFO
PAGE 108

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

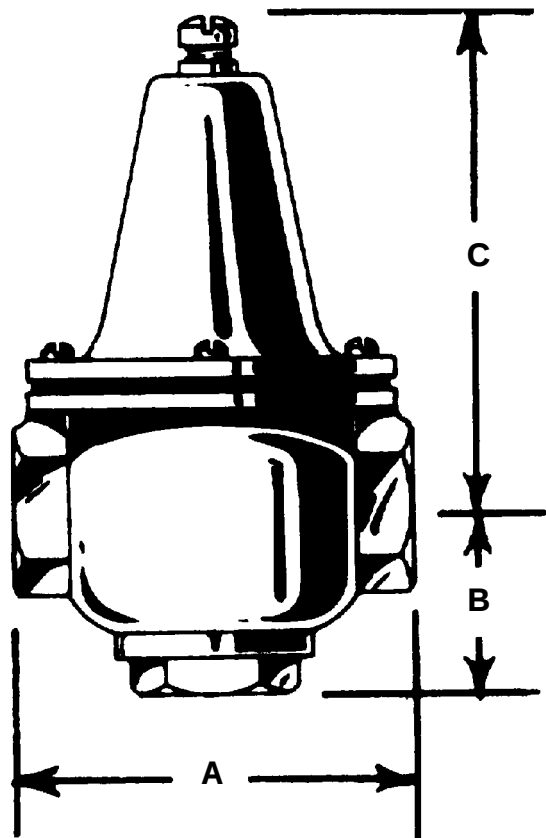
TYPE D36 WATER PRESSURE REDUCING VALVE

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**

**D36 WATER PRESSURE
REDUCING VALVE**

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)

NOTES:

REGULATOR SIZING

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.

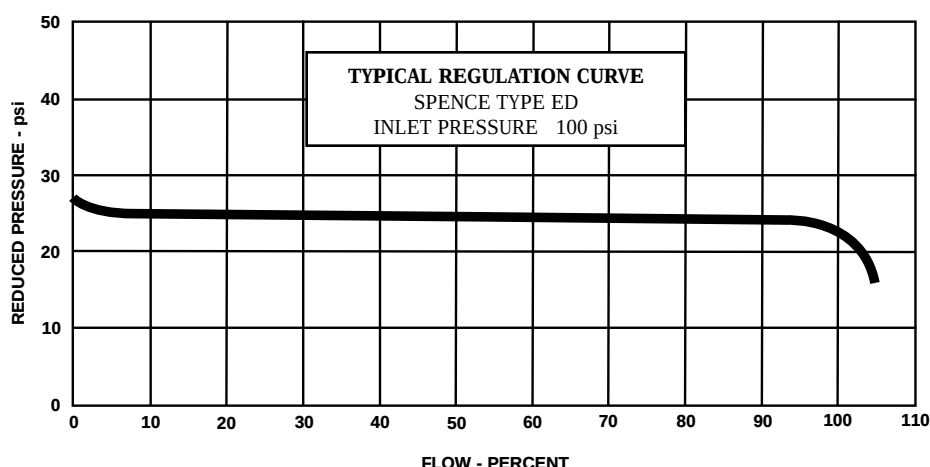
* **SET POINT** is the value of the regulated pressure at minimum controlled flow.

* **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

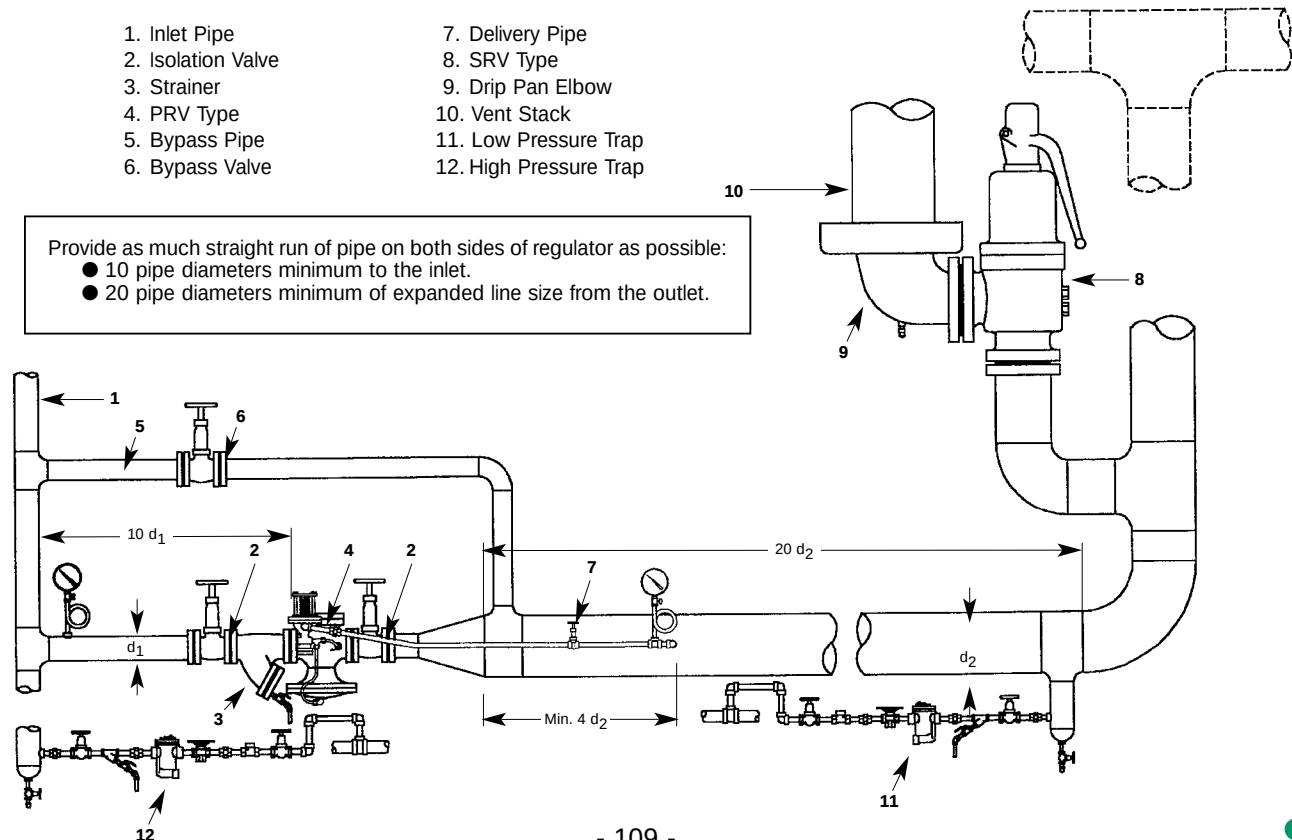
1. Locate the valve in a straight run of horizontal pipe. See Fig. 1.
2. Allow headroom above the valve for access through the blind flange. Provide clearance for stem withdrawal underneath.
3. Prevent water hammer and erratic operation by installing traps to provide proper drainage before and after 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.
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.



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. For Differential Pressures of 15-50 psi, specify optional LP Spring (10 psi minimum Differential Pressure is attainable by adding optional fittings).

- (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.

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. For Differential Pressures of 15-50 psi, specify optional LP Spring (10 psi minimum Differential Pressure is attainable by adding optional fittings).

- (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.

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.

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 several types of Main Valves.

VALVE SIZING BY COMPUTATION

FORMULA KEY

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

$\Delta P_s = P_1 - P_v$ when $P_2 > P_v$
 $\Delta P_s = P_1 - (.96 - .28 \sqrt{\frac{P_v}{P_c}}) P_v$ when $P_2 \leq P_v$
 q = Liquid Flow Rate, U.S. gpm
 Q = Flow Rate, SCFH
 T = Absolute T ($T + 460$)°R
 T_{SH} = Steam Superheat (°F) = Total Steam Temp. – Saturated Steam Temp.
 $\bar{v}$ = Specific Volume Ft³/#
 V = Velocity, FPM
 W = Steam Flow, #/Hr.
 W_s = Flow, #/Hr. Superheated Steam

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

C_v

SUBCRITICAL

CRITICAL

SATURATED STEAM:

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

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

SUPERHEATED STEAM:

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

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

GAS:

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

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

LIQUID:

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

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

LOADS

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

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

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

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

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:

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

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

IV. TWO STAGE PARALLEL PRESSURE REGULATORS[†]

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

SPACE CONSIDERATIONS FOR REDUCING STATIONS

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

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

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

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

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

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

PRESSURE REDUCING STATION GENERAL SPECIFICATION

- A. Pressure Reducing Station shall consist of:
 - pressure regulator
 - inlet strainer
 - inlet and outlet stop valves (gate type)
 - by-pass valve (globe type)
 - trap at inlet to pressure regulator
 - pressure gauges on inlet and outlet of station
 - pressure relief valve downstream of regulator
- B. Stop valves and strainer shall be at least pressure regulator size
- C. Expand pressure regulator outlet pipe size to obtain discharge line velocity which will not exceed:

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

Regulator outlet velocity shall be limited to:

Up to and including 2"	45,000 FPM
2 1/2" up to 8"	30,000 FPM
Above 8"	24,000 FPM
- D. Unions shall be used on either side of screwed end by-pass valve and pressure regulator to facilitate removal.
- E. Pressure regulators 2-1/2" and larger shall have flanged ends and be suitable for pressure and temperature specified.
- F. Limit pressure regulator inlet velocity to:

Up to and including 2"	15,000 FPM
2 1/2" thru 8"	10,000 FPM
Above 8"	8,000 FPM
- G. Regulator sound pressure level while operating at specified maximum capacity shall not exceed 90 dbA as measured at a point three feet downstream and three feet from uninsulated pipe surface.
- H. Pressure regulator capacity shall not be greater than 120 of specified maximum capacity.
- I. For details of safety valve sizing and installation, please refer to the latest National Board Inspection Code and ANSI B31.1 Code.

REGULATOR Cv DATA

Valve Size	E				E2	E5,E6		C34	D	D34 60%	D50	N6 50%	Series 2000
	Normal 50%	Normal 75%	Normal	Full 50%	Full 75%	Full	Full						
1/4	—	—	—	—	—	—	—	—	.25	—	—	—	—
3/8	—	—	.65	—	—	—	—	—	.32	—	—	—	—
1/2	—	—	1.5	1.4	2.1	2.8	—	—	.32	—	2.2	—	4-5.22
3/4	—	—	4.8	2.7	4.0	5.4	5.7	7.6	—	—	3.3	5.3	6.85
1	—	—	7.5	4.4	6.6	8.8	10.0	11.7	—	—	4.9	9.2	9.15
1 1/4	—	—	10.4	7.0	10.6	14.1	13.4	18.9	—	—	5.0	14.3	14.3
1 1/2	—	—	14.6	9.9	14.8	19.8	19.8	27.4	—	—	10.1	20.8	15.1
2	—	—	17.6	15.5	23.3	31	25	43	—	—	10.8	37.5	17.2
2 1/2	12	18	24	22	33	44	35	67	—	—	—	60	—
3	22	33	43	37	56	74	59	95	—	—	—	—	—
4	39	59	78	55	82	109	120	159	—	—	—	—	—
5	58	87	115	85	127	169	176	258	—	—	—	—	—
6	76	114	151	124	186	248	228	350	—	—	—	—	—
8	125	187	249	222	333	444	366	665	—	—	—	—	—
10	189	283	377	353	530	706	525	1018	—	—	—	—	—
12	316	474	631	557	835	1113	952	1611	—	—	—	—	—

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 1/4" 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

SATURATED STEAM
FLOW TABLE

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		Cast Steel		Delivery Pressure			Diameter inches	Material		
	Maximum Initial Pressure psi	Maximum Temperature °F	Maximum Initial Pressure psi	Maximum Temperature °F	Maximum Initial Pressure psi	Maximum Temperature °F	Minimum psi	Maximum psi					
D	250	450	—	—	600	750	3	150	1 psi	3½	St. Stl.	Spring	E or C Series
D2	250	450	—	—	600	750	100	300	2 psi	3½	St. Stl.	Spring	E or C Series
D5	250	450	—	—	—	—	1	25	½ psi	5¾	St. Stl.	Spring	E or C Series
D120	250	450	—	—	600	750	5	150	1 psi	4½	St. Stl.	Spring	E or C Series
A73	250	450	—	—	600	750	See response curves on A Pilot Product Page 50		½ psi	3½-7¼ ^b	St. Stl.	Air	E or C Series
A53	250	450	—	—	600	750			½ psi	3½-5¾ ^b	St. Stl.	Air	E or C Series
A	250	450	—	—	600	750			½ psi	3½	St. Stl.	Air	E or C Series
A35	250	450	—	—	—	—			⅞ psi	5¾-3½ ^b	St. Stl.	Air	E or C Series
A54	250	450	—	—	600	750			1 psi	4½-5¾ ^b	St. Stl.	Air	E or C Series
A70	250	450	—	—	600	750			2 psi	7¼	St. Stl.	Air	E or C Series
A86	250	450	—	—	600	750			½ psi	4½	St. Stl.	Air	E or C Series
A87	250	450	—	—	600	750			½ psi	7¼	St. Stl.	Air	E or C Series
A85	250	450	—	—	600	750			½ psi	3½-5¾ ^b	St. Stl.	Air	E or C Series
A84	250	450	—	—	600	750			½ psi	3½	St. Stl.	Air	E or C Series
A83	250	450	—	—	600	750			½ psi	3½	St. Stl.	Air	E or C Series
A82	250	450	—	—	—	—			⅞ 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
P125	250	450	—	—	600	750	5	175	1 psi	4½	St. Stl.	Spring	E or C Series

^bThese 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
A. TYPE —See Selection Criteria for Steam, Air, Gases or Water and Liquids in beginning of this Section.	See Selection Criteria and Selection Charts opposite.
B. SIZE —See applicable Valve Capacity Tables in this Section.	
C. MATERIAL — See Main Valve Selection Chart in Technical Reference Section or individual Product Pages.	See Pilot Selection Chart opposite or individual Product Pages.
D. ACCESSORIES —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
A. Since maximum Delivery Pressure is less than 75% of minimum Initial Pressure and the least pressure drop exceeds required "minimal differential". SELECT TYPE E	Since maximum Initial Pressure 175 psi, Total Temperature 378°F maximum Delivery Pressure 40 psi, Pilot spring loaded and required accuracy 2 psi: SELECT TYPE D
B. For 14,600 lb. per hour and 150 psi minimum Initial Pressure Economical: SELECT 3" FULL PORT Engineered: SELECT 4" NORMAL PORT	
C. For 175 psi, 378°F: SELECT CAST IRON, FLANGED 250 LB.	For 175 psi, 378°F: SELECT CAST IRON
D. 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, precise predetermined temperature. Pilots fully stroke valve within 5°F. 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 ^a		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	—	—	600	750	20	Cascade Control—Closes on rise in temperature—controls delivery pressure—decreases delivery pressure as temperature increases & vice versa—spring loaded pressure control.	E or C Series
T124	250	450	—	—	—	—	125		
T14	250	450	—	—	600	750	—	Closes on rise in temperature.	E or C Series
T14D	250	450	—	—	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	—	—	600	750	300		
T52	250	450	—	—	—	—	—	Opens on rise in temperature.	E or C Series
Safety Pilot	—	—	300	500	—	—	—	Prevents excessive temperature rise.	E or C Series

^aBronze 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. ¹	½ NPT	50-250	350	Proportional	Reverse*
T64	No. 738	St. Stl. ¹	Sanitary Thermometer Bushing	50-250	350	Proportional	Reverse*
T60	No. 745	St. Stl. ²	½ NPT Union Mounted	30-150	180	Proportional	Reverse*
				100-300***	350	Proportional	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 ¹Type 304 ²Type 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
A. TYPE —See Selection Criteria for Steam, Air, Gases or Water and Liquids in beginning of this Section.	See Selection Criteria and Selection Charts opposite.
B. SIZE —See applicable Valve Capacity Tables in this Section.	
C. MATERIAL — See Main Valve Selection Chart in Technical Reference Section or individual Product Pages.	See Pilot Selection Chart opposite or individual Product Pages.
D. ACCESSORIES —See Accessories in Other Products Section.	

SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
A. Since maximum Delivery Pressure is less than 75% of minimum Initial Pressure and the least pressure drop exceeds required "minimal differential". SELECT TYPE E	Since maximum Initial Pressure 125 psi, Total Temperature 353°F maximum Delivery Pressure 30 psi SELECT TYPE T124
B. Using Capacity Tables in this Section, for 7200#/Hr and 125 psi initial pressure SELECT 2" FULL PORT	
C. For 125 psi, 353°F: SELECT CAST IRON, NPT 250	For 125 psi, 353°F: SELECT CAST IRON
D. 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 ^a			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 E or C Series
N33	250	450	240	300	500	290	600	750	300	3	150	1 psi	3½	St. Stl.	Spring		
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

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

SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
A. Since pressure drop across valve (Initial Pressure minus Delivery Pressure) is greater than 10 psi: SELECT TYPE E	Since Initial Pressure 220 psi, 240°F, Differential (Excess) Pressure 50 psi and the Delivery and Controlled Pressures are the same: SELECT TYPE N
B. For 90 gpm: SELECT 3"	
C. For 220 psi, 240°F: SELECT CAST IRON, FLANGED 250 LB.	For 220 psi, 240°F: SELECT BRONZE
D. 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 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							Diaphragm		Main Valve
	Cast Iron		Cast Steel		Delivery Pressure					
	Maximum Initial Pressure psi	Maximum Temper- ature °F	Maximum Initial Pressure psi	Maximum Temper- ature °F	Minimum psi	Maximum psi	Normal Accuracy ±	Diameter inches	Material	
Q	150	366	150	366	3	150	1 psi	3½	St. Stl.	E or C Series
Q2	250	450	600	750	100	400	2 psi	3½	St. Stl.	E or C Series
Q73 ^b	150	366	150	366	3	150	½ psi	3½-7¼ ^c	St. Stl.	E or C Series
F14	250	450	600	750	3	150	1 psi	4½	St. Stl.	E or C Series
F13	250	450	600	750	100	300	2 psi	3½	St. Stl.	E or C Series
F15	250	450	600	750	2	25	1/2 psi	5%	St. Stl.	E or C Series
F32	250	450	600	750	200	2000	10 psi	¾ piston	St. Stl.	E or C Series

^bType Q73 is air adjusted, all others are spring loaded.

^cThese 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.

TYPE F SERIES have bellows stem seals and separate diaphragm chambers. They are designed for applications where a regulator is required to open on rise in pressure of a fluid other

than that flowing through the regulator. Type F Series Pilots are also recommended for usual back pressure service in the event that long control pipes are unavoidable.

In either series of back pressure pilots, a larger Diaphragm will produce closer accuracy of control but with less range in back pressure.

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

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 $\pm 1/2$ psi.

- 1.** Steam
- 2.** (a) 5 psi
(b) None (saturated, 228°F total temperature)
- 3.** 6" Hg vacuum
- 4.** 9000lb. per hour
- 5.** Flanged, if 2 1/2" size or larger

SELECTION OF TYPE AND SIZE OF REGULATOR

MAIN VALVE	PILOT
A. Since Initial Pressure is less than 15 psi and the least pressure drop exceeds "minimum differential": SELECT TYPE E2	Since maximum Initial Pressure 5 psi, Total Temperature 228°F, accuracy of control $\pm 1/2$ psi and Pilot spring loaded: SELECT TYPE F15
B. For 9000 lb. per hour and 5 psi Initial Pressure: SELECT 8" SIZE.	
C. For 5 psi, 228°F: SELECT CAST IRON, FLANGED 125 LB.	For 5 psi, 228°F: SELECT CAST IRON
D. For discharge into vacuum: Condensation Chamber required.	None required in this case.

ANSWER: 8" SPENCE TYPE E2F15, CAST IRON BODY, 125 LB. FLANGED ENDS, EQUIPPED WITH CONDENSATION CHAMBER.

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

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 Steel		Pump Discharge Pressure					
	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	600	750	100	300	3½	St. Stl.	E or C Series	Constant Pressure
P14	250	450	600	750	5	150	4½	St. Stl.	E or C Series	Constant Pressure
P15	250	450	600	750	3	25	5¾	St. Stl.	E or C Series	Constant Pressure
P32	250	450	600	750	200	2000	7/8 Piston	St. Stl.	E or C Series	Constant Pressure
F46	250	450	600	750	0	30" Hg vac	4½	St. Stl.	E or C Series	Vacuum
N	250	450	600	500	3 ^b	300 ^b	3½	St. Stl.	E or C Series	Differential ^c

^bRegulator discharge pressure

^cFor 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.

RATED STEAM CAPACITY TABLE

TYPE E MAIN VALVE—FULL PORT

Pounds of Saturated Steam per Hour

VALVE INFO
PAGE 28

TYPE E FULL PORT
CAPACITY TABLE

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

RATED STEAM CAPACITY TABLE

TYPE E MAIN VALVE—NORMAL PORT

Pounds of Saturated Steam per Hour

VALVE INFO
PAGE 28

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.

RATED STEAM CAPACITY TABLE

TYPE E2 MAIN VALVE

Pounds of Saturated Steam per Hour

VALVE INFO
PAGE 30

TYPE E2
CAPACITY TABLE

PRESSURE-psig		VALVE SIZE (inches)												
INLET	REDUCED	¾	1	1¼	1½	2	2½	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)

$\Delta P'$ = ΔP 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

ΔP = Pressure drop, psi

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

Size	E2 Cv Valve Coefficient	ΔP Nominal	K Factor
¾	7.6		
1	11.7		
1¼	18.9	3	0.635
1½	27.4	4	0.785
2	44	5	0.855
2½	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

VALVE INFO
PAGE 32

PRESSURE-psig		VALVE SIZE (inches)												
INLET	REDUCED	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
20	15	286	441	712	1033	1620	2525	3580	5992	9722	13189	25059	38361	60708
	10	389	599	967	1402	2201	3429	4862	8138	13205	17914	34036	52103	82453
	5.4	451	694	1121	1626	2551	3976	5637	9435	15309	20768	39459	60405	95592
25	20	308	474	766	1110	1742	2714	3848	6440	10450	14176	26935	41232	65251
	15	420	647	1046	1516	2379	3707	5256	8796	14273	19363	36789	56318	89124
	10	496	764	1234	1788	2807	4373	6201	10378	16839	22844	43404	66444	105149
	8.3	516	794	1283	1860	2919	4548	6449	10794	17515	23760	45145	69109	109366
30	25	328	505	815	1182	1855	2890	4098	6859	11130	15099	28688	43916	69498
	20	450	692	1118	1621	2544	3965	5622	9409	15267	20711	39351	60239	95329
	15	533	821	1326	1922	3017	4700	6665	11154	18100	24554	46652	71417	113018
	11.2	581	894	1445	2094	3287	5121	7262	12153	19721	26753	50831	77813	123140
40	35	365	561	907	1315	2063	3215	4558	7629	12379	16793	31906	48843	77295
	30	503	775	1251	1814	2847	4436	6290	10527	17082	23173	44029	67400	106662
	25	601	925	1494	2165	3398	5295	7507	12565	20388	27658	52550	80445	127305
	17	711	1094	1768	2563	4022	6267	8886	14872	24133	32738	62202	95221	150688
50	45	398	613	990	1435	2252	3509	4976	8327	13512	18331	34829	53317	84374
	40	551	849	1371	1988	3120	4862	6894	11538	18722	25397	48255	73870	116901
	35	661	1018	1644	2384	3741	5828	8264	13832	22444	30447	57849	88558	140144
	22.8	841	1294	2091	3031	4757	7413	10511	17591	28544	38723	73574	112628	178236
75	70	471	726	1172	1699	2667	4155	5891	9860	15999	21704	41238	63128	99902
	65	657	1011	1634	2368	3717	5791	8211	13743	22300	30251	57477	87988	139242
	60	793	1220	1971	2857	4484	6987	9907	16581	26905	36499	69349	106161	168001
	37.3	1166	1795	2899	4203	6596	10277	14572	24389	39574	53685	102002	156148	247106
100	95	535	823	1329	1927	3025	4713	6683	11184	18148	24620	46778	71608	113321
	90	748	1151	1859	2695	4230	6590	9345	15640	25378	34428	65412	100135	158465
	85	905	1393	2251	3263	5121	7979	11314	18935	30725	41682	79195	121234	191855
	51.8	1491	2295	3707	5374	8434	13141	18633	31186	50603	68648	130431	199667	315977
125	120	591	910	1470	2131	3345	5212	7390	12368	20069	27225	51727	79185	125312
	115	828	1275	2060	2987	4687	7303	10355	17331	28121	38149	72484	110960	175596
	110	1005	1547	2500	3624	5687	8861	12564	21028	34120	46287	87946	134630	213055
	90	1476	2272	3671	5322	8352	13013	18451	30882	50110	67979	129159	197720	312896
	66.3	1816	2751	4374	6574	10019	15297	22890	36660	57921	82226	160923	261002	404004
150	145	643	990	1598	2317	3637	5667	8035	13448	21820	29601	56243	86098	136251
	140	902	1389	2243	3252	5103	7952	11275	18871	30620	41539	78924	120819	191198
	135	1096	1687	2726	3951	6201	9662	13700	22930	37207	50475	95902	146809	232328
	110	1717	2644	4270	6191	9716	15138	21465	35925	58293	79080	150252	230010	363994
	80.8	2140	3275	5091	7545	113051	170965	253038	40454	623834	904610	174955	283770	438491
175	170	691	1063	1717	2490	3907	6088	8632	14447	23442	31801	60422	92495	146375
	165	970	1493	2412	3497	5488	8552	12125	20294	32930	44672	84877	129932	205619
	160	1180	1817	2934	4254	6676	10402	14750	24686	40057	54340	103247	158053	250121
	125	2048	3153	5094	7384	11589	18057	25603	42851	69532	94327	179221	274356	434172
	95.3	2465	3700	5641	8415	12607	19208	28258	45966	73906	112368	187941	304841	473476
200	195	735	1132	1828	2651	4160	6481	9190	15381	24958	33858	64330	98478	155843
	185	1258	1937	3129	4537	7119	11093	15729	26325	42716	57949	110102	168548	266729
	150	2198	3384	5467	7925	12437	19379	27477	45989	74623	101233	192342	294443	465960
	109.8	2790	4296	6939	10060	15787	24598	34878	58375	94721	128498	244146	373745	591458
250	245	817	1258	2032	2946	4624	7205	10215	17098	27743	37636	71508	109467	173233
	235	1402	2158	3486	5054	7932	12359	17524	29330	47592	64563	122670	187786	297174
	200	2471	3804	6145	8908	13980	21784	30887	51695	83883	113795	216210	330979	523780
	138.8	3440	5296	8555	12402	19463	30327	43001	71969	116780	158423	301004	460784	729198

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

VALVE INFO
PAGE 32

TYPE E5 NORMAL
PORT CAPACITY TABLE

PRESSURE-psig		VALVE SIZE (inches)												
INLET	REDUCED	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12
20	15	215	377	505	746	942	1319	2223	4522	6632	8592	12662	19784	35874
	10	292	512	686	1013	1280	1791	3020	6142	9008	11669	17197	26870	48725
	5.4	338	593	795	1175	1483	2077	3501	7120	10443	13529	19937	31152	56489
25	20	231	405	543	802	1013	1418	2390	4860	7129	9235	13609	21264	38559
	15	315	553	741	1095	1383	1936	3264	6639	9737	12613	18588	29044	52667
	10	372	653	875	1292	1632	2284	3851	7832	11487	14881	21930	34266	62136
	8.3	387	679	910	1344	1697	2376	4005	8146	11948	15478	22810	35641	64628
30	25	246	431	578	854	1078	1510	2545	5177	7593	9836	14495	22648	41069
	20	337	592	793	1172	1479	2071	3491	7101	10415	13492	19882	31066	56333
	15	400	702	940	1389	1754	2455	4139	8418	12347	15995	23572	36831	66786
	11.2	436	764	1024	1513	1911	2675	4510	9172	13453	17428	25683	40129	72768
40	35	273	480	643	950	1199	1679	2831	5758	8444	10939	16121	25189	45676
	30	377	662	887	1311	1655	2317	3906	7945	11653	15095	22246	34759	63030
	25	450	790	1059	1565	1976	2766	4662	9483	13908	18017	26552	41487	75229
	17	533	935	1253	1852	2338	3274	5519	11224	16463	21326	31428	49107	89047
50	45	299	524	702	1037	1309	1833	3090	6285	9218	11941	17598	27496	49860
	40	414	726	972	1437	1814	2540	4281	8708	12771	16545	24382	38096	69081
	35	496	870	1166	1722	2175	3045	5133	10439	15311	19834	29229	45671	82816
	22.8	631	1106	1483	2191	2766	3872	6528	13276	19472	25225	37174	58084	105326
75	70	353	620	831	1228	1550	2170	3659	7441	10914	14139	20836	32556	59036
	65	493	864	1158	1711	2161	3025	5100	10372	15212	19707	29041	45377	82284
	60	594	1043	1397	2065	2607	3650	6153	12514	18354	23777	35039	54749	99278
	37.3	874	1534	2055	3037	3835	5369	9050	18406	26996	34972	51538	80528	146024
100	95	401	703	943	1393	1759	2462	4150	8441	12380	16038	23635	36930	66966
	90	561	984	1318	1948	2459	3443	5803	11804	17312	22427	33050	51641	93643
	85	679	1191	1596	2358	2977	4168	7026	14291	20960	27153	40014	62523	113374
	51.8	1118	1961	2628	3884	4903	6865	11572	23536	34520	44719	65902	102972	186722
125	120	443	778	1042	1540	1945	2722	4589	9334	13690	17735	26136	40837	74051
	115	621	1090	1461	2158	2725	3815	6431	13080	19184	24852	36623	57224	103766
	110	754	1322	1772	2619	3306	4629	7803	15870	23276	30153	44436	69431	125902
	90	1107	1942	2603	3846	4856	6798	11459	23307	34184	44283	65259	101968	184902
	66.3	1362	1313	143	4465	7725	10303	15155	19098	26679	44875	91124	133581	173006
150	145	482	846	1133	1675	2114	2960	4990	10149	14885	19283	28417	44402	80516
	140	676	1187	1590	2350	2967	4154	7002	14242	20888	27060	39877	62308	112986
	135	822	1442	1932	2855	3605	5047	8509	17306	25382	32881	48456	75712	137291
	110	1288	2259	3028	4474	5649	7908	13331	27113	39766	51515	75917	118620	215098
	80.8	1605	1557	143	4842	8387	11190	16466	20752	28996	48780	99066	145230	188097
175	170	518	909	1218	1799	2271	3180	5361	10903	15991	20716	30529	47701	86499
	165	728	1276	1710	2527	3191	4467	7530	15316	22464	29101	42885	67008	121508
	160	885	1553	2080	3074	3881	5434	9160	18631	27325	35399	52167	81510	147806
	125	1536	2695	3611	5336	6738	9433	15901	32341	47433	61447	90554	141490	256568
	95.3	1849	1800	143	5191	8999	12010	17678	22284	31140	52394	106417	156011	202063
200	195	551	967	1296	1915	2418	3386	5707	11608	17026	22056	32504	50787	92093
	185	944	1656	2219	3278	4139	5795	9768	19868	29140	37749	55631	86923	157620
	150	1649	2892	3876	5727	7231	10123	17065	34708	50906	65946	97183	151849	275353
	109.8	2093	3671	4920	7269	9178	12850	21661	44056	64616	83707	123358	192747	349514
250	245	613	1075	1441	2129	2688	3764	6344	12904	18926	24517	36131	56454	102370
	235	1051	1845	2472	3652	4612	6456	10883	22136	32466	42058	61980	96844	175611
	200	1853	3251	4357	6438	8128	11379	19183	39015	57222	74129	109243	170692	309521
	138.8	2580	4526	6065	8962	11316	15842	26706	54316	79664	103201	152086	237634	430910

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

RATED STEAM CAPACITY TABLE

TYPE C20 MAIN VALVE

AVAILABLE ON SPECIAL ORDER ONLY – CONSULT FACTORY

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

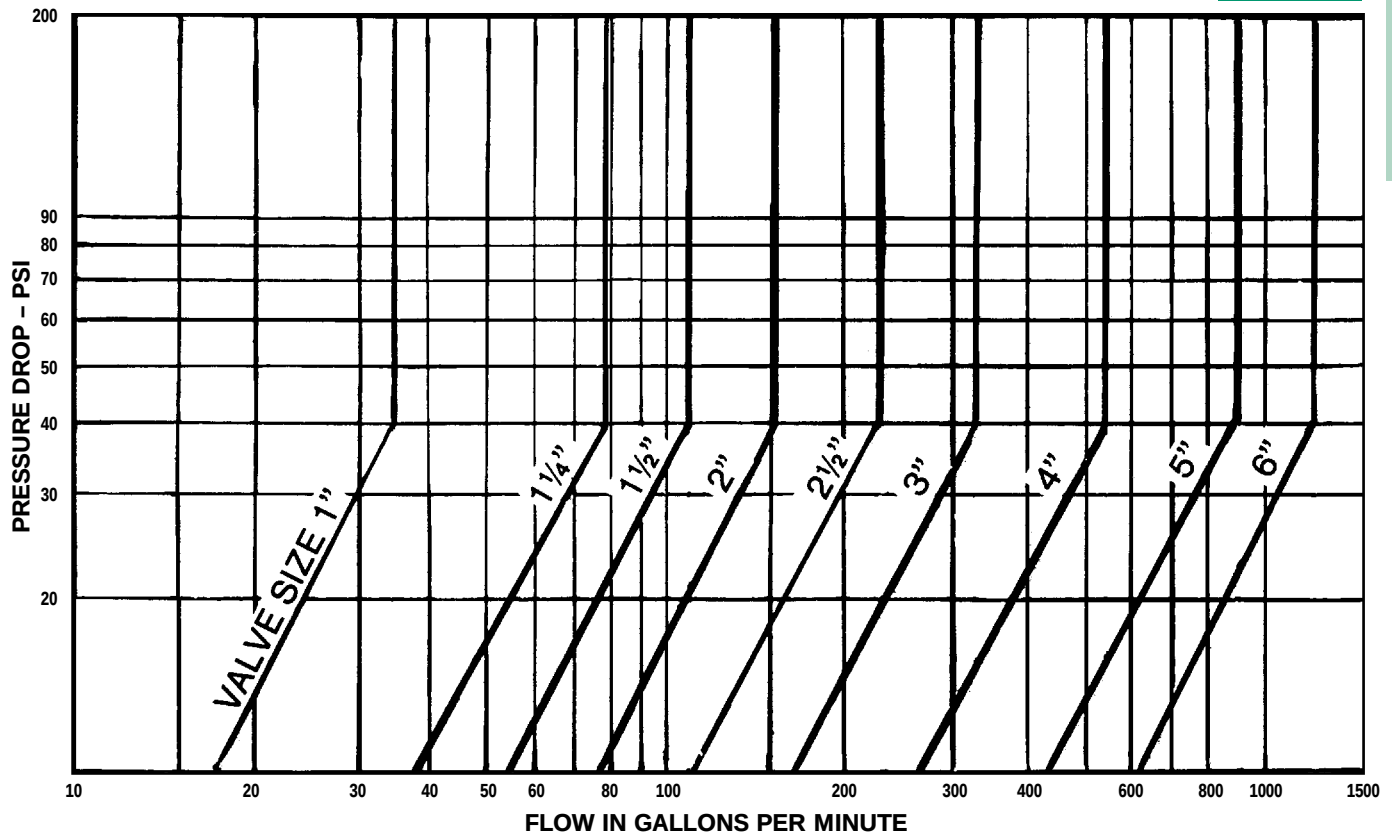
Based on 10% (2 psi minimum) accuracy of regulation.

RATED WATER CAPACITY CHART

TYPE C34 PILOT OPERATED MAIN VALVE

(Specific Gravity of 1)

VALVE INFO
PAGE 38



TYPE C34 WATER
CAPACITY CHART

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

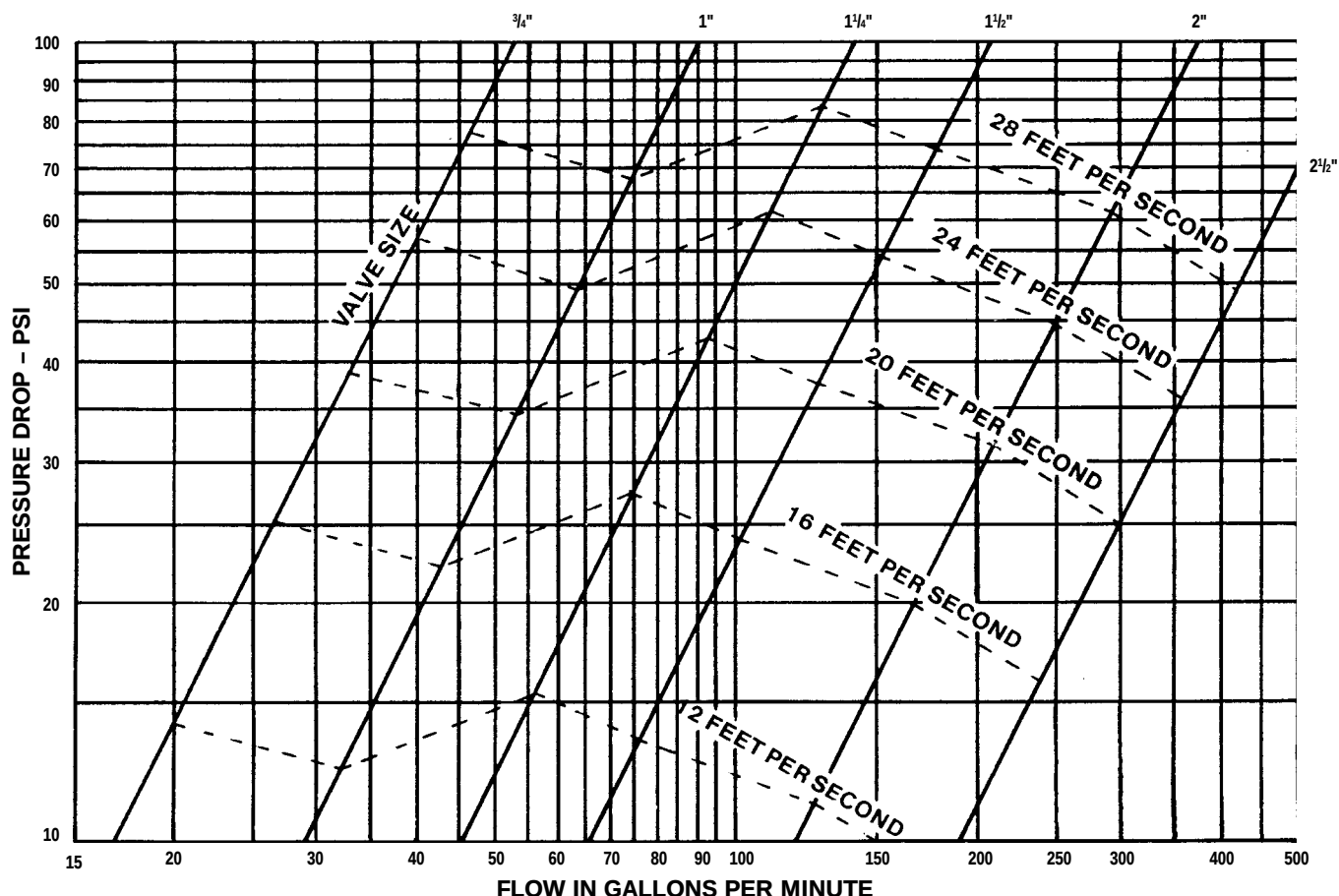
Required maximum flow is 100 GPM, Inlet Pressure is 60 psi, Delivery Pressure is 35 psi (Pressure drop is 25 psi). Enter the Capacity Chart at the 100 GPM line and follow up to 25 psi pressure drop. It falls to the right of the 1 1/2" valve size line, therefore 2" is the minimum valve size required.

RATED WATER CAPACITY CHART

TYPE N6 DIFFERENTIAL PRESSURE VALVE

(Specific Gravity of 1)

VALVE INFO
PAGE 98



RATED WATER CAPACITY TABLE

TYPE D34 VALVE

Water in GPM

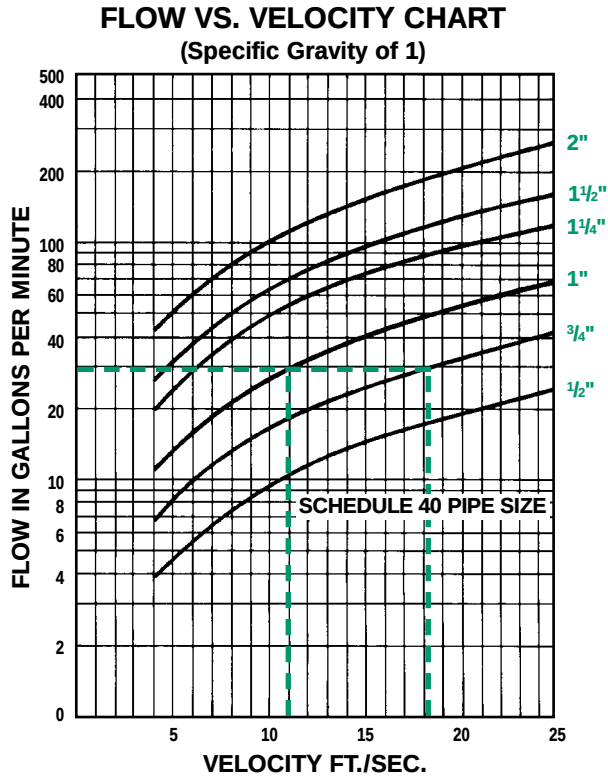
PRESSURE DROP-psig	VALVE SIZE (inches)								
	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6
5	7.4	17	23	32	48	71	116	188	263
10	10	24	33	45	68	101	164	266	373
15	13	29	40	55	84	124	201	325	457
20	15	33	47	64	97	143	233	376	528
30	18	41	51	79	118	175	285	460	646
50	23	53	74	102	153	226	368	594	834
75	29	65	90	125	187	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.



VALVE INFO
PAGE 104

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 (¾") at a droop of approximately 16 psi.

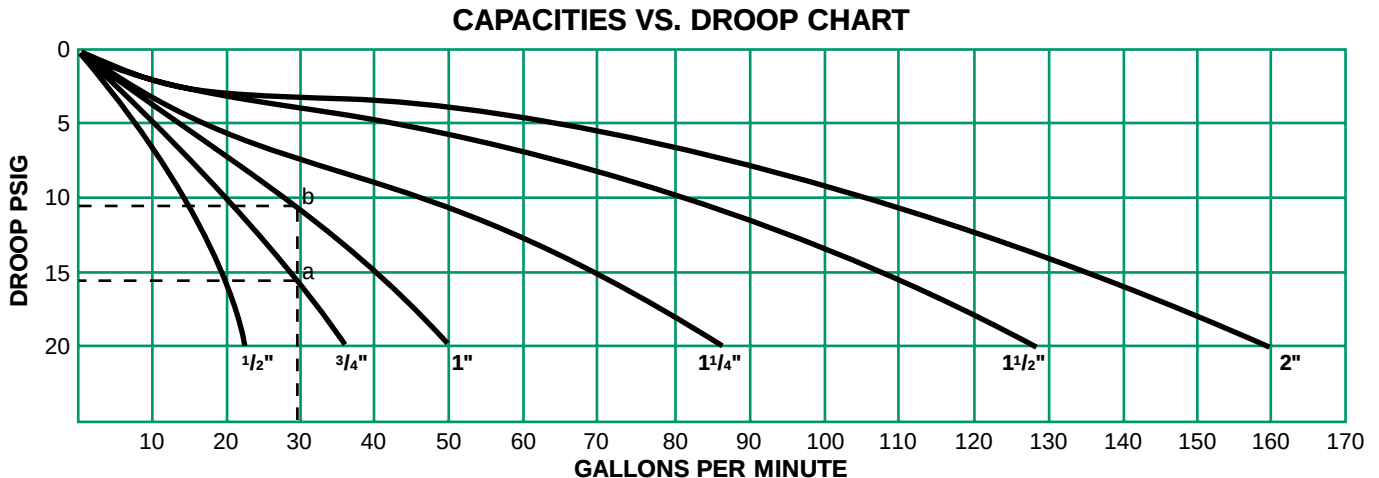
- Enter Flow vs. Velocity Chart (left) at 30 GPM and move up until you reach the ¾" pipe size curve. Move downward and note that the velocity is approximately 18.5 ft./sec., which is unacceptably high.

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.



RATED STEAM, AIR AND WATER CAPACITY TABLE

TYPE D50 DIRECT ACTING PRESSURE REGULATOR

VALVE INFO
PAGE 96

VALVE SIZE		1/2"			3/4"			1"			1 1/4"			1 1/2"			2"		
IN	OUT	2.2			3.3			4.9			5.0			10.1			10.8		
		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:

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

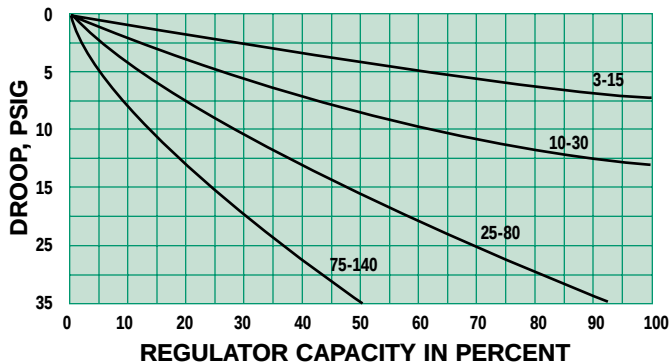
Referring to the C_v line of the Capacity Table opposite, the $\frac{3}{4}$ " valve size ($C_v = 3.3$) is the smallest valve with the required capacity.

Droop is a function of valve size ($\frac{3}{4}$ "), regulator capacity in percent [(3.2 ÷ 3.3) x 100 = 97%] and adjusting spring range (10-30). Enter the $\frac{3}{4}$ " 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.

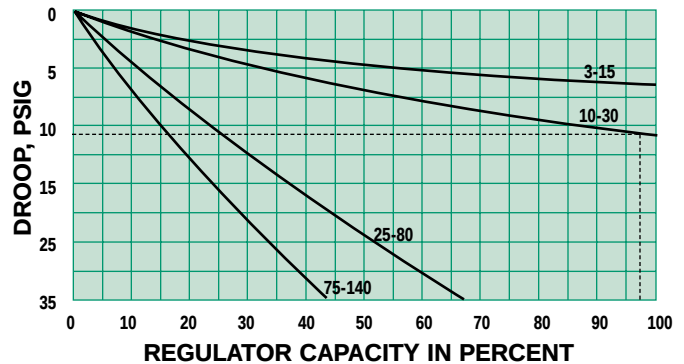
Minimum Controllable Flow Pressure = Reduced Pressure + Droop = 25 + 11 = 36 PSIG

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.

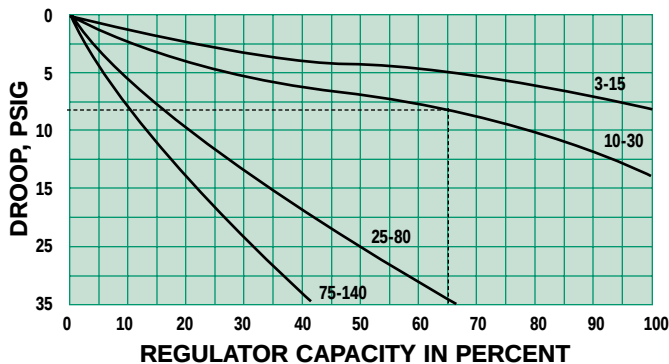
$\frac{1}{2}$ " VALVE DROOP CHART



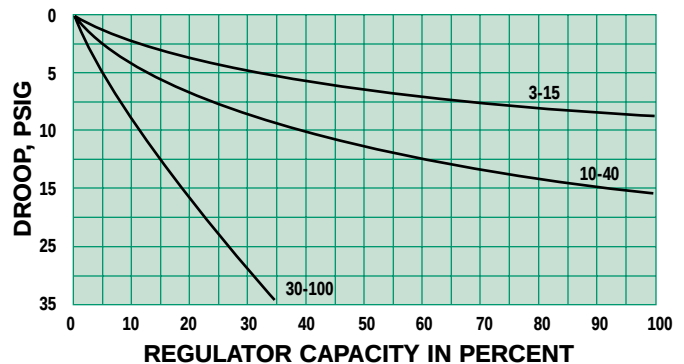
$\frac{3}{4}$ " VALVE DROOP CHART



1" & 1 1/4" VALVE DROOP CHART



1 1/2" & 2" VALVE DROOP CHART



NOTES:

SECTION II

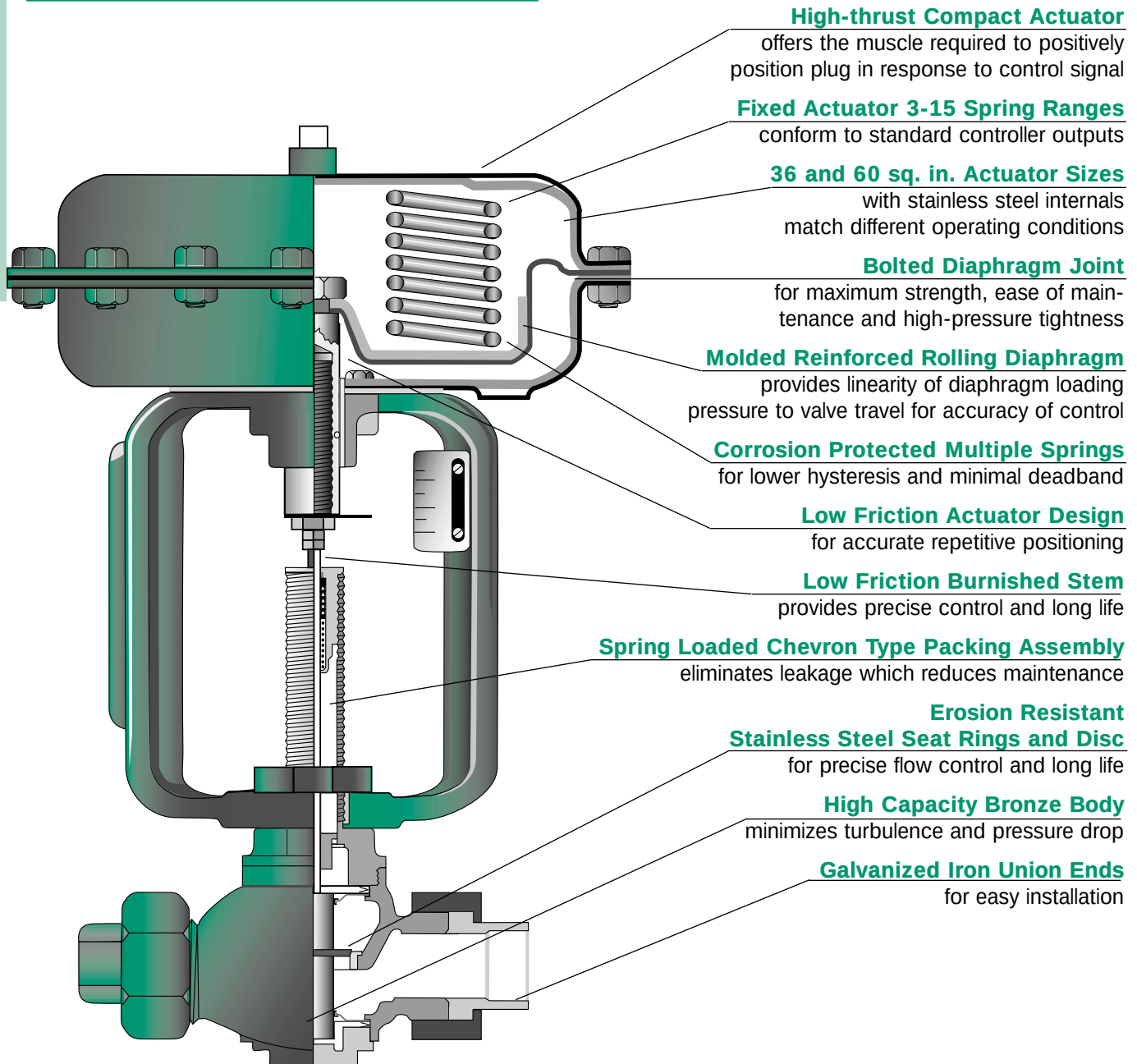
CONTROL VALVES

Applications

- Bottle Washing Machinery
- Steam Tables
- Plating Tanks
- Heating Ducts
- Fuel Oil Heaters
- Cooking Vats
- Heat Exchangers
- Induction Furnaces
- Industrial Compressors
- Cold Storage Boxes
- Cooling Ducts
- Engine Jacket Cooling
- Liquid Chillers
- Water Heaters
- Parts Washers

KOMBAT K1 Pneumatic Control Valve

Pressures To 400 PSIG
Temperatures to 400°F

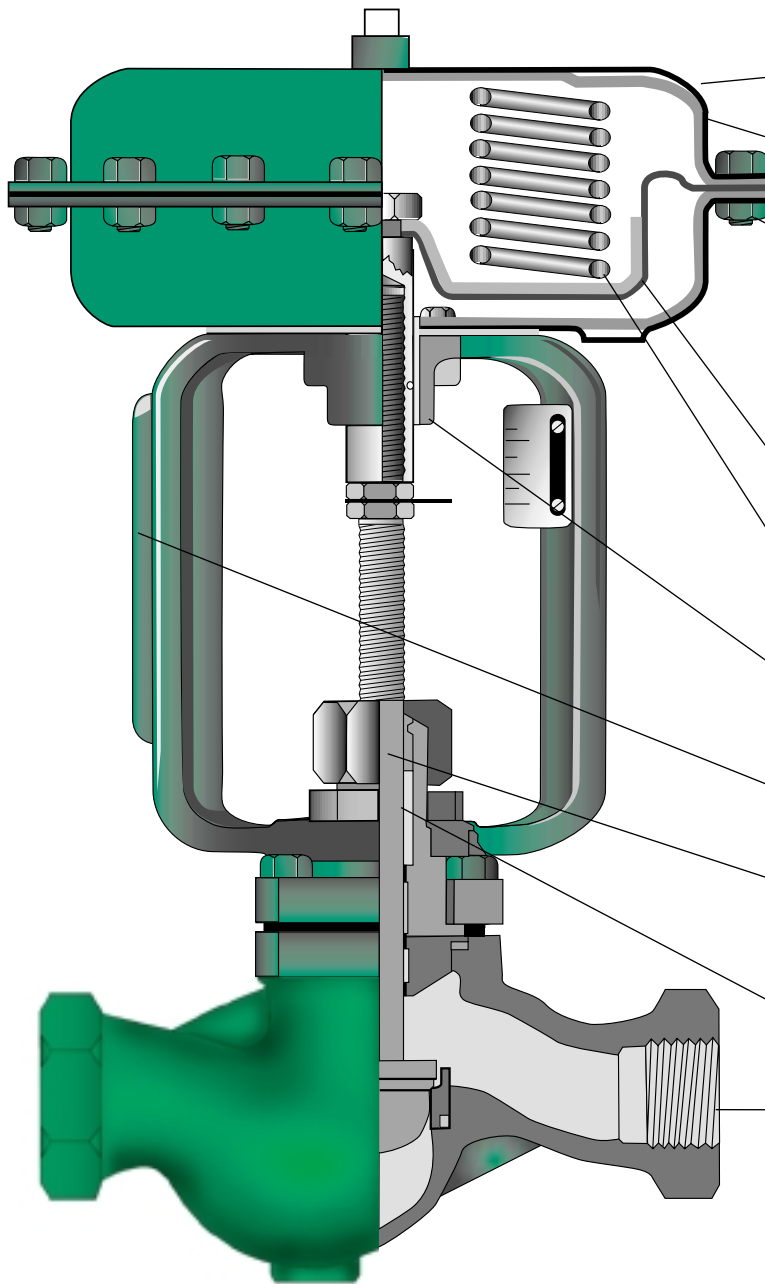


Applications

- Process control systems for food, pulp and paper, chemical, petrochemical & other industries
- HVAC systems
- Feed water and fuel system controls in boiler rooms
- Packaged systems (OEM) such as heat exchangers, water purification systems & vaporizer, metal cleaning and plating

INTIMIDATOR Type J Control Valve

**Pressures to 1440 PSIG
Temperatures to 750°F**



High-thrust, Compact Actuator

offers the muscle required to positively position the plug in response to control signal

36 & 60 Inch Actuator

sizes match different operating conditions

Bolted Diaphragm Joint

for maximum strength, ease of maintenance and high-pressure tightness

Molded, Reinforced Rolling Diaphragm

provides dependable, accurate control

Corrosion-protected Multiple Springs

for lower hysteresis and positive shutoff with 3-15 psi signal

Low-friction Actuator Stem Guiding

for accurate repetitive positioning

Mounting Pad NEMUR 4 Compliant

drilled and tapped for accessories

Superfinished Stem

reduces friction, extends packing life

High Performance, Low Friction Packing

selections to meet your system requirements

High-capacity Streamlined Body

minimizes turbulence and pressure drop

**INTIMIDATOR TYPE J
FEATURES**

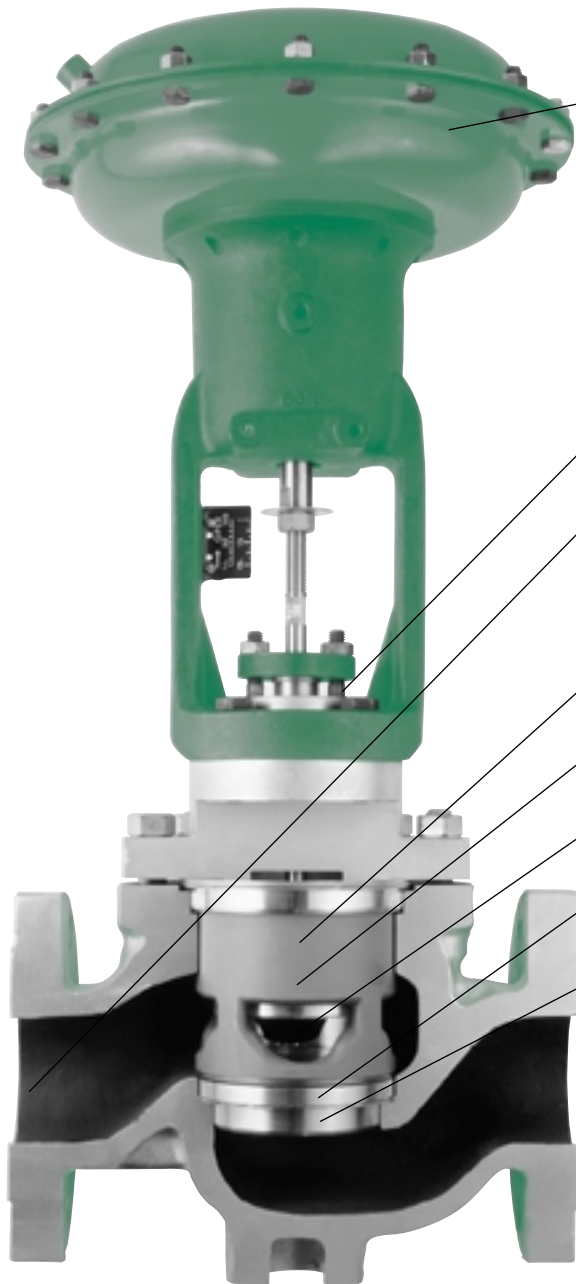
Applications

- Process control systems for food, pulp and paper, chemical, petrochemical & other industries
- HVAC systems
- Feed water and fuel system controls in boiler rooms
- Packaged systems (OEM) such as heat exchangers, water purification systems & vaporizer, metal cleaning and plating

BOSS Series D Control Valve

**Pressures to 1550 PSIG
Temperatures to 800°F**

BOSS SERIES D FEATURES



Ultra Compact Actuators
install in tight spaces

Bolted Actuator Yoke
Four bolt mounting
guarantees easy disassembly

High Flow Capacities
Valve body flow areas 42% of
pipe area, reducing velocities
and pressure loss

Multiple Cage Options
for maximum versatility

Hung Cage Design
eliminates problems
associated with fixed cages

Rugged Piston Seal
with three times the wear
surface of competitive valves
for long lasting leak tight seal

Hardened Stainless Steel Trim
provides twice the service
life of 316 stainless trim

Controlled Seat Loading
maintains constant seat gasket load

Balanced Plug Design
provides smooth high pressure control

Tighter Shutoffs to Class VI
Superior design provides
exceptional performance up to Class VI

CONTROL VALVES

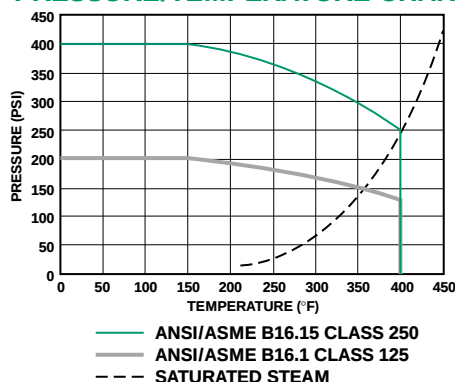


KOMBAT K1 CONTROL VALVE

APPLICATION DATA

- Process control systems for food, pulp and paper, chemical, petrochemical & other industries
- HVAC systems
- Feed water and fuel system controls in boiler rooms
- Packaged systems (OEM) such as heat exchangers, water purification systems & vaporizer, metal cleaning and plating
- Mixing or diverting applications

PRESSURE/TEMPERATURE CHART



KOMBAT SERIES K CONTROL VALVE

SIZES 1/2" – 4"
ANSI Class 125/250

- **Shutoff to 400 PSI without Positioner** for broad range of applications.
- **Ultra Compact Multi-spring Pneumatic Actuator** installs in tight spaces.
- **3–15 lb. Spring Ranges** in durable epoxy coated pneumatic actuators accommodate most standard input devices.
- **Powerful Electric Actuator** accepts a wide variety of signals while providing highest shutoff in it's class.
- **Live Loaded V ring Packing Assembly** is self adjusting.
- **Stainless Steel Valve Plugs & Seat Rings** resist wear and corrosion
- **Optional 3-Way Body** for mixing or diverting

MODELS

- Type K1 — Single Seat Bronze w/union ends & Pneumatic Actuator
- Type K3 — 3-Way Bronze w/union ends & Pneumatic Actuator
- Type K4 — Single Seat Flanged Cast Iron w/Pneumatic Actuator
- Type K5 — Same as K1 w/Electric Actuator, fail closed
- Type K6 — Same as K1 w/Electric Actuator, fail open
- Type K7 — Same as K3 w/Electric Actuator

OPTIONS

- 36 or 60 sq. in. Pneumatic Actuator
- Electric Actuator

APPLICABLE CODES

- Meets or exceeds ANSI B16.15 Class 250 or ANSI B16.1 Class 125
- ANSI/FCI 70-2 Class IV Seat Leakage

PLUG CHARACTERISTICS

Modified Equal Percent, 30:1 flow rangeability

KOMBAT SERIES K VALVE ORDERING CODE

Model		Orifice Size	Valve Size	Connections	Trim Material	Packing	Actuator		Spring		Positioner		Posit. Set		Accessories	
K	1	T	E	8	1	1 - 3	6	R	B	M - P	0	2	0	1		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Model - Position 1 & 2 K1 = Bronze, Pneumatic K3 = Bronze, 3 Way, Pneumatic K4 = Cast Iron, Pneumatic K5 = Bronze, Electric, FC K6 = Bronze, Electric, FO K7 = Bronze, 3 Way, Electric	Orifice Size - Position 3 A B C E T

Valve Size - Position 4 C = 1/2 D = 3/4 E = 1 F = 1 1/4 G = 1 1/2 H = 2 J = 2 1/2 K = 3 M = 4	Connections - Position 5 2 = 125 Flg 8 = Unions	Trim Material - Position 6 1 = Metal

Packing - Position 7 1 = V-ring	Actuator - Position 8 & 9 K1, K3, K4 only 01 = None 36 = 36 sq. in. 60 = 60 sq. in. K5, K6, K7 only 90 = 0-10vDC 91 = 4-20mA 92 = 0-135ohm

Spring - Position 10 & 11 All except K4 DA = Dir 36 DC = Dir 36 DD = Dir 36 DG = Dir 60 FM = Dir 36 RA = Rev 36 RB = Rev 36 RC = Rev 36 RD = Rev 36 RE = Rev 36 DF = Dir 60 DG = Dir 60 RG = Rev 60 K4 only DH = Dir 60 RH = Rev 60 RQ = Rev 60 RT = Rev 60

Positioner - Position 12 & 13 A = None MI = Moore I/P MP = Moore P 4P = PMV P4 P 5I = PMV P5 I/P 5P = PMV P5 P	Positioner Set Position 14 & 15 01 = None 02 = 8-15/4-20 mA 03 = 3-9/4-12 mA 04 = 9-15/12-20 mA	Accessories - Position 16 & 17 01 = None 02 = Limit Switch, Mechanical 03 = Limit Switch, Proximity Sw. 04 = Feedback Potentiometer 1K 05 = Feedback 4-20mA Posit. Tra

KOMBAT SERIES K CONTROL VALVE

SPECIFICATION

Valve shall be pneumatically or electrically actuated, have a bronze or cast iron body and meet ANSI B16.15 Class 250 or ANSI B16.1 Class 125 accommodating pressures to 400 PSIG. Guiding shall be low friction utilizing spring loaded self adjusting chevron type teflon packing, burnished stem and double guided stainless steel monolithic disc assembly. Valve trim shall be erosion resistant stainless steel with a modified equal percent flow characteristic capable of exceeding ANSI/FCI 70-2 Class IV shut off. Valve connections shall be female NPT with integral galvanized cast iron unions or flanged.

Pneumatic actuator shall be 36 sq. in. or 60 sq. in. and have a high thrust multi spring diaphragm. Actuator components shall be stainless steel and epoxy coated. Fixed 3-15 pound springs shall be utilized to accommodate standard controller outputs without a positioner.

The electric actuator shall accept 0-10 VDC, 4-20 mA or 0-135 ohm input signal. Spring shall return to initial position on loss of signal. Actuator shall have manual override. It shall close to 400 psi. Enclosure shall meet NEMA 1.

MATERIALS OF CONSTRUCTION

Body K1, K3, K5, K6, K7 Bronze ASTM B62
K4 Cast Iron ASTM A126 CL B
Bonnet K4 DI ASTM A536 65-45-12
Seat K1, K3, K5, K6, K7 303 SS ASTM A276
K4 420 SS ASTM A743
Plug/Stem Assy K1, K3, K5, K6, K7 303 SS ASTM A276
Plug K4 420 SS ASTM A743
Stem 303SS ASTM A582
Stem Guide - Body K1, K3, K5, K6, K7 ...301 SS/Monel/Brass
Live Loaded Packing PTFE/302 SS Spring/Viton O-Ring
Actuator Casing K1, K3, K4 ...Steel SAE 1006 - 1008/Epoxy
K5, K6, K7 Powder Coated Aluminum
Actuator Spring K1, K3, K4 Music Wire ASTM A228
Diaphragm K1, K3, K4 Nitrile/Polyester
Yoke K1, K3, K4 D Iron ASTM A536/Epoxy
K5, K6, K7 Powder Coated Aluminum

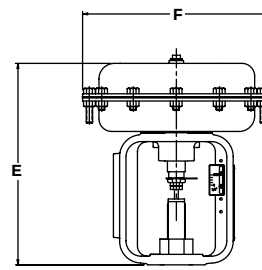
MAXIMUM RATED FLOW COEFFICIENTS* (Cv)

VALVE	VALVE SIZE								
	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
2-WAY	5.2	7	11	20	25	30	71	94	146
3-WAY	5.4	6.4	8.7	19.5	24	34	—	—	—

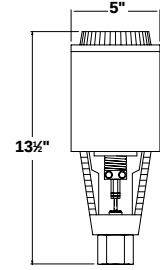
*See Flow Characteristic Chart on following pages.

K1, K4, K5 & K6 DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

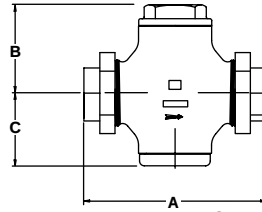
Size	A	B	C	Weight		
				K1, K4 36 in ²	K1, K4 60 in ²	K5, K6
1/2-3/4 (15)-(20)	5 1/2 (140)	11 1/16 (43)	1 3/16 (30)	21 (9.5)	—	13 (6)
1 (25)	7 7/16 (183)	2 3/8 (74)	2 5/16 (58)	25 1/2 (11.6)	39 (17)	17 1/2 (8)
1 1/4-1 1/2 (32)-(40)	8 3/8 (226)	3 3/8 (79)	2 7/8 (74)	31 1/2 (14.3)	45 (20)	23 1/2 (11)
2 (50)	8 3/8 (226)	3 3/8 (79)	2 7/8 (74)	33 3/8 (15.2)	47 (21)	25 1/2 (12)
2 1/2 (65)	9 3/8 (238)	5 1/4 (133)	4 3/8 (118)	—	72 (33)	—
3 (80)	10 (254)	6 3/8 (155)	5 3/8 (136)	—	84 (39)	—
4 (100)	11 3/8 (302)	7 3/8 (181)	7 3/8 (187)	—	145 (66)	—



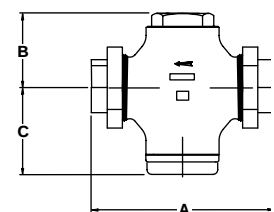
K1, K3, K4 ACTUATOR



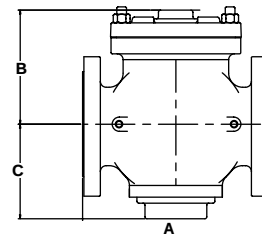
K5, K6, K7 ACTUATOR



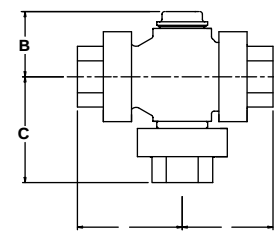
K1, K5 1/2" - 2"



K6 1/2" - 2"



K4 2 1/2" - 4"



K3, K7 1/2" - 2"

PNEUMATIC ACTUATOR

DIMENSIONS inches (mm)

Size	E		F	
	36 in ²	60 in ²	36 in ²	60 in ²
1/2-3/4 (15)-(20)	9 3/8 (251)	—	9 3/8 (235)	—
1 (25)	9 3/8 (251)	11 1/4 (298)	9 3/8 (235)	11 1/4 (286)
1 1/4-1 1/2 (32)-(40)	9 3/8 (251)	11 1/4 (298)	9 3/8 (235)	11 1/4 (286)
2 (50)	9 3/8 (251)	11 1/4 (298)	9 3/8 (235)	11 1/4 (286)
2 1/2 (65)	—	11 1/8 (302)	—	11 1/4 (286)
3 (80)	—	11 1/8 (302)	—	11 1/4 (286)
4 (100)	—	11 1/8 (302)	—	11 1/4 (286)

K3, K7 DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size	A	B	C	D	Weight	
					36 in ²	60 in ²
1/2-3/4 (15)-(20)	3 3/8 (92)	3 7/16 (84)	4 3/8 (105)	2 3/8 (73)	28 (13)	—
1 (25)	3 3/8 (92)	3 7/16 (84)	4 3/8 (105)	2 3/8 (73)	28 (13)	—
1 1/4 (32)	4 1/16 (119)	4 3/8 (105)	4 1/16 (119)	3 3/8 (79)	35 (16)	48 (22)
1 1/2 (40)	4 1/16 (119)	4 3/8 (105)	4 1/16 (119)	3 3/8 (79)	37 (17)	50 (23)
2 (50)	4 3/8 (124)	4 3/16 (106)	4 3/8 (125)	3 3/8 (79)	42 (19)	55 (25)

Control Tip: Pair with Airmaster Pneumatic Temperature Controller for local temperature control. SEE PAGE 83.

Control Tip: Install with Model 65A Air Filter Regulator to convert plant air to instrument quality air. SEE PAGE 187.

KOMBAT SERIES K
CONTROL VALVES

K1, K4, K5, K6 ACTUATOR SHUTOFF TABLE

(Refer to Temperature Limits)

Size	Orifice	Act. Size	Bench Range	Actuator Code	Reverse Shutoff, K1,K4*			Bench Range	Actuator Code	Direct Shutoff, K1,K4*			Shutoff, K5,K6
					3-15 psi	0-20 psi†	0-30 psi‡			3-15 psi	0-20 psi†	0-30 psi‡	
1/2	A, C, E	36	6-15	RA	400	400	—	3-12	DA	400	400	—	400
	B	36	6-15	RA	400	400	—	3-12	DA	300	400	—	
			—	—	—	—	3-9	DB	400	400	—		
	T	36	6-15	RA	300	400	—	3-9	DB	400	400	—	
3/4	T	36	6-15	RA	100	300	—	3-9	DB	250	400	—	400
			9-15	RR	225	350	—	—	—	—	—	—	
			12-15	RC	300	400	—	—	—	—	—	—	
		60	12-15	RC	400	400	—	3-7	DG	400	400	—	
1	T	36	9-15	RB	150	250	—	3-9	DB	100	200	—	330
			12-15	RC	250	400	—	—	—	—	—	—	
			13-15	RE	400	400	—	—	—	—	—	—	
		60	—	—	—	—	—	3-7	DG	400	400	—	
1¼	T	36	9-15	RB	150	175	—	3-9	DR	150	250	—	210
			12-15	RC	200	250	—	—	—	—	—	—	
			13-15	RE	250	275	—	—	—	—	—	—	
		60	12-15	RG	300	400	—	3-7	DG	300	400	—	
			13-15	RH	400	400	—	—	—	—	—	—	
1½	T	36	12-15	RC	150	225	—	—	—	—	—	—	161
			13-15	RE	200	250	—	—	—	—	—	—	
		60	12-15	RG	225	275	—	3-7	DG	200	400	—	
			13-15	RH	275	300	—	—	—	—	—	—	
2	T	36	12-15	RC	50	75	—	—	—	—	—	—	121
			13-15	RE	75	100	—	—	—	—	—	—	
		60	12-15	RG	125	200	—	3-7	DG	100	300	—	
			13-15	RH	175	250	—	—	—	—	—	—	
2½	T	60	10-15	RH	75	—	100	3-8	DH	70	—	200	—
			12-15	RQ	125	—	125	3-8	DH	70	—	200	
			22-30	RT	—	—	125	3-8	DH	70	—	200	
3	T	60	10-15	RH	40	—	60	3-8	DH	40	—	100	—
			12-15	RQ	60	—	80	3-8	DH	40	—	100	
			22-30	RT	—	—	110	3-8	DH	40	—	100	
4	T	60	12-15	RQ	20	—	32	3-8	DH	10	—	25	—
			22-30	RT	—	—	50	3-8	DH	10	—	25	

* Shutoff pressures are in conformance with ANSI/FCI 70-2 Class IV

Reverse Acting - Fail Closed/Air to Open (FC/ATO)

Direct Acting - Fail Open/Air to Close (FO/ATC)

† Based on 20 psi air supply.

‡ Based on 30 psi air supply.

K1, K4, K5, K6 C_v TABLE

PERCENT OF TRAVEL			5	10	20	30	40	50	60	70	80	90	100
Valve Size	Travel	Orifice	C _v										
1/2	1/4	C	0.1	0.2	0.3	0.36	0.41	0.46	0.51	0.56	0.6	0.65	0.7
		E	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2	2.1
		A	0.3	0.6	1.2	1.7	2.2	2.6	2.9	3.1	3.2	3.25	3.3
		B	0.15	0.25	0.65	1.5	2.7	3.3	3.7	3.9	4.1	4.2	4.3
		T	0.7	1.2	2.0	2.7	3.2	3.8	4.3	4.7	4.9	5.1	5.2
3/4	5/16	T	0.7	1.3	2.4	3.3	4.2	4.9	5.5	6.0	6.4	6.8	7.0
1	1/4	T	0.7	1.3	2.4	3.8	5.5	7.4	9.0	10.0	10.6	10.9	11.0
1-1/4	5/16	T	0.8	1.7	4.0	6.5	9.3	12.6	15.3	17.0	18.1	19.1	20.0
1-1/2	5/16	T	1.0	2.0	4.5	7.2	9.9	12.4	15.2	18.2	20.9	23.4	25.0
2	5/16	T	1.0	2.0	4.5	7.4	10.6	15.1	18.8	22.8	26.1	28.3	30.0
2-1/2	3/4	T	5	11	23	36	46	53	59	62.5	65.7	68	71
3	3/4	T	5	11	30	47	61	72	79	85	90	92	94
4	3/4	T	12	23	46	69	89	104	116	127	134	140	146

K3, K7 ACTUATOR SHUTOFF TABLE

(Refer to Temperature Limits)

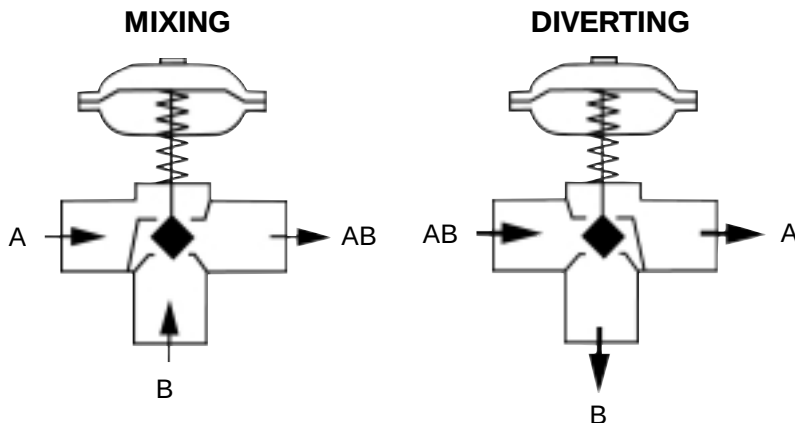
Size	Act. Size	Bench Range	Actuator Code	K3 Reverse Shutoff*		Bench Range	Actuator Code	K3 Direct Shutoff*		K7 Shutoff
				3-15 psi	0-20 psi			3-15 psi	0-20 psi	
1/2	36	5.5 - 12.5	RA	125	300	4.5 - 13.5	DM	85	400	400
		6.5 - 11.5	RB	175	375	6 - 12	DA	175	400	
		8 - 11	RC	250	400	-	-	-	-	
3/4	36	5.5 - 12.5	RA	125	300	4.5 - 13.5	DM	85	400	400
		6.5 - 11.5	RB	175	375	6 - 12	DA	175	400	
		8 - 11	RC	250	400	-	-	-	-	
1	36	5.5 - 12.5	RA	75	200	4.5 - 13.5	DM	60	250	295
		6.5 - 11.5	RB	125	250	6 - 12	DA	125	300	
		8 - 11	RC	200	300	-	-	-	-	
1¼	36	5.5 - 12.5	RC	60	125	6 - 12	DC	80	200	185
		7.5 - 10.5	RE	110	200	7 - 11	DD	100	225	
	60	7.5 - 12	RG	200	300	7 - 11	DG	175	XX	
		8 - 11	RH	225	350	-	-	-	-	
1½	36	5.5 - 12.5	RC	50	100	6 - 12	DC	60	150	145
		7.5 - 10.5	RE	85	150	7 - 11	DD	75	175	
	60	7.5 - 12	RG	125	250	7 - 11	DG	135	XX	
		8 - 11	RH	175	275	-	-	-	-	
2	36	5.5 - 12.5	RC	35	75	6 - 12	DC	45	100	105
		7.5 - 10.5	RE	70	100	7 - 11	DD	60	135	
	60	7.5-12	RG	75	175	7-11	DG	100	XX	
		8 - 11	RH	125	200	--	-	-	-	

* Fail Closed

K3, K7 C_v TABLE

PERCENT OF TRAVEL			0	10	20	30	40	50	60	70	80	90	100
Valve Size	Travel (In)	Port	C _v										
1/2	7/32	Lower	0	0.9	1.9	2.7	3.6	4.3	4.8	5.2	5.3	5.35	5.4
		Upper	5.6	5.55	5.5	5.3	4.9	4.5	3.9	3.1	2.2	1.2	0
3/4	7/32	Lower	0	0.9	2	3	4	4.9	5.5	6	6.2	6.3	6.4
		Upper	7.1	7	6.9	6.5	5.9	5.2	4.4	3.4	2.3	1.2	0
1	7/32	Lower	0	0.8	1.7	2.9	4	5.3	6.2	7.2	7.8	8.4	8.7
		Upper	9.2	8.5	7.9	7.1	6.2	5.3	4.2	3.2	2.1	1.1	0
1-1/4	1/2	Lower	0	2.7	6.2	10.2	15	18.8	20	20.8	21.2	21.6	22
		Upper	19.5	19	18.5	17.5	15.5	13.5	11	8	5	2.5	0
1-1/2	1/2	Lower	0	2	6	11	16	20	22.5	24.5	26	27	28
		Upper	24	23	22	20	18	15	12	9	6	2.7	0
2	1/2	Lower	0	2.2	5.7	10.9	16	21	24	27.4	30	32	34
		Upper	35	32.4	30	27	23.5	20	16	12	8	4	0

K3, K7 OPERATION



When used for mixing service, the forces developed by the two inlet flows oppose each other, creating little, if any, unbalance. Thus, the actuator can control the flow efficiently with very little power lost in overcoming dynamic unbalance. When used for diverting service, simply reverse the valve installation.

KOMBAT SERIES
KCONTROL VALVES

K1, K4, K5, K6 SATURATED STEAM CAPACITY TABLE

(Modified Equal Percent Contour Plug) (Lb/Hr)

KOMBAT STEAM CAPACITY TABLE

Pressure (PSI)		Valve Size and Port												
P1	P2	1/2" C	1/2" E	1/2" A	1/2" B	1/2" T	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	5	22	65	102	133	161	217	341	620	775	930	2237	2962	4601
	0	27	81	128	166	201	270	425	773	966	1159	2846	3768	5853
15	10	24	72	114	148	179	241	379	689	861	1033	2477	3280	5094
	5	31	92	145	189	229	308	484	880	1099	1319	3216	4257	6613
	0	34	101	159	207	250	337	529	962	1202	1443	3586	4748	7374
20	15	26	79	124	161	195	262	412	750	937	1125	2692	3565	5537
	10	34	102	161	209	253	341	536	974	1217	1461	3543	4691	7286
	0	40	119	187	243	294	396	623	1132	1416	1699	4262	5643	8765
30	25	30	90	142	184	223	300	472	858	1072	1287	3072	4067	6316
	15	46	137	215	280	338	455	715	1301	1626	1951	4755	6295	9778
	0	51	152	239	312	377	507	797	1450	1812	2174	5525	7315	11362
40	25	52	156	245	319	385	519	815	1482	1852	2223	5384	7128	11071
	15	59	178	280	365	442	595	935	1699	2124	2549	6297	8337	12948
	0	62	185	290	378	457	615	967	1758	2198	2637	6724	8903	13827
50	35	57	172	271	353	427	575	903	1643	2053	2464	5943	7869	12222
	30	63	190	299	389	470	633	995	1809	2262	2714	6596	8732	13563
	25	67	202	318	414	501	674	1059	1925	2406	2888	7076	9368	14550
	2-0	72	217	341	444	537	723	1136	2066	2582	3099	7905	10466	16256
60	45	63	188	295	384	464	625	982	1786	2232	2679	6444	8531	13250
	40	69	208	327	426	515	693	1090	1981	2477	2972	7194	9524	14792
	35	74	223	351	457	552	744	1169	2125	2656	3187	7767	10282	15971
	4-0	83	249	391	509	616	829	1303	2370	2962	3555	9067	12005	18645
75	55	77	232	365	476	575	774	1216	2212	2765	3318	7996	10587	16443
	50	84	251	395	514	622	837	1315	2391	2989	3587	8690	11505	17870
	45	89	266	417	544	658	885	1391	2530	3162	3795	9246	12241	19013
	8-0	99	296	466	607	734	988	1552	2822	3527	4233	10797	14294	22202
100	75	97	291	457	596	721	970	1525	2773	3466	4159	10020	13266	20604
	60	113	340	534	696	841	1133	1780	3236	4045	4854	11845	15683	24358
	15-0	125	375	589	767	927	1249	1962	3567	4459	5351	13649	18071	28068
125	100	109	326	512	667	806	1086	1706	3102	3877	4652	11169	14787	22968
	75	138	413	649	845	1022	1376	2163	3933	4916	5899	14409	19077	29630
	21-0	151	452	710	925	1119	1507	2367	4304	5381	6457	16470	21806	33869
150	125	119	356	560	730	882	1188	1866	3394	4242	5090	12192	16142	25071
	100	153	460	723	943	1140	1535	2412	4385	5481	6577	15975	21150	32850
	28-0	176	529	831	1082	1309	1762	2769	5035	6293	7552	19264	25505	39614
175	150	128	384	604	787	951	1281	2013	3659	4574	5489	13124	17376	26988
	125	168	503	791	1030	1246	1677	2635	4791	5989	7187	17388	23021	35755
	100	189	567	891	1161	1403	1889	2969	5398	6747	8097	19859	26293	40838
	35-0	202	605	951	1239	1498	2016	3168	5761	7201	8641	22031	29168	45304
200	150	181	542	852	1110	1342	1806	2839	5161	6452	7742	18677	24728	38407
	125	206	618	971	1265	1529	2059	3235	5882	7353	8823	21533	28509	44279
	41-0	227	681	1069	1393	1685	2268	3565	6481	8101	9722	24799	32833	50996
225	175	193	578	908	1183	1430	1925	3025	5500	6875	8250	-	-	-
	150	221	664	1043	1359	1644	2213	3478	6323	7904	9485	-	-	-
	48-0	252	755	1187	1547	1870	2518	3956	7194	8992	10790	-	-	-
250	200	204	611	960	1251	1512	2036	3199	5817	7271	8725	-	-	-
	150	256	769	1208	1574	1904	2563	4027	7322	9153	10984	-	-	-
	100	275	825	1297	1690	2044	2752	4324	7862	9827	11792	-	-	-
	54-0	277	830	1304	1699	2055	2766	4346	7902	9878	11854	-	-	-

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

K1, K4, K5, K6 SATURATED STEAM CAPACITY TABLE

(Modified Equal Percent Contour Plug) (Kg/Hr)

Pressure (bar)		Valve Size and Port												
P1	P2	1/2" C	1/2" E	1/2" A	1/2" B	1/2" T	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
0.7	0.3	10	31	49	64	78	104	164	298	373	447	1079	1429	2220
	0.2	11	34	53	69	84	113	177	322	402	483	1171	1551	2409
1	0.7	10	31	48	63	76	102	161	292	365	438	1049	1389	2157
	0.5	12	37	59	76	92	125	196	356	445	534	1289	1707	2651
	0.3	14	42	65	85	103	139	218	396	495	594	1448	1918	2978
1.5	1	14	43	67	87	106	142	224	407	508	610	1467	1942	3017
	0.7	17	50	79	103	124	167	263	479	598	718	1746	2312	3591
	0.5	18	53	84	109	132	178	280	508	635	762	1870	2476	3846
2	1.5	16	47	74	97	117	157	247	449	562	674	1616	2139	3323
	1.2	19	56	88	115	139	188	295	536	670	804	1945	2575	3999
	1	20	60	95	124	149	201	316	575	719	862	2100	2781	4319
3	2	24	73	114	149	180	242	381	692	865	1038	2508	3321	5158
	1.0	29	87	137	179	216	291	457	832	1040	1248	3098	4102	6371
	0	32	97	152	198	239	322	506	920	1149	1379	3264	4322	6713
3.5	3.0	20	59	92	120	145	195	307	558	698	838	2000	2647	4112
	2.0	30	89	140	182	221	297	466	848	1060	1272	3099	4103	6373
	1.0	33	99	155	202	245	329	518	941	1176	1412	3531	4675	7261
	.1-0	36	108	170	222	268	361	567	1031	1289	1547	3661	4847	7528
4	3.0	28	83	130	169	204	275	432	786	983	1179	2836	3755	5832
	2.0	34	103	162	211	255	344	540	982	1228	1473	3615	4786	7433
	1.0	37	110	172	224	271	365	574	1044	1305	1566	3942	5219	8105
	.3-0	39	118	186	242	293	394	620	1126	1408	1690	4000	5296	8225
5	4.0	30	91	144	187	226	305	479	870	1088	1306	3131	4145	6438
	3.0	39	117	184	239	290	390	612	1113	1392	1670	4069	5387	8367
	2.0	43	128	201	262	317	427	671	1220	1525	1830	4544	6016	9344
	.6-0	47	140	220	287	347	467	734	1334	1667	2001	4757	6299	9783
7	5.0	47	140	221	288	348	468	736	1338	1672	2007	4848	6419	9970
	3.0	56	169	265	346	418	563	884	1607	2009	2411	5987	7926	12311
	1.0-0	62	187	293	382	462	622	978	1778	2222	2667	6311	8356	12978
9	5.0	53	160	252	328	397	534	839	1526	1907	2289	5505	7289	11321
	7.0	67	200	314	410	496	667	1048	1906	2382	2859	7015	9288	14425
	1.6-0	77	230	361	470	569	765	1203	2187	2733	3280	7762	10277	15962
10	8.0	56	168	265	345	417	562	882	1605	2006	2407	5780	7652	11885
	5.0	75	224	353	459	556	748	1175	2137	2671	3205	7916	10480	16277
	1.8-0	84	251	395	515	623	838	1317	2395	2994	3592	8502	11256	17483
12	10.0	62	185	291	379	458	616	968	1761	2201	2641	6327	8376	13009
	7.0	85	254	399	520	629	846	1330	2418	3023	3627	8886	11764	18272
	5.0	90	270	425	553	669	900	1415	2573	3216	3859	9633	12753	19808
	2.4-0	98	294	462	602	728	979	1539	2798	3498	4197	9939	13158	20438
14	10.0	87	261	410	535	647	871	1368	2488	3110	3732	-	-	-
	5.0	104	312	491	640	774	1041	1636	2975	3719	4463	-	-	-
	2.9-0	112	337	530	691	835	1124	1767	3213	4016	4819	-	-	-
15	12.0	81	243	383	499	603	812	1275	2319	2898	3478	-	-	-
	5.0	111	332	521	679	821	1105	1737	3158	3948	4737	-	-	-
	3.1-0	120	359	564	734	888	1195	1878	3415	4269	5123	-	-	-
17	15.0	73	219	344	448	542	730	1147	2086	2607	3129	-	-	-
	10.0	115	346	544	709	858	1155	1815	3300	4125	4950	-	-	-
	5.0	127	380	597	778	941	1266	1990	3619	4523	5428	-	-	-
	3.7-0	133	400	629	819	990	1333	2095	3809	4762	5714	-	-	-

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

KOMBAT STEAM
CAPACITY TABLE

K1, K4, K5, K6 WATER CAPACITY TABLE

(Modified Equal Percent Contour Plug) (G.P.M.)

KOMBAT WATER CAPACITY TABLE

Pressure (PSI)		Valve Size and Port												
P1	P2	1/2" C	1/2" E	1/2" A	1/2" B	1/2" T	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	5	2	5	7	10	12	16	25	45	56	67	159	210	326
	3	2	6	9	11	14	19	29	53	66	79	188	249	386
15	10	2	5	7	10	12	16	25	45	56	67	159	210	326
	7	2	6	9	12	15	20	31	57	71	85	201	266	413
20	4	2	7	11	14	17	23	36	66	83	99	235	312	484
	15	2	5	7	10	12	16	25	45	56	67	159	210	326
30	10	2	7	10	14	16	22	35	63	79	95	225	297	462
	5	3	8	13	17	20	27	43	77	97	116	275	364	565
40	22	2	6	9	12	15	20	31	57	71	85	201	266	413
	17	3	8	12	16	19	25	40	72	90	108	256	339	526
50	6	3	10	16	21	25	34	54	98	122	147	348	461	715
	25	3	8	13	17	20	27	43	77	97	116	275	364	565
60	20	3	9	15	19	23	31	49	89	112	134	318	420	653
	8	4	12	19	24	29	40	62	113	141	170	402	532	826
75	35	3	8	13	17	20	27	43	77	97	116	275	364	565
	30	3	9	15	19	23	31	49	89	112	134	318	420	653
100	25	4	11	17	22	26	35	55	100	125	150	355	470	730
	10	4	13	21	27	33	44	70	126	158	190	449	595	923
125	50	2	7	10	14	16	22	35	63	79	95	225	297	462
	40	3	9	15	19	23	31	49	89	112	134	318	420	653
150	25	4	12	20	25	31	41	65	118	148	177	420	556	864
	12	5	15	23	30	36	48	76	139	173	208	492	651	1012
175	70	2	5	7	10	12	16	25	45	56	67	159	210	326
	50	4	11	17	22	26	35	55	100	125	150	355	470	730
200	25	5	15	23	30	37	49	78	141	177	212	502	665	1032
	15	5	16	26	33	40	54	85	155	194	232	550	728	1131
225	75	4	11	17	22	26	35	55	100	125	150	355	470	730
	60	4	13	21	27	33	44	70	126	158	190	449	595	923
250	20	6	19	30	38	47	63	98	179	224	268	635	841	1306
	100	4	11	17	22	26	35	55	100	125	150	355	470	730
300	75	5	15	23	30	37	49	78	141	177	212	502	665	1032
	24	7	21	33	43	52	70	111	201	251	301	714	945	1467
350	125	4	11	17	22	26	35	55	100	125	150	355	470	730
	100	5	15	23	30	37	49	78	141	177	212	502	665	1032
400	29	8	23	36	47	57	77	121	220	275	330	781	1034	1606
	150	4	11	17	22	26	35	55	100	125	150	355	470	730
450	125	5	15	23	30	37	49	78	141	177	212	502	665	1032
	100	6	18	29	37	45	61	95	173	217	260	615	814	1264
500	34	8	25	39	51	62	83	131	237	297	356	843	1116	1734
	150	5	15	23	30	37	49	78	141	177	212	502	665	1032
550	100	7	21	33	43	52	70	110	200	250	300	710	940	1460
	39	9	27	42	55	66	89	140	254	317	381	901	1193	1853
600	175	5	15	23	30	37	49	78	141	177	212	-	-	-
	100	8	23	37	48	58	78	123	224	280	335	-	-	-
650	43	9	28	45	58	70	94	148	270	337	405	-	-	-
	200	5	15	23	30	37	49	78	141	177	212	-	-	-
700	150	7	21	33	43	52	70	110	200	250	300	-	-	-
	100	9	26	40	53	64	86	135	245	306	367	-	-	-
750	48	10	30	47	61	74	99	156	284	355	426	-	-	-
	250	5	15	23	30	37	49	78	141	177	212	-	-	-
800	150	9	26	40	53	64	86	135	245	306	367	-	-	-
	58	11	33	51	67	81	109	171	311	389	467	-	-	-
850	350	5	15	23	30	37	49	78	141	177	212	-	-	-
	200	10	30	47	61	74	99	156	283	354	424	-	-	-
900	77	13	38	59	77	93	126	198	359	449	539	-	-	-

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

K1, K4, K5, K6 WATER CAPACITY TABLE

(Modified Equal Percent Contour Plug) (M3/Hr.)

Pressure (bar)		Valve Size and Port												
P1	P2	1/2" C	1/2" E	1/2" A	1/2" B	1/2" T	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
0.7	0.3	0.4	1.1	1.8	2.4	2.8	3.8	6.0	10.9	13.7	16.4	38.8	51.4	79.9
	0.2	0.4	1.3	2.0	2.6	3.2	4.3	6.7	12.2	15.3	18.3	43.4	57.5	89.3
1	0.7	0.3	1.0	1.6	2.0	2.5	3.3	5.2	9.5	11.8	14.2	33.6	44.5	69.2
	0.5	0.4	1.3	2.0	2.6	3.2	4.3	6.7	12.2	15.3	18.3	43.4	57.5	89.3
	0.25	0.5	1.6	2.5	3.2	3.9	5.2	8.2	15.0	18.7	22.5	53.2	70.4	109.3
1.5	1	0.4	1.3	2.0	2.6	3.2	4.3	6.7	12.2	15.3	18.3	43.4	57.5	89.3
	0.7	0.5	1.6	2.6	3.3	4.0	5.4	8.5	15.5	19.3	23.2	54.9	72.7	112.9
	0.3	0.7	2.0	3.1	4.1	4.9	6.6	10.4	18.9	23.7	28.4	67.3	89.0	138.3
2	1.5	0.4	1.3	2.0	2.6	3.2	4.3	6.7	12.2	15.3	18.3	43.4	57.5	89.3
	1	0.6	1.8	2.9	3.7	4.5	6.1	9.5	17.3	21.6	25.9	61.4	81.3	126.3
	0.4	0.8	2.3	3.6	4.7	5.7	7.7	12.0	21.9	27.3	32.8	77.7	102.8	159.7
3	2	0.6	1.8	2.9	3.7	4.5	6.1	9.5	17.3	21.6	25.9	61.4	81.3	126.3
	1.5	0.7	2.2	3.5	4.6	5.5	7.4	11.7	21.2	26.5	31.8	75.2	99.6	154.6
	0.6	0.9	2.8	4.4	5.8	7.0	9.4	14.7	26.8	33.5	40.2	95.1	125.9	195.6
3.5	3	0.4	1.3	2.0	2.6	3.2	4.3	6.7	12.2	15.3	18.3	43.4	57.5	89.3
	2	0.7	2.2	3.5	4.6	5.5	7.4	11.7	21.2	26.5	31.8	75.2	99.6	154.6
	1.5	0.9	2.6	4.0	5.3	6.4	8.6	13.5	24.5	30.6	36.7	86.8	115.0	178.6
	0.7	1.0	3.0	4.8	6.2	7.5	10.1	15.9	28.9	36.2	43.4	102.7	136.0	211.3
4	3.5	0.4	1.3	2.0	2.6	3.2	4.3	6.7	12.2	15.3	18.3	43.4	57.5	89.3
	3	0.6	1.8	2.9	3.7	4.5	6.1	9.5	17.3	21.6	25.9	61.4	81.3	126.3
	2	0.9	2.6	4.0	5.3	6.4	8.6	13.5	24.5	30.6	36.7	86.8	115.0	178.6
	0.8	1.1	3.2	5.1	6.7	8.0	10.8	17.0	30.9	38.7	46.4	109.8	145.4	225.9
5	4	0.6	1.8	2.9	3.7	4.5	6.1	9.5	17.3	21.6	25.9	61.4	81.3	126.3
	3	0.9	2.6	4.0	5.3	6.4	8.6	13.5	24.5	30.6	36.7	86.8	115.0	178.6
	2	1.0	3.1	4.9	6.4	7.8	10.5	16.5	30.0	37.4	44.9	106.3	140.8	218.7
	1	1.2	3.6	5.7	7.4	9.0	12.1	19.0	34.6	43.2	51.9	122.8	162.6	252.5
6	5	0.6	1.8	2.9	3.7	4.5	6.1	9.5	17.3	21.6	25.9	61.4	81.3	126.3
	3	1.0	3.1	4.9	6.4	7.8	10.5	16.5	30.0	37.4	44.9	106.3	140.8	218.7
	1.2	1.3	4.0	6.3	8.1	9.9	13.3	20.8	37.9	47.4	56.8	134.5	178.1	276.6
8	6	0.9	2.6	4.0	5.3	6.4	8.6	13.5	24.5	30.6	36.7	86.8	115.0	178.6
	5	1.0	3.1	4.9	6.4	7.8	10.5	16.5	30.0	37.4	44.9	106.3	140.8	218.7
	1.6	1.5	4.6	7.2	9.4	11.4	15.3	24.1	43.8	54.7	65.6	155.3	205.6	319.4
10	8	0.9	2.6	4.0	5.3	6.4	8.6	13.5	24.5	30.6	36.7	86.8	115.0	178.6
	5	1.4	4.1	6.4	8.3	10.1	13.5	21.3	38.7	48.3	58.0	137.3	181.8	282.3
	2	1.7	5.1	8.1	10.5	12.7	17.1	26.9	48.9	61.1	73.4	173.7	229.9	357.1
12	10	0.9	2.6	4.0	5.3	6.4	8.6	13.5	24.5	30.6	36.7	86.8	115.0	178.6
	8	1.2	3.6	5.7	7.4	9.0	12.1	19.0	34.6	43.2	51.9	122.8	162.6	252.5
	5	1.6	4.8	7.6	9.8	11.9	16.0	25.2	45.8	57.2	68.6	162.4	215.1	334.0
	2.3	1.9	5.7	8.9	11.6	14.0	18.9	29.6	53.9	67.3	80.8	191.2	253.2	393.2
14	10	1.2	3.6	5.7	7.4	9.0	12.1	19.0	34.6	43.2	51.9	-	-	-
	5	1.8	5.4	8.6	11.2	13.5	18.2	28.5	51.9	64.9	77.8	-	-	-
	2.7	2.0	6.1	9.6	12.5	15.1	20.3	32.0	58.1	72.7	87.2	-	-	-
15	12	1.0	3.1	4.9	6.4	7.8	10.5	16.5	30.0	37.4	44.9	-	-	-
	5	1.9	5.7	9.0	11.8	14.2	19.1	30.1	54.7	68.4	82.0	-	-	-
	2.9	2.1	6.3	9.9	12.9	15.6	21.1	33.1	60.2	75.2	90.2	-	-	-
17	14	1.0	3.1	4.9	6.4	7.8	10.5	16.5	30.0	37.4	44.9	-	-	-
	10	1.6	4.8	7.6	9.8	11.9	16.0	25.2	45.8	57.2	68.6	-	-	-
	5	2.1	6.3	9.9	12.9	15.6	21.0	33.0	59.9	74.9	89.9	-	-	-
	3.2	2.2	6.7	10.6	13.8	16.7	22.5	35.3	64.2	80.3	96.4	-	-	-
20	17	1.0	3.1	4.9	6.4	7.8	10.5	16.5	30.0	37.4	44.9	-	-	-
	14	1.5	4.4	7.0	9.1	11.0	14.8	23.3	42.4	53.0	63.5	-	-	-
	3.9	2.4	7.3	11.5	14.9	18.0	24.3	38.2	69.4	86.7	104.1	-	-	-
27	24	1.0	3.1	4.9	6.4	7.8	10.5	16.5	30.0	37.4	44.9	-	-	-
	20	1.6	4.8	7.6	9.8	11.9	16.0	25.2	45.8	57.2	68.6	-	-	-
	5.2	2.8	8.5	13.3	17.4	21.0	28.3	44.4	80.8	100.9	121.1	-	-	-

KOMBAT WATER
CAPACITY TABLE

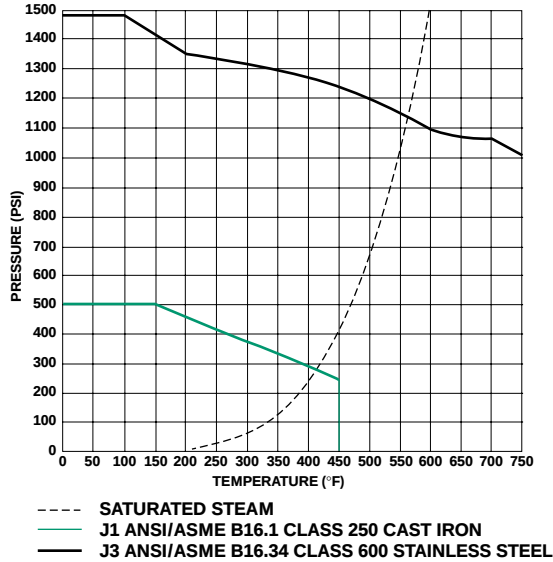
- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.



APPLICATION DATA

- Process control systems for food, pulp and paper, chemical, petrochemical & other industries
- HVAC systems
- Feed water and fuel system controls in boiler rooms
- Packaged systems (OEM) such as heat exchangers, water purification systems & vaporizer, metal cleaning and plating

PRESSURE/TEMPERATURE CHART



INTIMIDATOR TYPE J CONTROL VALVE

SIZES 1/2" - 2"
ANSI CLASS 150, 250/300, 600

- **High Capacity Streamlined Body** reduces velocity and pressure loss.
- **Compact Design** for ease of installation.
- **Multiple Port Sizes** allows flexibility in sizing.
- **Stainless Steel Trim** for long life and corrosion resistance.
- **Super Polished, Extra Thick Stem** provides low friction and precise control.
- **Live Loaded V ring Packing** is self adjusting.
- **Slip-on Flanges** for flexibility in piping.
- **NEMUR 4 Mounting Pad** for accessories.

MODELS

- J1 — Cast Iron
- J3 — Stainless Steel*

OPTIONS

- 36 or 60 sq. in. actuators
- Soft Seats
- Moore, PMV, Eckardt Accessories
- Threaded or Flanged Connections
- Graphite or High Temperature Packing
- High Temperature 600°F and 750°F Construction

APPLICABLE CODES

- ANSI/ISA 70-2 Class IV & VI seat leakage
- NEMUR 4 mounting of accessories

PLUG CHARACTERISTICS

- 1/8" to 1/4" Port Sizes - Equal Percent, 50:1 flow rangeability
- 5/8" to 2-1/4" Port Sizes - Modified Equal Percent, 100:1 flow rangeability

Canadian Registration # OC 0591.9C

MAXIMUM RATED FLOW COEFFICIENTS* (Cv)

VALVE SIZE				
1/2	3/4	1	1 1/2	2
5.1	10.3	18.2	37	67

* Body is ANSI Class 600. Pressure rating may be limited by choice of flanges.

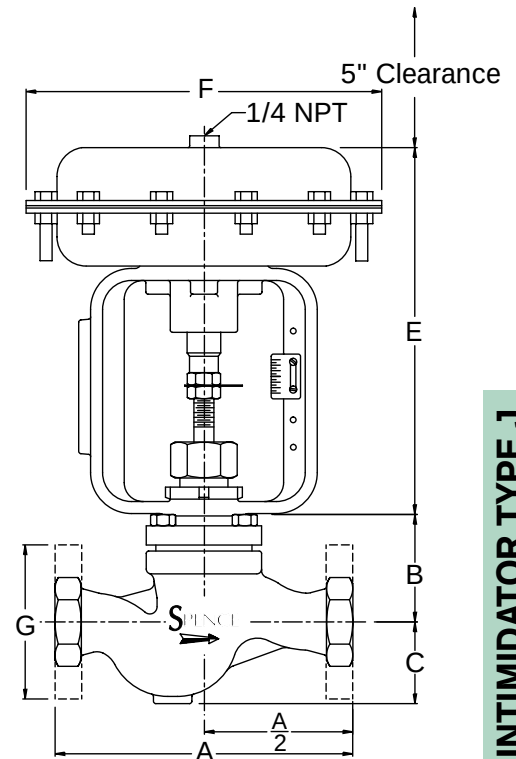
INTIMIDATOR TYPE J CONTROL VALVE

SPECIFICATION

The valve shall be single seated, top guided compact pneumatic globe control valve with a streamlined body. The actuator shall have all SS hardware with a maximum deadband of .3 PSIG. the valve trim shall be all 316SS with replaceable threaded seats for easy maintenance. Standard packing shall be spring loaded teflon V-Rings. Optional graphite or high temperature packings available. The valve seat leakage shall conform to ANSI/ISA 70-2 Class IV for metal seats and Class VI for teflon soft seats. The valve shall conform to NEMUR 4 for mounting of accessories.

MATERIALS OF CONSTRUCTION

Body	316 SS ASTM A351 CF8M
	Cast Iron ASTM A126 CL B
Seat Ring	316 SS ASTM A276 Cond A
Packing	PTFE V ring
	PTFE/Graphite
	Graphite
Plug & Stem Ass'y	316 SS ASTM A276 Cond A
Yoke	DI ASTM A536/Epoxy
Stem	303 SS ASTM A582
Diaphragm	Nitrile/Polyester
Piston	316 SS ASTM A743 Grd CF8
Spring	Music Wire ASTM A228
Actuator Housing	Steel SAE 1006-1008/Epoxy



INTIMIDATOR TYPE J
CONTROL VALVE

DIMENSIONS inches AND WEIGHTS pounds

Size	A		B	C	E		F		G (Flange Diameter)		Weights*			
	Scrd.	Flg.			36 in. ²	60 in. ²	36 in. ²	60 in. ²	150	300/600	Screwed		Flanged	
											36 in. ²	60 in. ²	36 in. ²	60 in. ²
1/2	7%	8	2 11/16	1 7/8	9%	11%	9 3/4	11 1/4	3 1/2	3 3/4	20 1/2	36 1/2	23 1/2	39 1/2
3/4	7%	8 3/8	2 11/16	1 7/8	9%	11%	9 3/4	11 1/4	3 7/8	4 5/8	20 1/2	36 1/2	25 3/4	41 3/4
1	7 3/4	8 3/4	2 3/4	2 7/8	9%	11%	9 3/4	11 1/4	4 1/4	4 7/8	22 1/2	38 3/4	29	45 1/4
1 1/2	9 3/4	9%	3 3/8	2 11/16	9%	11%	9 3/4	11 1/4	5	6%	29 3/4	45 1/2	40%	57 1/2
2	10 1/2	11 1/4	3 9/32	3 1/16	9%	11%	9 3/4	11 1/4	6	6 1/2	38 3/4	54 1/4	50%	68 1/4

*Weights are approximate.

PRESSURE RECOVERY FACTORS

For Gas: $X_T=0.7$, For F_L : See Chart

1/2		3/4			1				1 1/2			2		
1/4	3/8	1/4	3/8	1/2	1/4	3/8	1/2	3/4	1/4	1/2	3/4	1/4	1/2	3/4
.851	.79	.864	.82	.775	.869	.839	.805	.768	.843	.82	.782	.841	.811	.772

INTIMIDATOR ORDERING CODE

CODE SELECTION CHART

Model		Orifice	Size	Connections	Trim	Packing-	Actuator		Spring		Positioner		Posit. Set		Accessories		-	Inlet Pressure		
J	1	J	C	9	1	1	3	6	R	M	M	P	0	2	0	1	-	1	2	5
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

Model -

Position 1 & 2
J1 = Cast Iron
J3 = Stainless

Orifice -

Position 3
F = $\frac{1}{8}$
G = $\frac{3}{16}$
H = $\frac{1}{4}$
J = $\frac{5}{8}$
K = $\frac{7}{8}$
L = $1\frac{1}{4}$
M = $1\frac{3}{4}$
N = $2\frac{1}{4}$

Size -

Position 4
C = $\frac{1}{2}$
D = $\frac{3}{4}$
E = 1
G = $\frac{1}{2}$
H = 2

Connections -

Position 5
1 = 125/150
3 = 250/300
6 = 600#
9 = Threaded

Trim -

Position 6
1 = Metal
2 = Soft

Packing -

Position 7
1 = V-ring
2 = Graphite
3 = Hi-Temp

Actuator -

Position 8 & 9
01 = None
36 = 36 sq. in.
60 = 60 sq. in.

Spring -

Position 10 & 11
DC = 3-13 Dir 36
DD = 3-10 Dir 36
DE = 3-5 Dir 36
DF = 3-10 Dir 60*
DG = 3-11 Dir 60
DH = 3-8 Dir 60
RC = 5-15 Rev 36
RD = 8-15 Rev 36
RE = 10-15 Rev 36
RG = 8-15 Rev 60
RH = 10-15 Rev 60
RJ = 11-15 Rev 60*
RK = 20-60 Rev 60
RL = 20-60 Rev 60*
RQ = 12-15 Rev 60

Positioner -

Position 12 & 13
AA = None
EI = Eckardt I/P
EP = Eckardt P
MI = Moore I/P
MP = Moore P
4P = PMV P4 P
5I = PMV P5 I/P
5P = PMV P5 P

Positioner Set

Position 14 & 15
01 = None
02 = 3-15/4-20 mA
03 = 3-9/4-12 mA
04 = 9-15/12-20 mA

Accessories -

Position 16 & 17
01 = None
02 = Limit Switch, Mechanical
03 = Limit Switch, Proximity Switch
04 = Feedback Potentiometer 1K
05 = Feedback 4-20mA Posit. Trans

Inlet Pressure -

Position 18, 19 & 20
___ = Actual Setting

* $2\frac{1}{4}$ " port only.

INTIMIDATOR
ORDERING CODE

INTIMIDATOR SHUTOFF & CV TABLES

ACTUATOR SHUTOFF TABLE

PORT SIZE	ACTUATOR SIZE	BENCH RANGE	REVERSE SHUTOFF		BENCH RANGE	DIRECT SHUTOFF	
			3-15 PSI	0-20 PSI*		3-15 PSI	0-20 PSI
1/8	36	5 - 15	0 - 750	0 - 750	3 - 13	0 - 750	0 - 750
3/16, 1/4	36	5 - 15	0 - 250	0 - 750	3 - 13	0 - 250	0 - 750
5/8	36	5 - 15	—	0 - 50	3 - 10	0 - 300	0 - 750
		8 - 15	0 - 350	50 - 500	3 - 5	300 - 750	300 - 750
		10 - 15	350 - 550	500 - 750	—	—	—
7/8	36	8 - 15	0 - 200	0 - 300	3 - 10	0 - 150	0 - 350
		10 - 15	200 - 300	300 - 450	3 - 5	150 - 400	350 - 650
	60	8 - 15	0 - 500	0 - 700	3 - 11	0 - 300	0 - 600
		10 - 15	500 - 650	700 - 750	3 - 8	300 - 500	600 - 750
		12 - 15	650 - 750	—	—	—	—
1-1/4	36	—	—	—	3 - 10	0 - 150	0 - 300
		10 - 15	0 - 150	0 - 225	3 - 5	150 - 225	300 - 375
	60	8 - 15	0 - 200	0 - 300	3 - 11	0 - 150	0 - 350
		10 - 15	200 - 250	300 - 350	3 - 8	150 - 250	350 - 450
		12 - 15	250 - 300	350 - 400	—	—	—
		20 - 60**	—	0 - 750**	—	—	—
1-3/4	36	10 - 15	0 - 75	0 - 125	3 - 5	0 - 100	0 - 200
	60	8 - 15	0 - 75	0 - 125	3 - 11	0 - 100	0 - 200
		10 - 15	75 - 125	125 - 175	3 - 8	100 - 125	200 - 250
		12 - 15	125 - 175	175 - 225	—	—	—
		20 - 60**	—	0 - 375**	—	—	—
2-1/4	60	11 - 15	0 - 100	0 - 125	3 - 10	0 - 50	0 - 100
		20 - 60**	—	0 - 225**	—	—	—

* Based on 20 psi air supply w/ EPC or Positioner

** Based on 60 psi air supply w/ EPC or Positioner

NOTES:

- 1) For pressures over 750 psi please consult factory
- 2) For direct configured actuators 60 psi air signal will achieve 750 psi shutoff except for 2.25 port which will achieve 650 psi shutoff
- 3) Do not exceed 60 psi air signal to actuator

ACTUATOR SELECTION

Select Actuator size and bench range that will accommodate require shut off with port size selected. Select reverse for air to open fail close applications, direct for air to close fail open applications.

Cv TABLE

SIZE	TRAVEL	PORT SIZE	PLUG CONTOUR	PERCENT OF TRAVEL										
				5	10	20	30	40	50	60	70	80	90	100
1/2	3/4	1/8	EP	0.002	0.003	0.006	0.011	0.021	0.032	0.042	0.052	0.062	0.072	0.08
		3/16	EP	0.004	0.008	0.014	0.021	0.03	0.045	0.063	0.095	0.145	0.25	0.5
		1/4	EP	0.03	0.04	0.07	0.12	0.18	0.25	0.36	0.49	0.7	1.1	1.5
		5/8	MEP	0.05	0.1	0.18	0.31	0.49	0.73	1.1	1.6	2.3	3.4	5.1
3/4	3/4	1/8	EP	0.002	0.003	0.006	0.011	0.021	0.032	0.042	0.052	0.062	0.072	0.08
		3/16	EP	0.004	0.008	0.014	0.021	0.03	0.045	0.063	0.095	0.145	0.25	0.5
		1/4	EP	0.03	0.04	0.07	0.12	0.18	0.25	0.36	0.49	0.7	1.1	1.5
		5/8	MEP	0.05	0.07	0.18	0.31	0.47	0.73	1.1	1.6	2.4	3.8	6
		7/8	MEP	0.07	0.19	0.58	1	1.3	1.9	2.5	3.8	5.7	8.7	10.3
1	3/4	5/8	MEP	0.04	0.07	0.16	0.31	0.54	0.79	1.1	1.8	2.2	4	6.2
		7/8	MEP	0.07	0.15	0.42	0.75	1.2	1.9	2.9	4.2	6.7	9.8	12.1
		1-1/4	MEP	0.09	0.27	0.63	1	1.4	3.2	5.3	7.5	11.5	15.6	18.2
1-1/2	3/4	7/8	MEP	0.11	0.21	0.54	0.89	1.4	1.9	2.7	3.9	6.4	10.1	13.2
		1-1/4	MEP	0.14	0.37	0.99	1.5	2.4	3.6	5.3	7.5	12.3	16.8	22
		1-3/4	MEP	0.41	0.85	2.4	4.3	6.4	9.9	15.7	22.7	29	34.2	37
2	3/4	1-1/4	MEP	0.14	0.37	0.99	1.5	2.4	3.6	5.3	7.5	12.3	17.3	23
		1-3/4	MEP	0.41	0.85	2.4	4.3	6.5	10	16	23	31	37	43
	1-1/16	2-1/4	MEP	0.75	1.5	3.5	6.5	10.5	15.5	26	39	50	60	67

INTIMIDATOR Cv & SHUTOFF TABLES

INTIMIDATOR SATURATED STEAM CAPACITY TABLE

(Lbs./Hr.)

INTIMIDATOR STEAM CAPACITY TABLE

Pressure (PSI)		Valve Size and Port																	
		1/2				3/4					1			1-1/2			2		
P1	P2	1/8	3/16	1/4	5/8	1/8	3/16	1/4	5/8	7/8	5/8	7/8	1-1/4	7/8	1-1/4	1-3/4	1-1/4	1-3/4	2-1/4
10	5	2	16	47	159	2	16	47	187	322	194	378	569	412	687	1156	719	1344	2094
	3	3	18	53	181	3	18	53	213	366	220	430	646	469	781	1314	817	1527	2380
15	10	3	17	52	177	3	17	52	208	357	215	419	630	457	762	1281	796	1489	2320
	7	3	21	62	212	3	21	62	250	429	258	503	757	549	915	1540	957	1789	2788
	5	4	22	67	229	4	22	67	269	463	278	543	817	593	988	1662	1033	1931	3009
20	15	3	19	56	192	3	19	56	226	387	233	455	685	497	828	1392	865	1617	2520
	10	4	25	74	253	4	25	74	297	510	307	599	902	654	1090	1833	1139	2130	3319
	7	4	27	81	275	4	27	81	324	555	334	652	981	712	1186	1995	1240	2319	3613
30	22	4	26	79	268	4	26	79	315	541	326	636	957	694	1156	1945	1209	2260	3522
	17	5	32	95	323	5	32	95	380	652	393	766	1153	836	1393	2343	1457	2723	4243
	10	6	36	108	369	6	36	108	434	744	448	874	1315	954	1590	2674	1662	3108	4842
40	25	6	38	113	384	6	38	113	452	775	467	911	1370	994	1656	2786	1732	3237	5044
	20	7	41	124	423	7	41	124	497	854	514	1003	1508	1094	1823	3067	1906	3564	5553
	3-0	8	47	141	480	8	47	141	564	969	583	1138	1711	1241	2069	3479	2163	4043	6300
50	35	7	42	125	424	7	42	125	498	855	515	1005	1511	1096	1827	3073	1910	3571	5564
	30	7	46	138	470	7	46	138	553	950	572	1116	1679	1217	2029	3413	2121	3966	6179
	25	8	49	148	505	8	49	148	594	1019	614	1198	1801	1307	2178	3662	2277	4256	6632
	6-0	9	55	166	564	9	55	166	663	1139	686	1338	2013	1460	2433	4091	2543	4755	7409
60	45	7	45	135	460	7	45	135	541	928	559	1090	1640	1189	1982	3334	2072	3874	6037
	40	8	50	151	513	8	50	151	604	1036	624	1217	1831	1328	2213	3722	2313	4325	6739
	35	9	54	163	554	9	54	163	652	1119	674	1315	1977	1434	2390	4020	2499	4672	7279
	9-0	10	64	191	648	10	64	191	763	1309	788	1538	2314	1678	2797	4704	2924	5466	8517
75	55	9	56	168	571	9	56	168	671	1153	694	1354	2036	1477	2462	4140	2574	4811	7497
	50	10	61	182	620	10	61	182	730	1253	754	1472	2214	1606	2677	4501	2798	5231	8151
	45	10	65	194	660	10	65	194	777	1334	803	1567	2356	1709	2848	4791	2978	5568	8675
	14-0	12	76	227	772	12	76	227	909	1560	939	1833	2757	1999	3332	5604	3484	6513	10148
100	75	11	70	210	715	11	70	210	841	1444	869	1697	2552	1851	3085	5188	3225	6029	9394
	60	13	83	249	847	13	83	249	996	1710	1029	2009	3021	2191	3652	6142	3818	7138	11122
	22-0	15	96	288	978	15	96	288	1151	1975	1189	2321	3491	2532	4219	7096	4411	8247	12850
125	100	13	78	234	797	13	78	234	938	1609	969	1891	2844	2063	3438	5782	3594	6719	10469
	75	16	101	303	1030	16	101	303	1212	2081	1252	2444	3676	2666	4444	7474	4646	8686	13534
	30-0	19	116	348	1182	19	116	348	1391	2388	1437	2805	4220	3060	5101	8578	5332	9969	15534
150	125	14	86	257	875	14	86	257	1029	1766	1063	2075	3121	2264	3773	6346	3945	7375	11491
	100	18	112	336	1142	18	112	336	1343	2306	1388	2709	4074	2955	4925	8283	5149	9626	14998
	38-0	22	136	407	1385	22	136	407	1629	2796	1683	3285	4941	3584	5973	10045	6244	11674	18190
175	150	15	92	275	936	15	92	275	1101	1890	1138	2221	3340	2422	4037	6790	4221	7891	12296
	125	20	122	367	1249	20	122	367	1469	2522	1518	2963	4457	3232	5387	9060	5632	10529	16406
	100	22	139	418	1421	22	139	418	1672	2870	1728	3372	5072	3678	6131	10311	6409	11983	18671
	46-0	25	155	466	1585	25	155	466	1865	3202	1927	3761	5657	4103	6838	11501	7149	13366	20826
200	150	21	131	392	1333	21	131	392	1569	2693	1621	3164	4759	3451	5752	9674	6014	11243	17518
	125	24	152	455	1549	24	152	455	1822	3127	1883	3674	5526	4008	6680	11235	6984	13056	20344
	54-0	28	175	525	1784	28	175	525	2098	3602	2168	4232	6365	4616	7694	12939	8043	15038	23431
225	175	22	139	417	1418	22	139	417	1669	2865	1724	3365	5062	3671	6119	10291	6397	11960	18635
	150	26	162	485	1649	26	162	485	1940	3331	2005	3913	5885	4268	7114	11964	7437	13904	21665
	63-0	31	194	583	1981	31	194	583	2330	4001	2408	4700	7069	5127	8545	14371	8933	16701	26023
250	200	23	147	441	1498	23	147	441	1762	3025	1821	3554	5345	3877	6461	10866	6755	12628	19676
	175	27	172	515	1751	27	172	515	2060	3536	2129	4154	6249	4532	7554	12704	7897	14764	23004
	150	30	189	566	1926	30	189	566	2266	3889	2341	4569	6872	4984	8307	13971	8685	16237	25300
	71-0	34	214	641	2179	34	214	641	2564	4401	2649	5170	7776	5640	9400	15808	9827	18372	28626

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

INTIMIDATOR SATURATED STEAM CAPACITY TABLE

(Kg./Hr.)

Pressure (bar)		Valve Size and Port																	
		1/2				3/4					1			1-1/2			2		
P1	P2	1/8	3/16	1/4	5/8	1/8	3/16	1/4	5/8	7/8	5/8	7/8	1-1/4	7/8	1-1/4	1-3/4	1-1/4	1-3/4	2-1/4
0.7	0.3	1	8	23	77	1	8	23	90	155	93	182	274	199	331	557	346	647	1008
	0.2	1	8	25	83	1	8	25	98	169	101	198	298	216	360	606	376	704	1097
1	0.7	1	7	22	75	1	7	22	88	151	91	178	267	194	323	543	337	631	983
	0.5	1	9	27	92	1	9	27	108	186	112	218	328	238	397	667	415	775	1208
	0.3	2	10	30	103	2	10	30	121	208	125	245	368	267	445	748	465	869	1354
1.5	1	2	10	31	104	2	10	31	123	211	127	247	372	270	450	756	470	879	1370
	0.7	2	12	37	124	2	12	37	146	251	151	295	444	322	536	902	561	1048	1633
	0.5	2	13	39	133	2	13	39	157	269	162	316	475	345	574	966	600	1122	1749
2	1.5	2	11	34	115	2	11	34	136	233	140	273	411	298	497	836	520	972	1514
	1.2	2	14	41	139	2	14	41	163	280	169	329	495	359	599	1007	626	1170	1823
	1	2	15	44	151	2	15	44	178	305	184	358	539	391	651	1095	681	1273	1983
3	2	3	18	53	179	3	18	53	211	362	218	425	639	464	773	1299	808	1510	2353
	1.5	3	20	60	205	3	20	60	241	414	249	487	732	531	885	1489	925	1730	2696
	.3-0	4	23	68	231	4	23	68	272	467	281	549	826	599	998	1679	1044	1951	3040
3.5	3.0	2	14	42	143	2	14	42	169	289	174	340	511	371	618	1040	646	1208	1883
	2.0	3	22	65	221	3	22	65	260	446	268	524	788	571	952	1601	996	1861	2900
	1.0	4	24	73	249	4	24	73	293	503	303	591	889	645	1075	1808	1124	2101	3273
	.4-0	4	25	76	259	4	25	76	304	523	315	614	923	670	1116	1877	1167	2181	3399
4	3.0	3	20	59	202	3	20	59	238	409	246	480	722	524	873	1468	912	1706	2657
	2.0	4	25	75	256	4	25	75	301	517	311	607	913	662	1104	1856	1154	2158	3362
	1.0	4	27	81	276	4	27	81	325	558	336	656	986	715	1192	2005	1246	2330	3631
	.6-0	4	28	84	286	4	28	84	337	578	348	679	1021	741	1234	2076	1290	2413	3759
5	4.0	4	22	66	224	4	22	66	264	453	272	532	800	580	967	1625	1010	1889	2943
	3.0	5	28	85	290	5	28	85	341	585	352	687	1034	750	1250	2101	1306	2442	3805
	2.0	5	31	94	321	5	31	94	378	649	391	762	1146	831	1386	2331	1449	2708	4220
	.9-0	5	33	100	341	5	33	100	401	688	414	808	1215	881	1469	2471	1536	2871	4474
7	5.0	5	34	102	345	5	34	102	406	698	420	820	1233	894	1490	2506	1558	2913	4538
	3.0	7	42	125	424	7	42	125	499	856	515	1006	1513	1097	1829	3075	1912	3574	5569
	1.6-0	7	44	132	449	7	44	132	529	908	546	1066	1604	1163	1939	3260	2027	3789	5904
9	7.0	6	38	115	392	6	38	115	462	793	477	931	1400	1016	1693	2847	1770	3309	5155
	5.0	8	49	147	500	8	49	147	589	1010	608	1187	1786	1295	2158	3630	2256	4219	6573
	2.1-0	9	55	164	557	9	55	164	656	1126	678	1322	1989	1442	2404	4043	2513	4699	7321
10	8.0	6	41	122	414	6	41	122	487	836	503	982	1478	1072	1786	3004	1867	3491	5439
	5.0	9	55	165	561	9	55	165	660	1132	682	1330	2001	1451	2419	4068	2529	4727	7366
	2.5-0	10	60	179	609	10	60	179	716	1230	740	1445	2173	1576	2627	4417	2746	5134	7999
12	10.0	7	44	133	451	7	44	133	530	910	548	1069	1608	1167	1944	3270	2033	3800	5921
	7.0	10	62	186	634	10	62	186	746	1280	771	1504	2262	1641	2735	4599	2859	5345	8328
	5.0	11	67	201	683	11	67	201	803	1379	830	1620	2437	1768	2946	4955	3080	5758	8972
14	3.2-0	11	70	210	715	11	70	210	841	1444	869	1697	2552	1851	3085	5188	3225	6030	9395
	10.0	10	63	189	644	10	63	189	757	1300	783	1527	2297	1666	2777	4670	2903	5427	8456
	7.0	12	75	225	766	12	75	225	901	1546	931	1817	2733	1982	3303	5555	3453	6456	10059
15	3.8-0	13	80	241	820	13	80	241	965	1656	997	1946	2927	2123	3538	5950	3699	6915	10775
	12.0	9	59	176	597	9	59	176	703	1207	726	1417	2132	1546	2577	4334	2694	5037	7849
	10.0	11	71	213	724	11	71	213	852	1462	880	1718	2584	1874	3123	5253	3265	6104	9511
17	4.2-0	14	85	256	870	14	85	256	1024	1758	1058	2065	3106	2252	3754	6313	3925	7337	11432
	15.0	8	53	158	536	8	53	158	630	1082	651	1271	1911	1386	2310	3885	2415	4515	7035
	12.0	12	76	229	778	12	76	229	915	1572	946	1846	2777	2014	3357	5645	3509	6561	10223
17	10.0	14	85	255	868	14	85	255	1022	1754	1056	2060	3099	2248	3746	6300	3916	7322	11408
	4.8-0	15	96	287	975	15	96	287	1147	1969	1185	2314	3480	2524	4206	7075	4398	8222	12811

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

INTIMIDATOR STEAM
CAPACITY TABLE

INTIMIDATOR AIR CAPACITY TABLE

(SCFH)

INTIMIDATOR AIR CAPACITY TABLE

Pressure (PSI)		Valve Size and Port																	
		1/2				3/4					1			1-1/2			2		
P1	P2	1/8	3/16	1/4	5/8	1/8	3/16	1/4	5/8	7/8	5/8	7/8	1-1/4	7/8	1-1/4	1-3/4	1-1/4	1-3/4	2-1/4
10	5	48	300	901	3064	48	300	901	3605	6189	3725	7270	10936	7931	13219	22232	13820	25837	40258
	3	55	341	1023	3477	55	341	1023	4091	7023	4227	8250	12409	9000	15000	25227	15682	29318	45682
15	10	54	335	1005	3418	54	335	1005	4021	6904	4156	8110	12199	8847	14745	24799	15416	28821	44907
	7	64	403	1208	4106	64	403	1208	4831	8293	4992	9743	14655	10629	17714	29792	18519	34623	53948
	5	69	434	1303	4429	69	434	1303	5211	8945	5385	10508	15806	11464	19106	32133	19975	37344	58188
20	15	59	367	1100	3739	59	367	1100	4399	7552	4546	8872	13345	9678	16131	27129	16864	31528	49126
	10	77	482	1445	4914	77	482	1445	5781	9924	5973	11658	17535	12718	21196	35648	22160	41429	64552
	7	84	524	1572	5346	84	524	1572	6290	10797	6499	12684	19078	13837	23062	38786	24110	45075	70234
30	22	83	517	1552	5276	83	517	1552	6208	10656	6414	12519	18830	13657	22761	38280	23796	44488	69318
	17	100	623	1868	6350	100	623	1868	7470	12824	7719	15065	22660	16435	27391	46067	28636	53537	83419
	10	113	708	2124	7222	113	708	2124	8497	14586	8780	17135	25774	18693	31155	52398	32572	60895	94882
40	25	119	746	2239	7612	119	746	2239	8955	15373	9253	18059	27163	19701	32835	55222	34327	64177	99996
	20	131	820	2461	8367	131	820	2461	9844	16898	10172	19851	29859	21656	36094	60703	37734	70547	109922
	3-0	148	924	2773	9429	148	924	2773	11093	19043	11463	22371	33649	24405	40674	68407	42523	79500	123871
50	35	133	830	2489	8463	133	830	2489	9956	17091	10288	20078	30200	21903	36505	61395	38164	71351	111174
	30	147	920	2760	9384	147	920	2760	11040	18951	11408	22263	33487	24287	40478	68077	42318	79117	123275
	25	158	986	2958	10057	158	986	2958	11832	20312	12227	23862	35891	26031	43385	72966	45357	84798	132127
	6-0	175	1094	3281	11156	175	1094	3281	13124	22530	13562	26467	39810	28873	48122	80933	50310	94057	146555
60	45	145	906	2717	9238	145	906	2717	10868	18657	11231	21918	32967	23910	39850	67021	41662	77889	121362
	40	162	1010	3031	10306	162	1010	3031	12125	20814	12529	24452	36778	26674	44457	74769	46478	86894	135393
	35	174	1090	3270	11119	174	1090	3270	13081	22455	13517	26380	39679	28778	47963	80665	50143	93746	146070
	9-0	202	1263	3789	12882	202	1263	3789	15155	26017	15661	30563	45971	33342	55570	93459	58096	108614	169236
75	55	181	1133	3399	11558	181	1133	3399	13598	23343	14051	27422	41247	29915	49859	83853	52125	97451	151842
	50	197	1231	3692	12554	197	1231	3692	14769	25354	15262	29785	44800	32493	54154	91078	56616	105847	164925
	45	209	1309	3926	13349	209	1309	3926	15704	26959	16228	31670	47636	34549	57582	96843	60199	112547	175364
	14-0	243	1516	4549	15466	243	1516	4549	18195	31236	18802	36694	55193	40030	66717	112206	69749	130401	203183
100	75	230	1436	4309	14650	230	1436	4309	17235	29587	17810	34758	52281	37918	63196	106285	66069	123520	192462
	60	271	1696	5087	17295	271	1696	5087	20347	34928	21025	41032	61718	44763	74604	125471	77995	145817	227204
	22-0	310	1939	5817	19777	310	1939	5817	23267	39941	24042	46921	70576	51187	85311	143478	89189	166745	259811
125	100	259	1617	4850	16490	259	1617	4850	19400	33303	20046	39123	58846	42679	71132	119631	74365	139031	216630
	75	333	2082	6245	21232	333	2082	6245	24979	42881	25812	50375	75770	54954	91591	154039	95754	179018	278935
	30-0	378	2361	7084	24087	378	2361	7084	28338	48647	29282	57148	85958	62343	103906	174750	108629	203088	316440
150	125	285	1779	5338	18148	285	1779	5338	21350	36651	22062	43057	64763	46971	78285	131660	81843	153011	238412
	100	372	2328	6983	23742	372	2328	6983	27932	47950	28863	56330	84727	61450	102417	172247	107073	200179	311907
	38-0	445	2784	8352	28398	445	2784	8352	33409	57352	34523	67375	101341	73500	122500	206023	128068	239432	373068
175	150	309	1928	5785	19669	309	1928	5785	23140	39723	23911	46665	70191	50907	84846	142695	88702	165835	258394
	125	408	2551	7654	26024	408	2551	7654	30617	52559	31637	61744	92871	67357	112262	188804	117365	219421	341889
	100	466	2910	8729	29679	466	2910	8729	34917	59940	36080	70415	105914	76816	128027	215319	133847	250235	389902
	46-0	513	3207	9620	32708	513	3207	9620	38480	66058	39763	77602	116723	84657	141094	237295	147508	275775	429696
200	150	441	2758	8274	28130	441	2758	8274	33094	56812	34197	66740	100385	72807	121345	204080	126861	237174	369551
	125	508	3175	9526	32390	508	3175	9526	38105	65414	39376	76846	115587	83832	139720	234984	146071	273089	425511
	54-0	581	3629	10888	37019	581	3629	10888	43551	74763	45003	87829	132106	95813	159689	268567	166947	312119	486325
225	175	472	2950	8851	30094	472	2950	8851	35404	60778	36585	71399	107394	77890	129816	218328	135717	253732	395350
	150	548	3422	10266	34905	548	3422	10266	41065	70495	42434	82815	124564	90343	150572	253235	157416	294300	458560
	63-0	648	4051	12152	41317	648	4051	12152	48608	83444	50229	98027	147445	106938	178230	299751	186332	348359	542792
250	200	501	3131	9394	31941	501	3131	9394	37577	64507	38830	75781	113984	82670	137783	231726	144046	269303	419612
	175	584	3653	10959	37262	584	3653	10959	43837	75254	45298	88405	132973	96442	160736	270329	168043	314167	489515
	150	641	4008	12024	40881	641	4008	12024	48096	82564	49699	96993	145890	105810	176350	296589	184366	344685	537067
	71-0	716	4473	13420	45628	716	4473	13420	53680	92150	55469	108254	162828	118095	196825	331024	205771	384703	599421

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

INTIMIDATOR AIR CAPACITY TABLE

(M3/Hr.)

Pressure (bar)		Valve Size and Port																	
		1/2				3/4					1			1-1/2			2		
P1	P2	1/8	3/16	1/4	5/8	1/8	3/16	1/4	5/8	7/8	5/8	7/8	1-1/4	7/8	1-1/4	1-3/4	1-1/4	1-3/4	2-1/4
0.7	0.3	1.4	9.0	27	92	1.4	9.0	27	109	186	112	219	329	239	398	669	416	778	1212
	0.2	1.6	10	29	100	1.6	10	29	118	202	122	237	357	259	432	726	451	844	1315
1	0.7	1.4	8.9	27	90	1.4	8.9	27	106	183	110	214	323	234	390	656	408	762	1187
	0.5	1.7	11	33	111	1.7	11	33	131	224	135	263	396	287	479	805	500	936	1458
	0.3	2.0	12	37	125	2.0	12	37	147	252	151	295	444	322	537	904	562	1050	1636
1.5	1	2.0	12	37	127	2.0	12	37	150	257	155	302	454	329	549	923	573	1072	1671
	0.7	2.4	15	44	151	2.4	15	44	178	305	184	359	539	391	652	1097	682	1274	1986
	0.5	2.5	16	48	162	2.5	16	48	190	327	197	384	577	419	698	1174	730	1364	2125
2	1.5	2.2	14	42	142	2.2	14	42	167	286	172	336	505	366	611	1027	638	1194	1860
	1.2	2.7	17	50	170	2.7	17	50	200	344	207	404	607	441	734	1235	768	1435	2236
	1	2.9	18	54	184	2.9	18	54	216	371	223	436	655	475	792	1333	828	1549	2413
3	2	3.5	22	65	221	3.5	22	65	261	447	269	525	790	573	955	1607	999	1867	2909
	1.5	4.0	25	75	254	4.0	25	75	299	512	308	602	905	657	1095	1841	1144	2139	3333
	1.3-0	4.5	28	84	284	4.5	28	84	334	574	345	674	1014	735	1225	2060	1281	2395	3731
3.5	3.0	2.8	17	52	178	2.8	17	52	209	359	216	422	635	461	768	1291	803	1501	2338
	2.0	4.3	27	81	275	4.3	27	81	324	556	335	653	982	712	1187	1997	1241	2321	3616
	1.0	4.9	31	92	313	4.9	31	92	368	631	380	742	1116	809	1349	2268	1410	2636	4108
	4-0	5.0	31	94	320	5.0	31	94	376	646	389	758	1141	827	1379	2319	1442	2695	4200
4	3.0	4.0	25	75	254	4.0	25	75	299	513	309	602	906	657	1095	1842	1145	2141	3336
	2.0	5.1	32	95	323	5.1	32	95	380	652	393	766	1152	836	1393	2342	1456	2722	4242
	1.0	5.5	34	103	351	5.5	34	103	413	709	427	833	1253	909	1515	2547	1583	2960	4613
	1.6-0	5.6	35	104	355	5.6	35	104	418	717	431	842	1267	919	1531	2575	1601	2992	4662
5	4.0	4.4	28	83	283	4.4	28	83	333	571	344	671	1009	732	1220	2051	1275	2384	3714
	3.0	5.8	36	108	367	5.8	36	108	432	741	446	870	1309	949	1582	2661	1654	3093	4819
	2.0	6.4	40	120	409	6.4	40	120	481	826	497	970	1459	1058	1763	2965	1843	3446	5370
	1.9-0	6.7	42	125	426	6.7	42	125	501	860	518	1010	1520	1102	1837	3089	1920	3590	5594
7	5.0	6.9	43	130	442	6.9	43	130	521	894	538	1050	1579	1145	1909	3210	1995	3731	5813
	3.0	8.5	53	160	545	8.5	53	160	641	1100	662	1292	1944	1410	2350	3952	2457	4593	7157
	1.6-0	8.9	56	167	567	8.9	56	167	667	1145	689	1345	2024	1468	2446	4114	2557	4781	7450
9	7.0	8.0	50	149	507	8.0	50	149	597	1025	617	1204	1811	1313	2189	3681	2288	4278	6666
	5.0	10	63	190	645	10	63	190	759	1303	784	1531	2302	1670	2783	4680	2909	5439	8475
	2.1-0	11	70	209	709	11	70	209	834	1433	862	1683	2531	1836	3060	5146	3199	5981	9318
10	8.0	8.4	53	158	537	8.4	53	158	632	1085	653	1274	1916	1390	2316	3896	2422	4528	7055
	5.0	12	72	216	733	12	72	216	863	1481	891	1740	2617	1898	3163	5319	3307	6182	9632
	2.5-0	12	76	229	780	12	76	229	917	1575	948	1850	2783	2018	3364	5657	3517	6575	10244
12	10.0	9.3	58	174	592	9.3	58	174	696	1195	720	1404	2112	1532	2553	4294	2669	4990	7776
	7.0	13	81	244	829	13	81	244	976	1675	1008	1967	2959	2146	3577	6016	3740	6992	10894
	5.0	14	88	264	897	14	88	264	1055	1812	1091	2129	3202	2322	3870	6509	4046	7564	11786
	3.2-0	14	90	271	921	14	90	271	1084	1860	1120	2185	3287	2384	3973	6682	4154	7766	12100
14	10.0	13	83	250	849	13	83	250	999	1715	1032	2014	3030	2197	3662	6159	3829	7158	11153
	7.0	16	99	296	1006	16	99	296	1183	2031	1223	2386	3589	2603	4338	7296	4536	8480	13212
	3.8-0	17	104	313	1063	17	104	313	1250	2147	1292	2522	3793	2751	4585	7711	4793	8961	13963
15	12.0	12	78	233	791	12	78	233	930	1597	961	1876	2822	2047	3411	5737	3566	6667	10388
	10.0	15	94	281	957	15	94	281	1126	1932	1163	2270	3414	2476	4127	6942	4315	8067	12570
	4.2-0	18	111	333	1133	18	111	333	1333	2289	1378	2689	4044	2933	4888	8222	5111	9555	14888
17	15.0	11	70	209	711	11	70	209	837	1436	864	1687	2537	1840	3067	5158	3207	5995	9341
	12.0	16	101	304	1034	16	101	304	1216	2088	1257	2452	3689	2675	4459	7499	4662	8715	13579
	10.0	18	113	339	1152	18	113	339	1355	2326	1400	2732	4110	2981	4968	8355	5193	9709	15129
	4.8-0	20	125	375	1275	20	125	375	1500	2575	1550	3025	4550	3300	5500	9250	5750	10750	16751

INTIMIDATOR AIR
CAPACITY TABLE

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

INTIMIDATOR WATER CAPACITY TABLE

(G.P.M.)

INTIMIDATOR WATER CAPACITY TABLE

Pressure (PSI)		Valve Size and Port																	
		1/2				3/4					1			1-1/2			2		
P1	P2	1/8	3/16	1/4	5/8	1/8	3/16	1/4	5/8	7/8	5/8	7/8	1-1/4	7/8	1-1/4	1-3/4	1-1/4	1-3/4	2-1/4
10	5	0.18	1.1	3.4	11.4	0.18	1.1	3.4	13.4	23.0	13.9	27.1	40.7	29.5	49.2	82.7	51.4	96.2	150
	4	0.20	1.2	3.7	12.5	0.20	1.2	3.7	14.7	25.2	15.2	29.6	44.6	32.3	53.9	90.6	56.3	105	164
15	10	0.18	1.1	3.4	11.4	0.18	1.1	3.4	13.4	23.0	13.9	27.1	40.7	29.5	49.2	82.7	51.4	96.2	150
	7	0.23	1.4	4.2	14.4	0.23	1.4	4.2	17.0	29.1	17.5	34.2	51.5	37.3	62.2	105	65	122	190
	6	0.24	1.5	4.5	15.3	0.24	1.5	4.5	18.0	30.9	18.6	36.3	54.6	39.6	66.0	111	69	129	201
20	15	0.18	1.1	3.4	11.4	0.18	1.1	3.4	13.4	23.0	13.9	27.1	40.7	29.5	49.2	82.7	51.4	96.2	150
	10	0.25	1.6	4.7	16.1	0.25	1.6	4.7	19.0	32.6	19.6	38.3	57.6	41.7	69.6	117	72.7	136	212
	8	0.28	1.7	5.2	17.7	0.28	1.7	5.2	20.8	35.7	21.5	41.9	63.0	45.7	76.2	128	79.7	149	232
30	25	0.18	1.1	3.4	11.4	0.18	1.1	3.4	13.4	23.0	13.9	27.1	40.7	29.5	49.2	83	51.4	96	150
	20	0.25	1.6	4.7	16.1	0.25	1.6	4.7	19.0	32.6	19.6	38.3	57.6	41.7	69.6	117	72.7	136	212
	12	0.34	2.1	6.4	21.6	0.34	2.1	6.4	25.5	43.7	26.3	51.3	77.2	56.0	93.3	157	98	182	284
40	25	0.31	1.9	5.8	19.8	0.31	1.9	5.8	23.2	39.9	24.0	46.9	70.5	51.1	85.2	143	89.1	167	259
	20	0.36	2.2	6.7	22.8	0.36	2.2	6.7	26.8	46.1	27.7	54.1	81.4	59.0	98.4	165	103	192	300
	15	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
50	35	0.31	1.9	5.8	19.8	0.31	1.9	5.8	23.2	39.9	24.0	46.9	70.5	51.1	85.2	143	89.1	167	259
	30	0.36	2.2	6.7	22.8	0.36	2.2	6.7	26.8	46.1	27.7	54.1	81.4	59.0	98.4	165	103	192	300
	25	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
	15	0.47	3.0	8.9	30.2	0.47	3.0	8.9	35.5	60.9	36.7	71.6	107.7	78.1	130	219	136	254	396
60	45	0.31	1.9	5.8	19.8	0.31	1.9	5.8	23.2	39.9	24.0	46.9	70.5	51.1	85.2	143	89.1	167	259
	40	0.36	2.2	6.7	22.8	0.36	2.2	6.7	26.8	46.1	27.7	54.1	81.4	59.0	98.4	165	103	192	300
	35	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
	25	0.47	3.0	8.9	30.2	0.47	3.0	8.9	35.5	60.9	36.7	71.6	107.7	78.1	130	219	136	254	396
75	55	0.36	2.2	6.7	22.8	0.36	2.2	6.7	26.8	46.1	27.7	54.1	81.4	59.0	98.4	165	103	192	300
	50	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
	45	0.44	2.7	8.2	27.9	0.44	2.7	8.2	32.9	56.4	34.0	66.3	99.7	72.3	120	203	126	236	367
	31	0.53	3.3	9.9	33.8	0.53	3.3	9.9	39.8	68.3	41.1	80.3	121	88	146	245	153	285	444
100	75	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
	60	0.51	3.2	9.5	32.3	0.51	3.2	9.5	37.9	65.1	39.2	76.5	115	83.5	139	234	145	272	424
	50	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	86	129	93	156	262	163	304	474
125	100	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
	75	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	55	0.67	4.2	12.5	42.7	0.67	4.2	12.5	50.2	86.2	51.9	101	152	110	184	310	192	360	561
150	125	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
	100	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	75	0.69	4.3	13.0	44.2	0.69	4.3	13.0	52.0	89	53.7	105	158	114	191	320	199	372	580
175	150	0.40	2.5	7.5	25.5	0.40	2.5	7.5	30.0	51.5	31.0	60.5	91.0	66.0	110	185	115	215	335
	125	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	100	0.69	4.3	13.0	44.2	0.69	4.3	13.0	52.0	89.2	53.7	105	158	114	191	320	199	372	580
	75	0.80	5.0	15.0	51.0	0.80	5.0	15.0	60.0	103	62.0	121	182	132	220	370	230	430	670
200	150	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	125	0.69	4.3	13.0	44.2	0.69	4.3	13.0	52.0	89.2	53.7	105	158	114	191	320	199	372	580
	85	0.86	5.4	16.1	54.7	0.86	5.4	16.1	64.3	110	66.5	130	195	142	236	397	247	461	718
225	175	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	150	0.69	4.3	13.0	44.2	0.69	4.3	13.0	52.0	89.2	53.7	105	158	114	191	320	199	372	580
	100	0.89	5.6	16.8	57.0	0.89	5.6	16.8	67.1	115	69.3	135	203	148	246	414	257	481	749
250	200	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	175	0.69	4.3	13.0	44.2	0.69	4.3	13.0	52.0	89.2	53.7	105	158	114	191	320	199	372	580
	150	0.80	5.0	15.0	51.0	0.80	5.0	15.0	60.0	103	62.0	121	182	132	220	370	230	430	670
	125	0.89	5.6	16.8	57.0	0.89	5.6	16.8	67.1	115	69.3	135	203	148	246	414	257	481	749
300	250	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	200	0.80	5.0	15.0	51.0	0.80	5.0	15.0	60.0	103	62.0	121	182	132	220	370	230	430	670
	125	1.1	6.6	19.8	67.5	1.1	6.6	19.8	79.4	136	82.0	160	241	175	291	489	304	569	886
400	350	0.57	3.5	10.6	36.1	0.57	3.5	10.6	42.4	72.8	43.8	85.6	129	93.3	156	262	163	304	474
	300	0.80	5.0	15.0	51.0	0.80	5.0	15.0	60.0	103	62.0	121	182	132	220	370	230	430	670
	175	1.2	7.5	22.5	76.5	1.2	7.5	22.5	90.0	155	93.0	182	273	198	330	555	345	645	1005

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

INTIMIDATOR WATER CAPACITY TABLE

(M3/Hr.)

Pressure (bar)		Valve Size and Port																	
		1/2				3/4					1			1-1/2			2		
P1	P2	1/8	3/16	1/4	5/8	1/8	3/16	1/4	5/8	7/8	5/8	7/8	1-1/4	7/8	1-1/4	1-3/4	1-1/4	1-3/4	2-1/4
0.7	0.5	0.03	0.2	0.6	2.0	0.03	0.2	0.6	2.3	4.0	2.4	4.7	7.0	5.1	8.5	14.3	8.9	16.6	25.9
	0.3	0.04	0.3	0.8	2.8	0.04	0.3	0.8	3.3	5.6	3.4	6.6	10.0	7.2	12.0	20.2	12.6	23.5	36.6
1	0.7	0.04	0.2	0.7	2.4	0.04	0.2	0.7	2.8	4.9	2.9	5.7	8.6	6.3	10.4	17.5	10.9	20.4	31.7
	0.5	0.05	0.3	0.9	3.1	0.05	0.3	0.9	3.7	6.3	3.8	7.4	11.1	8.1	13.5	22.6	14.1	26.3	41.0
	0.4	0.05	0.3	1.0	3.4	0.05	0.3	1.0	4.0	6.9	4.2	8.1	12.2	8.8	14.7	24.8	15.4	28.8	44.9
1.5	1	0.05	0.3	0.9	3.1	0.05	0.3	0.9	3.7	6.3	3.8	7.4	11.1	8.1	13.5	22.6	14.1	26.3	41.0
	0.7	0.06	0.4	1.2	3.9	0.06	0.4	1.2	4.6	8.0	4.8	9.4	14.1	10.2	17.0	28.6	17.8	33.3	51.8
	0.6	0.07	0.4	1.2	4.2	0.07	0.4	1.2	4.9	8.5	5.1	9.9	14.9	10.8	18.0	30.4	18.9	35.3	55.0
2	1.5	0.05	0.3	0.9	3.1	0.05	0.3	0.9	3.7	6.3	3.8	7.4	11.1	8.1	13.5	22.6	14.1	26.3	41.0
	1	0.07	0.4	1.3	4.4	0.07	0.4	1.3	5.2	8.9	5.4	10.5	15.7	11.4	19.0	32.0	19.9	37.2	57.9
	0.8	0.08	0.5	1.4	4.8	0.08	0.5	1.4	5.7	9.8	5.9	11.5	17.2	12.5	20.8	35.1	21.8	40.7	63.5
3	2	0.07	0.4	1.3	4.4	0.07	0.4	1.3	5.2	8.9	5.4	10.5	15.7	11.4	19.0	32.0	19.9	37.2	57.9
	1.5	0.08	0.5	1.6	5.4	0.08	0.5	1.6	6.4	10.9	6.6	12.8	19.3	14.0	23.3	39.2	24.4	45.5	71.0
	1.0	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
3.5	3	0.05	0.3	0.9	3.1	0.05	0.3	0.9	3.7	6.3	3.8	7.4	11.1	8.1	13.5	22.6	14.1	26.3	41.0
	2	0.08	0.5	1.6	5.4	0.08	0.5	1.6	6.4	10.9	6.6	12.8	19.3	14.0	23.3	39.2	24.4	45.5	71.0
	1.5	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
	1	0.11	0.7	2.1	7.0	0.11	0.7	2.1	8.2	14.1	8.5	16.5	24.9	18.0	30.1	50.6	31.4	58.8	91.6
4	3.5	0.05	0.3	0.9	3.1	0.05	0.3	0.9	3.7	6.3	3.8	7.4	11.1	8.1	13.5	22.6	14.1	26.3	41.0
	3	0.07	0.4	1.3	4.4	0.07	0.4	1.3	5.2	8.9	5.4	10.5	15.7	11.4	19.0	32.0	19.9	37.2	57.9
	2	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
	1.7	0.10	0.7	2.0	6.7	0.10	0.7	2.0	7.9	13.5	8.1	15.9	23.9	17.3	28.9	48.5	30.2	56.4	87.9
5	4	0.07	0.4	1.3	4.4	0.07	0.4	1.3	5.2	8.9	5.4	10.5	15.7	11.4	19.0	32.0	19.9	37.2	57.9
	3	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
	2.5	0.11	0.7	2.1	7.0	0.11	0.7	2.1	8.2	14.1	8.5	16.5	24.9	18.0	30.1	50.6	31.4	58.8	91.6
	2.2	0.12	0.7	2.2	7.4	0.12	0.7	2.2	8.7	14.9	9.0	17.5	26.3	19.1	31.8	53.5	33.3	62.2	97.0
6	5	0.07	0.4	1.3	4.4	0.07	0.4	1.3	5.2	8.9	5.4	10.5	15.7	11.4	19.0	32.0	19.9	37.2	57.9
	4	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
	3.5	0.11	0.7	2.1	7.0	0.11	0.7	2.1	8.2	14.1	8.5	16.5	24.9	18.0	30.1	50.6	31.4	58.8	91.6
8	6	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
	5	0.12	0.7	2.2	7.6	0.12	0.7	2.2	9.0	15.4	9.3	18.1	27.3	19.8	33.0	55.4	34.5	64.4	100
	4	0.14	0.9	2.6	8.8	0.14	0.9	2.6	10.4	17.8	10.7	20.9	31.5	22.8	38.0	64.0	39.8	74.4	116
10	8	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
	6	0.14	0.9	2.6	8.8	0.14	0.9	2.6	10.4	17.8	10.7	20.9	31.5	22.8	38.0	64.0	39.8	74.4	116
	5	0.15	1.0	2.9	9.9	0.15	1.0	2.9	11.6	19.9	12.0	23.4	35.2	25.5	42.5	71.5	44.5	83.1	130
12	10	0.10	0.6	1.8	6.2	0.10	0.6	1.8	7.3	12.6	7.6	14.8	22.3	16.1	26.9	45.2	28.1	52.6	81.9
	8	0.14	0.9	2.6	8.8	0.14	0.9	2.6	10.4	17.8	10.7	20.9	31.5	22.8	38.0	64.0	39.8	74.4	116
	6	0.17	1.1	3.2	10.8	0.17	1.1	3.2	12.7	21.8	13.1	25.6	38.6	28.0	46.6	78.4	48.7	91.1	142
	5	0.18	1.1	3.4	11.7	0.18	1.1	3.4	13.7	23.6	14.2	27.7	41.6	30.2	50.3	84.7	52.6	98.4	153
14	10	0.14	0.9	2.6	8.8	0.14	0.9	2.6	10.4	17.8	10.7	20.9	31.5	22.8	38.0	64.0	39.8	74.4	116
	8	0.17	1.1	3.2	10.8	0.17	1.1	3.2	12.7	21.8	13.1	25.6	38.6	28.0	46.6	78.4	48.7	91.1	142
	6	0.20	1.2	3.7	12.5	0.20	1.2	3.7	14.7	25.2	15.2	29.6	44.5	32.3	53.8	90.5	56.3	105	164
15	12	0.12	0.7	2.2	7.6	0.12	0.7	2.2	9.0	15.4	9.3	18.1	27.3	19.8	33.0	55.4	34.5	64.4	100
	10	0.15	1.0	2.9	9.9	0.15	1.0	2.9	11.6	19.9	12.0	23.4	35.2	25.5	42.5	71.5	44.5	83.1	130
	7	0.20	1.2	3.7	12.5	0.20	1.2	3.7	14.7	25.2	15.2	29.6	44.5	32.3	53.8	90.5	56.3	105	164
17	14	0.12	0.7	2.2	7.6	0.12	0.7	2.2	9.0	15.4	9.3	18.1	27.3	19.8	33.0	55.4	34.5	64.4	100
	12	0.15	1.0	2.9	9.9	0.15	1.0	2.9	11.6	19.9	12.0	23.4	35.2	25.5	42.5	71.5	44.5	83.1	130
	10	0.18	1.1	3.4	11.7	0.18	1.1	3.4	13.7	23.6	14.2	27.7	41.6	30.2	50.3	84.7	52.6	98.4	153
	9	0.20	1.2	3.7	12.5	0.20	1.2	3.7	14.7	25.2	15.2	29.6	44.5	32.3	53.8	90.5	56.3	105	164
20	17	0.12	0.7	2.2	7.6	0.12	0.7	2.2	9.0	15.4	9.3	18.1	27.3	19.8	33.0	55.4	34.5	64.4	100
	15	0.15	1.0	2.9	9.9	0.15	1.0	2.9	11.6	19.9	12.0	23.4	35.2	25.5	42.5	71.5	44.5	83.1	130
	9	0.23	1.4	4.3	14.6	0.23	1.4	4.3	17.2	29.5	17.8	34.7	52.2	37.9	63.1	106	66.0	123	192
27	20	0.18	1.1	3.4	11.7	0.18	1.1	3.4	13.7	23.6	14.2	27.7	41.6	30.2	50.3	84.7	52.6	98.4	153
	15	0.24	1.5	4.5	15.3	0.24	1.5	4.5	18.0	30.9	18.6	36.2	54.5	39.5	65.9	111	68.9	129	201
	12	0.27	1.7	5.0	17.1	0.27	1.7	5.0	20.1	34.5	20.8	40.5	61.0	44.2	73.7	124	77.0	144	224

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

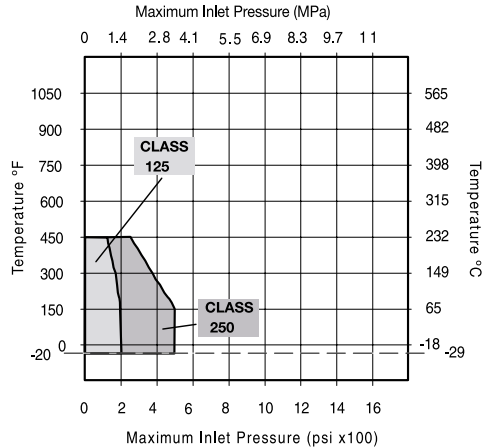


BOSS D SERIES PNEUMATIC CONTROL VALVE

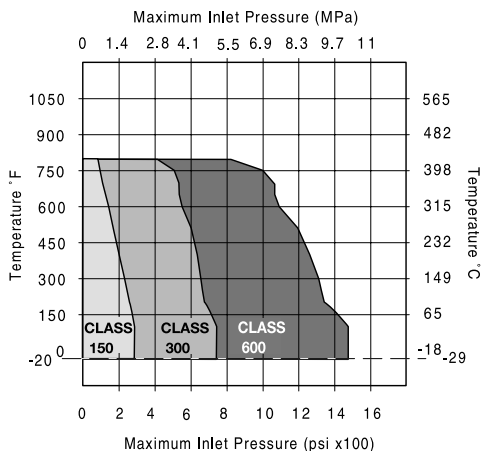
APPLICATION DATA

- Process control systems for food, pulp and paper, chemical, petrochemical & other industries
- HVAC systems
- Feed water and fuel system controls in boiler rooms
- Packaged systems (OEM) such as heat exchangers, water purification systems & vaporizer, metal cleaning and plating

CAST IRON A126 CLASS B



CARBON STEEL A216WCB



BOSS SERIES D CONTROL VALVE

SIZES 2" – 8"

ANSI CLASS 125/250, 250/300, 600

- **Available in Pneumatic & Electric Actuators** for modulating control and on/off applications.
- **Electric Actuator Accepts Analog Signals** 4-20 mA, 0-10 VDC or Profibus DP
- **High Flow Capacities** - Valve body flow areas 42% of pipe area, reducing velocities and pressure loss.
- **Controlled Seat Loading** maintains constant seat gasket load.
- **Hung Cage Design** eliminates problems associated with fixed cages.
- **Hardened/Stainless Steel Trim** provides twice the service life of 316 stainless trim.
- **Rugged Piston Seal** with three times the wear surface of competitive valves for long lasting leak tight seal.
- **Multiple Cage Options** for maximum versatility.
- **Balanced Plug Design** provides smooth high pressure control.
- **Tighter Shut Offs to Class VI** - Superior design provides exceptional performance up to Class VI.

MODELS

- D1 — Cast Iron Stainless Trim, Pneumatic or Electrically Actuated
- D2 — Cast Steel Stainless Trim, Pneumatic or Electrically Actuated

OPTIONS

- 35, 55, 85 or 135 sq. in. Actuator, Reverse or Direct
- Electric Actuator Accepts Analog Signals 4-20 mA, 0-10 VDC or Profibus DP
- Soft Seats
- Thread of Flange Connection
- Moore and PMV Accessories
- Noise and Cavitation Reducing Trim
- Reduced Flow Caging
- Alternate Packings for Severe Service
- High Temperature Trim

APPLICABLE CODES

- ANSI B16.0 Face-To-Face Dimensions and ISA S75.03 Uniform Face-To-Face Dimensions for Flanged Globe Style Control Valves
- ANSI B16.37 Hydrotesting of Control Valves
- ISA S75.02 Control Valve Capacity Test Procedure
- Canadian Registration # OC 0591.9C

BOSS SERIES D

CONTROL VALVE

SPECIFICATION

All cage-guided control valves shall be designed, built and tested in accordance with the latest revision of applicable industry standards (see previous page). Valve body materials and end connections shall be as specified on the valve data sheets, in accordance with ANSI B16.34 and B16.5. Bonnets shall be through bolted, of the same material as the valve body. Stem packing shall be adjustable and suitable for the intended service. Asbestos or asbestos filled packings are prohibited. If graphite packing is selected or specified, use alternating rings of braided and die-cut anti-extrusion rings. Live-loaded PTFE V-ring packing shall be used to 450°F. Packing gland, clamp, studs and nuts shall be of 300 Series stainless steel. Cage type guiding and throttling shall be used for 2" valves and larger. Valves shall be of a "quick change" trim design utilizing a hung cage in all pressure classes. Seat rings shall be non-threaded and retained by a load spring with laminated graphite seat/body gasket. Trim shall be of 400 Series

hardened stainless steel. Plugs shall be balanced unless otherwise noted. Where specified or required, valves shall be provided with stellite seating surfaces on 400 Series hardened stainless steel plug and seat ring. Seat stellite thickness shall be 3/32" minimum. Valve characteristic shall be modified linear or equal percent. Valve leakage shall be ANSI/ISA 70-2 Class IV unless otherwise specified. Valve stems shall be 316 stainless steel with a minimum 16 RMS finish. Plug/stem assemblies shall be of a two piece threaded and pinned design. Actuators shall be of the spring and diaphragm type or electrically driven. Pneumatic Actuators shall be capable of shutting off the valve without the use of line pressure assist. Pneumatic Actuator yokes shall be of cast iron unless otherwise specified and bolted or clamped to the valve bonnet. Locknut mounting is not preferred. Electric Actuators shall have integral handwheel permitting easy manual operation when power is lost. Top mounted handwheel manual overrides shall be provided where specified. Rim pull required to operate valve shall not exceed 40 pounds. Valve body size shall not be less than 1/2 the nominal inlet pipe size. Provide reduced window cages where required. Valves shall be sized to control within manufacturers published rangeability. Size valve to pass 110% of maximum stated flow. Valve generated noise shall not exceed 85 dBA when measured 3 feet downstream and 3 feet away from the pipe.

MATERIALS OF CONSTRUCTION

BODY ASSEMBLY:

Style: Single seated, top entry bolted bonnet, globe style body, cage guided balanced plug

BODY/BONNET MATERIALS:

Cast Iron, ASTM A126 Class B

Carbon Steel, ASTM A216 Gr WCB

Chrome Moly, ASTM A217 Gr WC-9

Note: See ANSI B16.1 (cast iron) or ANSI B16.34 (other materials) for pressure/temp. limits of body/bonnet assemblies.

SIZES: 2"-8" (50-200mm)

END CONNECTIONS:

ANSI Class 125/150 Integral Flanged, 2-8"

ANSI Class 250/300 Integral Flanged, 2-8"

ANSI Class 600 Integral Flanged, 2-8"

Threaded, NPT - 2" only, (ANSI 250 Cast Iron

Bodies), (ANSI 600 Carbon Steel & Alloy)

Socketweld - 2" only, (ANSI 600 Class)

Buttweld Ends

DIN Flanges: ND-16, ND-25, ND-40, ND-64,

ND-100

BONNET:

Bolted Bonnet, Standard

BODY/BONNET BOLTING:

ASTM A-193 GRB7 Studs

ASTM A-194 GR2H Nuts

STEM PACKING:

PTFE V-Rings, -40 to 460°F (-22 to 238°C)

PTFE/Graphite, -40 to 500°F (-22 to 260°C)

Laminated Graphite, -320 to 800°F (-195 to 426°C)

PACKING STUDS, NUTS & FOLLOWER:

300 Series Stainless Steel

GASKETS:

Body/Bonnet and Seat Ring/Body:

Filled 304 stainless steel 500°F (260°C) Max.

Inconel/Graphite: 800°F (426°C) Max.

TRIM SIZES:

Full Port and 40% reduced

PLUG (PISTON) SEAL MATERIALS:

Standard TFE/Graphite, max. temp. 500°

(Class IV shutoff)

Ni-Resist, max. temp. 800°F (Class III shutoff)

FLOW CHARACTERISTICS:

Modified Linear, Standard

Equal % (w/ CAM Characterized Positioner)

SHUTOFF CLASS (ANSI /ISA 70-2):

Standard trim, 0-500°F (-18 to 260°C) Max.

Class IV (.01% Cv).

Metal/PTFE seats - Class VI, bubble tight to 460°F (238°C).

High-temp trim, 0-800°F (-18 to 426°C),

Class III (.1% Cv).

For optional Class IV or V shutoff above

500°F, contact factory.

TRIM MATERIAL COMBINATIONS:

See Chart on page 172

ACTUATORS:

Standard: Spring & Diaphragm

Digi Electric

Optional: Piston Double Acting/Spring Return

Hydraulic

PRESSURE RECOVERY FACTOR:

Liquid: $F_L = 0.8$, Gas: $X_T = 0.7$

ANSI BODY RATINGS:

Class 125 & 250 Cast Iron

Class 150, 300, & 600 Steel and Alloy

BOSS SERIES D
CONTROL VALVE

BOSS SERIES D ORDERING CODE

Model		Orifice	Size	Connections	Trim	Packing-	Actuator		Spring		Positioner		Posit. Set		Accessories		-	Inlet Pressure			
D	1	T	H	1	1	1	-	3	4	D	A	M	I	0	2	0	2	-	#	#	#
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		

Model -	Position 1 & 2
D1 - Cast Iron	
D2 - Cast Steel	
Orifice -	Position 3
T = STD	
P = 40%	
Q = Seco-Sonic	
R = Seco-Cav	
Size -	Position 4
H = 2	
J = 2½	
K = 3	
M = 4	
P = 6	
Q = 8	

Connections -	Position 5
1 = 150 RF Flg	
2 = 125#	
3 = 300RF Flg	
4 = 250#	
6 = 600 RF Flg	
9 = Threaded	
Trim - Position 6	
1 = Metal	
2 = Soft	
3 = Hi-Temp	
4 = Stellite	
Packing -	Position 7
1 = V-ring	
2 = Graphite	
3 = Hi-Temp	

Actuator -	Position 8 & 9
01 = None	
02 = ST5112-34	
03 = ST5113-07	
04 = ST5114-17	
34 = 35	
35 = 35R	
52 = 55	
53 = 55R	
54 = 55A	
55 = 55AR	
82 = 85	
83 = 85R	
84 = 85A	
85 = 85AR	
86 = 135	
87 = 135R	

Spring -	Position
10 & 11	
AA = None	
TA - 38422	
TB - 41968	
TC - 23239	
TD - 35014	
TE - 24296	
TF - 24297	
TG - 24299	
TH - 24301	
TJ - 42489	
TK - 23996	
TL - 61264	
TM - 42489/	
25390	

Positioner - Position 12 & 13	
AA = None	
MI = Moore I/P	
MP = Moore P	
4P = PMV P4 P	
5I = PMV P5 I/P	
Positioner Set - Position 14 & 15	
01 = None	
02 = Std 3-15	
03 = S.R. 3-9	
04 = S.R. 9-15	
Accessories - Position 16 & 17	
01 = None	
02 = Limit Switch, Mechanical	
03 = Limit Switch, Proximity Switch	
04 = Feedback Potentiometer 1K	
05 = Feedback 4-20mA Posit. Trans	
Inlet Pressure - Position 18, 19 & 20	
___ = Actual Setting	

BOSS SERIES D CONTROL VALVE

DIMENSIONS

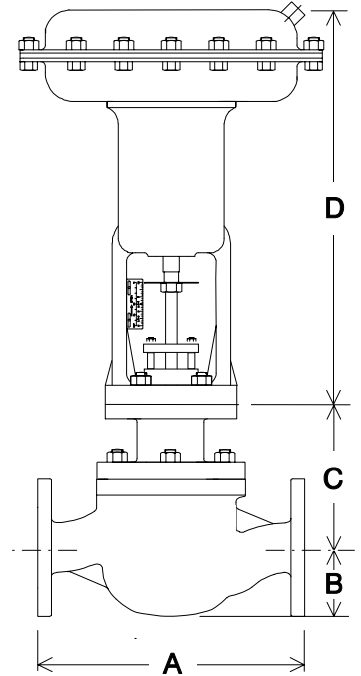
PNEUMATIC ACTUATOR

BOSS DIMENSIONS

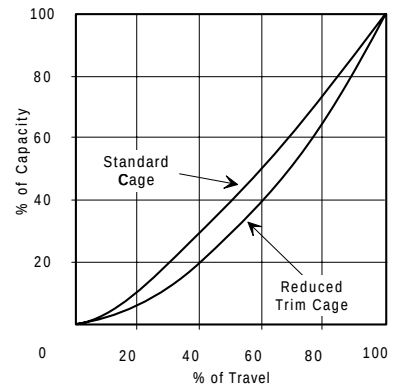
CONTROL VALVE - CAST IRON DIMENSIONS IN INCHES						CONTROL VALVE - CAST STEEL DIMENSIONS IN INCHES					
SIZE	A	B	C	D*	WGT.*	SIZE	A	B	C	D*	WGT.*
THREADED						THREADED					
2	9 ¹ / ₄	3 ³ / ₄	7 ¹ / ₄	12 ³ / ₈	80 lb.	2	9 ¹ / ₄	3	7 ¹ / ₈	12 ³ / ₈	45 lb.
125 LB. ANSI FLANGE STANDARD						150 LB. ANSI FLANGE STANDARD					
2	10	3 ³ / ₄	7 ¹ / ₄	12 ³ / ₈	85 lb.	2	10	3	7 ¹ / ₈	12 ³ / ₈	85 lb.
2½	10 ⁷ / ₈	4 ³ / ₈	6 ⁵ / ₈	15 ¹ / ₄	125 lb.	2½	10 ⁷ / ₈	3½	6 ⁵ / ₈	15 ¹ / ₄	125 lb.
3	11 ³ / ₄	4½	6 ⁷ / ₈	15 ¹ / ₄	145 lb.	3	11 ³ / ₄	3¾	6 ⁷ / ₈	15 ¹ / ₄	145 lb.
4	13 ⁷ / ₈	5½	8 ¹ / ₂	15 ¹ / ₄	190 lb.	4	13 ⁷ / ₈	4½	8 ⁵ / ₈	15 ¹ / ₄	190 lb.
6	17 ³ / ₄	5 ⁷ / ₈	9¾	19 ⁵ / ₈	460 lb.	6	17 ³ / ₄	5½	9¾	19 ⁵ / ₈	450 lb.
8	21 ³ / ₈	7 ⁵ / ₈	12¼	27 ³ / ₈	625 lb.	8	21 ³ / ₈	6¾	12¼	27 ³ / ₈	600 lb.
250 LB. ANSI FLANGE STANDARD						300 LB. ANSI FLANGE STANDARD					
2	10½	3¾	7¼	12¾	88 lb.	2	10½	3¾	7¼	12¾	88 lb.
2½	11½	4¾	6¾	15¾	130 lb.	2½	11½	3¾	6¾	15¾	130 lb.
3	12½	4½	6¾	15¾	152 lb.	3	12½	4½	6¾	15¾	152 lb.
4	14½	5½	8½	15¾	198 lb.	4	14½	5	8½	15¾	198 lb.
6	18 ⁵ / ₈	5 ⁷ / ₈	9¾	19 ⁵ / ₈	480 lb.	6	18 ⁵ / ₈	6¼	9¾	19 ⁵ / ₈	470 lb.
8	22 ³ / ₈	7 ⁵ / ₈	12¼	27 ³ / ₈	640 lb.	8	22 ³ / ₈	7½	12¼	27 ³ / ₈	635 lb.
600 LB. ANSI FLANGE STANDARD						600 LB. ANSI FLANGE STANDARD					
—	—	—	—	—	—	2	11¼	3¾	7¼	12¾	90 lb.
—	—	—	—	—	—	2½	12¼	3¾	6¾	15¾	135 lb.
—	—	—	—	—	—	3	13¼	4¾	6¾	15¾	158 lb.
—	—	—	—	—	—	4	15½	5¾	8½	15¾	205 lb.
—	—	—	—	—	—	6	20	7	9¾	19 ⁵ / ₈	485 lb.
—	—	—	—	—	—	8	24	8¾	12¼	27 ³ / ₈	660 lb.
DIMENSIONS IN MILLIMETERS						DIMENSIONS IN MILLIMETERS					
SIZE	A	B	C	D*	WGT.*	SIZE	A	B	C	D	WGT.*
THREADED						THREADED					
50	235	95	184	314	36.3 kg	50	235	76	181	314	20.4 kg
DIN 2533 FLANGE STANDARD (ND-16)						DIN 2543 FLANGE STANDARD (ND-16)					
50	254	95	184	314	39 kg	50	254	76	181	314	39 kg
65	276	111	168	387	57 kg	65	276	89	168	387	57 kg
80	299	114	175	387	66 kg	80	299	95	175	387	66 kg
100	352	140	206	387	86 kg	100	352	114	219	387	86 kg
160	451	149	248	499	209 kg	160	451	140	248	499	204 kg
200	543	194	311	695	284 kg	200	543	172	311	695	272 kg
DIN 2534 FLANGE STANDARD (ND-25)						DIN 2545 FLANGE STANDARD (ND-40)					
50	267	95	184	314	40 kg	50	267	83	181	314	40 kg
65	292	111	168	387	59 kg	65	292	95	168	387	59 kg
80	318	114	175	387	69 kg	80	318	105	175	387	69 kg
100	368	140	206	387	90 kg	100	368	127	219	387	90 kg
160	473	149	248	499	218 kg	160	473	159	248	499	213 kg
200	568	194	311	695	290 kg	200	568	191	311	695	288 kg
DIN 2547 FLANGE STANDARD (ND-100)						DIN 2547 FLANGE STANDARD (ND-100)					
—	—	—	—	—	—	50	286	83	181	314	41 kg
—	—	—	—	—	—	65	311	95	168	387	61 kg
—	—	—	—	—	—	80	337	105	175	387	72 kg
—	—	—	—	—	—	100	394	137	219	387	93 kg
—	—	—	—	—	—	160	508	178	248	499	220 kg
—	—	—	—	—	—	200	610	210	311	695	299 kg

* With standard actuator

Dimensions are subject to change without notice.
Request certified drawings for installation purposes



Inherent Flow Characteristics



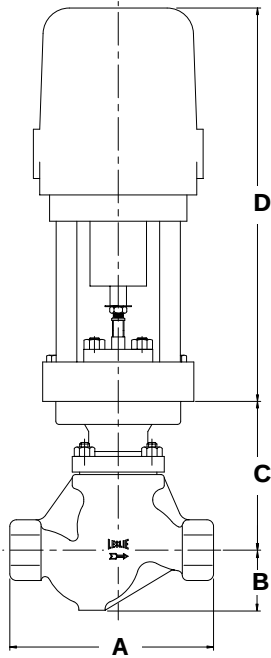
C_v TABLE

Valve Size	Full Port		40% Red.		Seco-Sonic		Seco-Cav		Stroke (in.)	Seat Dia.	Unbalanced Area (in ²)
	Cv	Range	Cv	Range	Cv	Range	Cv	Range			
2	65	30:1	26	20:1	48	30:1	32	14:1	0.750	2.3	0.14
2½	90	40:1	36	25:1	70	40:1	40	17:1	0.875	2.9	0.18
3	125	40:1	50	25:1	97	40:1	63	20:1	1.00	3.5	0.21
4	205	50:1	82	30:1	156	50:1	103	25:1	1.25	4.6	0.28
6	435	50:1	174	30:1	349	50:1	217	25:1	2.00	6.9	0.42
8	760	50:1	304	30:1	579	50:1	304	25:1	2.75	9.2	0.56

BOSS SERIES D CONTROL VALVE

DIMENSIONS

ELECTRIC ACTUATOR



ELECTRIC ACTUATORS SPECIFICATIONS,
DIMENSIONS inches (mm) **AND WEIGHTS** pounds (kg)

Model	Std. Stroke (in)	Max Thrust (lb/f)	Stroke Time (sec)	Sec./Inch	Rating	Power Supply	Power Consumption	Ambient Temp. Limits	D	Wgt.
ST5112-34	1.57	674	39	25	IP-65	24V(DC), 115V, 230V, 50/60 Hz	18VA	-68°F to 158°F	16 $\frac{1}{16}$ (424)	12 (5.5)
ST5113-07	2.36	1348	38	16	IP-55	24V(DC), 115V, 230V, 50/60 Hz	72VA	-68°F to 140°F	21 $\frac{1}{16}$ (541)	23 (10.5)
ST5114-17	3.14	2248	91	29	IP-55	24V(DC), 115V, 230V, 50/60 Hz	66VA	-68°F to 140°F	21 $\frac{1}{16}$ (558)	23 (10.5)

CARBON STEEL AND CHROME MOLY
VALVE BODY ASSEMBLY
DIMENSIONS[†] inches (mm) **AND WEIGHTS** pounds (kg)

SIZE	A				B	C	WEIGHT	
	THD	150	300	600			THD	FLG
2 (50)	9 $\frac{1}{4}$ (235)	10 (254)	10 $\frac{1}{2}$ (267)	11 $\frac{1}{2}$ (286)	2 $\frac{1}{2}$ (67)	7 $\frac{1}{2}$ (181)	85 (39)	90 (41)
2 $\frac{1}{2}$ (65)	—	10 $\frac{1}{2}$ (276)	11 $\frac{1}{2}$ (292)	12 $\frac{1}{2}$ (311)	3 $\frac{1}{2}$ (83)	6 $\frac{1}{2}$ (172)	—	135 (61)
3 (80)	—	11 $\frac{1}{2}$ (299)	12 $\frac{1}{2}$ (318)	13 $\frac{1}{2}$ (337)	3 $\frac{1}{2}$ (92)	6 $\frac{1}{2}$ (175)	—	158 (72)
4 (100)	—	13 $\frac{1}{2}$ (352)	14 $\frac{1}{2}$ (368)	15 $\frac{1}{2}$ (394)	4 $\frac{1}{2}$ (105)	8 $\frac{1}{2}$ (206)	—	205 (93)
6 (160)	—	17 $\frac{1}{2}$ (451)	18 $\frac{1}{2}$ (473)	20 (508)	5 $\frac{1}{2}$ (140)	9 $\frac{1}{2}$ (248)	—	485 (220)
8 (200)	—	21 $\frac{1}{2}$ (543)	22 $\frac{1}{2}$ (568)	24 (610)	7 $\frac{1}{2}$ (184)	12 $\frac{1}{2}$ (311)	—	660 (299)

[†] Threaded Carbon Steel & Chrome Moly available in 2" only.
Flanged (150, 300 & 600#) Carbon Steel & Chrome Moly available in 2" to 8".

CLASS IV SHUTOFF

VALVE SIZE	VALVE STROKE (IN)	MAXIMUM DELTA P (PSI)		
		ST5112-34	ST5113-07	ST5114-17
2	$\frac{3}{4}$	750	—	—
2 $\frac{1}{2}$	$\frac{7}{8}$	600	—	—
3	1	600	750	—
4	1 $\frac{1}{4}$	—	750	—
6	2	—	350	500
8	2 $\frac{3}{4}$	—	—	300

DIGI ACTUATOR OPTIONS

Model	Prod. Ref. No.
Heater, 12 volt	E68717
Heater, 115 volt	E68718
Heater, 230 volt	E68719
Limit Switch Set	E68720
Field Bus	*

* Consult factory.

DIGI MOUNTING KITS

Actuator Code**	Model	Valve Size	Prod. Ref. No.
02	ST5112-34	$\frac{1}{2}$ to 1 $\frac{1}{2}$ 2 to 4	U009005096 U009005097
03	ST5113-07	$\frac{1}{2}$ to 1 $\frac{1}{2}$ 2 to 4	U009005096 U009005097
04	ST5114-17	$\frac{1}{2}$ to 1 $\frac{1}{2}$ 2 to 4	U009005096 U009005097

** Use Actuator Code for ordering.

CAST IRON VALVE BODY ASSEMBLY
DIMENSIONS[†] inches (mm) **AND WEIGHTS** pounds (kg)

SIZE	A			B	C	WEIGHT	
	THD	125	250			THD	FLG
2 (50)	9 $\frac{1}{4}$ (235)	10 (254)	10 $\frac{1}{2}$ (267)	3 $\frac{1}{2}$ (95)	7 $\frac{1}{2}$ (181)	85 (39)	90 (41)
2 $\frac{1}{2}$ (65)	—	10 $\frac{1}{2}$ (276)	11 $\frac{1}{2}$ (292)	4 $\frac{1}{2}$ (111)	6 $\frac{1}{2}$ (172)	—	135 (61)
3 (80)	—	11 $\frac{1}{2}$ (299)	12 $\frac{1}{2}$ (318)	4 $\frac{1}{2}$ (114)	6 $\frac{1}{2}$ (175)	—	158 (72)
4 (100)	—	13 $\frac{1}{2}$ (352)	14 $\frac{1}{2}$ (368)	5 $\frac{1}{2}$ (140)	8 $\frac{1}{2}$ (206)	—	205 (93)
6 (160)	—	17 $\frac{1}{2}$ (451)	18 $\frac{1}{2}$ (473)	5 $\frac{1}{2}$ (149)	9 $\frac{1}{2}$ (245)	—	485 (220)
8 (200)	—	21 $\frac{1}{2}$ (543)	22 $\frac{1}{2}$ (568)	7 $\frac{1}{2}$ (194)	12 $\frac{1}{2}$ (311)	—	660 (299)

[†] Threaded Cast Iron available in 2" only.
Flanged (125 and 250#) Cast Iron available in 2" to 8".

BOSS SATURATED STEAM CAPACITY TABLE

(Modified Equal Percent Contour Plug) (Lb/Hr)

BOSS STEAM CAPACITY TABLE

Pressure (PSI)		Valve Port and Trim											
		2		2-1/2		3		4		6		8	
P1	P2	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic
10	5	2022	1483	2800	2162	3888	2996	6377	4819	13531	10781	23641	17885
	0	2531	1840	3505	2683	4867	3718	7982	5979	16938	13376	29594	22191
15	10	2244	1648	3107	2403	4315	3330	7077	5355	15018	11980	26238	19876
	5	2876	2097	3982	3059	5531	4238	9071	6816	19248	15249	33629	25299
	0	3158	2283	4373	3330	6074	4614	9961	7421	21137	16603	36929	27544
20	15	2443	1795	3382	2618	4698	3628	7705	5835	16349	13054	28563	21656
	10	3181	2325	4405	3390	6118	4698	10034	7556	21291	16904	37198	28044
	0	3726	2682	5159	3912	7165	5420	11751	8717	24935	19502	43565	32355
30	25	2793	2055	3867	2997	5371	4152	8808	6678	18690	14940	32654	24786
	15	4253	3102	5889	4523	8179	6268	13414	10080	28464	22552	49730	37414
	0	4780	3427	6618	4998	9192	6926	15074	11139	31987	24919	55886	41342
40	25	4839	3539	6701	5161	9307	7151	15263	11501	32387	25729	56585	42685
	15	5572	4039	7715	5891	10716	8163	17574	13128	37291	29369	65152	48724
	3-0	5798	4157	8028	6063	11150	8401	18286	13512	38801	30228	67791	50148
50	35	5356	3923	7416	5721	10300	7928	16892	12750	35844	28524	62623	47322
	30	5909	4314	8181	6291	11363	8718	18635	14021	39543	31366	69087	52038
	25	6298	4582	8720	6682	12111	9259	19863	14891	42147	33313	73637	55267
	7-0	6808	4882	9426	7119	13092	9865	21471	15865	45560	35493	79600	58884
60	45	5824	4271	8063	6228	11199	8631	18367	13880	38973	31052	68091	51517
	40	6469	4732	8958	6900	12441	9562	20403	15378	43295	34403	75642	57076
	35	6948	5067	9620	7389	13361	10239	21912	16467	46496	36840	81235	61118
	11-0	7814	5603	10819	8171	15027	11323	24644	18210	52293	40738	91362	67586
75	55	7215	5287	9990	7710	13876	10684	22756	17182	48287	38440	84363	63773
	50	7809	5709	10812	8325	15017	11536	24628	18553	52259	41507	91303	68862
	45	8271	6032	11453	8797	15906	12190	26087	19605	55355	43859	96711	72763
	16-0	9304	6672	12883	9730	17893	13482	29345	21683	62268	48509	108790	80478
100	75	9045	6629	12523	9667	17393	13395	28525	21543	60529	48195	105752	79957
	60	10584	7714	14655	11249	20354	15588	33381	25070	70832	56086	123753	93048
	25-0	11757	8434	16279	12300	22609	17045	37079	27412	78680	61325	137463	101740
125	100	10110	7420	13998	10822	19442	14996	31885	24117	67659	53953	118209	89509
	75	12865	9372	17813	13668	24741	18939	40574	30459	86097	68143	150422	113051
	33-0	14194	10178	19653	14842	27295	20567	44765	33077	94988	74000	165956	122767
150	125	11056	8123	15309	11846	21262	16416	34870	26400	73992	59062	129273	97986
	100	14327	10463	19837	15258	27552	21143	45185	34004	95880	76073	167515	126207
	42-0	16601	11904	22987	17360	31926	24056	52358	38688	111102	86553	194109	143593
175	150	11918	8762	16501	12778	22918	17707	37586	28478	79756	63709	139344	105695
	125	15642	11443	21659	16687	30081	23124	49334	37189	104684	83199	182895	138029
	100	17674	12852	24472	18743	33988	25972	55741	41770	118280	93447	206650	155031
	51-0	18986	13621	26288	19863	36511	27525	59878	44267	127059	99034	221988	164299
200	150	16831	12328	23305	17978	32368	24913	53083	40066	112639	89634	196795	148705
	125	19228	14013	26624	20436	36977	28318	60642	45543	128680	101887	224821	169034
	59-0	21359	15315	29574	22335	41075	30950	67362	49775	142940	111356	249734	184742
225	175	17939	13152	24838	19179	34497	26577	56575	42743	120050	95623	209743	158641
	150	20666	15086	28614	22000	39741	30485	65176	49028	138300	109684	241628	181969
	67-0	23720	17009	32844	24804	45616	34372	74810	55278	158744	123667	277345	205167
250	200	18963	13913	26256	20290	36467	28116	59806	45218	126906	101160	221721	167827
	175	21990	16073	30447	23439	42288	32480	69352	52237	147162	116862	257111	193878
	150	23966	17442	33183	25437	46088	35248	75584	56688	160385	126820	280212	210398
	76-0	26058	18685	36080	27249	50111	37759	82182	60726	174387	135854	304676	225385

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

BOSS SATURATED STEAM CAPACITY TABLE

(Modified Equal Percent Contour Plug) (Kg/Hr)

Pressure (bar)		Valve Port and Trim											
		2		2-1/2		3		4		6		8	
P1	P2	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic
0.7	0.3	973	713	1348	1039	1872	1440	3069	2317	6513	5183	11379	8598
	0.2	1051	768	1456	1120	2022	1552	3316	2497	7036	5586	12293	9267
1	0.7	951	699	1317	1019	1830	1413	3001	2272	6367	5083	11124	8432
	0.5	1161	850	1608	1239	2233	1717	3662	2762	7770	6179	13575	10252
	0.3	1294	943	1792	1376	2489	1906	4082	3066	8662	6859	15133	11379
1.5	1	1326	973	1836	1418	2550	1966	4182	3161	8875	7072	15506	11732
	0.7	1564	1142	2166	1665	3008	2307	4933	3710	10468	8300	18288	13769
	0.5	1664	1210	2304	1765	3200	2445	5249	3933	11138	8798	19459	14596
2	1.5	1464	1075	2027	1568	2815	2173	4617	3494	9798	7817	17118	12968
	1.2	1749	1280	2422	1866	3364	2586	5517	4159	11707	9304	20454	15435
	1	1879	1371	2602	1999	3614	2770	5928	4455	12578	9967	21976	16536
3	2	2259	1653	3128	2411	4344	3341	7124	5374	15117	12022	26411	19944
	1.5	2566	1868	3552	2724	4934	3774	8092	6070	17170	13580	29999	22529
	.3-0	2798	2006	3874	2926	5380	4054	8823	6520	18723	14586	32711	24198
3.5	3.0	1817	1337	2516	1950	3494	2702	5731	4345	12161	9721	21246	16128
	2.0	2771	2021	3837	2948	5329	4085	8740	6569	18546	14696	32402	24381
	1.0	3092	2229	4282	3251	5947	4505	9752	7245	20694	16208	36155	26889
	.4-0	3123	2240	4325	3266	6006	4526	9850	7279	20902	16283	36518	27015
4	3.0	2564	1880	3550	2742	4930	3800	8085	6111	17157	13671	29975	22680
	2.0	3216	2338	4453	3410	6185	4725	10143	7599	21522	17001	37602	28205
	1.0	3437	2471	4759	3603	6610	4993	10840	8030	23002	17965	40188	29805
	.6-0	3449	2473	4775	3606	6632	4997	10877	8037	23081	17981	40325	29830
5	4.0	2836	2083	3927	3038	5455	4209	8946	6769	18983	15144	33165	25125
	3.0	3641	2655	5041	3872	7001	5366	11482	8629	24364	19306	42567	32029
	2.0	4005	2896	5545	4224	7701	5853	12630	9413	26800	21058	46823	34936
	.9-0	4102	2941	5680	4290	7889	5944	12937	9560	27452	21386	47963	35481
7	5.0	4366	3196	6045	4661	8396	6458	13770	10386	29220	23236	51050	38549
	3.0	5276	3816	7306	5565	10147	7711	16641	12402	35311	27745	61693	46030
	1.6-0	5404	3875	7483	5651	10393	7831	17044	12594	36167	28176	63189	46744
9	7.0	4976	3649	6890	5322	9569	7375	15693	11860	33300	26534	58180	44020
	5.0	6241	4537	8641	6617	12002	9169	19683	14746	41766	32990	72970	54732
	2.1-0	6690	4797	9264	6996	12866	9695	21101	15592	44775	34881	78227	57869
10	8.0	5230	3839	7242	5598	10059	7757	16496	12476	35004	27910	61156	46304
	5.0	7007	5080	9702	7409	13475	10266	22099	16510	46893	36937	81927	61279
	2.5-0	7300	5235	10108	7634	14039	10579	23024	17013	48857	38061	85359	63145
12	10.0	5736	4214	7943	6146	11032	8516	18092	13697	38390	30642	67072	50836
	7.0	7916	5759	10960	8399	15223	11639	24965	18718	52975	41875	92553	69472
	5.0	8455	6101	11708	8898	16261	12330	26667	19830	56587	44362	98864	73598
	3.2-0	8569	6145	11865	8961	16479	12417	27026	19970	57348	44676	100194	74119
14	10.0	8118	5938	11240	8659	15612	12000	25603	19298	54329	43174	94920	71626
	7.0	9476	6866	13121	10012	18223	13874	29886	22313	63416	49919	110796	82817
	3.8-0	9822	7043	13600	10271	18888	14232	30977	22889	65731	51207	114840	84954
15	12.0	7559	5546	10466	8088	14536	11208	23840	18026	50587	40326	88381	66902
	10.0	9073	6623	12563	9659	17448	13385	28615	21526	60719	48157	106083	79893
	4.2-0	10421	7472	14429	10897	20040	15100	32866	24285	69740	54330	121845	90135
17	15.0	6791	4997	9403	7287	13060	10098	21419	16240	45450	36332	79406	60276
	12.0	9773	7145	13532	10420	18795	14440	30824	23222	65407	51953	114274	86191
	10.0	10803	7859	14958	11460	20775	15881	34072	25540	72299	57139	126315	94794
	4.8-0	11661	8362	16146	12194	22426	16898	36778	27176	78041	60797	136348	100864

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

BOSS STEAM
CAPACITY TABLE

BOSS AIR CAPACITY TABLE

(Modified Equal Percent Contour Plug) (SCFH)

BOSS AIR CAPACITY TABLE

Pressure (PSI)		Valve Port and Trim											
		2		2-1/2		3		4		6		8	
P1	P2	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic
10	5	38908	28546	53872	41630	74823	57687	122709	92775	260383	207554	454921	344337
	0	49154	35773	68059	52169	94527	72291	155024	116262	328954	260099	574724	431511
15	10	43431	31902	60135	46524	83520	64470	136974	103683	290651	231957	507804	384823
	5	56067	40924	77631	59681	107822	82701	176827	133004	375219	297554	655555	493650
	0	62112	44987	86001	65606	119446	90911	195892	146208	415672	327093	726232	542656
20	15	47534	34945	65816	50962	91411	70618	149914	113572	318111	254080	555780	421526
	10	62271	45541	86221	66414	119751	92031	196392	148009	416734	331122	728087	549340
	0	74057	53434	102540	77925	142417	107982	233563	173661	495610	388511	865893	644550
30	25	54839	40359	75931	58856	105460	81558	172954	131165	367001	293440	641196	486825
	15	84296	61532	116718	89734	162108	124346	265857	199979	564136	447389	985618	742230
	0	96540	69304	133671	101068	185654	140051	304473	225237	646077	503896	1128778	835977
40	25	96492	70607	133604	102969	185562	142685	304321	229473	645754	513372	1128215	851697
	15	112097	81384	155212	118685	215572	164464	353538	264498	750190	591730	1310677	981695
	2-0	118211	84808	163677	123678	227330	171383	372821	275626	791107	616625	1382164	1022996
50	35	107378	78698	148678	114768	206497	159036	338655	255770	718609	572203	1255500	949299
	30	118861	86856	164576	126665	228578	175521	374868	282282	795452	631514	1389756	1047699
	25	127156	92616	176062	135066	244531	187162	401030	301004	850966	673399	1486745	1117186
	5-0	139823	100312	193601	146289	268891	202714	440981	326015	935740	729353	1634855	1210016
60	45	117295	86063	162409	125509	225568	173919	369931	279705	784976	625750	1371452	1038135
	40	130667	95638	180924	139473	251284	193269	412105	310825	874467	695370	1527804	1153638
	35	140754	102747	194890	149839	270680	207635	443916	333928	941968	747056	1645737	1239386
	8-0	161435	115816	223525	168899	310452	234046	509140	376403	1080371	842082	1887545	1397035
75	55	146686	107542	203103	156832	282088	217324	462624	349511	981666	781920	1715095	1297225
	50	159129	116421	220333	169781	306018	235268	501870	378369	1064943	846479	1860591	1404330
	45	168983	123354	233976	179892	324966	249279	532945	400902	1130883	896890	1975796	1487963
	12-0	193951	139073	268547	202814	372982	281043	611690	451986	1297977	1011174	2267730	1677564
100	75	185945	136350	257463	198843	357587	275540	586443	443136	1244403	991375	2174129	1644717
	60	218861	159670	303038	232852	420886	322666	690253	518926	1464683	1160932	2558987	1926016
	20-0	247881	177833	343220	259340	476694	359371	781778	577958	1658894	1292996	2898298	2145113
125	100	209464	153808	290028	224304	402816	310821	660619	499876	1401800	1118313	2449122	1855310
	75	268632	195905	371952	285694	516601	395891	847225	636690	1797770	1424390	3140932	2363099
	27-0	302061	216594	418239	315866	580887	437700	952655	703930	2021487	1574817	3531793	2612662
150	125	230652	169523	319364	247221	443561	342578	727440	550950	1543593	1232575	2696851	2044873
	100	300776	219837	416459	320595	578416	444254	948602	714470	2012888	1598397	3516769	2651782
	35-0	355938	255354	492837	372392	684496	516028	1122573	829901	2382045	1856638	4161734	3080210
175	150	250081	183926	346266	268225	480924	371683	788716	597758	1673617	1337292	2924021	2218602
	125	329987	241563	456905	352279	634590	488158	1040728	785079	2208373	1756363	3858307	2913852
	100	375147	273137	519434	398325	721436	551965	1183155	887696	2510597	1985936	4386331	3294719
	42-0	410172	294115	567930	428917	788792	594357	1293619	955873	2744997	2138459	4795857	3547759
200	150	356925	261583	494204	381475	686394	528616	1125687	850145	2388652	1901926	4173277	3155344
	125	409880	299020	567526	436071	788231	604270	1292699	971816	2743043	2174127	4792443	3606932
	50-0	463995	332875	642454	485443	892297	672685	1463368	1081845	3105195	2420280	5425168	4015308
225	175	382039	280236	528978	408677	734691	566310	1204894	910766	2556726	2037548	4466923	3380344
	150	442100	323009	612138	471055	850192	652748	1394314	1049780	2958667	2348547	5169165	3896300
	57-0	518283	371636	717622	541969	996697	751014	1634584	1207816	3468507	2702102	6059920	4482856
250	200	405650	297762	561669	434237	780096	601728	1279358	967728	2714734	2164981	4742984	3591760
	175	472265	345453	653905	503786	908202	698103	1489451	1122722	3160543	2511731	5521868	4167027
	150	516974	376690	715810	549339	994180	761227	1630456	1224242	3459748	2738849	6044616	4543821
	65-0	572051	410396	792071	598495	1100099	829342	1804162	1333788	3828344	2983923	6688601	4950405

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

BOSS AIR CAPACITY TABLE

(Modified Equal Percent Contour Plug) (M3/Hr.)

Pressure (bar)		Valve Port and Trim											
		2		2-1/2		3		4		6		8	
P1	P2	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic
0.7	0.3	1171	847	1621	1235	2252	1712	3692	2753	7835	6158	13689	10216
	0.2	1268	915	1756	1335	2439	1850	3999	2975	8486	6655	14827	11040
1	0.7	1149	834	1591	1216	2209	1684	3623	2709	7688	6060	13432	10054
	0.5	1408	1018	1949	1484	2707	2057	4439	3307	9420	7399	16458	12276
	0.3	1576	1135	2182	1655	3031	2294	4971	3689	10548	8253	18429	13692
1.5	1	1615	1169	2236	1705	3105	2363	5092	3801	10806	8503	18879	14107
	0.7	1914	1380	2650	2013	3681	2789	6037	4485	12810	10035	22381	16648
	0.5	2045	1469	2831	2143	3932	2969	6448	4775	13683	10682	23905	17722
2	1.5	1799	1304	2490	1902	3459	2636	5673	4239	12037	9483	21030	15732
	1.2	2158	1559	2988	2274	4150	3151	6806	5067	14442	11337	25232	18808
	1	2325	1676	3220	2444	4472	3386	7334	5446	15563	12184	27190	20214
3	2	2809	2031	3890	2962	5402	4104	8859	6600	18799	14766	32845	24497
	1.5	3209	2308	4443	3366	6171	4665	10120	7502	21475	16783	37519	27844
	1.0	3562	2522	4931	3678	6849	5097	11233	8197	23835	18338	41644	30423
3.5	3.0	2264	1645	3135	2398	4354	3323	7140	5345	15151	11958	26470	19838
	2.0	3484	2511	4825	3662	6701	5074	10990	8161	23319	18257	40742	30288
	1.0	3935	2806	5448	4092	7567	5670	12409	9119	26332	20400	46005	33844
	0.3	4007	2836	5549	4136	7706	5732	12638	9218	26818	20622	46855	34213
4	3.0	3224	2335	4464	3405	6200	4719	10168	7589	21575	16977	37695	28166
	2.0	4081	2932	5650	4276	7848	5926	12870	9530	27310	21320	47714	35370
	1.0	4412	3138	6109	4577	8485	6342	13915	10199	29526	22818	51586	37855
	0.3	4449	3150	6160	4594	8556	6367	14031	10239	29774	22906	52019	38002
5	4.0	3592	2605	4974	3799	6908	5264	11330	8466	24041	18940	42003	31421
	3.0	4644	3346	6430	4880	8930	6762	14645	10875	31076	24329	54294	40363
	2.0	5152	3684	7134	5373	9908	7446	16249	11975	34479	26789	60240	44444
	0.3	5336	3779	7389	5511	10262	7636	16830	12281	35712	27475	62394	45582
7	5.0	5612	4057	7771	5917	10792	8199	17700	13186	37558	29500	65618	48941
	3.0	6866	4910	9507	7161	13204	9923	21655	15958	45951	35702	80282	59230
	1.4-0	7111	5036	9846	7343	13675	10176	22427	16365	47589	36613	83144	60741
9	7.0	6442	4666	8920	6805	12389	9429	20318	15165	43115	33926	75327	56284
	5.0	8153	5858	11289	8544	15680	11839	25714	19040	54565	42596	95332	70668
	2.0-0	8886	6292	12303	9176	17088	12716	28024	20450	59466	45750	103895	75900
10	8.0	6821	4943	9444	7209	13117	9990	21512	16066	45648	35942	79752	59629
	5.0	9254	6632	12813	9672	17795	13403	29184	21555	61927	48222	108195	80001
	2.3-0	9773	6921	13532	10093	18794	13985	30823	22492	65404	50319	114270	83480
12	10.0	7522	5457	10415	7958	14466	11027	23724	17735	50341	39675	87952	65823
	7.0	10485	7539	14518	10994	20163	15235	33068	24501	70169	54814	122594	90938
	5.0	11295	8061	15639	11756	21721	16290	35622	26199	75588	58611	132063	97237
	2.9-0	11548	8177	15989	11925	22207	16525	36420	26576	77281	59456	135020	98639
14	10.0	10764	7777	14905	11342	20701	15716	33949	25276	72039	56547	125861	93813
	7.0	12688	9089	17568	13254	24400	18367	40017	29538	84913	66082	148354	109631
	3.5-0	13323	9434	18447	13758	25621	19065	42019	30661	89162	68593	155777	113798
15	12.0	10043	7277	13906	10612	19313	14706	31674	23650	67211	52910	117426	87778
	10.0	12119	8740	16780	12746	23305	17662	38221	28405	81103	63547	141697	105427
	3.8-0	14211	10062	19676	14674	27328	20334	44819	32703	95103	73162	166157	121378
17	15.0	9044	6570	12523	9581	17392	13277	28524	21353	60526	47769	105746	79251
	12.0	13103	9462	18142	13799	25197	19122	41324	30753	87687	68800	153199	114141
	10.0	14559	10466	20158	15263	27998	21150	45916	34014	97431	76096	170225	126245
	4.4-0	15986	11319	22135	16507	30743	22874	50419	36787	106986	82299	186918	136537

BOSS AIR
CAPACITY TABLE

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

BOSS WATER CAPACITY TABLE

(Modified Equal Percent Contour Plug) (G.P.M.)

BOSS WATER CAPACITY TABLE

Pressure (PSI)		Valve Port and Trim											
		2		2-1/2		3		4		6		8	
P1	P2	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic
10	5	145	72	201	89	280	141	458	230	973	485	1699	680
	3	206	101	285	126	395	199	648	326	1376	686	2403	961
15	10	145	72	201	89	280	141	458	230	973	485	1699	680
	5	206	101	285	126	395	199	648	326	1376	686	2403	961
	0	252	124	349	155	484	244	794	399	1685	840	2943	1177
20	15	145	72	201	89	280	141	458	230	973	485	1699	680
	10	206	101	285	126	395	199	648	326	1376	686	2403	961
	0	291	143	402	179	559	282	917	461	1945	970	3399	1360
30	25	145	72	201	89	280	141	458	230	973	485	1699	680
	10	291	143	402	179	559	282	917	461	1945	970	3399	1360
	0	346	175	480	219	666	345	1093	564	2319	1189	4051	1665
40	25	252	124	349	155	484	244	794	399	1685	840	2943	1177
	10	356	175	493	219	685	345	1123	564	2383	1189	4163	1665
	0	384	202	531	253	738	398	1210	651	2567	1372	4484	1923
50	40	206	101	285	126	395	199	648	326	1376	686	2403	961
	30	291	143	402	179	559	282	917	461	1945	970	3399	1360
	25	325	160	450	200	625	315	1025	515	2175	1085	3800	1520
	0	417	226	578	283	802	445	1316	728	2793	1534	4879	2150
60	45	252	124	349	155	484	244	794	399	1685	840	2943	1177
	40	291	143	402	179	559	282	917	461	1945	970	3399	1360
	25	385	189	532	237	740	373	1213	609	2573	1284	4496	1798
	0	449	248	621	310	863	488	1415	798	3002	1681	5244	2355
75	55	291	143	402	179	559	282	917	461	1945	970	3399	1360
	50	325	160	450	200	625	315	1025	515	2175	1085	3800	1520
	25	460	226	636	283	884	445	1450	728	3076	1534	5374	2150
	0	492	277	681	346	946	546	1551	892	3290	1879	5749	2633
100	75	325	160	450	200	625	315	1025	515	2175	1085	3800	1520
	50	460	226	636	283	884	445	1450	728	3076	1534	5374	2150
	0	556	320	770	400	1070	630	1754	1030	3722	2170	6503	3040
125	100	325	160	450	200	625	315	1025	515	2175	1085	3800	1520
	50	563	277	779	346	1083	546	1775	892	3767	1879	6582	2633
	0	614	355	850	444	1181	699	1936	1143	4109	2408	7179	3374
150	100	460	226	636	283	884	445	1450	728	3076	1534	5374	2150
	50	650	320	900	400	1250	630	2050	1030	4350	2170	7600	3040
	0	667	386	923	482	1282	759	2103	1241	4462	2615	7796	3664
175	150	325	160	450	200	625	315	1025	515	2175	1085	3800	1520
	100	563	277	779	346	1083	546	1775	892	3767	1879	6582	2633
	50	716	358	991	447	1376	704	2257	1152	4789	2426	8367	3399
	0	716	414	991	517	1376	815	2257	1332	4789	2807	8367	3933
200	150	460	226	636	283	884	445	1450	728	3076	1534	5374	2150
	50	761	392	1054	490	1464	772	2401	1261	5096	2658	8903	3723
	0	761	440	1054	551	1464	867	2401	1418	5096	2987	8903	4184
225	150	563	277	779	346	1083	546	1775	892	3767	1879	6582	2633
	50	805	423	1114	529	1547	833	2537	1363	5384	2871	9407	4022
	0	805	465	1114	582	1547	916	2537	1498	5384	3156	9407	4421
250	200	460	226	636	283	884	445	1450	728	3076	1534	5374	2150
	150	650	320	900	400	1250	630	2050	1030	4350	2170	7600	3040
	50	846	453	1171	566	1626	891	2667	1457	5659	3069	9886	4299
	0	846	489	1171	611	1626	963	2667	1574	5659	3317	9886	4647
300	250	460	226	636	283	884	445	1450	728	3076	1534	5374	2150
	100	919	453	1273	566	1768	891	2899	1457	6152	3069	10748	4299
	0	922	533	1277	667	1773	1050	2908	1717	6171	3617	10781	5067
400	350	460	226	636	283	884	445	1450	728	3076	1534	5374	2150
	150	1028	506	1423	632	1976	996	3241	1629	6878	3431	12017	4807
	0	1059	612	1466	765	2036	1206	3339	1971	7084	4152	12377	5817

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

BOSS WATER CAPACITY TABLE

(Modified Equal Percent Contour Plug) (M3/Hr.)

Pressure (bar)		Valve Port and Trim											
		2		2½		3		4		6		8	
P1	P2	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic	Full	Sonic
0.7	0.5	25	12	35	15	48	24	79	40	168	84	294	118
	0	59	34	81	42	113	67	185	109	392	230	684	322
1	0.7	31	15	43	19	59	30	97	49	206	103	360	144
	0.5	63	20	88	24	122	39	200	63	425	133	742	186
	0	63	37	88	46	122	72	200	118	425	249	742	349
1.5	1	40	20	55	24	76	39	125	63	266	133	465	186
	0.7	71	25	98	31	137	49	224	80	475	168	830	235
	0	71	41	98	51	137	81	224	132	475	279	830	390
2	1.5	40	20	55	24	76	39	125	63	266	133	465	186
	1	56	28	78	35	108	54	177	89	376	188	657	263
	0	78	45	108	56	150	89	245	145	521	305	910	428
3	2	56	28	78	35	108	54	177	89	376	188	657	263
	1	90	39	124	49	173	77	283	126	601	265	1051	372
	0	90	52	124	65	173	102	283	167	601	352	1051	494
3.5	3	40	20	55	24	76	39	125	63	266	133	465	186
	2	69	34	95	42	132	67	217	109	461	230	805	322
	1	95	44	132	55	183	86	301	141	638	297	1114	416
	0	95	55	132	69	183	109	301	177	638	374	1114	524
4	3	56	28	78	35	108	54	177	89	376	188	657	263
	2	79	39	110	49	153	77	251	126	532	265	929	372
	1	100	48	139	60	193	94	317	154	672	325	1175	455
	0	100	58	139	73	193	114	317	187	672	394	1175	552
5	4	56	28	78	35	108	54	177	89	376	188	657	263
	3	79	39	110	49	153	77	251	126	532	265	929	372
	2	97	48	135	60	187	94	307	154	652	325	1138	455
	0	110	64	152	80	212	125	347	205	737	432	1287	605
6	5	56	28	78	35	108	54	177	89	376	188	657	263
	4	79	39	110	49	153	77	251	126	532	265	929	372
	0	119	69	165	86	229	135	375	221	796	466	1390	653
8	6	79	39	110	49	153	77	251	126	532	265	929	372
	5	97	48	135	60	187	94	307	154	652	325	1138	455
	0	135	78	187	98	259	154	425	251	902	529	1577	741
10	8	79	39	110	49	153	77	251	126	532	265	929	372
	5	126	62	174	77	242	122	396	199	841	420	1470	588
	0	149	86	206	108	287	170	470	278	998	585	1743	819
12	10	79	39	110	49	153	77	251	126	532	265	929	372
	8	112	55	156	69	216	109	355	178	752	375	1314	526
	5	149	73	206	92	286	144	469	236	995	496	1739	696
	0	162	94	224	117	312	185	511	302	1085	636	1895	891
14	10	112	55	156	69	216	109	355	178	752	375	1314	526
	5	174	83	241	104	335	163	549	267	1165	563	2036	789
	0	174	101	241	126	335	198	549	324	1165	683	2036	957
15	10	126	62	174	77	242	122	396	199	841	420	1470	588
	5	180	88	249	109	346	172	567	282	1204	593	2103	831
	0	180	104	249	130	346	205	567	335	1204	705	2103	988
17	14	97	48	135	60	187	94	307	154	652	325	1138	455
	10	149	73	206	92	286	144	469	236	995	496	1739	696
	5	191	96	264	120	367	189	602	309	1277	650	2230	911
	0	191	110	264	138	367	217	602	355	1277	748	2230	1048
20	15	126	62	174	77	242	122	396	199	841	420	1470	588
	10	178	88	246	109	342	172	561	282	1190	593	2078	831
	0	206	119	285	149	396	235	650	384	1379	808	2409	1132
27	20	149	73	206	92	286	144	469	236	995	496	1739	696
	10	232	114	321	143	446	225	731	367	1551	774	2710	1084
	0	238	138	329	172	458	271	750	443	1592	933	2782	1307

BOSS WATER
CAPACITY TABLE

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

BOSS SHUTOFF TABLE - REVERSE ACTING

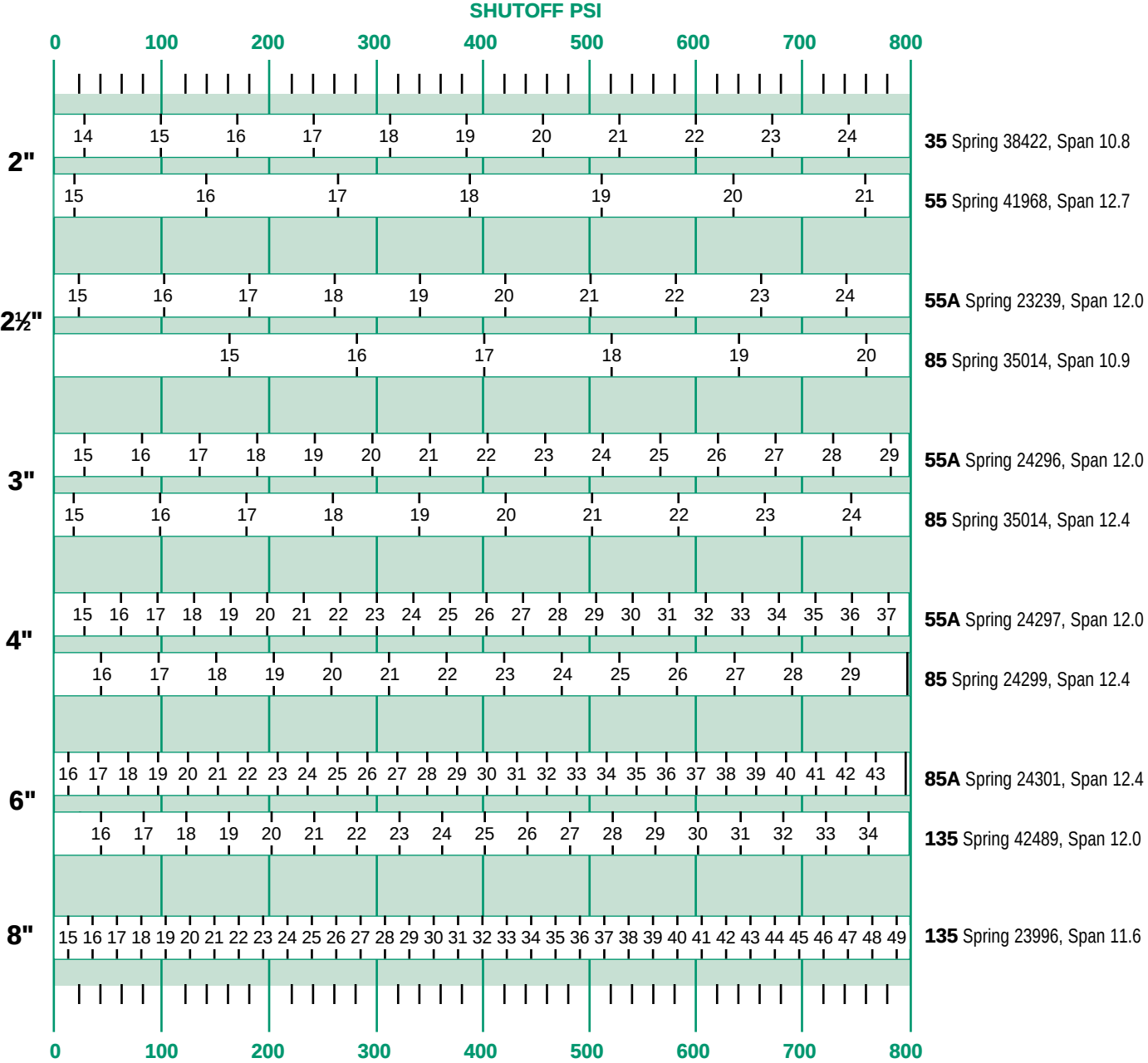
ACTUATOR SHUTOFF TABLE

		SHUTOFF PSI																																		
		0	100	200	300	400	500	600	700	800																										
CONTROL VALVES	2"	15 16 17 18 19 20 21 22 23 24 25 26																35R Spring 38422, Span 11.9																		
		16 17 18 19 20 21 22																55R Spring 41968, Span 12.7																		
	2½"	16 17 18 19 20 21 22 23 24 25																55AR Spring 23239, Span 12.6																		
		15 16 17 18 19 20																85R Spring 35014, Span 11.3																		
	3"	15 16 17 18 19 20 21 22																55AR Spring 24296, Span 12.7																		
		16 17 18 19 20 21 22 23 24 25																85R Spring 35014, Span 12.9																		
	4"	16 17 18 19 20 21																55AR Spring 24297, Span 12.6																		
		16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31																85R Spring 24299, Span 12.8																		
	6"	17 19 21 23																85AR Spring 24301, Span 12.9																		
		16 17 18 19 20 21 22 23 24 25 26 †																																		
	8"	15 17 19 21 23 †																135R Spring 23996, Span 11.8																		

† For shutoff pressure above this value, consult factory.

BOSS SHUTOFF TABLE - DIRECT ACTING

ACTUATOR SHUTOFF TABLE



CONTROL VALVES

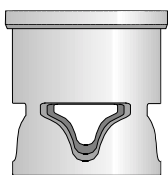
BOSS SERIES D CONTROL VALVE

HUNG CAGE DESIGN

Unlike competitor's valves (which use the cage to compress the seat ring into the body), Spence's cage is suspended in the body from a machined shoulder. This eliminates bonnet gasket leakage, cage deformation, sticking plugs, seat gasket and body washout which can occur with cage retained seat designs. The Spence hung cage design utilizes a 17-4 Ph stainless steel Belleville load ring to maintain a constant seat gasket load, even in temperature cycling service.

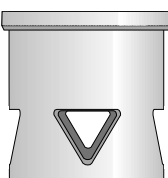
The Spence Boss D Series Control Valves are specifically designed for high pressure drop service. Pressure drop, high velocities and throttling occur between the cage window and the plug, thereby protecting the seat ring and tight shutoff capability of the valve. An optional "protected seat" seat ring provides outstanding wear and shutoff performance.

DIGIBOSS HUNG CAGE & TRIM MATERIAL



STANDARD CAGE

The full ported, standard cage, provides maximum flow with minimum pressure drop. The inherent modified linear flow characteristic provides excellent low flow control, high rangeability and maximum flows per given body size.

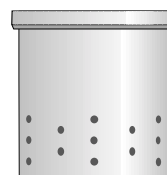


40% REDUCED TRIM CAGE

This optional cage reduces the maximum Cv and flow to 40% of the normal, full port valve. Used to provide body velocity control, future flow expandability, or to correct for oversized valve conditions.

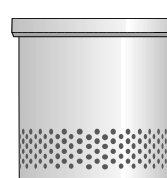
ANTI-CAVITATION CAGE

The Seco-Cav cage eliminates the effects of valve cavitation providing a normal valve/trim life expectancy in cavitating conditions. Diametrically opposed holes, increase the valves cavitation index (Kc) and direct impinging flows to the center of the cage, preventing mechanical trim/body damage.



NOISE REDUCING CAGE

The Seco-Sonic cage is designed to reduce valve generated noise up to 10dBA in steam, gas or any compressible fluid service. When used in conjunction with a Seco-Sonic silencing orifice, noise attenuations of 15-20dBA can be achieved.



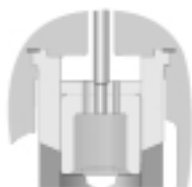
TRIM MATERIAL SELECTION

Balanced Plug design allows line pressure under the plug to build up above the plug, effectively cancelling out any unbalanced stem force due to pressure. In addition to providing smooth, high pressure control, balanced plugs allow use of small, light, cost effective actuators. Class III, IV or VI shutoff can be provided.

The piston seal is critical to maintaining tight shutoff in any cage valve. The Boss's heavy cupwasher style PTFE plug seal has three times the cross sectional area and wear surface of competitive valves and provides tight shutoff for longer than competitor's designs at both low and high pressures.

Table 1	Maximum Service Temp.	Plug	Seat Ring	Gaskets	ANSI/ISA 70-2 Shut-off
Standard Balanced Trim	500°F (260°C)	AISI 410 St. St. w/PTFE Seal	AISI Type 400 St. St.*	Filled Type 304 St. St	IV
Stellite Balanced Trim	500°F (260°C)	AISI 410 St. St. w/PTFE Seal	AISI Type 400 St. St. Stellite	Filled Type 304 St. St	IV
High Temp. Trim	800°F (426°C)	AISI 410 St. St. w/ Ni-Resist Seal	AISI Type 400 St. St. Stellite	Inconel Graphite	III
Soft-Seated Trim	500°F (260°C)	AISI 410 St. St. w/PTFE Seal	AISI Type 400 St. St. w/PTFE Insert	Filled Type 304 St. St	VI

* Stellite seat optional.



STANDARD & STELLITE BALANCED PLUG

Balanced plug design eliminates large stem forces allowing the use of small, cost-effective actuators. Provides smooth throttling control even at pressures to 1000 psi. Standard PTFE piston seal provides ANSI Class IV tight shut-off to temperatures of 500°F.



HIGH-TEMP BALANCED PLUG

Balanced plug with high-temp ni-resist or carbon piston seal provides ANSI Class II shut-off at temperatures up to 800°F.



SOFT SEATED TRIM

Balanced plug with PTFE piston seal and an optional seat design with PTFE insert provide ANSI Class VI bubble tight shut-off at temperatures up to 460°F.

Linear Valve Specification Form

 CONTROL VALVE SPEC SHEET	Project/Job _____		Data Sheet _____ of _____	
	Unit/Customer _____		Spec _____	
	P.O./LCO File # _____		Tag _____	
	Item _____		Dwg _____	
	Contract _____		Service _____	
MFR Serial# _____				

Fluid ☐ Steam ☐ Water ☐ Gas _____	☐ Liquid _____	Crit Pres PC	

Service Conditions Flow ☐ #/hr ☐ gpm ☐ scfh ☐ _____ Inlet Pressure ☐ psig ☐ psia ☐ _____ Outlet Pressure ☐ psig ☐ psia ☐ _____ Temperature ☐ °C ☐ °F _____ Max Press/Temperature: _____ / _____ Density/MW/SG _____ Viscosity _____ Vapor Pressure ☐ psia ☐ _____ Required C _v _____ Noise (dBA) Allowable _____	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%;">Max. Flow</th> <th style="width: 25%;">Norm. Flow</th> <th style="width: 25%;">Min. Flow</th> <th style="width: 25%;">Shut-off Pressure</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table>	Max. Flow	Norm. Flow	Min. Flow	Shut-off Pressure																																
Max. Flow	Norm. Flow	Min. Flow	Shut-off Pressure																																		

Line Info	Pipe Size In _____ /Sch _____	Pipe Size Out _____ /Sch _____

Valve, Body & Bonnet	
Body Size in. ☐ 1/2 ☐ 3/4 ☐ 1 ☐ 1 1/4 ☐ 1 1/2 ☐ 2 ☐ 2 1/2 ☐ 3 ☐ 4 ☐ 6 ☐ 8 ☐ 10 ☐ 12 ☐ 16	
ANSI Class ☐ 125 ☐ 150 ☐ 250 ☐ 300 ☐ 600 ☐ 900 ☐ 1500 ☐ 2500 ☐ 4500 ☐ Other _____	
Body/Bonnet Material: ☐ Cast Iron ☐ Cast Steel ☐ Cr Mo ☐ 316SS ☐ Bronze ☐ Hast C ☐ Titanium ☐ Alloy 20 ☐ Other _____	
End Conn. Inlet/Outlet: ☐ NPT ☐ SWE ☐ BWE Sch. _____ ☐ Sep. Flanges ☐ Int. Flanges ☐ Other _____	
Packing Material: ☐ PTFE ☐ BTG ☐ Laminated Graphite ☐ Kalrez ☐ Other _____	

Trim Size ☐ 100% ☐ 60% ☐ 40% ☐ 20% ☐ Other _____

Actuator	
Spring Action: ☐ Air to Open ☐ Air to Close ☐ Last Position ☐ None	
Available Air Supply Pressure: Max. _____ Min. _____	
Manual Override: ☐ Yes ☐ No ☐ Type _____	
Solenoid	☐ Yes ☐ No ☐ Type _____ ☐ Voltage _____
Positioner	☐ Yes ☐ No ☐ Type _____ ☐ Pneu ☐ I/P
Switch	☐ Yes ☐ No ☐ Type _____
Air Set	☐ Yes ☐ No ☐ Type: _____ ☐ Range: _____
Other Accessories	☐ Yes ☐ No ☐ Type _____
Test	ANSI/FCI Leakage Class: ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ Leslie VIII

BOSS



DOCTOR SERIES MD

3-WAY CONTROL VALVE

SIZES 1/2" – 12"
ANSI CLASS 125/150, 250/300

APPLICATION DATA

- Process control systems for food, pulp and paper, chemical, petrochemical & other industries
- HVAC systems
- Feed water and fuel system controls in boiler rooms
- Packaged systems (OEM) such as heat exchangers, water purification systems & vaporizer, metal cleaning and plating
- Especially designed for mix or diverting of clean, dirty, viscous and corrosive liquids, gasses and steam

- **Rigid Port Guiding** dampens vibration and ensures proper seating.
- **High Capacity Body Designs** means valve body flow areas are 140% of normal valve, reducing velocities and pressure loss.
- **Balanced Plug Design** of DV provides gradual, stable transition.
- **316 SS Valve Plugs & Seat Rings** for corrosion resistance
- **Mixing or Diverting** to suit your application.
- **Live Loaded V ring Packing** is self adjusting.

MODELS

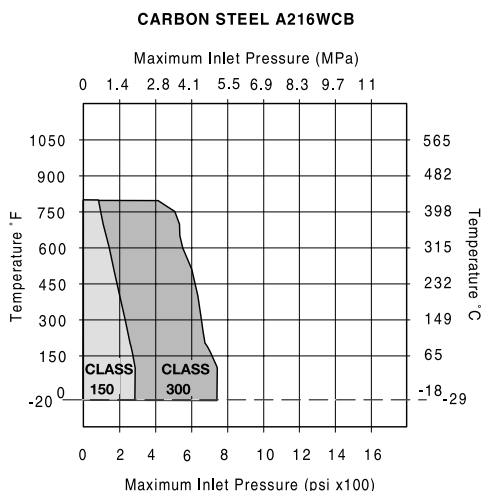
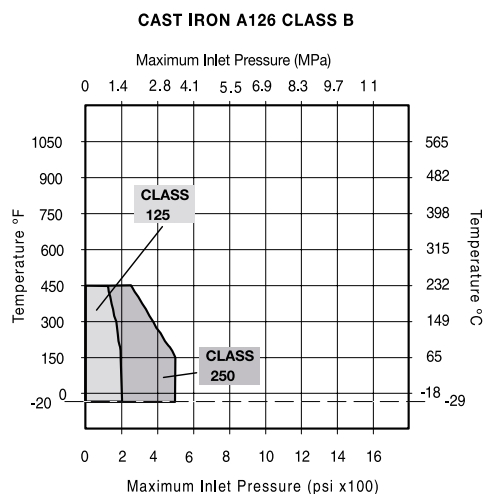
- M1 — Cast Iron Mix (MX)
- M2 — Cast Steel Mix (MX)
- M3 — Stainless Steel Mix (MX)
- M4 — Cast Iron Diverting (MX)
- M5 — Cast Steel Diverting (MX)
- M6 — Stainless Steel Diverting (MX)
- M7 — Cast Iron Diverting (DV)
- M8 — Cast Steel Diverting (DV)
- M9 — Stainless Steel Diverting (DV)

OPTIONS

- 40, 85, 145, 250 sq. in. Reverse and Direct Actuators
- Soft Seat
- Moore and PMV Accessories
- Alternate Packing for Severe Service
- Graphite or High Temperature Packing

APPLICABLE CODES

- ANSI B16.0 Face-To-Face Dimensions and ISA S75.03 Uniform Face-To-Face Dimensions for Flanged Globe Style Control Valves
- ANSI B16.37 Hydrotesting of Control Valves
- ISA S75.02 Control Valve Capacity Test Procedure



MAXIMUM RATED FLOW COEFFICIENTS* (Cv)

MODEL	VALVE SIZE											
	1/2	3/4	1	1 1/2	2	2 1/2	3	4	6	8	10	12
MX	5	7	12	28	50	70	116	158	352	475	739	1070
DV	5	7	12	28	52	76	108	160	365	475	795	1078

DOCTOR SERIES MD

3-WAY CONTROL VALVE

SPECIFICATION

All three way control valves shall be designed, built and tested in accordance with the latest revision of applicable industry standards. Valve body materials and end connections shall be as specified on the valve data sheets, in accordance with ANSI B16.34 and B16.5. Bonnets shall be through bolted, of the same material as the valve body. Stem packing shall be adjustable and suitable for the intended service. Asbestos or asbestos filled packings are prohibited. If graphite packing is selected or specified, use alternating rings of braided and die-cut anti-extrusion rings. Live-loaded PTFE V-ring packing shall be used to 450°F. Packing gland, clamp, studs and nuts shall be of 300 Series stainless steel. Rigid port guiding utilizing V-notch flow ports and balanced plug design on diverting service shall be used. Trim shall be of 316 Series corrosion resistant stainless steel. Valve Characteristic shall be modified linear or equal percent. Valve stems shall be 316 stainless steel with a minimum 16 RMS finish. Plug/stem assemblies shall be of a two piece threaded and pinned design. Actuators shall be of the spring and diaphragm type suitable for 60 psig continuous service. Actuators shall be capable of shutting off the valve without the use of line pressure assist. Actuator yokes shall be of cast iron unless otherwise specified and bolted or clamped to the valve bonnet. Locknut mounting is not preferred. Top mounted

handwheel manual overrides shall be provided where specified. Rim pull required to operate valve shall not exceed 40 pounds. Valves shall be sized to control within manufacturers published rangeability. Size valve to pass 110% of maximum stated flow. Valve generated noise shall not exceed 85 dBA when measured 3 feet downstream and 3 feet away from the pipe.

MATERIALS OF CONSTRUCTION

Body Iron ASTM A-126 Class B
ASTM A-216 Steel Gr.WCB
ASTM A-351 Gr.CF8M
Plug 316 St. Stl. ASTM A351 Grade CF8M
Seat Rings ...316 St. Stl. ASTM A351 Grade CF8M
Stem 316 Stainless Steel
Spring (V-Ring Packing) 316 Stainless Steel
Packing Set BTG, TC, LG or Environmental
Packing Follower 316 Stainless Steel
Packing Flange Cadmium Plated Steel
Gasket Nitrile Rubber Bonded, PTFE or Grafoil®

DOCTOR SERIES MD
3-WAY VALVE

CODE SELECTION CHART

Model	Orifice	Size	Connections	Trim	Packing-	Actuator	Spring	Positioner	Posit. Set	Accessories	-	Inlet Pressure								
M	1	T	J	2	1	1	4	2	C	1	A	A	0	1	0	1	1	2	5	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Model - Position 1 & 2 M1= Cast Iron M2= Cast Steel M3= SS Mix (MX) M4= CI Div (MX) M5= CS Div (MX) M6= SS Div (MX) M7= CI Div (DV) M8= CS Div (DV) M9= SS Div (DV)			Size - Position 4 C = ½ D = ¾ E = 1 F = 1¼ G = 1½ H = 2 J = 2½ K = 3 M = 4 P = 6 Q = 8 R = 10 T = 12			Trim - Position 6 1 = Metal			Packing - Position 7 1 = V-ring 2 = Graphite 3 = Hi-Temp			Actuator - Position 8 & 9 01 = None 40 = 40S Rev 41 = 40S Dir 42 = 85S Rev 43 = 85S Dir 44 = 145S Rev 45 = 145S Dir 46 = 250S Rev 47 = 250S Dir			Spring - Position 10 & 11 AA = None B1 = B1C B2 = B2C B6 = B6C C1 = C1E C2 = C2E C6 = C6E D1 = D1E D2 = D2E E1 = E1E E2 = E2E E3 = E3E F1 = F1F			Positioner Set Position 14 & 15 01 = None 02 = 3-15/4-20 mA 03 = 3-9/4-12 mA 04 = 9-15/12-20 mA		
Orifice - Position 3 T = STD			Connections - Position 5 1 = 150# 2 = 125# 3 = 300# 4 = 250# 9 = Threaded												Accessories - Position 16 & 17 01 = None 02 = Limit Switch, Mechanical 03 = Limit Switch, Proximity Switch 04 = Feedback Potentiometer 1K 05 = Feedback 4-20mA Posit. Trans					
															Inlet Pressure - Position 18, 19 & 20 — — — = Actual Setting					
									Positioner - Position 12 & 13 MI = Moore I/P MP= Moore P 4P = PMV P4 P 5I = PMV P5 I/P 5P = PMV P5 P											

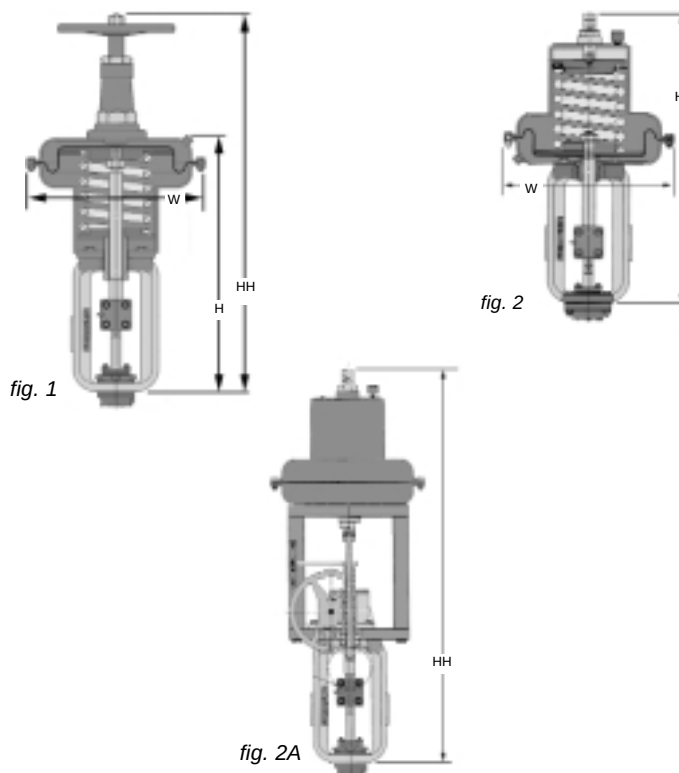
DOCTOR DIMENSIONS

Dimensions of Actuators

fig 1	D I R E C T A C T I N G	inches (mm)				
		MODEL	H	HH	W	WGT Lbs.(Kgs.)
		DL-40-D	19.5 (495)	32.7 (831)	10.1 (257)	37 (17)
		DL-85-D	20.9 (531)	41.7 (833)	14.8 (375)	84 (38)
		DL-145-D	29 (739)	49.8 (1044)	19.3 (489)	192 (87)
		DL-250-D	31.3 (795)	54.3 (1158)	23.6 (600)	251 (114)

fig 2	R E V E R S E A C T I N G	inches (mm)				
		MODEL	H	HH*	W	WGT Lbs.(kgs.)
		DL-40-R	25.8 (655)	39.8 (1011)	10.1 (257)	54 (25)
		DL-85-R	38.4 (975)	57.4 (1458)	14.8 (375)	125 (57)
		DL-145-R	47.5 (1207)	66.5 (1689)	19.3 (489)	197 (89)
		DL-250-R	57.8 (1468)	76.8 (1951)	23.6 (600)	331 (150)

* See Fig. 2A



Dimensions of Bodies C Dimensions

Valve Size inches (mm)	Standard Bonnet					
	Yoke Code					
	C&E		F		H	
	Mixing	Diverting	Mixing	Diverting	Mixing	Diverting
.5 (15)	4.62 (117.3)	4.62 (117.3)	—	—	—	—
.75 (20)	4.62 (117.3)	4.62 (117.3)	—	—	—	—
1 (25)	5.44 (138.2)	5.44 (138.2)	—	—	—	—
1.5 (40)	6.25 (158.8)	6.25 (158.8)	7.38 (187.5)	7.38 (187.5)	—	—
2 (50)	6.88 (174.8)	6.88 (174.8)	8.00 (203.2)	8.00 (203.2)	—	—
2.5 (65)	7.66 (194.6)	7.66 (194.6)	8.75 (222.2)	8.75 (222.2)	9.88 (251.0)	9.88 (277.1)
3 (80)	7.31 (185.7)	8.72 (221.5)	8.44 (214.4)	9.84 (249.9)	9.50 (241.3)	10.91 (277.1)
4 (100)	8.94 (227.1)	9.88 (251.0)	10.06 (255.5)	11.00 (279.4)	11.19 (284.2)	12.12 (307.8)
6 (150)	—	—	11.81 (300.0)	14.31 (363.5)	12.94 (328.7)	15.44 (392.2)
8 (200)	—	—	—	—	15.00 (381.0)	17.19 (436.6)
10* (250)	—	—	—	—	17.0 (431.8)	19.19 (487.4)
12* (300)	—	—	—	—	18.38 (466.9)	21.88 (555.8)

*On Application

Note: All dimensions are subject to change without notice. Request certified drawings for use in preparing piping layouts. All dimensions given in Inch (millimeter)

See diagrams on facing page

Actuator Notes

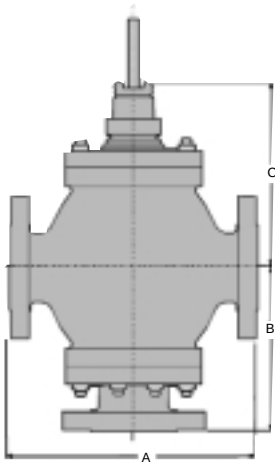
Size 40 uses "C" yoke only.

Size 85 uses "E" yoke only.

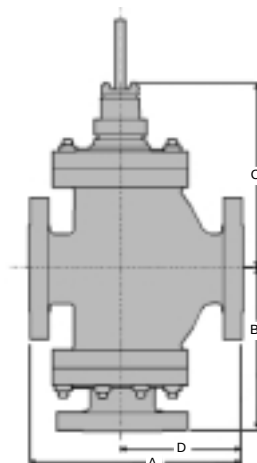
Size 145 uses "E" yoke only.

Size 250 uses "E, F, H" yoke sizes.

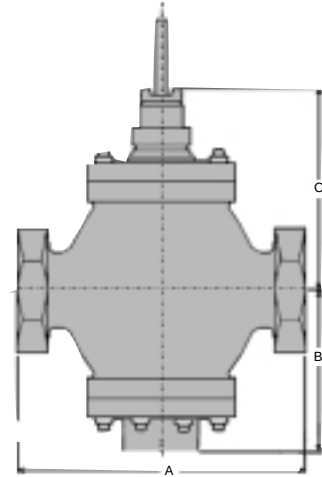
DOCTOR DIMENSIONS



Valve Sizes
Diverting 0.5" - 1.5"
Mixing 0.5" - 12"



Valve Sizes
Diverting 2" - 12"



Valve Sizes
Diverting 0.5" - 2"
Mixing 0.5" - 2"

**DOCTOR
DIMENSIONS**

Dimensions of Bodies A, B & D Dimensions

DIMENSIONS IN INCHES						Shpg. Info. ¹						DIMENSIONS IN MILLIMETERS						Shpg. Info. ¹					
SIZE	A	B	D	WGT.	VOL.	SIZE	A	B	D	WGT.	VOL.	SIZE	A	B	D	WGT.	VOL.	SIZE	A	B	D	WGT.	VOL.
ANSI 125/150 Flanged - Mixing & Diverting																							
.5	7.25	5.56	—	45 lb.	1 ft ³	15	184	141.2	—	20 kg	.03 m ³	15	184	141.2	—	20 kg	.03 m ³	15	184	141.2	—	20 kg	.03 m ³
.75	7.25	5.62	—	45 lb.	1 ft ³	20	184	142.7	—	20 kg	.03 m ³	20	184	142.7	—	20 kg	.03 m ³	20	184	142.7	—	20 kg	.03 m ³
1	7.25	6.19	—	61 lb.	1 ft ³	25	184	157.2	—	28 kg	.03 m ³	25	184	157.2	—	28 kg	.03 m ³	25	184	157.2	—	28 kg	.03 m ³
1.5	8.75	7.44	—	72 lb.	2 ft ³	40	222	189.0	—	33 kg	.06 m ³	40	222	189.0	—	33 kg	.06 m ³	40	222	189.0	—	33 kg	.06 m ³
2	10.00	7.81*	5.44	94 lb.	2 ft ³	50	254	198.4*	138	43 kg	.06 m ³	50	254	198.4*	138	43 kg	.06 m ³	50	254	198.4*	138	43 kg	.06 m ³
2.5	10.88	8.75*	—	105 lb.	3 ft ³	65	276	222.2*	—	48 kg	.08 m ³	65	276	222.2*	—	48 kg	.08 m ³	65	276	222.2*	—	48 kg	.08 m ³
3	11.75	8.19*	6.81	160 lb.	3 ft ³	80	298	208.0*	173	73 kg	.08 m ³	80	298	208.0*	173	73 kg	.08 m ³	80	298	208.0*	173	73 kg	.08 m ³
4	13.88	10.19*	8.12	193 lb.	5 ft ³	100	353	258.8*	206	88 kg	.14 m ³	100	353	258.8*	206	88 kg	.14 m ³	100	353	258.8*	206	88 kg	.14 m ³
6	17.75	12.12*	10.44	455 lb.	8 ft ³	150	451	307.8*	265	206 kg	.23 m ³	150	451	307.8*	265	206 kg	.23 m ³	150	451	307.8*	265	206 kg	.23 m ³
8	21.38	14.69*	12.69	635 lb.	13 ft ³	200	543	373.1*	322	288 kg	.37 m ³	200	543	373.1*	322	288 kg	.37 m ³	200	543	373.1*	322	288 kg	.37 m ³
10	26.00	17.50*	15.50	1050 lb.	21 ft ³	250	648	444.5*	394	476 kg	.59 m ³	250	648	444.5*	394	476 kg	.59 m ³	250	648	444.5*	394	476 kg	.59 m ³
12	29.75	19.81*	18.00	1690 lb.	30 ft ³	300	756	503.2*	457	767 kg	.85 m ³	300	756	503.2*	457	767 kg	.85 m ³	300	756	503.2*	457	767 kg	.85 m ³
ANSI 250/300 Flanged - Mixing & Diverting																							
.5	7.5	5.69	—	45 lb.	1 ft ³	15	191	144.5	—	20 kg	.03 m ³	15	191	144.5	—	20 kg	.03 m ³	15	191	144.5	—	20 kg	.03 m ³
.75	7.62	5.75	—	45 lb.	1 ft ³	20	194	146.0	—	20 kg	.03 m ³	20	194	146.0	—	20 kg	.03 m ³	20	194	146.0	—	20 kg	.03 m ³
1	7.75	6.44	—	61 lb.	1 ft ³	25	197	163.6	—	28 kg	.03 m ³	25	197	163.6	—	28 kg	.03 m ³	25	197	163.6	—	28 kg	.03 m ³
1.5	9.25	7.69	—	72 lb.	2 ft ³	40	235	195.3	—	33 kg	.06 m ³	40	235	195.3	—	33 kg	.06 m ³	40	235	195.3	—	33 kg	.06 m ³
2	10.5	8.06*	5.69	94 lb.	2 ft ³	50	267	204.7*	267	43 kg	.06 m ³	50	267	204.7*	267	43 kg	.06 m ³	50	267	204.7*	267	43 kg	.06 m ³
2.5	11.5	9.06*	—	105 lb.	3 ft ³	65	292	230.1*	—	48 kg	.08 m ³	65	292	230.1*	—	48 kg	.08 m ³	65	292	230.1*	—	48 kg	.08 m ³
3	12.5	8.56*	7.19	160 lb.	4 ft ³	80	318	217.4*	318	73 kg	.11 m ³	80	318	217.4*	318	73 kg	.11 m ³	80	318	217.4*	318	73 kg	.11 m ³
4	19.5	10.50*	8.44	193 lb.	8 ft ³	100	368	266.7*	368	88 kg	.23 m ³	100	368	266.7*	368	88 kg	.23 m ³	100	368	266.7*	368	88 kg	.23 m ³
6	18.62	12.56*	10.88	455 lb.	10 ft ³	150	473	319.0*	473	206 kg	.28 m ³	150	473	319.0*	473	206 kg	.28 m ³	150	473	319.0*	473	206 kg	.28 m ³
8	22.38	15.19*	13.19	635 lb.	16 ft ³	200	569	385.8*	568	288 kg	.45 m ³	200	569	385.8*	568	288 kg	.45 m ³	200	569	385.8*	568	288 kg	.45 m ³
10	26.88	18.19*	16.19	1050 lb.	24 ft ³	250	682	462.0*	683	476 kg	.68 m ³	250	682	462.0*	683	476 kg	.68 m ³	250	682	462.0*	683	476 kg	.68 m ³
12	31.25	20.56*	18.75	1690 lb.	36 ft ³	300	794	522.2*	817	767 kg	1.02 m ³	300	794	522.2*	817	767 kg	1.02 m ³	300	794	522.2*	817	767 kg	1.02 m ³
ANSI 250 Threaded - Mixing & Diverting																							
.5	5.69	3.62	—	45 lb.	1 ft ³	15	144.5	91.9	—	20 kg	.03 m ³	15	144.5	91.9	—	20 kg	.03 m ³	15	144.5	91.9	—	20 kg	.03 m ³
.75	5.69	3.62	—	45 lb.	1 ft ³	20	144.5	91.9	—	20 kg	.03 m ³	20	144.5	91.9	—	20 kg	.03 m ³	20	144.5	91.9	—	20 kg	.03 m ³
1	6.19	4.44	—	61 lb.	1 ft ³	25	157.2	112.8	—	28 kg	.03 m ³	25	157.2	112.8	—	28 kg	.03 m ³	25	157.2	112.8	—	28 kg	.03 m ³
1.5	7.75	5.30	—	72 lb.	2 ft ³	40	196.8	136.7	—	33 kg	.06 m ³	40	196.8	136.7	—	33 kg	.06 m ³	40	196.8	136.7	—	33 kg	.06 m ³
2	9.19	6.06	—	94 lb.	2 ft ³	50	233.4	153.9	—	43 kg	.06 m ³	50	233.4	153.9	—	43 kg	.06 m ³	50	233.4	153.9	—	43 kg	.06 m ³

NOTE: DIMENSIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE. Request certified drawings for piping layout and construction purposes.

1. Approximate weight and volume
 * Mixing Service ONLY

DOCTOR PRINCIPLE OF OPERATION

The Three Way Globe Valve design has been successfully applied for over 50 years in chemical, refining, power, paper, and H.V.A.C. industries worldwide. They are designed for mixing or diverting of clean, dirty, viscous and corrosive liquids, high and low pressure steam, and clean, dirty and corrosive gases.

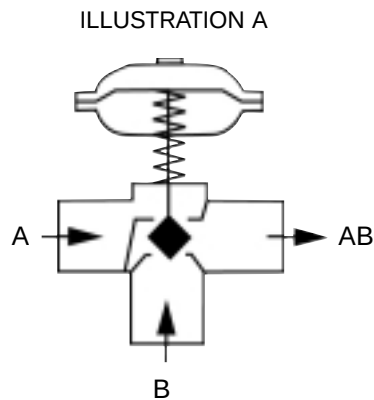
MIXING SERVICE (Type MX)

The inner valves in type MX seat inside the two seat rings (see illustration A). When these valves are used for mixing service, the forces developed by the two inlet flows oppose each other, creating little, if any, unbalance. Thus, the actuator can control the flow efficiently, with very little power lost in overcoming dynamic unbalance.

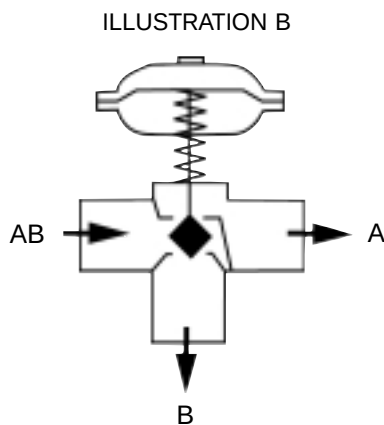
The Type MX valve is also used for diverting service, generally restricted to the smaller sizes (see illustration B).

DIVERTING SERVICE (Type DV)

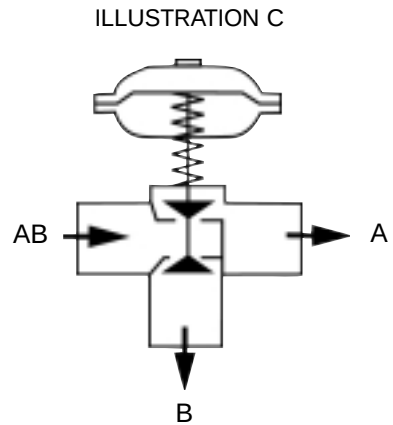
In contrast to the MX control valve, the inner valve in the type DV seats outside the two seat rings (see illustration C). The flow enters between the two seats and the pressure tends to move the inner valve away from the seats, adding to the stability of operation. Therefore, the Type DV is preferred for diverting service in larger valve sizes and at higher pressure.



Type MX Inner Valve used for mixing service.



Type MX Inner Valve used for diverting service 1/2\"-
2\" sizes only.



Type DV Inner Valve used for diverting service.

Note: When selecting a direct acting actuator, plug is up on air loss. When selecting a reverse acting actuator, plug is down on air loss.

DOCTOR SHUTOFF & CV TABLE

ACTUATOR SHUTOFF TABLE
(Direct & Reverse)

Valve Size	Actuator Code	Spring Number	20 psi air
			12 psi Span
1	40	B2	0 - 140
	40	B1	140 - 225
	42	C2	225 - 430
1-1/2	40	B1	0 - 65
	40	B6	65 - 105
	42	C1	105 - 200
	44	E2	200 - 220
	44	E1	220 - 445
2	42	C1	0 - 100
	42	C6	100 - 180
	44	E1	180 - 235
	46	E3	235 - 320
2-1/2	42	C1	0 - 50
	42	C6	50 - 90
	44	E1	90 - 110
	44	D2	110 - 200
3	42	C6	0 - 50
	44	D2	50 - 115
	46	E2	115 - 160
4	44	D1	0 - 75
	46	E1	75 - 115
6	46	F1	0 - 55

Consult Factory for 3/4" and 1/2" sizes.

Cv TABLE

Valve Size Inches (mm)	Mixing-Type MX	Diverting-Type DV
.5 (15)	5	5
.75 (20)	7	7
1 (25)	12	12
1.5 (40)	28	28
2 (50)	50	52
2.5 (65)	70	76
3 (80)	116	108
4 (100)	158	160
6 (150)	352	365
8 (200)	475	475
10 (250)	739	795
12 (300)	1070	1078

DOCTOR WATER CAPACITY TABLE

(Modified Equal Percent Contour Plug) (G.P.M.)

DOCTOR WATER CAPACITY TABLE

Pressure (PSI)		Valve Size and Type																		
						2		2.5		3		4		6		8	10		12	
P1	P2	1/2	3/4	1	1.5	MX	DV	MX	DV	MX	DV	MX	DV	MX	DV	MX/DV	MX	DV	MX	DV
10	5	11	16	27	63	112	116	157	170	259	241	353	358	787	816	1062	1652	1778	2393	2410
	2	14	20	34	79	141	147	198	215	328	305	447	453	996	1032	1344	2090	2249	3026	3049
15	10	11	16	27	63	112	116	157	170	259	241	353	358	787	816	1062	1652	1778	2393	2410
	7	14	20	34	79	141	147	198	215	328	305	447	453	996	1032	1344	2090	2249	3026	3049
	3	17	24	42	97	173	180	242	263	402	374	547	554	1219	1264	1645	2560	2754	3707	3734
20	15	11	16	27	63	112	116	157	170	259	241	353	358	787	816	1062	1652	1778	2393	2410
	10	16	22	38	89	158	164	221	240	367	342	500	506	1113	1154	1502	2337	2514	3384	3409
	3	21	29	49	115	206	214	289	313	478	445	651	660	1451	1505	1958	3047	3278	4412	4445
30	25	11	16	27	63	112	116	157	170	259	241	353	358	787	816	1062	1652	1778	2393	2410
	20	16	22	38	89	158	164	221	240	367	342	500	506	1113	1154	1502	2337	2514	3384	3409
	5	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
40	25	19	27	46	108	194	201	271	294	449	418	612	620	1363	1414	1840	2862	3079	4144	4175
	15	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
	6	29	41	70	163	292	303	408	443	676	630	921	933	2052	2128	2770	4309	4636	6239	6286
50	35	19	27	46	108	194	201	271	294	449	418	612	620	1363	1414	1840	2862	3079	4144	4175
	30	22	31	54	125	224	233	313	340	519	483	707	716	1574	1632	2124	3305	3555	4785	4821
	25	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
	7	33	46	79	184	328	341	459	498	761	708	1036	1049	2308	2393	3115	4846	5213	7016	7069
60	45	19	27	46	108	194	201	271	294	449	418	612	620	1363	1414	1840	2862	3079	4144	4175
	40	22	31	54	125	224	233	313	340	519	483	707	716	1574	1632	2124	3305	3555	4785	4821
	25	30	41	71	166	296	308	414	450	686	639	935	947	2082	2159	2810	4372	4703	6330	6378
	9	36	50	86	200	357	371	500	543	828	771	1128	1143	2514	2607	3392	5278	5677	7641	7698
75	55	22	31	54	125	224	233	313	340	519	483	707	716	1574	1632	2124	3305	3555	4785	4821
	50	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
	25	35	49	85	198	354	368	495	537	820	764	1117	1131	2489	2581	3359	5226	5621	7566	7623
	11	40	56	96	224	400	416	560	608	928	864	1264	1280	2816	2920	3800	5912	6360	8560	8624
100	75	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
	50	35	49	85	198	354	368	495	537	820	764	1117	1131	2489	2581	3359	5226	5621	7566	7623
	14	46	65	111	260	464	482	649	705	1076	1002	1465	1484	3264	3385	4405	6853	7373	9923	9997
125	100	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
	50	43	61	104	242	433	450	606	658	1005	935	1368	1386	3048	3161	4114	6400	6885	9266	9336
	18	52	72	124	290	517	538	724	786	1200	1117	1634	1655	3641	3776	4913	7644	8224	11068	11151
150	125	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
	75	43	61	104	242	433	450	606	658	1005	935	1368	1386	3048	3161	4114	6400	6885	9266	9336
	20	57	80	137	319	570	593	798	867	1323	1231	1801	1824	4013	4162	5416	8426	9064	12200	12291
175	150	25	35	60	140	250	260	350	380	580	540	790	800	1760	1825	2375	3695	3975	5350	5390
	100	43	61	104	242	433	450	606	658	1005	935	1368	1386	3048	3161	4114	6400	6885	9266	9336
	50	56	78	134	313	559	581	783	850	1297	1207	1766	1789	3935	4081	5311	8262	8888	11963	12052
	24	61	86	147	344	614	639	860	934	1425	1327	1942	1966	4325	4485	5837	9081	9769	13148	13247
200	150	35	49	85	198	354	368	495	537	820	764	1117	1131	2489	2581	3359	5226	5621	7566	7623
	100	50	70	120	280	500	520	700	760	1160	1080	1580	1600	3520	3650	4750	7390	7950	10700	10780
	27	66	92	158	368	658	684	921	1000	1526	1421	2078	2104	4630	4801	6248	9720	10457	14074	14179
225	175	35	49	85	198	354	368	495	537	820	764	1117	1131	2489	2581	3359	5226	5621	7566	7623
	100	56	78	134	313	559	581	783	850	1297	1207	1766	1789	3935	4081	5311	8262	8888	11963	12052
	30	70	98	168	391	698	726	977	1061	1620	1508	2206	2234	4915	5097	6633	10320	11102	14942	15053
250	200	35	49	85	198	354	368	495	537	820	764	1117	1131	2489	2581	3359	5226	5621	7566	7623
	175	43	61	104	242	433	450	606	658	1005	935	1368	1386	3048	3161	4114	6400	6885	9266	9336
	100	61	86	147	343	612	637	857	931	1421	1323	1935	1960	4311	4470	5818	9051	9737	13105	13203
	34	73	103	176	412	735	764	1029	1117	1705	1587	2322	2352	5173	5364	6981	10861	11684	15726	15843
300	250	35	49	85	198	354	368	495	537	820	764	1117	1131	2489	2581	3359	5226	5621	7566	7623
	100	71	99	170	396	707	735	990	1075	1640	1527	2234	2263	4978	5162	6718	10451	11243	15132	15245
	40	81	113	193	451	806	838	1129	1225	1870	1741	2548	2580	5676	5885	7659	11916	12819	17253	17382
400	350	35	49	85	198	354	368	495	537	820	764	1117	1131	2489	2581	3359	5226	5621	7566	7623
	200	71	99	170	396	707	735	990	1075	1640	1527	2234	2263	4978	5162	6718	10451	11243	15132	15245
	50	94	131	224	524	935	973	1310	1422	2170	2020	2956	2993	6585	6829	8886	13825	14873	20018	20168

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

DOCTOR WATER CAPACITY TABLE

(Modified Equal Percent Contour Plug) (M3/Hr.)

Pressure (bar)		Valve Size and Type																		
		1/2	3/4	1	1.5	2		2.5		3		4		6		8	10		12	
P1	P2	1/2	3/4	1	1.5	MX	DV	MX	DV	MX	DV	MX	DV	MX	DV	MX/DV	MX	DV	MX	DV
0.7	0.5	2	3	5	11	19	20	27	29	45	42	61	62	136	141	184	286	307	414	417
	0.2	3	4	7	17	31	32	43	46	71	66	97	98	215	223	290	452	486	654	659
1	0.7	2	3	6	13	24	25	33	36	55	51	75	76	167	173	225	350	377	507	511
	0.5	3	4	7	17	31	32	43	46	71	66	97	98	215	223	290	452	486	654	659
	.2	4	5	9	22	39	40	54	59	90	84	122	124	272	282	367	572	615	828	834
1.5	1	3	4	7	17	31	32	43	46	71	66	97	98	215	223	290	452	486	654	659
	0.7	4	5	9	22	39	40	54	59	90	84	122	124	272	282	367	572	615	828	834
	.2	5	7	12	28	49	51	69	75	114	106	156	158	347	360	468	729	784	1055	1063
2	1.5	3	4	7	17	31	32	43	46	71	66	97	98	215	223	290	452	486	654	659
	1	4	6	10	24	43	45	61	66	100	93	137	138	304	316	411	639	687	925	932
	.3	6	8	14	32	56	59	79	86	131	122	178	180	397	412	536	833	896	1206	1215
3	2	4	6	10	24	43	45	61	66	100	93	137	138	304	316	411	639	687	925	932
	1	6	9	15	34	61	64	86	93	142	132	193	196	430	446	581	904	972	1309	1318
	.5	7	10	16	38	68	71	96	104	159	148	216	219	481	499	649	1010	1087	1463	1474
3.5	3	3	4	7	17	31	32	43	46	71	66	97	98	215	223	290	452	486	654	659
	2	5	7	13	30	53	55	74	80	123	114	167	169	373	387	503	783	842	1133	1142
	1	7	10	16	38	68	71	96	104	159	148	216	219	481	499	649	1010	1087	1463	1474
	.5	7	10	18	42	75	78	105	114	174	162	237	240	527	547	711	1107	1191	1603	1615
4	3	4	6	10	24	43	45	61	66	100	93	137	138	304	316	411	639	687	925	932
	2	6	9	15	34	61	64	86	93	142	132	193	196	430	446	581	904	972	1309	1318
	1	7	10	18	42	75	78	105	114	174	162	237	240	527	547	711	1107	1191	1603	1615
	.6	8	11	19	45	80	83	112	121	185	172	252	255	561	582	757	1178	1268	1706	1719
5	4	4	6	10	24	43	45	61	66	100	93	137	138	304	316	411	639	687	925	932
	3	6	9	15	34	61	64	86	93	142	132	193	196	430	446	581	904	972	1309	1318
	2	7	10	18	42	75	78	105	114	174	162	237	240	527	547	711	1107	1191	1603	1615
	.8	9	12	21	50	89	92	124	135	206	191	280	284	624	647	842	1310	1409	1896	1910
6	5	4	6	10	24	43	45	61	66	100	93	137	138	304	316	411	639	687	925	932
	3	7	10	18	42	75	78	105	114	174	162	237	240	527	547	711	1107	1191	1603	1615
	1	10	14	23	54	97	101	135	147	224	209	306	309	681	706	919	1429	1537	2069	2085
8	6	6	9	15	34	61	64	86	93	142	132	193	196	430	446	581	904	972	1309	1318
	3	10	14	23	54	97	101	135	147	224	209	306	309	681	706	919	1429	1537	2069	2085
	1.1	11	16	27	64	114	118	159	173	264	245	359	363	800	829	1079	1679	1806	2431	2449
10	8	6	9	15	34	61	64	86	93	142	132	193	196	430	446	581	904	972	1309	1318
	5	10	14	23	54	97	101	135	147	224	209	306	309	681	706	919	1429	1537	2069	2085
	1.4	13	18	30	71	127	132	178	193	294	274	401	406	893	926	1205	1874	2016	2714	2734
12	10	6	9	15	34	61	64	86	93	142	132	193	196	430	446	581	904	972	1309	1318
	7	10	14	23	54	97	101	135	147	224	209	306	309	681	706	919	1429	1537	2069	2085
	5	11	16	27	64	114	119	160	174	265	247	361	366	805	835	1087	1691	1819	2448	2466
	1.7	14	19	33	78	139	144	194	211	322	300	439	444	977	1013	1318	2051	2206	2970	2992
14	10	9	12	21	48	86	90	121	131	201	187	273	277	609	631	822	1278	1375	1851	1864
	7	11	16	27	64	114	119	160	174	265	247	361	366	805	835	1087	1691	1819	2448	2466
	2	15	21	36	84	150	156	210	228	347	324	473	479	1054	1093	1423	2214	2382	3205	3229
15	12	7	10	18	42	75	78	105	114	174	162	237	240	527	547	711	1107	1191	1603	1615
	7	12	17	29	68	122	127	171	186	284	264	386	391	861	893	1162	1808	1945	2617	2637
	2	16	22	37	87	156	162	218	237	362	337	493	499	1098	1138	1481	2304	2479	3336	3361
17	14	7	10	18	42	75	78	105	114	174	162	237	240	527	547	711	1107	1191	1603	1615
	10	11	16	27	64	114	119	160	174	265	247	361	366	805	835	1087	1691	1819	2448	2466
	5	15	21	36	84	150	156	210	228	347	324	473	479	1054	1093	1423	2214	2382	3205	3229
	2.4	17	23	40	93	165	172	231	251	383	357	522	529	1163	1206	1570	2442	2627	3536	3562
20	15	10	14	23	54	97	101	135	147	224	209	306	309	681	706	919	1429	1537	2069	2085
	10	14	19	33	77	137	142	191	208	317	295	432	438	963	998	1299	2021	2174	2926	2948
	2.7	18	25	43	101	180	187	252	273	417	388	568	575	1266	1313	1709	2658	2860	3849	3877
27	20	11	16	27	64	114	119	160	174	265	247	361	366	805	835	1087	1691	1819	2448	2466
	15	15	21	36	84	150	156	210	228	347	324	473	479	1054	1093	1423	2214	2382	3205	3229
	3.5	21	29	50	117	210	218	293	319	486	453	662	671	1476	1530	1991	3098	3333	4486	4519

- It is recommended to keep valve outlet velocity below 30,000 ft./min.
- Capacities based on maximum Cv.

DOCTOR WATER
CAPACITY TABLE

Linear Valve Specification Form



CONTROL VALVE SPEC SHEET

Project/Job _____
Unit/Customer _____
P.O./LCO File # _____
Item _____
Contract _____
MFR Serial# _____

Data Sheet _____ of _____
Spec _____
Tag _____
Dwg _____
Service _____

Fluid ☐ Steam ☐ Water ☐ Gas _____

☐ Liquid _____

Crit Pres PC

Service Conditions

Flow ☐ #/hr ☐ gpm ☐ scfh ☐ _____

Inlet Pressure ☐ psig ☐ psia ☐ _____

Outlet Pressure ☐ psig ☐ psia ☐ _____

Temperature ☐ °C ☐ °F _____

Max Press/Temperature: _____ / _____

Density/MW/SG

Viscosity

Vapor Pressure ☐ psia ☐ _____

Required C_v _____

Noise (dBA) Allowable _____

Max. Flow

Norm. Flow

Min. Flow

Shut-off Pressure

Line Info

Pipe Size In _____

/Sch _____

Pipe Size Out _____

/Sch _____

Valve, Body & Bonnet

Body Size in. ☐ 1/2 ☐ 3/4 ☐ 1 ☐ 1 1/4 ☐ 1 1/2 ☐ 2 ☐ 2 1/2 ☐ 3 ☐ 4 ☐ 6 ☐ 8 ☐ 10 ☐ 12 ☐ 16

ANSI Class ☐ 125 ☐ 150 ☐ 250 ☐ 300 ☐ 600 ☐ 900 ☐ 1500 ☐ 2500 ☐ 4500 ☐ Other _____

Body/Bonnet Material: ☐ Cast Iron ☐ Cast Steel ☐ Cr Mo ☐ 316SS ☐ Bronze ☐ Hast C ☐ Titanium ☐ Alloy 20

☐ Other _____

End Conn. Inlet/Outlet: ☐ NPT ☐ SWE ☐ BWE Sch. _____ ☐ Sep. Flanges ☐ Int. Flanges ☐ Other _____

Packing Material: ☐ PTFE ☐ BTG ☐ Laminated Graphite ☐ Kalrez ☐ Other _____

Trim Size

☐ 100% ☐ 60% ☐ 40% ☐ 20% ☐ Other _____

Actuator

Spring Action: ☐ Air to Open ☐ Air to Close ☐ Last Position ☐ None

Available Air Supply Pressure: Max. _____ Min. _____

Manual Override: ☐ Yes ☐ No ☐ Type _____

Solenoid ☐ Yes ☐ No ☐ Type _____ ☐ Voltage _____

Positioner ☐ Yes ☐ No ☐ Type _____ ☐ Pneu ☐ I/P

Switch ☐ Yes ☐ No ☐ Type _____

Air Set ☐ Yes ☐ No ☐ Type: _____ ☐ Range: _____

Other Accessories ☐ Yes ☐ No ☐ Type _____

Test ANSI/FCI Leakage Class: ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ Leslie VIII

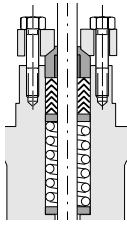
CONTROL VALVES



CONTROL VALVE OPTIONS & ACCESSORIES

**CONTROL VALVE OP-
TIONS & ACCESSORIES**

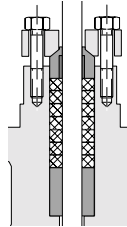
PACKING CONFIGURATIONS



LIVE-LOADED PTFE - V-RING (STANDARD)

Live-loaded PTFE V-ring packing provides the most maintenance free stem seal. The V-ring packing is both pressure energized and live-loaded by a 304 stainless steel spring to automatically compensate for packing wear. Maximum service temperature is 460°F (238°C). V-rings can be inverted for vacuum service.

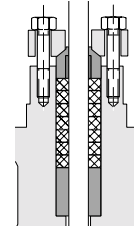
Available on Kombat, Intimidator, Boss and Doctor.



PTFE/GRAPHITE (OPTIONAL)

Split rings allow packing replacement without removal of actuator. Graphite impregnated PTFE provides 500°F (260°C) service temperature, better memory and sealing than pure PTFE rings, lowered stem hysteresis, and is ideal for fluids that contain suspended particles.

Available on Intimidator, Boss and Doctor.



HIGH TEMPERATURE LAMINATED GRAPHITE (OPTIONAL)

Split rings allow packing replacement without removal of actuator. Precision die-cut laminated graphite rings provide a reliable, tight stem seal to operating temperatures of 800+°F (426°C).

Available on Intimidator, Boss and Doctor.

PACKING & ACTUATORS

ACTUATORS



KOMBAT K1, K4 AND INTIMIDATOR

- Pneumatic Actuated
- 36 and 60 sq. in.
- High Thrust Multiple Spring
- Epoxy Coated
- Stainless Steel Internals
- Fixed 3-15 pound Springs
- Cast Iron Yoke



BOSS

- 35, 55 and 85 sq. in.
- High Thrust
- Four Bolt Yoke Mounting
- Cast Iron Yoke
- External Access for Spring Preload Adjustment
- Rolling Boot Seal on Stem for Increased Accuracy & Long Service Life (Reverse only)

KOMBAT K5, K6

- Electric Actuated
- Accepts 0-10vDC, 4-20mA or 0-135 ohm signal
- Spring Return to Fail Safe Position
- Manual Override
- NEMA 1 Enclosure
- Powder Coated Die Cast Aluminum Housing



DOCTOR

- 40, 85, 145 and 250 sq. in.
- High Thrust Multiple Spring
- Cast Iron Yoke
- Dual Accessory Mounting Pads
- External Access for Spring Preload Adjustment
- Split Clamp Stem Coupling for Easy Maintenance



Applications

- Process Control Systems ● HVAC Systems
- Water Purification Systems ● Vaporizers
- Metal Cleaning Systems ● Plating Systems
- Feed Water & Fuel System ● Pressure Control Controls in Boiler Rooms

EPC-1 Electro- Pneumatic Controller

**Accepts 4-20 mA Signal
Accuracy to $\pm 0.5\%$ of Span**

EPC FEATURES

NEMA 4 Enclosure

is rugged, watertight and tamper resistant

Backlit LED Display

shows set point, process variable, process deviation from set point or calibrate high or low as selected by display mode switch

Response Speed Adjustment

sets the duration and frequency of air pulses controlling speed of response

Pneumatic Output

sends air to control valve up to maximum air input

AC Power Input

is 115/230 VAC, 50/60 Hz, switch selectable

Optional Remote Control and Remote Set Point Modules

can be mounted up to 1000 feet away



Display Mode Switch

selects set point, process variable, process deviation from set point or calibrate high or low for display

Set Point Adjustment

establishes process set point

Dead Band Adjustment

for hysteresis to balance system accuracy with valve wear

Pneumatic Input

uses standard plant air up to 100 psig maximum

Electrical Signal Input

is 4-20 mA or from RTD with optional signal conditioning card

Intrinsically Safe Option

Factory Mutual Approved for hazardous locations

ONE BOX REPLACES I/P TRANSDUCERS, POSITIONERS AND EXTERNAL POWER SUPPLIES



EPC-1 ELECTRO-PNEUMATIC CONTROLLER

APPLICATION DATA

- Control of E8, Kombat Series K, Intimidator Type J, Boss Type D, Doctor Type MD and other manufacturer's control valves
- Process Control Systems
- HVAC Systems
- Packaged Systems such as Water Purification, Vaporizers, Metal Cleaning, Plating, etc.
- Feed Water and Fuel System Controls in Boiler Rooms
- Ideal for Pressure Control

APPLICABLE CODES

NEMA 4 Enclosure

EPC-1 ELECTRO-PNEUMATIC CONTROLLER

- **Simplified Installation** eliminates need for Positioner, I/P, External Power Supply & Instrument Quality Air
- **No Air Consumption at Steady State**
- **Air Output 0 to Maximum Supply Pressure**
- **Loss of Power Reset**
- **Accuracy to $\pm 0.5\%$ of Span**
- **Easy to Read Digital Display**
- **Internal Power Supply for Transmitter**

OPTIONS

- TSC—Temperature Signal Conditioning Card (for RTD without transmitter)
- LCM-90—Local Control Module (where distance between valve & EPC exceeds 60")
- EPC-RS—Remote Set Point Module
- Pressure Transmitter
- RTD Thermometer
- Differential Pressure Transmitter
- Thermowell

MODELS

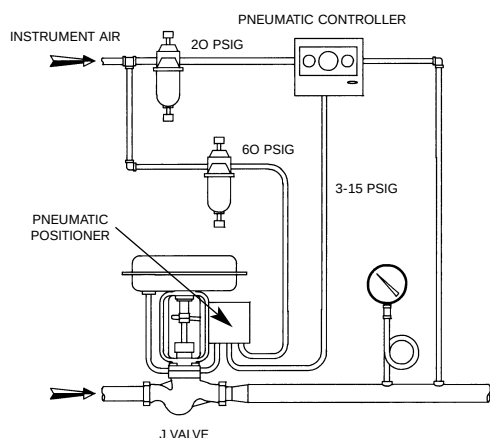
EPC-1—Electro-Pneumatic Controller

EPC-1M—For Actuators over 60 square inch or Dual 36 Applications

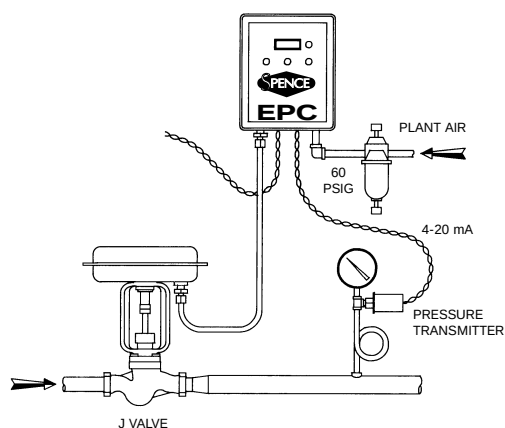
EPC-1H—For Dual 60 square inch Actuators

SPENCE EPC SIMPLIFIES YOUR CONTROL SYSTEM

Conventional Pneumatic Control System



Spence EPC-1 Electro-pneumatic Control System



EPC-1

ELECTRO-PNEUMATIC CONTROLLER

SPECIFICATION

EPC-1 AND EPC/IS SERIES

Controllers shall be electro-pneumatic, accepting an input signal of 4 to 20 mA or RTD input and providing an output of 0-100 psig capable of modulating diaphragm or cylinder actuators without the use of valve positioners or I/P transducers. Controllers shall be capable of operating on 115/230 VAC, 50/60 Hz or 24 VDC supply and provided with a minimum 3 1/2 inch digital display indicating set point, process variable, deviation from set point and high/low calibration values.

Controllers shall be capable of direct or reverse action and provided with external AUTO/MANUAL switch. Controllers shall have no steady-state air consumption and be capable of accepting a 100 psig input without the use of regulators. Accuracy shall be $\pm 0.5\%$ of span, gain shall be adjustable, dead band shall be adjustable 0-5% of span and controllers shall be provided with an adjustable derivative function.

Enclosures shall be NEMA 1, 2, 3, 3S, 4, 4X, 12 and 13 rated and provided with a hinged cover. Controllers shall be CSA-Approved, FM-Approved for intrinsic safety.

Controllers shall be Spence Engineering or approved equivalent.

EPC/RCS-90 AND EPC/RCS-90/IS

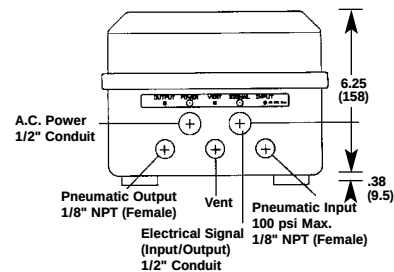
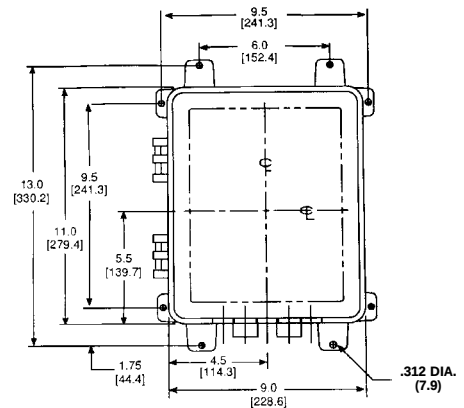
A control module shall be provided to be mounted at or near the valve which will enable the controller to be mounted up to 1000 feet away and linked to the module by only electrical connections. Enclosure shall be NEMA 1, 2, 3, 3S, 4, 4X, 12 and 13 rated. The local control module shall be CSA-Approved, FM-Approved for intrinsic safety.

EPC/RS MODULE

The remote set point module shall consist of a 1/4 DIN, NEMA 1 panel mount enclosure designed to be mounted up to 1000 feet away from the controller. Enclosure shall be provided with a clear, hinged cover equipped with a lock and two keys. Modules shall be provided with all necessary panel mount hardware and plug-in terminal connector. Modules shall have a minimum 3 1/2 inch digit backlit LCD display with 1/2 inch high characters. Display shall indicate high-low transmitter calibration values, process values, deviation from set point and process set point. Module shall allow calibration adjustment and manual change of controller set point. Module shall be powered by 24 VDC from the controller and require no external power supply.

SET POINT RAMP GENERATOR

Controller shall be capable of providing automatic ramp-up and/or ramp-down to or from final process set point incrementally in 4,096 discrete steps. Ramp time shall be adjustable from a minimum of one second to a maximum of 166 hours and shall be selected via digital switches on the front panel. Timer on/off, start/pause/resume, ramp-up/ramp-down and reset functions shall be capable of remote control with a PLC or DCC interface using a zero signal (shunt to ground contact closure).



EPC-1 ELECTRO-PNEUMATIC CONTROLLER

RATINGS

Supply Voltage	115 Volts 50/60 Hz 230 Volts 50/60 Hz 24 Volts DC
Operating Voltage Range	90 to 110%
Power Consumption	10 Watts (max) 0.7 Watts (steady state)
Input	4-20 mA
Air Supply	100 psig maximum
Output.....	0 to max supply pressure
Air Consumption	0 at steady state
Accuracy	$\pm 0.5\%$ Span
Response Speed Range	200:1
Amplifier Gain.....	Normal = 6 High = 12
Dead Band	Adjustable, 0 to 5% Span
Input Resistance	150 Ohms
Enclosure Material.....	Noryl*
Enclosure Cover	Polycarbonate
Pneumatic Fittings.....	1/8" FNPT
Air Delivery	0.45 scfm at 30 psi 0.55 scfm at 60 psi 0.63 scfm at 90 psi
Weight.....	9 lbs (4.1 kg)

*Noryl is a registered trademark of General Electric.

EPC-1 ELECTRO-PNEUMATIC CONTROLLER

OPTIONS



EPC/IS INTRINSICALLY SAFE

The Spence EPC/IS is an intrinsically safe, single loop electro-pneumatic controller when installed with barriers. It is Factory Mutual approved for:

- Class I, II, III Division 1, applicable Groups C, D, E, F and G
- Nonincendive for Class I, Division II, Groups C and D
- Suitable for Class II and III, Division 2, Groups F and G hazardous locations

EPC/RS REMOTE SET POINT MODULE

The Spence EPC/RS is a 1/4 DIN, panel mounted module in a NEMA 1 enclosure, designed to provide remote monitoring and control of the EPC-1 Series Controllers up to 1000 feet away.

Included are:

- 3 1/2" digit, backlit LCD display indicating:
 - PMC-1 low and high calibration values
 - Process value (temperature, pressure, etc.)
 - Process deviation from set point
 - Process set point
- Mode select button and LED indicators
- Remote set point button
- Hi-Lo calibration adjustments



EPC/RCS-90 & RCS-90/IS LOCAL CONTROL MODULE

The Spence EPC/RCS-90 is a small enclosure housing a terminal strip and the loading/unloading solenoid valves which are normally inside the EPC-1 Series Controller. Designed to mount on the wall or directly on the control valve, the RCS-90 minimizes the air signal line length and requires only electrical connections to the EPC-1 up to 1000 feet away. Available with hi-cycle standard or FM approved (same as EPC/IS) intrinsically safe solenoid valves for applications including:

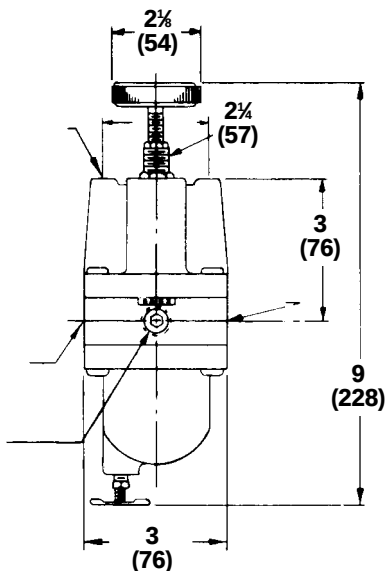
- Where EPC-1 air output line to the control valve exceeds 60 feet
- When system response speed needs to be increased
- Where valve location requires intrinsically safe equipment
- Ambient temperatures near valve exceed EPC-1 rating but are within RCS-90's -20 to 175°F (-29 to 79°C) temperature rating
- When EPC-1 is installed for remote valve operation
- To operate double acting cylinder actuators



SET POINT RAMP GENERATOR

The Spence EPC-1 Set Point Ramp Generator module is a factory mounted module which provides automatic ramp-up or ramp-down to or from final process set point. The ramp time is adjustable from one second to 166 hours. Ramp time is selected by digital switches on it's front panel which replaces the EPC-1's lower panel. Remote controllable functions include timer on/off, start/pause/resume, ramp-up/ramp-down and reset. Applications include:

- Steam Distribution Systems for automatic, gradual warm-up to prevent boiler overloads, allow traps to remove high startup condensate loads and to eliminate water hammer, "banging" and resulting mechanical damage
- Food, Pharmaceutical and Process Industries in single loop process control systems



MODEL 65A AIR FILTER REGULATOR

APPLICATION DATA

- Provides Remote Control of E8, A Series Pilots, Positioners, EPC-1.
- To Upgrade Plant Air to Instrument Quality Air

MODEL 65A AIR FILTER REGULATOR

- Converts Plant Air to Instrument Quality
- Delivers 0 to 50 PSIG

SPECIFICATION

Air Filter Regulator shall provide remote control for air actuated regulators and control valves. It shall convert plant air to instrument quality air and provide 0 to 50 psi delivery pressure. The Regulator shall have a flow capacity of 22 scfm.

OPTIONS See page 45

- **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
and I/P TRANSDUCER

ELECTRO-PNEUMATIC (I/P) TRANSDUCER

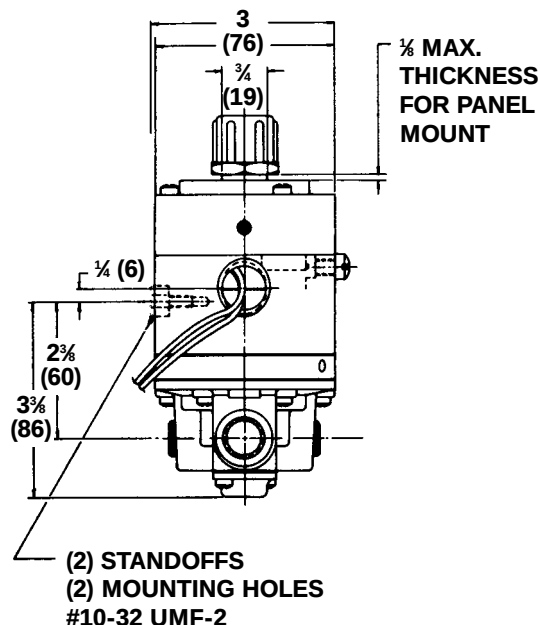
- Converts Current Signal to Pneumatic Signal
- Handles up to 150 PSIG Supply Air
- Accommodates 4-20 mA and 10-50 mA Input Signals

SPECIFICATION

Electro-pneumatic Transducer shall convert 4-20 mA or 10-50 mA input signals to a proportional 3-15 PSIG pneumatic output. Output capacity shall be a minimum of 17 SCFM with a 20 PSIG supply or 47 SCFM with a 120 PSIG supply.

MATERIALS OF CONSTRUCTION

Housing	Aluminum
Orifice	Sapphire
Nozzle.....	Bronze
PC Board	Fiberglass
Cover	Aluminum



ELECTRO-PNEUMATIC TRANSDUCER

APPLICATION DATA

- Simple way to control pneumatic valves with current signal

RTD RESISTANCE PROBE THERMOMETER

- 304 SS closed end probe measures temperature
- Varies electrical resistance in proportion to temperature changes
- Communicates change in resistance to automated systems

OPTIONS

- 304 SST Thermowell

SPECIFICATION

The RTD shall have a 304 stainless steel closed end probe with a 1/2 inch NPT male with hex fitting process connection. The RTD shall change resistance in proportion to a change in temperature and be capable of connecting to a device (such as a signal conditioning card) which can convert that resistance change to a standard 4-20 mA signal.

MATERIALS OF CONSTRUCTION

Connector Head:.....NB 1 Cast Iron
 Probe: 304 SS Closed End
 Process Connection: 1/2" NPT Male w/Hex fitting
 Electrical Connection: 1/2" NPT Female
 Sheath Length 5½" or 11½"
 Sheath Diameter ¼"



**RTD RESISTANCE
PROBE THERMOMETER**

APPLICATION DATA

- Building control systems
- Process control systems
- Systems utilizing the EPC Electro-Pneumatic Controller



**ELECTRONIC PRESSURE
TRANSMITTER**

APPLICATION DATA

- Building control systems
- Process control systems
- Systems utilizing the EPC Electro-Pneumatic Controller

ELECTRONIC PRESSURE TRANSMITTER

- Solid state, calibrated transmitter measures pressure to $\pm 0.5\%$ accuracy
- Outputs 4-20 mA signal; 10-30 VDC unregulated; 100 ohms output impedance
- Integral metal diaphragm and polysilicon bridge are virtually unaffected by shock, vibration or mounting
- Available in ranges 0-30, 0-300 and 0-1000 psig, overpressure protected
- NEMA 4 compliant with cable or waterproof connector
- Operates in 40-200°F
- 1/8 NPT male or female process connection

SPECIFICATION

The Electronic Pressure Transmitter shall have a 1/8 NPT male or female 316 stainless steel process connection. The Electronic Pressure Transmitter shall measure pressure to $\pm 0.5\%$ accuracy and output a standard 4-20 mA signal with 100 ohms output impedance. The Electronic Pressure Transmitter shall be shock and vibration resistant, overpressure protected, operate within 40-200°F and be NEMA 4 compliant.

MATERIALS OF CONSTRUCTION

Case: 304 SS
 Diaphragm: 17-4 PH SS
 Process Connection: 316 SS



- **Pneumatic or Electro-Pneumatic**
- **Modular Design**
- **Boost Adjustable**
- **Separate Control for Zero Point and Range of Travel**

- Gages

P6981 Pneumatic Positioner

EP6986 Electro-pneumatic Positioner

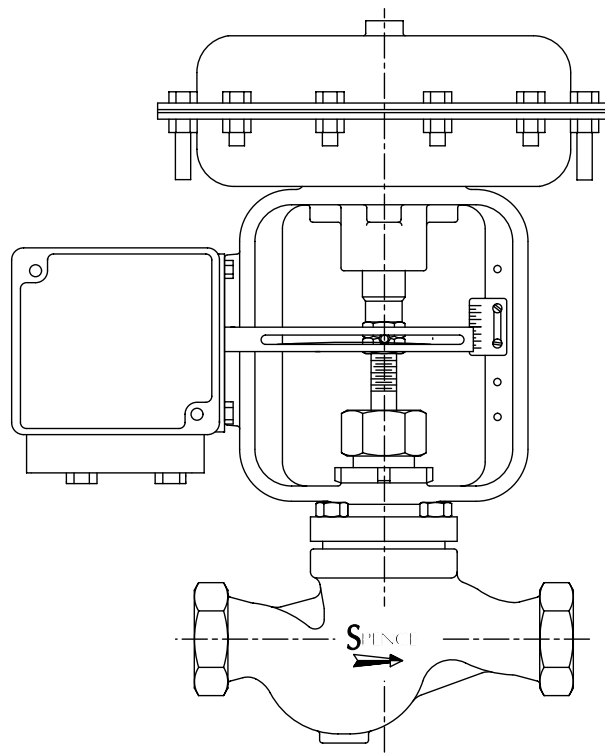
The positioner shall be SIRA and WIB approved and shall be mounted directly onto the valve. Feedback, I/P Transducer and/or Limit Switch options shall be available.

- Control of Intimidator Control Valve
- Split Range for Parallel Stations
- Fine Tune Control
- Where Required Air Pressure is Greater than Controller Output
- Where Change of Actuator Action is Desired (Reverse to Direct & vice versa)

Temperature Range	-40 to 176°F (-40 to 80°C)
Pneumatic Connections	1/4" NPT
Supply Pressure	60 psig
Air Consumption	0.11 to 0.21 scfm
Input Signal	3-15 psig, Split Range, 4-20mA*
Hysteresis	≤0.3%
Body Construction	Aluminum

SIRA & WIB Approved

*Applies to EP6986 only



ECKARDT P6981 POSITIONER ON INTIMIDATOR TYPE J CONTROL VALVE



PMV P4 PNEUMATIC POSITIONER

APPLICATION DATA

- Control of Intimidator, Boss and Doctor Control Valves
- Split Range for Parallel Stations
- Fine Tune Control
- Where Required Air Pressure is Greater than Controller Output
- Where Change of Actuator Action is Desired (Reverse to Direct & vice versa)

RATINGS

Temperature Range	-4 to 185°F (-20 to 85°C)
Supply Pressure	60 psig
Air Consumption	0.31 scfm (P4) 0.71 scfm (P5) 0.78 scfm (EP5)
Input Signal	3-15 psig, Split Range 4-20 mA
Linearity	±0.7% (P4) ≤0.5% (P5 & EP5)
Hysteresis	0.8% (P4) ≤0.75% (P5) ≤0.5% (EP5)
Body Construction	Aluminum

APPLICABLE CODES

CENELEC, FM & CSA approved

PMV POSITIONER

- Pneumatic or Electro-Pneumatic
- Compact, Rugged Design
- Easy to Calibrate
- Bright, Visible Indicator
- Low Air Consumption
- Mounts Compactly on Valve
- Stainless Steel Cam
- External Zero Adjustment
- Modular Design

OPTIONS

- Mechanical Limit Switch
- Proximity Limit Switch
- 4-20 mA Position Transmitter Feedback
- Potentiometer 1K Feedback
- Gauges

MODELS

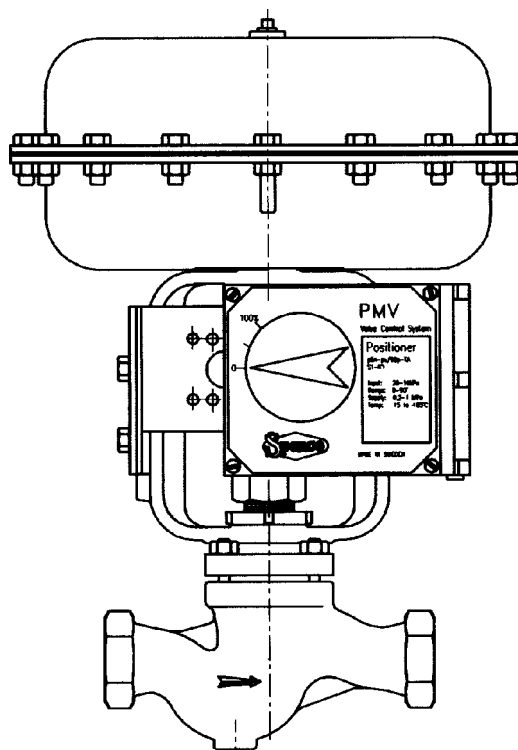
P4 Pneumatic Positioner

P5 Pneumatic Positioner w/Gauges

EP5 Electro-pneumatic Positioner w/Gauges

SPECIFICATION

The Positioner shall be modular and cam characterized with FM, CSA and CENELEC certifications and shall be mounted directly onto the valve. Feedback, I/P Transducer and/or Limit Switch options shall be available.



**PMV P4 POSITIONER
ON INTIMIDATOR TYPE J CONTROL VALVE**

MOORE POSITIONER

- Pneumatic or Electro-Pneumatic
- Modular Design
- Cam Characterized for Added Turndown
- Gauges Included
- Proportional Control
- Easy to Calibrate
- Non-Interacting Zero and Span
- Mounts compactly on Valve
- Provides Precise Control

OPTIONS

- Mechanical Limit Switch
- Proximity Limit Switch
- 4-20 mA Position Transmitter Feedback
- Potentiometer 1K Feedback

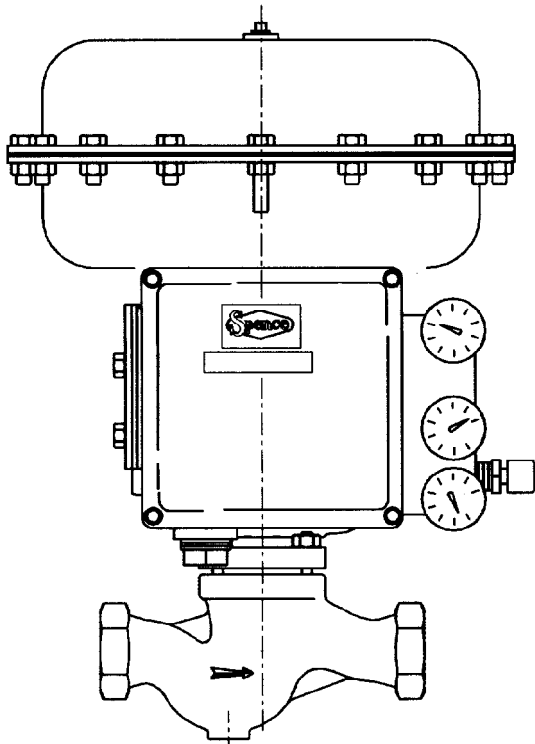
MODELS

760P Pneumatic Positioner

760EP Electro-pneumatic Positioner w/Integral I/P Transducer

SPECIFICATION

The Positioner shall be modular and cam characterized with NEMA 4X, FM, CSA, CENELEC and Sira certifications and shall be mounted directly onto the valve. Feedback, I/P Transducer and/or Limit Switch options shall be available. The Positioner shall include gages, have non-interacting zero and span and consume 0.5 to 0.6 scfm.



**MOORE 760P POSITIONER
ON INTIMIDATOR TYPE J CONTROL VALVE**



MOORE 760P PNEUMATIC POSITIONER

**MOORE
POSITIONER**

APPLICATION DATA

- Control of Intimidator, Boss & Doctor Control Valves
- Split Range for Parallel Stations
- Fine Tune Control
- Where Required Air Pressure is Greater than Controller Output
- Where Change of Actuator Action is Desired (Reverse to Direct & vice versa)

RATINGS

Temperature Range	-40 to 185°F (-40 to 85°C)
Pneumatic Connections	...1/4" NPT
Gauge Connections	1/8" NPT
Electrical Connections	3/4" NPT
Exhaust Connections	1/4" NPT
Action	Direct or Reverse
Supply Pressure	60 psig
Air Consumption, Typical	...0.5 scfm
Input Signal	3-15 psig, Split Range, 4-20 mA*
Span	Adjustable, -60% to +25% of normal
Zero	Adjustable, -10% to +60% of normal
Linearity, Typical	0.5% of normal span 0.75% of normal span*
Hysteresis, Typical	0.75% of normal span 1.0% of normal span*
Deadband	≤0.25% of span

APPLICABLE CODES

NEMA 4X, IP 65

FM, CSA, CENELEC, Sira Approved

*Applies to 760EP only

Linear Valve Specification Form



CONTROL VALVE SPEC SHEET

Project/Job _____
Unit/Customer _____
P.O./LCO File # _____
Item _____
Contract _____
MFR Serial# _____

Data Sheet _____ of _____
Spec _____
Tag _____
Dwg _____
Service _____

CONTROL VALVES

Fluid ☐ Steam ☐ Water ☐ Gas _____ ☐ Liquid _____		Crit Pres PC	
Service Conditions		Max. Flow	Norm. Flow
Flow ☐ #/hr ☐ gpm ☐ scfh ☐ _____ Inlet Pressure ☐ psig ☐ psia ☐ _____ Outlet Pressure ☐ psig ☐ psia ☐ _____ Temperature ☐ °C ☐ °F _____ Max Press/Temperature: _____ / _____ Density/MW/SG _____ Viscosity _____ Vapor Pressure ☐ psia ☐ _____ Required C _v _____ Noise (dBA) Allowable _____		Min. Flow	Shut-off Pressure

Line Info Pipe Size In _____ /Sch _____ Pipe Size Out _____ /Sch _____

Valve, Body & Bonnet

Body Size in. ☐ 1/2 ☐ 3/4 ☐ 1 ☐ 1 1/4 ☐ 1 1/2 ☐ 2 ☐ 2 1/2 ☐ 3 ☐ 4 ☐ 6 ☐ 8 ☐ 10 ☐ 12 ☐ 16

ANSI Class ☐ 125 ☐ 150 ☐ 250 ☐ 300 ☐ 600 ☐ 900 ☐ 1500 ☐ 2500 ☐ 4500 ☐ Other _____

Body/Bonnet Material: ☐ Cast Iron ☐ Cast Steel ☐ Cr Mo ☐ 316SS ☐ Bronze ☐ Hast C ☐ Titanium ☐ Alloy 20
☐ Other _____

End Conn. Inlet/Outlet: ☐ NPT ☐ SWE ☐ BWE Sch. _____ ☐ Sep. Flanges ☐ Int. Flanges ☐ Other _____

Packing Material: ☐ PTFE ☐ BTG ☐ Laminated Graphite ☐ Kalrez ☐ Other _____

Trim Size ☐ 100% ☐ 60% ☐ 40% ☐ 20% ☐ Other _____

Actuator

Spring Action: ☐ Air to Open ☐ Air to Close ☐ Last Position ☐ None

Available Air Supply Pressure: Max. _____ Min. _____

Manual Override: ☐ Yes ☐ No ☐ Type _____

Solenoid ☐ Yes ☐ No ☐ Type _____ ☐ Voltage _____

Positioner ☐ Yes ☐ No ☐ Type _____ ☐ Pneu ☐ I/P

Switch ☐ Yes ☐ No ☐ Type _____

Air Set ☐ Yes ☐ No ☐ Type: _____ ☐ Range: _____

Other Accessories ☐ Yes ☐ No ☐ Type _____

Test ANSI/FCI Leakage Class: ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ Leslie VIII

CONTROL VALVE SIZING

VALVE SIZING BY COMPUTATION

FORMULA KEY

C_v = Valve flow coefficient	P_2 = Reduced fluid pressure psia = $[p_2 \text{ (psig)} + 14.7]$
D = Nominal pipe size, inches	P_c = Critical pressure of liquid (water = 3206 psia)
d_p = Nominal valve size, inches	P_v = Vapor pressure of liquid at inlet temperature (water @ 60°F = 0.2563 psia)
F_L = Pressure recovery factor, Liquid (See valve page)	ΔP = Comparative fluid pressure factor = $P_1 - P_2$
F_p = Piping geometry factor, which is a capacity correction factor for a valve with reduced inlet and expanded outlet piping of the same size or a valve with expanded outlet piping only. (For Intimidator, see table on facing page.)	ΔP_c = Critical pressure drop (psi) = $P_1 - .96 P_v + .28 \sqrt{\frac{P_v^3}{P_c}}$
$= \frac{1}{\sqrt{\frac{\sum k C_v^2}{890 d^4} + 1}}$	Q = Flow - SCFM or GPM
F_R = Valve Reynolds Number factor = 1 if $C_v > 0.1$ and viscosity <1000 cs. (consult factory for other applications)	T_1 = Initial absolute temperature of gas = $[t_1 \text{ (°F)} + 460]$
G = Specific gravity of liquid at flowing temperature	W = Flow - lb/hr
K = Specific heat ratio (see table) $\frac{C_p}{C_v} = \frac{\text{Specific heat at constant pressure}}{\text{Specific heat at constant volume}}$	X_T = Pressure recovery factor, Gas (See valve page)
M = Molecular weight (see table)	Z = Compressibility factor (Typically = 1)
P_1 = Initial fluid pressure psia = $[p_1 \text{ (psig)} + 14.7]$	$\sum k$ = Valve/piping friction factor $1.5 \left(1 - \frac{d^2}{D^2}\right)^2$

STEAM (MASS)

$$C_v = \frac{W}{19.3 F_p P_1 Y F_R} \sqrt{\frac{T_1 Z}{X M}}$$

GAS (VOLUME)

$$C_v = \frac{Q}{7320 F_p P_1 Y F_R} \sqrt{\frac{T_1 M Z}{X}}$$

SUBCRITICAL FLOW

$$\text{if } X < \frac{X_T K}{1.4}$$

$$X = \frac{\Delta P}{P_1} = \frac{P_1 - P_2}{P_1}$$

$$Y = 1 - \frac{X}{2.14 X_T K}$$

CRITICAL FLOW

$$\text{if } X \geq \frac{X_T K}{1.4}$$

$$X = \frac{X_T K}{1.4}$$

$$Y = .667$$

LIQUID (VOLUME)

SUBCRITICAL FLOW

$$\text{if } \Delta P < \Delta P_c F_L^2$$

$$C_v = \frac{Q}{F_p F_R \sqrt{\frac{\Delta P}{G}}}$$

CRITICAL FLOW

$$\text{if } \Delta P \geq \Delta P_c F_L^2$$

$$C_v = \frac{Q}{F_L F_p F_R \sqrt{\frac{\Delta P_c}{G}}}$$

AVERAGE VALUE OF K & M TABLE

	K	M
Air	1.4	29
Nitrogen	1.404	28
Oxygen	1.401	32
Hydrogen	1.41	2
Carbon Dioxide	1.304	44
Steam	1.31	18.3

INTIMIDATOR PIPING GEOMETRY FACTORS

F_p
for Expanded Outlet Only

d/D	Valve Size	1/2		3/4			1				1-1/2			2		
	Port Size	1/4	5/8	1/4	5/8	7/8	1/4	5/8	7/8	1 1/4	7/8	1 1/4	1 3/4	1 1/4	1 3/4	2 1/4
1		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
.9		1.0	1.03	1.0	1.01	1.04	1.0	1.0	1.02	1.06	1.0	1.01	1.04	1.0	1.02	1.05
.8		1.0	1.05	1.0	1.02	1.07	1.0	1.01	1.04	1.09	1.01	1.02	1.06	1.01	1.03	1.07
.7		1.0	1.05	1.0	1.02	1.07	1.0	1.01	1.04	1.1	1.01	1.02	1.06	1.01	1.03	1.08
.6		1.0	1.05	1.0	1.02	1.07	1.0	1.01	1.04	1.09	1.01	1.02	1.06	1.01	1.03	1.07
.5		1.0	1.04	1.0	1.02	1.05	1.0	1.0	1.03	1.07	1.01	1.02	1.05	1.01	1.02	1.06
.4		1.0	1.03	1.0	1.01	1.04	1.0	1.0	1.02	1.05	1.0	1.01	1.03	1.0	1.01	1.04
.3		1.0	1.02	1.0	1.01	1.02	1.0	1.0	1.01	1.03	1.0	1.01	1.02	1.0	1.01	1.02

INTIMIDATOR PIPING
GEOMETRY FACTORS

F_p
for Reduced Inlet & Expanded Outlet of the Same Size

d/D	Valve Size	1/2		3/4			1				1-1/2			2		
	Port Size	1/4	5/8	1/4	5/8	7/8	1/4	5/8	7/8	1 1/4	7/8	1 1/4	1 3/4	1 1/4	1 3/4	2 1/4
1		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
.9		1.0	.995	1.0	.997	.993	1.0	.999	.996	.992	.999	.998	.994	.999	.997	.992
.8		.998	.981	.999	.991	.976	1.0	.997	.987	.971	.997	.992	.978	.997	.989	.974
.7		.997	.963	.999	.983	.953	.999	.993	.974	.945	.994	.984	.958	.993	.978	.95
.6		.995	.945	.998	.974	.929	.999	.989	.96	.917	.991	.976	.936	.99	.967	.925
.5		.993	.926	.998	.965	.906	.999	.985	.947	.891	.988	.967	.915	.986	.955	.90
.4		.991	.91	.997	.956	.886	.999	.981	.935	.868	.985	.96	.897	.983	.944	.88
.3		.99	.897	.997	.95	.87	.999	.979	.925	.85	.982	.953	.882	.98	.936	.862

Linear Valve Specification Form



CONTROL VALVE SPEC SHEET

Project/Job _____
Unit/Customer _____
P.O./LCO File # _____
Item _____
Contract _____
MFR Serial# _____

Data Sheet _____ of _____
Spec _____
Tag _____
Dwg _____
Service _____

Fluid ☐ Steam ☐ Water ☐ Gas _____ ☐ Liquid _____ Crit Pres PC

Service Conditions

Flow ☐ #/hr ☐ gpm ☐ scfh ☐ _____
Inlet Pressure ☐ psig ☐ psia ☐ _____
Outlet Pressure ☐ psig ☐ psia ☐ _____
Temperature ☐ °C ☐ °F _____
Max Press/Temperature: _____ / _____
Density/MW/SG _____
Viscosity _____
Vapor Pressure ☐ psia ☐ _____
Required C_v _____
Noise (dBA) Allowable _____

Max. Flow	Norm. Flow	Min. Flow	Shut-off Pressure

Line Info Pipe Size In _____ /Sch _____ Pipe Size Out _____ /Sch _____

Valve, Body & Bonnet

Body Size in. ☐ 1/2 ☐ 3/4 ☐ 1 ☐ 1 1/4 ☐ 1 1/2 ☐ 2 ☐ 2 1/2 ☐ 3 ☐ 4 ☐ 6 ☐ 8 ☐ 10 ☐ 12 ☐ 16
ANSI Class ☐ 125 ☐ 150 ☐ 250 ☐ 300 ☐ 600 ☐ 900 ☐ 1500 ☐ 2500 ☐ 4500 ☐ Other _____
Body/Bonnet Material: ☐ Cast Iron ☐ Cast Steel ☐ Cr Mo ☐ 316SS ☐ Bronze ☐ Hast C ☐ Titanium ☐ Alloy 20
☐ Other _____
End Conn. Inlet/Outlet: ☐ NPT ☐ SWE ☐ BWE Sch. _____ ☐ Sep. Flanges ☐ Int. Flanges ☐ Other _____
Packing Material: ☐ PTFE ☐ BTG ☐ Laminated Graphite ☐ Kalrez ☐ Other _____

Trim Size ☐ 100% ☐ 60% ☐ 40% ☐ 20% ☐ Other _____

Actuator

Spring Action: ☐ Air to Open ☐ Air to Close ☐ Last Position ☐ None
Available Air Supply Pressure: Max. _____ Min. _____
Manual Override: ☐ Yes ☐ No ☐ Type _____

Solenoid ☐ Yes ☐ No ☐ Type _____ ☐ Voltage _____

Positioner ☐ Yes ☐ No ☐ Type _____ ☐ Pneu ☐ I/P

Switch ☐ Yes ☐ No ☐ Type _____

Air Set ☐ Yes ☐ No ☐ Type: _____ ☐ Range: _____

Other Accessories ☐ Yes ☐ No ☐ Type _____

Test ANSI/FCI Leakage Class: ☐ II ☐ III ☐ IV ☐ V ☐ VI ☐ Leslie VIII

CONTROL VALVES

SECTION III

SAFETY RELIEF

VALVES

SPENCE SAFETY VALVE SELECTION CHART

SAFETY RELIEF VALVE SELECTION CHART

Valve Series	Inlet Sizes inches (mm)	Min/Max* Set Pressures PSIG (barg)	Min/Max* Temperatures °F (°C)	Connections		Fluid					O ₂ Cleaning	ASME Section [†]	PED [†]	Page
				Threaded	Flanged	Steam	Air	Gas	Liquid	Vacuum				
10	3/4 - 3 (20 - 80)	5 - 15 (.3 - 1)	-10 to 250 (-29 to 121)	X		X						IV		230
15C/15LC	3/4 - 3 (20 - 80)	5 - 15 (.3 - 1)	-20 to 400 (-29 to 204)	X			X	X				VIII (2" only)		232
15A/15LA	3/4 - 3 (20 - 80)	5 - 15 (.3 - 1)	-20 to 400 (-29 to 204)	X			X	X				None		232
15V/15LV	3/4 - 3 (20 - 80)	5 - 30 in HG (169.3 - 1015.9 mbarg)	-20 to 400 (-29 to 204)	X						X		None		234
31/33 Bronze	1/2 - 2-1/2 (15 - 65)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X		X						I	†	204
32 Bronze	1/2 - 2-1/2 (15 - 65)	5 - 300 (.3 - 20.7)	-20 to 422 (-29 to 216)	X		X						I	†	204
41/43 Bronze	1/2 - 2-1/2 (15 - 65)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X		X						VIII	†	204
42 Bronze	1/2 - 2-1/2 (15 - 65)	5 - 300 (.3 - 20.7)	-20 to 422 (-29 to 216)	X		X						VIII	†	204
41A/43A Bronze	1/2 - 2-1/2 (15 - 65)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X			X					VIII	†	204
42A Bronze	1/2 - 2-1/2 (15 - 65)	5 - 300 (.3 - 20.7)	-20 to 422 (-29 to 216)	X			X					VIII	†	204
41AA Bronze	1/2 - 3/4 (15 - 20)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X			X	X				VIII	†	204
42AA Bronze	1/2 - 3/4 (15 - 20)	5 - 300 (.3 - 20.7)	-20 to 422 (-29 to 216)	X			X	X				VIII	†	204
41AT/43AT Bronze	1/2 - 2 (15 - 50)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X			X					VIII	†	204
42AT Bronze	1/2 - 2 (15 - 50)	5 - 300 (.3 - 20.7)	-20 to 422 (-29 to 216)	X			X					VIII	†	204
31/32 Cast Iron	1-1/2 - 6 (40 - 150)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X	X	X						I		212
41/42 Cast Iron	1-1/2 - 6 (40 - 150)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X	X	X						VIII		212
41A/42A Cast Iron	1-1/2 - 6 (40 - 150)	5 - 250 (.3 - 17.2)	-20 to 406 (-29 to 208)	X	X		X					VIII		212
810/812/814/816	1/2 - 1-1/2 (15 - 40)	5 - 250 (.3 - 17.2) 10 to 30 in HG (338.6 to 1015.9 mbarg)	-20 to 406 (-29 to 208)	X		X	X	X	X	X		VIII	†	218
820/822/824/826	1/2 - 1-1/2 (15 - 40)	5 - 900 * (.3 - 62.0) 10 to 30 in HG (338.6 to 1015.9 mbarg)	-20 to 422 (-29 to 216)	X		X	X	X	X	X		VIII	†	218
860/862/864/866	1/2 - 1-1/2 (15 - 40) 10 to 30 in HG (338.6 to 1015.9 mbarg)	5 - 900 * (.3 - 62.0)	-20 to 422 (-29 to 216)	X		X	X	X	X	X		VIII	†	218
50/52	2 (50)	10 - 30 (.7 - 2.1)	-20 to 225 (-29 to 107)	X			X					None		236
51/53	2 (50)	10 - 30 (.7 - 2.1)	-20 to 225 (-29 to 107)	X			X					VIII		236
710/715 RXSO	1/2 - 2 (15 - 50)	10-400 (.7 - 27.6)	-423 - 400 (-252 - 204)	X			X	X			X	VIII	†	242
760/765 RXSO-S	1/2 - 1 (15 - 25)	10-400 (.7 - 27.6)	-423 - 400 (-252 - 204)	X			X	X			X	VIII	†	244
770 RSL	1/2 - 2 (15 - 50)	10-300 (.7 - 27.6)	0 - 300 (-17 - 148)	X					X		X	None		246
775 RLS-S	1/2 - 2 (15 - 50)	10-300 (.7 - 27.6)	0 - 300 (-17 - 148)	X					X		X	None		246

* Pressure and temperature ranges may vary, depending upon valve size, material, etc.
Please consult the appropriate product catalog for specific data.

[†] ASME does not certify valves below 15 PSIG.

[†] Consult Factory for PED availability.

SPENCE/KUNKLE COMPETITIVE CROSSOVER CHART

WHY CHOOSE SPENCE SAFETY AND RELIEF VALVES?

- 1) Spence Engineering sets and tests all valves in accordance with the applicable ASME code and API 527. Most competitive valves do not meet API 527, leading to premature simmering and leakage causing system problems and premature valve failure.
- 2) Spence Engineering Safety and Relief Valves are designed and manufactured with a more rugged body/bonnet design than most competitive valves. This exceptionally rugged design withstands excessive piping strains that often lead to valve failure.

KUNKLE	SPENCE	KUNKLE	SPENCE	KUNKLE	SPENCE	KUNKLE	SPENCE	KUNKLE	SPENCE	KUNKLE	SPENCE
6000 Series		6000 Series cont.		900 Series		900 Series cont.		930 Series		20 Series cont.	
Model 6010 Side Outlet with bronze/brass trim ¹		Model 6121 Same as 6182 with Teflon disc insert ⁵		Model 910 Full nozzle with Carbon Steel body and bonnet with SS Trim See Model 911 for equal SS conversion		Model 916 Same as 910 with soft seat See Model 917 for equal SS conversion		Model 930 Cast Iron for ASME Sec. IV Service ¹⁰		020P-F01 810PGFA 020P-G01 810PHGA	
6010DC _DCA 6010DD _DDA 6010ED _EDA 6010EE _EEA 6010FE _FEA 6010FF _FFA 6010GF _GFA 6010GG _GGA 6010HG _HGA 6010HH _HHA 6010JH _JHA 6010JJ _JJA		6121DC 43ATCDE 6121ED 43ATEDE 6121FE 43ATFEE 6121GF 43ATGFE 6121HG 43ATHGE 6121JH 43ATJHE		Model 911 Full nozzle with all SS contruction		Model 917 Same as 911 with soft seat ^{6, 9}		0930-H01 0010ZHA 0930-J01 0010ZJA 0930-K01 0010ZKA		299 Series	
Model 6021 Same as Model 6010 with Teflon disc insert ^{2, 3}		Model 6130 Same as 6182 with SS nozzle and base		Plain Cap 911BDCM01 860NDCA 911BEDM01 860NEDA 911BFEM01 860NFEA 911BGM01 860NGFA 911BHG01 860NHGA Open Lever 911BDCM03 860EDCA 911BEDM03 860EEDA 911BFEM03 860EFEA 911BGM03 860EGFA 911BHG03 860EHGA Packed Lever 911BDCM06 860PDCA 911BEDM06 860PEDA 911BFEM06 860PFEA 911BGM06 860PGFA 911BHG06 860PHGA		Plain Cap 917BDC_01 86_NDCA 917BED_01 86_NEDA 917BFE_01 86_NFEA 917BGF_01 86_NGFA 917BHG_01 86_NHGA Open Lever 917BDC_03 86_EDCA 917BED_03 86_EEDA 917BFE_03 86_EFEA 917BGF_03 86_EGFA 917BHG_03 86_EHGA Packed Lever 917BDC_06 86_PDCA 917BED_06 86_PEDA 917BFE_06 86_PFEA 917BGF_06 86_PGFA 917BHG_06 86_PHGA		363 *710E Bronze 363C *710N 389C *760N (SS)		299-D DPE-D 299-E DPE-E 299-F DPE-F 299-G DPE-G 299-H DPE-H 299-J DPE-J 299-K DPE-K 299-M DPE-M 299-P DPE-P 299-Q DPE-Q	
6021DC _DCA 6021DD _DDA 6021ED _EDA 6021EE _EEA 6021FE _FEA 6021FF _FFA 6021GF _GFA 6021GG _GGA 6021HG _HGA 6021HH _HHA 6021JH _JHA 6021JJ _JJA		6252 Series (Formerly 252)		Model 912 Full nozzle with SS disc and bronze base		Model 918 Same as 912 with soft seat ^{6, 7}		20 Series		215V Series	
Model 6030 Same as Model 6010 with SS disc and nozzle ⁴		Model 6252 (Formerly 252) Cast Iron with bronze/brass trim ¹		Plain Cap 912BDCM12 810NDCA 912BEDM01 810NEDA 912BFEM01 810NFEA 912BGM01 810NGFA 912BHG01 810NHGA Open Lever 912BDCM14 810EDCA 912BEDM03 810EEDA 912BFEM03 810EFEA 912BGM03 810EGFA 912BHG03 810EHGA Packed Lever 912BDCM17 810PDCA 912BEDM06 810PEDA 912BFEM06 810PFEA 912BGM06 810PGFA 912BHG06 810PHGA		Model 919 Same as 912 with soft seat ^{6, 8}		Model 20 Bronze with plain cap for Liquid		Model 215V Cast Iron for Vacuum Service ¹⁰	
6030DC _DCA 6030DD _DDA 6030ED _EDA 6030EE _EEA 6030FE _FEA 6030FF _FFA 6030GF _GFA 6030GG _GGA 6030HG _HGA 6030HH _HHA 6030JH _JHA 6030JJ _JJA		6252AJG _JGB 6252FJG _JGC 6252AKH _KHB 6252FKH _KHC 6252FKJ _KJC 6252FKK _KKC 6252ALJ _LJB 6252FLJ _LJC 6252FLK _LKC 6252AMK _MKB 6252FMK _MKC 6252KNM _NMD 6252KPM _PMD 6252KQP _QPD 6252KRP _RPD		Model 913 Same as 912 with 316SS base and disc holder		Plain Cap 918BDC_12 81_NDCA 918BED_01 81_NEDA 918BFE_01 81_NFEA 918BGF_01 81_NGFA 918BHG_01 81_NHGA Open Lever 918BDC_14 81_EDCA 918BED_03 81_EEDA 918BFE_03 81_EFEA 918BGF_03 81_EGFA 918BHG_03 81_EHGA Packed Lever 918BDC_17 81_PDCA 918BED_06 81_PEDA 918BFE_06 81_PFEA 918BGF_06 81_PGFA 918BHG_06 81_PHGA		0020-C01 810NDCA 0020-D01 810NEDA 0020-E01 810NFEA 0020-F01 810NGFA 0020-G01 810NHGA		215V-H01 015VZHA 215V-J01 015VZJA 215V-K01 015VZKA	
Model 6182 Top Outlet with bronze/brass trim		Model 6253 (Formerly 253) Same as 6252 with SS semi nozzle and disc ⁴		Plain Cap 913BDCM12 820NDCA 913BEDM01 820NEDA 913BFEM01 820NFEA 913BGM01 820NGFA 913BHG01 820NHGA Open Lever 913BDCM14 820EDCA 913BEDM03 820EEDA 913BFEM03 820EFEA 913BGM03 820EGFA 913BHG03 820EHGA Packed Lever 913BDCM17 820PDCA 913BEDM06 820PEDA 913BFEM06 820PFEA 913BGM06 820PGFA 913BHG06 820PHGA		Model 919 Same as 913 with soft seat ^{6, 8}		Model 20P Same as model 20 with packed lever		Model 337 Cast Iron with pull ring ¹⁰	
6182DC 41ATCDE 6182ED 41ATEDE 6182FE 41ATFEE 6182GF 41ATGFE 6182HG 41ATHGE 6182JH 41ATJHE		6253AJG _JGB 6253FJG _JGC 6253AKH _KHB 6253FKH _KHC 6253FKJ _KJC 6253FKK _KKC 6253ALJ _LJB 6253FLJ _LJC 6253FLK _LKC 6253AMK _MKB 6253FMK _MKC 6253KNM _NMD 6253KPM _PMD 6253KQP _QPD 6253KRP _RPD		Model 919 Same as 913 with soft seat ^{6, 8}		Plain Cap 919BDC_12 82_DCA 919BED_01 82_NEDA 919BFE_01 82_NFEA 919BGF_01 82_NGFA 919BHG_01 82_NHGA Open Lever 919BDC_14 82_EDCA 919BED_03 82_EEDA 919BFE_03 82_EFEA 919BGF_03 82_EGFA 919BHG_03 82_EHGA Packed Lever 919BDC_17 82_PDCA 919BED_06 82_PEDA 919BFE_06 82_PFEA 919BGF_06 82_PGFA 919BHG_06 82_PHGA		020P-C01 810PDCA 020P-D01 810PEDA 020P-E01 810PFEA		0337-H01 015CZHA 0337-J01 015CZJA 0337-K01 015CZKA	
Model 6186 Same as 6182 except maximum pressure is 150 PSIG											
6186DC 41ATCDE 6186ED 41ATEDE 6186FE 41ATFEE 6186GF 41ATGFE 6186HG 41ATHGE											

SPENCE/KUNKLE CROSSOVER CHART

- 1Choose SPENCE model 0031, 0041 or 041A depending on Choice of ASME code Setting
See page 204
- 2Choose SPENCE model 0033, 0043 or 043A depending on Choice of ASME code Setting
See page 204
- 3SPENCE models 0033 and 0043 have EPDM and model 043A has Viton disc insert
- 4Choose SPENCE model 0032, 0042 or 042A depending on Choice of ASME code Setting
See page 204
- 5SPENCE model has Viton disc insert
- 6Kunkle Soft Seat (o-ring) choices - B (Buna N), E (EPR), S (Silicone), V (Viton) or N(Neoprene)
- 7Choose SPENCE model 812 (EPDM), 814 (Viton) or 816 (TFE/25% Glass) o-ring
- 8Choose SPENCE model 822 (EPDM), 824 (Viton) or 826 (TFE/25% Glass) o-ring
- 9SPENCE model 862 (EPDM), 864 (Viton) or 866 (TFE/25% Glass) o-ring
- 10Spence model is 2 x 2-1/2 connections - for vacuum service, outlet connection gets connected to vacuum side

* Pressure limited

This crossover chart is to be used as a guideline ONLY. All applications should be reviewed in the product catalog or by the factory. All valve data should be reviewed before final selection (physical dimensions, capacity requirements, materials, inlet/outlet connections, etc.) Neither Spence Engineering nor it's agents assume any responsibility for the selection and/or cross reference of any product. Spence Engineering does not guarantee that this information is accurate and/or up to date, therefore it should be used only as a guide.

NOTES:

**SAFETY RELIEF
VALVES**

COMMERCIAL/ INDUSTRIAL SAFETY RELIEF VALVES

COMMERCIAL/INDUSTRIAL
SAFETY VALVES



FIGURE 31 BRONZE SERIES

FIGURE 31 / 41 BRONZE SERIES

SIZES 1/2" – 2 1/2"
PRESSURES to 300 PSIG at 422°F

- Meets ASME Section I & VIII Code for Steam, Air & Non-hazardous Gas Service
- "V" or "UV" National Board Certified
- Dual Ring Control See page 206
- Rugged Cast Unitized Bonnet
- SS Spring Supplied as Standard
- Full Nozzle
- Soft Seat Design Available See page 206
- Open Lever Assembly

APPLICATION DATA

- Steam Boilers
- Pressure Reducing Stations
- Unfired Steam Pressure Vessels & Lines
- Accumulators, Sterilizers, Steam Cleaners
- Air compressors, Cookers, Receivers
- Pneumatic Systems
- OEM Equipment

VALVE RATINGS *See Capacity Charts beginning on page 208*

Model	Pressure PSIG (bar)	Temperature °F (°C)
0031/0041/041A/41AT/41AA	5 to 250 (.3 to 17.2)	-20 to 406 (-29 to 208)
0032/0042/042A/42AT/42AA	5 to 300 (.3 to 20.7)	-20 to 422 (-29 to 216)
0033/0043/043A/43AT	5 to 250 (.3 to 17.2)	-20 to 406 (-29 to 208)

APPLICABLE CODES

- ASME Section I "V" for Steam
- ASME Section VIII "UV" for Steam/Air/Gas
- API 527
- Canadian Registration # OG0591.9C
- PED (Consult Factory)

OPTIONS

- Top Outlet Discharge
- BSP Connections
- Soft Seated Valves
- Plain Cap (on selected models)
- Test Reports Available

MODELS

- 0031 - ASME Section I Steam, Bronze Trim
- 0041 - ASME Section VIII Steam, Bronze Trim
- 041A - ASME Section VIII Air, Bronze Trim
- 41AT - Top Outlet on 041A
- 41AA - Plain Cap on 041A (D orifice only)
- 0032 - SS Base & Disc on 0031
- 0042 - SS Base & Disc on 0041
- 042A - SS Base & Disc on 041A
- 42AT - SS Base & Disc on 41AT
- 42AA - SS Base & Disc on 41AA (D orifice only)
- 0033 - EPDM Soft Seat on 0031
- 0043 - EPDM Soft Seat on 0041
- 043A - Viton Soft Seat on 041A
- 43AT - Viton Soft Seat on 41AT

CODE SELECTION CHART

Model				Orifice	Inlet Size	Connections	Set Pressure			
0	0	4	1	D	C	A	-	0	4	0
1	2	3	4	5	6	7	8	9	10	

Model - Position 1, 2, 3 & 4

0031 = ASME Section I Steam, Bronze Trim
 0041 = ASME Section VIII Steam, Bronze Trim
 041A = ASME Section VIII Air, Bronze Trim
 41AT = Top Outlet on 041A
 41AA = Plain Cap on 041A (D orifice only)
 0032 = SS Base & Disc on 0031
 0042 = SS Base & Disc on 0041
 042A = SS Base & Disc on 041A
 42AT = SS Base & Disc on 41AT
 42AA = SS Base & Disc on 41AA
 0033 = EPDM Soft Seat on 0031
 0043 = EPDM Soft Seat on 0041
 043A = Viton Soft Seat on 041A
 43AT = Viton Soft Seat on 41AT

Orifice - Position 5

D
E
F
G
H
J

Inlet Size - Position 6

C = 1/2
D = 3/4
E = 1
F = 1 1/4
G = 1 1/2
H = 2
J = 2 1/2

Connections - Position 7

A = MPT x FPT
 E = MPT x Top
 F = MBSP x FBSP
 Z = Other

Set Pressure - Position 8, 9 & 10

___ = Actual Setting
 LAS - Loosely Assembled*

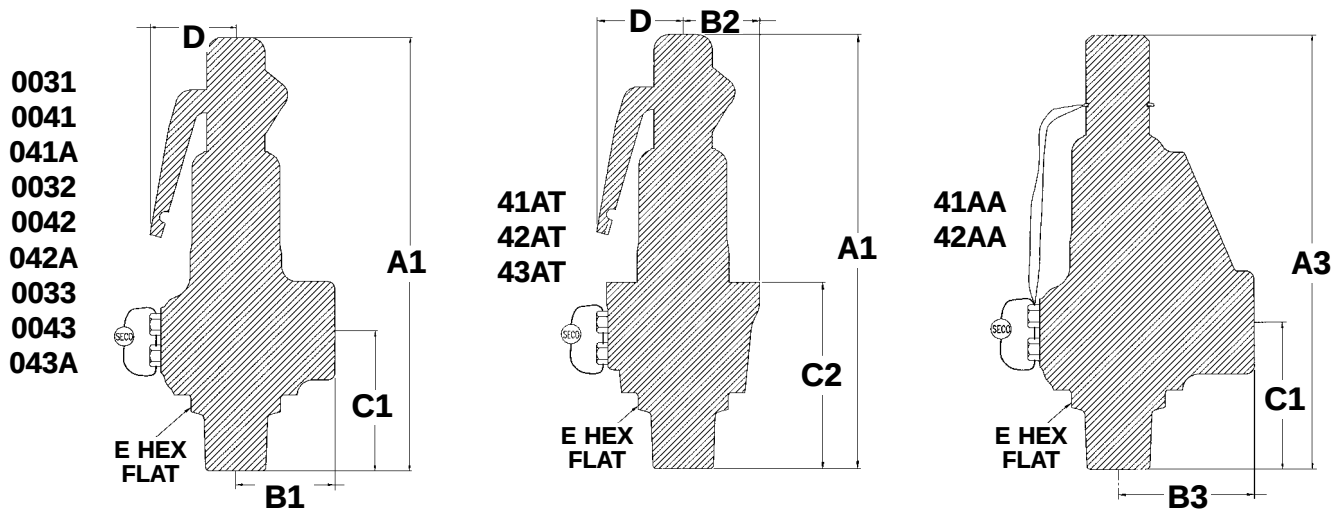
*Spence Certified Assemblers Only
 (use 0031, 0032, 0033, 41AT, 42AT,
 43AT, 41AA or 42AA only)

FIGURE 31 / 41

BRONZE SERIES

SPECIFICATION

The valve shall meet the ASME Section I or VIII Code for steam, air and gas services. It shall be "V" or "UV" National Board Certified. The valve shall have dual blowdown ring to allow better adjustment of the pop and blowdown. The valve shall consist of a unitized bonnet design guaranteeing proper guiding and making the valve extremely dependable in terms of pop action, seat tightness and repeatability. The valve shall be top guided and shall have a full nozzle for optimum flow performance. The valve shall have a stainless steel spring for better corrosion and yield strength. The valve shall meet the API 527 leakage standard requiring bubble tight shutoff up to 90% of set pressure.



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

Model	Inlet	Orifice	Outlet ⁽²⁾	A1	A3	B1	B2	B3	C1	C2	D ⁽¹⁾	E	Weight
****DCA	½ MPT (15)	D	¾ FPT (20)	6⅞ (166.7)	6¼ (158.8)	1⅝ (34.9)	1⅞ (27.0)	1⅝ (47.6)	2¼ (57.2)	2⅞ (73.0)	1⅝ (34.9)	1⅝ (28.6)	2 (0.91)
****DDA	¾ MPT (20)	D	¾ FPT (20)	6⅞ (166.7)	6¼ (158.8)	1⅝ (34.9)	—	1⅝ (47.6)	2¼ (57.2)	—	1⅝ (34.9)	1¼ (31.8)	2¼ (1.02)
****EDA	¾ MPT (20)	E	1 FPT (25)	7⅞ (181.0)	—	1⅝ (41.3)	1¼ (31.8)	—	2⅞ (58.7)	3⅞ (79.4)	1⅝ (34.9)	1¼ (31.8)	2½ (1.13)
****EEA	1 MPT (25)	E	1 FPT (25)	7⅞ (181.0)	—	1⅝ (41.3)	—	—	2⅞ (58.7)	—	1⅝ (34.9)	1½ (38.1)	2¾ (1.25)
****FEA	1 MPT (25)	F	1¼ FPT (32)	9 (228.6)	—	1⅝ (47.6)	1⅞ (36.5)	—	2 1⅞ (71.4)	3⅞ (88.9)	1 1⅞ (42.9)	1½ (38.1)	4 (1.81)
****FFA	1¼ MPT (32)	F	1¼ FPT (32)	9 (228.6)	—	1⅝ (47.6)	—	—	2 1⅞ (71.4)	—	1 1⅞ (42.9)	1¼ (44.5)	4¼ (1.93)
****GFA	1¼ MPT (32)	G	1½ FPT (40)	9 1⅞ (246.1)	—	2⅞ (54.0)	1 1⅞ (42.9)	—	3 (76.2)	3¼ (82.5)	1 1⅞ (42.9)	1⅝ (47.6)	7 (3.18)
****GGA	1½ MPT (40)	G	1½ FPT (40)	9 1⅞ (246.1)	—	2⅞ (54.0)	—	—	3 (76.2)	—	1 1⅞ (42.9)	2⅞ (52.4)	7¼ (3.29)
****HGA	1½ MPT (40)	H	2 FPT (50)	12⅞ (308.0)	—	2⅞ (65.1)	2⅞ (52.4)	—	3½ (88.9)	4 1⅞ (119.1)	2⅞ (69.9)	2¼ (57.2)	13½ (6.12)
****HHA	2 MPT (50)	H	2 FPT (50)	12⅞ (308.0)	—	2 ⅞ (65.1)	—	—	3½ (88.9)	—	2⅞ (69.9)	2⅞ (65.1)	13¾ (6.24)
****JHA	2 MPT (50)	J	2½ FPT (65)	13⅞ (338.1)	—	3⅞ (79.4)	2⅞ (63.5)	—	3⅞ (95.3)	5 (127.0)	2⅞ (69.9)	2¼ (69.9)	17½ (7.94)
****JJA	2½ MPT (65)	J	2½ FPT (65)	13⅞ (338.1)	—	3⅞ (79.4)	—	—	3⅞ (95.3)	—	2⅞ (69.9)	3 (76.2)	17¾ (8.05)

*Accurate to ±1/8".

**** Use appropriate Model Number.

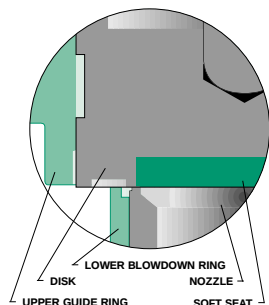
⁽¹⁾ Add 50% to D Dimension when lever is pulled out to manually operate valve.

⁽²⁾ Outlet connections do not apply for **AT top outlet valve.

FIGURE 31 / 41
BRONZE SERIES

FIGURE 31 / 41 BRONZE SERIES SOFT SEATS

Safety Valves with metal seats will start to leak at 90% of set pressure. A Spence Safety Valve equipped with a soft seat seals on both the metal and soft seats (see illustration). As a result, it will not begin to leak until system pressure reaches 95% of set pressure, minimizing system energy loss.



The o-rings in standard soft seat safety valves tend to blow out during discharge. Spence Soft Seat Safety Valves utilize a flat soft seat insert in the disc assembly of the valve that stays in place during operation, thus providing hassle-free operation.

There are many troublesome applications where using a Spence Soft Seat Safety Valve can reduce costly downtime and repair costs. Consider a Spence Soft Seat Safety Valve for:

- Operating very close to set pressure
- Heavy vibration
- Hard-to-hold fluids
- Occasional foreign particles
- Icing problems
- Pipe strain due to excessive discharge

SERVICE RECOMMENDATIONS*

EPDM Soft Seat

WET - -20 to 422°F (-29 to 216°C)

DRY - -20 to 250°F (-29 to 121°C)

Acetone	Freon 22
Acetylene Gas	Hydrazine
Beer	Lindol Hydraulic Fluid
Bleach Liquor	Lye
Brake Fluid	Methanol
Calcium Chloride	Methyl Alcohol
Carbon Monoxide	Methyl Butyl Ketone
Carbonic Acid	Nitrogen
Citric Acid	STEAM
Denatured Alcohol	Sulfur Hexafluoride
Ethylene Diamine	WATER

Viton Soft Seat

-20 to 400°F (-29 to 204°C)

AIR

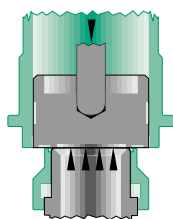
Benzoic Acid	Dowtherm A	Iodine
Benzul Alcohol	Ethane	Kerosene
Butane	Ethyl Alcohol	Linseed Oil
Butyl Alcohol	Ethyl Chloride	Methane
Carbon Disulfide	Ethylene	Mineral Oils
Carbon Tetrachloride	Ethylene Glycol	Natural Gas
Castor Oil	Fuel Oil	Petroleum Oil
Chlorine	Gasoline	Propane
Chromic Acid	Glucose	Propyl Alcohol
Corn Oil	Glycerin	Propylene
Crude Oil	Helium	Sulfur Dioxide
Diesel Oil	Hydraulic Oil	Turpentine
	Hydrogen Gas	

*These recommendations should be used as a guide only. It is the sole responsibility of the user to select suitable materials.

FIGURE 31 BRONZE SERIES DUAL RING CONTROL

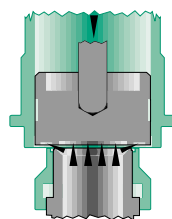
Safety Valves are pressure relief devices actuated by inlet static pressure and characterized by rapid opening or "pop" action. The difference between Safety Valves from different manufacturers is how well they do this.

Spence Figure 31 Safety Valves have Dual Ring Control which allows for finer adjustment of the "popping" action and length of "blowdown". This allows exceptional flow efficiency and maximum lifting force while minimizing system energy loss.



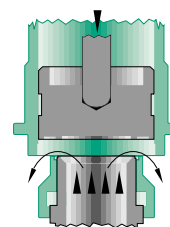
CLOSED

System pressure is pushing upward against the disk which is held closed by the downward force of the spring against the spindle.



OPENING

When system pressure rises above the set pressure of the spring, the disc begins to lift. This simmer/warn stage allows system pressure to enter the "huddling chamber" where it acts on a larger, secondary area of the disc. This magnified force causes the valve to "pop" open.



OPEN

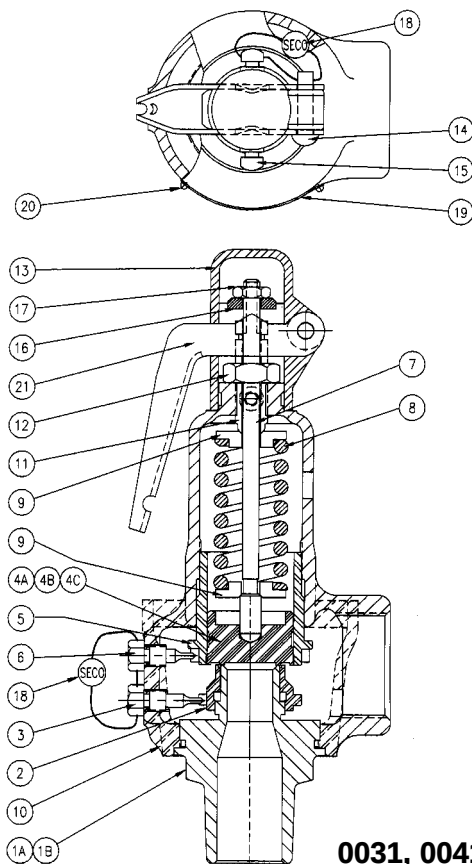
As pressure increases, the disc continues to lift until fully open. When pressure is reduced to a level below the set point of the valve, the spring force against the spindle will snap shut the disc.

FIGURE 31 / 41 BRONZE SERIES

MATERIALS OF CONSTRUCTION

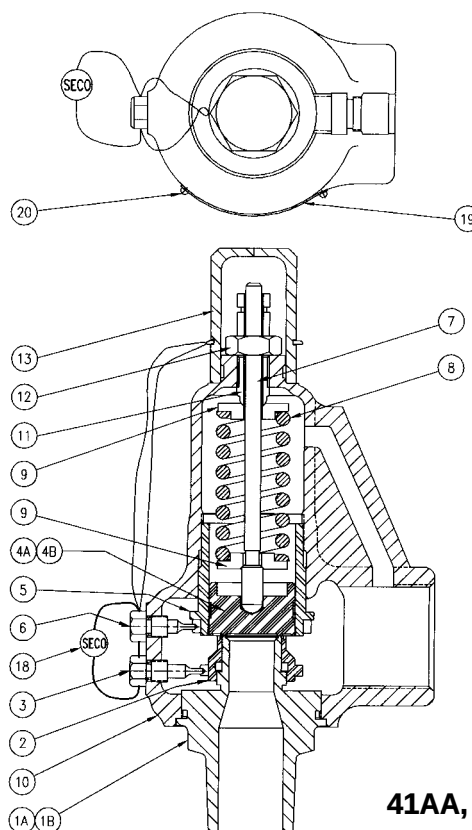
Ref	Part Name	Material
1A	Base/Nozzle - Bronze	Brass or Brz ASTM B283 or ASME SB62
1B	Base/Nozzle - SST	316 SST ASTM A276
2	Base Ring	Brass or Brz ASTM B283 or ASTM B62
3	Nozzle Ring Set Screw	Brass ASTM B16
4A	Disc - Bronze Metal	Brass or Brz ASTM B16 or ASTM B62
4B	Disc - SST Metal	316 SST ASTM A276
4C	Disc Assembly - Soft	Brass or Brz - EPDM/Viton
5	Guide Ring	Brass or Brz B283 or B584
6	Guide Ring Set Screw	Brass ASTM B16
7	Spindle	Steel ASTM A108
8	Spring	302 SST/17-7 SST
9	Spring Washer	Steel ASTM A108
10	Bonnet†	Cast Brz ASME SB62
11	Adjusting Bolt	Brass ASTM B16
12	Adjusting Bolt Locknut	Steel (Plated) SAE J995 GRD 2
13	Lifting Cap	Zinc Alloy
14	Lifting Cap Pin	Steel
15	Lifting Cap Lockscrew	Plated Steel
16	Spindle Nut	Steel ASTM
17	Spindle Nut Locknut	Plated Steel
18	Seal and Wire	Lead and SST
19	Nameplate	SST
20	Drive Screw	SST
21	Lever	Steel (Plated)

†41AT, 42AT, 43AT denoted by dotted line.



**0031, 0041, 041A
0032, 0042, 042A
0033, 0043, 043A
41AT, 42AT, 43AT**

Ref	Part Name	Material
1A	Base/Nozzle - Bronze	Brass ASTM B283
1B	Base/Nozzle - SST	316 SST ASTM A276
2	Base Ring	Brass ASTM B283
3	Nozzle Ring Set Screw	Brass ASTM B16
4A	Disc - Bronze Metal	Brass ASTM B16
4B	Disc - SST Metal	316 SST ASTM A276
5	Guide Ring	Brass B283
6	Guide Ring Set Screw	Brass ASTM B16
7	Spindle	Steel ASTM A108
8	Spring	302 SST/17-7 SST
9	Spring Washer	Steel ASTM A108
10	Bonnet	Cast Brz ASME SB62
11	Adjusting Bolt	Brass ASTM B16
12	Adjusting Bolt Locknut	Steel (Plated) SAE J995 GRD 2
13	Cap	Brass ASTM B16
18	Seal and Wire	Lead and SST
19	Nameplate	SST
20	Drive Screw	SST



41AA, 42AA

**FIGURE 31 / 41
BRONZE SERIES**

SATURATED STEAM CAPACITY CHART

BRONZE MODELS 31, 32, 33

ASME Section I V" 90% rated at 3% Overpressure LBS/HR (KGS/HR)
Flow Coefficient = .9 x .975 = .878

LBS/HR

KGS/HR

Set Pressure PSIG	Orifice Area in ²					
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479	J 1.391
5 *	116	207	325	532	831	1364
10 *	143	255	400	654	1023	1678
15	170	303	475	776	1213	1991
20	197	351	550	899	1405	2305
25	224	398	625	1021	1596	2619
30	250	446	700	1144	1788	2933
35	277	494	774	1266	1979	3247
40	304	542	849	1388	2171	3561
45	331	589	924	1511	2362	3875
50	358	637	999	1633	2553	4189
55	385	685	1074	1756	2745	4503
60	411	733	1149	1878	2936	4817
65	438	780	1224	2001	3128	5131
70	466	829	1300	2126	3323	5451
75	493	878	1377	2252	3520	5774
80	521	928	1455	2378	3717	6098
85	548	977	1532	2504	3914	6421
90	576	1026	1609	2630	4111	6745
95	604	1075	1686	2756	4308	7068
100	631	1124	1763	2882	4506	7392
105	659	1174	1840	3008	4703	7715
110	687	1223	1917	3134	4900	8038
115	714	1272	1995	3261	5097	8362
120	742	1321	2072	3387	5294	8685
125	769	1370	2149	3513	5491	9009
130	797	1420	2226	3639	5688	9332
135	825	1469	2303	3765	5886	9655
140	852	1518	2380	3891	6083	9979
145	880	1567	2457	4017	6280	10302
150	908	1616	2535	4143	6477	10626
155	935	1666	2612	4269	6674	10949
160	963	1715	2689	4396	6871	11273
165	990	1764	2766	4522	7068	11596
170	1018	1813	2843	4648	7266	11919
175	1046	1862	2920	4774	7463	12243
180	1073	1912	2997	4900	7660	12566
185	1101	1961	3075	5026	7857	12890
190	1128	2010	3152	5152	8054	13213
195	1156	2059	3229	5178	8251	13537
200	1184	2108	3306	5404	8448	13860
205	1211	2158	3383	5531	8646	14183
210	1239	2207	3460	5657	8843	14509
215	1267	2256	3538	5783	9040	14830
220	1294	2305	3615	5909	9237	15154
225	1322	2354	3692	6035	9434	15477
230	1349	2404	3769	6161	9631	15800
235	1377	2453	3846	6287	9829	16124
240	1405	2502	3923	6413	10026	16447
245	1432	2551	4000	6540	10223	16771
250	1460	2600	4078	6666	10420	17094
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
1.0	6	10	15	25	39	65

Set Pressure Barg	Orifice Area cm ²					
	D .766	E 1.365	F 2.141	G 3.499	H 5.47	J 8.974
0.4*	55	97	153	250	391	641
0.6*	62	110	173	282	441	723
0.8*	69	123	192	314	491	806
1*	76	135	212	346	542	889
1.2	83	148	232	379	592	971
1.4	90	160	251	411	642	1054
1.6	97	173	271	443	693	1136
1.8	104	185	291	475	743	1219
2	111	198	310	508	793	1302
2.2	118	211	330	540	844	1384
2.4	125	223	350	572	894	1467
2.6	132	236	370	604	944	1549
2.8	139	248	389	636	995	1632
3	146	261	409	669	1045	1715
3.2	153	273	429	701	1095	1797
3.4	161	286	448	733	1146	1880
3.6	168	299	468	765	1196	1962
3.8	175	311	488	797	1247	2045
4	182	324	507	830	1297	2128
4.2	189	336	527	862	1347	2210
4.4	196	349	547	894	1398	2293
4.6	203	361	567	926	1448	2375
4.8	210	374	587	959	1500	2460
5	217	387	607	993	1552	2545
5.2	225	400	627	1026	1603	2631
5.4	232	413	648	1059	1655	2716
5.6	239	426	668	1092	1707	2801
5.8	246	439	688	1125	1759	2886
6	254	452	709	1158	1811	2971
6.5	272	484	759	1241	1941	3184
7	290	517	810	1324	2070	3396
7.5	308	549	861	1407	2200	3609
8	326	581	912	1490	2329	3822
8.5	345	614	962	1573	2459	4034
9	363	646	1013	1656	2589	4247
9.5	381	678	1064	1739	2718	4460
10	399	711	1114	1822	2848	4672
10.5	417	743	1165	1905	2978	4885
11	435	775	1216	1988	3107	5098
11.5	454	808	1267	2071	3237	5310
12	472	840	1317	2154	3367	5523
12.5	490	873	1368	2237	3496	5736
13	508	905	1419	2319	3626	5948
13.5	526	937	1470	2402	3756	6161
14	544	970	1520	2485	3885	6374
14.5	563	1002	1571	2568	4015	6586
15	581	1034	1622	2651	4144	6799
15.5	599	1067	1673	2734	4274	7012
16	617	1099	1723	2817	4404	7224
16.5	635	1131	1774	2900	4533	7437
17	653	1164	1825	2983	4663	7650
17.5	672	1196	1875	3066	4793	7862
18	690	1228	1926	3149	4922	8075
18.5	708	1261	1977	3232	5052	8288
19	726	1293	2028	3315	5182	8500
19.5	744	1325	2078	3398	5311	8713
20	762	1358	2129	3481	5441	8926
20.5	780	1390	2180	3563	5571	9139
21	799	1423	2231	3646	5700	9351
21.5	817	1455	2281	3729	5830	9564
0.1	3.6	6.4	10.1	16.6	25.9	42.5

* Pressure settings below 15 PSIG (1.034 barg) are non code.

SATURATED STEAM CAPACITY CHART

BRONZE MODELS 41, 42, 43

ASME Section VIII "UV" 90% rated at 10% Overpressure LBS/HR (KGS/HR)
Flow Coefficient = .9 x .975 = .878

LBS/HR

Set Pressure PSIG	Orifice Area in ²					
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479	J 1.391
5 *	122	217	341	557	870	1428
10 *	149	265	416	679	1062	1742
15	176	313	491	802	1254	2057
20	203	361	566	925	1445	2371
25	229	409	641	1047	1637	2686
30	256	456	716	1170	1829	3000
35	286	509	798	1305	2040	3346
40	315	562	881	1440	2251	3692
45	345	614	963	1575	2461	4038
50	374	667	1046	1709	2672	4384
55	404	720	1128	1844	2883	4730
60	434	772	1211	1979	3094	5076
65	463	825	1293	2114	3305	5422
70	493	877	1376	2249	3516	5768
75	522	930	1458	2384	3727	6114
80	552	983	1541	2519	3937	6460
85	581	1035	1623	2654	4148	6805
90	611	1088	1706	2789	4359	7151
95	640	1140	1788	2923	4570	7497
100	670	1193	1871	3058	4781	7843
105	699	1246	1953	3193	4992	8189
110	729	1298	2036	3328	5203	8535
115	758	1351	2118	3463	5414	8881
120	788	1404	2201	3598	5624	9227
125	818	1456	2283	3733	5835	9573
130	847	1509	2366	3868	6046	9919
135	877	1561	2448	4003	6257	10265
140	906	1614	2531	4137	6468	10611
145	936	1667	2614	4272	6679	10957
150	965	1719	2696	4407	6890	11303
155	995	1772	2779	4542	7100	11648
160	1024	1825	2861	4677	7311	11994
165	1054	1877	2944	4812	7522	12340
170	1083	1930	3026	4947	7733	12686
175	1113	1982	3109	5082	7944	13032
180	1143	2035	3191	5217	8155	13378
185	1172	2088	3274	5352	8366	13724
190	1202	2140	3356	5486	8577	14070
195	1231	2193	3439	5621	8787	14416
200	1261	2246	3521	5756	8998	14762
205	1290	2298	3604	5891	9209	15108
210	1320	2351	3686	6026	9420	15454
215	1349	2403	3769	6161	9631	15800
220	1379	2456	3851	6296	9842	16146
225	1408	2509	3934	6431	10053	16492
230	1438	2561	4016	6566	10263	16837
235	1468	2614	4099	6700	10474	17183
240	1497	2667	4181	6835	10685	17529
245	1527	2719	4264	6970	10896	17875
250	1556	2772	4346	7105	11107	18221
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
1.0	6.0	10.5	16.5	27.0	42.2	69

KGS/HR

Set Pressure Barg	Orifice Area cm ²					
	D .766	E 1.365	F 2.141	G 3.499	H 5.47	J 8.974
0.4*	57	102	160	261	409	670
0.6*	64	115	180	294	459	753
0.8*	71	127	199	326	509	836
1*	78	140	219	358	560	918
1.2	86	152	239	390	610	1001
1.4	93	165	259	423	661	1084
1.6	100	177	278	455	711	1167
1.8	107	190	298	487	762	1249
2	114	203	318	519	812	1332
2.2	121	216	339	554	866	1420
2.4	129	230	360	589	921	1511
2.6	137	244	382	625	977	1602
2.8	145	258	404	660	1032	1693
3	152	271	426	696	1088	1784
3.2	160	285	447	731	1143	1875
3.4	168	299	469	767	1199	1966
3.6	176	313	491	802	1254	2057
3.8	183	327	512	838	1309	2148
4	191	341	534	873	1365	2239
4.2	199	354	556	909	1420	2330
4.4	207	368	578	944	1476	2421
4.6	215	382	599	980	1531	2512
4.8	222	396	621	1015	1587	2603
5	230	410	643	1051	1642	2694
5.2	238	424	664	1086	1698	2785
5.4	246	438	686	1122	1753	2876
5.6	253	451	708	1157	1809	2967
5.8	261	465	729	1192	1864	3058
6	269	479	751	1228	1920	3149
6.2	277	493	773	1263	1975	3240
6.4	284	507	795	1299	2031	3331
6.6	292	521	816	1334	2086	3422
7	308	548	860	1405	2197	3604
7.5	327	583	914	1494	2336	3832
8	347	617	968	1583	2474	4059
8.5	366	652	1022	1671	2613	4287
9	386	687	1077	1760	2752	4514
9.5	405	721	1131	1849	2890	4742
10	424	756	1185	1938	3029	4969
10.5	444	790	1240	2026	3168	5196
11	463	825	1294	2115	3306	5424
11.5	483	860	1348	2204	3445	5651
12	502	894	1402	2292	3584	5879
12.5	522	929	1457	2381	3722	6106
13	541	964	1511	2470	3861	6334
13.5	560	998	1565	2559	4000	6561
14	580	1033	1619	2647	4138	6789
14.5	599	1067	1674	2736	4277	7016
15	619	1102	1728	2825	4416	7244
15.5	638	1137	1782	2913	4554	7471
16	658	1171	1836	3002	4693	7699
16.5	677	1206	1891	3091	4832	7926
17	696	1240	1945	3179	4970	8154
17.5	716	1275	1999	3268	5109	8381
18	735	1310	2053	3357	5248	8609
18.5	755	1344	2108	3446	5386	8836
19	774	1379	2162	3534	5525	9064
19.5	794	1413	2216	3623	5664	9291
20	813	1448	2271	3712	5802	9519
20.5	832	1483	2325	3800	5941	9746
0.1	3.9	6.9	10.9	17.7	27.7	45.5

BRONZE SERIES
STEAM CAPACITY

* Pressure settings below 15 PSIG (1.034 barg) are non code.

AIR CAPACITY CHART

BRONZE MODELS 41A, 42A, 43A, 41AT, 42AT, 43AT, 41AA, 42AA

ASME Section VIII "UV" 90% rated at 10% Overpressure SCFM (M³/HR)

Flow Coefficient = .9 x .975 = .878

SCFM

Set Pressure PSIG	Orifice Area in ²					
	D	E	F	G	H	J
	0.1188	0.2116	0.3318	0.5424	0.8479	1.391
5 *	43	77	121	198	310	508
10 *	53	94	148	242	378	620
15	63	111	175	285	446	732
20	72	128	201	329	514	844
25	82	145	228	373	583	956
30	91	162	255	416	651	1068
35	102	181	284	464	726	1191
40	112	200	313	512	801	1314
45	123	219	343	560	876	1437
50	133	237	372	608	951	1560
55	144	256	402	656	1026	1684
60	154	275	431	704	1101	1807
65	165	294	460	753	1176	1930
70	175	312	490	801	1251	2053
75	186	331	519	849	1326	2176
80	196	350	548	897	1402	2299
85	207	368	578	945	1477	2422
90	217	387	607	993	1552	2545
95	228	406	637	1041	1627	2669
100	238	425	666	1089	1702	2792
105	249	443	695	1137	1777	2915
110	259	462	725	1185	1852	3038
115	270	481	754	1233	1927	3161
120	280	500	783	1281	2002	3284
125	291	518	813	1329	2077	3407
130	302	537	842	1377	2152	3531
135	312	556	872	1425	2227	3654
140	323	575	901	1473	2302	3777
145	333	593	930	1521	2377	3900
150	344	612	960	1569	2452	4023
155	354	631	989	1617	2527	4146
160	365	649	1018	1665	2602	4269
165	375	668	1048	1713	2677	4392
170	386	687	1077	1761	2753	4516
175	396	706	1106	1809	2828	4639
180	407	724	1136	1857	2903	4762
185	417	743	1165	1905	2978	4885
190	428	762	1195	1953	3053	5008
195	438	781	1224	2001	3128	5131
200	449	799	1253	2049	3203	5254
205	459	818	1283	2097	3278	5378
210	470	837	1312	2145	3353	5501
215	480	855	1341	2193	3428	5624
220	491	874	1371	2241	3503	5747
225	501	893	1400	2289	3578	5870
230	512	912	1430	2337	3653	5993
235	522	930	1459	2385	3728	6116
240	533	949	1488	2433	3803	6239
245	543	968	1518	2481	3878	6363
250	554	987	1547	2529	3953	6486
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
1.0	2.2	3.6	6.0	9.6	15.0	24.6

M³/HR

Set Pressure Barg	Orifice Area cm ²					
	D	E	F	G	H	J
	.766	1.365	2.141	3.499	5.47	8.974
0.4*	76	136	213	349	545	894
0.6*	86	153	240	392	612	1004
0.8*	95	170	266	435	679	1114
1*	105	186	292	478	747	1225
1.2	114	203	318	521	814	1335
1.4	123	220	345	564	881	1445
1.6	133	237	371	607	948	1556
1.8	142	253	397	650	1016	1666
2	152	270	424	693	1083	1776
2.2	162	288	452	738	1154	1894
2.4	172	307	481	786	1228	2015
2.6	182	325	510	833	1302	2137
2.8	193	343	539	880	1376	2258
3	203	362	568	928	1450	2379
3.2	214	380	596	975	1524	2501
3.4	224	399	625	1022	1598	2622
3.6	234	417	654	1070	1672	2743
3.8	245	436	683	1117	1746	2865
4	255	454	712	1164	1820	2986
4.2	265	473	741	1212	1894	3107
4.4	276	491	770	1259	1968	3229
4.6	286	510	799	1306	2042	3350
4.8	296	528	828	1354	2116	3471
5	307	547	857	1401	2190	3593
5.2	317	565	886	1448	2264	3714
5.4	328	583	915	1496	2338	3835
5.6	338	602	944	1543	2412	3957
5.8	348	620	973	1590	2486	4078
6	359	639	1002	1637	2560	4199
6.2	369	657	1031	1685	2634	4321
6.4	379	676	1060	1732	2708	4442
6.6	390	694	1088	1779	2782	4563
7	410	731	1146	1874	2930	4806
7.5	436	777	1219	1992	3114	5109
8	462	823	1291	2111	3299	5413
8.5	488	870	1363	2229	3484	5716
9	514	916	1436	2347	3669	6019
9.5	540	962	1508	2465	3854	6323
10	566	1008	1581	2584	4039	6626
10.5	592	1054	1653	2702	4224	6929
11	618	1100	1725	2820	4409	7233
11.5	644	1146	1798	2939	4594	7536
12	670	1193	1870	3057	4779	7839
12.5	695	1239	1942	3175	4964	8143
13	721	1285	2015	3293	5148	8446
13.5	747	1331	2087	3412	5333	8749
14	773	1377	2159	3530	5518	9053
14.5	799	1423	2232	3648	5703	9356
15	825	1469	2304	3767	5888	9659
15.5	851	1516	2376	3885	6073	9963
16	877	1562	2449	4003	6258	10266
16.5	903	1608	2521	4121	6443	10570
17	929	1654	2594	4240	6628	10873
17.5	955	1700	2666	4358	6813	11176
18	980	1746	2738	4476	6998	11480
18.5	1006	1792	2811	4595	7182	11783
19	1032	1839	2883	4713	7367	12086
19.5	1058	1885	2955	4831	7552	12390
20	1084	1931	3028	4949	7737	12693
20.5	1110	1977	3100	5068	7922	12996
0.1	5.2	9.2	14.5	23.6	37	60.7

* Pressure settings below 15 PSIG (1.034 barg) are non code.

NOTES:



FIGURE 31 CAST IRON SERIES

FIGURE 31 / 41 CAST IRON SERIES

SIZES 1½" – 6"
PRESSURES to 250 PSIG at 406°F

- Meets ASME Section I & VIII Code for Steam, Air & Non-hazardous Gas Service
- "V" or "UV" National Board Certified
- Dual Ring Control See page 206
- Heavy Duty Construction
- Flanged or Threaded Connections
- SS Trim Design Available
- Heavy Duty Open Lever Assembly

OPTIONS

- SS Trim
- BSP Connections
- Test Reports Available

MODELS

- 0031 - ASME Section I Steam, Bronze Trim
- 0041 - ASME Section VIII Steam, Bronze Trim
- 041A - ASME Section VIII Air, Bronze Trim
- 0032 - SS Base & Disc on 0031
- 0042 - SS Base & Disc on 0041
- 042A - SS Base & Disc on 041A

APPLICABLE CODES

- ASME Section I "V" for Steam
- ASME Section VIII "UV" for Steam/Air/Gas
- API 527
- Canadian Registration # OG0591.9C

APPLICATION DATA

- Steam Boilers
- Pressure Reducing Stations
- Unfired Steam Pressure Vessels & Lines
- Air compressors, Cookers, Receivers
- Pneumatic Systems
- OEM Equipment

VALVE RATINGS *See Capacity Charts beginning on page 215*

Model	Pressure PSIG (bar)	Temperature °F (°C)
All	5 to 250 (.3 to 17.2)	-20 to 406 (-29 to 208)

CODE SELECTION CHART

Model				Orifice	Inlet Size	Connec- tions	Set Pressure		
0	4	1	A	K	H	C	-	1	0 0
1	2	3	4	5	6	7	8	9	10

Model -

Position 1, 2, 3 & 4

- 0031 = ASME Section I Steam, Bronze Trim
- 0041 = ASME Section VIII Steam, Bronze Trim
- 041A = ASME Section VIII Air, Bronze Trim
- 0032 = SS Base & Disc on 0031
- 0042 = SS Base & Disc on 0041
- 042A = SS Base & Disc on 041A

Orifice -

Position 5

- J
- K
- L
- M
- N
- P
- Q
- R

Inlet Size -

Position 6

- G = 1½"
- H = 2"
- J = 2½"
- K = 3"
- M = 4"
- P = 6"

Connections -

Position 7

- B = FPT x FPT
- C = 250# x FPT
- D = 250# x 125#
- Z = Other

Set Pressure -

Position 8, 9 & 10

- ___ = Actual Setting
- LAS - Loosely Assembled†

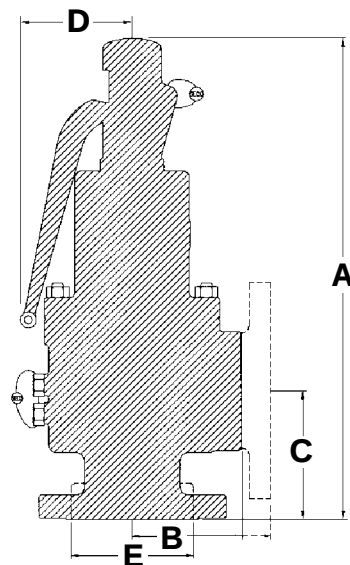
†Spence Certified Assemblers Only
(use 0031 or 0032 only)

FIGURE 31 / 41

CAST IRON SERIES

SPECIFICATION

The valve shall meet the ASME Section I or VIII Code for steam, air and gas services. It shall be "V" or "UV" National Board Certified. The valve shall have dual blowdown ring to allow better adjustment of the pop and blowdown. The valve shall be top guided and shall have a semi nozzle for optimum flow performance. The valve shall have an open lever assembly. The valve shall meet the API 527 leakage standard requiring bubble tight shutoff up to 90% of set pressure.



0031, 0041, 041A
0032, 0042, 042A

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

Model	Inlet	Orifice	Outlet	A	B	C	D ⁽¹⁾	E	Weight
****JGB	1½" FPT (40)	J	2½" FPT (65)	15⅞ (384.2)	3½ (88.9)	4¼ (108)	3 (76.2)	3¼ (82.6)	29 (13.2)
****JGC	1½" 250# (40)	J	2½" FPT (65)	15⅞ (384.2)	3½ (88.9)	4¼ (108)	3 (76.2)	—	36 (16.3)
****JHC	2" 250# (50)	J	3" FPT (80)	15¾ (400.1)	4 (101.6)	45/8 (117.5)	3½ (88.9)	—	42 (19.1)
****KHB	2" FPT (50)	K	3" FPT (80)	15¾ (400.1)	4 (101.6)	4¼ (117.5)	3½ (88.9)	3¾ (92.1)	36 (16.3)
****KHC	2" 250# (50)	K	3" FPT (80)	15¾ (400.1)	4 (101.6)	4⅝ (117.5)	3½ (88.9)	—	42 (19.1)
****KJC	2½" 250# (65)	K	3" FPT (80)	15¾ (400.1)	4 (101.6)	4¾ (120.7)	3½ (88.9)	—	45 (20.4)
****LJB	2½" FPT (65)	L	4" FPT (100)	23 ⁽²⁾ (584.2)	5⅞ (130.2)	5½ (139.7)	6 (152.4)	4½ (114.3)	97 (44.0)
****LJC	2½" 250# (65)	L	4" FPT (100)	23 ⁽²⁾ (584.2)	5⅞ (130.2)	5½ (139.7)	6 (152.4)	—	105 (47.6)
****KKC	3" 250# (80)	K	3" FPT (80)	15¾ (400.1)	4 (101.6)	5 (127)	3½ (88.9)	—	48 (21.8)
****LKC	3" 250# (80)	L	4" FPT (100)	23 ⁽²⁾ (584.2)	5⅞ (130.2)	5½ (139.7)	6 (152.4)	—	107 (48.5)
****MKB	3" FPT (80)	M	4" FPT (100)	23⅞ ⁽²⁾ (587.4)	5⅞ (130.2)	55/8 (142.9)	6 (152.4)	4½ (114.3)	99 (44.9)
****MKC	3" 250# (80)	M	4" FPT (100)	23 ⁽²⁾ (584.2)	5⅞ (130.2)	5½ (139.7)	6 (152.4)	—	107 (48.5)
****NMD	4" 250# (100)	N	6" 125# (150)	29⅞ ⁽²⁾ (749.3)	7¼ (184.2)	6¾ (171.5)	6 (152.4)	—	215 (97.5)
****PMD	4" 250# (100)	P	6" 125# (150)	29⅞ ⁽²⁾ (749.3)	7¼ (184.2)	6¾ (171.5)	6 (152.4)	—	215 (97.5)
****QPD ⁽²⁾	6" 250# (150)	Q	8" 125# (200)	39⅞ ⁽²⁾ (1003.3)	10 (254)	9¼ (235)	10½ (266.7)	—	605 (274.4)
****RPD ⁽²⁾	6" 250# (150)	R	8" 125# (200)	39⅞ ⁽²⁾ (1003.3)	10 (254)	9¼ (235)	10½ (266.7)	—	605 (274.4)

*Accurate to ±1/8".

**** Use appropriate Model Number.

⁽¹⁾ Add 50% to D Dimension when lever is pulled out to manually operate valve.

⁽²⁾ Dimensions are current as of printing, consult factory for updated dimensions as they may change.

FIGURE 31 / 41
CAST IRON SERIES

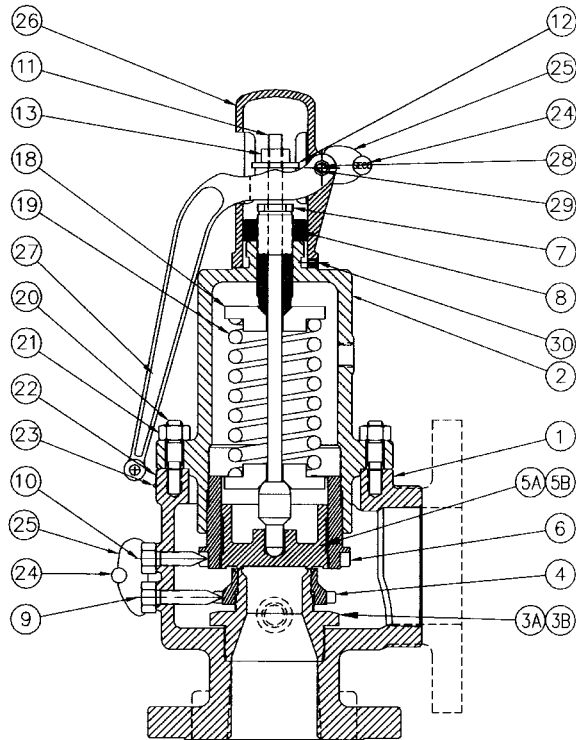
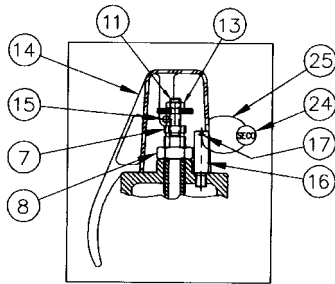


FIGURE 31 CAST IRON SERIES



CAP & LEVER CONFIGURATION
FOR J & K ORIFICES

FIGURE 31 / 41 CAST IRON SERIES

MATERIALS OF CONSTRUCTION

Ref	Part Name	Material
1	Body	Cast Iron ASTM A126-B
2	Bonnet	Cast Iron ASTM A126-B
3A	Nozzle - Bronze	Brass or Bronze ASTM B16 or B62
3B	Nozzle - SST	SST ASME SA351, CF8M or ASME SA479, S31600
4	Nozzle Ring	Bronze ASTM B584-C84400
5A	Disc - Bronze	Brass or Bronze ASTM B16 or B62
5B	Disc - SST	SST ASTM A479, S31600
6	Guide Ring	ASTM B584-C84400
7	Adjusting Bolt	Brass ASTM B16
8	Adjusting Bolt Locknut	Steel, Zinc Plated
9	Nozzle Ring Set Screw	Brass ASTM B16
10	Guide Ring Set Screw	Brass ASTM B16
11	Spindle	Steel ASTM A108 Grade 1212
12	Spindle Nut	Steel ASTM A108 Grade 1212
13	Spindle Nut Locknut	Steel, Zinc Plated
14	Lifting Cap	Zinc Alloy Zamac #3
15	Lifting Cap Pins	Steel, Zinc Plated AISI 1020
16	Pivot Post	Steel AISI 1020
17	Post Pin	Steel, Zinc Plated AISI 1070
18	Spring Washer	Steel AISI 1212
19	Spring	Steel Zinc Plated
20	Stud	Steel, Chrome-Moly ASTM A193 B7
21	Stud Nut	Steel, Chrome-Moly ASTM A194 2H
22	Nameplate	SST AISI 304
23	Nameplate Screws	SST Commercial 18-8
24	Lead Seal	Lead
25	Seal Wire	SST AISI 304
26	Lifting Cap	Cast Iron A126-B*
27	Lifting Lever	Cast Iron ASTM A126-B
28	Clevis Pin	Steel, Zinc Plated
29	Cotter Pin	Steel
30	Liftcap Lockscrew	Steel

*Ductile Iron for 4" and above.

ASTM A395 Grade 60-40-18

SATURATED STEAM CAPACITY CHART

CAST IRON MODELS 31 & 32

ASME Section I "V" 90% rated at 3% Overpressure LBS/HR (KGS/HR)

Flow Coefficient = .9 x .975 = .878

LBS/HR

Set Pressure PSIG	Orifice Area, in ²							
	J	K	L	M	N	P	Q	R
5 *	1.391	1.892	2.935	3.715	4.468	6.564	11.365	16.475
10 *	1363	1854	2875	3640	4377	6431	11134	16141
15	1465	2281	3538	4478	5386	7912	13700	19860
20	1991	2708	4200	5318	6394	9394	16265	23579
25	2305	3135	4863	6157	7403	10876	18831	27298
30	2619	3562	5526	6996	8412	12358	21396	31017
35	2983	3989	6188	7835	9420	13839	23962	34736
40	3247	4416	6851	8674	10429	15321	26527	38455
45	3561	4843	7513	9512	11437	16803	29093	42174
50	3875	5270	8176	10351	12446	18285	31658	45893
55	4189	5697	8838	11190	13455	19766	34224	49612
60	4503	6125	9501	12029	14463	21248	36789	53331
65	4817	6552	10163	12868	15472	22730	39355	57050
70	5131	6979	10826	13707	16480	24212	41920	60769
75	5451	7414	11502	14562	17509	25723	44537	64562
80	5774	7854	12184	15426	18548	27249	47180	68393
85	6098	8294	12866	16290	19587	28775	49822	72223
90	6421	8734	13549	17154	20626	30302	52464	76054
95	6745	9174	14231	18018	21665	31828	55107	79884
100	7068	9614	14914	18882	22703	33354	57749	83715
105	7392	10054	15596	19746	23742	34880	60392	87546
110	7715	10494	16279	20610	24781	36406	63034	91376
115	8038	10934	16961	21474	25820	37932	65677	95207
120	8362	11374	17643	22338	26859	39459	68319	99037
125	8685	11813	18326	23202	27898	40985	70962	102868
130	9009	12253	19008	24066	28937	42511	73604	106699
135	9332	12693	19691	24930	29975	44037	76247	110529
140	9655	13133	20373	25794	31014	45563	78889	114360
145	9979	13573	21055	26658	32053	47090	81532	118190
150	10302	14013	21738	27522	33092	48616	84174	122021
155	10626	14453	22420	28386	34131	50142	86817	125851
160	10949	14893	23103	29250	35170	51668	89459	129682
165	11273	15333	23785	30114	36208	53194	92101	133513
170	11596	15773	24468	30978	37247	54721	94744	137343
175	11919	16212	25150	31842	38286	56247	97386	141174
180	12243	16652	25832	32706	39325	57773	100029	145004
185	12566	17092	26515	33570	40364	59299	102671	148835
190	12890	17532	27197	34434	41403	60825	105314	152666
195	13213	17972	27880	35298	42442	62351	107956	156496
200	13537	18412	28562	36162	43480	63878	110599	160327
205	13860	18852	29244	37026	44519	65404	113241	164157
210	14183	19292	29927	37890	45558	66930	115884	167988
215	14507	19732	30609	38754	46597	68456	118526	171818
220	14830	20172	31292	39618	47636	69982	121169	175649
225	15154	20612	31974	40482	48675	71509	123811	179480
230	15477	21051	32656	41346	49714	73035	126453	183310
235	15800	21491	33339	42210	50752	74561	129096	187141
240	16124	21931	34021	43074	51791	76087	131738	190971
245	16447	22371	34704	43938	52830	77613	134381	194802
250	16771	22811	35386	44802	53869	79140	137023	198633
1.0	64.6	88.0	136.4	172.8	207.8	305.2	528.4	766.0

KGS/HR

Set Pressure Barg	Orifice Area, cm ²							
	J	K	L	M	N	P	Q	R
0.4*	8.97	12.21	18.94	23.97	28.83	42.35	73.32	106.29
0.6*	641	872	1352	1712	2059	3025	5237	7591
0.8*	724	984	1527	1932	2324	3414	5912	8570
1*	806	1097	1701	2153	2589	3804	6587	9548
1.2	889	1209	1875	2374	2855	4194	7262	10527
1.4	971	1321	2050	2594	3120	4584	7937	11505
1.6	1054	1434	2224	2815	3385	4974	8611	12483
1.8	1137	1546	2398	3036	3651	5363	9286	13462
2	1219	1658	2573	3256	3916	5753	9961	14440
2.2	1302	1771	2747	3477	4182	6143	10636	15419
2.4	1384	1883	2921	3697	4447	6533	11311	16397
2.6	1467	1995	3095	3918	4712	6923	11986	17376
2.8	1550	2108	3270	4139	4978	7313	12661	18354
3	1632	2220	3444	4359	5243	7702	13336	19332
3.2	1715	2333	3618	4580	5508	8092	14011	20311
3.4	1797	2445	3793	4801	5774	8482	14686	21289
3.6	1880	2557	3967	5021	6039	8872	15361	22268
3.8	1963	2670	4141	5242	6304	9262	16036	23246
4	2045	2782	4316	5462	6570	9652	16711	24225
4.2	2128	2894	4490	5683	6835	10041	17386	25203
4.4	2211	3007	4664	5904	7100	10431	18061	26181
4.6	2293	3119	4838	6124	7366	10821	18736	27160
4.8	2376	3231	5013	6345	7631	11211	19411	28139
5	2461	3347	5192	6572	7904	11613	20106	29146
5.2	2546	3463	5372	6800	8178	12014	20801	30154
5.4	2631	3579	5551	7027	8451	12416	21497	31162
5.6	2716	3694	5731	7254	8724	12817	22192	32170
6	2801	3810	5911	7481	8998	13219	22887	33177
6.5	2971	4042	6270	7936	9544	14022	24277	35193
7	3184	4331	6718	8504	10228	15025	26015	37713
7.5	3397	4620	7167	9072	10911	16029	27753	40232
8	3610	4910	7616	9640	11594	17033	29491	42751
8.5	3822	5199	8065	10208	12277	18037	31229	45271
9	4035	5488	8514	10776	12961	19041	32967	47790
9.5	4248	5778	8963	11345	13644	20045	34705	50310
10	4460	6067	9411	11913	14327	21048	36443	52829
10.5	4673	6356	9860	12481	15010	22052	38181	55349
11	4886	6646	10309	13049	15694	23056	39919	57868
11.5	5099	6935	10758	13617	16377	24060	41657	60388
12	5311	7224	11207	14185	17060	25064	43395	62907
12.5	5524	7514	11656	14753	17744	26067	45133	65426
13	5737	7803	12104	15321	18427	27071	46871	67946
13.5	5949	8092	12553	15889	19110	28075	48609	70465
14	6162	8382	13002	16458	19793	29079	50347	72985
14.5	6375	8671	13451	17026	20477	30083	52085	75504
15	6588	8960	13900	17594	21160	31086	53823	78024
15.5	6800	9250	14349	18162	21843	32090	55561	80543
16	7013	9539	14798	18730	22526	33094	57299	83063
16.5	7226	9828	15246	19298	23210	34098	59037	85582
17	7438	10118	15695	19866	23893	35102	60775	88102
17.5	7651	10407	16144	20434	24576	36105	62513	90621
0.1	42.5	57.9	89.8	113.6	136.6	200.8	347.6	503.9

CAST IRON SERIES
STEAM CAPACITY

* Pressure settings below 15 PSIG (1.034 barg) are non code.

SATURATED STEAM CAPACITY CHART

CAST IRON MODELS 41 & 42

ASME Section VIII "UV" 90% rated at 10% Overpressure LBS/HR (KGS/HR)
Flow Coefficient = .9 x .975 = .878

LBS/HR

Set Pressure PSIG	Orifice Area, in ²							
	J	K	L	M	N	P	Q	R
5 *	1.391	1.892	2.935	3.715	4.468	6.564	11.365	16.475
10 *	1428	1845	3013	3813	4586	6737	11665	16910
15	1742	2251	3676	4653	5596	8221	14235	20635
20	2057	2798	4340	5494	6606	9706	16804	24360
25	2371	3225	5003	6335	7617	11190	19374	28085
30	2686	3653	5667	7175	8627	12674	21943	31809
35	3000	4081	6330	8015	9637	14158	24513	35534
40	3346	4551	7060	8939	10748	15790	27339	39631
45	3692	5022	7790	9863	11859	17422	30165	43729
50	4038	5492	8520	10787	12970	19055	32992	47826
55	4384	5963	9250	11711	14081	20687	35818	51923
60	4730	6433	9980	12636	15193	22320	38645	56020
65	5076	6904	10710	13560	16304	23952	41471	60117
70	5422	7374	11440	14484	17415	25585	44297	64215
75	5768	7845	12170	15408	18526	27217	47124	68312
80	6114	8316	12900	16332	19637	28849	49950	72409
85	6460	8786	13630	17256	20748	30482	52777	76506
90	6805	9257	14359	18180	21860	32114	55603	80604
95	7151	9727	15089	19105	22971	33747	58429	84701
100	7497	10198	15819	20029	24082	35379	61256	88798
105	7843	10668	16549	20953	25193	37012	64082	92895
110	8189	11139	17279	21877	26304	38644	66909	96992
115	8538	11609	18009	22801	27415	40276	69735	101090
120	8881	12080	18739	23725	28527	41909	72561	105187
125	9227	12550	19469	24649	29638	43541	75388	109284
130	9573	13021	20199	25574	30749	45174	78214	113381
135	9919	13491	20929	26498	31860	46806	81041	117479
140	10265	13962	21659	27422	32971	48438	83867	121576
145	10611	14432	22388	28346	34082	50071	86693	125673
150	10957	14903	23118	29270	35194	51703	89520	129770
155	11303	15373	23848	30194	36305	53336	92346	133868
160	11648	15844	24578	31118	37416	54968	95173	137965
165	11994	16314	25308	32043	38527	56601	97999	142062
170	12340	16785	26038	32967	39638	58233	100825	146159
175	12686	17256	26768	33891	40749	59865	103652	150256
180	13032	17726	27498	34815	41861	61498	106478	154354
185	13378	18197	28228	35739	42972	63130	109305	158451
190	13724	18667	28958	36663	44083	64763	112131	162548
195	14070	19138	29688	37587	45194	66395	114957	166645
200	14416	19608	30418	38512	46305	68028	117784	170743
205	14762	20079	31147	39436	47416	69660	120610	174840
210	15108	20549	31877	40360	48527	71292	123437	178937
215	15454	21020	32607	41284	49639	72925	126263	183034
220	15800	21490	33337	42208	50750	74557	129089	187131
225	16146	21961	34067	43132	51861	76190	131916	191229
230	16492	22431	34797	44057	52972	77822	134742	195326
235	16837	22902	35527	44981	54083	79455	137569	199423
240	17183	23372	36257	45905	55194	81087	140395	203520
245	17529	23843	36987	46829	56306	82719	143221	207618
250	17875	24313	37717	47753	57417	84352	146048	211715
1.0	18221	24784	38447	48677	58528	85984	148874	215812
1.0	69.2	94.0	146.0	184.8	222.2	326.4	565.2	819.4

KGS/HR

Set Pressure Barg	Orifice Area, cm ²							
	J	K	L	M	N	P	Q	R
0.4*	8.97	12.21	18.94	23.97	28.83	42.35	73.32	106.29
0.6*	670	912	1414	1790	2153	3163	5477	7939
0.8*	753	1024	1589	2011	2419	3554	6153	8919
1*	836	1137	1763	2232	2685	3944	6829	9899
1.2	918	1249	1938	2453	2950	4334	7504	10879
1.4	1001	1362	2113	2674	3216	4725	8180	11858
1.6	1084	1474	2287	2895	3482	5115	8856	12838
1.8	1167	1587	2462	3116	3747	5505	9532	13818
2	1249	1699	2636	3337	4013	5896	10208	14798
2.2	1332	1812	2811	3558	4279	6286	10884	15777
2.4	1420	1932	2997	3793	4562	6702	11604	16821
2.6	1511	2056	3189	4036	4854	7131	12347	17899
2.8	1602	2179	3381	4279	5146	7561	13091	18977
3	1693	2303	3573	4522	5439	7990	13834	20055
3.2	1784	2427	3765	4765	5731	8420	14578	21132
3.4	1875	2551	3957	5008	6023	8849	15321	22210
3.6	1966	2674	4149	5251	6316	9278	16065	23288
3.8	2057	2798	4341	5494	6608	9708	16808	24365
4	2148	2922	4533	5737	6900	10137	17552	25443
4.2	2239	3046	4725	5980	7192	10567	18295	26521
4.4	2330	3169	4917	6223	7485	10996	19038	27599
4.6	2421	3293	5109	6466	7777	11425	19782	28676
4.8	2512	3417	5301	6709	8069	11855	20525	29754
5	2603	3541	5493	6952	8362	12284	21269	30832
5.2	2694	3665	5685	7195	8654	12713	22012	31910
5.4	2785	3788	5877	7438	8946	13143	22756	32987
5.6	2876	3912	6069	7681	9238	13572	23499	34065
6	2967	4036	6261	7924	9531	14002	24243	35143
6.5	3149	4283	6645	8410	10115	14860	25730	37298
7	3377	4593	7125	9018	10846	15934	27588	39993
7.5	3604	4902	7605	9626	11577	17007	29447	42687
8	3832	5212	8085	10233	12307	18081	31305	45381
8.5	4059	5521	8565	10841	13038	19154	33164	48075
9	4287	5830	9045	11448	13769	20228	35023	50770
9.5	4514	6140	9525	12056	14499	21301	36881	53464
10	4742	6449	10005	12663	15230	22375	38740	56158
10.5	4969	6759	10485	13271	15961	23448	40599	58853
11	5196	7068	10965	13878	16691	24522	42457	61547
11.5	5424	7378	11445	14486	17422	25595	44316	64241
12	5651	7687	11925	15094	18153	26669	46174	66936
12.5	5879	7996	12404	15701	18884	27742	48033	69630
13	6106	8306	12884	16309	19614	28816	49892	72324
13.5	6334	8615	13364	16916	20345	29889	51750	75019
14	6561	8925	13844	17524	21076	30963	53609	77713
14.5	6789	9234	14324	18131	21806	32036	55468	80407
15	7016	9543	14804	18739	22537	33110	57326	83102
15.5	7244	9853	15284	19346	23268	34183	59185	85796
16	7471	10162	15764	19954	23998	35256	61044	88490
16.5	7699	10472	16244	20562	24729	36330	62902	91185
17	7926	10781	16724	21169	25460	37403	64761	93879
0.1	8154	11091	17204	21777	26191	38477	66619	96573
0.1	45.5	61.9	96	121.5	146.1	214.7	371.7	538.9

* Pressure settings below 15 PSIG (1.034 barg) are non code.

AIR CAPACITY CHART

CAST IRON MODELS 41A & 42A

ASME Section VIII "UV" 90% rated at 10% Overpressure SCFM (M³/HR)
Flow Coefficient = .9 x .975 = .878

SCFM

Set Pressure PSIG	Orifice Area, in ²							
	J	K	L	M	N	P	Q	R
	1.391	1.892	2.935	3.715	4.468	6.564	11.365	16.475
5 *	508	691	1072	1357	1632	2398	4152	6019
10 *	620	843	1308	1656	1992	2926	5067	7345
15	732	996	1545	1956	2351	3455	5981	8671
20	844	1148	1781	2255	2711	3983	6896	9996
25	956	1300	2017	2554	3071	4511	7810	11322
30	1068	1453	2253	2853	3430	5039	8725	12648
35	1191	1620	2513	3182	3826	5620	9731	14106
40	1314	1787	2773	3511	4221	6201	10737	15565
45	1437	1955	3033	3840	4617	6782	11743	17023
50	1560	2122	3292	4169	5012	7363	12749	18482
55	1684	2290	3552	4498	5408	7945	13755	19940
60	1807	2457	3812	4826	5803	8526	14761	21398
65	1930	2625	4072	5155	6199	9107	15767	22857
70	2053	2792	4332	5484	6594	9688	16773	24315
75	2176	2960	4592	5813	6990	10269	17779	25773
80	2299	3127	4851	6142	7385	10850	18785	27232
85	2422	3295	5111	6471	7781	11431	19791	28690
90	2545	3462	5371	6800	8176	12012	20797	30149
95	2669	3630	5631	7129	8572	12593	21804	31607
100	2792	3797	5891	7458	8967	13174	22810	33065
105	2915	3965	6150	7787	9363	13755	23816	34524
110	3038	4132	6410	8116	9758	14336	24822	35982
115	3161	4300	6670	8445	10154	14917	25828	37440
120	3284	4467	6930	8774	10549	15498	26834	38899
125	3407	4635	7190	9103	10945	16079	27840	40357
130	3531	4802	7449	9432	11340	16660	28846	41816
135	3654	4970	7709	9761	11736	17241	29852	43274
140	3777	5137	7969	10090	12131	17822	30858	44732
145	3900	5305	8229	10418	12527	18403	31864	46191
150	4023	5472	8489	10747	12922	18984	32870	47649
155	4146	5640	8748	11076	13318	19565	33876	49107
160	4269	5807	9008	11405	13713	20147	34882	50566
165	4392	5974	9268	11734	14109	20728	35888	52024
170	4516	6142	9528	12063	14504	21309	36894	53483
175	4639	6309	9788	12392	14900	21890	37900	54941
180	4762	6477	10047	12721	15295	22471	38906	56399
185	4885	6644	10307	13050	15691	23052	39912	57858
190	5008	6812	10567	13379	16086	23633	40918	59316
195	5131	6979	10827	13708	16482	24214	41924	60774
200	5254	7147	11087	14037	16877	24795	42930	62233
205	5378	7314	11346	14366	17273	25376	43936	63691
210	5501	7482	11606	14695	17668	25957	44942	65150
215	5624	7649	11866	15024	18064	26538	45948	66608
220	5747	7817	12126	15353	18459	27119	46954	68066
225	5870	7984	12386	15682	18855	27700	47960	69525
230	5993	8152	12646	16010	19251	28281	48966	70983
235	6116	8319	12905	16339	19646	28862	49972	72441
240	6239	8487	13165	16668	20042	29443	50979	73900
245	6363	8654	13425	16997	20437	30024	51985	75358
250	6486	8822	13685	17326	20833	30605	52991	76817
1.0	24.6	33.6	52.0	65.8	79.2	116.2	201.2	291.8

M³/HR

Set Pressure Barg	Orifice Area, cm ²							
	J	K	L	M	N	P	Q	R
	8.97	12.21	18.94	23.97	28.83	42.35	73.32	106.29
0.4*	894	1216	1886	2387	2871	4218	7303	10587
0.6*	1004	1366	2119	2682	3225	4739	8205	11893
0.8*	1114	1516	2352	2976	3580	5259	9106	13200
1*	1225	1666	2584	3271	3934	5780	10007	14506
1.2	1335	1816	2817	3566	4288	6300	10908	15813
1.4	1445	1966	3050	3860	4643	6821	11810	17119
1.6	1556	2116	3283	4155	4997	7341	12711	18426
1.8	1666	2266	3515	4450	5351	7862	13612	19732
2	1776	2416	3748	4744	5706	8382	14513	21039
2.2	1894	2576	3996	5058	6083	8937	15474	22431
2.4	2015	2741	4252	5382	6473	9510	16465	23868
2.6	2137	2906	4508	5706	6863	10082	17456	25305
2.8	2258	3071	4764	6030	7252	10655	18448	26742
3	2379	3236	5020	6354	7642	11227	19439	28179
3.2	2501	3401	5276	6678	8032	11800	20430	29617
3.4	2622	3566	5532	7002	8422	12372	21422	31054
3.6	2743	3731	5788	7326	8811	12945	22413	32491
3.8	2865	3896	6044	7651	9201	13518	23405	33928
4	2986	4061	6300	7975	9591	14090	24396	35365
4.2	3107	4226	6556	8299	9981	14663	25387	36802
4.4	3229	4391	6812	8623	10370	15235	26379	38239
4.6	3350	4556	7068	8947	10760	15808	27370	39676
4.8	3471	4722	7324	9271	11150	16381	28361	41114
5	3593	4887	7580	9595	11540	16953	29353	42551
5.2	3714	5052	7836	9919	11929	17526	30344	43988
5.4	3835	5217	8092	10243	12319	18098	31336	45425
5.6	3957	5382	8348	10567	12709	18671	32327	46862
6	4199	5712	8860	11215	13488	19816	34310	49736
6.5	4503	6124	9501	12025	14463	21247	36788	53329
7	4806	6537	10141	12836	15437	22679	39267	56922
7.5	5109	6950	10781	13646	16412	24110	41745	60515
8	5413	7362	11421	14456	17386	25542	44224	64108
8.5	5716	7775	12061	15266	18360	26973	46702	67700
9	6019	8187	12701	16076	19335	28405	49180	71293
9.5	6323	8600	13341	16886	20309	29836	51659	74886
10	6626	9013	13981	17696	21283	31268	54137	78479
10.5	6929	9425	14621	18507	22258	32699	56616	82072
11	7233	9838	15261	19317	23232	34131	59094	85665
11.5	7536	10250	15901	20127	24206	35562	61573	89257
12	7839	10663	16541	20937	25181	36994	64051	92850
12.5	8143	11076	17181	21747	26155	38425	66530	96443
13	8446	11488	17821	22557	27130	39856	69008	100036
13.5	8749	11901	18461	23368	28104	41288	71486	103629
14	9053	12313	19101	24178	29078	42719	73965	107221
14.5	9356	12726	19741	24988	30053	44151	76443	110814
15	9659	13139	20381	25798	31027	45582	78922	114407
15.5	9963	13551	21022	26608	32001	47014	81400	118000
16	10266	13964	21662	27418	32976	48445	83879	121593
16.5	10570	14376	22302	28228	33950	49877	86357	125186
17	10873	14789	22942	29039	34925	51308	88836	128778
0.1	60.7	82.5	128	162	194.9	286.3	495.7	718.6

**CAST IRON SERIES AIR
CAPACITY**

* Pressure settings below 15 PSIG (1.034 barg) are non code.



FIGURE 800 SAFETY RELIEF VALVE

APPLICATION DATA

- Liquid Filled Pressure Vessels & Systems
- Steam/air/gas Pressure Vessels & Systems
- Low temperature cryogenic systems
- Pumps, Tanks & Hydraulic Systems
- Pressure Reducing Stations
- Vacuum Systems
- OEM Equipment

APPLICABLE CODES

- ASME Section VIII "UV" for Liquid/Steam/Air/Gas
- API 527
- Canadian Registration # OG0591.9C
- PED (Consult Factory)

FIGURE 800 SERIES

SIZES 1/2" – 1 1/2"

PRESSURES to 900 PSIG at 422°F

- Meets ASME VIII Code for Liquid, Steam, Air & Gas Service
- "UV" National Board Certified
- Short Blowdown
- No Ring Adjustments Required
- Unitized Bonnet Design
- All SS Internals/SS Springs
- Pivoting Disc Design
- Full Nozzle
- Soft Seat Design Available
- Wide Variety of Options

OPTIONS

- Screwed, Plain & Packed Caps
- BSP Connections
- Vacuum Service (Non-code)
- EPDM, Viton & TFE/25% Glass Soft Seats
- Low Temperature Cryogenic Service Trim*
- Test Reports Available

MODELS

- 810 - Bronze Bonnet & Base, SS Disc
- 812 - EPDM Seat on 810
- 814 - Viton Seat on 810
- 816 - TFE/25% Glass Seat on 810
- 820 - Bronze Bonnet, SS Base & Disc
- 822 - EPDM Seat on 820
- 824 - Viton Seat on 820
- 826 - TFE/25% Glass Seat on 820
- 860 - 316 SS Bonnet, Base & Disc
- 862 - EPDM Seat on 860
- 864 - Viton Seat on 860
- 866 - TFE/25% Glass Seat on 860

VALVE RATINGS *See Capacity Charts beginning on page 222*

Model	Temperature* °F (°C)	Pressure PSIG (bar)		
		D,E Orifices	F,G Orifices	H Orifice
810/812	-20-406 (-28.9-207.8)	5-250 (0.34-17.24)		
814/816	-20-400 (-28.9-204.4)			
820 ⁽¹⁾	-20-422 (-28.9-216.7)	5-900 (0.34-62.06)	5-600 (0.34-41.37)	5-500 (0.34-34.48)
822 ⁽¹⁾ /824 ⁽²⁾ /826 ⁽²⁾	-20-400 (-28.9-204.4)			
860	-20-800 (-28.9-427)			
862/864/866	-20-400 (-28.9-204.4)			

Maximum Backpressure (Plain/Packed Cap) - 50 PSIG (3.45 barg)
Vacuum Pressure Range - 10 to 30" HG (3.38.64 to 1015.92 mbarg)

⁽¹⁾ Maximum pressure for steam is 300 PSIG (20.67 barg).

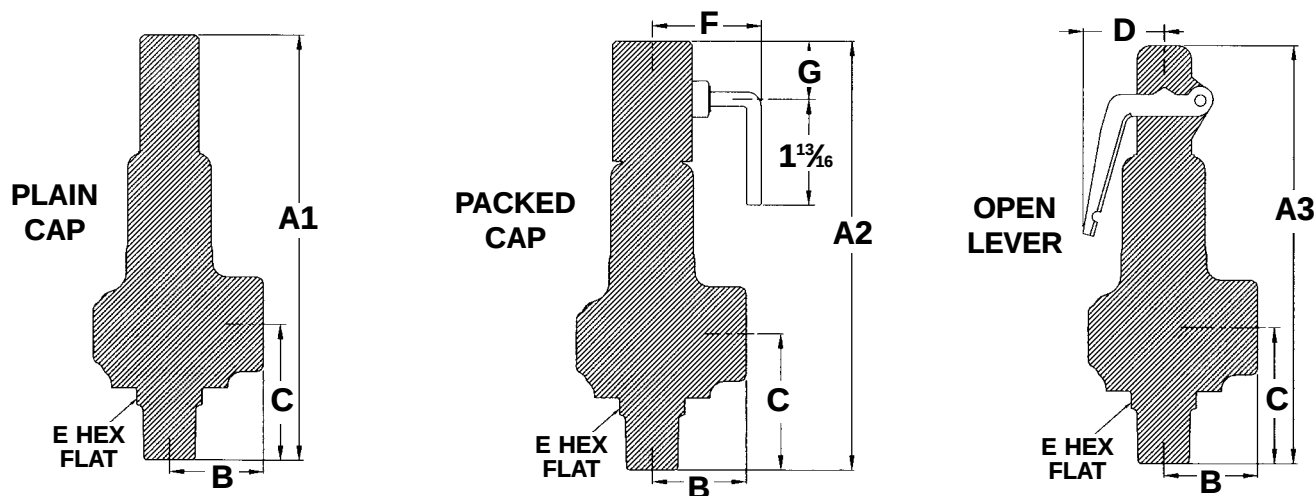
⁽²⁾ Maximum pressure for steam is 250 PSIG (17.4 barg).

FIGURE 800 SERIES

SPECIFICATION

The valve shall meet the ASME Section VIII code for liquid, steam, air and gas services. It shall be "UV" National Board Certified. It shall have non-adjustable blowdown that shall be less than 10% for steam, air or gas and less than 20% for liquid. The valve shall consist of a unitized bonnet design guaranteeing proper guiding and making the valve extremely dependable in terms of pop

action, seat tightness and repeatability. The disc shall have a pivoting design which optimizes the seating performance. The valve shall have a full nozzle for optimum flow performance. Internal trim (excepting the base) shall be stainless steel. The valve shall meet the API 527 leakage standard requiring bubble tight shutoff up to 90% of set pressure.



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

Model	Inlet	Orifice	Outlet	A1	A2	A3	B	C	D ⁽¹⁾	E	F	G	Weight
8**+DCA	½ (15)	D	1 (25)	7⅞ (18.73)	7⅞ (18.73)	7⅞ (18.10)	1⅞ (3.49)	2¼ (5.72)	1⅞ ₃₂ (3.57)	1⅞ (2.86)	1⅞ ₁₆ (4.92)	½ (1.27)	2.50 (1.13)
8**+EDA	¾ (20)	E	1¼ (32)	8⅞ (22.54)	8⅞ (22.54)	8⅞ (22.23)	1⅞ (4.13)	2⅞ ₁₆ (5.87)	1⅞ ₃₂ (3.57)	1¼ (3.18)	1⅞ ₁₆ (4.92)	1⅞ ₁₆ (2.70)	4.50 (2.04)
8**+FEA	1 (25)	F	1½ (40)	9⅞ (25.08)	9⅞ (25.08)	9⅞ (24.77)	1⅞ (4.76)	2⅞ ₁₆ (7.14)	2¼ (5.72)	1½ (3.81)	1⅞ ₁₆ (4.92)	1⅞ ₁₆ (2.70)	7.00 (3.18)
8**+GFA	1¼ (32)	G	2 (50)	12 (30.48)	12 (30.48)	11⅞ (30.16)	2⅞ (5.40)	3 (7.62)	2¼ (5.72)	1⅞ (4.76)	2⅞ (5.40)	1⅞ (4.45)	11.50 (5.22)
8**+HGA	1½ (40)	H	2½ (65)	13⅞ (33.97)	13⅞ (33.97)	13⅞ (33.66)	2⅞ ₁₆ (6.51)	3½ (8.89)	3 (7.62)	2½ (6.35)	2⅞ (5.40)	1⅞ (4.45)	17.00 (7.71)

*Accurate to ±1/8". **Use appropriate model number. ⁽¹⁾ Add 50% to D Dimension when lever is pulled out to manually operate valve.

+Use appropriate Cap Letter

CODE SELECTION CHART

Model	Cap	Orifice	Inlet Size	Connections	Service	Set Pressure
8 1 0 N D C A - A 0 2 5						
1 2 3 4 5 6 7 8 9 10 11						

Model -

Position 1, 2 & 3

810 = Bronze Bonnet & Base, SS Disc
 812 = EPDM Seat on 810
 814 = Viton Seat on 810
 816 = TFE/25% Glass Seat on 810
 820 = Bronze Bonnet, SS Base & Disc
 822 = EPDM Seat on 820
 824 = Viton Seat on 820
 826 = TFE/25% Glass Seat on 820
 860 = 316 SS Bonnet, Base & Disc
 862 = EPDM Seat on 860
 864 = Viton Seat on 860
 866 = Teflon Seat on 860

Cap -

Position 4

N = Plain Cap
 E = Open Lever
 P = Packed Cap

Orifice -

Position 5

D
 E
 F
 G
 H

Inlet Size -

Position 6

C = ½
 D = ¾
 E = 1
 F = 1¼
 G = 1½

Connections -

Position 7

A = MPT x FTP
 F = MBSP x FBSP
 Z = Other

Service -

Position 8

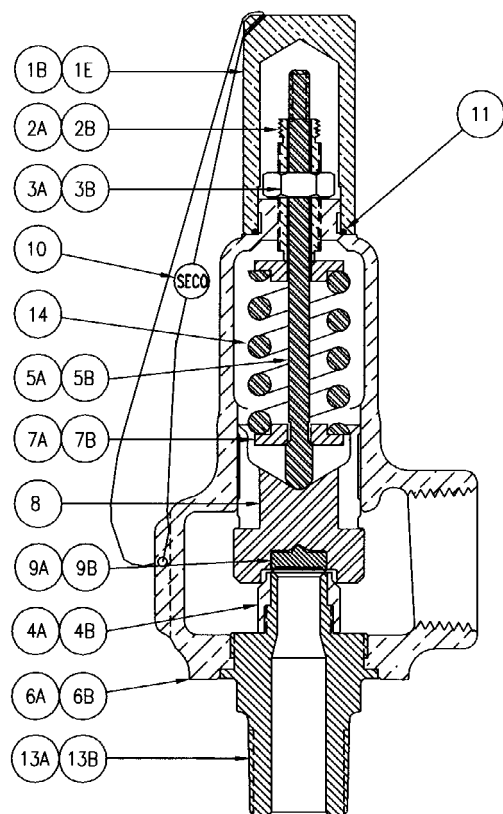
A = Air/Gas Sect. VIII
 M = Steam Non-code
 N = Air/Gas Non-code
 P = Liquid Non-code
 T = Steam Sect. VIII
 V = Vacuum
 W = Liquid Sect. VIII
 G = Loosely Assembled Gas[†]
 X = Loosely Assembled Liquid[†]
 Z = Other

Set Pressure -

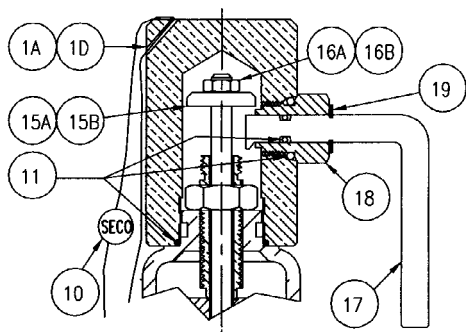
Position 9, 10 & 11

____ = Actual Setting
 LAS - Loosely Assembled[†]

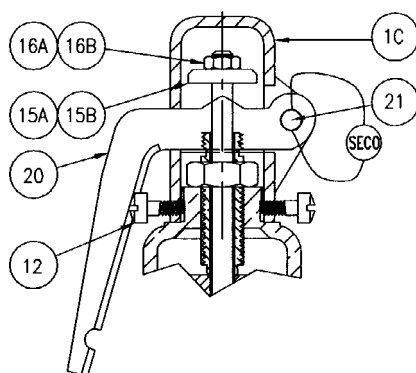
[†] Spence Certified Assemblers Only



PLAIN CAP VALVE



PACKED CAP OPTION



OPEN LEVER OPTION

FIGURE 800 SERIES

MATERIALS OF CONSTRUCTION

Ref	Part Name	Material
1A	Cap - Packed	Brass ASTM B16
1B	Cap - Plain	Brass ASTM B16
1C	Cap - Open Lever	Zinc Alloy
1D	Cap - Packed (860 Series)	316 SST ASTM A276
1E	Cap - Plain (860 Series)	316 SST ASTM A276
2A	Adjusting Bolt	Brass ASTM B16
2B	Adjusting Bolt (860 Series)	316 SST ASTM A276
3A	Adjusting Bolt Locknut	303 SST ASTM A582
3B	Adjusting Bolt Locknut (860 Series)	316 SST ASTM A276
4A	Base Ring (Liquid Only)	Brass ASTM B16
4B	Base Ring (Liquid Only - Series 860)	316 SST ASTM A276
5A	Spindle	304 SST ASTM A479
5B	Spindle (860 Series)	316 SST ASTM A276
6A	Bonnet	Bronze ASME SB62
6B	Bonnet	316 SST ASTM A351 CF8M
7A	Spring Washer	303 SST ASTM A582
7B	Spring Washer (860 Series)	316 SST ASTM A276
8	Disc Holder - Metal/Soft ¹	316 SST ASTM A351 CF8M
9A	Disc - Metal	316 SST ASTM A276
9B	Disc Assembly - Soft	316SST - EPDM/Viton/TFE
10	Seal and Wire	Lead and SST
11	O-rings, various ³	Buna-N/TFE
12	Lock Screw	Plated Steel
13A	Base ²	Brass/Brz, ASTM B283/ASME SB62
13B	Base ² (820 & 860 Series)	316 SST ASTM A276
14	Spring	316 SST or 302 SST or 17-7 SST
15A	Spindle Nut	Steel
15B	Spindle Nut (860 Series)	316 SST ASTM A276
16A	Spindle Nut Locknut	Plated Steel
16B	Spindle Nut Locknut (860 Series)	316 SST ASTM A582
17	Lifting Lever Packed Cap	316 SST ASTM A276
18	Packed Cap Plug	316 SST ASTM A276
19	Cap Snap Ring	SST AMS 5813, S15700
20	Lifting Lever Open Cap	Plated Steel
21	Lifting Cap Pin Open Lever	Steel
22	Nameplate (Not Shown)	SST
23	Drive Screw (Not Shown)	SST

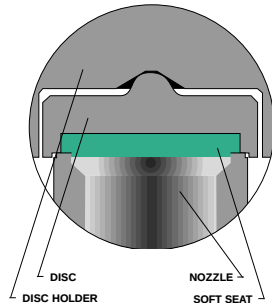
⁽¹⁾ ½, ¾ & 1 (15, 20, 25 mm) Metal and Soft Seat disc holders are different. 1¼ & 1½ (32 & 40mm) disc holders are identical.

⁽²⁾ ½ & ¾ (15, 20 mm) Gas and Liquid bases are identical. 1, 1¼ & 1½ (25, 32 & 40 mm) Liquid Bases differ from Gas bases.

⁽³⁾ TFE cap o-ring for models 816, 826, 866.

FIGURE 800 SERIES SOFT SEATS

Safety Valves with metal seats will start to leak at 90% of set pressure. A Spence Safety Valve equipped with a soft seat seals on both the metal and soft seats (see illustration). As a result, it will not begin to leak until system pressure reaches 95% of set pressure, minimizing system energy loss.



The o-rings in standard soft seat safety valves tend to blow out during discharge. Spence Soft Seat Safety Valves utilize a flat soft seat insert in the disc assembly of the valve that stays in place during operation, thus providing hassle-free operation.

There are many troublesome applications where using a Spence Soft Seat Safety Valve can reduce costly downtime and repair costs. Consider a Spence Soft Seat Safety Valve for:

- Operating very close to set pressure
- Heavy vibration
- Hard-to-hold fluids
- Occasional foreign particles
- Icing problems
- Pipe strain due to excessive discharge

SERVICE RECOMMENDATIONS*

EPDM Soft Seat

WET - -20 to 422°F (-29 to 216°C)

DRY - -20 to 250°F (-29 to 121°C)

Acetone	Freon 22
Acetylene Gas	Hydrazine
Beer	Lindol Hydraulic Fluid
Bleach Liquor	Lye
Brake Fluid	Methanol
Calcium Chloride	Methyl Alcohol
Carbon Monoxide	Methyl Butyl Ketone
Carbonic Acid	Nitrogen
Citric Acid	STEAM
Denatured Alcohol	Sulfur Hexafluoride
Ethylene Diamine	WATER

Viton Soft Seat

-20 to 400°F (-29 to 204°C)

AIR

Benzoic Acid	Dowtherm A	Iodine
Benzul Alcohol	Ethane	Kerosene
Butane	Ethyl Alcohol	Linseed Oil
Butyl Alcohol	Ethyl Chloride	Methane
Carbon Disulfide	Ethylene	Mineral Oils
Carbon Tetrachloride	Ethylene Glycol	Natural Gas
Castor Oil	Fuel Oil	Petroleum Oil
Chlorine	Gasoline	Propane
Chromic Acid	Glucose	Propyl Alcohol
Corn Oil	Glycerin	Propylene
Crude Oil	Helium	Sulfur Dioxide
Diesel Oil	Hydraulic Oil	Turpentine
	Hydrogen Gas	

TFE/25% Glass Soft Seat

-400 to 400°F (-240 to 204°C)

Helium
Hydrogen
Nitrogen

FIGURE 800 SERIES

*These recommendations should be used as a guide only. It is the sole responsibility of the user to select suitable materials.

SATURATED STEAM CAPACITY CHART

MODEL 800

ASME Section VIII "UV" 90% rated at 10% Overpressure LBS/HR (KGS/HR)
Flow Coefficient = .9 x .975 = .878

LBS/HR

KGS/HR

Set Pressure PSIG	Orifice Area in ²				
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479
5 *	122	217	341	557	870
10 *	149	265	416	679	1062
15	176	313	491	802	1254
20	203	361	566	925	1445
25	229	409	641	1047	1637
30	256	456	716	1170	1829
35	286	509	798	1305	2040
40	315	562	881	1440	2251
45	345	614	963	1575	2461
50	374	667	1046	1709	2672
55	404	720	1128	1844	2883
60	434	772	1211	1979	3094
65	463	825	1293	2114	3305
70	493	877	1376	2249	3516
75	522	930	1458	2384	3727
80	552	983	1541	2519	3937
85	581	1035	1623	2654	4148
90	611	1088	1706	2789	4359
95	640	1140	1788	2923	4570
100	670	1193	1871	3058	4781
105	699	1246	1953	3193	4992
110	729	1298	2036	3328	5203
115	758	1351	2118	3463	5414
120	788	1404	2201	3598	5624
125	818	1456	2283	3733	5835
130	847	1509	2366	3868	6046
135	877	1561	2448	4003	6257
140	906	1614	2531	4137	6468
145	936	1667	2614	4272	6679
150	965	1719	2696	4407	6890
155	995	1772	2779	4542	7100
160	1024	1825	2861	4677	7311
165	1054	1877	2944	4812	7522
170	1083	1930	3026	4947	7733
175	1113	1982	3109	5082	7944
180	1143	2035	3191	5217	8155
185	1172	2088	3274	5352	8366
190	1202	2140	3356	5486	8577
195	1231	2193	3439	5621	8787
200	1261	2246	3521	5756	8998
205	1290	2298	3604	5891	9209
210	1320	2351	3686	6026	9420
215	1349	2403	3769	6161	9631
220	1379	2456	3851	6296	9842
225	1408	2509	3934	6431	10053
230	1438	2561	4016	6566	10263
235	1468	2614	4099	6700	10474
240	1497	2667	4181	6835	10685
245	1527	2719	4264	6970	10896
250	1556	2772	4346	7105	11107
255	1586	2824	4429	7240	11318
260	1615	2877	4511	7375	11529
265	1645	2930	4594	7510	11740
270	1674	2982	4676	7645	11950
275	1704	3035	4759	7780	12161
280	1733	3088	4841	7914	12372
285	1763	3140	4924	8049	12583
290	1793	3193	5007	8184	12794
295	1822	3245	5089	8319	13005
300	1852	3298	5172	8454	13216
1.0	6.0	10.5	16.5	27.0	42.2

Set Pressure Barg	Orifice Area cm ²				
	D .766	E 1.365	F 2.141	G 3.499	H 5.47
0.4*	57	102	160	261	409
0.6*	64	115	180	294	459
0.8*	71	127	199	326	509
1*	78	140	219	358	560
1.2	86	152	239	390	610
1.4	93	165	259	423	661
1.6	100	177	278	455	711
1.8	107	190	298	487	762
2	114	203	318	519	812
2.2	121	216	339	554	866
2.4	129	230	360	589	921
2.6	137	244	382	625	977
2.8	145	258	404	660	1032
3	152	271	426	696	1088
3.2	160	285	447	731	1143
3.4	168	299	469	767	1199
3.6	176	313	491	802	1254
3.8	183	327	512	838	1309
4	191	341	534	873	1365
4.2	199	354	556	909	1420
4.4	207	368	578	944	1476
4.6	215	382	599	980	1531
4.8	222	396	621	1015	1587
5	230	410	643	1051	1642
5.2	238	424	664	1086	1698
5.4	246	438	686	1122	1753
5.6	253	451	708	1157	1809
5.8	261	465	729	1192	1864
6	269	479	751	1228	1920
6.2	277	493	773	1263	1975
6.4	284	507	795	1299	2031
6.6	292	521	816	1334	2086
7	308	548	860	1405	2197
7.5	327	583	914	1494	2336
8	347	617	968	1583	2474
8.5	366	652	1022	1671	2613
9	386	687	1077	1760	2752
9.5	405	721	1131	1849	2890
10	424	756	1185	1938	3029
10.5	444	790	1240	2026	3168
11	463	825	1294	2115	3306
11.5	483	860	1348	2204	3445
12	502	894	1402	2292	3584
12.5	522	929	1457	2381	3722
13	541	964	1511	2470	3861
13.5	560	998	1565	2559	4000
14	580	1033	1619	2647	4138
14.5	599	1067	1674	2736	4277
15	619	1102	1728	2825	4416
15.5	638	1137	1782	2913	4554
16	658	1171	1836	3002	4693
16.5	677	1206	1891	3091	4832
17	696	1240	1945	3179	4970
17.5	716	1275	1999	3268	5109
18	735	1310	2053	3357	5248
18.5	755	1344	2108	3446	5386
19	774	1379	2162	3534	5525
19.5	794	1413	2216	3623	5664
20	813	1448	2271	3712	5802
20.5	832	1483	2325	3800	5941
0.1	3.9	6.9	10.9	17.7	27.7

FIGURE 800 SERIES
STEAM CAPACITY

* Pressure settings below 15 PSIG (1.034 barg) are non code.

AIR CAPACITY CHART – MODEL 800

ASME Section VIII “UV”

90% rated at 10% Overpressure SCFM at 60°F **

Flow Coefficient = .9 x .975 = .878

SCFM

Set Pressure PSIG	Orifice Area in²				
	D	E	F	G	H
5 *	43	77	121	198	310
10 *	53	94	148	242	378
15	63	111	175	285	446
20	72	128	201	329	514
25	82	145	228	373	583
30	91	162	255	416	651
35	102	181	284	464	726
40	112	200	313	512	801
45	123	219	343	560	876
50	133	237	372	608	951
55	144	256	402	656	1026
60	154	275	431	704	1101
65	165	294	460	753	1176
70	175	312	490	801	1251
75	186	331	519	849	1326
80	196	350	548	897	1402
85	207	368	578	945	1477
90	217	387	607	993	1552
95	228	406	637	1041	1627
100	238	425	666	1089	1702
105	249	443	695	1137	1777
110	259	462	725	1185	1852
115	270	481	754	1233	1927
120	280	500	783	1281	2002
125	291	518	813	1329	2077
130	302	537	842	1377	2152
135	312	556	872	1425	2227
140	323	575	901	1473	2302
145	333	593	930	1521	2377
150	344	612	960	1569	2452
155	354	631	989	1617	2527
160	365	649	1018	1665	2602
165	375	668	1048	1713	2677
170	386	687	1077	1761	2753
175	396	706	1106	1809	2828
180	407	724	1136	1857	2903
185	417	743	1165	1905	2978
190	428	762	1195	1953	3053
195	438	781	1224	2001	3128
200	449	799	1253	2049	3203
205	459	818	1283	2097	3278
210	470	837	1312	2145	3353
215	480	855	1341	2193	3428
220	491	874	1371	2241	3503
225	501	893	1400	2289	3578
230	512	912	1430	2337	3653
235	522	930	1459	2385	3728
240	533	949	1488	2433	3803
245	543	968	1518	2481	3878
250	554	987	1547	2529	3953
255	564	1005	1576	2577	4028
260	575	1024	1606	2625	4104
265	585	1043	1635	2673	4179
270	596	1062	1665	2721	4254
275	606	1080	1694	2769	4329
280	617	1099	1723	2817	4404
285	628	1118	1753	2865	4479
290	638	1136	1782	2913	4554
295	649	1155	1811	2961	4629
300	659	1174	1841	3009	4704
1.0	2.2	3.6	6.0	9.6	15.0

Set Pressure PSIG	Orifice Area in²				
	D	E	F	G	H
305	670	1099	1723	2817	4404
310	680	1116	1750	2861	4472
315	691	1133	1777	2904	4540
320	701	1249	1958	3201	5004
325	712	1268	1988	3249	5079
330	722	1286	2017	3297	5154
335	733	1305	2046	3345	5229
340	743	1324	2076	3393	5304
345	754	1342	2105	3441	5380
350	764	1361	2134	3489	5455
355	775	1380	2164	3537	5530
360	785	1399	2193	3585	5605
365	796	1417	2223	3633	5680
370	806	1436	2252	3681	5755
375	817	1455	2281	3729	5830
380	827	1474	2311	3777	5905
385	838	1492	2340	3825	5980
390	848	1511	2369	3873	6055
395	859	1530	2399	3921	6130
400	869	1549	2428	3969	6205
405	880	1567	2458	4017	6280
410	890	1586	2487	4065	6355
415	901	1605	2516	4113	6430
420	911	1623	2546	4161	6505
425	922	1642	2575	4209	6580
430	933	1661	2604	4257	6655
435	943	1680	2634	4305	6731
440	954	1698	2663	4354	6806
445	964	1717	2693	4402	6881
450	975	1736	2722	4450	6956
455	985	1755	2751	4498	7031
460	996	1773	2781	4546	7106
465	1006	1792	2810	4594	7181
470	1017	1811	2839	4642	7256
475	1027	1829	2869	4690	7331
480	1038	1848	2898	4738	7406
485	1048	1867	2927	4786	7481
490	1059	1886	2957	4834	7556
495	1069	1904	2986	4882	7631
500	1080	1923	3016	4930	7706
505	1090	1942	3045	4978	-
510	1101	1961	3074	5026	-
515	1111	1979	3104	5074	-
520	1122	1998	3133	5122	-
525	1132	2017	3162	5170	-
530	1143	2036	3192	5218	-
535	1153	2054	3221	5266	-
540	1164	2073	3251	5314	-
545	1174	2092	3280	5362	-
550	1185	2110	3309	5410	-
555	1195	2129	3339	5458	-
560	1206	2148	3368	5506	-
565	1216	2167	3397	5554	-
570	1227	2185	3427	5602	-
575	1237	2204	3456	5650	-
580	1248	2223	3486	5698	-
585	1259	2242	3515	5746	-
590	1269	2260	3544	5794	-
595	1280	2279	3574	5842	-
600	1290	2298	3603	5890	-
1.0	2.2	3.6	6.0	9.6	15.0

Set Pressure PSIG	Orifice Area in²	
	D	E
605	1301	2121
610	1311	2138
615	1322	2155
620	1332	2373
625	1343	2391
630	1353	2410
635	1364	2429
640	1374	2448
645	1385	2466
650	1395	2485
655	1406	2504
660	1416	2523
665	1427	2541
670	1437	2560
675	1448	2579
680	1458	2597
685	1469	2616
690	1479	2635
695	1490	2654
700	1500	2672
705	1511	2691
710	1521	2710
715	1532	2729
720	1542	2747
725	1553	2766
730	1563	2785
735	1574	2804
740	1585	2822
745	1595	2841
750	1606	2860
755	1616	2878
760	1627	2897
765	1637	2916
770	1648	2935
775	1658	2953
780	1669	2972
785	1679	2991
790	1690	3010
795	1700	3028
800	1711	3047
805	1721	3066
810	1732	3084
815	1742	3103
820	1753	3122
825	1763	3141
830	1774	3159
835	1784	3178
840	1795	3197
845	1805	3216
850	1816	3234
855	1826	3253
860	1837	3272
865	1847	3291
870	1858	3309
875	1868	3328
880	1879	3347
885	1889	3365
890	1900	3384
895	1911	3403
900	1921	3422
1.0	2.2	3.6

* Pressure settings below 15 PSIG (1.034 barg) are non code.

**For other temperatures, please use temperature correction factor.

AIR CAPACITY CHART – MODEL 800 – CONT'D.

ASME Section VIII “UV”

90% rated at 10% Overpressure NM³/HR at 15.68°C**

Flow Coefficient = .9 x .975 = .878

NM³/HR

Set Pressure Barg	Orifice Area cm ²				
	D	E	F	G	H
	.766	1.365	2.141	3.499	5.47
0.4*	76	136	213	349	545
0.6*	86	153	240	392	612
0.8*	95	170	266	435	679
1*	105	186	292	478	747
1.2	114	203	318	521	814
1.4	123	220	345	564	881
1.6	133	237	371	607	948
1.8	142	253	397	650	1016
2	152	270	424	693	1083
2.2	162	288	452	738	1154
2.4	172	307	481	786	1228
2.6	182	325	510	833	1302
2.8	193	343	539	880	1376
3	203	362	568	928	1450
3.2	214	380	596	975	1524
3.4	224	399	625	1022	1598
3.6	234	417	654	1070	1672
3.8	245	436	683	1117	1746
4	255	454	712	1164	1820
4.2	265	473	741	1212	1894
4.4	276	491	770	1259	1968
4.6	286	510	799	1306	2042
4.8	296	528	828	1354	2116
5	307	547	857	1401	2190
5.2	317	565	886	1448	2264
5.4	328	583	915	1496	2338
5.6	338	602	944	1543	2412
5.8	348	620	973	1590	2486
6	359	639	1002	1637	2560
6.2	369	657	1031	1685	2634
6.4	379	676	1060	1732	2708
6.6	390	694	1088	1779	2782
6.8	400	713	1117	1827	2856
7	410	731	1146	1874	2930
7.2	421	750	1175	1921	3004
7.4	431	768	1204	1969	3077
7.6	442	786	1233	2016	3151
7.8	452	805	1262	2063	3225
8	462	823	1291	2111	3299
8.2	473	842	1320	2158	3373
8.4	483	860	1349	2205	3447
8.6	493	879	1378	2253	3521
8.8	504	897	1407	2300	3595
9	514	916	1436	2347	3669
9.2	524	934	1465	2394	3743
9.4	535	953	1494	2442	3817
9.6	545	971	1523	2489	3891
9.8	556	990	1552	2536	3965
10	566	1008	1581	2584	4039
10.2	576	1026	1609	2631	4113
10.4	587	1045	1638	2678	4187
10.6	597	1063	1667	2726	4261
10.8	607	1082	1696	2773	4335
11	618	1100	1725	2820	4409
11.2	628	1119	1754	2868	4483
11.4	638	1137	1783	2915	4557
11.6	649	1156	1812	2962	4631
11.8	659	1174	1841	3010	4705
12	670	1193	1870	3057	4779
12.2	680	1211	1899	3104	4853
0.1	5.2	9.2	14.6	23.6	37

Set Pressure Barg	Orifice Area cm ²				
	D	E	F	G	H
	.766	1.365	2.141	3.499	5.47
12.4	690	1229	1928	3151	4927
12.6	701	1248	1957	3199	5001
12.8	711	1266	1986	3246	5074
13	721	1285	2015	3293	5148
13.5	747	1331	2087	3412	5333
14	773	1377	2159	3530	5518
14.5	799	1423	2232	3648	5703
15	825	1469	2304	3767	5888
15.5	851	1516	2376	3885	6073
16	877	1562	2449	4003	6258
16.5	903	1608	2521	4121	6443
17	929	1654	2594	4240	6628
17.5	955	1700	2666	4358	6813
18	980	1746	2738	4476	6998
18.5	1006	1792	2811	4595	7182
19	1032	1839	2883	4713	7367
19.5	1058	1885	2955	4831	7552
20	1084	1931	3028	4949	7737
20.5	1110	1977	3100	5068	7922
21	1136	2023	3172	5186	8107
21.5	1162	2069	3245	5304	8292
22	1188	2115	3317	5423	8477
22.5	1214	2162	3389	5541	8662
23	1240	2208	3462	5659	8847
23.5	1265	2254	3534	5777	9031
24	1291	2300	3607	5896	9216
24.5	1317	2346	3679	6014	9401
25	1343	2392	3751	6132	9586
25.5	1369	2438	3824	6251	9771
26	1395	2485	3896	6369	9956
26.5	1421	2531	3968	6487	10141
27	1447	2577	4041	6605	10326
27.5	1473	2623	4113	6724	10511
28	1499	2669	4185	6842	10696
28.5	1524	2715	4258	6960	10881
29	1550	2761	4330	7079	11065
29.5	1576	2808	4402	7197	11250
30	1602	2854	4475	7315	11435
30.5	1628	2900	4547	7433	11620
31	1654	2946	4620	7552	11805
31.5	1680	2992	4692	7670	11990
32	1706	3038	4764	7788	12175
32.5	1732	3084	4837	7907	12360
33	1758	3131	4909	8025	12545
33.5	1784	3177	4981	8143	12730
34	1809	3223	5054	8261	12915
34.5	1835	3269	5126	8380	13099
35	1861	3315	5198	8498	—
35.5	1887	3361	5271	8616	—
36	1913	3408	5343	8735	—
36.5	1939	3454	5416	8853	—
37	1965	3500	5488	8971	—
37.5	1991	3546	5560	9089	—
38	2017	3592	5633	9208	—
38.5	2043	3638	5705	9326	—
39	2069	3684	5777	9444	—
39.5	2094	3731	5850	9563	—
40	2120	3777	5922	9681	—
40.5	2146	3823	5994	9799	—
41	2172	3869	6067	9917	—
0.1	5.2	9.2	14.6	23.6	37

Set Pressure Barg	Orifice Area cm ²	
	D	E
	.766	1.365
41.5	2198	3915
42	2224	3961
42.5	2250	4007
43	2276	4054
43.5	2302	4100
44	2328	4146
44.5	2354	4192
45	2379	4238
45.5	2405	4284
46	2431	4330
46.5	2457	4377
47	2483	4423
47.5	2509	4469
48	2535	4515
48.5	2561	4561
49	2587	4607
49.5	2613	4653
50	2639	4700
50.5	2664	4746
51	2690	4792
51.5	2716	4838
52	2742	4884
52.5	2768	4930
53	2794	4976
53.5	2820	5023
54	2846	5069
54.5	2872	5115
55	2898	5161
55.5	2923	5207
56	2949	5253
56.5	2975	5299
57	3001	5346
57.5	3027	5392
58	3053	5438
58.5	3079	5484
59	3105	5530
59.5	3131	5576
60	3157	5622
60.5	3183	5669
61	3208	5715
61.5	3234	5761
62	3260	5807
0.1	5.2	9.2

FIGURE 800 SERIES
AIR CAPACITY



* Pressure settings below 15 PSIG (1.034 barg) are non code.

**For other temperatures, please use temperature correction factor.

WATER CAPACITY CHART – MODEL 800

ASME Section VIII “UV”

90% rated at 10% Overpressure GPM at 60°F**

Flow Coefficient = .9 x .836 = .752

GPM

Set Pressure PSIG	Orifice Area in ²				
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479
5 *	9.6	17.1	26.8	43.9	68.6
10 *	12.3	21.8	34.2	55.9	87.4
15	14.4	25.7	40.3	65.8	102.9
20	16.3	29.0	45.5	74.4	116.3
25	18.0	32.0	50.2	82.1	128.3
30	19.5	34.8	54.5	89.1	139.3
35	21.1	37.6	58.9	96.3	150.5
40	22.5	40.1	63.0	102.9	160.9
45	23.9	42.6	66.8	109.2	170.6
50	25.2	44.9	70.4	115.1	179.9
55	26.4	47.1	73.8	120.7	188.7
60	27.6	49.2	77.1	126.0	197.0
65	28.7	51.2	80.3	131.2	205.1
70	29.8	53.1	83.3	136.1	212.8
75	30.9	55.0	86.2	140.9	220.3
80	31.9	56.8	89.0	145.5	227.5
85	32.9	58.5	91.8	150.0	234.5
90	33.8	60.2	94.4	154.4	241.3
95	34.7	61.9	97.0	158.6	247.9
100	35.6	63.5	99.5	162.7	254.4
105	36.5	65.1	102.0	166.7	260.7
110	37.4	66.6	104.4	170.7	266.8
115	38.2	68.1	106.7	174.5	272.8
120	39.0	69.5	109.0	178.3	278.7
125	39.8	71.0	111.3	181.9	284.4
130	40.6	72.4	113.5	185.5	290.0
135	41.4	73.8	115.7	189.1	295.6
140	42.2	75.1	117.8	192.5	301.0
145	42.9	76.4	119.9	195.9	306.3
150	43.7	77.7	121.9	199.3	311.6
155	44.4	79.0	123.9	202.6	316.7
160	45.1	80.3	125.9	205.8	321.8
165	45.8	81.5	127.9	209.0	326.8
170	46.5	82.8	129.8	212.2	331.7
175	47.1	84.0	131.7	215.3	336.5
180	47.8	85.2	133.6	218.3	341.3
185	48.5	86.3	135.4	221.3	346.0
190	49.1	87.5	137.2	224.3	350.6
195	49.8	88.6	139.0	227.2	355.2
200	50.4	89.8	140.8	230.1	359.7
205	51.0	90.9	142.5	233.0	364.2
210	51.6	92.0	144.3	235.8	368.6
215	52.3	93.1	146.0	238.6	373.0
220	52.9	94.2	147.6	241.4	377.3
225	53.5	95.2	149.3	244.1	381.6
230	54.1	96.3	151.0	246.8	385.8
235	54.6	97.3	152.6	249.5	390.0
240	55.2	98.3	154.2	252.1	394.1
245	55.8	99.4	155.8	254.7	398.2
250	56.4	100.4	157.4	257.3	402.2
255	56.9	101.4	159.0	259.9	406.2
260	57.5	102.4	160.5	262.4	410.2
265	58.0	103.3	162.0	264.9	414.1
270	58.6	104.3	163.6	267.4	418.0
275	59.1	105.3	165.1	269.9	421.8
280	59.6	106.2	166.6	272.3	425.7
285	60.2	107.2	168.0	274.7	429.4
290	60.7	108.1	169.5	277.1	433.2
295	61.2	109.0	171.0	279.5	436.9
300	61.7	110.0	172.4	281.9	440.6
1.0	0.10	0.20	0.28	0.48	0.74

Set Pressure PSIG	Orifice Area in ²				
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479
305	62.2	110.9	173.8	284.2	444.3
310	62.8	111.8	175.3	286.5	447.9
315	63.3	112.7	176.7	288.8	451.5
320	63.8	113.6	178.1	291.1	455.0
325	64.3	114.4	179.5	293.4	458.6
330	64.7	115.3	180.8	295.6	462.1
335	65.2	116.2	182.2	297.8	465.6
340	65.7	117.1	183.6	300.1	469.1
345	66.2	117.9	184.9	302.3	472.5
350	66.7	118.8	186.2	304.4	475.9
355	67.2	119.6	187.6	306.6	479.3
360	67.6	120.4	188.9	308.8	482.7
365	68.1	121.3	190.2	310.9	486.0
370	68.6	122.1	191.5	313.0	489.3
375	69.0	122.9	192.8	315.1	492.6
380	69.5	123.8	194.0	317.2	495.9
385	69.9	124.6	195.3	319.3	499.1
390	70.4	125.4	196.6	321.4	502.4
395	70.8	126.2	197.8	323.4	505.6
400	71.3	127.0	199.1	325.5	508.8
405	71.7	127.8	200.3	327.5	511.9
410	72.2	128.5	201.6	329.5	515.1
415	72.6	129.3	202.8	331.5	518.2
420	73.0	130.1	204.0	333.5	521.3
425	73.5	130.9	205.2	335.5	524.4
430	73.9	131.6	206.4	337.4	527.5
435	74.3	132.4	207.6	339.4	530.6
440	74.8	133.2	208.8	341.3	533.6
445	75.2	133.9	210.0	343.3	536.6
450	75.6	134.7	211.2	345.2	539.6
455	76.0	135.4	212.3	347.1	542.6
460	76.4	136.2	213.5	349.0	545.6
465	76.9	136.9	214.7	350.9	548.5
470	77.3	137.6	215.8	352.8	551.5
475	77.7	138.4	217.0	354.7	554.4
480	78.1	139.1	218.1	356.5	557.3
485	78.5	139.8	219.2	358.4	560.2
490	78.9	140.5	220.4	360.2	563.1
495	79.3	141.2	221.5	362.0	566.0
500	79.7	142.0	222.6	363.9	568.8
505	80.1	142.7	223.7	365.7	-
510	80.5	143.4	224.8	367.5	-
515	80.9	144.1	225.9	369.3	-
520	81.3	144.8	227.0	371.1	-
525	81.7	145.5	228.1	372.9	-
530	82.1	146.1	229.2	374.6	-
535	82.4	146.8	230.2	376.4	-
540	82.8	147.5	231.3	378.1	-
545	83.2	148.2	232.4	379.9	-
550	83.6	148.9	233.5	381.6	-
555	84.0	149.6	234.5	383.4	-
560	84.3	150.2	235.6	385.1	-
565	84.7	150.9	236.6	386.8	-
570	85.1	151.6	237.7	388.5	-
575	85.5	152.2	238.7	390.2	-
580	85.8	152.9	239.7	391.9	-
585	86.2	153.5	240.8	393.6	-
590	86.6	154.2	241.8	395.3	-
595	86.9	154.9	242.8	396.9	-
600	87.3	155.5	243.8	398.6	-
1.0	0.10	0.20	0.28	0.48	0.74

Set Pressure PSIG	Orifice Area in ²	
	D 0.1188	E 0.2116
605	87.7	156.1
610	88.0	156.8
615	88.4	157.4
620	88.7	158.1
625	89.1	158.7
630	89.5	159.3
635	89.8	160.0
640	90.2	160.6
645	90.5	161.2
650	90.9	161.8
655	91.2	162.5
660	91.6	163.1
665	91.9	163.7
670	92.3	164.3
675	92.6	164.9
680	92.9	165.5
685	93.3	166.1
690	93.6	166.8
695	94.0	167.4
700	94.3	168.0
705	94.6	168.6
710	95.0	169.2
715	95.3	169.7
720	95.6	170.3
725	96.0	170.9
730	96.3	171.5
735	96.6	172.1
740	97.0	172.7
745	97.3	173.3
750	97.6	173.9
755	97.9	174.4
760	98.3	175.0
765	98.6	175.6
770	98.9	176.2
775	99.2	176.7
780	99.5	177.3
785	99.9	177.9
790	100.2	178.4
795	100.5	179.0
800	100.8	179.6
805	101.1	180.1
810	101.4	180.7
815	101.7	181.2
820	102.1	181.8
825	102.4	182.3
830	102.7	182.9
835	103.0	183.4
840	103.3	184.0
845	103.6	184.5
850	103.9	185.1
855	104.2	185.6
860	104.5	186.2
865	104.8	186.7
870	105.1	187.2
875	105.4	187.8
880	105.7	188.3
885	106.0	188.9
890	106.3	189.4
895	106.6	189.9
900	106.9	190.4
1.0	0.10	0.20

FIGURE 800 SERIES
WATER CAPACITY

* Pressure settings below 15 PSIG (1.034 barg) are non code.

**For other temperatures, please use temperature correction factor.



WATER CAPACITY CHART – MODEL 800 – CONT'D.

ASME Section VIII “UV”

90% rated at 10% Overpressure NM³/HR at 15.68°C**

Flow Coefficient = .9 x .836 = .752

NM³/HR

FIGURE 800 SERIES
WATER CAPACITY

Set Pressure Barg	Orifice Area cm ²				
	D .766	E 1.365	F 2.141	G 3.499	H 5.47
0.4*	2.3	4.1	6.4	10.5	16.3
0.6*	2.6	4.7	7.4	12.1	18.8
0.8*	2.9	5.3	8.2	13.5	21
1*	3.2	5.8	9	14.7	23
1.2	3.5	6.2	9.7	15.9	24.9
1.4	3.7	6.6	10.4	17	26.6
1.6	4	7	11	18	28.2
1.8	4.2	7.4	11.6	19	29.7
2	4.4	7.8	12.2	19.9	31.2
2.2	4.6	8.1	12.8	20.9	32.6
2.4	4.8	8.5	13.3	21.8	34.1
2.6	5	8.9	13.9	22.7	35.5
2.8	5.2	9.2	14.4	23.5	36.8
3	5.3	9.5	14.9	24.4	38.1
3.2	5.5	9.8	15.4	25.2	39.4
3.4	5.7	10.1	15.9	25.9	40.6
3.6	5.8	10.4	16.3	26.7	41.7
3.8	6	10.7	16.8	27.4	42.9
4	6.2	11	17.2	28.1	44
4.2	6.3	11.3	17.6	28.8	45.1
4.4	6.5	11.5	18.1	29.5	46.1
4.6	6.6	11.8	18.5	30.2	47.2
4.8	6.8	12	18.9	30.8	48.2
5	6.9	12.3	19.2	31.5	49.2
5.2	7	12.5	19.6	32.1	50.2
5.4	7.2	12.8	20	32.7	51.1
5.6	7.3	13	20.4	33.3	52.1
5.8	7.4	13.2	20.7	33.9	53
6	7.5	13.4	21.1	34.5	53.9
6.2	7.7	13.7	21.4	35	54.8
6.4	7.8	13.9	21.8	35.6	55.7
6.6	7.9	14.1	22.1	36.2	56.5
6.8	8	14.3	22.4	36.7	57.4
7	8.2	14.5	22.8	37.2	58.2
7.2	8.3	14.7	23.1	37.8	59
7.4	8.4	14.9	23.4	38.3	59.8
7.6	8.5	15.1	23.7	38.8	60.6
7.8	8.6	15.3	24	39.3	61.4
8	8.7	15.5	24.3	39.8	62.2
8.2	8.8	15.7	24.7	40.3	63
8.4	8.9	15.9	24.9	40.8	63.8
8.6	9	16.1	25.2	41.3	64.5
8.8	9.1	16.3	25.5	41.7	65.3
9	9.2	16.5	25.8	42.2	66
9.2	9.3	16.7	26.1	42.7	66.7
9.4	9.4	16.8	26.4	43.1	67.4
9.6	9.5	17	26.7	43.6	68.2
9.8	9.6	17.2	26.9	44.1	68.9
10	9.7	17.4	27.2	44.5	69.6
10.2	9.8	17.5	27.5	44.9	70.3
10.4	9.9	17.7	27.8	45.4	70.9
10.6	10	17.9	28	45.8	71.6
10.8	10.1	18	28.3	46.2	72.3
11	10.2	18.2	28.6	46.7	73
11.2	10.3	18.4	28.8	47.1	73.6
11.4	10.4	18.5	29.1	47.5	74.3
11.6	10.5	18.7	29.3	47.9	74.9
11.8	10.6	18.9	29.6	48.3	75.6
12	10.7	19	29.8	48.7	76.2
12.2	10.8	19.2	30.1	49.2	76.8
.1	0.02	0.05	0.06	0.11	0.17

Set Pressure Barg	Orifice Area cm ²				
	D .766	E 1.365	F 2.141	G 3.499	H 5.47
12.4	10.9	19.3	30.3	49.6	77.5
12.6	10.9	19.5	30.6	50	78.1
12.8	11	19.6	30.8	50.3	78.7
13	11.1	19.8	31	50.7	79.3
13.5	11.3	20.2	31.6	51.7	80.8
14	11.5	20.5	32.2	52.7	82.3
14.5	11.7	20.9	32.8	53.6	83.8
15	11.9	21.3	33.3	54.5	85.2
15.5	12.1	21.6	33.9	55.4	86.6
16	12.3	22	34.4	56.3	88
16.5	12.5	22.3	35	57.2	89.4
17	12.7	22.6	35.5	58	90.7
17.5	12.9	23	36	58.9	92
18	13.1	23.3	36.5	59.7	93.3
18.5	13.3	23.6	37	60.5	94.6
19	13.4	23.9	37.5	61.3	95.9
19.5	13.6	24.2	38	62.1	97.1
20	13.8	24.6	38.5	62.9	98.4
20.5	14	24.9	39	63.7	99.6
21	14.1	25.2	39.4	64.5	100.8
21.5	14.3	25.5	39.9	65.2	102
22	14.5	25.7	40.4	66	103.2
22.5	14.6	26	40.8	66.7	104.3
23	14.8	26.3	41.3	67.5	105.5
23.5	14.9	26.6	41.7	68.2	106.6
24	15.1	26.9	42.2	68.9	107.8
24.5	15.3	27.2	42.6	69.7	108.9
25	15.4	27.4	43	70.4	110
25.5	15.6	27.7	43.5	71.1	111.1
26	15.7	28	43.9	71.8	112.2
26.5	15.9	28.3	44.3	72.4	113.2
27	16	28.5	44.7	73.1	114.3
27.5	16.2	28.8	45.1	73.8	115.4
28	16.3	29	45.6	74.5	116.4
28.5	16.5	29.3	46	75.1	117.4
29	16.6	29.6	46.4	75.8	118.5
29.5	16.7	29.8	46.8	76.4	119.5
30	16.9	30.1	47.1	77.1	120.5
30.5	17	30.3	47.5	77.7	121.5
31	17.2	30.6	47.9	78.4	122.5
31.5	17.3	30.8	48.3	79	123.5
32	17.4	31.1	48.7	79.6	124.4
32.5	17.6	31.3	49.1	80.2	125.4
33	17.7	31.5	49.5	80.8	126.4
33.5	17.8	31.8	49.8	81.4	127.3
34	18	32	50.2	82.1	128.3
34.5	18.1	32.2	50.6	82.7	129.2
35	18.2	32.5	50.9	83.3	-
35.5	18.4	32.7	51.3	83.8	-
36	18.5	32.9	51.6	84.4	-
36.5	18.6	33.2	52	85	-
37	18.7	33.4	52.4	85.6	-
37.5	18.9	33.6	52.7	86.2	-
38	19	33.8	53.1	86.7	-
38.5	19.1	34.1	53.4	87.3	-
39	19.2	34.3	53.8	87.9	-
39.5	19.4	34.5	54.1	88.4	-
40	19.5	34.7	54.4	89	-
40.5	19.6	34.9	54.8	89.6	-
41	19.7	35.2	55.1	90.1	-
.1	0.02	0.05	0.06	0.11	0.17

Set Pressure Barg	Orifice Area cm ²	
	D .766	E 1.365
41.5	19.9	35.4
42	20	35.6
42.5	20.1	35.8
43	20.2	36
43.5	20.3	36.2
44	20.4	36.4
44.5	20.6	36.6
45	20.7	36.8
45.5	20.8	37
46	20.9	37.2
46.5	21	37.4
47	21.1	37.6
47.5	21.2	37.8
48	21.4	38
48.5	21.5	38.2
49	21.6	38.4
49.5	21.7	38.6
50	21.8	38.8
50.5	21.9	39
51	22	39.2
51.5	22.1	39.4
52	22.2	39.6
52.5	22.3	39.8
53	22.4	40
53.5	22.5	40.2
54	22.6	40.3
54.5	22.8	40.5
55	22.9	40.7
55.5	23	40.9
56	23.1	41.1
56.5	23.2	41.3
57	23.3	41.4
57.5	23.4	41.6
58	23.5	41.8
58.5	23.6	42
59	23.7	42.2
59.5	23.8	42.3
60	23.9	42.5
60.5	24	42.7
61	24.1	42.9
61.5	24.2	43.1
62	24.3	43.2
.1	0.02	0.05

* Pressure settings below 15 PSIG (1.034 barg) are non code.

**For other temperatures, please use temperature correction factor.

WATER CAPACITY CHART – MODEL 800 – CONT'D

NON CODE

90% rated at 25% Overpressure GPM at 60°F**

Flow Coefficient = .9 x .836 = .752

GPM

Set Pressure PSIG	Orifice Area in ²				
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479
5	8.5	15.1	23.7	38.8	60.6
10	12.0	21.4	33.6	54.9	85.8
15	14.7	26.2	41.1	67.2	105.0
20	17.0	30.3	47.5	77.6	121.3
25	19.0	33.8	53.1	86.7	135.6
30	20.8	37.1	58.1	95.0	148.5
35	22.5	40.0	62.8	102.6	160.4
40	24.0	42.8	67.1	109.7	171.5
45	25.5	45.4	71.2	116.4	181.9
50	26.9	47.9	75.0	122.7	191.7
55	28.2	50.2	78.7	128.6	201.1
60	29.4	52.4	82.2	134.4	210.0
65	30.6	54.6	85.6	139.9	218.6
70	31.8	56.6	88.8	145.1	226.9
75	32.9	58.6	91.9	150.2	234.8
80	34.0	60.5	94.9	155.2	242.5
85	35.0	62.4	97.8	159.9	250.0
90	36.0	64.2	100.7	164.6	257.3
95	37.0	66.0	103.4	169.1	264.3
100	38.0	67.7	106.1	173.5	271.2
105	38.9	69.3	108.7	177.8	277.9
110	39.8	71.0	111.3	181.9	284.4
115	40.7	72.6	113.8	186.0	290.8
120	41.6	74.1	116.2	190.0	297.1
125	42.5	75.7	118.6	193.9	303.2
130	43.3	77.2	121.0	197.8	309.2
135	44.1	78.6	123.3	201.6	315.1
140	45.0	80.1	125.6	205.2	320.9
145	45.8	81.5	127.8	208.9	326.5
150	46.5	82.9	130.0	212.5	332.1
155	47.3	84.3	132.1	216.0	337.6
160	48.1	85.6	134.2	219.4	343.0
165	48.8	86.9	136.3	222.8	348.3
170	49.5	88.2	138.4	226.2	353.6
175	50.3	89.5	140.4	229.5	358.7
180	51.0	90.8	142.4	232.7	363.8
185	51.7	92.0	144.3	235.9	368.8
190	52.4	93.3	146.3	239.1	373.8
195	53.1	94.5	148.2	242.2	378.7
200	53.7	95.7	150.1	245.3	383.5
205	54.4	96.9	151.9	248.4	388.3
210	55.1	98.1	153.8	251.4	393.0
215	55.7	99.2	155.6	254.4	397.6
220	56.4	100.4	157.4	257.3	402.2
225	57.0	101.5	159.2	260.2	406.8
230	57.6	102.6	160.9	263.1	411.3
235	58.2	103.7	162.7	265.9	415.7
240	58.9	104.8	164.4	268.7	420.1
245	59.5	105.9	166.1	271.5	424.4
250	60.1	107.0	167.8	274.3	428.8
255	60.7	108.1	169.5	277.0	433.0
260	61.3	109.1	171.1	279.7	437.2
265	61.8	110.2	172.7	282.4	441.4
270	62.4	111.2	174.4	285.0	445.6
275	63.0	112.2	176.0	287.7	449.7
280	63.6	113.2	177.6	290.3	453.8
285	64.1	114.2	179.1	292.8	457.8
290	64.7	115.2	180.7	295.4	461.8
295	65.3	116.2	182.3	297.9	465.8
300	65.8	117.2	183.8	300.5	469.7
1.0	0.10	0.20	0.30	0.50	0.80

Set Pressure PSIG	Orifice Area in ²				
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479
305	66.4	118.2	185.3	302.9	473.6
310	66.9	119.2	186.8	305.4	477.4
315	67.4	120.1	188.3	307.9	481.3
320	68.0	121.1	189.8	310.3	485.1
325	68.5	122.0	191.3	312.7	488.9
330	69.0	122.9	192.8	315.1	492.6
335	69.5	123.9	194.2	317.5	496.3
340	70.1	124.8	195.7	319.9	500.0
345	70.6	125.7	197.1	322.2	503.7
350	71.1	126.6	198.5	324.5	507.3
355	71.6	127.5	199.9	326.8	510.9
360	72.1	128.4	201.3	329.1	514.5
365	72.6	129.3	202.7	331.4	518.1
370	73.1	130.2	204.1	333.7	521.6
375	73.6	131.0	205.5	335.9	525.1
380	74.1	131.9	206.9	338.1	528.6
385	74.5	132.8	208.2	340.4	532.1
390	75.0	133.6	209.6	342.6	535.5
395	75.5	134.5	210.9	344.8	538.9
400	76.0	135.3	212.2	346.9	542.3
405	76.5	136.2	213.6	349.1	545.7
410	76.9	137.0	214.9	351.2	549.1
415	77.4	137.9	216.2	353.4	552.4
420	77.9	138.7	217.5	355.5	555.7
425	78.3	139.5	218.8	357.6	559.0
430	78.8	140.3	220.0	359.7	562.3
435	79.2	141.1	221.3	361.8	565.6
440	79.7	142.0	222.6	363.9	568.8
445	80.1	142.8	223.8	365.9	572.0
450	80.6	143.6	225.1	368.0	575.2
455	81.0	144.4	226.3	370.0	578.4
460	81.5	145.1	227.6	372.0	581.6
465	81.9	145.9	228.8	374.1	584.7
470	82.4	146.7	230.1	376.1	587.9
475	82.8	147.5	231.3	378.1	591.0
480	83.2	148.3	232.5	380.0	594.1
485	83.7	149.0	233.7	382.0	597.2
490	84.1	149.8	234.9	384.0	600.3
495	84.5	150.6	236.1	385.9	603.3
500	85.0	151.3	237.3	387.9	606.4
505	85.4	152.1	238.5	389.8	-
510	85.8	152.8	239.6	391.7	-
515	86.2	153.6	240.8	393.7	-
520	86.6	154.3	242.0	395.6	-
525	87.1	155.1	243.1	397.5	-
530	87.5	155.8	244.3	399.4	-
535	87.9	156.5	245.4	401.2	-
540	88.3	157.3	246.6	403.1	-
545	88.7	158.0	247.7	405.0	-
550	89.1	158.7	248.9	406.8	-
555	89.5	159.4	250.0	408.7	-
560	89.9	160.1	251.1	410.5	-
565	90.3	160.9	252.2	412.3	-
570	90.7	161.6	253.3	414.1	-
575	91.1	162.3	254.5	416.0	-
580	91.5	163.0	255.6	417.8	-
585	91.9	163.7	256.7	419.6	-
590	92.4	164.4	257.8	421.4	-
595	92.8	165.1	258.9	423.2	-
600	93.2	165.8	260.0	425.0	-
1.0	0.10	0.20	0.28	0.48	0.74

Set Pressure PSIG	Orifice Area in ²	
	D 0.1188	E 0.2116
605	93.5	166.5
610	93.8	167.1
615	94.2	167.8
620	94.6	168.5
625	95.0	169.2
630	95.4	169.9
635	95.7	170.5
640	96.1	171.2
645	96.5	171.9
650	96.9	172.5
655	97.2	173.2
660	97.6	173.9
665	98.0	174.5
670	98.3	175.2
675	98.7	175.8
680	99.1	176.5
685	99.4	177.1
690	99.8	177.8
695	100.2	178.4
700	100.5	179.0
705	100.9	179.7
710	101.2	180.3
715	101.6	181.0
720	101.9	181.6
725	102.3	182.2
730	102.7	182.8
735	103.0	183.5
740	103.4	184.1
745	103.7	184.7
750	104.1	185.3
755	104.4	185.9
760	104.7	186.6
765	105.1	187.2
770	105.4	187.8
775	105.8	188.4
780	106.1	189.0
785	106.5	189.6
790	106.8	190.2
795	107.1	190.8
800	107.5	191.4
805	107.8	192.0
810	108.1	192.6
815	108.5	193.2
820	108.8	193.8
825	109.1	194.4
830	109.5	195.0
835	109.8	195.5
840	110.1	196.1
845	110.4	196.7
850	110.8	197.3
855	111.1	197.9
860	111.4	198.5
865	111.7	199.0
870	112.1	199.6
875	112.4	200.2
880	112.7	200.7
885	113.0	201.3
890	113.3	201.8
895	113.7	202.5
900	114.0	203.0
1.0	0.10	0.20

FIGURE 800 SERIES
WATER CAPACITY

**For other temperatures, please use temperature correction factor.

WATER CAPACITY CHART – MODEL 800 – CONT'D.

NON CODE

90% rated at 25% Overpressure NM³/HR at 15.6°C**

Flow Coefficient = .9 x .836 = .752

NM³/HR

Set Pressure Barg	Orifice Area cm ²				
	D .766	E 1.365	F 2.141	G 3.499	H 5.47
0.4	2.3	4.1	6.4	10.5	16.3
0.6	2.6	4.7	7.4	12.1	18.8
0.8	2.9	5.3	8.2	13.5	21
1	3.3	5.9	9.2	15	23.5
1.2	3.6	6.4	10.1	16.4	25.7
1.4	3.9	6.9	10.9	17.7	27.7
1.6	4.2	7.4	11.6	19	29.7
1.8	4.4	7.9	12.3	20.1	31.5
2	4.6	8.3	13	21.2	33.2
2.2	4.9	8.7	13.6	22.2	34.8
2.4	5.1	9.1	14.2	23.2	36.3
2.6	5.3	9.4	14.8	24.2	37.8
2.8	5.5	9.8	15.4	25.1	39.2
3	5.7	10.1	15.9	26	40.6
3.2	5.9	10.5	16.4	26.8	41.9
3.4	6.1	10.8	16.9	27.7	43.2
3.6	6.2	11.1	17.4	28.5	44.5
3.8	6.4	11.4	17.9	29.2	45.7
4	6.6	11.7	18.4	30	46.9
4.2	6.7	12	18.8	30.7	48.1
4.4	6.9	12.3	19.2	31.5	49.2
4.6	7	12.6	19.7	32.2	50.3
4.8	7.2	12.8	20.1	32.9	51.4
5	7.3	13.1	20.5	33.5	52.4
5.2	7.5	13.3	20.9	34.2	53.5
5.4	7.6	13.6	21.3	34.9	54.5
5.6	7.8	13.8	21.7	35.5	55.5
5.8	7.9	14.1	22.1	36.1	56.5
6	8	14.3	22.5	36.7	57.4
6.2	8.2	14.6	22.8	37.4	58.4
6.4	8.3	14.8	23.2	37.9	59.3
6.6	8.4	15	23.6	38.5	60.2
6.8	8.6	15.3	23.9	39.1	61.2
7	8.7	15.5	24.3	39.7	62
7.2	8.8	15.7	24.6	40.3	62.9
7.4	8.9	15.9	25	40.8	63.8
7.6	9.1	16.1	25.3	41.4	64.6
7.8	9.2	16.3	25.6	41.9	65.5
8	9.3	16.6	26	42.4	66.3
8.2	9.4	16.8	26.3	43	67.2
8.4	9.5	17	26.6	43.5	68
8.6	9.6	17.2	26.9	44	68.8
8.8	9.7	17.4	27.2	44.5	69.6
9	9.9	17.6	27.5	45	70.4
9.2	10	17.8	27.8	45.5	71.1
9.4	10.1	17.9	28.1	46	71.9
9.6	10.2	18.1	28.4	46.5	72.7
9.8	10.3	18.3	28.7	47	73.4
10	10.4	18.5	29	47.4	74.2
10.2	10.5	18.7	29.3	47.9	74.9
10.4	10.6	18.9	29.6	48.4	75.6
10.6	10.7	19.1	29.9	48.8	76.3
10.8	10.8	19.2	30.2	49.3	77.1
11	10.9	19.4	30.4	49.8	77.8
11.2	11	19.6	30.7	50.2	78.5
11.4	11.1	19.8	31	50.6	79.2
11.6	11.2	19.9	31.3	51.1	79.9
11.8	11.3	20.1	31.5	51.5	80.6
12	11.4	20.3	31.8	52	81.2
12.2	11.5	20.4	32.1	52.4	81.9
.1	0.02	0.05	0.07	0.11	0.18

Set Pressure Barg	Orifice Area cm ²				
	D .766	E 1.365	F 2.141	G 3.499	H 5.47
12.4	11.6	20.6	32.3	52.8	82.6
12.6	11.7	20.8	32.6	53.2	83.2
12.8	11.8	20.9	32.8	53.7	83.9
13	11.8	21.1	33.1	54.1	84.6
13.5	12.1	21.5	33.7	55.1	86.2
14	12.3	21.9	34.3	56.1	87.7
14.5	12.5	22.3	34.9	57.1	89.3
15	12.7	22.7	35.5	58.1	90.8
15.5	12.9	23	36.1	59.1	92.3
16	13.1	23.4	36.7	60	93.8
16.5	13.3	23.8	37.3	60.9	95.3
17	13.5	24.1	37.8	61.9	96.7
17.5	13.7	24.5	38.4	62.8	98.1
18	13.9	24.8	38.9	63.6	99.5
18.5	14.1	25.2	39.5	64.5	100.9
19	14.3	25.5	40	65.4	102.2
19.5	14.5	25.8	40.5	66.2	103.6
20	14.7	26.2	41	67.1	104.9
20.5	14.9	26.5	41.5	67.9	106.2
21	15.1	26.8	42.1	68.7	107.5
21.5	15.2	27.1	42.5	69.6	108.7
22	15.4	27.4	43	70.4	110
22.5	15.6	27.8	43.5	71.2	111.2
23	15.8	28.1	44	71.9	112.5
23.5	15.9	28.4	44.5	72.7	113.7
24	16.1	28.7	45	73.5	114.9
24.5	16.3	29	45.4	74.3	116.1
25	16.4	29.3	45.9	75	117.3
25.5	16.6	29.6	46.3	75.8	118.4
26	16.8	29.8	46.8	76.5	119.6
26.5	16.9	30.1	47.2	77.2	120.7
27	17.1	30.4	47.7	77.9	121.8
27.5	17.2	30.7	48.1	78.7	123
28	17.4	31	48.6	79.4	124.1
28.5	17.5	31.2	49	80.1	125.2
29	17.7	31.5	49.4	80.8	126.3
29.5	17.8	31.8	49.8	81.5	127.4
30	18	32.1	50.3	82.2	128.4
30.5	18.1	32.3	50.7	82.8	129.5
31	18.3	32.6	51.1	83.5	130.6
31.5	18.4	32.8	51.5	84.2	131.6
32	18.6	33.1	51.9	84.9	132.7
32.5	18.7	33.4	52.3	85.5	133.7
33	18.9	33.6	52.7	86.2	134.7
33.5	19	33.9	53.1	86.8	135.7
34	19.2	34.1	53.5	87.5	136.7
34.5	19.3	34.4	53.9	88.1	137.7
35	19.4	34.6	54.3	88.7	-
35.5	19.6	34.9	54.7	89.4	-
36	19.7	35.1	55.1	90	-
36.5	19.9	35.4	55.4	90.6	-
37	20	35.6	55.8	91.2	-
37.5	20.1	35.8	56.2	91.9	-
38	20.3	36.1	56.6	92.5	-
38.5	20.4	36.3	56.9	93.1	-
39	20.5	36.5	57.3	93.7	-
39.5	20.6	36.8	57.7	94.3	-
40	20.8	37	58	94.9	-
40.5	20.9	37.2	58.4	95.5	-
41	21	37.5	58.8	96.1	-
.1	0.02	0.05	0.07	0.11	0.18

Set Pressure Barg	Orifice Area cm ²	
	D .766	E 1.365
41.5	21.2	37.7
42	21.3	37.9
42.5	21.4	38.2
43	21.5	38.4
43.5	21.7	38.6
44	21.8	38.8
44.5	21.9	39
45	22	39.3
45.5	22.2	39.5
46	22.3	39.7
46.5	22.4	39.9
47	22.5	40.1
47.5	22.6	40.3
48	22.8	40.5
48.5	22.9	40.8
49	23	41
49.5	23.1	41.2
50	23.2	41.4
50.5	23.3	41.6
51	23.5	41.8
51.5	23.6	42
52	23.7	42.2
52.5	23.8	42.4
53	23.9	42.6
53.5	24	42.8
54	24.1	43
54.5	24.3	43.2
55	24.4	43.4
55.5	24.5	43.6
56	24.6	43.8
56.5	24.7	44
57	24.8	44.2
57.5	24.9	44.4
58	25	44.6
58.5	25.1	44.8
59	25.2	45
59.5	25.3	45.1
60	25.5	45.3
60.5	25.6	45.5
61	25.7	45.7
61.5	25.8	45.9
62	25.9	46.1
.1	0.02	0.05

FIGURE 800 SERIES
WATER CAPACITY

**For other temperatures, please use temperature correction factor.

VACUUM CAPACITY CHART – MODEL 800

NON CODE – Plain or Packed Cap
90% rated SCFM (NM³/HR) at 60°F (15.6°C)**
Flow Coefficient = .9 x .975 = .878

SCFM

Set Pressure in.HG	Orifice Area in ²				
	D 0.1188	E 0.2116	F 0.3318	G 0.5424	H 0.8479
10	27	48	76	124	194
11	28	50	78	127	199
12	28	51	80	130	204
13	29	52	82	133	208
14	29	53	83	135	211
15	30	53	84	137	214
16	30	54	85	138	216
17	30	54	85	139	218
18	30	55	86	140	219
19	31	55	86	140	220
20	31	55	86	141	220
21	31	55	86	141	220
22	31	55	86	141	220
23	31	55	86	141	220
24	31	55	86	141	220
25	31	55	86	141	220
26	31	55	86	141	220
27	31	55	86	141	220
28	31	55	86	141	220
29	31	55	86	141	220
30	31	55	86	141	220

NM³/HR

Set Pressure mmHG	Orifice Area cm ²				
	D .766	E 1.365	F 2.141	G 3.499	H 5.47
254.0	46	82	129	211	330
279.4	48	85	133	216	338
304.8	48	87	136	221	347
330.2	49	88	139	226	353
355.6	49	90	141	229	358
381.0	51	90	143	233	364
406.4	51	92	144	234	367
431.8	51	92	144	236	370
457.2	51	93	146	238	372
482.6	53	93	146	238	374
508.0	53	93	146	240	374
533.4	53	93	146	240	374
558.8	53	93	146	240	374
584.2	53	93	146	240	374
609.6	53	93	146	240	374
635.0	53	93	146	240	374
660.4	53	93	146	240	374
685.8	53	93	146	240	374
711.2	53	93	146	240	374
736.6	53	93	146	240	374
762.0	53	93	146	240	374

** For other temperatures, please use temperature correction factor.

**FIGURE 800 SERIES
VACUUM CAPACITY**



FIGURE 10 SERIES SAFETY VALVE

FIGURE 10 SERIES

SIZES 3/4" – 3"

PRESSURES to 15 PSIG at 250°F

- Meets ASME Section IV Code for Steam Service
- "HV" National Board Certified
- Low Cost
- High Capacity
- Dependable
- Tight Shutoff
- Sharp Popping and Closing Action
- High Degree of Repeatability
- Unitized Body

MODELS

- 0010 - Cast Iron Body, Bronze Seats

APPLICATION DATA

- Industrial Low Pressure Steam Heating Boilers
- Commercial Low Pressure Steam Heating Boilers

VALVE RATINGS

Model	Pressure PSIG (bar)	Temperature °F (°C)
All	5 to 15 (.3 to 1)	-20 to 250 (-29 to 121)

APPLICABLE CODES

- ASME Section IV "HV" for Low Pressure Steam (when set @ 15 PSI)
- Canadian Registration #0G0591.9C

CODE SELECTION CHART

Model				Orifice	Inlet Size	Connec- tions	Set Pressure		
0	0	1	0	Z	H	A	-	0	1 5
1	2	3	4	5	6	7	8	9	10

Model - Position 1, 2, 3 & 4 0010 = Cast Iron Body, Bronze Seats
Orifice - Position 5 Z

Inlet Size - Position 6 D = 3/4 E = 1 F = 1 1/4 G = 1 1/2 H = 2 J = 2 1/2 K = 3

Connections - Position 7 A = MPT x FPT
Set Pressure - Position 8, 9 & 10 ___ = Actual Setting

FIGURE 10 SERIES

SPECIFICATION

The valve shall meet the ASME Section IV Code for low pressure steam service. It shall be "HV" National Board Certified. The valve inlet and outlet shall be one integral casting assuring proper alignment of disc, seat and spindle for smooth action. The valve shall maintain a high degree of repeatability. The valve shall be top guided by a disc guide fitted into the body. The valve shall have an open lever assembly. The valve shall have a non-adjustable blowdown.

MATERIALS OF CONSTRUCTION

Ref	Part Name	Material
1	Pull Ring	SST
3	Compression Screw	Stl. plated CI ASTM A108/A126
4	Seal Wire	SST
5	Seal	Lead
6	Lock Screw	Brass ASTM B16
7	Drive Screw	SST
8	Nameplate	SST
9	Wave Washer	Plated Steel
10	Spring	Plated Steel
11	Disc Guide	Brass/Bronze ASTM B135/B505
12	Spindle Pin	Plated Steel
13	Spring Washer	Plated Steel
14	Spindle	Steel ASTM A108
15	Disc	Brass/Bronze ASTM B16/B62
16	Seat	Brass/Bronze ASTM B16/B505
17	Body	Cast Iron ASTM A126
18	Sealant	Sealant

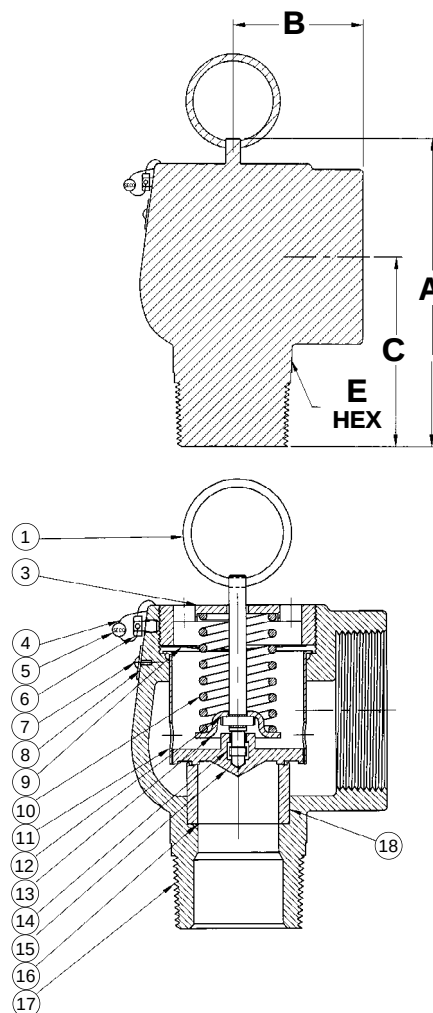


FIGURE 10 SERIES

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Model	Inlet	Orifice	Outlet	A*	B	C	E Hex	Weight
0010ZDA	¾ (20)	Z	1 (25)	3⅞ (76)	1½ (38)	2⅞ (56)	1¼ (32)	1 (.4)
0010ZEA	1 (25)	Z	1¼ (32)	4 (95)	2 (51)	2⅞ (67)	1½ (38)	2 (.9)
0010ZFA	1¼ (32)	Z	1½ (40)	5 (108)	2⅞ (54)	3 (76)	1⅞ (48)	3 (1.4)
0010ZGA	1½ (40)	Z	2 (50)	5⅞ (117)	2⅞ (56)	3⅞ (81)	2 (51)	4 (1.8)
0010ZHA	2 (50)	Z	2½ (65)	6⅞ (156)	2⅞ (73)	4 (102)	3 (76)	8 (3.6)
0010ZJA	2½ (65)	Z	2½ (65)	8⅞ (194)	3⅞ (95)	4⅞ (111)	3¼ (83)	14 (6.3)
0010ZKA	3 (80)	Z	3 (80)	9⅞ (229)	3⅞ (98)	5⅞ (130)	4 (102)	22 (10)

* Add 1/4" to "A" dimension to allow for lift.

SATURATED STEAM CAPACITY CHART—MODEL 0010

ASME Section IV "HV" 90% rated at 33.3% Overpressure** LBS/HR (KGS/HR)

LBS/HR

Set Pressure PSIG	Valve & Orifice Area, in²					
	¾ Z 1	1 Z 1¼	1¼ Z 1½	1½ Z 2	2 Z 2½	3 Z 3
5*	243	431	673	974	1725	3896
10*	318	565	883	1277	2263	5112
15	394	700	1093	1581	2801	6327

* Pressure settings below 15 PSIG (1.034 barg) are non code.

** Pressure settings below 15 PSIG (1 barg) are at 10% overpressure.

KGS/HR

Set Pressure Barg	Valve & Orifice Area cm²						
	20 Z 25	25 Z 32	32 Z 40	40 Z 50	50 Z 65	65 Z 65	80 Z 80
0.4*	1.78	3.16	4.94	7.14	12.65	19.76	25.58
0.7*	255	452	706	1022	1811	2828	4091
1*	321	569	889	1286	2279	3559	5148
	387	686	1072	1551	2747	4291	6205

Consult Factory for capacities below 5 PSIG



FIGURE 15LC SAFETY VALVE

APPLICATION DATA

- Bulk Hauling Railroad and Truck Tank Cars
- High Volume Blowers
- Compressors
- Dryers
- Pneumatic Equipment
- Tanks

VALVE RATINGS

Model	Pressure PSIG (bar)	Temperature °F (°C)
All	5 to 15 (.3 to 1)	-20 to 400 (-29 to 204)

APPLICABLE CODES

- ASME Section VIII "UV" for Air (2" Figure 15C & 15LC only)
- Canadian Registration #OG0591.9C — 015C, 015LC
#OH0591.9C — 015A, 015LA

FIGURE 15 SERIES

SIZES 3/4" – 3"

PRESSURES to 15 PSIG at 400°F

- Air & Non-hazardous Service
- Low Cost
- High Capacity
- Cast Iron or Aluminum Body
- Dependable
- Tight Shutoff
- Sharp Popping & Closing Action
- High Degree of Repeatability
- Unitized Body

OPTIONS

- Stainless Trim
- Set Pressures 15 to 60 psi (Consult Factory)
- Polyurethane Soft Seat Available (Consult Factory)

MODELS

- 015C - Cast Iron Body, Bronze Seats, Pull Ring
- 015A - Cast Iron Body, Bronze Seats, Sealed Cap
- 15LC - Aluminum Body on 015C (2 x 2½ only)
- 15LA - Aluminum Body on 015A (2 x 2½ only)

CODE SELECTION CHART

Model				Orifice	Inlet Size	Connections	Set Pressure			
0	1	5	C	Z	K	A	-	0	1	5
1	2	3	4	5	6	7	8	9	10	

Model -

Position 1, 2, 3 & 4

015C = Cast Iron Body, Brz Seats, Pull Ring

015A = Cast Iron Body, Brz Seats, Sealed Cap

15LC = Aluminum Body on 015C (2 x 2½ only)

15LA = Aluminum Body on 015A (2 x 2½ only)

Orifice -

Position 5

Z

Inlet Size -

Position 6

D = ¾

E = 1

F = 1¼

G = 1½

H = 2

J = 2½

K = 3

Connections -

Position 7

A = MPT x FPT

Set Pressure -

Position 8, 9 & 10

___ = Actual Setting

LAS - Loosely Assembled†

† Spence Certified Assemblers Only

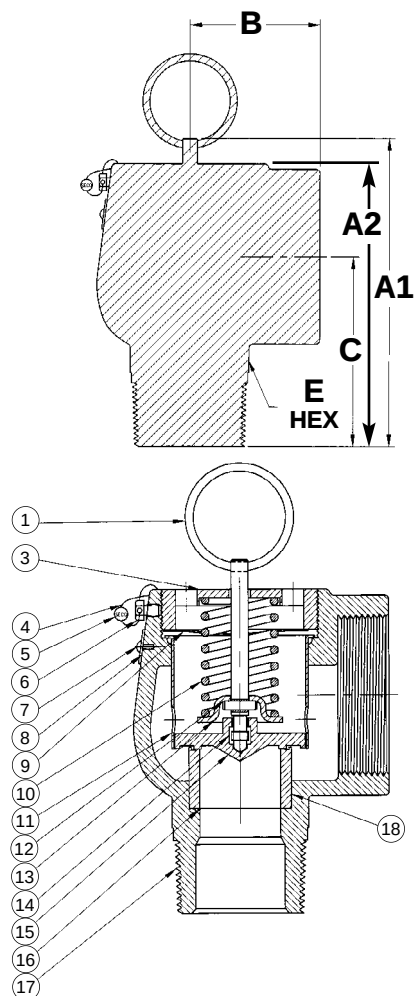
FIGURE 15 SERIES

SPECIFICATION

The valve inlet and outlet shall be one integral casting assuring proper alignment of disc, seat and spindle for smooth action. The valve shall maintain a high degree of repeatability. The valve shall be top guided by a disc guide fitted into the body. The valve shall have a non-adjustable blowdown.

MATERIALS OF CONSTRUCTION

Ref	Part Name	Material
1	Pull Ring	SST
3	Compression Screw	Stl. plated CI ASTM A108/A126
4	Seal Wire	SST
5	Seal	Lead
6	Lock Screw	Brass ASTM B16
7	Drive Screw	SST
8	Nameplate	SST
9	Wave Washer	Plated Steel
10	Spring	Plated Steel
11	Disc Guide	Brass/Bronze ASTM B135/B505
12	Spindle Pin	Plated Steel
13	Spring Washer	Plated Steel
14	Spindle	Steel ASTM A108
15	Disc	Brass/Bronze ASTM B16/B62
16	Seat	Brass/Bronze ASTM B16/B505
17	Body Body	Cast Iron ASTM A126 Aluminum ASTM B26, A03560, T6
18	Sealant	Sealant
19	Bushing 015A/15LA	Brass ASTM B16



DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Model	Inlet	Orifice	Outlet	A1	A2	B	C	E Hex	Weight
****ZDA	¾ (20)	Z	1 (25)	3⅝ (76)	3 (76)	1½ (38)	2⅜ (56)	1¼ (32)	1 (.4)
****ZEA	1 (25)	Z	1¼ (32)	4 (95)	3¾ (95)	2 (51)	2⅝ (67)	1½ (38)	2 (.9)
****ZFA	1¼ (32)	Z	1½ (40)	5 (108)	4¼ (108)	2⅝ (54)	3 (76)	1⅝ (48)	3 (1.4)
****ZGA	1½ (40)	Z	2 (50)	5⅝ (117)	4⅝ (117)	2⅜ (56)	3⅜ (81)	2 (51)	4 (1.8)
****ZHA	2 (50)	Z	2½ (65)	6⅞ (156)	6⅝ (156)	2⅝ (73)	4 (102)	3 (76)	8 (3.6)
****ZJA	2½ (65)	Z	2½ (65)	8⅝ (194)	7⅝ (194)	3⅝ (95)	4⅝ (111)	3¾ (83)	14 (6.3)
****ZKA	3 (80)	Z	3 (80)	9½ (229)	9 (229)	3⅝ (98)	5⅝ (130)	4 (102)	22 (10)

**** Use appropriate Model Number.

AIR CAPACITY CHART – MODELS 015C, 015A, 15LC, 15LA

****ASME Section VIII “UV” 90% rated at 3 PSI Overpressure SCFM (M³/HR)**

SCFM

Set Pressure PSIG	Valve & Orifice Area, in²						
	¾ Z 1	1 Z 1¼	1½ Z 1½	2 Z 2	2½ Z 2½	3 Z 3	3 Z 3
5*	82	145	226	328	579	906	1311
10*	100	177	276	400	706	1105	1599
15	118	209	326	472	834	1305	1888

* Pressure settings below 15 PSIG (1.034 barg) are non code.

**Only 2" size is ASME Certified.

M³/HR

Set Pressure Barg	Valve & Orifice Area cm²						
	20 Z 25	25 Z 32	32 Z 40	40 Z 50	50 Z 65	65 Z 65	80 Z 80
0.4*	144	255	398	576	1018	1593	2305
0.7*	171	302	472	683	1207	1888	2732
1.0*	197	350	545	790	1395	2183	3159

Consult factory for capacities below 5 psi or between 15 to 60 psi.

FIGURE 15 SERIES



FIGURE 15V SERIES SAFETY VALVE

APPLICATION DATA

- Vacuum Pumps
- Bulk Hauling Railroad & Truck Tank Cars
- Pneumatic Equipment
- Tanks

VALVE RATINGS

Model	Pressure in.HG (mmHG)	Temperature °F (°C)
All	5 to 30 (.2 to 1)	-20 to 400 (-29 to 204)

APPLICABLE CODES

- Canadian Registration #0H0591.9C

FIGURE 15V SERIES

SIZES 3/4" – 3"

PRESSURES to 30" HG at 400°F

- Vacuum Service
- Low Cost
- High Capacity
- Cast Iron or Aluminum Body
- Dependable
- Tight Shutoff
- Sharp Popping & Closing Action
- High Degree of Repeatability
- Unitized Body

OPTIONS

- Stainless Trim

MODELS

- 015V - Cast Iron Body, Bronze Seats, Vacuum Service
- 015LV - Aluminum Body on 015V (2" x 2½" only)

CODE SELECTION CHART

Model				Orifice	Inlet Size	Connec- tions	Set Pressure			
0	0	5	2	Z	H	Z	-	0	1	5
1	2	3	4	5	6	7	8	9	10	

Model -

Position 1, 2, 3 & 4
 0050 = Bronze Body, Viton Soft Seat
 0051 = Pull Ring on 0050
 0052 = Aluminum Body, Viton Soft Seat
 0053 = Pull Ring on 0052

Orifice -

Position 5
 Z

Inlet Size -

Position 6
 H = 2

Connections -

Position 7
 Z

Set Pressure -

Position 8, 9 & 10
 — — — = Actual Setting

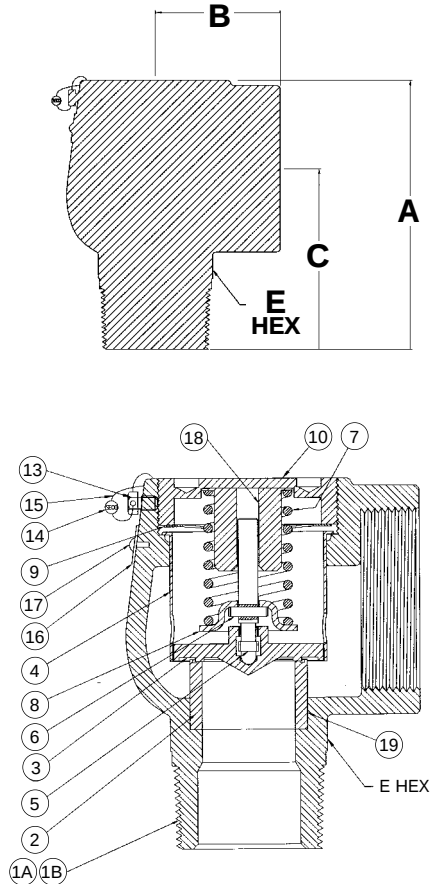
FIGURE 15V SERIES

SPECIFICATION

The valve inlet and outlet shall be one integral casting assuring proper alignment of disc, seat and spindle for smooth action. The valve shall maintain a high degree of repeatability. The valve shall be top guided by a disc guide fitted into the body. The valve shall have a non-adjustable blowdown.

MATERIALS OF CONSTRUCTION

Ref	Part Name	Material
1A	Body	Cast ASTM A126
1B	Body	Aluminum ASTM B26, A03560, T6
2	Seat	Bronze ASTM B505
3	Disc	Brass/Bronze ASTM B505
4	Disc Guide	Brass ASTM B135
5	Spindle	Steel ASTM A108
6	Spindle Pin	Plated Steel
7	Spring	Plated Steel
8	Spring Washer	Plated Steel
9	Wave Washer	Plated Steel
10	Compression Screw	Cast Iron ASTM A126
13	Lock Screw	Brass ASTM B16
14	Seal	Lead
15	Seal Wire	SST
16	Nameplate	SST
17	Drive Screw	SST
18	Bushing	Brass ASTM B16



DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Model	Inlet	Orifice	Outlet*	A1	B	C	E Hex	Weight
****ZDA	¾ (20)	Z	1 (25)	3 (76)	1½ (38)	2⅝ (56)	1¼ (32)	1 (.4)
****ZEA	1 (25)	Z	1¼ (32)	3¾ (95)	2 (51)	2⅝ (67)	1½ (38)	2 (.9)
****ZFA	1¼ (32)	Z	1½ (40)	4¼ (108)	2⅝ (54)	3 (76)	1⅝ (48)	3 (1.4)
****ZGA	1½ (40)	Z	2 (50)	4⅝ (117)	2⅝ (56)	3⅝ (81)	2 (51)	4 (1.8)
****ZHA	2 (50)	Z	2½ (65)	6⅝ (156)	2⅝ (73)	4 (102)	3 (76)	8 (3.6)
****ZJA	2½ (65)	Z	2½ (65)	7⅝ (194)	3⅝ (95)	4⅝ (111)	3¾ (83)	14 (6.3)
****ZKA	3 (80)	Z	3 (80)	9 (229)	3⅝ (98)	5⅝ (130)	4 (102)	22 (10)

**** Add appropriate model number

* Valve outlet should be mounted at vacuum side of system.

AIR CAPACITY CHART – MODELS 015V & 015LV

Rated Flow SCFM (M³/HR)

Set* Pressure in. HG	Valve & Orifice Area, in.*						
	¾ Z 1 0.276	1 Z 1¼ 0.49	1½ Z 1½ 0.765	1¾ Z 2 1.107	2 Z 2½ 1.961	2½ Z 2½ 3.063	3 Z 3 4.43
5	36	85	132	191	337	528	764
6	39	90	140	203	359	561	812
7	41	94	147	213	376	588	851
8	42	98	152	221	389	609	881
9	43	100	156	227	400	625	904
10	44	102	159	231	407	637	922
11	45	104	161	234	412	645	933
12	45	104	162	236	415	650	940
12.8-30	45	105	163	236	417	651	943

Set Pressure mmHG	Valve & Orifice Area cm.*						
	20 Z 25 1.78	25 Z 32 3.16	32 Z 40 4.94	40 Z 50 7.14	50 Z 65 12.65	65 Z 65 19.76	80 Z 80 25.58
127	62	144	224	325	573	897	1297
152	66	153	238	346	610	953	1380
178	69	160	249	362	639	999	1445
203	71	166	258	375	661	1034	1497
229	73	171	265	385	679	1062	1536
254	75	174	270	392	692	1082	1566
279	76	176	274	397	701	1096	1586
305	76	177	276	400	706	1104	1597
325-762	76	178	276	401	708	1107	1601

*Valve outlet should be mounted at vacuum side of system.



FIGURE 50 SERIES SAFETY VALVE

FIGURE 50 SERIES

SIZES 2"

PRESSURES to 30 PSIG at 225°F

- Air, Gas, Vapors and Powdered Solids
- High Capacity
- Tamper Proof Spring Setting
- Weatherproof
- Spring Chamber Isolated from Process Fluid
- Soft Seat Seal
- Bronze or Aluminum Body
- "UV" National Board Certified

MODELS

- 0050 - Bronze Body, Viton Soft Seat
- 0051 - Pull Ring on 0050
- 0052 - Aluminum Body, Viton Soft Seat
- 0053 - Pull Ring on 0052

APPLICATION DATA

- Bulk Hauling Truck Tank Trailers
- Bulk Hauling Railroad Tank Cars
- Storage Vessels for Powdered Solids (flour, cement, etc.)

VALVE RATINGS

Model	Pressure PSIG (bar)	Temperature °F (°C)
All	10 to 30 (.7 to 2.1)	-20 to 225 (-29 to 107)

APPLICABLE CODES

- ASME Section VIII "UV" for Air (Figure 51 & 53 only - 15 PSI or higher)
- Canadian Registration #0G0591.9C

CODE SELECTION CHART

Model				Orifice	Inlet Size	Connections	Set Pressure		
0	0	5	2	Z	H	Z	-	0	1 5
1	2	3	4	5	6	7	8	9	10
Model - Position 1, 2, 3 & 4 0050 = Bronze Body, Viton Soft Seat 0051 = Pull Ring on 0050 0052 = Aluminum Body, Viton Soft Seat 0053 = Pull Ring on 0052				Orifice - Position 5 Z		Connections - Position 7 Z			
				Inlet Size - Position 6 H = 2		Set Pressure - Position 8, 9 & 10 ____ = Actual Setting LAS - Loosely Assembled†			

†Spence Certified Assemblers Only

FIGURE 50 SERIES

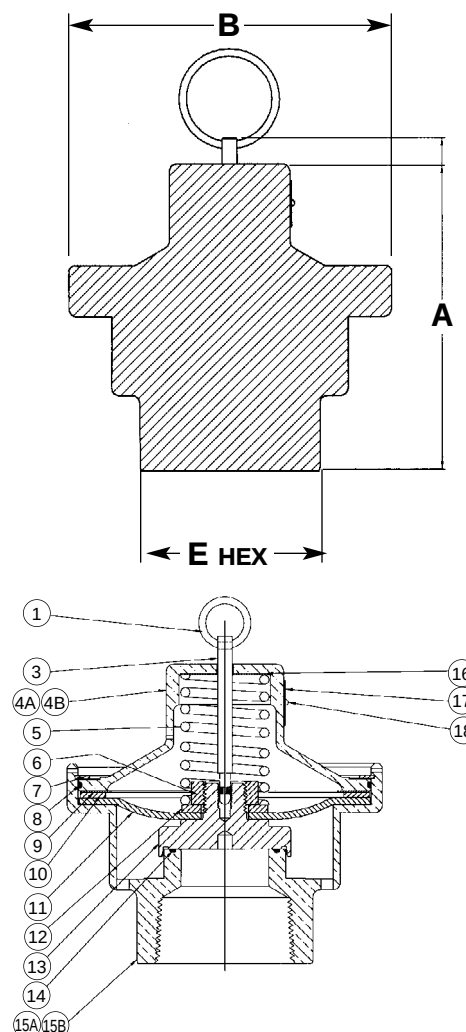
SPECIFICATION

The valve shall meet the ASME Section VIII Code for air services. It shall be "UV" National Board Certified. The valve setting shall be tamper resistant. The valve shall be weatherproof and the diaphragm shall completely seal the spring chamber from the process fluid. The valve shall have an O-ring seat seal for tight shutoff.

MATERIALS OF CONSTRUCTION

Ref	Part Name	Material
1	Pull Ring	SST
3	Spindle (0051/0053)	Steel ASTM A108. 12L14
4A	Cover	Bronze ASTM B62
4B	Cover	Aluminum ASTM B 26, A03560, T6
5	Spring	Steel ASTM A228, Plated
6	Disc Nut	Steel, Plated
7	Retaining Ring	Steel, Plated
8	Weather Seal	Viton
9	Wave Spring	Steel, Plated
10	Washer	Steel, Plated
11	Diaphragm	Nylon Reinforced
12	Disc Washer	Plated Steel
13	Disc	ASTM B16, C36000, H02
14	Seat Seal	Viton
15A	Body	Bronze ASME SB62
15B	Body	Aluminum ASTM B26, A03560, T6
16	Fender Washer	Steel, Plated
17	Nameplate	SST
18	Drive Screw	SST

Lead seal plus SS wire not shown



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

Model	Inlet	Orifice	Outlet	A	B	E	Weight
0050ZHZ	2 (50)	Z	Atmosphere	5 $\frac{3}{32}$ (129)	5 $\frac{5}{8}$ (136)	3 (76)	7 (3.2)
0051ZHZ	2 (50)	Z	Atmosphere	6 (152)	5 $\frac{5}{8}$ (136)	3 (76)	7 (3.2)
0052ZHZ	2 (50)	Z	Atmosphere	5 $\frac{3}{32}$ (129)	5 $\frac{5}{8}$ (136)	3 (76)	3 (1.4)
0053ZHZ	2 (50)	Z	Atmosphere	6 (152)	5 $\frac{5}{8}$ (136)	3 (76)	3 (1.4)

AIR CAPACITY CHART – MODELS 0050, 0051, 0052, 0053

ASME Section VIII "UV" 90% rated at 10% Slope SCFM (NM³/HR)

SCFM

Set Pressure PSIG	Orifice Area, in ²
10*	637
15	752
20	867
25	982
30	1097
1.0	25.3

NM³/HR

Set Pressure Barg	Orifice Area cm ²
0.6*	1082
0.8*	1278
1.0*	1473
1.2	1669
0.1	43.0

* Pressure settings below 15 PSIG (1.034 barg) are non code.



DRIP PAN ELBOW

SIZES 3/4" – 8"

PRESSURES to 250 PSIG at 406°F

- Collects Discharge Condensate from Steam Systems
- Returns Condensate to Safe Areas
- Increases Life of Safety Valves
- Reduces Discharge Piping Strain
- Female NPT or Flange Connections
- Compatible with All Spence ASME Safety Valves
- Helps Prevent Injury & Property Damage

APPLICATION DATA

- Steam Boilers
- Steam Pressure Reducing Stations
- Steam Pressure Vessels & Lines

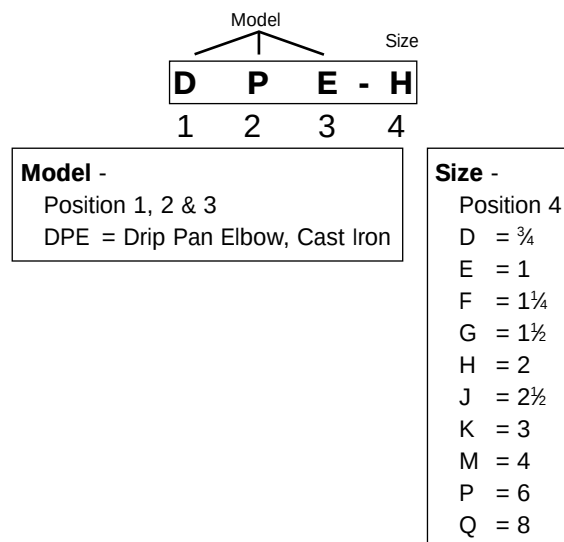
VALVE RATINGS

Model	Pressure PSIG (bar)	Temperature °F (°C)
All	250 (17.2)	406 (208)

MODELS

- DPE - Drip Pan Elbow, Cast Iron

CODE SELECTION CHART



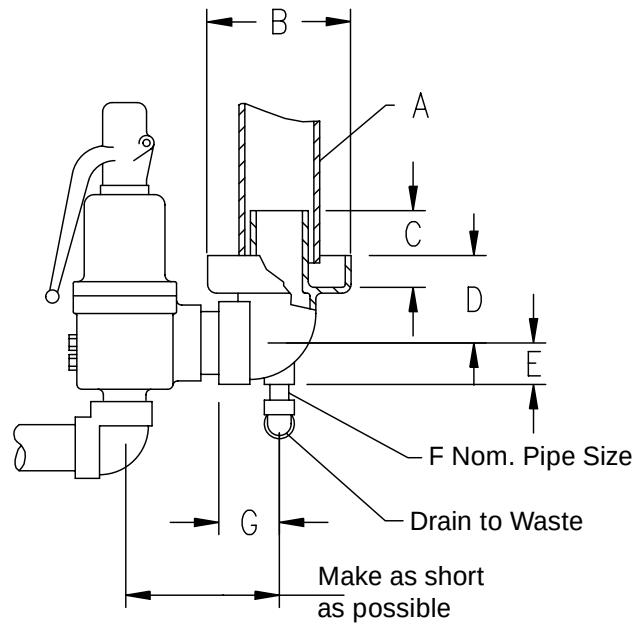
DRIP PAN ELBOW

SPECIFICATION

The Drip Pan Elbow shall be a minimum of the size of the safety valve discharge and installed on the discharge side of the safety valve. It shall be made of cast iron and conform to the Power Piping Code. It shall have a pan to collect condensate in the steam riser pipe and a drain to pipe away the condensate.

MATERIALS OF CONSTRUCTION

Body Cast Iron
ASTM A126 Class B



DRIP PAN ELBOW

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

Model	Outlet	A	B	C	D	E	F	G	Weight
DPE-D	$\frac{3}{4}$	2 (51)	$3\frac{3}{4}$ (95)	$2\frac{3}{4}$ (70)	2 (51)	1 (25)	$\frac{3}{8}$ (10)	$1\frac{1}{2}$ (38)	2 (.9)
DPE-E	1	2 (51)	$3\frac{3}{4}$ (95)	$2\frac{3}{4}$ (70)	2 (51)	1 (25)	$\frac{3}{8}$ (10)	$1\frac{1}{2}$ (38)	2 (.9)
DPE-F	$1\frac{1}{4}$	2.5 (65)	$5\frac{1}{2}$ (140)	$4\frac{15}{16}$ (125)	$4\frac{1}{8}$ (105)	$1\frac{1}{16}$ (37)	$\frac{3}{8}$ (10)	$2\frac{3}{8}$ (54)	4 (1.8)
DPE-G	$1\frac{1}{2}$	2.5 (65)	$5\frac{1}{2}$ (140)	$4\frac{15}{16}$ (125)	$4\frac{1}{8}$ (105)	$1\frac{1}{16}$ (37)	$\frac{3}{8}$ (10)	$2\frac{3}{8}$ (54)	4 (1.8)
DPE-H	2	3 (76)	$6\frac{1}{4}$ (159)	$4\frac{3}{8}$ (117)	$3\frac{5}{8}$ (92)	$1\frac{3}{8}$ (41)	$\frac{1}{2}$ (13)	$2\frac{3}{4}$ (57)	6 (2.7)
DPE-J	$2\frac{1}{2}$	4 (102)	$7\frac{3}{8}$ (187)	$5\frac{5}{16}$ (141)	$4\frac{1}{16}$ (110)	$1\frac{15}{16}$ (49)	$\frac{3}{4}$ (19)	$2\frac{1}{16}$ (68)	11 (5.0)
DPE-K	3	4 (102)	8 (203)	$6\frac{1}{2}$ (165)	$4\frac{7}{8}$ (124)	$2\frac{5}{16}$ (59)	$\frac{3}{4}$ (19)	$3\frac{3}{8}$ (79)	14 (6.4)
DPE-M	4	6 (152)	$9\frac{3}{8}$ (244)	$8\frac{3}{4}$ (210)	$5\frac{1}{4}$ (146)	$2\frac{3}{8}$ (73)	$\frac{3}{4}$ (19)	$3\frac{3}{4}$ (95)	26 (11.8)
DPE-P*	6	8 (203)	$12\frac{3}{4}$ (324)	$11\frac{15}{16}$ (294)	$7\frac{7}{16}$ (192)	$4\frac{1}{16}$ (106)	$\frac{3}{4}$ (19)	8 (203)	74 (33.6)
DPE-Q*	8	10 (254)	$16\frac{1}{2}$ (419)	$14\frac{3}{8}$ (378)	$9\frac{1}{16}$ (243)	$5\frac{3}{4}$ (146)	1 (25)	$10\frac{3}{4}$ (273)	100 (45.4)

*6" and 8" Drip Pan Elbows have integral 125# flange.

NOTES:

**SAFETY RELIEF
VALVES**

CRYOGENIC SAFETY RELIEF VALVES

**CRYOGENIC
SAFETY VALVES**



FIGURE 710 SERIES RXSO BRONZE

SIZES 1/2" – 2"

PRESSURES to 400 psig at 400°F

APPLICATION DATA

- Especially recommended where noxious or expensive liquids or gases place a premium on seal quality.
- Stationary Cryogenic storage tanks
- Dual Safety relief systems
- Overpressure relief of tanks, pipelines, vessels, pumps
- Air and gas compressors
- Corrosive industrial applications

APPLICABLE CODES

- V-4301 (Cryogenic Non-Oxygen)
- V-4401 (Oxygen)
- API 527
- CRN 0G0591.9C
- CGA S-1.2 and S-1.3.
- ASME sec.VIII, "UV"
- AD-Merkblatt A2
- PED

- Special Teflon® seat, making bubble-tight seals possible to over 90% of set pressures per spec API 527; not applicable to steam.**
- Adjustable blowdown ring**
- PED certified**
- Cleaned and packaged for use in O₂ service in compliance with the CGA specification G-4.1**
Additional cleaning specifications:
 - 4WPI-SW70003
 - ES.660.503
 - GS-38
 - GS-40

OPTIONS

- Large and Extra Large Capacity (Consult factory for flow rates)
- BSP threads are available on most sizes
- Lever operation
- Test Reports available

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Inlet	Orifice	Outlet	Part #	Max Psi	Dimensions			Wt.
					A	B	C	
1/2 (15)	A	3/4 (20)	710NACD	400 (27.6)	5 7/8 (150)	2 1/8 (65)	1 1/8 (34)	2 (.91)
3/4 (20)	A	3/4 (20)	710NADD	400 (27.6)	5 7/8 (150)	2 1/8 (65)	1 1/8 (34)	2 (.91)
1/2 (15)	A	1 (25)	710NACE	400 (27.6)	6 1/2 (166)	2 3/16 (71)	1 1/8 (43)	3 (1.36)
3/4 (20)	A	1 (25)	710NADE	400 (27.6)	6 1/2 (166)	2 3/16 (71)	1 1/8 (43)	3 (1.36)
1/2 (15)	B	1 (25)	710NBCE	400 (27.6)	7 1/2 (188)	2 1/2 (74)	1 1/8 (42)	4 (1.82)
3/4 (20)	B	1 (25)	710NBDE	400 (27.6)	7 1/2 (188)	2 1/2 (74)	1 1/8 (42)	4 (1.82)
1 (25)	B	1 (25)	710NBEE	400 (27.6)	7 1/2 (188)	2 1/2 (74)	1 1/8 (42)	4 (1.82)
1/2 (25)	B	1 1/2 (32)	710NBCF	400 (27.6)	7 1/2 (190)	3 (76)	1 1/2 (48)	5 (2.27)
3/4 (20)	B	1 1/2 (32)	710NBDF	400 (27.6)	7 1/2 (190)	3 (76)	1 1/2 (48)	5 (2.27)
1 (25)	B	1 1/2 (32)	710NBEF	400 (27.6)	7 1/2 (190)	3 (76)	1 1/2 (48)	5 (2.27)
3/4 (20)	C	1 1/2 (32)	710NCDF	300 (20.7)	8 1/2 (220)	3 1/2 (90)	2 1/2 (57)	6 (2.72)
1 (25)	C	1 1/2 (32)	710NCEF	300 (20.7)	8 1/2 (220)	3 1/2 (89)	2 1/2 (57)	6 (2.72)
1 1/2 (32)	C	1 1/2 (32)	710NCFF	300 (20.7)	8 1/2 (220)	3 1/2 (89)	2 1/2 (57)	6 (2.72)

Inlet	Orifice	Outlet	Part #	Max Psi	Dimensions			Wt.
					A	B	C	
3/4 (20)	C	1 1/2 (40)	710NCDG	400 (27.6)	9 7/8 (251)	3 3/16 (91)	2 3/8 (66)	7 (3.18)
1 (25)	C	1 1/2 (40)	710NCEG	400 (27.6)	9 7/8 (251)	3 3/16 (91)	2 3/8 (66)	7 (3.18)
1 1/4 (32)	C	1 1/2 (40)	710NCFG	400 (27.6)	9 7/8 (251)	3 3/16 (91)	2 3/8 (66)	7 (3.18)
1 (25)	D	1 1/2 (40)	710NDEG	350 (24.1)	9 3/16 (250)	3 3/16 (90)	2 3/8 (66)	7 (3.18)
1 1/4 (32)	D	1 1/2 (40)	710NDFG	350 (24.1)	9 3/16 (250)	3 3/16 (90)	2 3/8 (66)	7 (3.18)
1 1/2 (40)	D	1 1/2 (40)	710NDGG	350 (24.1)	9 3/16 (250)	3 3/16 (90)	2 3/8 (66)	7 (3.18)
1 (25)	D	2 (50)	710NDEH	400 (27.6)	9 1/16 (246)	3 1/16 (94)	2 3/4 (70)	8 (3.63)
1 1/4 (32)	D	2 (50)	710NDFH	400 (27.6)	9 1/16 (246)	3 1/16 (94)	2 3/4 (70)	8 (3.63)
1 1/2 (40)	D	2 (50)	710NDGH	400 (27.6)	9 1/16 (246)	3 1/16 (94)	2 3/4 (70)	8 (3.63)
1 1/2 (40)	E	2 (50)	710NEGH	400 (27.6)	9 1/16 (247)	3 1/16 (94)	2 3/4 (70)	9 (4.09)
2 (50)	E	2 (50)	710NEHH	400 (27.6)	9 1/16 (246)	3 1/16 (94)	2 3/4 (70)	9 (4.09)
1 1/2 (40)	E	2 1/2 (65)	710NEGJ	400 (27.6)	9 1/16 (247)	4 (102)	2 5/8 (75)	10 (4.54)
2 (50)	E	2 1/2 (65)	710NEHJ	400 (27.6)	9 1/16 (246)	4 (102)	2 5/8 (75)	10 (4.54)

NOTE: 1. 715 (PED) Valve Combinations are the same as the 710's listed above.
2. For open lever, replace "N" in model number with "E".

CODE SELECTION CHART

Model			Cap	Orifice	Inlet Size	Outlet Size	Valve Service	Set Pressure		
7	1	0	N	B	D	E	- A	0	2	5
1	2	3	4	5	6	7	8	9	10	11

Model - Position 1, 2 & 3 710 = Bronze ASME w/O ₂ cleaning 715 = Bronze PED w/O ₂ cleaning	Cap - Position 4 N = Plain Cap E = Open Lever

Orifice - Position 5 A B C D E

Inlet Size - Position 6 C = 1/2 D = 3/4 E = 1 F = 1 1/4 G = 1 1/2 H = 2

Outlet Size - Position 7 D = 3/4 E = 1 F = 1 1/4 G = 1 1/2 H = 2 J = 2 1/2

Valve Service - Position 8 A = Air/Gas Sect. VIII E = Air / Gas PED Z = Other	Set Pressure - Position 9, 10 & 11 ___ = Actual Setting

FIGURE 710/715
SERIES

FIGURE 710 SERIES

RXSO BRONZE

SPECIFICATION

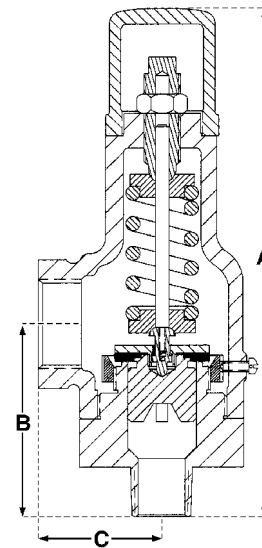
The valve shall meet the ASME Section VIII code for air and gas services. It shall be "UV" National Board Certified. The valve shall have an adjustable blowdown ring. The valve shall have a Teflon(r) seat and conform to API 527. The valve shall be cleaned and packaged for use in Oxygen service in compliance with CGA specification G-4.1. The spring shall be of stainless steel.

MATERIALS OF CONSTRUCTION

Shell Cast Bronze, ASME SB-62
 Base Forged Brass, Alloy C37700
 Trim Copper Alloy
 Spring Stainless Steel
 17-7 PH ASTM, A-313, Type 631

MODELS

- 710 - Bronze ASME w/O₂ cleaning
- 715 - Bronze PED w/O₂ cleaning



AIR CAPACITY TABLE

Discharge capacities in cubic feet per minute of air at 10% or 3 PSI, whichever is greater, overpressure. (SCFM) Ambient

Inlet Sizes Inches		1/2	3/4	1	1-1/4
		1/2	3/4	1	1-1/4
		3/4	1	1-1/4	2
Outlet Sizes		3/4	1	1-1/4	2
		1	1-1/4	1-1/2	2
Seat Diameter		A	B	C	D
		0.750	1.000	1.250	1.500
Flow Area		0.118	0.204	0.326	0.424
Set Pressure		0.628			
10	36	63	100	130	193
15	43	74	118	154	227
20	48	85	136	177	262
25	55	96	154	200	297
30	62	108	172	224	332
35	70	120	192	250	370
40	77	133	212	276	408
45	84	145	232	301	446
50	91	157	252	327	485
55	98	170	271	353	523
60	105	182	291	379	561
65	113	195	311	405	599
70	120	207	331	430	638
75	127	220	351	456	676
80	134	232	371	482	714
85	141	244	391	508	752
90	149	257	410	534	791
95	156	269	430	560	829
100	163	282	450	585	867
105	170	294	470	611	905
110	177	307	490	637	944
115	184	319	510	663	982
120	192	331	530	689	1020
125	199	344	549	715	1058
130	206	356	569	740	1097
135	213	369	589	766	1135
140	220	381	609	792	1173
145	228	393	629	818	1211
150	235	406	649	844	1249
155	242	418	668	869	1288
160	249	431	688	895	1326
165	256	443	708	921	1364
170	264	456	728	947	1402
175	271	468	748	973	1441
180	278	480	768	999	1479
185	285	493	788	1024	1517
190	292	505	807	1050	1555
195	299	518	827	1076	1594
200	307	530	847	1102	1632
205	314	543	867	1128	1670

Inlet Sizes Inches		1/2	3/4	1	1-1/4
		3/4	1	1-1/4	2
Outlet Sizes		3/4	1	1-1/4	2
		1	1-1/4	1-1/2	2
Seat Diameter		A	B	C	D
		0.750	1.000	1.250	1.500
Flow Area		0.118	0.204	0.326	0.424
Set Pressure		0.628			
210	321	555	887	1153	1708
215	328	567	907	1179	1747
220	335	580	927	1205	1785
225	343	592	946	1231	1823
230	350	605	966	1257	1861
235	357	617	986	1283	1900
240	364	629	1006	1308	1938
245	371	642	1026	1334	1976
250	378	654	1046	1360	2014
255	386	667	1066	1386	2053
260	393	679	1085	1412	2091
265	400	692	1105	1437	2129
270	407	704	1125	1463	2167
275	414	716	1145	1489	2206
280	422	729	1165	1515	2244
285	429	741	1185	1541	2282
290	436	754	1204	1567	2320
295	443	766	1224	1592	2359
300	450	779	1244	1618	2397
305	458	791	1264	1644	2435
310	465	803	1284	1670	2473
315	472	816	1304	1696	2511
320	479	828	1324	1721	2550
325	486	841	1343	1747	2588
330	493	853	1363	1773	2626
335	501	866	1383	1799	2664
340	508	878	1403	1825	2703
345	515	890	1423	1851	2741
350	522	903	1443	1876	2779
355	529	915	1463	1902	2817
360	537	928	1482	1928	2856
365	544	940	1502	1954	2894
370	551	952	1522	1980	2932
375	558	965	1542	2005	2970
380	565	977	1562	2031	3009
385	590	989	1582	2057	3047
390	580	1002	1602	2083	3085
395	587	1015	1621	2109	3123
400	594	1027	1641	2135	3162

FIGURE 710/715
SERIES



FIGURE 760/765 SERIES RXSO-S STAINLESS STEEL

SIZES ½" – 1"

PRESSURES to 400 PSIG at 400°F

- **Special Teflon® seat, making bubble-tight seals possible to over 90% of set pressures per spec API 527; not applicable to steam.**

- **Adjustable blowdown ring**

- **Cleaned and packaged for use in O₂ service in compliance with the CGA specification G-4.1**

Additional cleaning specifications:

4WPI-SW70003

● **ES.660.503**

● **GS-38**

● **GS-40**

APPLICATION DATA

- Especially recommended where corrosive or expensive gases benefit from stainless steel construction.
- Overpressure relief of tanks, pipelines, vessels, pumps
- Stationary Cryogenic storage tanks
- Dual Safety relief systems
- Air and gas compressors

APPLICABLE CODES

- CGA S-1.2 and S-1.3.
- V-4301 (Cryogenic Non-Oxygen)
- V-4401 (Oxygen)
- ASME sec.VIII
- API 527
- AD-Merkblatt A2
- CRN 0G0591.9C

OPTIONS

- Large and Extra Large Capacity
- BSP threads are available on most sizes.
- Lever operation
- Electropolish
- Test Reports available

MODELS

- 760 Stainless Steel ASME w/O₂ cleaning
- 765 Stainless Steel PED w/O₂ cleaning

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Inlet	Orifice	Outlet	Part #	Max PSI (barg)	Dimensions			Wgt.
					A	B	C	
1/2 (15)	A	3/4 (20)	760NACD	400 (27.6)	5 7/8 (150)	2 1/8 (65)	1 1/8 (34)	2 (.91)
3/4 (20)	A	3/4 (20)	760NADD	400 (27.6)	5 7/8 (150)	2 1/8 (65)	1 1/8 (34)	2 (.91)
1/2 (15)	A	1 (25)	760NACE	400 (27.6)	6 1/2 (166)	2 1/8 (71)	1 1/8 (43)	3 (1.36)
3/4 (20)	A	1 (25)	760NADE	400 (27.6)	6 1/2 (166)	2 1/8 (71)	1 1/8 (43)	3 (1.36)
1/2 (15)	B	1 (25)	760NBCE	400 (27.6)	7 7/8 (188)	2 7/8 (74)	1 1/8 (42)	4 (1.82)
3/4 (20)	B	1 (25)	760NBDE	400 (27.6)	7 7/8 (188)	2 7/8 (74)	1 1/8 (42)	4 (1.82)
1 (25)	B	1 (25)	760NBEE	400 (27.6)	7 7/8 (188)	2 7/8 (74)	1 1/8 (42)	4 (1.82)
1/2 (25)	B	1 1/4 (32)	760NBCF	400 (27.6)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)
3/4 (20)	B	1 1/4 (32)	760NBDF	400 (27.6)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)
1 (25)	B	1 1/4 (32)	760NBEF	400 (27.6)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)

NOTE: 765 (PED) Valve Combinations are the same as the 760's listed above.

CODE SELECTION CHART

Model			Cap	Orifice	Inlet Size	Outlet Size	Valve Service	Set Pressure		
7	6	0	N	B	D	E	- A	0	2	5
1	2	3	4	5	6	7	8	9	10	11

Model - Position 1, 2 & 3 760 = ASME w/O ₂ cleaning 765 = PED w/O ₂ cleaning
Cap - Position 4 N = Plain Cap E = Open Lever

Orifice - Position 5 A B

Inlet Size - Position 6 C = ½ D = ¾ E = 1

Outlet Size - Position 7 D = ¾ E = 1 F = 1 ¼

Valve Service - Position 8 A = Air/Gas Sect. VIII E = Air/Gas PED Z = Other
Set Pressure - Position 9, 10 & 11 ___ = Actual Setting

FIGURE 760/765 SERIES

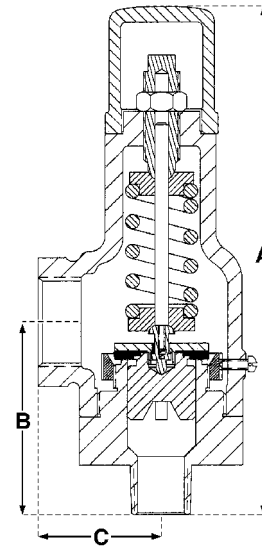
RXSO-S STAINLESS STEEL

SPECIFICATION

The valve shall meet the ASME Section VIII code for air and gas services. It shall be "UV" National Board Certified. The valve shall have an adjustable blowdown ring. The valve shall have a Teflon(r) seat and conform to API 527. The valve shall be cleaned and packaged for use in Oxygen service in compliance with CGA specification G-4.1. The valve shall be 316SS except the spring (17-7 PH SS).

MATERIALS OF CONSTRUCTION

Shell Investment Cast 316SS, ASME SA-351
 Base Investment Cast 316SS, ASME SA-351
 Trim 316SS, ASME SA-479
 Spring StainlessSteel
 17-7 PH ASTM A-313, Type 631



AIR CAPACITY TABLE

Discharge capacities in cubic feet per minute of air at 10% or 3 PSI, whichever is greater, overpressure.

Inlet Sizes Inches	1/2 3/4	1/2 3/4 1
Outlet Sizes Inches	3/4 1	1 1/4
Seat Diameter Inches	A 0.750	B 1.000
Flow Area	0.118	0.204
Set Pressure		
10	36	63
15	43	74
20	48	85
25	55	96
30	62	108
35	70	120
40	77	133
45	84	145
50	91	157
55	98	170
60	105	182
65	113	195
70	120	207
75	127	220
80	134	232
85	141	244
90	149	257
95	156	269
100	163	282
105	170	294
110	177	307
115	184	319
120	192	331
125	199	344
130	206	356
135	213	369

Inlet Sizes Inches	1/2 3/4	1/2 3/4 1
Outlet Sizes Inches	3/4 1	1 1/4
Seat Diameter Inches	A 0.750	B 1.000
Flow Area	0.118	0.204
Set Pressure		
140	220	381
145	228	393
150	235	406
155	242	418
160	249	431
165	256	443
170	264	456
175	271	468
180	278	480
185	285	493
190	292	505
195	299	518
200	307	530
205	314	543
210	321	555
215	328	567
220	335	580
225	343	592
230	350	605
235	357	617
240	364	629
245	371	642
250	378	654
255	386	667
260	393	679
265	400	692

Inlet Sizes Inches	1/2 3/4	1/2 3/4 1
Outlet Sizes Inches	3/4 1	1 1/4
Seat Diameter Inches	A 0.750	B 1.000
Flow Area	0.118	0.204
Set Pressure		
270	407	704
275	414	716
280	422	729
285	429	741
290	436	754
295	443	766
300	450	779
305	458	791
310	465	803
315	472	816
320	479	828
325	486	841
330	493	853
335	501	866
340	508	878
345	515	890
350	522	903
355	529	915
360	537	928
365	544	940
370	551	952
375	558	965
380	565	977
385	572	989
390	580	1002
395	587	1015
400	594	1027

FIGURE 760/765
SERIES



FIGURE 770/775 SERIES RSL/RSL-S

770 BRONZE SIZES 1/2" – 2"
775 STAINLESS STEEL SIZES 1/2" – 1"
PRESSURES to 300 psig at 300°F

- Teflon® seat for improved seat tightness
- Cleaned and packaged for use in O₂ service in compliance with the CGA specification G-4.1

Additional cleaning specifications:

- 4WPI-SW 7003
- GS-38
- GS-40
- ES.660.503

APPLICATIONS DATA

- Tanks, pumps, pipe lines and other vessels containing non-corrosive liquid, and where large relieving capacities are not required.

OPTIONS

- BSP threads available on most sizes
- Lever operation
- Test reports available

MODELS

- 770 - Bronze Non ASME w/O₂ cleaning
- 775 - Stainless Steel Non ASME w/O₂ cleaning (1/2" x 3/4" through 1" x 1-1/4" Only)

CODE SELECTION CHART

Model			Cap	Orifice	Inlet Size	Outlet Size	Valve Service	Set Pressure		
7	7	0	N	B	D	E	- N	0	2	5
1	2	3	4	5	6	7	8	9	10	11

Model -

Position 1, 2 & 3

770 = Bronze Non ASME w/O₂ cleaning

775 = S.S. Non ASME w/O₂ cleaning

Cap -

Position 4

N = Plain Cap

E = Open Lever

Orifice -

Position 5

A

B

C

D

E

Inlet Size -

Position 6

C = 1/2

D = 3/4

E = 1

F = 1 1/4

G = 1 1/2

H = 2

Outlet Size -

Position 7

C = 1/2

D = 3/4

E = 1

F = 1 1/4

G = 1 1/2

H = 2

J = 2 1/2

Valve Service -

Position 8

N = Air/Gas/Liquid Non Code

Z = Other

Set Pressure -

Position 9, 10 & 11

___ = Actual Setting

FIGURE 770/775 SERIES

RSL/RSL-S

SPECIFICATION

The valve shall be used for liquid services. The valve shall have an adjustable blowdown ring. The valve shall have a Teflon[®] seat. The valve shall be cleaned and packaged for use in Oxygen service in compliance with CGA specification G-4.1. The spring shall be of stainless steel.

MATERIALS OF CONSTRUCTION

BRONZE

Shell Cast Bronze, ASME SB-62
 Base.....Forged Brass, Alloy C37700
 Trim.....Copper Alloy
 Spring Stainless Steel
 17-7 PH ASTM, A-313, Type 631

STAINLESS STEEL

Shell Investment Cast 316SS, ASME SA-351
 Base Investment Cast 316SS, ASME SA-351
 Trim 316SS, ASME SA-479
 Spring Stainless Steel
 17-7 PH, ASTM, A-313, Type 631

WATER CAPACITY TABLE

Rate of discharge in gallons of water per minute at set pressure plus 25% accumulation or overpressure.

Inlet Sizes Inches	1/2	3/4	1	1 1/4	1 1/2
	3/4	1	1 1/4	1 1/2	2
Outlet Sizes	3/4	1	1 1/4	1 1/2	2
	1	1 1/4	1 1/2	2	2 1/2
Seat Diameter Inches	A	B	C	D	E
	.75	1.00	1.25	1.50	2.00
Flow Area	.118	0.204	0.326	0.424	0.628
Set Pressure					
5	10.5	17.6	28.1	36.5	54.1
10	12.0	20.0	32.0	41.6	61.6
15	13.3	22.2	35.5	46.1	68.3
20	14.5	24.2	38.6	50.3	74.4
25	15.6	26.0	41.6	54.1	80.1
30	16.6	27.7	44.3	57.6	85.3
35	17.6	29.3	46.9	61.0	90.3
40	18.5	30.9	49.3	64.1	95.0
45	19.4	32.3	51.6	67.2	99.5
50	20.2	33.7	53.9	70.1	103.8
55	21.0	35.1	56.0	72.9	107.9
60	21.8	36.3	58.1	75.5	111.9
65	22.5	37.6	60.1	78.1	115.7
70	23.3	38.8	62.0	80.6	119.4
75	24.0	40.0	63.9	83.1	123.0
80	24.6	41.1	65.7	85.4	126.5
85	25.3	42.2	67.4	87.7	129.9
90	25.9	43.3	69.2	89.9	133.2
95	26.6	44.3	70.8	92.1	136.5
100	27.2	45.4	72.5	94.3	139.6
105	27.8	46.4	74.1	96.3	142.7
110	28.4	47.3	75.6	98.4	145.7
115	29.0	48.3	77.2	100.4	148.7
120	29.5	49.2	78.7	102.4	151.6
125	30.1	50.2	80.2	104.3	154.4
130	30.6	51.1	81.6	106.2	157.2
135	31.2	52.0	83.1	108.0	160.0
140	31.7	52.8	84.5	109.8	162.7
145	32.2	53.7	85.8	111.6	165.4
150	32.7	54.6	87.2	113.4	168.0

Inlet Sizes Inches	1/2	3/4	1	1 1/4	1 1/2
	3/4	1	1 1/4	1 1/2	2
Outlet Sizes	3/4	1	1 1/4	1 1/2	2
	1	1 1/4	1 1/2	2	2 1/2
Seat Diameter Inches	A	B	C	D	E
	.75	1.00	1.25	1.50	2.00
Flow Area	.118	0.204	0.326	0.424	0.628
Set Pressure					
155	33.2	55.4	88.5	115.1	170.5
160	33.7	56.2	89.8	116.9	173.1
165	34.2	57.0	91.1	118.5	175.6
170	34.7	57.8	92.4	120.2	178.0
175	35.1	58.6	93.7	121.9	180.5
180	35.6	59.4	94.9	123.5	182.9
185	36.1	60.2	96.2	125.1	185.3
190	36.5	60.9	97.4	126.7	187.6
195	37.0	61.7	98.6	128.2	189.9
200	37.4	62.4	99.8	129.8	192.2
205	37.9	63.2	100.9	131.3	194.4
210	38.3	63.9	102.1	132.8	196.7
215	38.7	64.6	103.2	134.3	196.9
220	39.2	65.3	104.4	135.7	201.1
225	39.6	66.0	105.5	137.2	203.2
230	40.0	66.7	106.6	138.6	205.3
235	40.4	67.4	107.7	140.1	207.5
240	40.8	68.1	108.8	141.5	209.5
245	41.2	68.7	109.9	142.9	211.6
250	41.6	69.4	110.9	144.3	213.7
255	42.0	70.1	112.0	145.6	215.7
260	42.4	70.7	113.0	147.0	217.7
265	42.8	71.4	114.1	148.3	219.7
270	43.2	72.0	115.1	149.7	221.7
275	43.5	72.6	116.1	151.0	223.6
280	43.9	73.3	117.7	152.3	225.6
285	44.3	73.9	118.1	153.6	227.5
290	44.7	74.5	119.1	154.9	229.4
295	45.0	75.1	120.1	156.2	231.3
300	45.4	75.7	121.0	157.4	233.2

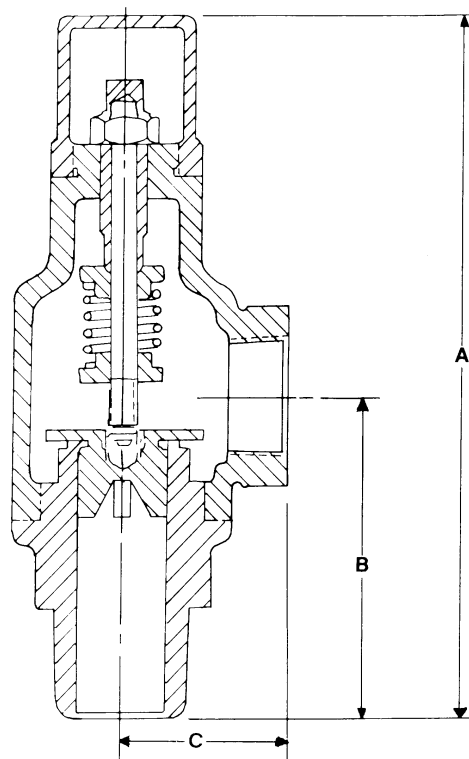
FIGURE 770/775
SERIES

DIMENSIONS AND WEIGHTS

RSL FIGURE 770 SERIES

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

Inlet	Orifice	Outlet	Part #	Max PSI (barg)	Dimensions			Wgt.
					A	B	C	
1/2 (15)	A	1/2 (20)	770NACC	300 (20.7)	5 7/8 (150)	2 1/16 (65)	1 5/16 (34)	2 (.91)
1/2 (15)	A	3/4 (20)	770NACD	300 (20.7)	5 7/8 (150)	2 1/16 (65)	1 5/16 (34)	2 (.91)
3/4 (20)	A	3/4 (20)	770NADD	300 (20.7)	5 7/8 (150)	2 1/16 (65)	1 5/16 (34)	2 (.91)
1/2 (15)	A	1 (25)	770NACE	300 (20.7)	6 1/2 (166)	2 13/16 (71)	1 13/16 (43)	3 (1.36)
3/4 (20)	A	1 (25)	770NADE	300 (20.7)	6 1/2 (166)	2 13/16 (71)	1 13/16 (43)	3 (1.36)
1/2 (15)	B	1 (25)	770NBCE	300 (20.7)	7 3/8 (188)	2 7/8 (74)	1 13/16 (42)	4 (1.82)
3/4 (20)	B	1 (25)	770NBDE	300 (20.7)	7 3/8 (188)	2 7/8 (74)	1 13/16 (42)	4 (1.82)
1 (25)	B	1 (25)	770NBEE	300 (20.7)	7 3/8 (188)	2 7/8 (74)	1 13/16 (42)	4 (1.82)
1/2 (25)	B	1 1/4 (32)	770NBCF	300 (20.7)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)
3/4 (20)	B	1 1/4 (32)	770NBDF	300 (20.7)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)
1 (25)	B	1 1/4 (32)	770NBEF	300 (20.7)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)
3/4 (20)	C	1 1/4 (32)	770NCDF	300 (20.7)	8 13/16 (220)	3 1/2 (90)	2 3/4 (57)	6 (2.72)
1 (25)	C	1 1/4 (32)	770NCEF	300 (20.7)	8 5/8 (220)	3 1/2 (89)	2 3/4 (57)	6 (2.72)
1 1/4 (32)	C	1 1/4 (32)	770NCFF	300 (20.7)	8 5/8 (220)	3 1/2 (89)	2 3/4 (57)	6 (2.72)
3/4 (20)	C	1 1/2 (40)	770NCDG	300 (20.7)	9 7/8 (251)	3 5/16 (91)	2 5/16 (66)	7 (3.18)
1 (25)	C	1 1/2 (40)	770NCEG	300 (20.7)	9 7/8 (251)	3 5/16 (91)	2 5/16 (66)	7 (3.18)
1 1/4 (32)	C	1 1/2 (40)	770NCFG	300 (20.7)	9 7/8 (251)	3 5/16 (91)	2 5/16 (66)	7 (3.18)
1 (25)	D	1 1/2 (40)	770NDEG	300 (20.7)	9 13/16 (250)	3 5/16 (90)	2 5/16 (66)	7 (3.18)
1 1/4 (32)	D	1 1/2 (40)	770NDFG	300 (20.7)	9 13/16 (250)	3 5/16 (90)	2 5/16 (66)	7 (3.18)
1 1/2 (40)	D	1 1/2 (40)	770NDGG	300 (20.7)	9 13/16 (250)	3 5/16 (90)	2 5/16 (66)	7 (3.18)
1 (25)	D	2 (50)	770NDEH	300 (20.7)	9 13/16 (246)	3 13/16 (94)	2 3/4 (70)	8 (3.63)
1 1/4 (32)	D	2 (50)	770NDFH	300 (20.7)	9 13/16 (246)	3 13/16 (94)	2 3/4 (70)	8 (3.63)
1 1/2 (40)	D	2 (50)	770NDGH	300 (20.7)	9 13/16 (246)	3 13/16 (94)	2 3/4 (70)	8 (3.63)
1 1/2 (40)	E	2 (50)	770NEGH	300 (20.7)	9 13/16 (247)	3 13/16 (94)	2 3/4 (70)	9 (4.09)
2 (50)	E	2 (50)	770NEHH	300 (20.7)	9 13/16 (246)	3 13/16 (94)	2 3/4 (70)	9 (4.09)
1 1/2 (40)	E	2 1/2 (65)	770NEGJ	300 (20.7)	9 13/16 (247)	4 (102)	2 15/16 (75)	10 (4.54)
2 (50)	E	2 1/2 (65)	770NEHJ	300 (20.7)	9 13/16 (246)	4 (102)	2 15/16 (75)	10 (4.54)



**SAFETY RELIEF
VALVES**

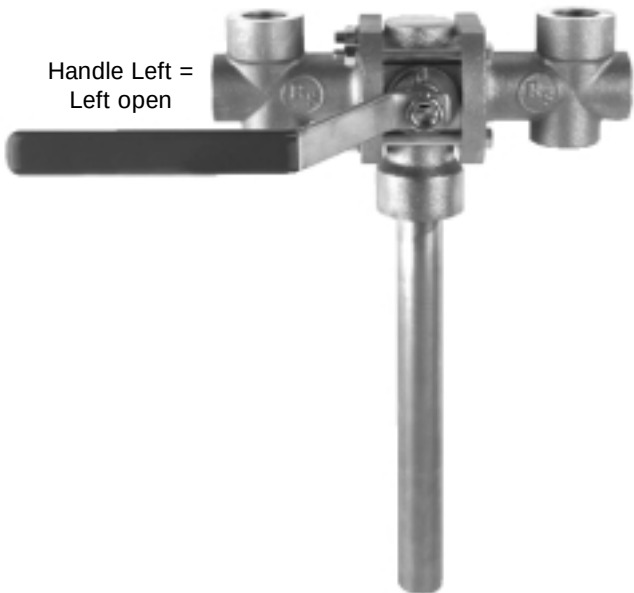
DIMENSIONS AND WEIGHTS

RSL-S FIGURE 775 SERIES

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

Inlet	Orifice	Outlet	Part #	Max PSI (barg)	Dimensions			Wgt.
					A	B	C	
1/2 (15)	A	3/4 (20)	775NACD	300 (20.7)	5 7/8 (150)	2 9/16 (65)	1 5/16 (34)	2 (.91)
3/4 (20)	A	3/4 (20)	775NADD	300 (20.7)	5 7/8 (150)	2 9/16 (65)	1 5/16 (34)	2 (.91)
1/2 (15)	A	1 (25)	775NACE	300 (20.7)	6 1/2 (166)	2 13/16 (71)	1 11/16 (43)	3 (1.36)
3/4 (20)	A	1 (25)	775NADE	300 (20.7)	6 1/2 (166)	2 13/16 (71)	1 11/16 (43)	3 (1.36)
1/2 (15)	B	1 (25)	775NBCE	300 (20.7)	7 3/8 (188)	2 7/8 (74)	1 11/16 (42)	4 (1.82)
3/4 (20)	B	1 (25)	775NBDE	300 (20.7)	7 3/8 (188)	2 7/8 (74)	1 11/16 (42)	4 (1.82)
1 (25)	B	1 (25)	775NBEE	300 (20.7)	7 3/8 (188)	2 7/8 (74)	1 11/16 (42)	4 (1.82)
1/2 (25)	B	1 1/4 (32)	775NBCF	300 (20.7)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)
3/4 (20)	B	1 1/4 (32)	775NBDF	300 (20.7)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)
1 (25)	B	1 1/4 (32)	775NBEF	300 (20.7)	7 1/2 (190)	3 (76)	1 7/8 (48)	5 (2.27)

**SAFETY RELIEF
VALVES**



Handle Left =
Left open

Handle Right =
Right open

Handle Down = Left & Right both open

FIGURE 780 DIVERTER VALVE

SIZES $\frac{3}{4}$ " to $1\frac{1}{2}$ "
PRESSURES to 400 PSIG at 400°F

- Engineered for maximum safety and reliability
- Full flow manifold ends
- Cleaned and packaged for use in O₂ service in compliance with the CGA specification G-4.1
- 180 degree operation
- Handle indicates flow direction
- Low maintenance
- Blow out proof stem
- V-ring stem packing
- All stainless externals

APPLICATIONS DATA

- Dual safety relief systems
- Stationary cryogenic tanks
- Manifolding
- Distribution systems
- Process systems
- Liquid and Gaseous Cryogenic Applications

APPLICABLE CODES

- ANSI B31.1
- API 527
- ANSI B16.18
- ASME Sec. VIII
- CRN: 0C0945.9087YTN

MODELS

- 780 - Bronze Diverter Valve

CODE SELECTION CHART

	Model			Valve Size	Orifice	Top Port	Bottom Port	Side Port	Mat'l
	7	8	0	G	E	D	E	B	B
	1	2	3	4	5	6	7	8	9
Model - Position 1, 2 & 3 780 = Diverter Valve									
Valve Size - Position 4 D = ¾ E = 1 G = 1½									

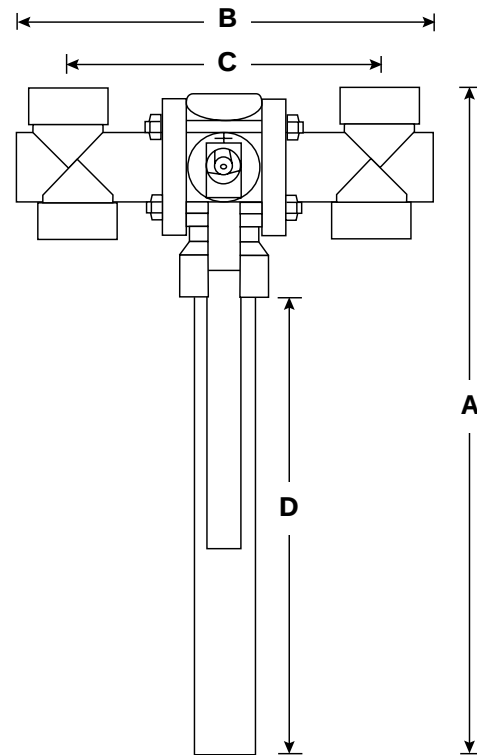
FIGURE 780 DIVERTER VALVE

SPECIFICATION

The valve shall be utilized for applications that requires full flow manifolds. The valve shall have 180 degrees of operation. The handle shall indicate the direction of flow. The stem shall be blow out proof and contain V-ring packing material. The valve shall be cleaned to CGA G-4.1.

MATERIALS OF CONSTRUCTION

Body.....	Bronze B61
End Plate	Bronze B61
Ball	Bronze
Stem	316SS
Seats	MTFE
Body Seals	TFE
Stem Seals.....	CTFE
Stem Bearing	TFE
Bellville Wsh	17-7 SS
External Hdwe	300 Series SS
Inlet Pipe	304SS ASTM A312 Schedule 10
Bolts	304SS A193



High Flow Diverter Valve CV Values*

Sizes (inches)	Safety Relief Valve Outlet		Rupture Disc Outlet		Torque Max. Value
	CV@ mid position (90°)	CV@ full open (180°)	CV@ mid position (90°)	CV@ full open (180°)	
¾F	9.2	8.2	10.7	8.1	200 in. lbs.
1F	25.3	18.3	16.4	14.0	300 in. lbs.
1½F	40.0	30.4	23.8	22.2	340 in. lbs.

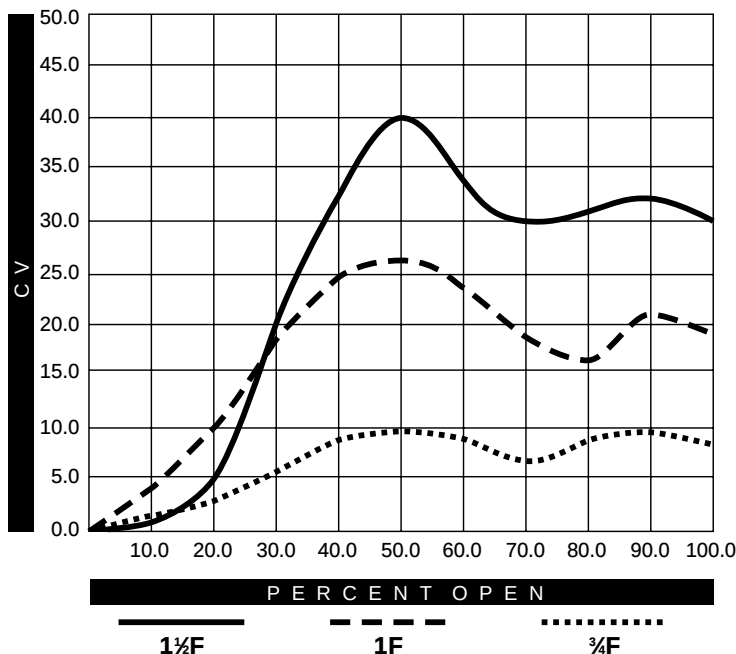
* Flows may vary slightly due to outlet connection sizes.

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size	A	B	C	D	WEIGHT
¾F (20)	13.00 (330.2)	9.38 (238.3)	7.25 (184.2)	7.75 (196.9)	11.5 (5.21)
1F (25)	17.66 (448.6)	11.61 (294.9)	8.73 (221.7)	12.00 (304.8)	24.5 (11.11)
1½F (40)	19.70 (500.4)	13.6 (345.4)	10.15 (257.8)	12.00 (304.8)	36.5 (16.56)

Dimensions for reference only

HIGH FLOW DIVERTER VALVE Cv GRAPH



Diverter Valve Configuration Chart

780DFxxxB

¾" Diverter Valve

Largest Configuration Possible = 780DFDCDB

Top = ¾" NPT Max

Bottom = ½" NPT Max

Side = ¾" NPT Max

780EFxxxB

1" Diverter Valve

Largest Configuration Possible = 780EFFEED

Top = 1¼" NPT Max

Bottom = 1" NPT Max

Side = 1" NPT Max

780GFxxxB

1½" Diverter Valve

Largest Configuration Possible = 780GFGFFB

Top = 1½" NPT Max

Bottom = 1½" NPT Max

Side = 1½" NPT Max

FIGURE 780
DIVERTER VALVE



FIGURE 790 CRYOTREE™ ASSEMBLY

SIZES 3/4" to 1 1/2"
PRESSURES to 400 psig at 400°F

- Dual safety relief systems engineered for maximum safety and reliability
- Easy system installation
- Includes high capacity safety relief valves, full flow diverting valve, rupture discs, bleed valves, and related piping assembled
- Standardized components
- Low maintenance
- Eliminates the need to shut down and evacuate the tank for service
- Minimizes pressure drop in system
- Cleaned and packaged for use in O₂ service in compliance with the CGA specification G-4.1
- Sealed in 6 mil poly bags to eliminate contamination prior to installation
- Handle indicates flow direction

APPLICATIONS DATA

- On stationary cryogenic storage tanks to isolate safety relief valves and rupture discs in the event they need to be serviced

APPLICABLE CODES

- CGA S-1.2 and S-1.3.
- ASME Sec.VIII
- API 527
- ANSI B16.18
- ANSI B31.1

Our CryoTree™ assemblies are manufactured for use on stationary cryogenic storage tanks to isolate safety relief valves and rupture discs in the event they need to be serviced. Utilizing this system eliminates the need to shut down and evacuate the tank for service. This modular assembly provides for just a single connection to the internal tank piping.

MODELS

- 790 - Bronze CryoTree™

CODE SELECTION CHART

Model			Valve Size	Orifice	Top Port	Bottom Port	Side Port	Mat'l	SRV Outlet	SRV Orifice	Set Pressure		
7	9	0	G	F	D	E	A	B - E	B		2	5	0
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Model - Position 1, 2 & 3 790 = CryoTree™			Orifice - Position 5 F = Full		Bottom Port - Position 7 A = 1/4 B = 3/8 C = 1/2 D = 3/4 E = 1 F = 1 1/2		Side Port - Position 8 A = 1/4	Material - Position 9 B = Bronze w/316 Stem		SRV Orifice - Position 11 A B C D E		Set Pressure - Position 12, 13 & 14 ____ = Actual Setting	
Valve Size - Position 4 D = 3/4 E = 1 G = 1 1/2			Top Port - Position 6 D = 3/4 E = 1 F = 1 1/2 G = 1 1/2					SRV Outlet - Position 10 D = 3/4 E = 1 F = 1 1/4 G = 1 1/2 H = 2					

FIGURE 790 CRYOTREE™ ASSEMBLY

SPECIFICATION

The valve shall be utilized for applications that requires full flow manifolds. The valve shall have 180 degrees of operation. The valve shall contain two safety relief valves, two rupture discs and two bleed valves. The handle shall indicate the direction of flow. The stem shall be blow out proof and contain V-ring packing material. The valve shall be cleaned to CGA G-4.1.

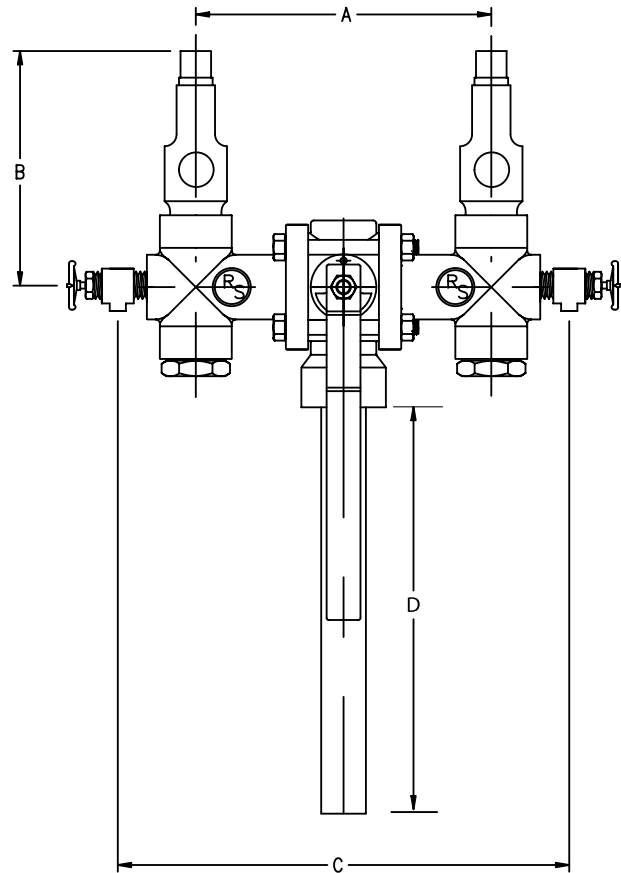
MATERIALS

Body Bronze B62
End Plate Bronze B62
Ball Bronze
Stem 316SS
Inlet Pipe.....304SS ASTM 312 Schedule
Bleed Port Valve Brass
Rupture Disk Brass/Monel
Bolts 304SS A193

High Flow Diverter Valve C_v Values*

Size (inches)	Safety Relief Valve Outlet		Rupture Disc Outlet	
	C _v @ mid position (90°)	C _v @ full open (180°)	C _v @ mid position (90°)	C _v @ full open (180°)
¾F	9.2	8.2	10.7	8.1
1F	25.3	18.3	16.4	14.0
1½F	40.0	30.4	23.8	22.2

Flows may vary slightly due to outlet connection sizes.



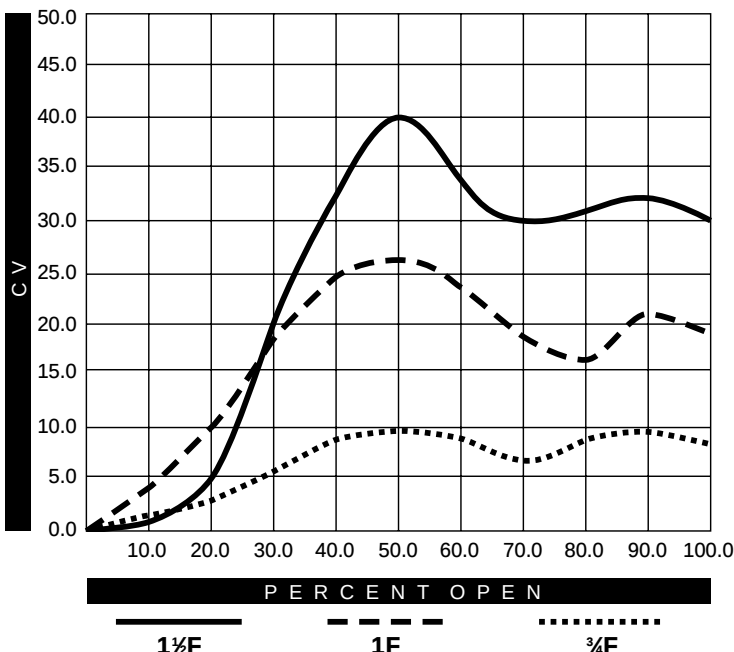
DIMENSIONS inches (mm)

SIZE	A	B*	C	D
¾F (20)	7.3 (185.4)	22.5 (571.5)	14.8 (375.9)	7.75 (196.9)
1F (25)	8.7 (221.0)	25.7 (652.8)	16.5 (419.1)	12.00 (304.8)
1½F (40)	10.2 (259.1)	27.3 (693.4)	18.3 (464.8)	12.00 (304.8)

Dimensions for reference only.

* Height varies depending on valve.

High Flow Diverter Valve C_v Graph



CryoTree Configuration Chart

790DFxxxB-xx ¾" CryoTree

Largest Configuration Possible = 790DFDCDB-GC
Top = ¾" NPT Max
Bottom = ½" NPT Max
Side = ¾" NPT Max (¼" recommended)
SRV Outlet = ½" Max
SRV Orifice = C Max

790EFxxxB-xx 1" CryoTree

Largest Configuration Possible = 790EFFEED-HD
Top = 1½" NPT Max
Bottom = 1" NPT Max
Side = 1" NPT Max (¼" recommended)
SRV Outlet = 2" Max
SRV Orifice = D Max

790GFxxxB-xx 1½" CryoTree

Largest Configuration Possible = 790GFGFFB-JE
Top = 1½" NPT Max
Bottom = 1½" NPT Max
Side = 1½" NPT Max (¼" recommended)
SRV Outlet = 2½" Max
SRV Orifice = E Max

Refer to valve information for maximum set pressure.

**FIGURE 790
CRYOTREE™**

SAFETY RELIEF VALVES

SAFETY RELIEF VALVE SIZING

**SAFETY RELIEF
VALVE SIZING**

BASICS OF RELIEF VALVES



Types of Relieving Devices

Pressure Relief Valve - A pressure relief device designed to re-close and prevent the further flow of fluid after normal conditions have been restored.

- **Safety Valve** - An automatic pressure relieving device actuated by the static pressure upstream of the valve, and characterized by rapid full opening or pop action. It is used for steam, gas or vapor service
- **Relief Valve** - An automatic pressure relieving device actuated by the static pressure upstream of the valve, opening in direct proportion to the pressure increase. It is used primarily for liquid service.
- **Safety Relief Valve** - An automatic pressure relieving device suitable for use as either a safety or relief valve, depending on application.
- **Conventional Safety Relief Valve** - A safety relief valve having its spring housing vented to the discharge side and which is directly affected by fluctuations in backpressure.
- **Balanced-Bellows Safety Relief Valve** - A safety relief valve incorporation in its design a means of compensation for fluctuations due to backpressure.
- **Pilot Operated Pressure Relief Valve** - A pressure relief valve in which the major relieving valve is combined with and is controlled by a self-actuated auxiliary pressure relief valve.

Temperature Relief Valve (P&T) - A pressure relief valve which may be actuated by external or internal temperature or by pressure on the inlet side.

Rupture Disc - A nonre-closing pressure relief device actuated by inlet static pressure and designed to function by the bursting of a pressure containing disc.

Breaking Pin Device - A nonre-closing pressure relief device actuated by inlet static pressure and designed to function by the breakage of a load-carrying section of a pin which supports a pressure containing member.

Parts

Nozzle - The pressure containing element which constitutes the inlet flow passage and includes the fixed portion of the seat closure. The nozzle can be of two designs: Full-nozzle or Semi-nozzle.

- **Full Nozzle** - a single member extending from the face of the inlet flange to the valve seat.
- **Semi-Nozzle** - the lower part of the inlet throat is formed by the body casting and the upper part is valve seat threaded or welded into the valve body

Disc - The pressure containing movable element of a pressure relief valve which effects closure.

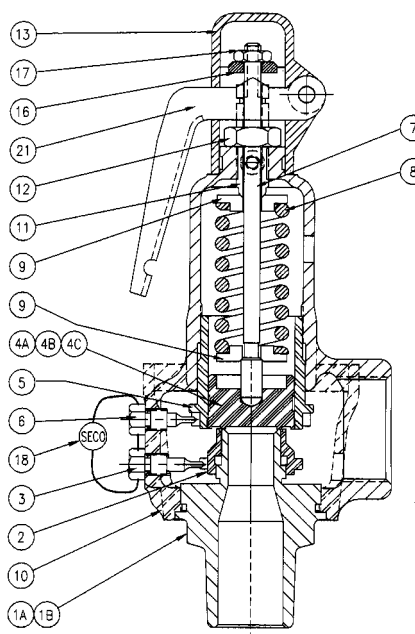
Trim - Internal parts. Specifically the seat (nozzle) & disc.

Orifice - A computed area of flow for use in flow formulas to determine the capacity of a pressure relief valve.

Huddling Chamber - The annular pressure chamber located beyond the valve seat for the purpose of generating a popping characteristic.

Lifting Device (Lever) - A device to manually open a pressure relief valve by the application of external force to lessen the spring loading which holds the valve closed. Lifting devices can be an open lever or a packed lever (fully enclosed design).

Balanced Bellows - A bellows designed so that the effective area of the bellow is equivalent to that of the valve seat, thereby canceling out the additive effect of the backpressure. Balanced bellows are used for the following reasons: Backpressure is excessive or variable, fluid is highly viscous or slurry, or the fluid is corrosive to the upper works of the valve.



BASICS OF RELIEF VALVES, CONT'D.

Operational Characteristics

Rated Capacity - The measured flow at an authorized percent overpressure permitted by the applicable code. Rated capacity is generally expressed in lbs/hr for Steam, SCFM for gases and GPM for liquids.

Operating Pressure - The pressure to which the vessel is usually subjected in normal service.

Set Pressure - The inlet pressure at which the valve is adjusted to open under service conditions. On a relief valve (liquid service), this is considered the point at which the first continuous stream of water starts to discharge and runs vertically down from the outlet of the valve. On a safety valve (Steam, air or gas) it is the inlet pressure at which the valve "pops" (not the point of first audible simmer or warning).

Cold Differential Test Pressure (CDTP) - The inlet static pressure at which a pressure relief valve is adjusted to open on the test stand. This test pressure includes corrections for service conditions of backpressure and/or temperature.

Simmer (Warn/Pre-Open) - The audible or visible escape of fluid between the seat and disc at an inlet static pressure below set pressure and at no measurable capacity. All pressure relief valves will have some simmer. Typically a metal seated valve will simmer at 90% of the set pressure and a soft seated valve will simmer at 95% of the set pressure.

Coefficient of Discharge - The ratio of the measured relieving capacity to the theoretical relieving capacity.

Maximum Allowable Working Pressure (MAWP) - The maximum gauge pressure permissible in a vessel at a designated temperature.

Overpressure - The pressure increase over the set pressure of a pressure relief valve, usually expressed as a percentage of the set pressure.

Accumulation - The pressure increase over the maximum allowable working pressure (MAWP) of the vessel during discharge through the pressure relief valve usually expressed as a percentage of the set pressure.

Blowdown - The difference between the actual set pressure of a pressure relief valve and the actual reseating pressure, expressed as a percentage of the set pressure or in pressure units.

Leak Test Pressure - The specified inlet static pressure at which a standard quantitative seat leakage test is performed.

Backpressure - Pressure from the discharge side of a pressure relief valve. There are two types of backpressure: Constant Backpressure and Variable Backpressure.

- **Constant Backpressure** - Backpressure which does not change appreciably under any condition of operation, whether or not the pressure relief valve is open or closed. A conventional relief valve may be used, provided the spring setting is reduced by the amount of the constant backpressure.

- **Variable Backpressure** - Pressure from the outlet side of the relief valve as a result of the Superimposed Variable Backpressure or Built-up Backpressure.

- **Superimposed Variable Backpressure** - A variable backpressure that is present before the pressure relief valve starts to open. It is usually the result of one or more valves discharging into a common header, causing a varying degree of backpressure on each valve connected to the system. It will cause the spring set pressure to be increased an amount equal to the backpressure. It can be negated by the use of a bellows-style relief valve.

- **Built-up Backpressure** - Pressure which develops at the valve outlet as a result of flow after the pressure relief valve has opened.

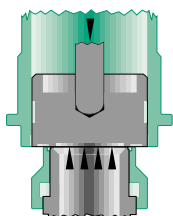
Lift - The actual travel of the disc away from the closed position when a valve is relieving.

Chatter - Abnormal, rapid reciprocation movement of the disc on the seat of a pressure relief valve.

DUAL RING CONTROL

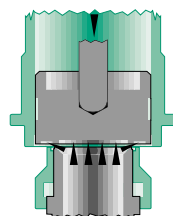
Safety Valves are pressure relief devices actuated by inlet static pressure and characterized by rapid opening or "pop" action. The difference between Safety Valves from different manufacturers is how well they do this.

Spence Figure 31 Safety Valves' Dual Ring Control allows for finer adjustment of the "popping" action and length of "blowdown". This allows exceptional flow efficiency and maximum lifting force while minimizing system energy loss.



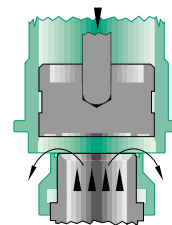
CLOSED

System pressure is pushing upward against the disk which is held closed by the downward force of the spring against the spindle.



OPENING

When system pressure rises above the set pressure of the spring, the disc begins to lift. This simmer/warn stage allows system pressure to enter the "huddling chamber" where it acts on a larger, secondary area of the disc. This magnified force causes the valve to "pop" open.



OPEN

As pressure increases, the disc continues to lift until fully open. When pressure is reduced to a level below the set point of the valve, the spring force against the spindle will snap shut the disc.

SIZING GUIDELINES

GENERAL

1. Recommend a 20% or 10 PSIG differential between operating and set pressure, whichever is greater. The set pressure of each pressure relief valve must be in conformance with limits specified in the appropriate ASME code.
2. Relieving Capacity
 - a. ASME Section I - The minimum required relieving capacity of the pressure relief valve for all types of boilers shall not be less than the maximum designed steaming capacity as determined by the Manufacturer and shall be based on the capacity of all the fuel burning equipment as limited by other boiler functions. (ASME Section I, PG-67.2.1, 1998)
 - b. ASME Section VIII - The minimum required relieving capacity shall be sufficient to carry off the maximum quantity that can be generated or supplied to the attached equipment without permitting a rise in pressure within the vessel with appropriate overpressure condition above the maximum allowable working pressure.
3. Pressure relief valves should not be oversized. Oversizing a pressure relief valve will cause chatter. A multiple valve selection should be used in order to eliminate the possibility of chattering. Use a multiple valve installation when:
 - a. The maximum specified capacity requires selection of a pressure relief valve greater than 6 inch pipe size.
 - b. When it is more economical to install two smaller valves than one very large one.
 - c. If the normal operating capacity of the system is less than approximately 50% of the valve capacity. In this case the volume is not sufficient to keep the valve in its open position and the spring will push the valve closed causing chattering. The first pressure relief valve should be sized on the normal operating capacity and the remaining should be sized on the additional capacity that can be required during the maximum possible capacity of the system.

SINGLE VALVE INSTALLATION

1. Set pressure of the pressure relief valve shall be set at or below the Maximum Allowable Working Pressure (MAWP) of the weakest item in the system. This includes but is not limited to Steam Boilers, Pressure Vessels and Equipment and Piping Systems.
2. Overpressure
 - a. ASME Section I - The pressure cannot rise more than 6% above the maximum allowable working pressure (ASME Section I, PG-67.2, 1998)
 - b. ASME Section VIII - The pressure cannot rise more than 10% or 3 psi, whichever is greater, above the MAWP. (ASME Section VIII, UG-125 (c), 1998).

MULTIPLE VALVE INSTALLATION

1. Overpressure
 - a. ASME Section I - The pressure cannot rise more than 6% above the maximum allowable working pressure (ASME Section I, PG-67.2, 1998)
 - b. ASME Section VIII - The pressure cannot rise more than 16% or 4 psi, whichever is greater, above the maximum allowable working pressure (ASME Section VIII, UG-125 (c)(1), 1998).

2. Set Pressure

- a. ASME Section I - One or more safety valves shall be set at or below the maximum allowable working pressure. If additional valves are used the highest pressure setting shall not exceed the MAWP by more than 3%. The complete range of pressure settings of all the saturated steam safety valves shall not exceed 10% of the highest set pressure to which any valve is set. (ASME Section I, PG-67.3, 1998)
- b. Section VIII - One valve need to be set at or below the MAWP and the other valves can be set at a higher pressure not to exceed 105% of the MAWP of the weakest item in the system. (ASME Section VIII, UG-134, 1998)

PRESSURE RELIEF VALVES IN PRESSURE REDUCING STATIONS

There has been much debate in regards to the sizing of Pressure Relief Valves in Pressure Reducing Stations. The sizing guidelines presented below are the recommendations of Spence Engineering. These recommendations are conservative and based on the worst case scenarios. The guidelines are in agreement with the ASME Section VIII code, the National Board Inspection Code and the Power Piping Code ASME B31.1. It is important to understand that each local jurisdiction may have its own set of approved practices and those practices should be followed.

All sizing is based on maximum capacity from the source and piping is in accordance with handling the maximum pressure from the source. Determination of capacity through a given pipe size is complicated. Spence recommends the computation of such values should be through published fluid dynamics reference materials. If the capacity through the pipe is unknown, Spence suggests that when sizing for the limiting value, use the maximum capacity of the first pressure reducing valve and by-pass in the system or maximum capacity from the source, whichever is less.

A. Single Stage Reducing Stations

1. Where pressure reducing valves are used, one or more pressure relief valves shall be provided on the low pressure side of the system. Otherwise, the piping and equipment on the low pressure side of the system shall be designed to withstand the upstream design pressure. The relieving capacity provided shall be such that the design pressure of the low pressure system will not be exceeded if the reducing valve fails open ③ (ASME B31.1 section 122.5.1, 1995)

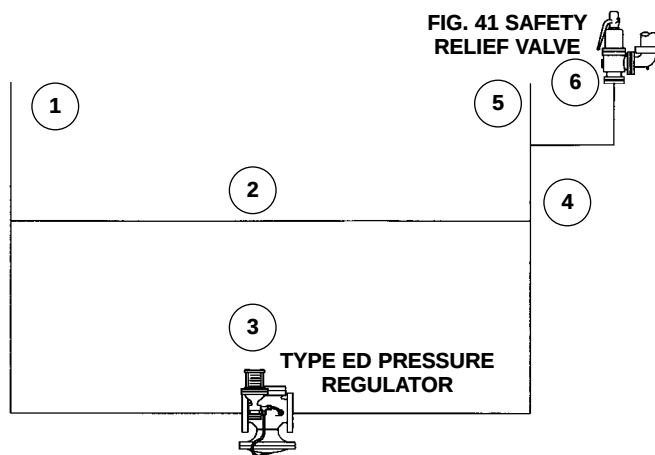


FIGURE A

SIZING GUIDELINES – CONT'D

- Size SRV for pressure drop across regulator using regulator high side pressure and the safety relief valve set pressure.
- Hand controlled bypass valves having a capacity no greater than the reducing valve may be installed around pressure reducing valves if the downstream piping is protected by relief valves as required in section ASME B31.1 Section 122.5.1 or if the design pressure of the downstream piping system and equipment is at least as high as the upstream pressure (ASME B31.1 section 122.5.2, 1995)
- When a pressure reducing valve is installed, there are two possibilities of introducing boiler pressure into the low pressure system. It is necessary to determine the flow under both circumstances and check that the size of the pressure relief valve under either condition will be adequate. The two possibilities are:
 - the failure of the pressure reducing valve so that it remains at 100% full travel ③
 - the possibility of the by-pass valve being wide open ②
 (National Board Inspection Code ANSI/NB-23, Appendix G, 1999)

When taking into consideration the worst possible scenario, Spence Engineering recommends that the pressure relief valve be sized for the maximum flow through both the pressure reducing valve ③ and the by-pass ② or the maximum possible flow through the downstream piping ④ whichever is less. Consideration should be given to the maximum capacity of the source ①.

For unknown regulator and/or bypass valve capacities, see Section E for approximate sizing formulas

- When calculating the maximum possible flow through the regulator, in all cases your sizing should be based on the largest orifice size available in the pipe size of the regulator ③. It may be possible that an originally supplied reduced orifice can be changed in the field to a full port orifice without any consideration to the effect on the capacity of the Pressure Relief Valve.
- In determining the maximum flow through the pressure reducing valve when the valve fails, the failure mode should be considered when the valve plug has reached 100% full travel ③.

B. Parallel Pressure Reducing Stations

- When sizing a pressure relief valve in a parallel pressure reducing station, the conditions listed above in (A) should all be met.

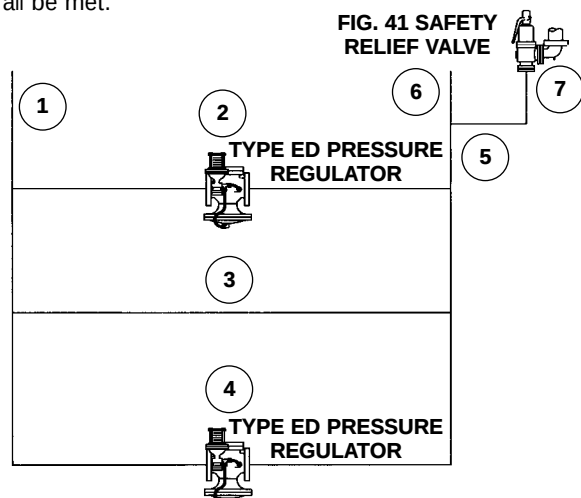


FIGURE B

- In the case of failure of the pressure reducing valve, the capacity shall be sized on the basis of the possibility that both valves ② & ④ would fail open at the same time plus the by-pass ③ or the maximum possible flow through the downstream piping, whichever is less ⑤. Consideration should be given to the maximum capacity of the source ①.
- Size SRV for pressure drop across regulator using regulator high side pressure and the safety relief valve set pressure.

C. Two Stage Pressure Reducing Stations

- When sizing a pressure relief valve in a two stage pressure reducing station, the conditions listed above in (A) should all be met.
- In the case of failure of the pressure reducing valve, the capacity shall be sized on the basis of the high side pressure regulator (National Board Inspection Code ANSI/NB-23, Appendix G, 1999) having the largest possible orifice size plus the bypass ② or the maximum possible flow through the downstream piping, whichever is less. Consideration should be given to the maximum capacity of the source ①.

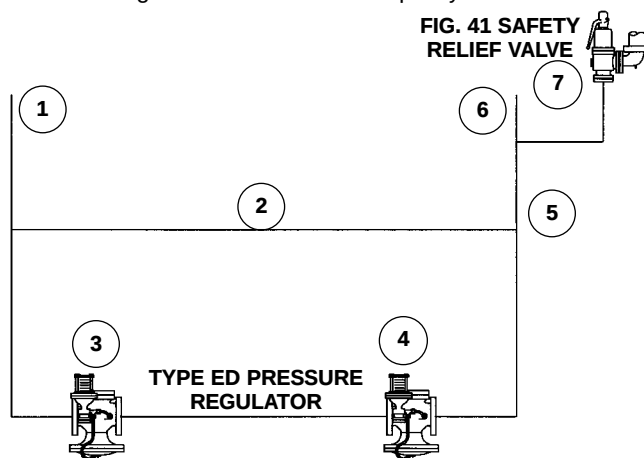


FIGURE C

- If an intermediate pressure line is taken off between the pressure reducing valves then this line and the final low side shall be protected by pressure relief valves sized on the basis of the high side pressure and the largest possible orifice size of the first pressure reducing valve ③ in the line (National Board Inspection Code ANSI/NB-23, Appendix G, 1999) plus the bypass ② or the maximum possible flow through the downstream pipe ⑦, whichever is less. Consideration should be given to the maximum capacity of the source ①.

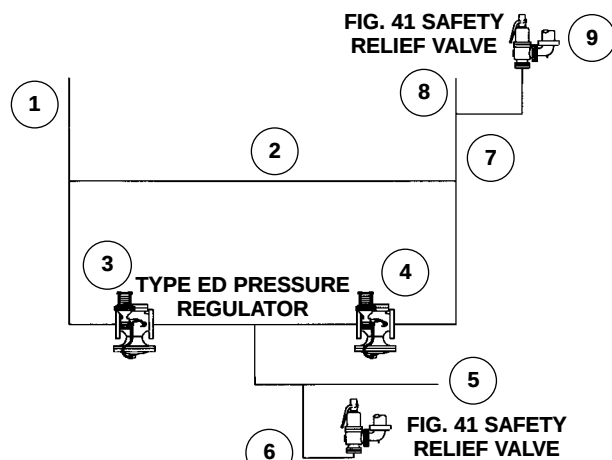


FIGURE D

SIZING GUIDELINES – CONT'D

- If an intermediate by-pass line is designed in between the pressure reducing valves then the final low side shall be protected by a pressure relief valve sized on the basis of the high side pressure and the largest possible orifice size of the first of the two pressure reducing valves plus the bypass valves ②, ③ and ⑤ or the maximum possible flow through the downstream piping ⑦, whichever is less. Consideration should be given to the maximum capacity of the source ①.
- Size SRV for pressure drop across regulator using regulator high side pressure and the safety relief valve set pressure.

FIG. 41 SAFETY RELIEF VALVE

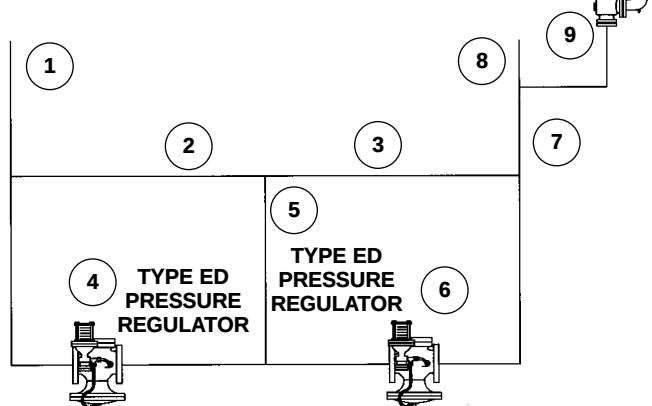


FIGURE E

D. Two Stage Parallel Pressure Reducing Station

- Sizing is based whenever any condition from (B) and any condition from (C) applies.
- In addition, all sizing should be based on maximum capacity from sources.

E. When Flow Coefficients Are Not Known

For sizing Spence regulators and/or control valves:

See Main Valve Sizing Formulas on page 111

See CV Data beginning on page 113

For all other manufacturer's valves where flow coefficients are not known, the following may be approximated.

It is possible that the flow coefficients K and K_1 may not be known and in such instances for approximating the flow, a factor of 1/3 may be substituted for K and 1/2 for K_1 .

The formulas in E above then become:

W = 1/3AC for the capacity through the pressure reducing valve and

W = 1/2A₁ for the capacity through the by-pass valve

WHERE:

W = steam flow, in lbs/hr through the pressure reducing valve

A = internal area in sq. in. of the inlet pipe size of the pressure reducing valve (See Pipe Data Table)

A₁ = internal area in sq. in. of the pipe size of the bypass around the pressure reducing valve (See Pipe Data Table)

C = flow of saturated steam through a 1 sq. in. pipe at various pressure differentials (See Steam Capacity Table)

C₁ = flow of saturated steam through a 1 sp. in. pipe at various pressure differentials (See Steam Capacity Table)

Caution should be exercised when substituting these factors for the actual coefficients since this method will provide approximate values only and the capacities so obtained may in fact be lower than actual. It is recommended that the actual flow coefficient be obtained from the pressure reducing valve manufacture and reference books be consulted for the flow coefficient of the by-pass valve (National Board Inspection Code ANSI/NB-23, Appendix G, 1998).

PIPE DATA TABLE

Nominal Pipe Size, Inches	Actual external diameter, inches	Approx. internal diameter, inches	Approx. internal area square inches
3/8	0.675	0.49	0.19
1/2	0.840	0.62	0.3
3/4	1.050	0.82	0.53
1	1.315	1.05	0.86
1 ¼	1.660	1.38	1.5
1 ½	1.900	1.61	2.04
2	2.375	2.07	3.36
2 ½	2.875	2.47	4.78
3	3.500	3.07	7.39
3 ½	4.000	3.55	9.89
4	4.500	4.03	12.73
5	5.563	5.05	19.99
6	6.625	6.07	28.89
8	8.625	8.07	51.15
10	10.750	10.19	81.55
12	12.750	12.09	114.8

Note: In applying these rules, the area of the pipe is always based upon standard weight pipe and the inlet size of the pressure reducing valve.

Adapted from National Board Inspection Code ANSI/NB-23, Appendix G, 1998.

CAPACITY OF SATURATED STEAM TABLE

(lb/hr) per sq. in. of pipe area

Outlet pres. psi	PRESSURE REDUCING VALVE INLET PRESSURE, PSI												
	1500	1450	1400	1350	1300	1250	1200	1150	1100	1050	1000	950	900
1000	76560	72970	69170	64950	60540	55570	49930	43930	35230	25500	—	—	—
950	77430	74180	70760	67000	63100	58770	53920	48610	42380	34890	24910	—	—
900	77750	74810	71720	68340	64870	61040	56820	52260	47050	41050	33490	23960	—
850	77830	74950	72160	69130	66020	62610	58900	54930	50480	45470	39660	29080	23190
800	—	75070	72330	69490	66700	63680	60390	56910	53060	48800	43980	38340	31610
750	—	—	—	69610	66880	64270	61260	58200	54840	51170	47080	42420	37110
700	—	—	—	—	66900	64270	61520	58820	55870	52670	49170	45230	40860
650	—	—	—	—	—	—	61550	56260	56260	53480	50440	47070	43400
600	—	—	—	—	—	—	—	56270	56270	53660	51020	48470	45010
550	—	—	—	—	—	—	—	—	—	53810	51040	48470	45800
500	—	—	—	—	—	—	—	—	—	—	—	—	45850
450	—	—	—	—	—	—	—	—	—	—	—	—	45870

Outlet pres. psi	PRESSURE REDUCING VALVE INLET PRESSURE, PSI												
	850	800	750	700	650	600	550	500	450	400	350	300	250
800	22550	—	—	—	—	—	—	—	—	—	—	—	—
750	30600	21800	—	—	—	—	—	—	—	—	—	—	—
700	35730	29420	21020	—	—	—	—	—	—	—	—	—	—
650	39200	34250	28260	20190	—	—	—	—	—	—	—	—	—
600	41500	37470	32800	27090	19480	—	—	—	—	—	—	—	—
550	42840	39850	35730	31310	25940	18620	—	—	—	—	—	—	—
500	43330	40530	37610	33880	29760	24630	17720	—	—	—	—	—	—
450	43330	40730	38150	35260	31980	28080	23290	16680	—	—	—	—	—
400	—	40760	38220	35680	33050	29980	26380	21870	15760	—	—	—	—
350	—	—	—	—	33120	30690	27910	24570	20460	14790	—	—	—
300	—	—	—	—	33240	—	28140	25610	22620	18860	13630	—	—
250	—	—	—	—	—	—	28150	25650	23200	21000	17100	10800	—
200	—	—	—	—	—	—	—	—	—	21350	18250	15350	10900
175	—	—	—	—	—	—	—	—	—	—	18250	16000	12600
150	—	—	—	—	—	—	—	—	—	—	18250	16200	13400
125	—	—	—	—	—	—	—	—	—	—	18780	—	13600
110	—	—	—	—	—	—	—	—	—	—	—	—	13600
100	—	—	—	—	—	—	—	—	—	—	—	—	13600
85	—	—	—	—	—	—	—	—	—	—	—	—	13600
75	—	—	—	—	—	—	—	—	—	—	—	—	13600
60	—	—	—	—	—	—	—	—	—	—	—	—	13630

Outlet pres. psi	PRESSURE REDUCING VALVE INLET PRESSURE, PSI												
	200	175	150	125	100	85	75	60	50	40	30	25	0
175	7250	—	—	—	—	—	—	—	—	—	—	—	—
150	9540	6750	—	—	—	—	—	—	—	—	—	—	—
125	10800	8780	6220	—	—	—	—	—	—	—	—	—	—
110	11000	9460	7420	4550	—	—	—	—	—	—	—	—	—
100	11000	9760	7970	5630	—	—	—	—	—	—	—	—	—
85	11000	—	8480	6640	4070	—	—	—	—	—	—	—	—
75	11000	—	—	7050	4980	3150	—	—	—	—	—	—	—
60	11000	—	—	7200	5750	4540	3520	—	—	—	—	—	—
50	11000	—	—	—	5920	5000	4230	2680	—	—	—	—	—
40	11000	—	—	—	—	5140	4630	3480	2470	—	—	—	—
30	11050	—	—	—	—	—	—	3860	3140	2210	—	—	—
25	—	—	—	—	—	—	—	—	3340	2580	1485	—	—
15	—	—	—	—	—	—	—	—	—	2830	2320	1800	—
10	—	—	—	—	—	—	—	—	—	—	—	2060	—

Where capacities are not shown for inlet and outlet conditions, use the highest capacity shown under the applicable inlet pressure column.

Adapted from National Board Inspection Code ANSI/NB-23, Appendix G, 1998.

CAPACITY OF
SATURATED STEAM

SAFETY VALVE SIZING BY COMPUTATION

FORMULA KEY

A = Actual discharge area through the valve at developed lift, inches ² <i>See formulas below</i>	K _{sh} = Steam superheat correction factor (use 1.00 for saturated steam) <i>See Table E4 on page 265</i>
C = Constant for gas or vapor based on ratio of specific heats C _p /C _v <i>See Tables E2 and E3 beginning on page 263</i>	K _v = Capacity correction factor for viscosity <i>See Graph E8 on page 268</i>
G = Specific gravity of fluid (Relates the densities of a fluid to that of a standard fluid) <i>See Table E2 on page 263</i> 1.0 for water @70°F and air at 14.7 psia and 60°F	K _w = Liquid capacity correction factor for backpressure service balanced bellows valves only <i>See Graph E9 on page 268</i>
K _b = Dimensionless number used to correct for the reduction in capacity due to effect of backpressure: For conventional valves: <i>See Graph E5 on page 266</i> For balanced bellows valves: <i>See Graph E6 on page 267</i>	M = Molecular weight <i>See Table E2 on page 263</i>
K _d = Coefficient of discharge (including 90% de-rating) <i>See Table E1 on page 263</i>	P = Stamped set pressure + overpressure + 14.7 psia <i>See Spence Testing Specification Chart page 269</i>
K _n = Napier steam correction factor for set pressures between 1423 and 2900 psig: ≤1423 psig K _n = 1.00 >1423 psig K _n = $\frac{.1906P - 1000}{.2292P - 1061}$	ΔP = [Stamped set pressure + 3 psi or 10% (whichever is greater)] – backpressure, psi
K _p = Correction factor for overpressure <i>See Table E7 on page 267</i> = 1.0 at 25% overpressure	ΔP ₁ = [Stamped set pressure + 3 psi or 25% (whichever is greater)] – backpressure, psi
	T = Absolute temperature at inlet, °R (degrees F + 460)
	W = Rated capacity, Steam (lbs/hr), Air (SCFM), Gas or Vapor (lbs/hr or SCFM), Liquid (GPM)
	Z = Compressibility factor corresponding to T and P for gas and vapor (If unknown, use 1.0)

ASME SECTION I POWER BOILERS

$$A = \frac{W}{51.45 K_d P K_{sh} K_b K_n}$$

ASME SECTION IV HEATING BOILERS

$$A = \frac{W}{51.45 K_d P K_b}$$

ASME SECTION VIII – PRESSURE VESSELS

STEAM (LBS/HR)

$$A = \frac{W}{51.5 K_d P K_{sh} K_b K_n}$$

AIR (SCFM)

$$A = \frac{W \sqrt{T}}{418 K_d P K_b}$$

GAS OR VAPOR (SCFM)

$$A = \frac{W \sqrt{G} \sqrt{T} \sqrt{Z}}{1.175 C K_d P K_b}$$

GAS OR VAPOR (LBS/HR)

$$A = \frac{W \sqrt{T} \sqrt{Z}}{C K_d P \sqrt{M} K_b}$$

LIQUID-10% OVERPRESSURE (GPM) CODE

$$A = \frac{W \sqrt{G}}{38.0 K_d \sqrt{\Delta P} K_v K_w}$$

LIQUID-25% OVERPRESSURE (GPM) NON CODE

$$A = \frac{W \sqrt{G}}{38.0 K_d \sqrt{\Delta P_1} K_p K_v K_w}$$

All sizing equations are in compliance with API 520 Part I 1997. Please refer to that document for further information on sizing. The user is responsible for verifying that these are the currently accepted formulae and for contacting the manufacturer(s) for

all applicable required coefficients. Neither Spence Engineering Company nor its agents assume any liability for improperly sized valves.

TABLE E1-SPENCE VALVE COEFFICIENTS (K_D)

(90% de-rated, as required by ASME)

Model	Steam/Air/Gas/Vapor (K_D)	Liquid (K_D)
Figure 31 Series Bronze	.878	—
Figure 31 Series Cast Iron	.878	—
Figure 800 Series	.878	.752
Figure 10 Series	.800	—
Figure 15 Series	.711	—
Figure 50 Series	.624	—
Figure 710 Series	.604	—
Figure 760 Series	.604	—

TABLE E2-TYPICAL PROPERTIES OF GASES

Gas or Vapor	Ratio of Specific Heats (k) @14.7 psia	Coefficient (C)	Molecular Weight (M)	Specific Gravity (Air=1)
Acetylene	1.25	342	26.04	.899
Acetic Acid	1.15	332	60.05	2.073
Air	1.40	356	28.97	1.00
Ammonia	1.30	347	17.03	.588
Argon	1.66	377	39.94	1.379
Benzene	1.12	329	78.11	2.696
N-Butane	1.18	335	58.12	2.006
Iso-Butane	1.19	336	58.12	2.006
Carbon Dioxide	1.29	346	44.01	1.519
Carbon Monoxide	1.40	356	28.01	.967
Chlorine	1.35	352	70.90	2.447
Ethane	1.19	336	30.07	1.038
Ethyl Alcohol	1.13	330	46.07	1.590
Ethylene	1.24	341	28.03	0.968
Freon 11	1.14	331	137.37	4.742
Freon 12	1.14	331	120.92	4.742
Freon 22	1.18	335	86.48	2.985
Freon 114	1.09	326	170.93	5.900
Helium	1.66	377	4.02	0.139
Hydrochloric Acid	1.41	357	36.47	1.259
Hydrogen	1.41	357	2.02	0.070
Hydrogen Chloride	1.41	357	36.47	1.259
Methane	1.31	348	16.04	0.554
Methyl Alcohol	1.20	337	32.04	1.106
Natural Gas	1.27	344	19.00	0.656
Nitric Oxide	1.40	356	30.00	1.036
Nitrogen	1.40	356	28.02	0.967
Nitrous Oxide	1.31	348	44.02	1.520
Oxygen	1.40	356	32.00	1.105
Propane	1.13	330	44.09	1.522
Propylene	1.15	332	42.08	3.60
Sulfur Dioxide	1.27	344	64.04	2.211

TABLE E1
TABLE E2

TABLE E3-GAS CONSTANT (C)

k	C
1.00	315
1.02	318
1.04	320
1.06	322
1.08	324
1.10	327
1.12	329
1.14	331
1.16	333
1.18	335
1.20	337
1.22	339
1.24	341
1.26	343
1.28	345
1.30	347
1.32	349
1.34	351
1.36	352
1.38	354
1.40	356
1.42	358
1.44	359
1.46	361
1.48	363
1.50	364
1.52	366
1.54	368
1.56	369
1.58	371
1.60	372
1.62	374
1.64	376
1.66	377
1.68	379
1.70	380
2.00	400
2.20	412

The relationship of (C) to (k) is expressed by the following equation:

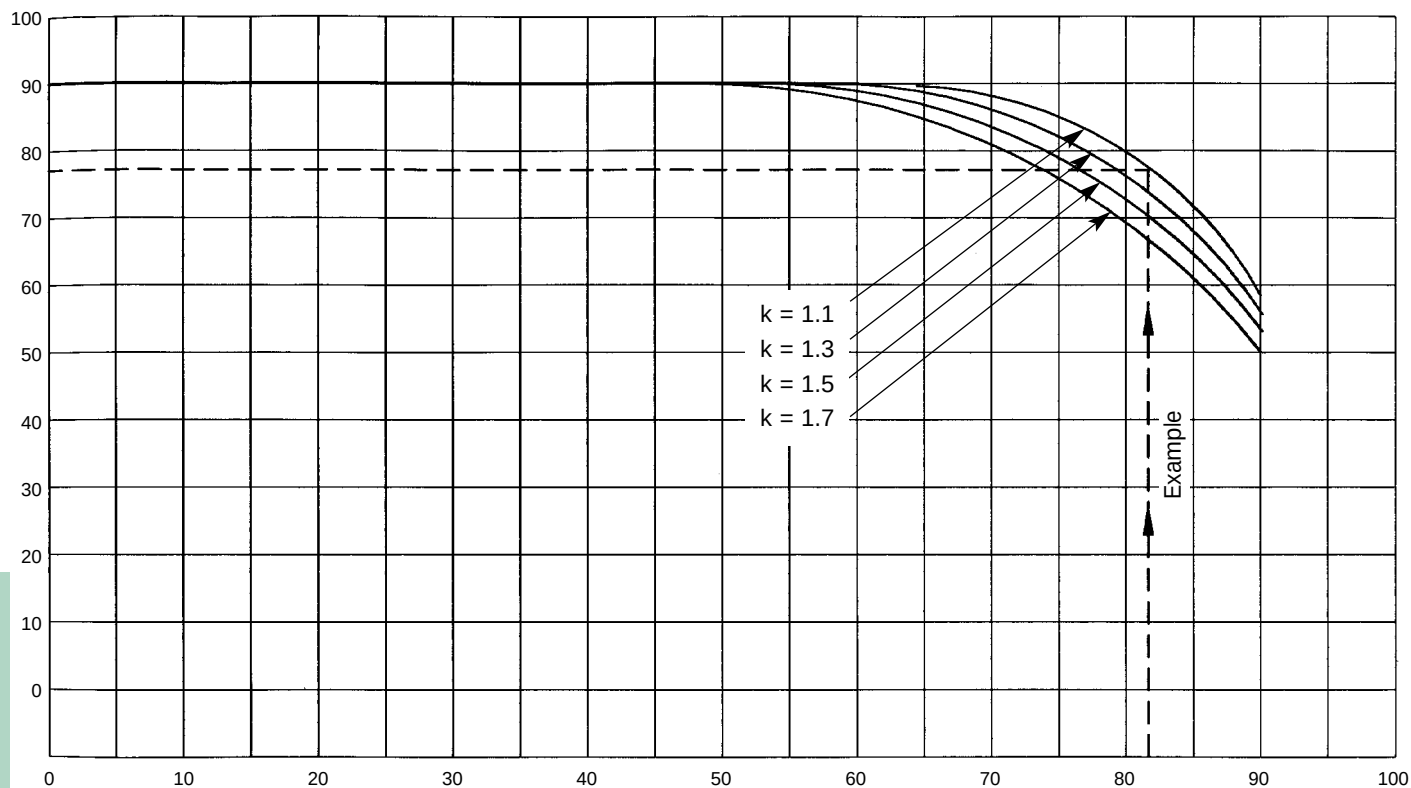
$$C = 520 \sqrt{k \left(\frac{2}{k+1} \right)^{\frac{k+1}{k-1}}}$$

TABLE E4-SUPERHEAT CORRECTION FACTOR (K_{SH})

Set Press. (psig)	Sat. Stm. Temp. °F	Total Temperature of Superheated Steam °F																																															
		280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900	920	940	960	980	1,000											
15	250	1.00	1.00	1.00	0.99	0.99	0.98	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75	0.75											
20	259	1.00	1.00	1.00	0.99	0.99	0.98	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.96	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75											
40	287	—	1.00	1.00	1.00	0.99	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.77	0.76	0.75	0.75											
60	308	—	—	1.00	1.00	0.99	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75											
80	324	—	—	—	1.00	1.00	0.99	0.99	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89	0.89	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75											
100	338	—	—	—	—	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75											
120	350	—	—	—	—	1.00	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75											
140	361	—	—	—	—	—	1.00	1.00	0.99	0.98	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.77	0.76	0.76	0.75											
160	371	—	—	—	—	—	1.00	1.00	0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75											
180	380	—	—	—	—	—	—	1.00	0.99	0.98	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75											
200	388	—	—	—	—	—	—	1.00	0.99	0.99	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.77	0.77	0.76	0.76	0.75											
220	395	—	—	—	—	—	—	1.00	1.00	0.99	0.98	0.96	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75											
240	403	—	—	—	—	—	—	—	1.00	0.99	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75											
260	409	—	—	—	—	—	—	—	1.00	0.99	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76	0.75											
280	416	—	—	—	—	—	—	—	1.00	1.00	0.99	0.97	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75											
300	422	—	—	—	—	—	—	—	1.00	0.99	0.98	0.96	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75											
350	436	—	—	—	—	—	—	—	1.00	1.00	0.99	0.97	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.76	0.76	0.75											
400	448	—	—	—	—	—	—	—	—	1.00	0.99	0.98	0.98	0.96	0.95	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76											
450	460	—	—	—	—	—	—	—	—	—	1.00	0.99	0.99	0.97	0.96	0.94	0.93	0.92	0.91	0.89	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76											
500	470	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.98	0.96	0.94	0.93	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76	0.76											
550	480	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.97	0.95	0.94	0.92	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76											
600	489	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.98	0.96	0.94	0.93	0.92	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76	0.76											
650	497	—	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.97	0.95	0.94	0.92	0.91	0.90	0.89	0.87	0.86	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.76	0.76											
700	506	—	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.97	0.96	0.94	0.93	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76											
750	513	—	—	—	—	—	—	—	—	—	—	—	—	1.00	1.00	0.98	0.96	0.95	0.93	0.92	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.83	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.77	0.76											
800	520	—	—	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.97	0.95	0.94	0.92	0.91	0.90	0.88	0.87	0.86	0.85	0.84	0.84	0.83	0.82	0.81	0.80	0.80	0.79	0.78	0.78	0.77	0.76											
850	527	—	—	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.98	0.96	0.94	0.93	0.92	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.78	0.78	0.77	0.76											
900	533	—	—	—	—	—	—	—	—	—	—	—	—	—	1.00	1.00	0.99	0.97	0.95	0.93	0.92	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.81	0.81	0.80	0.79	0.79	0.78	0.78	0.77											
950	540	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.97	0.95	0.94	0.92	0.91	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.82	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.77											
1000	546	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.00	0.99	0.98	0.96	0.94	0.93	0.91	0.90.																										

GRAPH E5–SUPERIMPOSED (CONSTANT) BACKPRESSURE SIZING FACTOR (K_B)

CONVENTIONAL VALVES (Vapors and Gases Only)



GRAPH E5

FORMULA KEY

P_b = Backpressure, psia
 P_s = Set Pressure, psia
 P_o = Overpressure, psi

$$\% \text{ of absolute backpressure} = \frac{P_b}{P_s + P_o} \times 100$$

EXAMPLE: (ASME SECTION VIII)

Set pressure = 100 psig
 Overpressure (10%) = 10 psi
 Superimposed backpressure = 70 psig
 k = 1.3

SOLUTION:

$$\% \text{ of absolute backpressure} = \frac{(70+10+14.7)}{(100+10+14.7)} \times 100 = 76$$

K_b (follow dotted line) = .89 (from curve)
 Capacity with backpressure = .89 (rated capacity without backpressure)

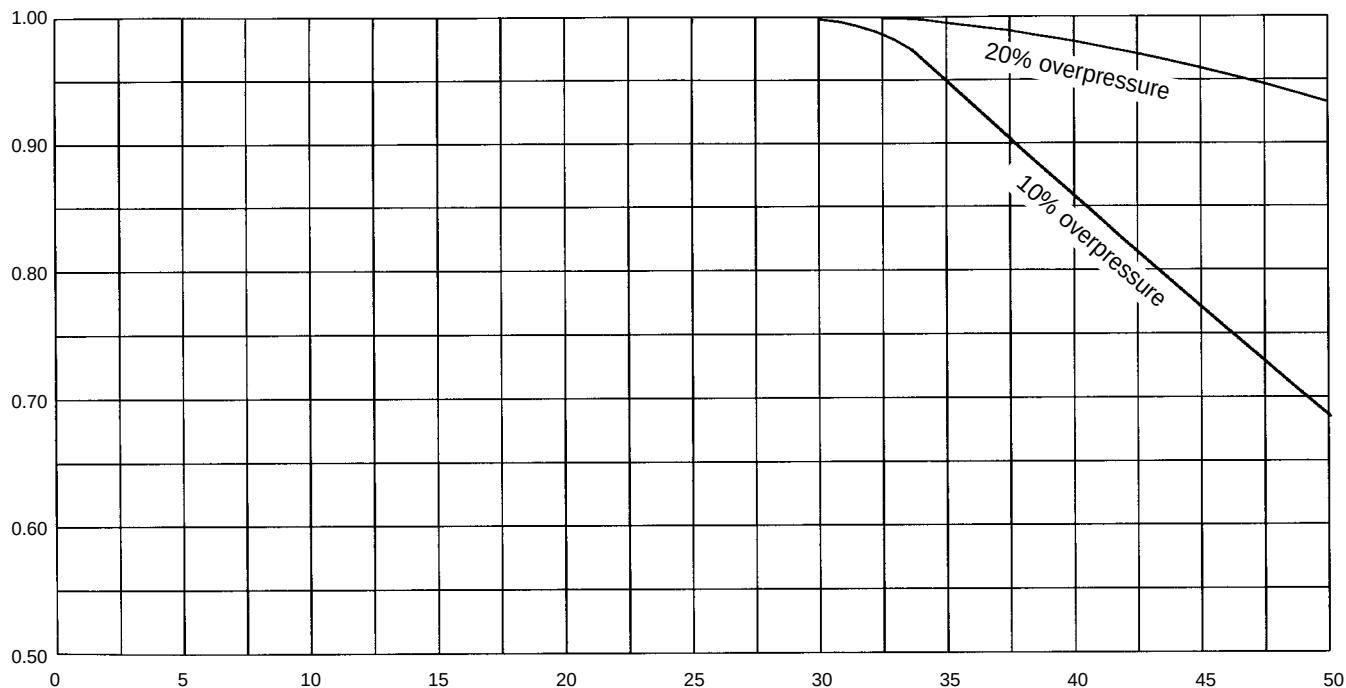
Note: This chart is typical and suitable for use only when the make of the valve or the actual critical flow pressure point for the vapor or gas is unknown; otherwise, the valve manufacturer should be consulted for specific data. This correction factor should be used only in the sizing of

conventional pressure relief valves that have their spring setting adjusted to compensate for the superimposed backpressure. It should not be used to size Balanced Bellows type valves (see next page).

Information from API 520 Part I, 1997

GRAPH E6—SUPERIMPOSED OR VARIABLE BACKPRESSURE SIZING FACTOR (K_B)

BELLOWS VALVES



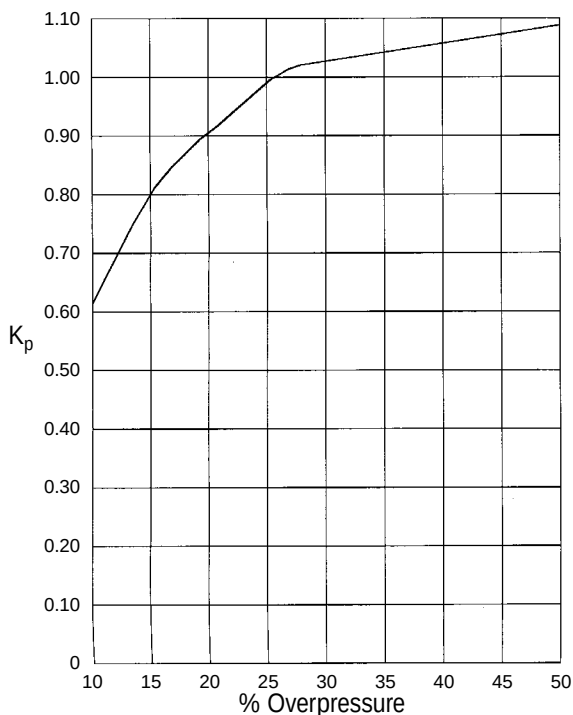
FORMULA KEY

P_b = Backpressure, psia
 P_s = Set Pressure, psia

$$\% \text{ of gauge backpressure} = \frac{P_b}{P_s} \times 100$$

Note: The curves above represent a compromise of the values recommended by a number of relief valve manufacturers and may be used when the make of the valve or the actual critical flow pressure point for the vapor of the gas is unknown. When make is known, the manufacturer should be consulted for the

correction factor. These curves are for set pressure of 50 psig and above. They are limited to backpressure below critical flow pressure for a given set pressure. For subcritical flow backpressure below 50 psig, the manufacturer must be consulted for values of K_b . Information from API 520 Part I, 1997



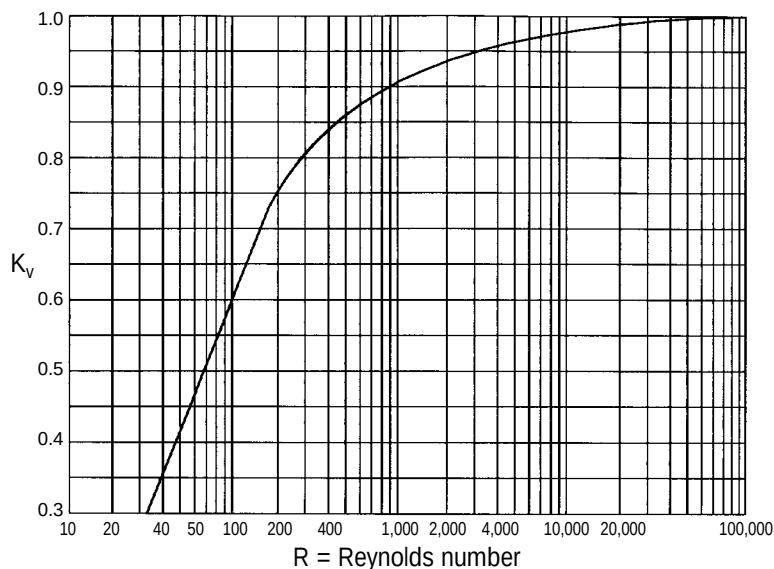
GRAPH E7—CAPACITY CORRECTION FACTORS DUE TO OVERPRESSURE

VALVES IN LIQUID SERVICE

Note: The curve on the left shows that, at 25% or less overpressure, capacity is affected by the change in lift, the change in orifice discharge coefficient and the change in over-pressure. Above 25% overpressure, capacity is affected only by the change in over-pressure. Valves operating at low overpressure tend to chatter, therefore, over-pressures of less than 10% should be avoided.

Information from API 520 Part I, 1997

GRAPH E6
GRAPH E7



FORMULA KEY

- A = Effective discharge area, inches²
- G = Specific gravity of the liquid (referred to as water) at the flowing temperature, G = 1.00 at 70°F
- Q = Flow rate at the flowing temperature, GPM
- μ = Absolute viscosity at the flowing temperature, centipoises
- U = Viscosity at the flowing temperature, Saybolt Universal seconds

GRAPH E8-CAPACITY CORRECTION FACTOR DUE TO VISCOSITY

When a relief valve is sized for viscous liquid service, it is suggested that it first be sized for nonviscous type application in order to obtain a preliminary required discharge area, (A). The next larger manufacturers' standard orifice size should be used in determining the Reynold's number from either of the formulae below.

After the value of R is determined, the factor K_v is obtained from the graph on the left. K_v is applied to correct the preliminary required discharge area. If the corrected area exceeds the chosen standard orifice area, the above calculation should be repeated using the next larger standard orifice size.

Information from API 520 Part I, 1997

$$R = \frac{Q(2800G)}{\mu\sqrt{A}} \quad \text{or} \quad R = \frac{12,700Q}{U\sqrt{A}}$$

Second equation not recommended for viscosities less than 100 Saybolt Universal seconds.

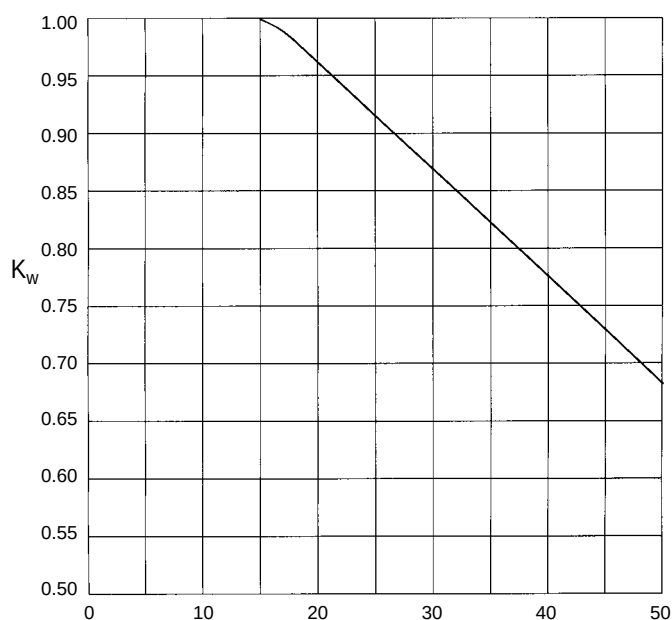
GRAPH E9-CAPACITY CORRECTION FACTOR DUE TO BACKPRESSURE (K_w)

BALANCED BELLOWS VALVES IN LIQUID SERVICE

$$\% \text{ of gauge backpressure} = \frac{P_b}{P_s} \times 100$$

FORMULA KEY

- P_b = Backpressure, psia
- P_s = Set Pressure, psia



Note: The curve above represents values recommended various manufacturers. This curve may be used when the manufacturer is not known. Otherwise, the manufacturer

should be consulted for the applicable correction factor.
Information from API 520 Part I, 1997

SPENCE SRV TESTING SPECIFICATIONS

Spence Safety and Relief Valves (unlike some competitor's valves) are tested and conform to API 527. These Spence Testing Specifications are in conformance with applicable ASME Code **and** API 527.

SET PRESSURE TOLERANCE/BLOWDOWN/OVERPRESSURE

Set Pressure psig or inches HG	Set Pressure Tolerance	Blowdown	Overpressure
ASME Section I – Power Boilers			
15 to 66	± 2 psig	2 to 4 psig	2 psig
67 to 70	± 2 psig	2 psig to 6%	3%
71 to 100	± 3%	2 psig to 6%	3%
101 to 250	± 3%	2% to 6%	3%
251 to 300	± 3%	2% to 15 psig	3%
301 to 375	± 10 psig	2% to 15 psig	3%
376 to 1000	± 10 psig	2% to 4%	3%
1001 and higher	± 1%	2% to 4%	3%
ASME Section IV – Heating Boilers			
Steam ≤ 15 psig	± 2 psig	2 to 4 psig	33.3%
Hot Water 15 to 60	± 3 psig	N/A *	10%
Hot Water 60 and higher	± 5%	N/A *	10%
ASME Section VIII – Pressure Vessels			
15 to 30	± 2 psig	N/A *	3 psig
31 to 70	± 2 psig	N/A *	10%
71 and higher	± 3%	N/A *	10%
Non-Code Set Pressure Tolerance			
5	± .5 psig	N/A *	3 psig
6 to 9	± 1 psig	N/A *	3 psig
10 to 14	± 2 psig	N/A *	3 psig
Vacuum Set Point Tolerances			
0 to 9	± 1 inch HG	N/A *	6 inch HG
10 to 19	± 2 inches HG	N/A *	6 inch HG
20 and higher	± 4 inches HG	N/A *	6 inch HG

* Contact factory for accurate blowdown setting.

LEAK TESTING (in accordance with API 527) Test Pressures - ≤ 50 psig test at 5 psig below set pressure
> 50 psig test at 90% of set pressure

Service	Set Pressure psig	Size	Acceptable Leakage rate
Metal Seats			
Steam	15 – higher	All	No audible or visible leakage for 1 min
Air	15 – 1000	≤ .307 sq in orifice > .307 sq in orifice	40 bubbles/min 20 bubbles/min
Liquid	15 – higher	< 1" inlet ≥ 1" inlet	10 cc/hr per inch of inlet size 10 cc/hr
Soft Seats			
Steam	15 – higher	All	No audible or visible leakage for 1 min
Air	15 – 1000	≤ .307" orifice size > .307" orifice size	0 bubbles/min 0 bubbles/min
Liquid	15 – higher	< 1" inlet size ≥ 1" inlet size	0 cc/hr per inch of inlet size 0 cc/hr

SPENCE SRV TESTING
SPECIFICATIONS

SUMMARY OF ASME CODES & STANDARDS

The American Society of Mechanical Engineers (ASME) through its committees have established Boiler and Pressure Vessel codes for safety through rules and formulae indicating good practice.

The National Board of Boiler and Pressure Vessel Inspectors (NB) verify, administer and enforce the ASME codes wherever the codes have been adopted.

The ASME Codes are broken down into the following sections:

- Sec I** - Power Boilers
- Sec II** - Material Specifications
- Sec III** - Nuclear Power Plant Components
- Sec IV** - Heating Boilers (Low Pressure Steam & Hot Water)
- Sec V** - Non-destructive Examination
- Sec VI** - Recommended Rules for Care & Operation of Heating Boilers
- Sec VII** - Recommended Rules for Care of Power Boilers
- Sec VIII** - Pressure Vessels
- Sec IX** - Welding and Brazing Qualifications
- Sec X** - Fiberglass Reinforced Plastic Pressure Vessels
- Sec XI** - Rules for in service Inspection of Nuclear Power Plant Components

The three codes that pertain to Spence Pressure Relief Valves are as follows:

Section I (Power Boilers) - This is a construction code covering power, electric and miniature boilers and high temperature boilers used in stationary service. This section includes power boilers used in locomotive, portable and traction service.

Section IV (Heating Boilers) - This is another construction code covering the design, fabrication, installation and inspection of steam heating, hot water heating and hot water supply boilers which are directly fired by oil, gas, electricity or coal.

Section VIII (Pressure Vessels) - Basic rules for the construction, design, fabrication, inspection and certification of pressure vessels. These rules have been formulated on the basis of design principles and construction practices applicable to vessels designed for pressures up to 3000 PSI. Stamping and coding are also covered in this section.

The appropriate symbols (below) are required on all ASME coded Pressure Relief Valves:

N B

National Board Capacity Certified

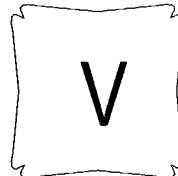
And one of the following for the applicable ASME code:



Heating Boiler safety valves



Pressure vessel safety valves



Boiler safety Valve

COMPARISON OF ASME SECTION I TO SECTION VIII

CRITERIA	SECTION I	SECTION VIII
Set Point Tolerances	≤ 70 2 psig $>70 \leq 300$ 3% $> 300 \leq 1000$ 10 psig > 1000 1% (ASME Section I, PG-72.1, 1995)	≤ 70 2 psig > 70 3% (ASME Section VIII, UG-126 (d), 1995)
Blowdown Tolerances	< 67 4 psig $> 67 \leq 250$ 6% $> 250 \leq 375$ 15 psig > 375 4% minimum blowdown for all valves: 2 psi or 2%, whichever is greater (ASME Section I, PG-72.2, 1995)	No blowdown requirement in service.
Capacity Certifications	Full lift at no greater than 3% or 2 psig, (whichever is greater) above the set pressure without chattering. The published rated capacity is 90% of the average capacity of the valves tested. (ASME Section I, PG-69.1.4 & 69.2.1, 1995)	Full lift at no greater than 10% or 3 psig, (whichever is greater) above the set pressure without chattering. The published rated capacity is 90% of the average capacity of the valves tested. (ASME Section VIII, UG-131 (c)(1) & (d)(1), 1995)
Lifting Device	Lifting devices are required to enable lifting the disc while 75% of the set pressure is present. (ASME Section I, PG-73.1.3, 1995)	Lifting devices are required to enable lifting the disc while 75% of the set pressure is present for Air, Steam & Hot Water (over 140°F). (ASME Section VIII, UG-136 (a)(3), 1995)
Sealing of Adjustments	All external adjustments are to be (wire) sealed to prevent changing the adjustment without breaking the seal. It also serves to identify the manufacturer or his authorized assembler making the adjustment. (ASME Section I, PG-73.1.8, 1995)	All external adjustments are to be (wire) sealed to prevent changing the adjustment without breaking the seal. It also serves to identify the manufacturer or his authorized assembler making the adjustment. (ASME Section VIII, UG-136 (a)(7), 1995)
Markings on Valve	The markings shall be placed on the valve or on a nameplate securely fastened to the valve by the manufacturer or assembler. The markings shall include: the ASME Code "V" symbol, the name of the manufacturer and assembler, model number, inlet size, set pressure, rated capacity, year built and the "NB" symbol. (ASME Section I, PG-110, 1995)	The markings shall be placed on the valve or on a nameplate securely fastened to the valve by the manufacturer or assembler. The markings shall include: the ASME Code "UV" symbol, the name of the manufacturer and assembler, model number, inlet size, set pressure (if applicable, the CDTP), rated capacity in lbs/hr of steam, gal/min of water, SCFM or lb/min of air, year built and the "NB" symbol. (ASME Section VIII, UG-129 (a), 1995)
Materials	Seats, discs, springs and sliding surfaces shall be of corrosion resistant material and listed in ASTM specifications. Bodies and bonnets must be listed in ASME Section II. (ASME Section I, PG-73.2, 1995)	Seats, discs, springs and sliding surfaces shall be of corrosion resistant material and listed in ASTM specifications. Bodies and bonnets must be listed in ASME Section II. (ASME Section VIII, UG-136 (b), 1995)

INSTALLATION, MAINTENANCE & TROUBLESHOOTING GUIDELINES

Spence Pressure Relief valves are safety devices designed to protect pressurized vessels, lines or systems during an overpressure event. The recommendations below are general and it is the responsibility of the user to assure that installation and maintenance are in accordance with the applicable ASME Codes, API 520 Part II, local jurisdictional requirements and any other requirements. Neither Spence Engineering nor its agents assume any liability for valves improperly installed, maintained or troubleshot.

A. INSTALLATION - SINGLE VALVE

1. Installation must be performed by qualified service personnel only.
2. Pressure relief devices intended for use in compressible fluid service shall be connected to the vessel in the vapor space above any contained liquid or to piping connected to the vapor space in the vessel that is to be protected. Pressure relief devices intended for use in liquid service shall be connected below the normal liquid level (ASME Section VIII, UG-135 (a), 1998).
3. The operating pressure of the system should be a minimum of 20% or 10 PSI, whichever is greater, below the set pressure of the valve. The set pressure of each pressure relief valve must be in conformance with pressure limits of the system and of the limits specified in the appropriate ASME codes.
4. Valves must be installed in an upright position with the spindle vertical. (ASME Section VIII, Appendix M, 1998). Mounting valves in any other position will cause additional friction on the guiding surfaces and the valve performance will be affected. Mounting valves in other positions may allow dirt and other foreign substances to accumulate in the valve and adversely affect the valve action.
5. The connection to the vessel should be provided with a radius to permit smooth flow to the valve - sharp corners should be avoided.
6. Pressure Relief Valves for use on steam, air and water (over 140(F) shall be supplied with a lifting device (ASME Section VIII, UG-136 (a)(3), 1998).
7. Do not plug or cap any drain or vent openings. Remove any and all shipping plugs.
8. Test gags must be removed (if supplied). Failure to do so renders the valve inoperable and, due to overpressure may damage the Pressure Relief Valve, the system and/or cause personal injury.
9. Make sure the system is clean and free of any dirt, sediment or scale that might become lodged on the valve seats.
10. Apply a small amount of sealant only to the male threads and tighten valve by hand. Use the proper wrench on the hex area of the base, taking care not use excessive force during tightening.
11. The valve should be normally placed close to the protected equipment so that the valve will be fed properly under flowing conditions. However, valves should be mounted downstream from any device at a distance sufficient to avoid turbulence.
12. In a pressure reducing valve station, it is recommended that the pressure relief valve be installed a minimum of 20 pipe diameters from the outlet of the pressure reducing valve to avoid turbulent flow and an unstable condition.
13. When Pressure Relief Valves are left on line during an extended shutdown, the valves should be inspected and re-tested due to the potential of corrosion, fouling or tampering.

Inlet Piping

14. The opening through all pipe, fittings, and nonreclosing pressure relief devices (if installed) between a pressure vessel and its pressure relief valve shall have at least the area of the pressure relief valve inlet. (ASME Section VIII, UG-135 (b)(1), 1998).
15. The flow characteristics of the upstream system shall be such that the cumulative total of all nonrecoverable inlet losses shall not exceed 3% of the valve set pressure (ASME Section VIII, Appendix M-7(a), 1998)

Outlet Piping

16. Discharge pipes shall be at least of the same size as the pressure relief valve outlet (ASME Section VIII, Appendix M-8(a), 1998).
17. Where feasible, the use of a short discharge pipe or vertical riser, connected through long-radius elbows from each individual device, blowing directly to the atmosphere, is recommended (ASME Section VIII, Appendix M-8(a), 1998). Discharge piping should be designed to place the minimum load on the valve under all conditions of valve operation. See 16 of this Section.
18. When the nature of the discharge permits, whereby condensed vapor in the discharge line, or rain, is collected and piped to a drain, a Drip Pan Elbow (Spence DPE) is recommended. This construction has the further advantage of not transmitting discharge-pipe strains to the valve (ASME Section VIII, Appendix M, 1998).
19. The discharge piping should be anchored to prevent any swaying or vibration while the valve is discharging.
20. If excessive lengths of discharge piping and fittings are required, they should be sized larger than the valve outlet. Any discharge piping that appears to be excessive should be reviewed by calculation for back-pressure and piping strains.
21. Discharge lines from Pressure Relief Valves shall be designed to facilitate drainage or shall be fitted with drains to prevent liquid from lodging in the discharge side of the pressure relief device, and such lines shall lead to a safe place of discharge (ASME Section VIII UG-135(f), 1998).

INSTALLATION, MAINTENANCE & TROUBLESHOOTING GUIDELINES - CONT'D

Stop Valves

22. ASME Section I - No valve of any description shall be placed between the required safety valve or safety relief valve or valves and the boiler, nor on the discharge pipe between the safety valve or safety relief valve and the atmosphere (ASME Section I PG 71.2, 1998).
23. ASME Section VIII - There shall be intervening stop valves between the vessel and its pressure relief device or devices, or between the pressure relief device or devices and the point of discharge, except as under the conditions as stated in ASME Section VIII UG-135(d)(1) and in Appendix M.

B. INSTALLATION - MULTIPLE VALVES

1. All items listed above in the Installation of Single Valves should be followed.
2. When two or more required pressure relief devices are placed on one connection, the inlet internal cross-sectional area of this connection shall be either sized to avoid restricting flow to the pressure relief devices or made at least equal to the combined inlet areas of the safety devices connected to it. (ASME Section VIII UG-136 (c)1998)
3. The sizing of any section of a common-discharge header downstream from each of the two or more pressure relieving devices that may reasonably be expected to discharge simultaneously shall be based on the total of their outlet areas. The effect of the back-pressure that may be developed when certain valves operate must be considered (ASME Section VIII, Appendix M-8 (b), 1998).
4. It is recommended that the smaller orifice valve be set at the lower set pressure and that it is installed up stream of the other valves.

C. MAINTENANCE

1. Valves are set and sealed to prevent tampering, guarantee is void if any seal is broken. The setting, adjustment or repair should be done only by an Authorized Pressure Relief Valve repair facility.
2. The valves should be checked periodically to see that they are not clogged or seized due to dirt or other foreign matter and that they will operate satisfactorily.
3. Installation conditions should be reviewed, seals should be checked to verify that they are not broken and no unauthorized adjustments have been made.
4. Valves may be manually operated by means of the lifting lever only when the system pressure is at least 75% of the nameplate set pressure. A Pressure Relief Valve should never be lifted without 75% of the nameplate set pressure.
5. Pressure Relief Valves should be re-tested as part a normal routine inspection program. The intervals between tests can vary in accordance with the severity of the service condition. Guidelines for inspection are

provided in the API Inspection Code and the National Board Inspection Code. However, consideration should be given to your local jurisdictional policies, your insurance company policies and/or your company policies.

6. Only original, unmodified manufacturer parts should be used to assure safe and proper operation.

D. TROUBLESHOOTING

1. Valves are set and sealed to prevent tampering, guarantee is void if any seal is broken. The setting, adjustment or repair should be done only by an Authorized Pressure Relief Valve repair facility.
2. Occasionally a newly installed valve may leak as a result of shipping and handling or installation procedures. For valves with levers, apply pressure to the inlet side equal to 75% of the operating pressure so that the lift lever can be manually activated. For valves without lift levers, raise the system pressure to the point of valve operation. In most instances, the valve will properly reseal and the leakage will stop.
See page 258
3. If a valve is leaking under normal operating conditions, the following three scenarios should be checked:
 - a. Make sure that a minimum operating to set point differential is maintained according to the guidelines specified in the Spence Sizing Guidelines.
 - b. It is possible that dirt or foreign material is lodged under the seat. Perform the check as outlined in part 2 of the troubleshooting.
 - c. Valve seating surface could be worn or damaged. Please contact your local Pressure Relief Valve Repair Facility.
4. If a valve is chattering it may be the result of the following:
 - a. Improper piping at valve inlet or outlet. See the appropriate ASME Codes and the Spence Installation Guidelines. *See page 109*
 - b. Valves are oversized. Review the Spence Sizing Guidelines. *See page 111*
 - c. Back-pressure may be present which may not have been accounted for in the original sizing. Review Sizing Formulas. *See page 111*
 - d. Valve holes may be plugged. Check to make sure all holes are not plugged and any shipping plugs have been removed.
 - e. Valve may be worn or damaged. Please contact your local Pressure Relief Valve Repair Facility.
5. If a valve is not popping at the set pressure as stamped on the nameplate, the following should be checked:
 - a. All Pressure Relief Valves have tolerance built into the set pressure. Review the Spence Engineering Testing Specifications and/or the appropriate ASME codes to ensure the valve is operating within the allowed tolerances.

INSTALLATION, MAINTENANCE & TROUBLESHOOTING GUIDELINES - CONT'D

- b. Make sure the gauge reading the pressure is properly installed and calibrated. Compensate for the water leg between the valve and gauge.
 - c. Review the inlet piping to make sure that the inlet piping is at least the area of the Pressure Relief Valve inlet. Review the inlet piping to ensure no other pressure drops can occur. See the Spence Installation Guidelines. *See page 109*
 - d. Review the outlet piping to ensure that backpressure has been accounted for in the original sizing and selection of the valve. See the Spence Installation Guidelines. *See page 109*
 - e. Valve may be worn or damaged. Please contact your local Pressure Relief Valve Repair Facility.
- 6. If a valve is not closing or has an excessive blowdown, the following should be checked:
 - a. It is possible that dirt or foreign material is lodged under the seat. Perform the check as outlined in part 2 of this Section.
 - b. Operating pressure may not be reduced below the reseating pressure of the valve. Reduce the operating pressure of the system to 50% of the normal operating pressure and then slowly bring the system back to the normal operating pressure. Make sure that a minimum operating to set point differential is maintained according the guidelines specified in the Spence Sizing Guidelines. *See page 111*
 - c. Valve may be worn or damaged. Please contact your local Pressure Relief Valve Repair Facility.

SECTION IV

DESUPERHEATERS

& NOISE

REDUCTION

NOTES:

DESUPER- HEATERS

DESUPERHEATERS

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

Canadian Registration # OH6267.51

STEAM ATOMIZING DESUPERHEATER

APPLICATION DATA

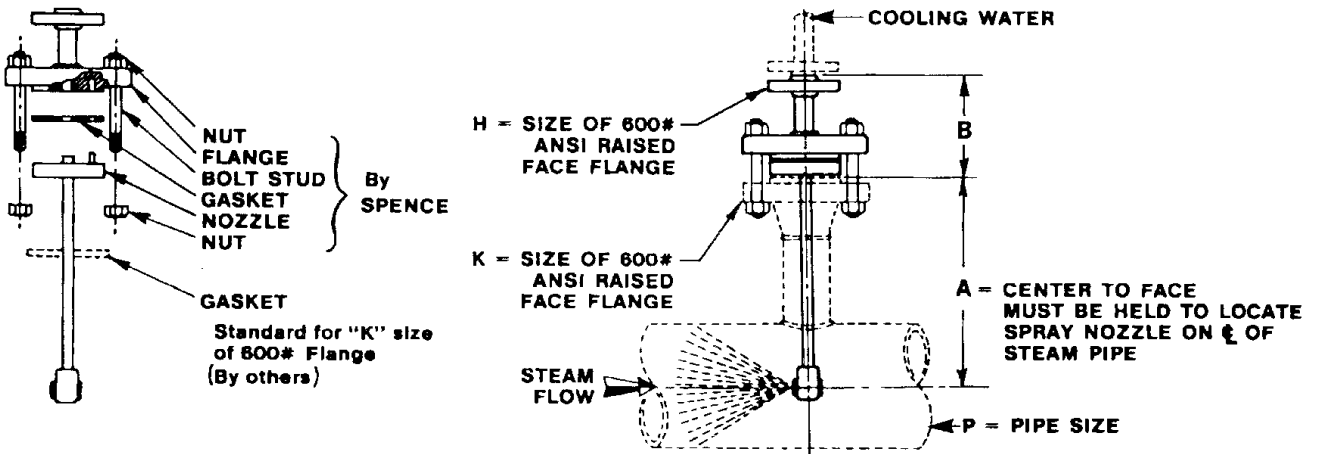
- Reduce Temperature of Superheated Steam

SIZING INFO
PAGE 280

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	5 (127)	¼ (6)	2 (51)	7 (178)	7½ (191)	8½ (216)	10 (254)	11 (280)	13 (330)	— —	— —	— —	— —	— —	— —	— —	15 (6.8)
#3	4½ (113)	½ (13)	2 (51)	— —	— —	8½ (216)	10 (254)	11 (280)	13 (330)	15½ (394)	16½ (419)	— —	— —	— —	— —	— —	22 (10)
#5	5⅞ (130)	1 (25)	4 (102)	— —	— —	— —	— —	11 (280)	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	— —	— —	— —	40 (18)
#6	7½ (190)	1¼ (32)	4 (102)	— —	— —	— —	— —	— —	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	— —	— —	75 (34)
#8	7⅞ (200)	2 (51)	6 (152)	— —	— —	— —	— —	— —	— —	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	23½ (597)	27½ (699)	135 (61)

DESUPERHEATERS



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.



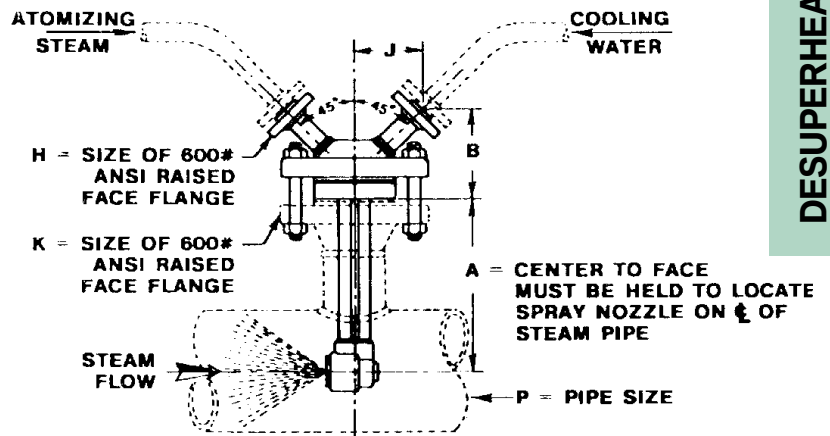
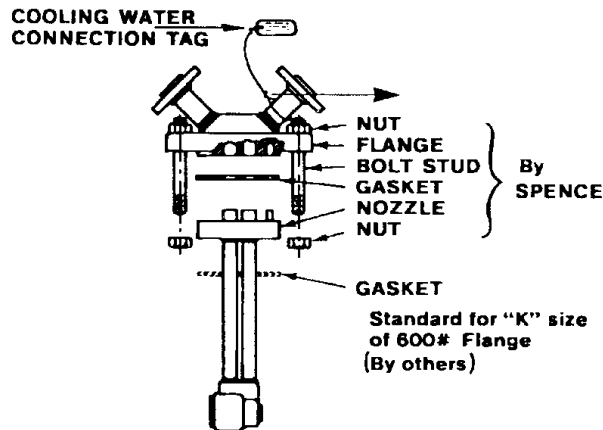
DUAL CONTROL DESUPERHEATER NOZZLE

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	5 (127)	¼ (6)	¾ (95)	2 (51)	7 (178)	7½ (191)	8½ (216)	10 (254)	11 (280)	13 (330)	— —	— —	— —	— —	— —	— —	— —	18 (8)
#3	5 (127)	½ (13)	¾ (79)	¾ (79)	— —	— —	8½ (216)	10 (254)	11 (280)	13 (330)	15½ (394)	16½ (419)	— —	— —	— —	— —	— —	28 (13)
#5	5⅞ (148)	1 (25)	4¼ (108)	4 (102)	— —	— —	— —	— —	11 (280)	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	— —	— —	— —	68 (31)
#6	6¼ (159)	1¼ (32)	6 (152)	5 (127)	— —	— —	— —	— —	— —	13 (330)	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	— —	— —	110 (50)
#8	8¼ (210)	2 (51)	7½ (191)	8 (203)	— —	— —	— —	— —	— —	— —	15½ (394)	16½ (419)	17½ (445)	19½ (495)	21½ (546)	23½ (597)	27½ (699)	270 (123)



DESUPERHEATERS

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.

NOISE REDUCTION



NOISE SUPPRESSOR

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 26 dBA
- Expansion fittings not required
- Straight through design minimizes pressure drop, permitting normal valve sizing

Canadian Registration # OH 6266.51C

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
PAGE 285

NOMINAL PIPE SIZE			D* — INSTALLED LENGTH			APPROX. WEIGHT			Average Attenu- ation dBa†
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 (65)	4 (100)	5 (125)	39¾ (1010)	40 (1016)	40⅜ (1025)	73 (33)	75 (34)	85 (39)	12
2½ (65)	5 (125)	6 (150)	47¼ (1200)	47½ (1207)	47⅞ (1216)	105 (48)	108 (49)	123 (56)	16
3 (80)	4 (100)	5 (125)	39¾ (1009)	40⅞ (1019)	40½ (1028)	76 (35)	82 (37)	91 (41)	10
3 (80)	5 (125)	6 (150)	47¼ (1200)	47⅞ (1210)	48 (1219)	108 (49)	114 (52)	129 (59)	14
3 (80)	6 (150)	8 (200)	58¼ (1480)	58⅞ (1489)	59 (1499)	174 (798)	180 (82)	199 (90)	19
4 (100)	5 (125)	6 (150)	47½ (1206)	47⅞ (1216)	48¼ (1225)	113 (51)	123 (56)	138 (63)	12
4 (100)	6 (150)	8 (200)	54½ (1384)	54⅞ (1393)	55¼ (1403)	175 (80)	185 (84)	204 (93)	15
4 (100)	8 (200)	10 (250)	66 (1676)	66⅞ (1686)	66¾ (1695)	284 (129)	294 (134)	321 (146)	21
5 (125)	6 (150)	8 (200)	55 (1397)	55⅞ (1406)	55¾ (1416)	180 (82)	195 (87)	214 (97)	14
5 (125)	8 (200)	10 (250)	66½ (1689)	66⅞ (1698)	67¼ (1708)	289 (131)	304 (138)	331 (150)	19
5 (125)	10 (250)	12 (300)	89 (2261)	89⅞ (2280)	90 (2286)	455 (207)	470 (214)	516 (235)	26
6 (150)	8 (200)	10 (350)	66½ (1689)	66⅞ (1698)	67¼ (1708)	295 (134)	314 (143)	341 (155)	17
6 (150)	10 (250)	12 (300)	83½ (2121)	83⅞ (2130)	84½ (2146)	451 (205)	470 (214)	516 (235)	24
8 (200)	10 (250)	12 (300)	84 (2134)	84⅞ (2143)	85 (2159)	468 (213)	495 (225)	541 (246)	21

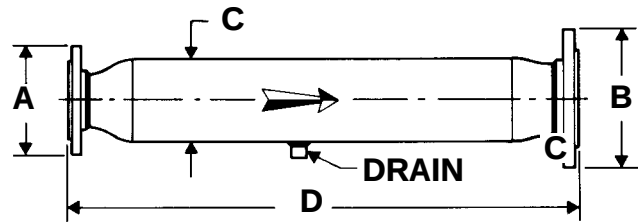
* ±1/4" for 8" Shell and under, otherwise ± 3/8".

† Consult factory for specifics.

NOISE SUPPRESSOR

SPECIFICATION

Noise Suppression equipment shall be of the dissipative reactive type. Suppressor shall not induce back pressure. 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)

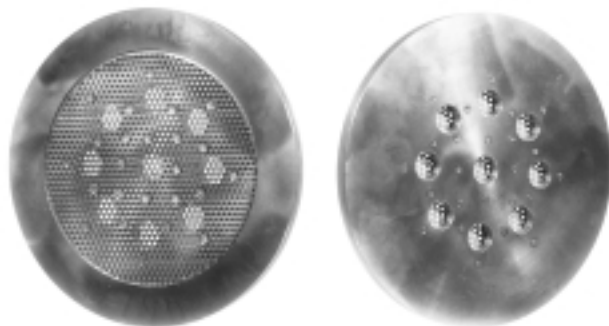
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

INLET SIZES 3/8" TO 2"

NOMINAL PIPE SIZE			D* — INSTALLED LENGTH			APPROX. WEIGHT						Average Attenuation dBa†
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 (10)	3/4 (20)	2 (50)	19 13/16 (502)	19 5/8 (498)	—	8 (3.6)	9 (4.1)	10 (4.5)	—	—	—	16
3/8 (10)	1 (25)	2 (50)	20 (508)	19 3/4 (502)	—	8 (3.6)	10 (4.5)	11 (5)	—	—	—	16
3/8 (10)	1 1/2 (40)	2 1/2 (65)	22 3/4 (578)	22 1/2 (572)	—	12 (5.4)	15 (6.8)	18 (8.2)	—	—	—	19
1/2 (15)	1 (25)	2 (50)	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)	13
1/2 (15)	1 1/4 (32)	2 1/2 (65)	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)	16
1/2 (15)	1 1/2 (40)	2 1/2 (65)	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)	16
3/4 (20)	1 1/4 (32)	2 1/2 (65)	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)	12
3/4 (20)	2 (50)	3 (80)	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)	16
1 (25)	1 1/2 (40)	2 1/2 (65)	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)	9
1 (25)	2 (50)	3 (80)	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)	12
1 1/4 (32)	2 (50)	3 (80)	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)	9
1 1/4 (32)	3 (80)	4 (100)	34 11/16 (882)	34 5/16 (879)	34 (864)	—	40 (18)	47 (21.4)	42 (19)	45 (20.5)	51 (23)	15
1 1/2 (40)	3 (80)	4 (100)	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)	13
2 (50)	3 (80)	4 (100)	31 7/8 (810)	31 1/2 (800)	31 1/4 (794)	—	40 (18)	46 (21)	45 (20.5)	47 (21.4)	53 (24)	10
2 (50)	4 (100)	5 (125)	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)	14

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

† Consult factory for specifics.



INLET OUTLET
MUFFLING ORIFICE

MUFFLING ORIFICE PLATES (MOPS)

- 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.

Canadian Registration # OH 6265.51a

MATERIALS OF CONSTRUCTION

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

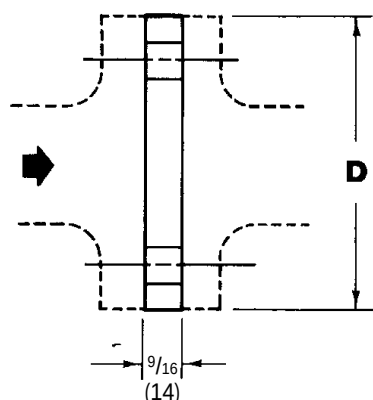
APPLICATION DATA

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

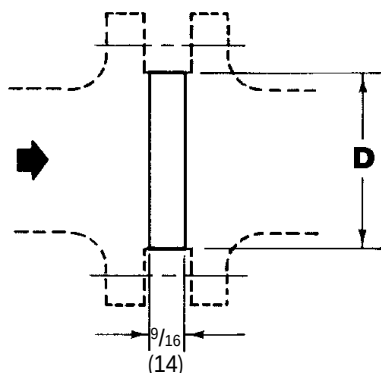
SIZING INFO
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SPECIFICATION

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 12 dBA of noise reduction on a high flow PRV.



ANSI 125 & 150 FLANGED

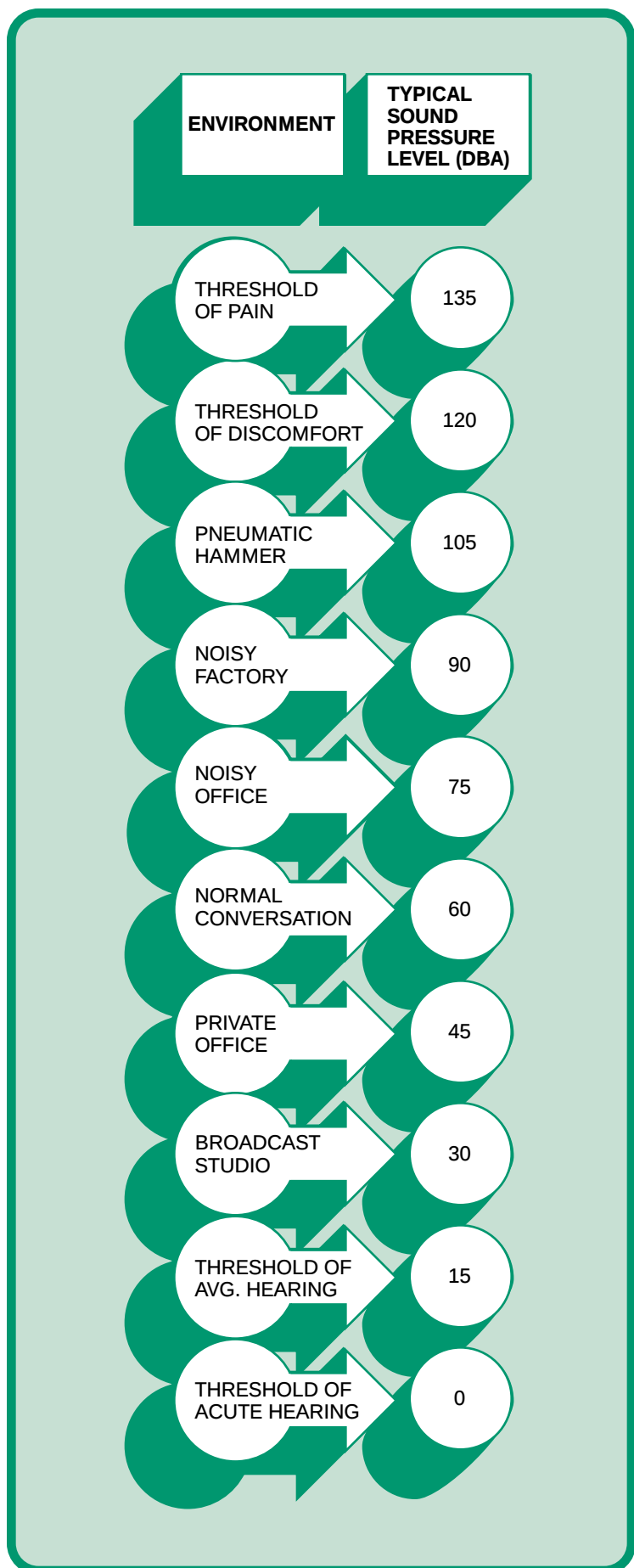


ANSI 250, 300 & 600 FLANGED

DIMENSIONS inches (mm)

NOMINAL PIPE SIZE	DIMENSION D		
	ANSI 125 150	ANSI 250 300	ANSI 600
2 (50)	6 (152)	4 ³ / ₁₆ (106)	3 ⁵ / ₈ (92)
2½ (65)	7 (178)	4 ¹⁵ / ₁₆ (126)	4 ¹ / ₈ (105)
3 (75)	7½ (190)	5 ¹¹ / ₁₆ (146)	5 (127)
4 (100)	9 (229)	6 ¹⁵ / ₁₆ (178)	6 ³ / ₁₆ (156)
5 (125)	10 (254)	8 ⁹ / ₁₆ (210)	7 ⁵ / ₁₆ (184)
6 (150)	11 (279)	9 ¹¹ / ₁₆ (247)	8½ (216)
8 (200)	13½ (343)	11 ¹⁵ / ₁₆ (305)	10 ⁵ / ₈ (270)
10 (250)	16 (406)	14 ¹ / ₁₆ (357)	12¾ (324)
12 (300)	19 (483)	16 ⁷ / ₁₆ (419)	15 (381)
14 (350)	21 (533)	18 ¹⁵ / ₁₆ (481)	16¾ (413)
16 (400)	23½ (597)	21 ¹ / ₁₆ (534)	18½ (470)
18 (450)	25 (635)	23 ⁹ / ₁₆ (591)	21 (533)

STEAM PRESSURE REDUCING STATION NOISE REDUCTION



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/m². 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.

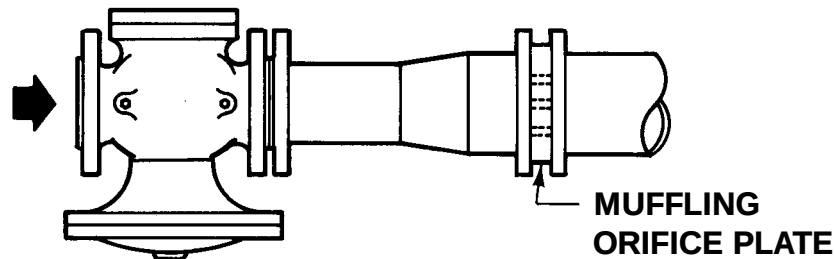


FIGURE 5A: SINGLE STAGE INSTALLATION WITH MUFFLING ORIFICE

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.

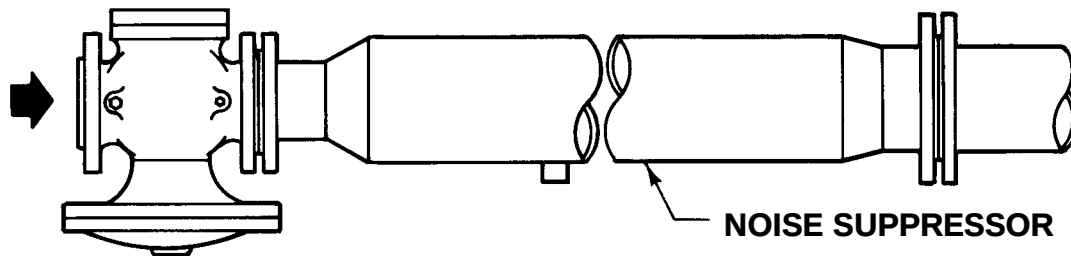


FIGURE 5B: SINGLE STAGE INSTALLATION WITH NOISE SUPPRESSOR

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.

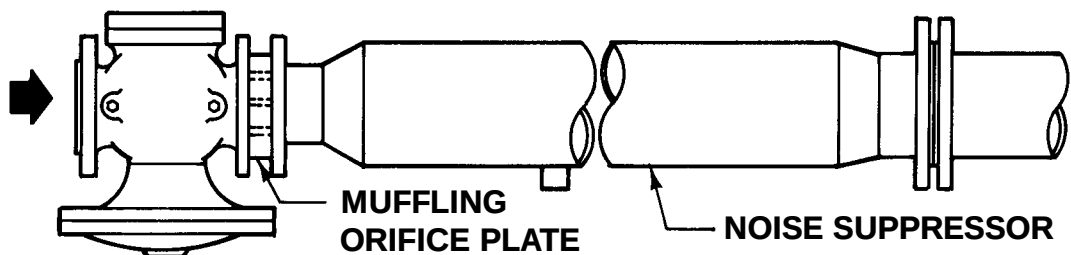


FIGURE 5C: SINGLE STAGE INSTALLATION WITH MUFFLING ORIFICE AND NOISE SUPPRESSOR

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
600	550	510
	500	706
	450	845
	400	953
	350	1040
	342	1050
550	500	488
	450	674
	400	805
	350	905
	325	947
	313	966
500	450	465
	400	640
	350	763
	325	812
	300	855
	284	881
450	400	440
	350	605
	325	666
	300	718
	275	763
	255	795
400	350	415
	325	500
	300	567
	275	623
	250	670
	226	709
350	300	387
	275	465
	250	527
	225	577
	200	619
	197	624

INLET PRESSURE (PSIG)	OUTLET PRESSURE (PSIG)	W/C_v
300	275	258
	250	357
	225	428
	200	483
	175	527
	168	538
250	225	236
	200	325
	175	388
	150	435
	145	433
	139	453
200	190	136
	175	211
	150	289
	125	342
	115	359
	110	367
175	165	128
	150	198
	125	270
	115	291
	100	317
	95	325
150	140	119
	125	183
	100	248
	90	267
	85	275
	81	282
125	115	109
	100	168
	90	194
	80	216
	75	225
	66	239

INLET PRESSURE (PSIG)	OUTLET PRESSURE (PSIG)	W/C_v
100	90	98.4
	80	136
	70	162
	60	183
	55	191
	52	196
90	80	93.8
	75	113
	70	129
	60	154
	50	173
	46	179
80	70	88.9
	60	122
	55	135
	50	145
	45	154
	40	162
70	60	83.8
	55	101
	50	115
	45	126
	40	136
	34	145
60	50	78.4
	45	94.3
	40	107
	35	117
	30	126
	29	128
50	45	52.4
	40	72.6
	35	87.0
	30	98.2
	25	107
	23	111

INLET PRESSURE (PSIG)	OUTLET PRESSURE (PSIG)	W/C_v
40	35	48.0
	33	56.2
	30	66.2
	25	79.0
	20	88.8
	17	93.6
30	25	43.1
	24	47.0
	22	53.6
	20	59.2
	15	70.2
	11	76.5
25	20	40.5
	19	44.1
	18	47.3
	15	55.3
	10	65.3
	8.3	67.9
20	15	37.7
	14	41.0
	13	43.9
	12	46.5
	10	51.2
	5.4	59.4
15	10	34.6
	9	37.6
	8	40.2
	7	42.6
	5	46.7
	2.5	50.8
10	5	31.3
	4	33.9
	3	36.2
	2	38.2
	0	41.7
	-0.4	42.3

NOISE REDUCTION
FLOW COEFFICIENTS

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 chose 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.

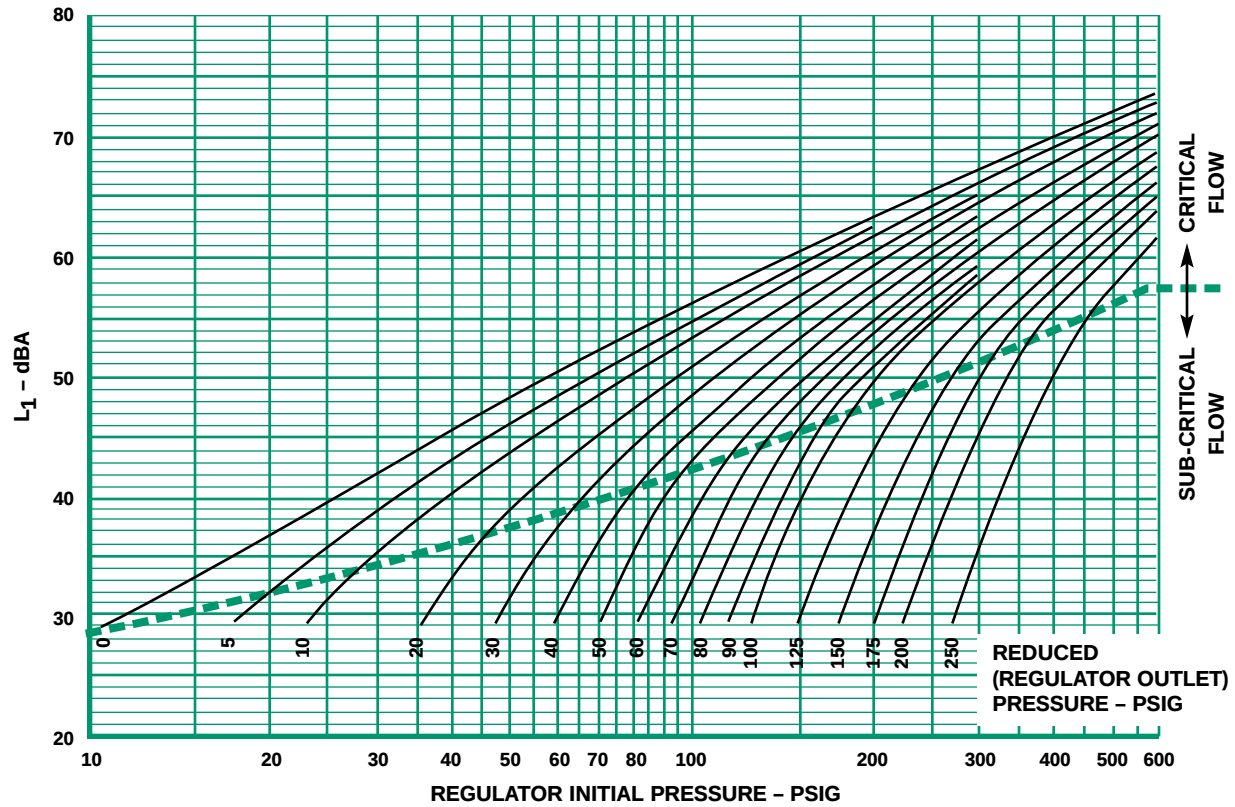
$SPLR - SPLO = 10$ dBA. From the dB Correction Table below, the decibel correction is 0.4 dB. Thus the combined SPL = $SPLR + 0.4 = 78.4$ dBA.

dB CORRECTION TABLE

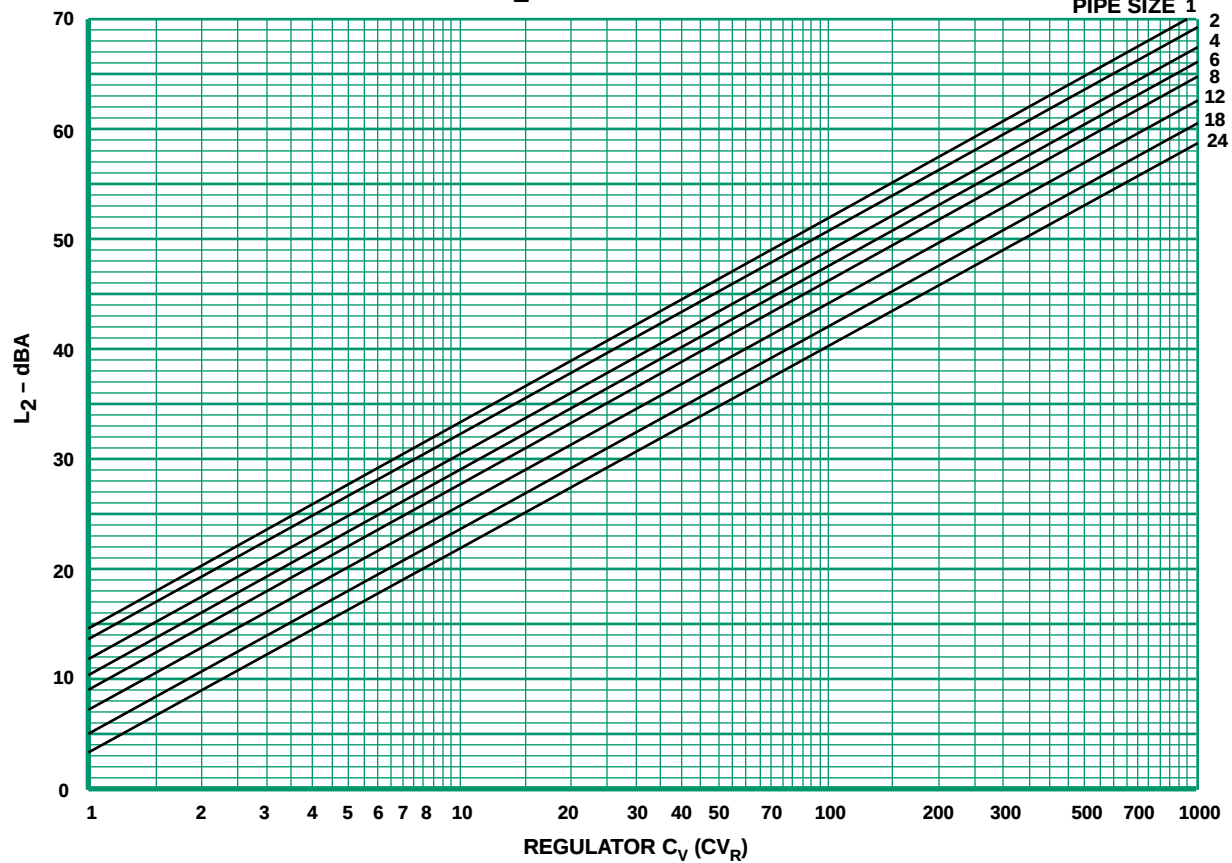
DECIBEL DIFFERENCE	DECIBEL CORRECTION
0	3.0
1	2.6
2	2.1
3	1.8
4	1.5
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4

REGULATOR SOUND PRESSURE LEVEL CHARTS

L₁ OF SPLR CHART



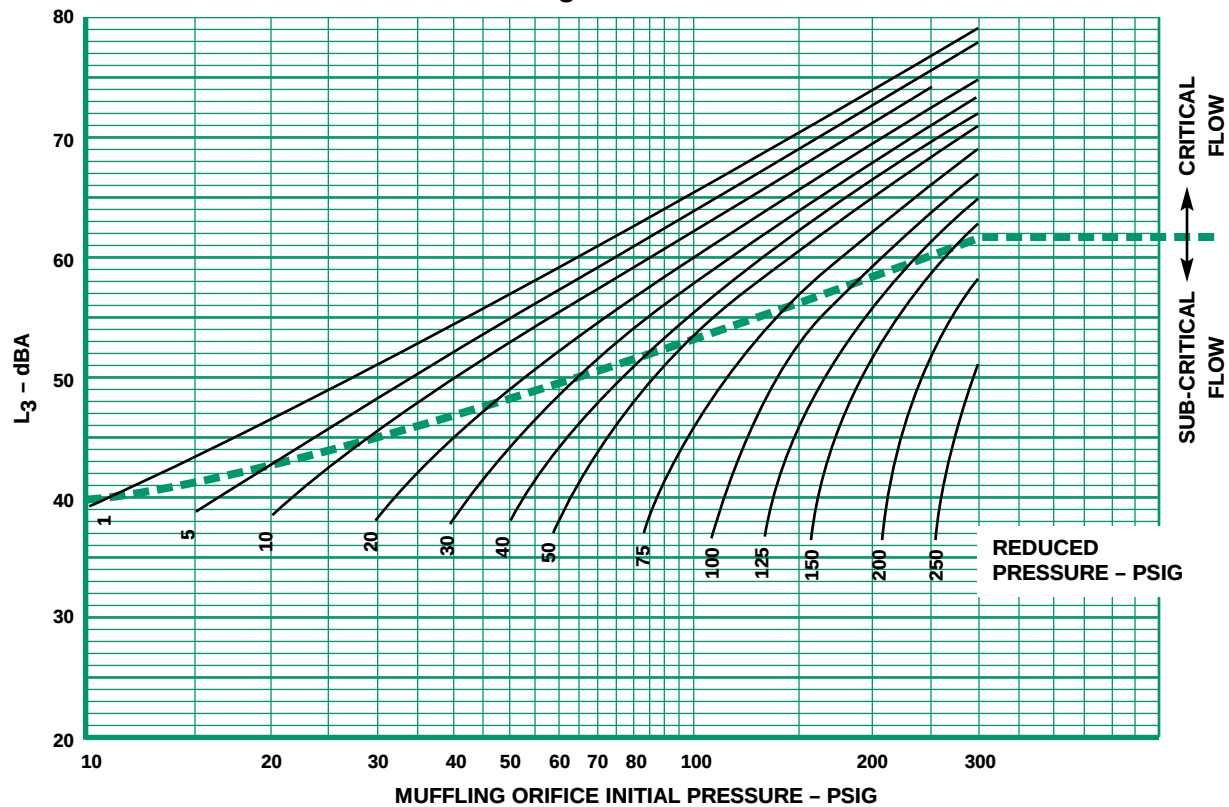
L₂ OF SPLR CHART



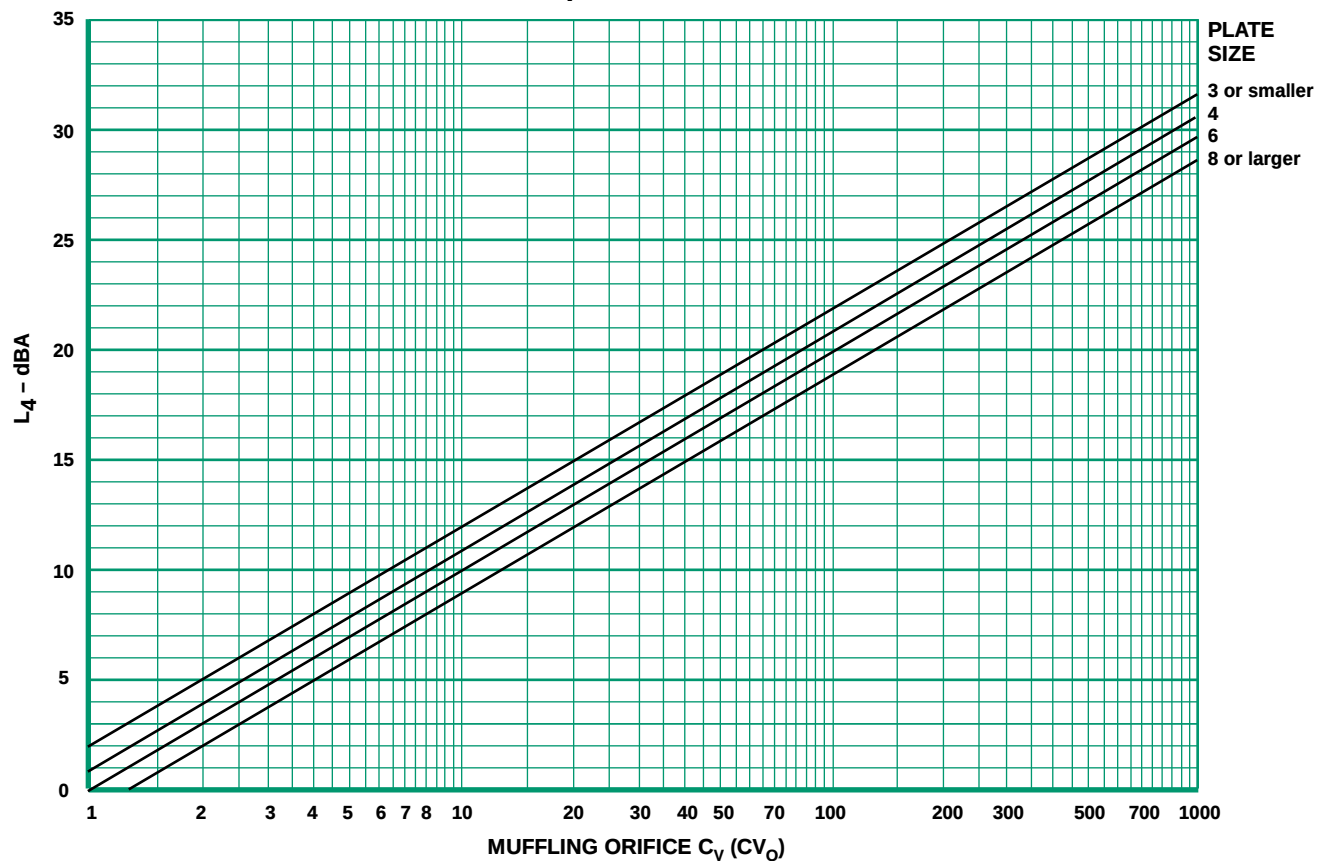
**NOISE REDUCTION
SPLR CHARTS**

MUFFLING ORIFICE SOUND PRESSURE LEVEL CHARTS

L₃ OF SPLO CHART



L₄ OF SPLO CHART



SECTION V

CONDENSATE

PUMPS

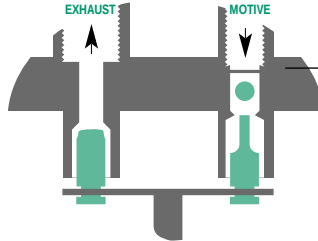
NOTES:

Applications

- Collection of condensate
- Where electrical service is unavailable
- Submerged or remote sumps and manholes
- Hazardous fluids and process fluids
- Low pressure and vacuum systems
- High back pressure systems
- High capacity process applications

Condensate Commander Pump

Pressures to 250 PSIG (17.2 barg)
Temperatures to 650°F (343°C)



Inlet Supply and Vent Valves

Lapped valves and seats for tight shutoff

Stainless steel construction resists corrosion

Floating ball design and hardened sealing surface of supply valve provide long service life

Floating disk and ball valves feature an infinite number of seating surfaces

Self centering design assures reliable performance



Unique Patented Single Spring Mechanism

Eliminates pump breakdown due to spring failure

Snap acting mechanism actuates the valve

Heavy duty spring operating in compression carries lifetime warranty

Unaffected by turbulence

Stainless steel construction maximizes reliability and service life

Valve and linkage positioning above condensate level minimizes corrosion



Cycle Counter

accurately depicts number of cycles and assists in maintenance scheduling

Retrofit Mechanism Available

Head assembly fits many manufacturer's tanks

ASME Code Stamped Tank

Fabricated steel tank is standard on most models

Warrantied 3 Years or One Million Cycles

Longest warranty in the industry

CONDENSATE COMMANDER PUMP

**Pressures To 250 PSIG (17.2 barg)
Temperatures to 650°F (343°C)**



APPLICATIONS

Collection of Condensate

- Remote Locations such as tank farms
- Low pressure and vacuum systems
- Condensate systems with high back pressure
- 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

OPTIONS

- Glass Water Gage
- Cycle Counter
- Bronze or Stainless Steel Check Valves
- Insulating Jacket
- Supply Pressure Regulator
- Stainless Steel Tanks
- High Temperature
- High Pressure

OPERATION

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

No Electricity Needed

- Uses pressurized gas or steam as the pumping force.
- Preferable for remote or hazardous locations.

Lifetime Warranty on Spring

- Single spring mechanism operates in compression only to assure long service life
- Stainless steel snap action mechanism in continuous compression offers superior performance.

Rugged Mechanism

- Unaffected by turbulence.
- No adjustments or maintenance necessary.

Superior Valve Technology

- Supply and exhaust valves are lapped for tight shutoff.
- Self centering design assures reliable performance.
- Unique floating ball design and hardened sealing surface of the supply valve provide long service life.

Suitable for a Wide Variety of Liquids

- Condensate from steam systems.
- High back pressure, low pressure and vacuum systems.
- Ideal in a sump or other submersible applications.
- Suitable for acids and other process fluids that may be incompatible with conventional pumps.

Warrantied 3 Years or One Million Cycles

- Longest warranty in the industry.

ASME Code Stamped Tank

- Fabricated steel tank is standard on most models.

Retrofit Mechanism Available

- Head assembly can fit other manufacturer's tanks.

Required suction head is minimal

- Optimal performance achieved at only 12 inches.

MODELS

- **Classic**–Standard capacity, vertical tank
- **Big Boy**–Super capacity, horizontal tank
- **Horizontal**–Standard capacity, high pressure, horizontal tank
- **Little Boy**–Reduced capacity, vertical tank
- **Skid**–Standard or custom multiplex configurations

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.

CONDENSATE COMMANDER CLASSIC PUMP

SPECIFICATION

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 200 psig. Body shall be fabricated steel ASME code to 200 psi. Pump mechanism shall be all stainless steel without external packing or seals. Mechanism shall employ one spring operating in continuous compression. Spring shall be warranted for the life of the unit. When required, unit shall be equipped with an external cycle counter, sight glass and insulating jacket.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure	200 psig	(13.8 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	200 psig	(13.8 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

With optional Temperature/Pressure upgrades:

PMO: Max. Operating Pressure	250 psig	(17.2 barg)
TMO: Max. Operating Temperature	650°F	(343°C)
PMA: Max. Allowable Pressure	250 psig	(17.2 barg)
TMA: Max. Allowable Temperature	650°F	(343°C)

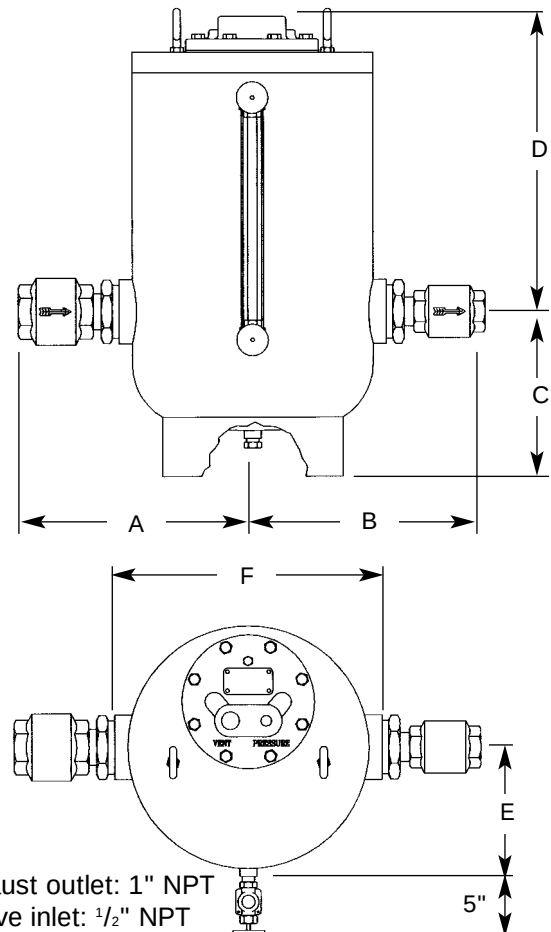
MATERIALS OF CONSTRUCTION

Tank Weldment	Steel
Trip Mechanism w/Flange	DI/Stl/SS
Gasket	Graphite
Bolt, Hex Head	Steel
Eye Bolt	Steel
Nut	Steel
Nameplate	Aluminum
Drive Screw	Steel
Pipe Plug, 1/2" NPT	Steel
Water Level Gage	Bronze
Inlet Reducer	M. Iron
Inlet Nipple	Steel
Inlet Check Valve	Bronze/Stainless Steel
Outlet Reducer	M. Iron
Outlet Nipple	Steel
Outlet Check Valve	Bronze/Stainless Steel

OPERATING CHARACTERISTICS

Pump Discharge per Cycle:	7.8 - 8.6 Gal
Max. Instantaneous Discharge Rate:	90 GPM (w/2" outlet check)
Steam Consumption:	~3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	~100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	12"

Canadian Registration # 1352.9C



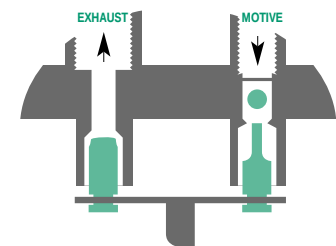
See capacities on page 303

Connections:
1" x 1" to 3" x 2" Screwed

Dimensions							
Size	Inches (mm)						Weight lbs(kg)
	A	B	C	D [†]	E*	F	
1" x 1"	13 ³ / ₈ (340)	13 ³ / ₈ (340)	11 (279)	21 ³ / ₄ (552)	9 (278)	17 ³ / ₄ (451)	168 (76)
1 1/2" x 1 1/2"	14 ³ / ₄ (375)	14 ³ / ₄ (375)	11 (279)	21 ³ / ₄ (552)	9 (278)	17 ³ / ₄ (451)	170 (77)
2" x 2"	15 (381)	15 (381)	11 (279)	21 ³ / ₄ (552)	9 (278)	17 ³ / ₄ (451)	173 (79)
3" x 2"	16 1/2 (419)	15 (381)	11 (279)	21 ³ / ₄ (552)	9 (278)	17 ³ / ₄ (451)	185 (84)

*Add 5" for Water Gage.

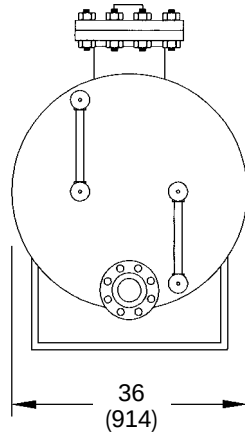
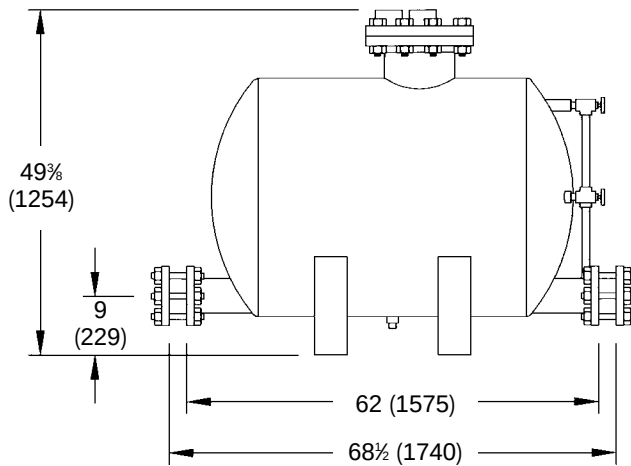
[†]Allow additional 21" clearance for maintenance.



COMMANDER
CLASSIC PUMP

CONDENSATE COMMANDER BIG BOY PUMP

SPECIFICATION



Exhaust outlet: 2" NPT
Motive inlet: 2" NPT

Dimensions-Inches (mm)

See capacities on page 303

Connections:
4" x 4" Flanged

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 150 psig. Body shall be fabricated steel ASME code to 150 psi. Mechanism shall employ one spring operating in continuous compression. Springs shall be warranted for the life of the unit. When required, unit shall be equipped with an external cycle counter and sight glass.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure	150 psig	(10.3 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	150 psig	(10.3 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

MATERIALS OF CONSTRUCTION

Tank Weldment	Steel
Trip Mechanism w/Flange	Stl/SS
Gasket	Non-asbestos
Stud, Flange	Steel
Nut, Hex	Steel
Nameplate	Aluminum
Drive Screw	Steel
Pipe Plug, 3/4" NPT	Steel
Water Level Gage	Bronze
Inlet Check Valve	Bronze/Stainless Steel
Inlet Flange	Steel
Outlet Check Valve	Bronze/Stainless Steel
Outlet Flange	Steel

OPERATING CHARACTERISTICS

Pump Discharge per Cycle:	140 - 185 Gal
Max. Instantaneous Discharge Rate:	195 GPM
Steam Consumption:	~3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	~100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	24"

Canadian Registration # 1350.9C

OPTIONS

- High Back Pressure for back pressures above 60 psi

CONDENSATE COMMANDER HORIZONTAL PUMP

SPECIFICATION

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 250 psig. Body shall be fabricated steel ASME code to 250 psi. Pump mechanism shall be all stainless steel without external packing or seals. Mechanism shall employ one spring operating in continuous compression. Spring shall be warranted for the life of the unit. When required, unit shall be equipped with an external cycle counter, sight glass and insulating jacket.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure	250 psig	(17.2 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	250 psig	(17.2 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

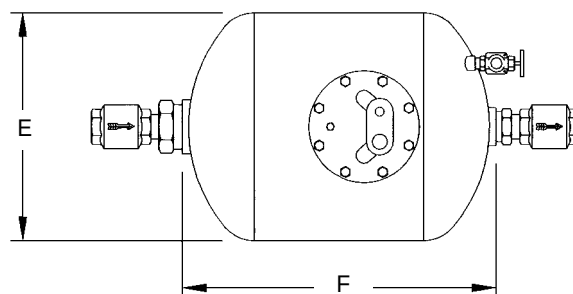
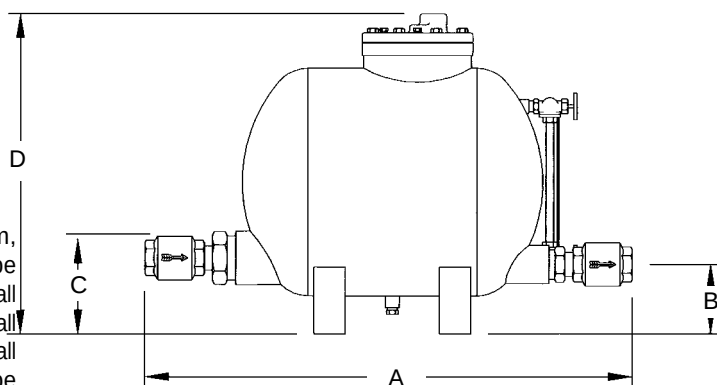
MATERIALS OF CONSTRUCTION

Tank Weldment	Steel
Trip Mechanism w/Flange	DI/Stl/SS
Gasket	Non-asbestos
Bolt, Hex Head	Steel
Nameplate	Aluminum
Drive Screw	Steel
Pipe Plug, 1/2" NPT	Steel
Water Level Gage	Bronze
Inlet Reducer	M. Iron
Inlet Nipple	Steel
Inlet Check Valve	Bronze/Stainless Steel
Outlet Reducer	M. Iron
Outlet Nipple	Steel
Outlet Check Valve	Bronze/Stainless Steel

OPERATING CHARACTERISTICS

Pump Discharge per Cycle:	8.8 - 11 Gal
Max. Instantaneous Discharge Rate:	90 GPM (w/2" outlet check)
Steam Consumption:	~3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	~100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	12"

Canadian Registration # 1351.9C



Exhaust outlet: 1" NPT
Motive inlet: 1/2" NPT

See capacities on page 303

Connections:
1" x 1" to 3" x 2" Screwed

Size	Inches (mm)						Weight lbs(kg)
	A	B	C	D [†]	E	F	
1"x 1"	34 3/4 (879)	5 1/2 (140)	6 (152)	25 3/4 (641)	18 (457)	25 (635)	174 (79)
1 1/2"x 1 1/2"	36 3/4 (933)	5 1/2 (140)	6 (152)	25 3/4 (641)	18 (457)	25 (639)	178 (81)
2"x 2"	37 3/4 (943)	5 1/2 (140)	6 (152)	25 3/4 (641)	18 (457)	25 (639)	183 (83)
3"x 2"	38 3/4 (971)	5 1/2 (140)	6 (152)	25 3/4 (641)	18 (457)	25 (639)	190 (86)

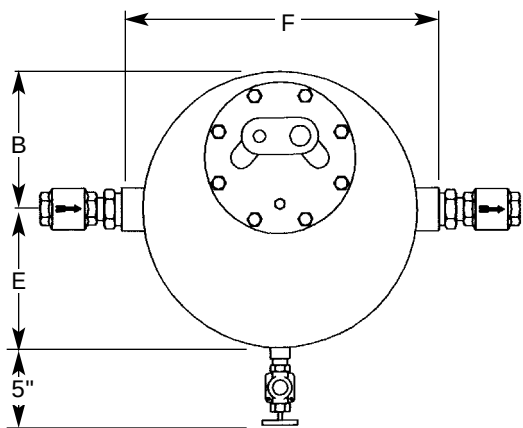
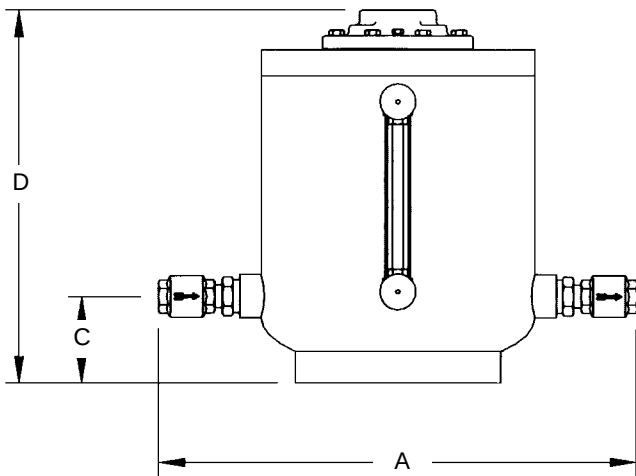
[†]Allow additional 21" clearance for maintenance.

COMMANDER
HORIZONTAL PUMP



CONDENSATE COMMANDER LITTLE BOY PUMP

SPECIFICATION



See capacities on page 303

Connections:
1" x 1" to 1½" x 1½" NPT

Dimensions							
Size	Inches (mm)						Weight lbs(kg)
	A	B	C	D*	E*	F	
1"x 1"	26¾ (679)	8 (203)	5 (127)	21¾ (540)	9 (229)	17¾ (451)	145 (66)
1½"x 1½"	29½ (749)	8 (203)	5 (127)	21¾ (540)	9 (229)	17¾ (451)	155 (71)

*Add 5" for Water Gage.

*Allow additional 18" clearance for maintenance.

Pump shall be a pressure vessel drainer operated by steam, compressed air or other pressurized gas to 150 psig. Body shall be fabricated steel. Mechanism shall employ one spring operating in continuous compression. Spring shall be warranted for the life of the unit. When required, unit shall be equipped with an external cycle counter and sight glass.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure	150 psig	(10.3 barg)
TMO: Max. Operating Temperature	400°F	(204°C)
PMA: Max. Allowable Pressure	150 psig	(10.3 barg)
TMA: Max. Allowable Temperature	400°F	(204°C)

MATERIALS OF CONSTRUCTION

Tank Weldment	Steel
Trip Mechanism w/Flange	DI/Stl/SS
Gasket	Non-asbestos
Bolt, Hex Head	Steel
Nameplate	Aluminum
Drive Screw	Steel
Water Level Gage	Bronze
Inlet Reducer	M. Iron
Inlet Nipple	Steel
Inlet Check Valve	Bronze/Stainless Steel
Outlet Reducer	M. Iron
Outlet Nipple	Steel
Outlet Check Valve	Bronze/Stainless Steel

OPERATING CHARACTERISTICS

Pump Discharge per Cycle:	4.2 - 5.1 Gal
Max. Instantaneous Discharge Rate:	60 GPM (w/1½" outlet check)
Steam Consumption:	~3 lbs per 1000 lbs. of liquid pumped
Air Consumption:	~100 SCF per 1000 lbs. of liquid pumped
Recommended Filling Head:	6"

Canadian Registration # 1353.9C

CONDENSATE COMMANDER PUMP CAPACITY TABLE*

Motive Pressure		Back Pressure		Fill Head 6" Little Boy		Fill Head 12" Classic & Horizontal				Fill Head 24" Big Boy	Fill Head 12" Classic Duplex
psig	barg	psig	barg	1 X 1	1.5 X 1.5	1 X 1	1.5 X 1.5	2 X 2	3 X 2	4 X 4	3 X 2
250	17.24	40	2.76	–	–	2703	6392	10196	11537	–	23073
		60	4.14	–	–	3670	7203	7787	8551	–	17101
		80	5.52	–	–	3457	6071	6531	7105	–	14209
		100	6.90	–	–	3891	5278	5753	6202	–	12404
		120	8.28	–	–	3700	4730	5213	5587	–	11173
		150	10.34	–	–	3196	4074	4552	4842	–	9683
		175	12.07	–	–	2845	3624	4092	4331	–	8663
		200	13.79	–	–	2456	3152	3650	3847	–	7694
		225	15.52	–	–	1963	2732	3221	3380	–	6761
200	13.79	40	2.76	–	–	2503	5919	9441	10682	–	21364
		60	4.14	–	–	3398	6669	7210	7918	–	15835
		80	5.52	–	–	4021	5579	6110	6619	–	13238
		100	6.90	–	–	3741	4855	5403	5804	–	11607
		120	8.28	–	–	3286	4242	4768	5088	–	10177
		150	10.34	–	–	2741	3533	4058	4297	–	8593
		175	12.07	–	–	2151	2926	3476	3661	–	7321
150	10.34	25	1.72	1814	5739	2314	5722	10376	12105	47994	24210
		40	2.76	3058	4860	3386	7077	8465	9450	45382	18899
		60	4.14	3127	4234	4464	6338	6995	7630	39757	15260
		80	5.52	2620	3472	3763	4974	5607	6040	35452	12080
		100	6.90	2261	2957	3168	4150	4743	5064	27971	10128
		120	8.28	1935	2530	2669	3522	4156	4408	20613	8815
125	8.62	25	1.72	2470	5645	2942	6740	10712	12337	48101	24674
		40	2.76	3215	4619	3983	7197	7965	8836	44256	17672
		60	4.14	2788	3768	4066	5513	6220	6758	38625	13516
		80	5.52	2358	3117	3326	4416	5064	5432	33012	10863
		100	6.90	1920	2535	2656	3544	4216	4482	25862	8964
		115	7.93	1491	2151	1952	2976	3589	3788	17512	7575
100	6.90	15	1.03	2036	6211	2762	6393	11889	14241	47156	28482
		25	1.72	3132	5336	3763	7658	9818	11170	45212	22340
		40	2.76	3082	4323	4569	6603	7403	8164	42041	16327
		60	4.14	2534	3406	3612	4893	5641	6092	35589	12184
		80	5.52	1959	2620	2716	3681	4428	4721	27783	9442
75	5.17	15	1.03	2975	6022	3867	7978	11977	14038	46485	28075
		25	1.72	3340	4940	4649	7823	8914	10026	43084	20052
		40	2.76	2817	3891	4078	5723	6654	7273	40027	14546
		60	4.14	2003	2732	2786	3863	4721	5057	20002	10114
50	3.45	10	0.69	3701	6273	4692	9227	12492	14737	46092	29474
		25	1.72	2976	4250	4343	6387	7603	8421	39727	16843
		40	2.76	2053	2891	2863	4120	5172	5578	19899	11156
25	1.72	5	0.34	3872	6625	5825	10486	13760	16560	45329	33120
		10	0.69	3315	5063	4845	7774	9812	11193	39945	22385
		15	1.03	2751	4016	3950	6043	7657	8513	18694	17026
10	0.69	2	0.14	3894	6646	5610	10348	14520	17621	–	35242
		5	0.34	2945	4600	4150	6954	9708	11085	–	22170
5	0.34	2	0.14	2981	5115	4130	7602	11747	13781	–	27562

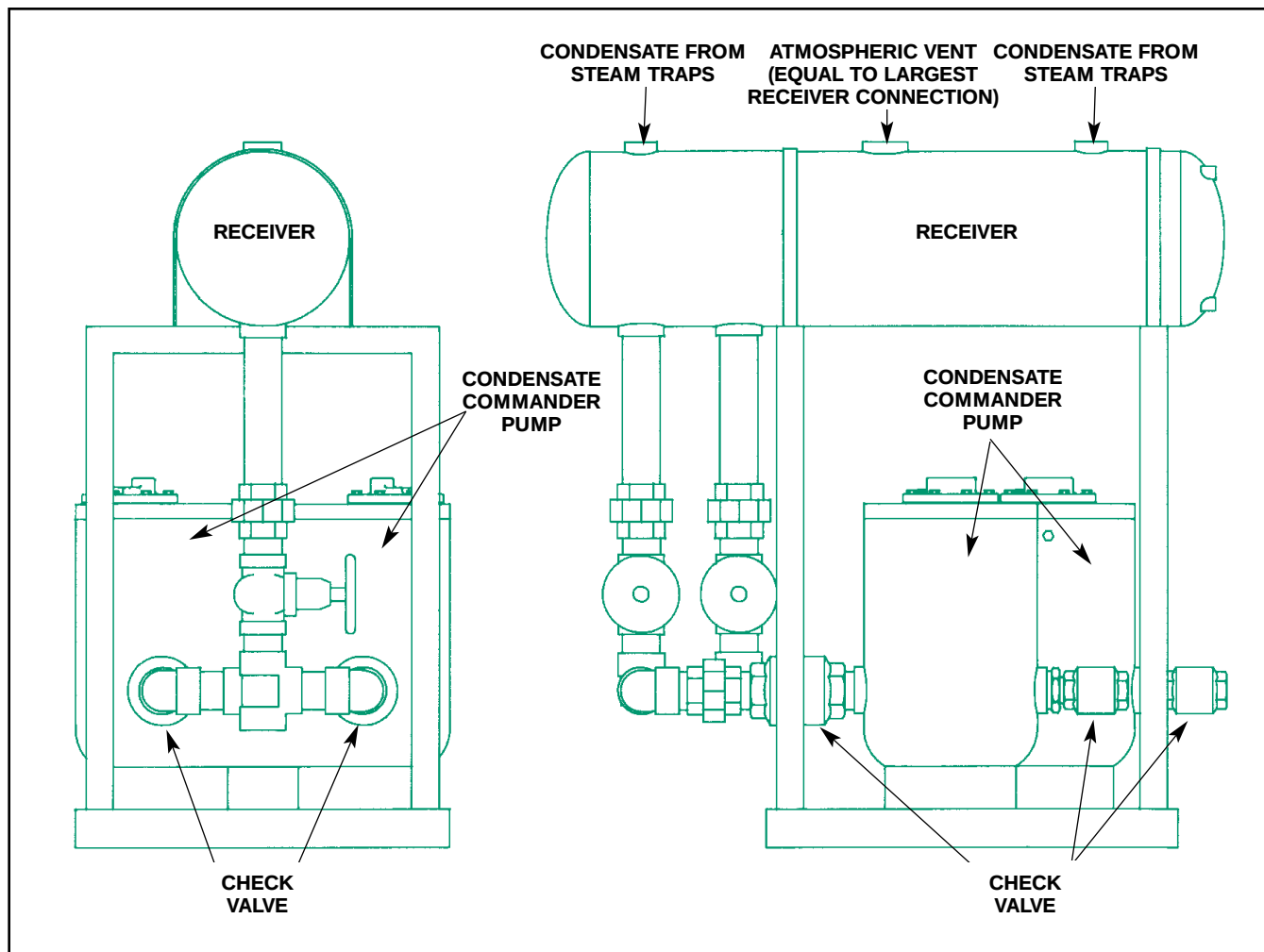
*Capacities shown are obtained with factory supplied check valves

For Kg/Hr multiply by .454

For other multiplex capacities, consult factory.

CONDENSATE COMMANDER PUMP SKID MOUNTED SYSTEM

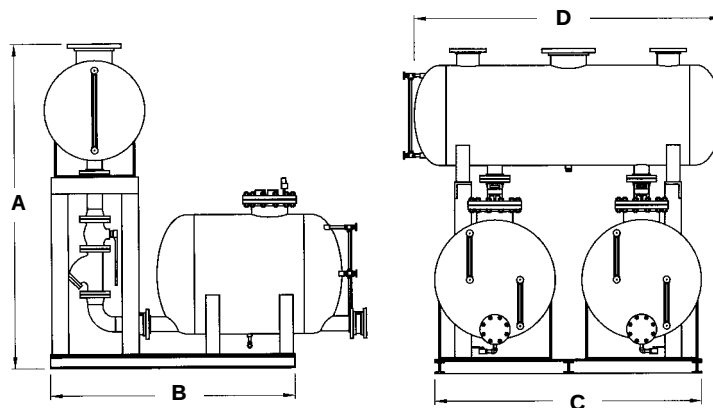
Where the condensate load exceeds the capacity of one Condensate Commander Pump, multiple pumps may be used in tandem. Skid mounted units may be simplex (one pump), duplex (two pumps), triplex (three pumps) or quadruplex (four pumps). The units are equipped with a receiver, Condensate Commander Pump(s) and all necessary piping fully connected and ready for use.



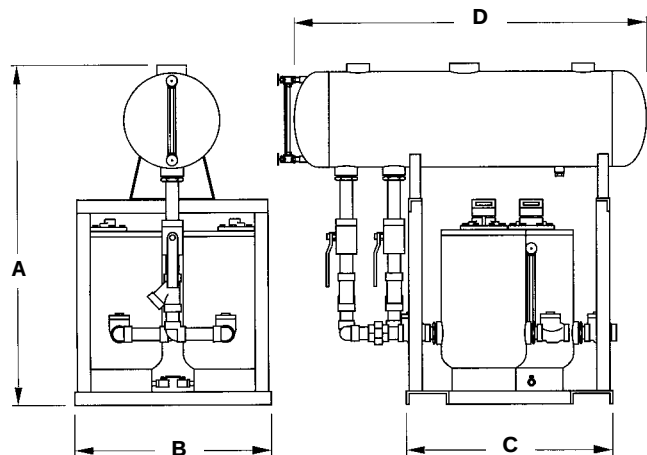
Typical Duplex Condensate Commander Pump Skid Mount System

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.

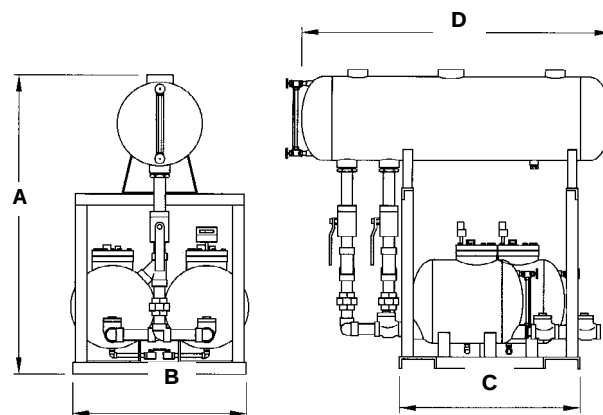
CONDENSATE COMMANDER PUMP SKID MOUNTED SYSTEM



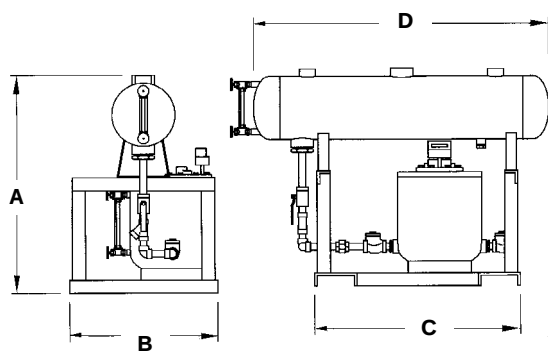
BIG BOY



CLASSIC VERTICAL



CLASSIC HORIZONTAL



LITTLE BOY

*The layout for the Big Boy Simplex is the same as the Classic Horizontal.

Dimensions							
Style	Config-uration	Receiver Gallons	Inches (mm)				Weight lb (kg)
			A	B	C	D	
Little Boy	Simplex	25	41 ½ (1054)	27 (686)	39 (991)	56 (1422)	435 (198)
Classic, Vertical	Simplex	25	58 ½ (1486)	27 (686)	39 (991)	56 (1422)	576 (262)
		65	64 ½ (1638)	27 (686)	39 (991)	66 ½ (1689)	635 (289)
Classic, Vertical	Duplex	65	64 ½ (1638)	36 (914)	39 (991)	66 ½ (1689)	1050 (477)
		80	66 ½ (1689)	36 (914)	39 (991)	68 (1727)	1095 (498)
Classic, Horizontal	Simplex	25	58 ½ (1486)	27 (686)	39 (991)	56 (1422)	596 (2713)
		65	64 ½ (1638)	27 (686)	39 (991)	66 ½ (1689)	655 (298)
Classic, Horizontal	Duplex	65	64 ½ (1638)	36 (914)	39 (991)	66 ½ (1689)	1095 (498)
		80	66 ½ (1689)	36 (914)	39 (991)	68 (1727)	1135 (516)
Big Boy	Simplex*	115	87 ½ (2228)	50 (1270)	70 ½ (1791)	96 (2438)	1900 (864)
Big Boy	Duplex	250	97 ½ (2482)	76 (1930)	80 (2032)	92 (2337)	3050 (1386)

CONDENSATE COMMANDER PUMP PRIMER

The SPENCE Condensate Commander belongs to a class of pressure operated pumps primarily intended to move condensate or other fluids without the use of electricity. When compared to conventional electrical pumps, the Condensate Commander is particularly suited to pumping "difficult" media such as high temperature condensate and corrosive fluids. Pressure operated pumps and the Condensate Commander in particular enjoy a reputation of long life with very little required maintenance. Generally these types of pumps, by eliminating rotating seals, electrical motors, and impellers, last five to ten times as long as conventional electrical pumps while eliminating most of the standard maintenance.

- Returns hot condensate conserving boiler feed water chemicals and reducing fuel cost associated with reheating boiler feed water.
- Pumps without requiring electrical service.
- Pump design provides safe operation for hazardous or explosive environments.
- Operates on steam, compressed air or gas from 5 psig to 250 psig depending on model.
- Capacities to 48,000 lbs./hr.

OPERATION

The Condensate Commander pumps by displacing fluid with steam or compressed gas. The float is connected to a linkage and spring that simultaneously actuates a motive valve and an exhaust valve. During the fill cycle the motive

valve closes while the exhaust valve opens, allowing condensate to fill the pump housing. When the float, rising with the entering fluid level, reaches the top of its stroke, the mechanism releases the spring, opening the motive and closing the exhaust valves. Steam or compressed gas then flows into the pump displacing the fluid. Check valves positioned at the inlet and outlet of the pump direct the fluid in the direction of the flow.

CHARACTERISTICS

Flow capacity is dependent on several parameters. Bearing in mind that the Condensate Commander pumps in discreet, relatively consistent slugs of fluid, the total capacity will depend on how quickly the Commander cycles. Motive pressure available and resistance in the flow line are the obvious causative and limiting factors of capacity. Less obvious is the Cv of the check valves, pressure or head of the incoming fluid, resistance in the vent line, and characteristics of the motive gas used.

There is no "vacuum" side of a Commander pump. While there certainly is an inlet side, it is important to understand that the class of pumps the Condensate Commander belongs to does not draw or suck fluid into it. The media must flow by gravity into the pump. The greater the pressure and/or head, the greater the Cv of the inlet check, and to a lesser extent the greater the Cv of the exhaust vent, the faster the fill portion of the cycle will complete. With the fill portion completed the

Commander mechanism will shut off the exhaust vent and open the motive valve. Steam or compressed gas will now displace the fluid contained in the pump housing. Factors controlling the speed of the discharge portion of the cycle include pressure of motive steam or gas, outlet check Cv, downstream backpressure, and potentially temperature of flow media and/or ambient conditions if steam is utilized as the motive gas. This last component is often overlooked, but the fact that steam will condense and reduce actual motive pressure could become significant in some applications.

RECEIVER

Conventional electric condensate pumps typically require a receiver sized to allow condensate to cool and vent flash steam. This is necessary, as the suction side of the pump will lower pressure potentially allowing the hot condensate to boil as it is drawn past the impeller. This action, known as cavitation, will quickly erode the impeller. While the temperature of the flow media is generally not a concern it must be remembered that the Condensate Commander pumps in discrete cycles. While the Commander is expelling fluid the body is pressurized and cannot receive fluid. If fluid is draining to the Commander in a continuous fashion, a receiver sized to accommodate the maximum volume expected during the time required to discharge the commander must be utilized. Failure to do so will back condensate up and possibly increase pressure, potentially causing problems.

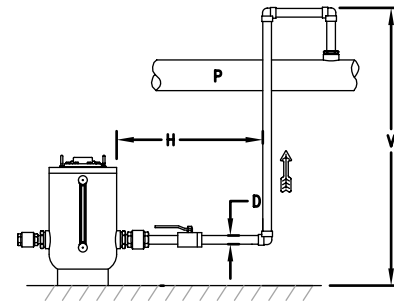
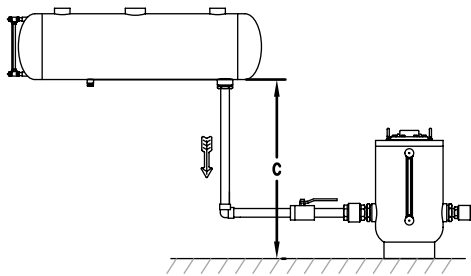
CONDENSATE COMMANDER PUMP CHECKLIST

(A) Sizing Requirements

1. What is the Fluid to be Pumped?
2. What is the fluid's Specific Gravity (i.e.: water = 1)?
3. What is the fluid's Fluid Temperature?
4. *What is the required Flow Rate?
5. What is the Clearance (C)?
6. Does the system have a Modulating Control Valve?

°F
☐ lb/hr ☐ GPM
feet

☐ Yes ☐ No



(B) Installation Requirements

Pump Connections:	Inlet	Outlet	☐ NPT	☐ Flanged	☐ Other
*Motive Gas:	psig	°F	☐ Air	☐ Steam	☐ Other
*Total Return Header Pressure (P):	psig	Downstream Pipe Size (D): inches			
Horizontal Run to Return Header (H):	feet	Vertical Lift to Return Header (V): feet			
Can pump be vented to atmosphere? ☐ Yes ☐ No If "No", please explain _____					
Does the system have an existing flash tank or receiver tank? ☐ Yes ☐ No					
If "Yes", is it vented to atmosphere or under pressure? ☐ Atmospheric ☐ Pressure psig					

(C) Materials & Accessories

Tank Material:	☐ Carbon Steel (STD)	☐ Stainless Steel	☐ Other
Tank Style:	☐ Little Boy	☐ Classic Vertical	☐ Classic Horizontal ☐ Big Boy
Receiver Size:	☐ 25 ☐ 65	☐ 80	☐ 115 ☐ 250
Number of Pumps:	☐ One	☐ Two	☐ Three ☐ Four
Check Valve:	☐ Bronze (STD)	☐ Stainless Steel	☐ Other
Options:	☐ Gage Glass Ass'y on Pump	☐ Cycle Counter	☐ Motive Pressure PRV [†]
	☐ Gage Glass Ass'y on Receiver	☐ Insulation Jacket	☐ Safety Relief Valve [†]
	☐ Skid Mounted Package	☐ Pressure Gages [†]	☐ Temperature Gages [†]

* Required Fields

[†]Non-standard items.

CONDENSATE COMMANDER PUMP 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 1" x 1" 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 1" x 1" 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

TABLE 1 – Pump Capacity–(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	4130	7602	11747	13781	27562
10	5	4150	6954	9708	11085	22170
	2	5610	10348	14520	17621	35242
25	15	3950	6043	7657	8513	17026
	10	4845	7774	9812	11193	22386
	5	5825	10486	13760	16560	33120
50	40	2863	4120	5172	5578	11156
	25	4343	6387	7603	8421	16842
	10	4692	9227	12492	14737	29474
75	60	2786	3863	4721	5057	10114
	40	4078	5723	6654	7273	14546
	15	3867	7978	11997	14038	28076
100	80	2716	3681	4428	4721	9442
	60	3612	4893	5641	6092	12184
	40	4569	6603	7403	8164	16328
	15	2762	6393	11889	14241	28482
125	115	1952	2976	3589	3788	7576
	100	2656	3544	4216	4482	8964
	80	3326	4416	5064	5432	10864
	60	4066	5513	6220	6758	13516
	40	3983	7197	7965	8836	17672
150	25	2942	6740	10712	12337	24674
	120	2669	3522	4156	4408	8816
	100	3168	4150	4743	5064	10128
	80	3763	4974	5607	6040	12080
	60	4464	6338	6995	7630	15260
	40	3386	7077	8465	9450	18900
	25	2314	5722	10376	12105	24210

TABLE 2 – Capacity Correction Factors for Motive Gas Supply other than Steam

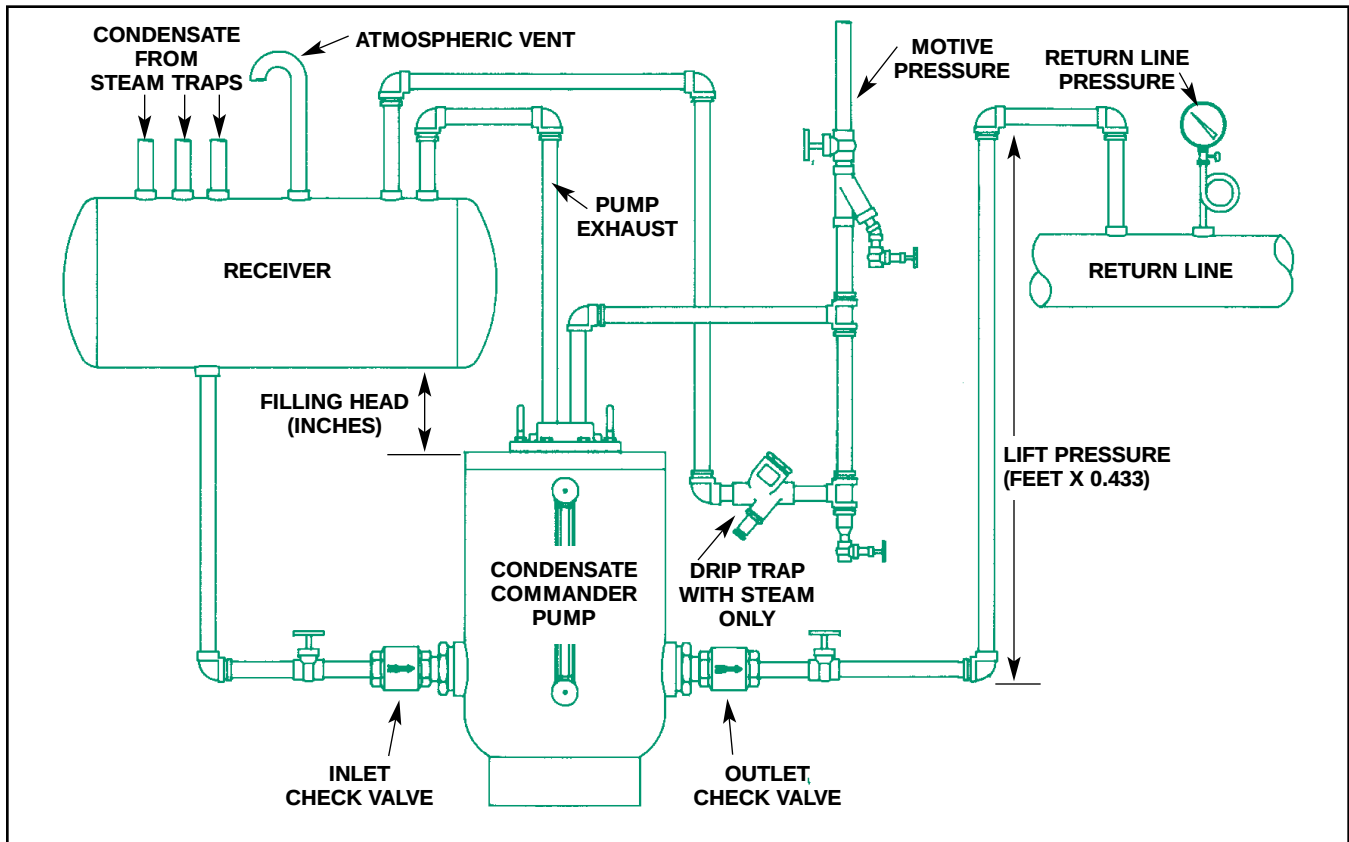
% Back Pressure vs. Motive Pressure (BP ÷ MP)								
10%	20%	30%	40%	50%	60%	70%	80%	90%
1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28

TABLE 3 – Capacity Correction Factor for Filling Head Variation

Filling Head (inches)	Check Valve and Piping Size Inches				
	1"	1½"	2"	3" x 2"	4"
6	0.70	0.70	0.70	0.84	—
12	1.00	1.00	1.00	1.0	0.7
24	1.20	1.20	1.20	1.08	1.0
36	1.35	1.35	1.35	1.20	1.1
48	—	—	—	—	1.15

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.



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.

Sizing Example: Condensate Load = 10,000 lb/hr. Traps are draining a Heat Exchanger running at 100 psig and the receiver is vented to atmosphere. Table 5 shows 13.3% of the condensate flashes to steam, so total flash steam = $10,000 \times .133 = 1,333$ lb/hr flash steam. Table 4 indicates a vent size of 6" and a receiver size of 16" Dia. x 36" long.

**TABLE 4 -
Vented Receiver Sizing**

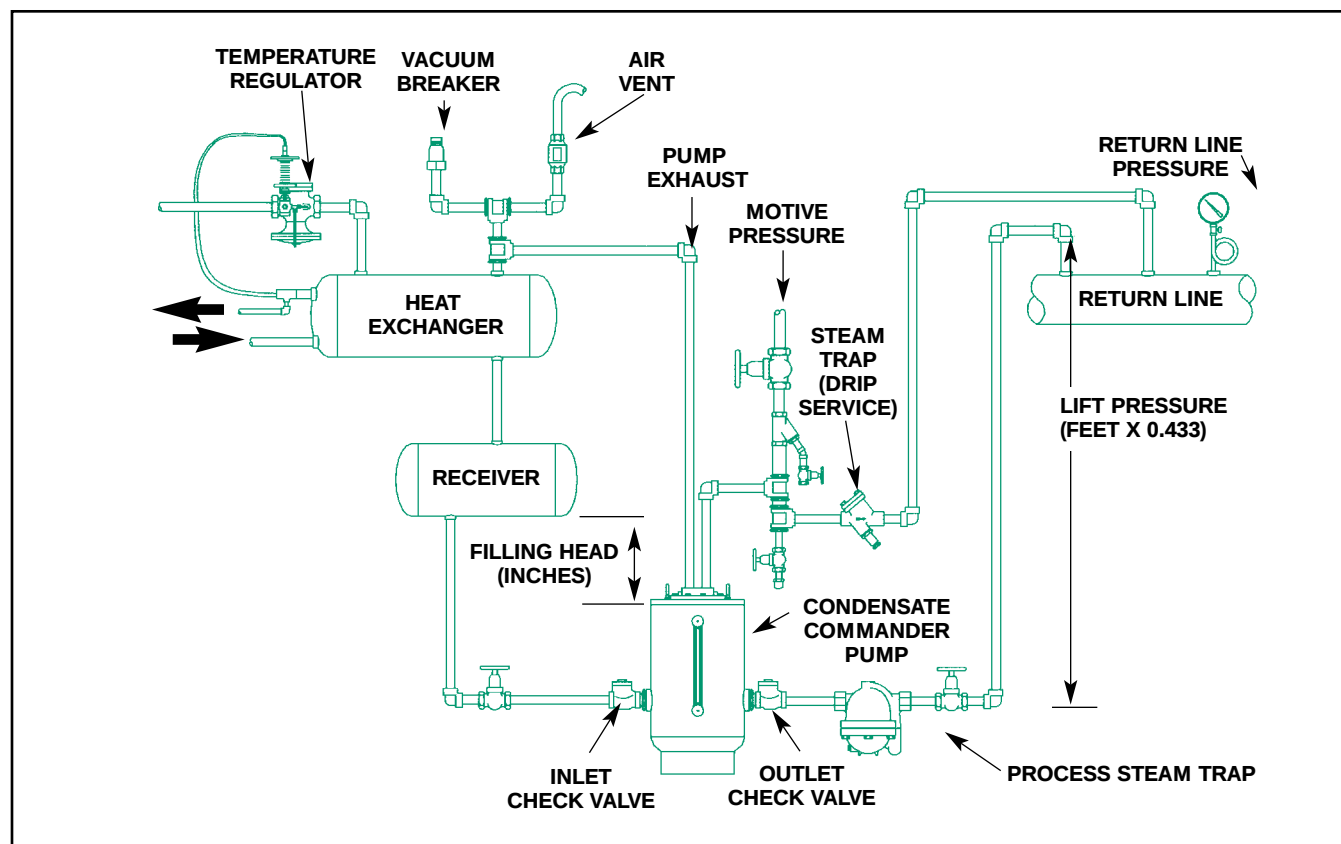
Receiver size based on 36" OAL		
Flash Vapor (lbs/hr)	Pipe Diameter (inches)	Vent Line Size (inches)
75	4	1½
150	6	2
300	8	3
600	10	4
900	12	6
1200	16	6
2000	20	8

TABLE 5 - 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

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.



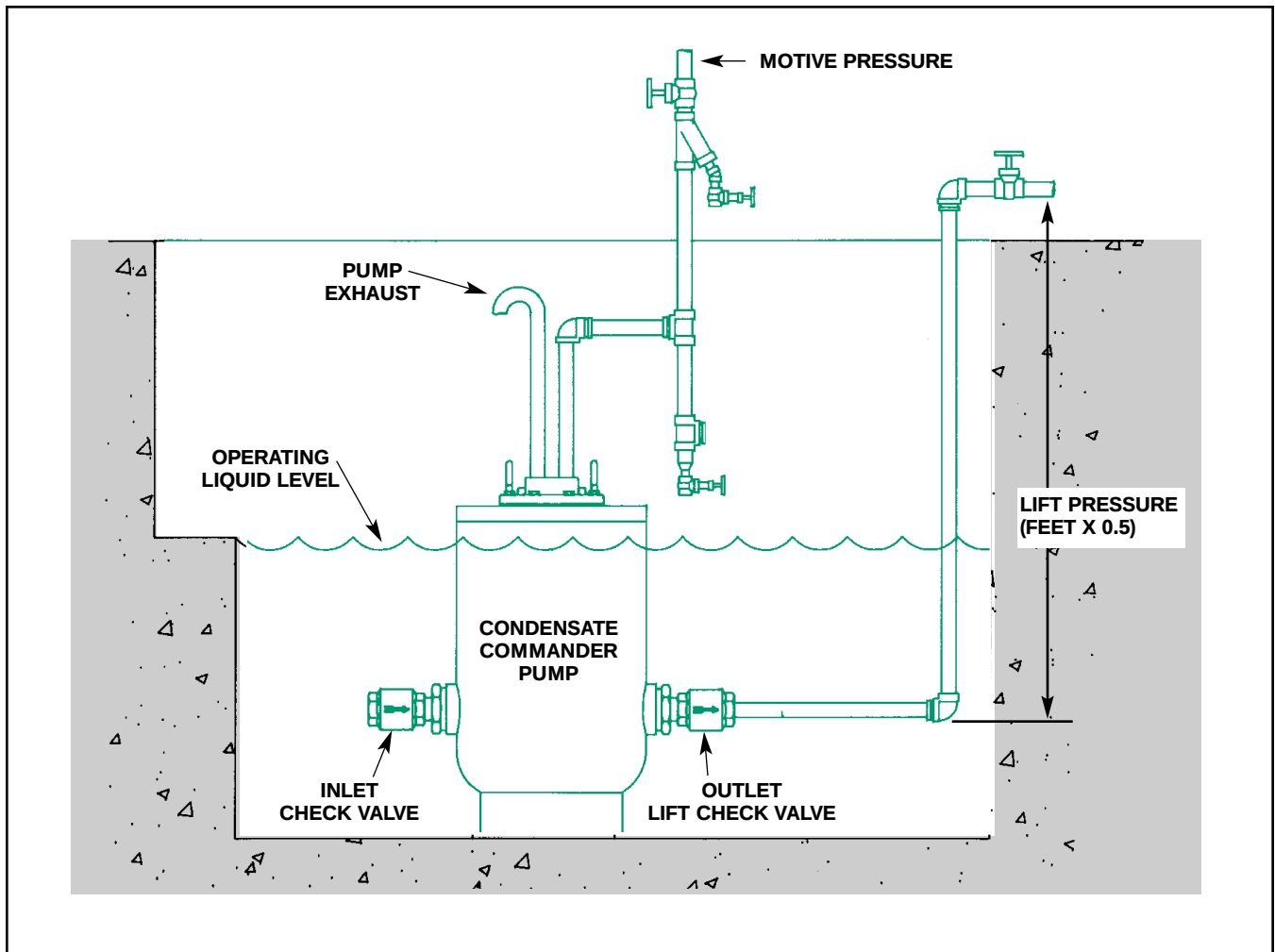
To efficiently drain condensate in a closed system, the receiver should be horizontally located a minimum of twelve inches above the pump to allow for sufficient condensate collection. The receiver must be sized to provide the minimum condensate capacity required to prevent equipment flooding. The receiver may be either an ASME coded tank or a length of large diameter pipe. A safety relief valve may be required. Consult factory for capacity when a steam trap is utilized after the pump.

TABLE 6 – Inlet Receiver Sizing

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

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.



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 compressed air or any other gas is readily available for use as the driving force. Steam is not recommended as a motive vapor because a submerged pump may quickly condense the motive steam, potentially reducing performance.

NOTES:

SECTION VI

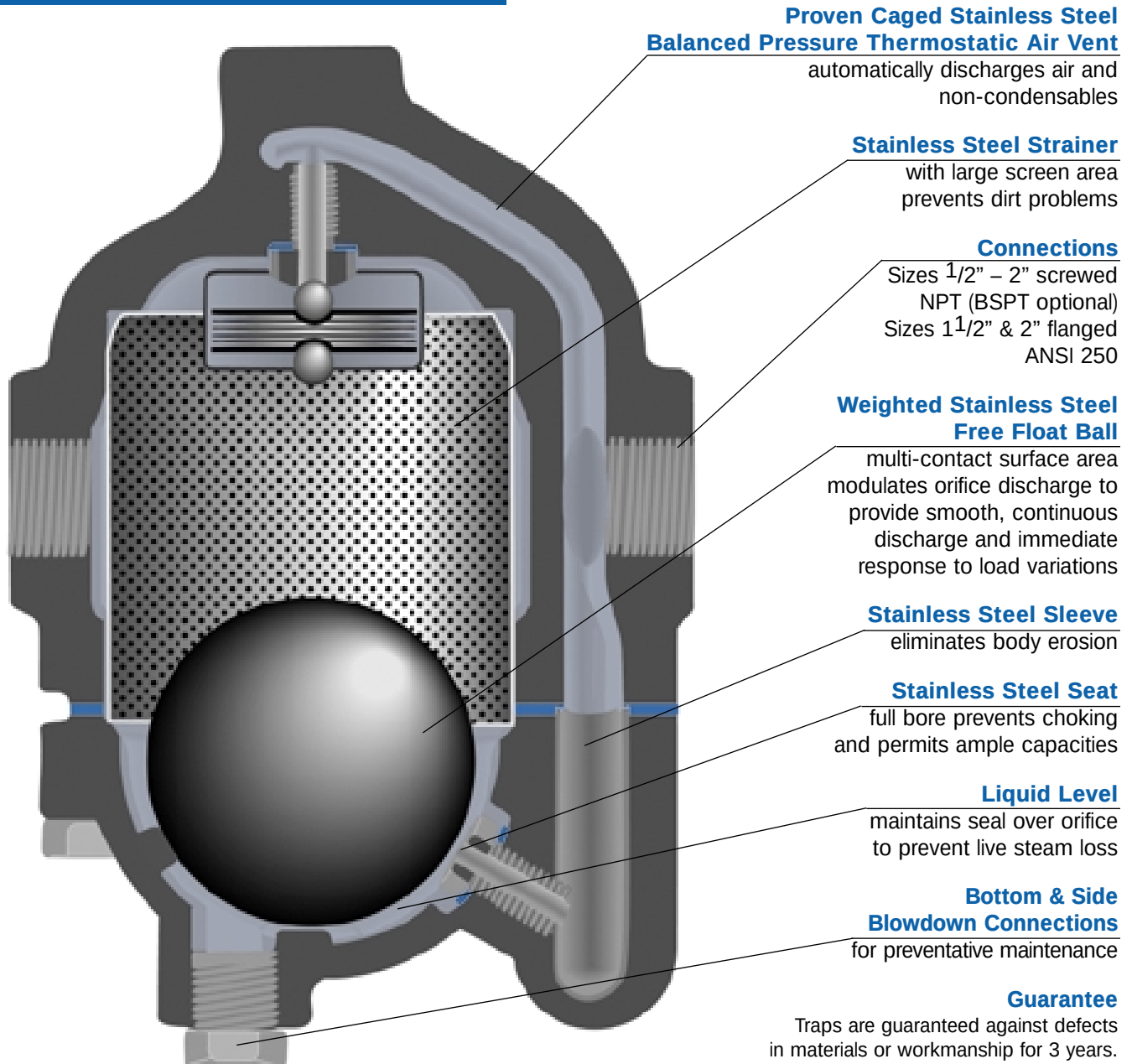
TRAPS & SPECIALTIES

NOVA NFT250 Series Variable Orifice Steam Traps

Applications

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

Pressures To 250 PSIG
Temperatures to 450°F



Applications

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

DURA-FLO Inverted Bucket Steam Trap

**Pressures To 250 PSIG
Temperatures to 450°F**



Easy to Maintain

Working parts lift out with top for quick inspection and maintenance.

Resists Corrosion

Stainless steel bucket provides maximum service life with minimum deterioration.

Minimizes Effects of Water Hammer

Open bucket design avoids collapse typical of sealed floats.

Suitable for Wide Variety of Loads/Applications

Horizontal and vertical models in thirteen body sizes are one of the most comprehensive inverted bucket trap lines available.

Withstands Severe Conditions

Heavy wall cast iron cover and body provide many years of trouble free service.

Smooth Action and Tight Shutoff

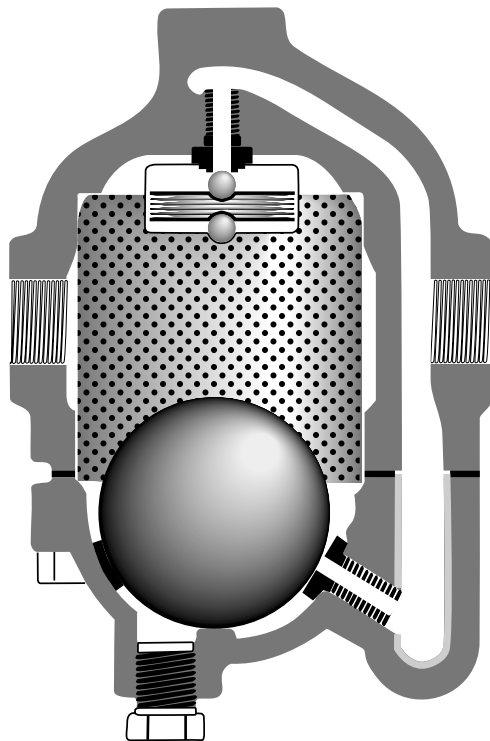
Stainless steel linkage, valve and seats are precision manufactured to insure optimal performance.

Ideal for "Dirty" Systems

Valve and seat located at top of trap and stainless steel strainers available on most horizontal models ensure long service.

Maximum Compatibility with Existing Installations

Pressure change assemblies are interchangeable with Armstrong which guarantees maximum flexibility when stocking repair parts.



APPLICATIONS

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

OPTIONS See Page 9

- SLR - SLR Orifice
- B - Blowdown Valve (contact factory)
- Orifice Continuous Bleed Air Vent
- 250# - 250# Flanged Connection* (Flat Faced)

*Available on NFT 253 only.

Canadian Registration # OE0591.9C

OPERATION

On startup, the thermostatic air vent (caged stainless welded bellows) is open, allowing air to flow freely through the vent valve orifice. When condensate flows into the trap, the float rises, allowing condensate to be discharged. Once air and non-condensibles have been evacuated, hot condensate will cause the thermostatic vent to close. Condensate will continue to be discharged as long as condensation occurs.

NOVA NFT250 SERIES

VARIABLE ORIFICE STEAM TRAPS

Pressures To 250 PSIG (17.2 barg)
Temperatures to 450°F (232°C)

All Stainless Steel Internal Components — Hardened valves and seats. Extra long life and dependable service. Resists water hammer. Protects against erosion and corrosion.

Erosion Proof — Discharge passage is protected with a stainless steel liner.

Integral Strainer — Stainless Steel screen prevents dirt problems. Blow-down connection provided.

Thermostatic Air Vent — Full balanced pressure element for immediate and complete air venting.

Variable Orifice — Condensate is discharged continuously through the seat ring which is modulated by the float. This provides a smooth, even flow without high velocity or steam entrainment.

SLR Orifice — Optional continuous bleed prevents flash steam lockup when it is impossible to install trap at low point in system.

Guarantee — Traps are guaranteed against defects in materials or workmanship for 3 years.

MODELS

- **NFT250**—Low capacity
- **NFT251**—Medium capacity
- **NFT252**—High capacity
- **NFT253**—Super high capacity

Installation Tip: Always install STV Test & Block Valve as part of trap station
SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 102

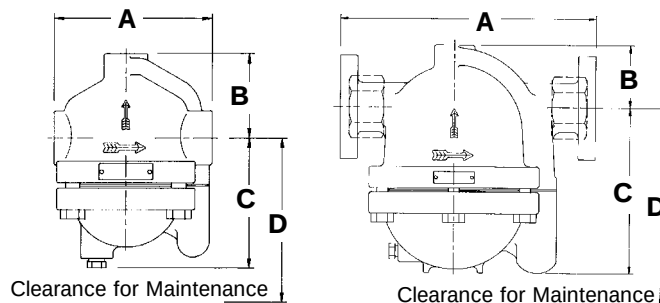
During normal operation, an increase in the load causes the liquid level in the trap to rise. The float then rises and rolls off the seat ring, allowing more condensate to flow out. The float sinks as the condensate load decreases, moving nearer to the seat ring, decreasing the effective size of the orifice and allowing less condensate to discharge. This provides smooth, continuous operation that reacts instantly to load variation while maintaining a water seal over the seat ring to prevent live steam loss.

NOVA NFT250 SERIES

VARIABLE ORIFICE STEAM TRAPS

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall be free of levers, linkages, or other mechanical connections. Float shall be weighted to maintain orientation and shall act as the valve being free to modulate condensate through the seat ring. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously within 15°F of saturated temperature. Trap shall contain integral strainer and stainless steel exhaust port sleeve. Trap shall be cast iron bodied suitable for pressures to 250 psi and available in 1/2" through 2" NPT or flanged.



Connections:
½"-2" NPT or 1½"-2" Flanged

MATERIALS OF CONSTRUCTION

Body and Cover Cast Iron ASTM A126B
All Internal Parts Stainless Steel
Air Vent Balanced Pressure, Stainless Steel
Cover Gasket Graphite Fiber

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure

ORIFICE	PMO
20	20 psig (1.4 barg)
50	50 psig (3.5 barg)
100	100 psig (6.9 barg)
150	150 psig (10.3 barg)
250	250 psig (17.2 barg)

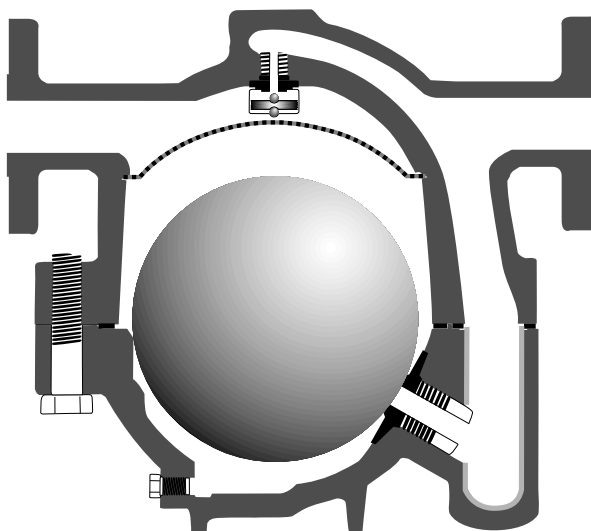
PMA: Max. Allowable Pressure:
250 psig (17.2 barg)

TMA: Max. Allowable Temperature:
450°F (232°C)

Dimensions							
Model	Size	Connection	Inches (mm)				Weight Lbs. (kg)
			A	B	C	D	
NFT250	1/2 & 3/4	NPT	4 1/4 (108)	2 3/4 (69)	3 5/8 (92)	5 1/2 (140)	6 (2.7)
NFT251	3/4 & 1	NPT	5 1/2 (140)	2 15/16 (74)	4 9/16 (116)	6 3/4 (171)	13 (5.9)
NFT252'	1 & 1 1/2	NPT	11 (279)	2 15/16 (74)	7 3/4 (197)	10 (254)	41 (18.6)
NFT253	1 1/2 & 2	NPT	13 3/4 (349)	2 15/16 (74)	11 5/8 (295)	15 3/8 (391)	120 (54.5)
		250# Flg.	15 3/4 (400)	2 15/16 (74)	11 5/8 (295)	15 3/8 (391)	130 (59.1)

Maximum Capacity—lbs/hr (10°F Below Saturation)																	
Trap	Orifice Size	Differential – PSIG (barg)															
		Max. ΔP	1 (.07)	5 (.34)	10 (.69)	15 (1.03)	20 (1.38)	30 (2.07)	50 (3.45)	75 (5.17)	100 (6.90)	125 (8.62)	150 (10.3)	175 (12.1)	200 (13.8)	225 (15.5)	250 (17.2)
NFT250	0.193	20	264	810	1050	1100	1200										
	0.141	50	190	430	610	750	870	1070	1400								
	0.102	100	88	160	250	300	350	425	530	670	710						
	0.091	150	70	140	219	260	295	345	410	470	520	555	590				
	0.067	250	37	90	140	170	200	240	300	340	390	405	415	440	460	480	500
NFT251	0.277	20	590	1600	2100	2400	2450										
	0.209	50	340	760	1080	1330	1540	1900	2460								
	0.157	100	200	500	650	740	830	950	1100	1300	1400						
	0.141	150	170	385	527	627	705	825	990	1130	1240	1330	1415				
	0.120	250	110	255	360	425	500	575	700	800	900	940	1000	1050	1100	1150	1200
NFT252	0.593	20	2720	6280	8600	10500	11700										
	0.469	50	1750	3920	5560	6830	7900	9700	12600								
	0.339	100	930	2170	3130	3840	4460	4990	6020	7030	7960						
	0.316	150	850	1935	2650	3150	3540	4140	4970	5685	6230	6690	7100				
	0.261	250	670	1400	1900	2400	2540	3000	3500	4100	4200	4900	5100	5300	5500	5750	6000
NFT253	1.102	20	8000	15000	18000	19900	22800										
	0.875	50	5460	12600	15600	16900	18400	21000	25400								
	0.593	100	2800	6350	8700	10900	12800	13700	16600	18700	21000						
	0.578	150	2690	6120	8385	9970	11200	13100	15700	17980	19700	21150	22450				
	0.484	250	1600	3770	5300	6470	7560	8610	10400	12100	13600	14600	15500	16300	17100	17800	18400

For Kg/Hr Multiply by .454



APPLICATIONS

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

OPTIONS See page 9

- SLR - SLR Orifice
- B - Blowdown Valve (contact factory)
- Continuous Bleed Air Vent
- 300# or 600# Flanged Connection* (Raised Face)

*Available on NFT652 and NFT653 only.

Canadian Registration # OE0591.9C

NOVA NFT650 SERIES

VARIABLE ORIFICE STEAM TRAPS

Pressures To 650 PSIG (44.8 barg)
Temperatures to 750°F (400°C)

All Stainless Steel Internal Components — Hardened valves and seats. Extra long life and dependable service. Resists water hammer. Protects against erosion and corrosion.

Erosion Proof — Discharge passage is protected with a stainless steel liner.

Integral Strainer — Stainless Steel screen prevents dirt problems. Blow-down connection provided.

Thermostatic Air Vent — Provided with balanced pressure element for immediate and complete air venting.

Variable Orifice — Condensate is discharged continuously through the seat ring which is modulated by the float. This provides a smooth, even flow without high velocity or steam entrainment.

SLR Orifice — Optional continuous bleed prevents flash steam lockup when it is impossible to install trap at low point in system.

Guarantee — Traps are guaranteed against defects in materials or workmanship for 3 years.

MODELS

- **NFT651**—Low capacity
- **NFT652**—Medium capacity
- **NFT653**—High capacity

Installation Tip: Always install STV Test & Block Valve as part of trap station
SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 102

OPERATION

On startup, the thermostatic air vent (caged stainless welded bellows) is open, allowing air to flow freely through the vent valve orifice. When condensate flows into the trap, the float rises, allowing condensate to be discharged. Once air and non-condensibles have been evacuated, hot condensate will cause the thermostatic vent to close. Condensate will continue to be discharged as long as condensation occurs.

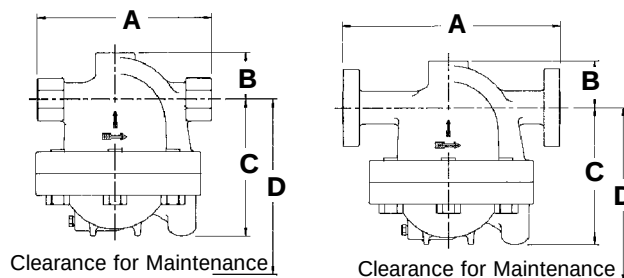
During normal operation, an increase in the load causes the liquid level in the trap to rise. The float then rises and rolls off the seat ring, allowing more condensate to flow out. The float sinks as the condensate load decreases, moving nearer to the seat ring, decreasing the effective size of the orifice and allowing less condensate to discharge. This provides smooth, continuous operation that reacts instantly to load variation while maintaining a water seal over the seat ring to prevent live steam loss.

NOVA NFT650 SERIES

VARIABLE ORIFICE STEAM TRAPS

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall be free of levers, linkages, or other mechanical connections. Float shall be weighted to maintain orientation and shall act as the valve being free to modulate condensate through the seat ring. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously within 15°F of saturated temperature. Trap shall contain integral strainer and stainless steel exhaust port sleeve. Trap shall be cast steel bodied suitable for pressures to 650 psi and available in 1/2" through 2" NPT, Socket Weld, or flanged.



Connections:
½-2" NPT or 1½-2" Flanged

MATERIALS OF CONSTRUCTION

Body & Cover ASTM A216 Grade WCB
Cover Gasket Spiral Wound 304 Stainless
w/graphite filler
All Internal Stainless Steel
Air Vent Balanced Pressure, Stainless Steel

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure

ORIFICE	PMO
20	20 psig (1.4 barg)
50	50 psig (3.5 barg)
100	100 psig (6.9 barg)
175	175 psig (12.1 barg)
300	300 psig (20.7 barg)
400	400 psig (27.6 barg)
600	600 psig (41.4 barg)

PMA: Max. Allowable Pressure:
650 psig (44.8 barg)

TMA: Max. Allowable Temperature:
750°F (400°C)

Dimensions								
Model	Size	Inches (mm)						Weight Lbs. (kg)
		A			B	C	D	
		NPT	300#	600#				
NFT651	1/2, 3/4 & 1	5 ¹ / ₂ (140)	—	—	3 ¹ / ₁₆ (78)	5 ⁷ / ₁₆ (138)	7 ¹ / ₄ (184)	21 (9.5)
NFT652	1	11 (279)	13 ³ / ₄ (349)	13 ³ / ₄ (349)	2 ¹⁵ / ₁₆ (75)	8 ³ / ₄ (222)	11 ³ / ₈ (290)	84 (38.2)
	1 ¹ / ₂ & 2	11 (279)	13 ³ / ₄ (349)	14 ⁹ / ₁₆ (370)	2 ¹⁵ / ₁₆ (75)	8 ³ / ₄ (222)	11 ³ / ₈ (290)	87 (39.5)
NFT653	1 ¹ / ₂	13 ³ / ₄ (349)	16 ³ / ₄ (426)	17 ³ / ₈ (411)	3 ⁵ / ₁₆ (84)	11 ⁷ / ₈ (392)	16 (406)	192 (87.3)
	2	13 ³ / ₄ (349)	16 ¹¹ / ₁₆ (424)	17 ⁷ / ₁₆ (443)	3 ⁵ / ₁₆ (84)	11 ⁷ / ₈ (302)	16 (406)	195 (88.6)

Maximum Capacity - lbs/hr (10 degrees Below Saturation)

Trap	Orifice Size	MAX ΔP	Differential - PSIG (barg)														
			1	5	10	20	50	75	100	150	175	200	250	300	400	500	600
			(.07)	(.34)	(.69)	(1.38)	(3.45)	(5.17)	(6.90)	(10.3)	(12.1)	(13.8)	(17.2)	(20.7)	(27.6)	(34.5)	(41.4)
NFT651	0.277	20	590	1600	2100	2450											
	0.209	50	340	760	1080	1540	2460										
	0.157	100	200	500	650	830	1100	1300	1400								
	0.141	150	170	385	527	705	990	1130	1240	1415							
	0.130	175	180	350	500	675	900	1000	1100	1300	1400						
	0.120	250	110	255	360	500	700	800	900	1000	1050	1100	1200				
	0.106	300	105	240	330	435	575	675	750	875	955	1020	1140	1255			
	0.096	400	100	220	300	390	510	585	640	740	795	835	920	1000	1140		
0.081	600	75	145	180	225	300	340	375	435	465	490	540	585	665	740	800	
NFT652	0.593	20	2720	6280	8600	11700											
	0.469	50	1750	3920	5560	7900	12600										
	0.339	100	930	2170	3130	4460	6020	7030	7960								
	0.316	150	850	1935	2650	3540	4970	5685	6230	7100							
	0.297	175	800	1700	2300	3200	4400	5000	5500	6400	6900						
	0.261	250	670	1400	1900	2540	3500	4100	4200	5100	5300	5500	6000				
	0.238	300	645	1240	1565	1955	2575	2940	3220	3740	4000	4220	4640	5060			
	0.213	400	515	995	1250	1565	2060	2355	2575	2995	3200	3380	3720	4050	4600		
0.180	600	370	710	895	1120	1470	1680	1840	2140	2290	2410	2655	2890	3300	3655	3955	
NFT653	1.102	20	8000	15000	18000	22800											
	0.875	50	5460	12600	15600	18400	25400										
	0.593	100	2800	6350	8700	12800	16600	18700	21000								
	0.578	150	2690	6120	8385	11200	15700	17980	19700	22450							
	0.547	175	2400	5500	7600	10300	14400	16500	18200	20750	21900						
	0.484	250	1600	3770	5300	7560	10400	12100	13600	15500	16300	17100	18400				
	0.453	300	1500	3500	5200	7075	9325	10655	11655	13545	14485	15275	16815	18315			
	0.404	400	1400	2800	4200	5630	7420	8480	9270	10770	11520	12150	13380	14570	16555		
	0.339	600	800	1800	2800	3900	5220	5970	6530	7585	8110	8555	9420	10260	11655	12960	13990

For Kg/Hr Multiply by .454

FTN SERIES FLOAT & THERMOSTATIC STEAM TRAPS

Pressures To 125 PSIG (8.6 barg)
Temperatures to 450°F (232°C)



Universal Four-port Design — Four possible hookup combinations of the “H” pattern body and piping dimensions similar to other major manufacturers allow maximum installation flexibility for easy replacement of other traps. Inlet and outlet taps on larger sized traps located in the cover to permit larger capacities.

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-condensibles while operating at design pressure.

Rugged Welded Stainless Steel Element — Increases service life.

Wide Selection of Differential Pressures — Sizes 3/4" to 2" available with 15, 30, 75 and 125 psig differential pressures.

Air Line Water Removal — Special configuration FTNA optimized for compressed air service.

Repairable In-line — Can be serviced without disturbing system piping.

APPLICATIONS

- Unit Heaters & other Space Heating Equipment
- Heat Exchangers/Reboilers
- Steam Heating Coils
- Steam Main Drips
- Air Compressor Receivers
- Air Line Drips
- Air Powered Process Equipment

OPTIONS See page 9

- Repair Kits

MODELS

- **FTN-15**—Steam pressures to 15 PSIG
- **FTN-30**—Steam pressures to 30 PSIG
- **FTN-75**—Steam pressures to 75 PSIG
- **FTN-125**—Steam pressures to 125 PSIG
- **FTNA-75**—Air pressures to 75 PSIG
- **FTNA-125**—Air pressures to 125 PSIG

Installation Tip: Always install STV Test & Block Valve as part of trap station
SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 102

OPERATION

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-condensibles 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.

FTN SERIES

FLOAT & THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously within 15°F of saturated temperature. Traps through 1-1/4" shall employ "H" pattern connections to accommodate multiple piping configurations. Trap shall be cast iron bodied suitable for pressures to 125 psi and available in 3/4" through 2" NPT.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure

ORIFICE	PMO
15	15 psig (1.03 barg)
30	30 psig (2.07 barg)
75	75 psig (5.17 barg)
125	125 psig (8.62 barg)

PMA: Max. Allowable Pressure

250 psig (17.2 barg)

TMA: Max. Allowable Temperature

450°F (232°C)

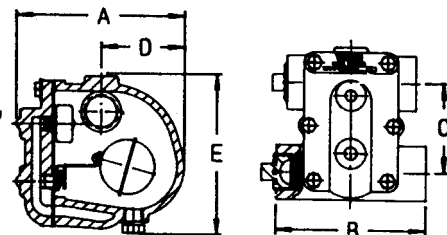
MATERIALS OF CONSTRUCTION

Body & Cover . . . Cast Iron ASTM A126B

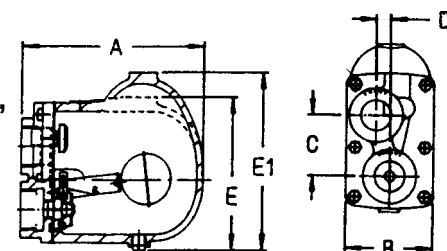
All Internal Stainless Steel

Air Vent (FTN only) Balanced Pressure,
Welded Stainless Steel

3/4", 1" - All
1 1/4" - FTN-15,
FTN-30



1 1/2", 2" - All *
1 1/4" - FTN-75,
FTNA-75*,
FTNA-125*



*1/8" NPT tap at top boss for balancing line.

Connections: 3/4"-2" NPT

Dimensions								
Model No.	Size	Inches (mm)						Weight lbs (kg)
		A	B	C	D	E	E1	
FTN-15, FTN-30	3/4	6.25 (159)	5.50 (140)	3.31 (84)	3.00 (76)	5.75 (146)	—	9 (4.1)
	1	6.25 (159)	5.50 (140)	3.31 (84)	3.00 (76)	5.75 (146)	—	9 (4.1)
	1 1/4	6.25 (159)	5.75 (146)	3.00 (76)	3.81 (97)	5.75 (146)	—	9 1/2 (4.3)
	1 1/2	8.50 (216)	4.25 (108)	3.00 (76)	0.70 (18)	—	8.40 (213)	18 (8.2)
	2	9.81 (249)	4.94 (123)	4.94 (123)	0.12 (3)	9.12 (232)	—	26 (11.8)
FTN-75, FTN-125 FTNA-75, FTNA-125	3/4	6.25 (159)	5.50 (140)	3.31 (84)	3.00 (76)	5.75 (146)	—	9 (4.1)
	1	6.25 (159)	5.50 (140)	3.31 (84)	3.00 (76)	5.75 (146)	—	9 (4.1)
	1 1/4	8.50 (216)	4.25 (108)	3.00 (76)	0.70 (18)	—	8.40 (213)	18 (8.2)
	1 1/2	8.50 (216)	4.25 (108)	3.00 (76)	0.70 (18)	—	8.40 (213)	18 (8.2)
	2	9.81 (249)	4.94 (123)	4.94 (123)	0.12 (3)	9.12 (232)	—	26 (11.8)

Maximum Capacity—lbs/hr (10°F Below Saturation)

Trap	Size NPT	Orifice (in.)	Differential-PSIG (barg)														
			1/4 (.017)	1/2 (.034)	1 (.069)	2 (.138)	5 (.345)	10 (.690)	15 (1.03)	20 (1.38)	25 (1.72)	30 (2.07)	40 (2.76)	50 (3.45)	75 (5.17)	100 (6.90)	125 (8.62)
FTN-15	3/4"	.218	279	369	489	650	785	1000	1075								
FTN-15	1"	.218	279	369	489	650	785	1000	1075								
FTN-15	1 1/4"	.312	600	770	980	1240	1640	2000	2340								
FTN-15	1 1/2"	.500	1100	1700	2400	3300	5000	6600	7600								
FTN-15	2"	.625	2300	2800	3600	4650	6900	9000	10900								
FTN-30	3/4"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
FTN-30	1"	.218	279	369	489	650	785	1000	1075	1210	1300	1370					
FTN-30	1 1/4"	.228	375	500	690	910	1200	1500	1680	1800	1900	2000					
FTN-30	1 1/2"	.390	1000	1300	1700	2300	3400	4600	5500	6000	6600	7000					
FTN-30	2"	.500	1300	1800	2500	3400	5200	6800	7800	8600	9300	10000					
FTN-75*	3/4"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
FTN-75*	1"	.166	160	213	280	365	520	700	795	875	930	970	1120	1230	1450		
FTN-75*	1 1/4"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
FTN-75*	1 1/2"	.312	550	725	960	1300	1900	2650	3050	3400	3700	4000	4400	4750	5400		
FTN-75*	2"	.421	850	1100	1500	2000	3100	4150	4750	5200	5500	5800	6400	6800	7700		
FTN-125*	3/4"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
FTN-125*	1"	.125	100	135	175	230	330	415	500	585	620	685	750	830	970	1110	1190
FTN-125*	1 1/4"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
FTN-125*	1 1/2"	.246	400	520	680	890	1300	1700	2050	2300	2500	2700	3000	3200	3800	4200	4500
FTN-125*	2"	.332	550	675	880	1225	1950	2600	3000	3250	3500	3800	4200	4600	5500	6100	6600

For Kg/Hr Multiply by .454 *For FTNA capacities, multiply by 1.33.



MAX-FLO

SUPER HIGH CAPACITY FLOAT & THERMOSTATIC STEAM TRAPS

Pressures to 175 PSIG (12.1 barg)
Temperatures to 377°F (192°C)

- **High Capacities**
- **Rugged cast iron body and cover**
- **Stainless steel thermostatic element eliminates air binding**
- **Stainless steel float and lever mechanism**
- **Below condensate level seat design prevents steam leakage**
- **Resistant to water hammer and corrosion**
- **In-Line repairable**

APPLICATIONS

- Very High Condensate Loads
- Continuous Drainage With High Air Venting Capacity Requirements
- Industrial And Commercial Applications
- Absorption Systems
- Air Handling Coils
- Heat Exchangers
- Dryers Evaporators
- Hot water Generators
- Rendering Machines
- Steam Process Equipment
- Air Make-up Coils
- Unit Heaters And Cooking Kettles

MODELS

- HC-15** - Steam pressures to 15 PSIG
- HC-30** - Steam pressures to 30 PSIG
- HC-75** - Steam pressures to 75 PSIG
- HC-125** - Steam pressures to 125 PSIG
- HC-175** - Steam pressures to 175 PSIG

Installation Tip: Always install STV Test & Block Valve as part of trap station
SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 102

OPERATION

During startup, air and non-condensable gases enter the trap and are automatically vented through an accurate balanced pressure internal thermostatic air vent. As condensate enters the trap, the float and lever mechanism is raised, lifting the valve off

the seat, discharging the condensate. Condensate will continue to be discharged at the same rate at which it is entering. Any air or non-condensable gas that may accumulate will be continually and efficiently passed by the thermostatic air vent.



FTE 10



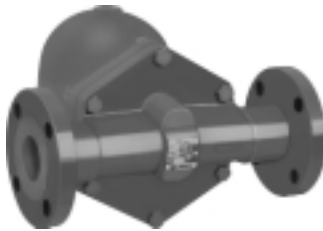
FTE 14



FTE 43



FTE 44



FTE 44F

APPLICATIONS

- Very High Condensate Loads
- Continuous Drainage With High Air Venting Capacity Requirements
- Industrial And Commercial Applications
- Absorption Systems
- Air Handling Coils
- Heat Exchangers
- Dryers Evaporators
- Hot water Generators
- Rendering Machines
- Steam Process Equipment
- Air Make-up Coils
- Unit Heaters And Cooking Kettles

OPTIONS

- BSPT Threaded connection
- S-SLR Orifice on FTE-10
- Socket Weld connection on FTE-44
- Flanged connections
 - ANSI 125/150, 300, 600
 - DIN 10, 16, 25 or 40
 - BS10 - F, H, J, K or R

OPERATION

During startup, air and non-condensable gases enter the trap and are automatically vented through an accurate balanced pressure internal thermostatic air vent. As condensate enters the trap, the float and lever mechanism is raised,

lifting the valve off the seat, discharging the condensate. Condensate will continue to be discharged at the same rate at which it is entering. Any air or non-condensable gas that may accumulate will be continually and efficiently passed by the thermostatic air vent.

FTE SERIES FLOAT & THERMOSTATIC STEAM TRAPS

**Pressures to 464 PSIG (32 barg)
Temperatures to 850°F (454°C)**

- High Capacities
- Rugged cast iron, ductile iron or cast steel body and cover
- Stainless steel thermostatic element eliminates air binding
- Stainless steel float and lever mechanism
- Below condensate level seat design prevents steam leakage
- Resistant to water hammer and corrosion
- In-Line repairable

MODELS

CAST IRON BODY

- **FTE-10** – To 200 PSIG Threaded Connections
- **FTE-43** – To 200 PSIG Flanged Connections

DUCTILE IRON BODY

- **FTE-14** – To 200 PSIG Threaded Connections

CAST STEEL BODY

- **FTE-44** – To 465 PSIG Threaded/Socket Weld Connections
- **FTE-44F** – To 465 PSIG Flanged Connections

Installation Tip: Always install STV Test & Block Valve as part of trap station
SEE PAGE 118

Installation Tip:
Add Uniflex Pipe Coupling for ease of maintenance on NPT Traps
SEE PAGE 102

FTE SERIES

FLOAT & THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of float and thermostatic design. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be of balanced pressure design with stainless steel welded encapsulated bellows capable of discharging air and noncondensable gases continuously. Trap shall be _____ bodied suitable for pressures to _____ PSI and shall be a _____ connection.

MAXIMUM OPERATING CONDITIONS

CAST IRON/DUCTILE IRON

PMO: Max. Operating Pressure see orifice selection

TMO: Max. Operating Temperature saturated at pressure

PMA: Max. Allowable Pressure 232 psig (16 barg)

PMA: Max. Allowable Pressure 450°F (232°C)

CAST STEEL

PMO: Max. Operating Pressure see orifice selection

TMO: Max. Operating Temperature saturated at pressure

PMA: Max. Allowable Pressure 465 psig (32 barg)

TMA: Max. Allowable Pressure 850°F (454°C)

MATERIALS OF CONSTRUCTION

Body & Cover Cast Iron (ASTM A48 Cl. 30)

.....Ductile Iron (DIN 1693 GGG 40)

.....Cast Steel (ASTM A216 Gr. WCB)

Valve Stainless Steel 304 (up to 1")

.....Stainless Steel 410 (1½", 2")

Valve Seat Stainless Steel 410

Housing & Housing Cover for Float Mechanism

.....ASTM A743 Gr. CA 40 (Investment Cast)

Float Stainless Steel 304

Lever Assembly Stainless Steel 304

Thermostatic Airvent Stainless Steel 304

Cover Bolts SAE Gr. 8

Connections:

1/2" – 2" NPT, Flanged or Socket Weld

Maximum Capacity—lbs/hr (10°F Below Saturation)

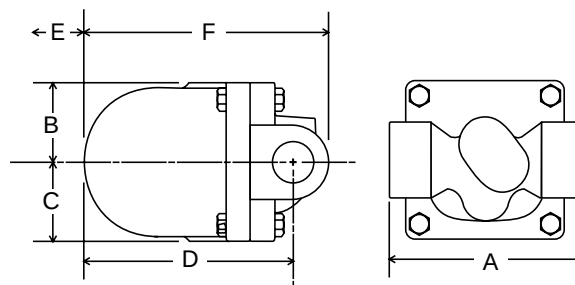
Trap	Size inlet	Orifice (in.)	Max ΔP		Differential Pressure-PSIG (barg)														
			BAR	PSI	5 (.345)	10 (.690)	20 (1.38)	40 (2.76)	50 (3.45)	65 (4.50)	80 (5.52)	100 (6.90)	125 (8.62)	145 (10.0)	180 (12.4)	200 (13.8)	300 20.7	400 27.6	465 32.1
FTE-10, 14, & 43	1/2 & 3/4	0.142	4.5	65	400	520	700	950	1000	1150									
		0.095	10.0	145	275	380	530	720	800	900	1000	1080	1250	1380					
		0.079	14.0	200	200	290	400	570	640	700	800	900	1020	1100	1240	1300			
FTE-10, 14, & 43	1	0.256	4.5	65	1650	2200	3050	4200	5000	5200									
		0.17	10.0	145	870	1250	1650	2350	2600	3000	3200	3500	3900	4100					
		0.142	14.0	200	640	800	1250	1600	1800	2000	2200	2550	2780	2900	3020	3100			
FTE-10 & 43	1½	0.689	4.5	65	4200	6000	8800	12500	13500	15000									
		0.571	10.0	145	2800	3900	5600	8000	9000	10000	11500	13000	14200	15000					
		0.531	14.0	200	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000			
FTE-10 & 43	2	1.063	4.5	65	13500	19800	28000	40000	45000	50500									
		0.811	10.0	145	7300	10000	14500	20000	22500	26000	29000	32000	35000	40000					
		0.657	14.0	200	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000			
FTE-44 & 44F	1/2 & 3/4	0.142	4.5	65	400	520	700	950	1000	1150									
		0.095	10.0	145	275	380	530	720	800	900	1000	1080	1250	1380					
		0.079	14.0	200	200	290	400	570	640	700	800	900	1020	1100	1240	1300			
		0.07	21.0	300	110	145	200	280	315	350	400	430	480	520	580	610	700		
		0.063	32.0	465	65	90	120	155	170	200	215	250	280	300	325	345	400	425	440
FTE-44 & 44F	1	0.256	4.5	65	1650	2200	3050	4200	5000	5200									
		0.17	10.0	145	870	1250	1650	2350	2600	3000	3200	3500	3900	4100					
		0.142	14.0	200	640	800	1250	1600	1800	2000	2200	2550	2780	2900	3020	3100			
		0.114	21.0	300	400	520	700	950	1000	1150	1600	1850	2020	2150	2350	2500	2800		
		0.095	32.0	465	275	380	530	720	800	900	1000	1080	1250	1380	1440	1500	1800	2000	2050
FTE-44 & 44F	1½	0.689	4.5	65	4200	6000	8800	12500	13500	15000									
		0.571	10.0	145	2800	3900	5600	8000	9000	10000	11500	13000	14200	15000					
		0.531	14.0	200	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000			
		0.531	21.0	300	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000	13000		
		0.531	32.0	465	1800	2600	3600	5000	5450	6000	6900	7800	8600	9000	9650	10000	13000	14300	15000
FTE-44 & 44F	2	1.063	4.5	65	13500	19800	28000	40000	45000	50500									
		0.811	10.0	145	7300	10000	14500	20000	22500	26000	29000	32000	35000	40000					
		0.657	14.0	200	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000			
		0.657	21.0	300	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000	27000		
		0.657	32.0	465	3500	5000	6800	9600	10500	12000	13500	15000	16500	17500	19000	20000	27000	29800	31000

For Kg/Hr Multiply by .454

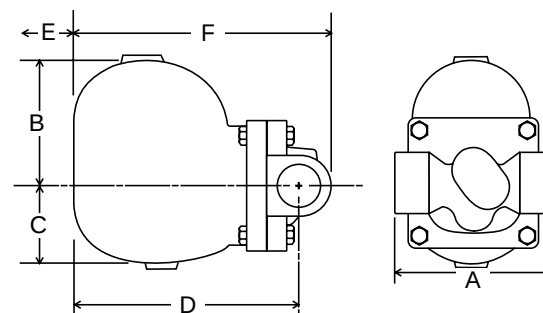
SERIES FTE DIMENSIONS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) SERIES FTE-10 & FTE 44

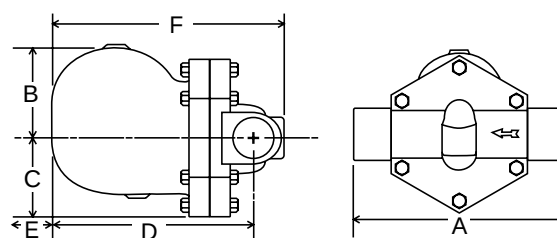
Size	Inches (mm)						Weight Lbs(kg)	
	A	B	C	D	E	F	FTE-10	FTE-44
1/2	5 $\frac{1}{16}$ (128)	2 $\frac{1}{8}$ (54)	2 $\frac{1}{8}$ (54)	5 $\frac{1}{16}$ (145)	4 $\frac{1}{16}$ (110)	6 $\frac{1}{16}$ (170)	10.5 (4.8)	11.4 (5.2)
3/4	5 $\frac{1}{16}$ (128)	2 $\frac{1}{8}$ (54)	2 $\frac{1}{8}$ (54)	5 $\frac{1}{16}$ (145)	4 $\frac{1}{16}$ (110)	6 $\frac{1}{16}$ (170)	10.5 (4.8)	11 (5.0)
1	5 $\frac{1}{16}$ (128)	4 $\frac{1}{16}$ (110)	2 $\frac{1}{16}$ (75)	7 $\frac{1}{2}$ (190)	6 $\frac{1}{16}$ (160)	8 $\frac{1}{2}$ (216)	18.7 (8.5)	17.6 (8.0)
1 $\frac{1}{2}$	11 $\frac{1}{16}$ (282)	5 (127)	4 $\frac{1}{16}$ (110)	10 (254)	7 $\frac{1}{8}$ (200)	11 $\frac{1}{16}$ (289)	49.5 (22.5)	48.4 (22.0)
2	12 $\frac{1}{8}$ (308)	5 $\frac{1}{2}$ (140)	5 (127)	10 $\frac{1}{4}$ (260)	7 $\frac{1}{8}$ (200)	11 $\frac{3}{16}$ (300)	61.6 (28.0)	59.4 (27.0)



FTE-10 CAST IRON & FTE-44 CAST STEEL 1/2" & 3/4"



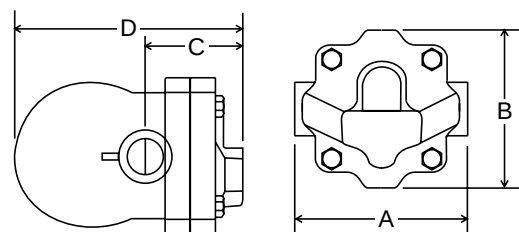
FTE-10 CAST IRON & FTE-44 CAST STEEL 1"



FTE-10 CAST IRON & FTE-44 CAST STEEL 1 $\frac{1}{2}$ " & 2"

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) SERIES FTE-14

Size	Inches (mm)				Weight lbs. (kg)
	A	B	C	D	
1/2	4 $\frac{3}{4}$ (121)	4 $\frac{1}{4}$ (108)	2 $\frac{5}{8}$ (67)	5 $\frac{13}{16}$ (148)	7.9 (3.6)
3/4	4 $\frac{3}{4}$ (121)	4 $\frac{1}{4}$ (108)	2 $\frac{5}{8}$ (67)	5 $\frac{13}{16}$ (148)	7.9 (3.6)
1	5 $\frac{1}{16}$ (145)	4 $\frac{1}{4}$ (108)	3 (76)	6 $\frac{1}{16}$ (167)	10.1 (4.6)

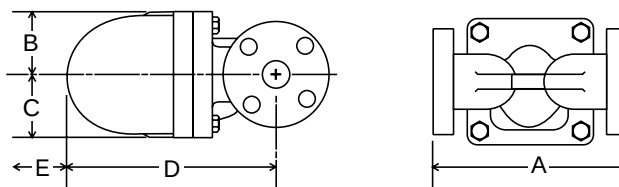


FTE-14-DUCTILE IRON 1/2", 3/4" & 1"

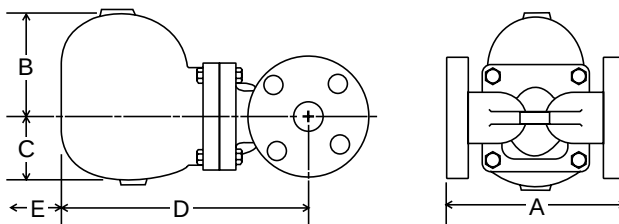
SERIES FTE DIMENSIONS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) SERIES FTE-43

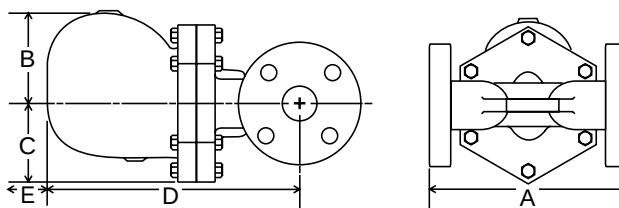
Size	Inches (mm)					Weight Lbs. (kg)
	A	B	C	D	E	
1/2	5 $\frac{5}{8}$ (150)	2 $\frac{3}{8}$ (54)	2 $\frac{3}{8}$ (54)	7 $\frac{1}{2}$ (190)	4 $\frac{5}{16}$ (110)	15.4 (7.0)
3/4	5 $\frac{5}{8}$ (150)	2 $\frac{3}{8}$ (54)	2 $\frac{3}{8}$ (54)	7 $\frac{7}{16}$ (192)	4 $\frac{5}{16}$ (110)	16.5 (7.5)
1	6 $\frac{5}{16}$ (160)	4 $\frac{5}{16}$ (110)	2 $\frac{15}{16}$ (75)	9 $\frac{9}{16}$ (245)	6 $\frac{5}{16}$ (160)	25.3 (11.5)
1 $\frac{1}{2}$	9 $\frac{5}{16}$ (230)	5 (127)	4 $\frac{5}{16}$ (110)	13 $\frac{3}{8}$ (333)	7 $\frac{7}{8}$ (200)	61.6 (28.0)
2	9 $\frac{5}{16}$ (230)	5 $\frac{1}{2}$ (140)	5 (127)	13 $\frac{3}{8}$ (343)	7 $\frac{7}{8}$ (200)	74.8 (34.0)



FTE-43 CAST IRON 1/2" & 3/4"

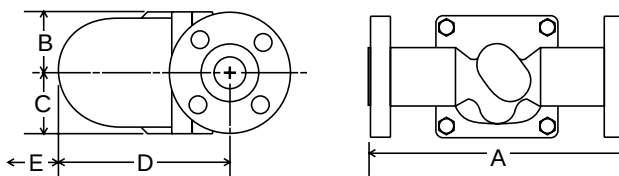


FTE-43 CAST IRON 1"

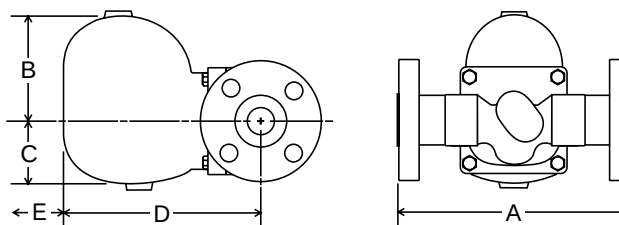
FTE-43 CAST IRON 1 $\frac{1}{2}$ " & 2"

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) SERIES FTE-44F

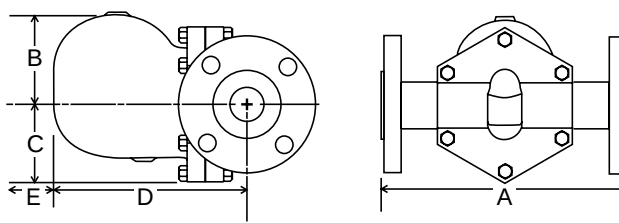
Size	Inches (mm)					Weight Lbs. (kg)
	A	B	C	D	E	
1/2	8 $\frac{3}{4}$ (210)	2 $\frac{3}{8}$ (54)	2 $\frac{3}{8}$ (54)	5 $\frac{5}{16}$ (141)	4 $\frac{5}{16}$ (110)	16.5 (7.5)
3/4	8 $\frac{3}{4}$ (210)	2 $\frac{3}{8}$ (54)	2 $\frac{3}{8}$ (54)	5 $\frac{5}{16}$ (141)	4 $\frac{5}{16}$ (110)	17.6 (8.0)
1	8 $\frac{3}{4}$ (210)	4 $\frac{5}{16}$ (110)	2 $\frac{15}{16}$ (75)	7 $\frac{1}{2}$ (190)	6 $\frac{5}{16}$ (160)	25.3 (11.5)
1 $\frac{1}{2}$	12 $\frac{13}{16}$ (325)	5 (127)	4 $\frac{5}{16}$ (110)	9 $\frac{9}{16}$ (245)	7 $\frac{7}{8}$ (200)	60.5 (27.5)
2	12 $\frac{13}{16}$ (325)	5 $\frac{1}{2}$ (140)	5 (127)	9 $\frac{9}{16}$ (251)	7 $\frac{7}{8}$ (200)	74.8 (34.0)



FTE-44F CAST STEEL 1/2" & 3/4"



FTE-44F CAST STEEL 1"

FTE-44F CAST STEEL 1 $\frac{1}{2}$ " & 2"



DURA-FLO INVERTED BUCKET STEAM TRAPS

**Pressures To 250 PSIG (17.2 barg)
Temperatures to 450°F (232°C)**

Hardened Stainless Steel Valve and Seat — Long life and maximum corrosion resistance.

Stainless Steel Bucket — Long lasting, rugged and naturally resistant to water hammer.

Inexpensive — Low maintenance and initial cost.

Repairable in-line — All working parts lift out of top of trap.

Cast Iron Body — Durable heavy wall construction provides years of reliable service.

Suitable for Wide Variety of Loads/Applications — Horizontal and vertical models in thirteen body sizes.

Resists Dirt and Scale — Valve and seats positioned at top of traps and internal stainless strainer available on most horizontal models ensure long service.

APPLICATIONS

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

OPTIONS See page 9

- Repair Kits

Canadian Registration # OE 0591.1C

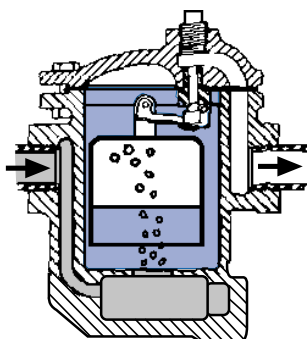
Installation Tip: Always install STV Test & Block Valve as part of trap station SEE PAGE 118

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance SEE PAGE 102

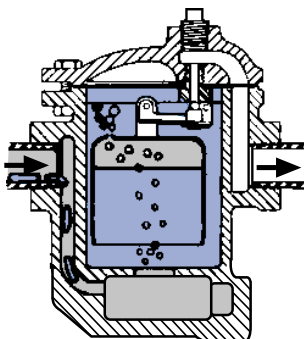
MODELS

- **80S**—Low capacity horizontal w/integral strainer
- **81S**—Medium low capacity horizontal w/integral strainer
- **82S**—Medium capacity horizontal w/integral strainer
- **83S**—Medium high capacity horizontal w/integral strainer
- **84**—High capacity horizontal
- **85**—Super high capacity horizontal
- **86**—Ultra high capacity horizontal
- **21**—Medium low capacity vertical
- **22**—Medium capacity vertical
- **23**—Medium high capacity vertical
- **24**—High capacity vertical
- **25**—Super high capacity vertical
- **26**—Ultra high capacity vertical

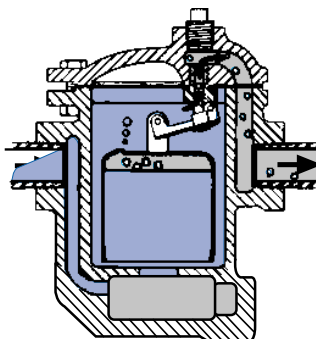
OPERATION



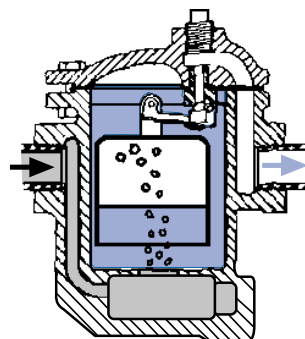
Trap Closed — After trap is installed and primed, steam entering the trap collects in the top of the bucket, floating the bucket and forcing the valve into its seat.



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.

DURA-FLO INVERTED BUCKET STEAM TRAPS

SPECIFICATION

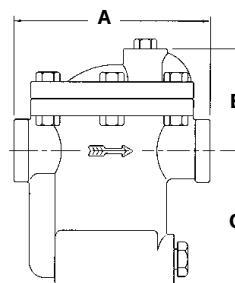
Furnish and install as shown on the plans, inverted bucket traps capable of discharging condensate, air and other non-condensable gases without loss of steam. These traps shall have a heavy cast iron body, hardened stainless steel valve and seat, all stainless steel linkage and bucket, and an asbestos free fiber cover gasket.

MAXIMUM OPERATING CONDITIONS

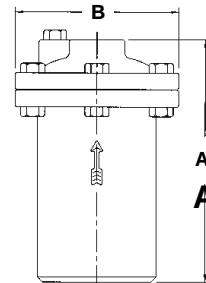
PMO: Max. Operating Pressure see orifice selection
TMO: Max. Operating Temperature saturated at pressure
PMA: Max. Allowable Pressure 250 psig (17.2 barg)
TMA: Max. Allowable Temperature 450°F (232°C)

MATERIALS OF CONSTRUCTION

Body & Cover Cast Iron ASTM-A-126/A48
Bucket & Linkage Stainless Steel
Valve & Seat Hardened Chrome Steel
Standpipe Steel Pipe
Cover Gasket Asbestos Free Fiber



**80 SERIES,
HORIZONTAL**



**20 SERIES,
VERTICAL**

Connections: ½" – 2½" NPT

DURA-FLO Dimension Table					
Trap	End Connections	Inches (mm)			Weight Lbs (kg)
		A	B	C	
80S	½, ¾	5½ ₁₆ (129)	2½ ₁₆ (69)	3½ ₁₆ (89)	7 (3.2)
81S	½, ¾, 1	5½ ₁₆ (129)	2½ ₁₆ (69)	4½ ₁₆ (113)	8 (3.6)
82S	½, ¾	7 (178)	3½ ₁₆ (98)	5½ ₁₆ (138)	22 (10.0)
83S	¾, 1	8½ ₁₆ (206)	5 (127)	7½ ₁₆ (194)	32 (14.5)
84	1, 1½	9 (229)	5½ ₁₆ (146)	7½ ₁₆ (199)	47 (21.3)
85	1½, 2	10½ ₁₆ (260)	8 (203)	8½ ₁₆ (213)	74 (33.6)
86	2, 2½	13 (330)	9½ ₁₆ (248)	11 (279)	140 (63.5)
21	½	6½ ₁₆ (162)	4¼ ₁₆ (108)	—	6.5 (2.9)
22	½, ¾	8 (203)	5½ ₁₆ (143)	—	16 (7.3)
23	¾, 1	10½ ₁₆ (267)	6½ ₁₆ (175)	—	28 (12.7)
24	1, 1½	12½ ₁₆ (318)	7½ ₁₆ (190)	—	35 (15.9)
25	1, 1½	14½ ₁₆ (365)	9½ ₁₆ (230)	—	60 (27.2)
26	1½, 2	16½ ₁₆ (424)	10½ ₁₆ (260)	—	90 (40.8)

DURA-FLO CAPACITY TABLES

Trap	Orifice		0.50	1	5	10	15	20	25	30	40	60	70	80	100	125	130	150	180	200	225	250
	Size	Max ΔP	(.034)	(.069)	(.345)	(.690)	(1.03)	(1.38)	(1.72)	(2.07)	(2.76)	(4.14)	(4.83)	(5.52)	(6.90)	(8.62)	(8.97)	(10.3)	(12.4)	(13.8)	(15.5)	(17.2)
80S	3/16	20	200	270	450	560	640	690														
	1/8	80	80	110	200	300	360	420	460	500	540	620	660	690								
	7/64	125	-	55	90	145	195	260	305	345	400	485	525	565	640	680						
	3/32	150	-	-	70	110	150	200	240	270	310	380	410	440	480	540	545	570				
81S & 21	1/4	15	300	450	830	950	1060															
	3/16	30	190	300	540	670	770	880	950	1000												
	5/32	70	100	165	180	430	495	585	655	710	770	900	950									
	1/8	125	70	130	220	340	390	460	515	560	610	710	760	800	860	950						
	7/64	200	-	65	150	230	275	335	375	405	455	545	580	610	665	735	780	810	850	860		
	3/32	250	-	-	100	150	190	240	270	290	340	420	450	470	520	575	585	620	670	700	730	760
82S & 22	5/16	15	570	850	1600	1900	2100															
	1/4	30	350	500	950	1380	1630	1800	1900	2050												
	3/16	70	250	420	785	950	1120	1260	1395	1500	1700	2000	2200									
	5/32	125	180	300	560	680	800	900	995	1070	1220	1440	1550	1650	1800	2000						
	1/8	200	100	180	325	465	505	575	650	710	805	980	1050	1105	1225	1375	1410	1500	1560	1600		
	7/64	250	75	130	240	340	370	420	480	520	590	720	770	810	900	1010	1020	1100	1170	1230	1280	1300
83S & 23	1/2	15	1410	1880	2900	3500	3900															
	3/8	30	990	1400	2300	2700	3300	3500	3800	4000												
	5/16	60	600	940	1730	2045	2510	2825	2995	3135	3800	4400										
	9/32	80	510	735	1350	1595	1960	2205	2340	2450	2880	3490	3800	4000								
	1/4	125	385	600	1100	1300	1600	1800	1910	2000	2350	2850	3100	3300	3600	3900						
	7/32	180	300	490	860	1165	1350	1595	1865	2085	2205	2510	2695	2820	3065	3185	3300	3500	3700			
	3/16	250	255	400	700	950	1100	1300	1520	1700	1800	2050	2200	2300	2500	2600	2700	2800	3020	3200	3400	3500
84 & 24	5/8	15	2160	2900	4800	5800	6500															
	1/2	30	1450	2250	3700	4750	5200	6000	6500	6800												
	3/8	60	1050	1750	2950	3550	4000	4700	5000	5400	5800	6800										
	11/32	80	800	1560	2500	2900	3200	3500	4000	4400	4850	5750	6000	6400								
	5/16	125	660	1200	1950	2450	2750	3100	3250	3500	4000	4800	5250	5600	6200	6700						
	9/32	180	550	950	1500	1900	2200	2350	2700	2900	3250	3800	4250	4500	4800	5500	5600	5700	6000			
85 & 25	1/4	250	350	580	1000	1250	1450	1800	2000	2200	2600	3150	3350	3500	3800	4300	4450	4700	5000	5300	5500	5700
	3/4	15	3100	4160	7600	9000	10000															
	9/16	30	1800	2900	5200	6400	7700	8500	9200	9800												
	7/16	60	1400	2200	3800	5000	6000	6600	7100	7600	8300	9500										
	3/8	100	1100	1700	3000	3600	4500	5200	5800	6100	7000	8500	9200	9700	10400							
	11/32	130	900	1500	2600	3200	3900	4500	5000	5400	6200	7500	8050	8500	9600	10900	11000					
	5/16	180	750	1200	2100	2600	3200	3700	4100	4500	5400	6600	7000	7257	8118	8979	9040.5	9500	10000			
	9/32	225	600	970	1700	2100	2600	2950	3300	3600	4500	5400	5700	5900	6600	7300	7350	7850	8400	9200	9800	
86 & 26	1/4	250	400	700	1200	1500	1900	2100	2400	2600	3200	3800	4000	4150	4600	5100	5150	5500	5950	6350	6650	7000
	1-1/16	15	6240	8400	14500	17300	19200															
	7/8	25	4100	5490	10000	12930	15620	18500	20000													
	3/4	40	2900	4500	8200	10600	12800	15000	16700	18000	20000											
	5/8	60	2100	3500	6900	8700	10600	12100	13300	14250	16300	19800										
	9/16	80	1900	3095	6000	7600	9300	10600	11700	12500	14300	17300	18300	19000								
	1/2	125	1600	2600	5000	6400	7800	8900	9800	10500	12000	14500	15400	16300	18000	20000						
	7/16	180	1400	2210	4180	5530	6640	7500	8490	9230	10450	12420	13300	14150	15750	17400	17900	18500	20000			
	3/8	250	1000	1800	3400	4500	5400	6100	6900	7500	8500	10100	10800	11500	12800	14200	14300	15600	16900	17500	18500	19000

For Kg/Hr Multiply by .454

DURA-FLO INVERTED BUCKET STEAM TRAPS PCA REPAIR KITS

Quick, easy and economical

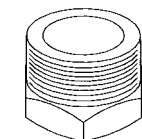
Simplifies and standardizes inventory

All stainless steel corrosion resistant internal parts

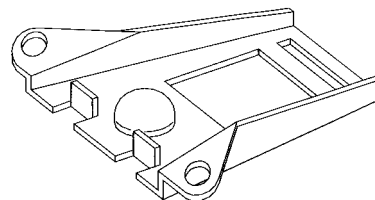
Hardened stainless steel condensate valves and seats
for extra long life

MODELS

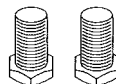
- **80S**—Orifice ratings 20, 80, 125, 150
- **81S & 21**—Orifice ratings 15, 30, 70, 125, 200, 250
- **82S & 22**—Orifice ratings 15, 30, 70, 125, 200, 250
- **83S & 23**—Orifice ratings 15, 30, 60, 80, 125, 180, 250
- **84 & 24**—Orifice ratings 15, 30, 60, 80, 125, 180, 250
- **85 & 25**—Orifice ratings 15, 30, 60, 100, 130, 180, 225, 250
- **86 & 26**—Orifice ratings 15, 25, 40, 60, 80, 125, 180, 250



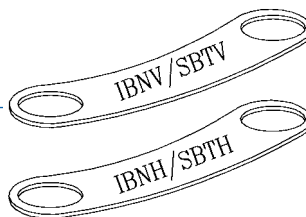
SEAT RING



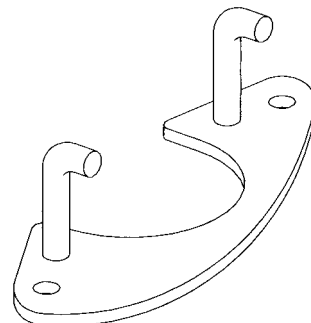
VALVE LINKAGE ASS'Y



CAP SCREWS
(2 req'd)



NAMEPLATES
(2 req'd)



PIVOT BRACKET

Supplied in a labeled, clear plastic bag.

FTN SERIES FLOAT & THERMOSTATIC STEAM TRAPS REPAIR KITS

High quality replacement kits

Rebuild existing F & T Traps far more economically than
replacement

Quick, easy and economical

Simplifies and standardizes inventory

All stainless steel corrosion resistant internal parts

Hardened stainless steel condensate valves and seats
for extra long life

Repairs other leading manufacturers' F & T Traps

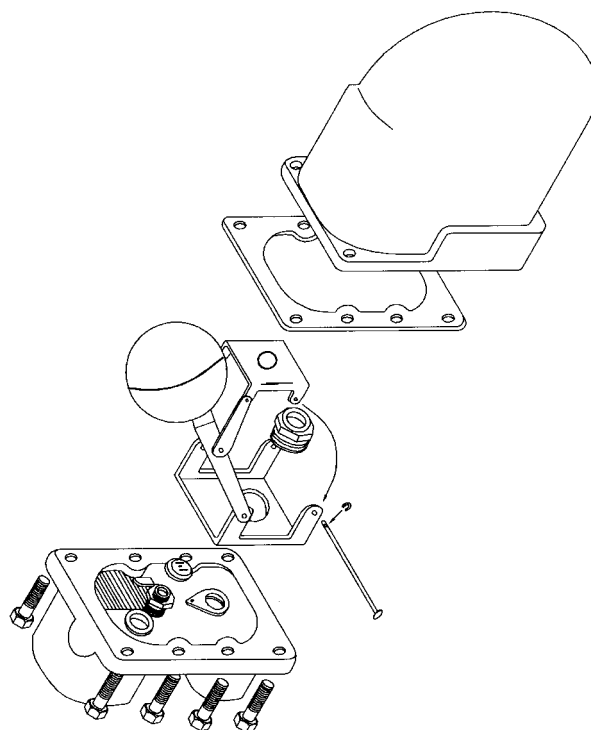
MODELS

- **FTN-15** available in ¾", 1", 1¼", 1½" and 2"
- **FTN-30** available in ¾", 1", 1¼", 1½" and 2"
- **FTN-75** available in ¾", 1", 1¼", 1½" and 2"
- **FTN-125** available in ¾", 1", 1¼", 1½" and 2"

All ¾" and 1" kits as well as 1¼" FTN-15 and FTN-30 kits
supplied with cover assembly.

All 1¼" FTN-75 and FTN-125 kits as well as all 1½" and 2"
kits supplied as mechanism complete.

See Capacity Charts on page 37



Consult factory for latest crossover fitments.



SEALED STAINLESS STEEL DURA-FLO INVERTED BUCKET STEAM TRAPS

Pressures to 650 PSIG (45 barg)
Temperatures to 497°F (258°C)

APPLICATIONS

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

Canadian Registration #: OE10389.52

For information on Big Block UMTVS-BB Connector
SEE PAGE 116

Easy Trap Replacement — Universal two bolt swivel mounting option simplifies removal from system.

Simple Installation — Stainless mounting Block mounts permanently into system. Trap installs via two bolt universal mount connection.

Hardened Chrome Steel Valve and Seat — Long life and maximum corrosion resistance.

Stainless Steel Bucket — Long lasting, rugged and naturally resistant to water hammer.

Inexpensive — Low maintenance and initial cost.

Stainless Steel Body — Durable heavy wall construction provides years of reliable service and resists corrosion and freezing.

Suitable for Wide Variety of Loads/Applications — Horizontal models in three body sizes.

Resists Dirt and Scale — Valve and seats positioned at top of traps ensure long service.

Maintenance Free (TSBT-S and USBT-S) — Sealed design prevents unnecessary tampering. Trap can be inspected and replaced without breaking pipe.

Freeze Resistant — Extruded SS Body helps prevent problems associated with freezing conditions.

MODELS

NPT CONNECTION

- **TSBT-LS** – Low Capacity, 200 PSIG
- **TSBT-MS** – Medium Capacity, 340 PSIG
- **TSBT-HS** – High Capacity, 650 PSIG

UMT CONNECTION

- **USBT-LS** – Low Capacity, 200 PSIG
- **USBT-MS** – Medium Capacity, 340 PSIG
- **USBT-HS** – High Capacity, 650 PSIG

UMT CONNECTOR BLOCKS

- **UMTC**—Standard connector (1/2" & 3/4" only)
- **UMTCY-RH**—Right Hand Connector with Y Strainer
- **UMTCY-LH**—Left Hand connector with Y Strainer
- **UMTVS-BB**—Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

OPERATION

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. 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. 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. As the flow of condensate stops, steam enters the trap and re-floats the bucket, forcing the valve into its seat. The cycle then repeats as more condensate reaches the trap.

SEALED STAINLESS STEEL DURA-FLO INVERTED BUCKET STEAM TRAPS

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 stainless steel sealed body, hardened chrome steel valve and seat and an all stainless steel linkage and bucket. It shall have a universal mount connector option.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure See Orifice Selection
TMO: Max. Operating Temperature Saturated at PMO

PMA: Max. Allowable Pressure -

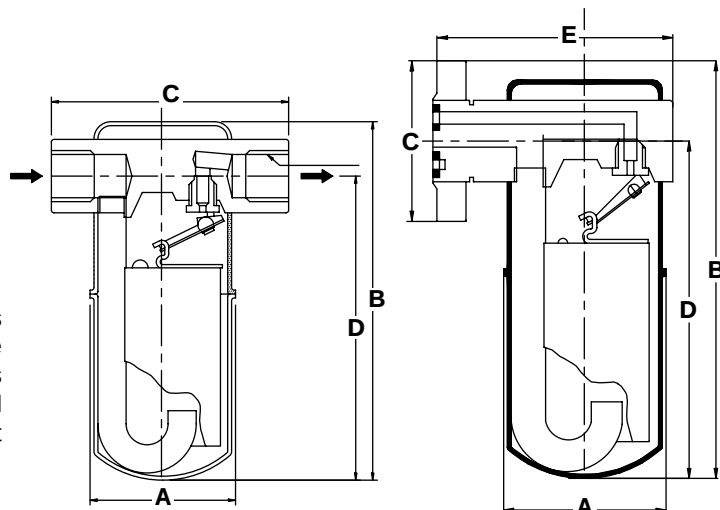
LS 200 psig (13.8 barg)	at	450°F (232°C)
MS 307 psig (21.2 barg)	at	450°F (232°C)
HS 650 psig (44.8 barg)	at	497°F (258°C)

TMA: Max. Allowable Temperature -

MS, LS & HS - 800°F (425°C)

MATERIALS OF CONSTRUCTION

Body	AISI 304 SS
Bucket	AISI 304 SS
Bucket Clip.....	AISI 304 SS
Lever	AISI 304 SS
Inlet Tube	AISI 304 SS
Valve.....	Hardened Chrome Steel AISI D3
Valve Seat	Hardened Chrome Steel AISI D3
Connector	AISI 304 SS



TSBT SEALED SERIES

USBT SEALED SERIES

Connections: 3/8" – 1" NPT

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Model	Inches (mm)				Weight lbs(kg)
	A	B	C	D	
TSBT-LS	2 3/4 (70)	5 1/16 (142)	4 3/16 (110)	4 3/16 (116)	2.25 (1)
TSBT-MS	2 3/4 (70)	6 1/16 (167)	4 3/16 (110)	5 1/16 (141)	2.5 (1.1)
TSBT-HS	3 3/8 (99)	8 1/16 (218)	5 (127)	7 3/8 (187)	7 (3.2)

Connections:

Universal Mount Two Bolt Swivel Connection

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Model	Inches (mm)					Weight lbs(kg)
	A	B	C	D	E	
USBT-LS	2 3/4 (70)	6 (152)	2 3/4 (70)	4 3/8 (117)	4 (101.6)	4.25 (2)
USBT-MS	2 3/4 (70)	7 3/8 (183)	2 3/4 (70)	5 3/8 (148)	4 (101.6)	4.75 (2.2)
USBT-HS	3 3/8 (99)	8 3/8 (222)	2 3/4 (70)	7 3/8 (187)	5 (127)	7 (3.2)

Maximum Capacity—(lbs/hr)

Trap	Orifice		Differential Pressure												
			5	10	15	30	40	70	80	125	200	250	300	400	650
	Size	MOP	(0.34)	(0.69)	(1.03)	(2.07)	(2.76)	(4.83)	(5.52)	(8.62)	(13.79)	(17.24)	(20.69)	(27.59)	(44.83)
SBT-LS & TSBT-LS	3/32	200	85	120	145	200	230	300	325	400	500				
USBT-MS & TSBT-MS	1/4	15	800	920	1040										
	3/16	30	540	690	800	1000									
	5/32	70	390	490	560	700	790	940							
	1/8	125	260	325	400	530	600	750	800	970					
	7/64	200	200	265	315	410	470	580	610	720	900				
	3/32	250	155	200	240	315	360	440	480	560	690	750			
	5/64	400	100	130	155	210	235	280	310	360	440	460	510	580*	
USBT-HS & TSBT-HS	1/4	40	1040	1350	1580	2000	2350								
	3/16	80	680	930	1120	1550	1775	2400	2300						
	1/8	250	320	42	510	700	790	1020	1090	1300	1650	1800			
	7/64	300	220	280	325	430	500	630	685	800	1000	1100	1200		
	3/32	650	175	225	270	370	400	510	540	650	800	870	930	1050	1300

For Kg/Hr Multiply by .454

* CRN not available



REPAIRABLE STAINLESS STEEL DURA-FLO INVERTED BUCKET STEAM TRAPS

Pressures to 650 PSIG (45 barg)
Temperatures to 497°F (258°C)

APPLICATIONS

- Steam Lines
- Process Equipment
- Steam Cookers
- Steam Heated Vats
- Pressing Machinery
- Unit Heaters
- Oil Preheaters
- Converters
- Coils
- Rotating Drum

Canadian Registration # OE10389.52

For information on Big Block UMTVS-BB Connector
SEE PAGE 116

Easy Trap Replacement — Universal two bolt swivel mounting option simplifies removal from system.

Simple Installation — Stainless mounting Block mounts permanently into system. Trap installs via two bolt universal mount connection.

Hardened Chrome Steel Valve and Seat — Long life and maximum corrosion resistance.

Stainless Steel Bucket — Long lasting, rugged and naturally resistant to water hammer.

Inexpensive — Low maintenance and initial cost.

Stainless Steel Body — Durable heavy wall construction provides years of reliable service and resists corrosion and freezing.

Suitable for Wide Variety of Loads/Applications — Horizontal models in three body sizes.

Resists Dirt and Scale — Valve and seats positioned at top of traps ensure long service.

Repairable Model (TSBT- R & USBT- R) — Removable cover allows pressure change or repair with existing Dura-Flo PCA kits.

MODELS

NPT CONNECTION, REPAIRABLE

- **TSBT-LR** – Low Capacity, 200 PSIG
- **TSBT-MR** – Medium Capacity, 400 PSIG
- **TSBT-HR** – High Capacity, 650 PSIG

UMT CONNECTION, REPAIRABLE

- **USBT-LR** – Low Capacity, 200 PSIG
- **USBT-MR** – Medium Capacity, 400 PSIG
- **USBT-HR** – High Capacity, 650 PSIG

UMT CONNECTOR BLOCKS

- **UMTC**—Standard connector (1/2" & 3/4" only)
- **UMTCY-RH**—Right Hand Connector w/Y strainer*
- **UMTCY-LH**—Left Hand Connector w/Y strainer*
- **UMTVS-BB**—Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

OPERATION

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. 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. 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. As the flow of condensate stops, steam enters the trap and re-floats the bucket, forcing the valve into its seat. The cycle then repeats as more condensate reaches the trap.

REPAIRABLE STAINLESS STEEL DURA-FLO INVERTED BUCKET STEAM TRAPS

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 stainless steel sealed body, hardened chrome steel valve and seat and an all stainless steel linkage and bucket. It shall also have a universal mount connection option. The repairable traps shall have a removable cover to allow repair or orifice change.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure See Orifice Selection
TMO: Max. Operating Temperature Saturated at PMO

PMA: Max. Allowable Pressure -

LR 200 psig (13.8 barg) at 450°F (232°C)

MR 420 psig (29.0 barg) at 450°F (232°C)

HR 650 psig (44.8 barg) at 497°F (258°C)

TMA: Max. Allowable Temperature 800°F (425°C)

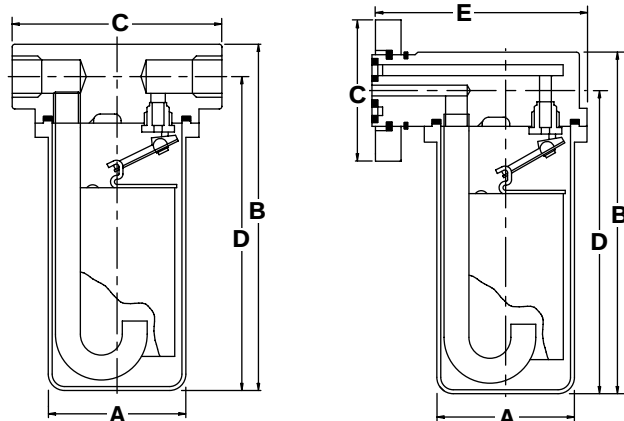
MATERIALS OF CONSTRUCTION

Body ASTM A351 CF8
Cover ASTM A351 CF8
Bucket.....AISI 304 SS
Bucket Clip.....AISI 304 SS
Lever AISI 304 SS
Inlet Tube AISI 304 SS
Valve Hardened Chrome Steel AISI D3
Valve Seat Hardened Chrome Steel AISI D3
Swivel Connector AISI 304 SS
Cover Gasket Spiral Wound 304 SS with Grafoil

Maximum Capacity—(lbs/hr)

Trap	Orifice		Differential Pressure												
			5	10	15	30	40	70	80	125	200	250	300	400	650
	Size	MOP	(0.34)	(0.69)	(1.03)	(2.07)	(2.76)	(4.83)	(5.52)	(8.62)	(13.79)	(17.24)	(20.69)	(27.59)	(44.83)
TSBT-LR, USBT-LR	3/32	200	85	120	145	200	230	300	325	400	500				
TSBT-MR, USBT-MR	1/4	15	800	920	1040										
	3/16	30	540	690	800	1000									
	5/32	70	390	490	560	700	790	940							
	1/8	125	260	325	400	530	600	750	800	970					
	7/64	200	200	265	315	410	470	580	610	720	900				
	3/32	250	155	200	240	315	360	440	480	560	690	750			
TSBT - HR USBT-HR	5/64	400	100	130	155	210	235	280	310	360	440	460	510	580	
	1/4	40	1040	1350	1580	2000	2350								
	3/16	80	680	930	1120	1550	1775	2400	2300						
	1/8	250	320	42	510	700	790	1020	1090	1300	1650	1800			
	7/64	300	220	280	325	430	500	630	685	800	1000	1100	1200		
	3/32	650	175	225	270	370	400	510	540	650	800	870	930	1050	1300

For Kg/Hr Multiply by .454



TSBT REPAIRABLE SERIES

USBT REPAIRABLE SERIES

Connections: 3/8" – 1" NPT

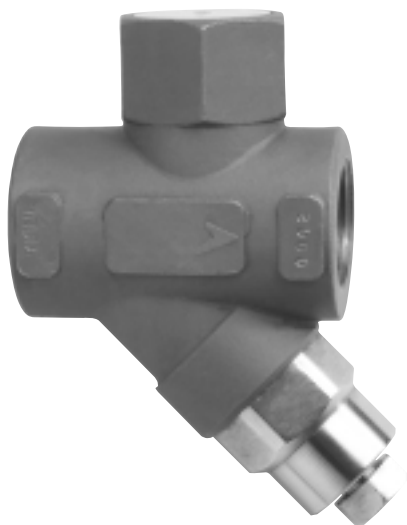
DIMENSIONS inches (mm)
AND WEIGHTS pounds (kg)

Model	Inches (mm)				Weight lbs(kg)
	A	B	C	D	
TSBT-LR	2 1/8 (73)	6 1/4 (159)	4 1/16 (110)	5 1/16 (141)	6.6 (3.0)
TSBT-MR	2 1/8 (73)	7 1/4 (184)	4 1/16 (110)	6 1/16 (166)	7.2 (3.2)
TSBT-HR	4 1/8 (104.8)	9 1/2 (241.3)	5 (127)	8 1/2 (215.9)	22 (10)

Connections:
Universal Mount Two Bolt Swivel Connection

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

Model	Inches (mm)					Weight lbs(kg)
	A	B	C	D	E	
USBT-LR	2 1/8 (73)	6 1/8 (161)	2 3/4 (70)	5 1/8 (143)	4 1/4 (108)	7.25 (3.3)
USBT-MR	2 1/8 (73)	7 1/8 (186)	2 3/4 (70)	6 1/8 (168)	4 1/4 (108)	8 (3.6)
USBT-HR	4 1/8 (104.8)	9 3/4 (247.7)	2 3/4 (70)	8 1/4 (222.3)	6 1/4 (158.8)	25 (11.33)



NTD600 SERIES THERMODYNAMIC STEAM TRAPS

Pressures To 600 PSIG (41.3 barg)
Temperatures to 800°F (426°C)

Compact Design — Hardened stainless steel disc is the only moving part.

Inexpensive — Low initial cost is less expensive than repairable technologies.

Simplifies Installation — Works in any position.

Rugged — Handles water hammer and superheat.

Reliable, Efficient Operation — Blast discharge helps to eliminate dirt buildup and provides tight shutoff

Freeze resistant — Self draining design prevents freezing.

All Stainless Steel Construction — Resists both internal and external corrosion.

Easy to Monitor — Audible discharge cycle makes checking operation simple.

MODELS

- **NTD600**—Thermodynamic Disc Trap
- **NTD600S**—NTD600 with integral strainer
- **NTD600B**—NTD600S with blowdown valve

APPLICATIONS

- Steam Tracing
- Drips
- Heating

NTD600 Model Only:
Canadian Registration # OE0591.9C

Installation Tip: Always install STV Test & Block Valve as part of trap station
SEE PAGE 354

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 374

OPERATION

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.

NTD600 SERIES

THERMODYNAMIC STEAM TRAPS

SPECIFICATION

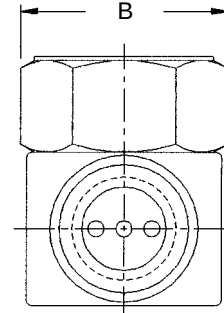
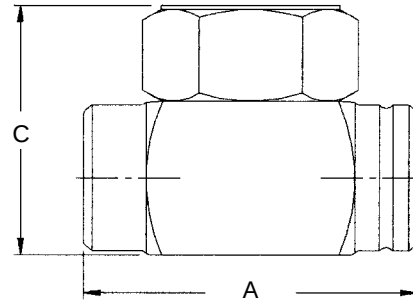
Steam trap shall be of thermodynamic design. Body shall be of all stainless construction and hardened throughout. Seat shall be integral to body. Cover shall seal to body without gaskets or seals. Trap shall be suitable for pressures through 600 psi and available in 3/8" through 1".

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure	600 psig	(41.3 barg)
TMO: Max. Operating Temperature	800°F	(426°C)
PMA: Max. Allowable Pressure	600 psig	(41.3 barg)
TMA: Max. Allowable Temperature	800°F	(426°F)

MATERIALS OF CONSTRUCTION

Body	420F SS ASTM A743 CA40F
Cap & Disc	416 SS ASTM A582
Blow Down Valve	304/316SS
Screen	Stainless Steel



Connections: 3/8" – 1" NPT

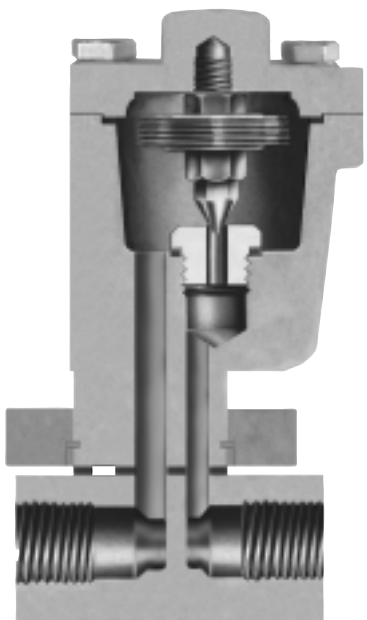
Dimensions in inches (mm)				Weight in Lbs. (kg)
Size	A	B	C	
3/8"	2 (51)	1 3/4 (44)	1 3/4 (44)	.8 (.36)
1/2"	2 11/16 (68)	1 3/4 (44)	2 (51)	1.2 (.55)
3/4"	2 13/16 (71)	2 5/16 (59)	2 7/16 (62)	1.85 (.86)
1"	3 5/16 (84)	2 1/2 (64)	2 7/8 (73)	3.1 (1.8)

Maximum Capacity—lbs/hr 10°F Below Saturation														
NPT Connection	Differential PSIG (barg)													
	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

NOTE: The NTD600 Series works efficiently at all line pressures between 5+600 psi and back pressures up to 80% of line pressures.

NTD600 SERIES
THERMO-ACTIVE TRAP



UMT SERIES TRAP AND UMTC CONNECTOR

APPLICATIONS

- Unit Heaters
- Steam Tracing
- Drip Legs
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Plating Tanks
- Platen Presses
- Air Vents

OPTIONS

- SLR - SLR Orifice*
- ISO - ISO Filled Actuator*
- SW - Socketweld
- B - Blowdown Valve

*Not available on UMT451T

Canadian Registration # OE1388.6C

For information on Big Block UMTVS-BB Connector
See Page 344

OPERATING PRINCIPLE

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator,

LIQUIDATOR 450 SERIES UNIVERSAL MOUNT THERMOSTATIC STEAM TRAPS

Pressures to 450 PSIG (31 barg)
Temperatures to 600°F (316°C)

Easily Maintained — Universal two bolt swivel mounting simplifies removal from system. Kits allow flexibility to replace or rebuild.

Simple Installation — Stainless mounting block mounts permanently into system. Trap installs via two bolt universal connection.

Improved Energy Savings — High efficiency—maximum elimination of air and non-condensibles.

Temperature Sensitive Actuators — One moving part. Stainless Steel, fail open, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Hardened Stainless Steel Valve and Seat — Long life. Lapped as a matched set for water tight seal.

Easily Maintained — Can be inspected and serviced without breaking pipe connections.

Freeze Proof — Self draining when installed vertically.

For Superheated Steam Applications — Because the trap closes at saturated steam temperature, superheated steam cannot reach trap.

Air Vent — Efficient steam service air vent when equipped with ISO filled Actuator and installed in air vent location.

Guaranteed — Traps are guaranteed against defects in materials or workmanship for three years.

Positive Shutoff and Long Life — Integral Stainless Steel Strainer helps prevent debris depositing on valve and seat.

MODELS

- **UMT-TD10L**—Low Capacity Trap
- **UMT-TD10**—Standard Capacity Trap
- **UMTC**—Standard connector (1/2" & 3/4" only)
- **UMTCY-RH**—Right Hand Connector w/Y strainer*
- **UMTCY-LH**—Left Hand Connector w/Y strainer*
- **UMTVS-BB**—Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

For complete unit, order trap and connector as separate items.

*Add (-B) for Blowdown Valve.

lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load. Restricted orifice in UMT451T (small opening at bottom of valve seat) prevents trap from discharging continuously on light loads such as are encountered on tracer lines.

LIQUIDATOR 450 SERIES

UNIVERSAL MOUNT THERMOSTATIC STEAM TRAPS

SPECIFICATIONS

Steam trap shall be of balanced pressure design with stainless steel welded actuator capable of discharging condensate within 10°F of saturated temperature. Where greater sensitivity is required, SLR orifice and Sterilizer trim will be available to allow condensate evacuation at or near saturated temperatures. Where subcooling of condensate is desired alternate thermostatic actuator will be available to allow condensate evacuation at or near 40°F below saturated temperatures. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. A minimum of two orifice sizes shall be available allowing for custom capacity sizing. Trap shall be stainless steel bodied suitable for pressures through 450 psig. Trap connection shall be two bolt universal swivel mount. Mounting block shall be stainless steel and available in 1/2" through 1" NPT or socket weld.

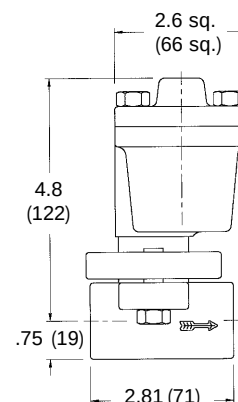
MAXIMUM OPERATING CONDITIONS

Traps with Welded Stainless Actuator			
PMO: Max. Operating Pressure	450 psig	(31 barg)	
TMO: Max. Operating Temperature	600°F	(316°C)	
Traps with Welded Stainless Actuator, ISO			
PMO: Max. Operating Pressure	450 psig	(31 barg)	
TMO: Max. Operating Temperature	600°F	(316°C)	
All Traps			
PMA: Max. Allowable Pressure	450 psig	(31 barg)	
TMA: Max. Allowable Temperature	750°F	(399°C)	

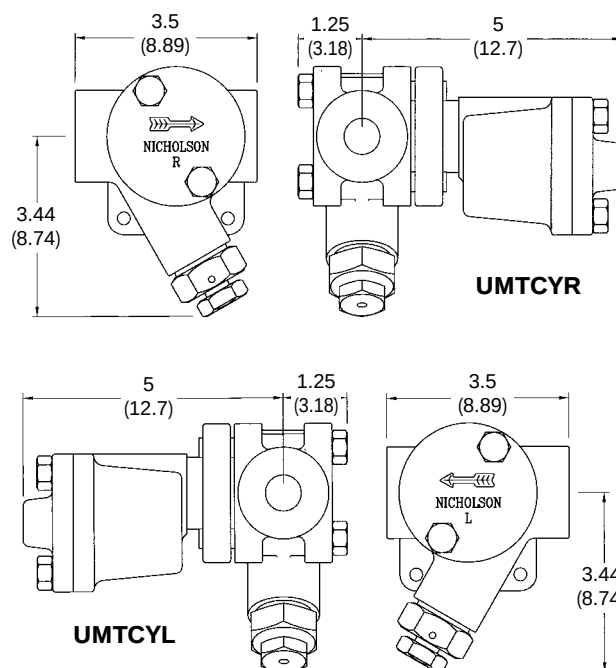
MATERIALS OF CONSTRUCTION

Body & Cover	ASTM A351 Grade CF8 (304)
Cover Gasket	.304 stainless spiral wound w/graphite fill
Actuator	Welded SS
Strainer	.033 perf. 304 Stainless Steel
Valve & Seat	Hardened 416 Stainless Steel
Mounting Block	ASTM A351 Grade CF8 (304)

UMT SERIES TRAP AND UMTC CONNECTOR



Connections:
1/2", 3/4" or 1" NPT or socketweld



DIMENSIONS - INCHES (MM)

WEIGHT

TRAP - 3.2 LBS. (1.4 KG)

STD. MOUNTING BLOCK - 1.1 LBS. (0.5 KG)

Y STRAINER MOUNTING BLOCK - 2.3 LBS. (1.0 KG)

Maximum Capacity—lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)														
Trap	Orifice Inch (mm)	Differential PSIG (barg)												
		5 (0.34)	10 (0.7)	20 (1.4)	50 (3.4)	100 (6.7)	125 (8.4)	150 (10.1)	200 (13.4)	250 (16.8)	300† (20.1)	350 (24.1)	400 (27.6)	450 (31.0)
UMT451T	5/64 (2)	84 (38)	119 (54)	168 (76)	265 (120)	348 (158)	375 (170)	398 (181)	439 (199)	472 (214)	502 (228)	529 (240)	553 (251)	575 (261)
UMT452T	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (381)	890 (405)	980 (445)	1055 (480)	1121 (510)	1180 (536)	1235 (561)	1284 (584)
UMT453T	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)	3425 (1554)	3650 (1656)	3960 (1796)	4100 (1860)	4230 (1919)	4420 (2005)	4600 (2086)

ISO filled Actuator recommended for superheated steam.



UMT-TD SERIES TRAP AND UMTC CONNECTOR

APPLICATIONS

- Steam Tracing
- Drips
- Light Process

OPTIONS

- SW - Socketweld Connections
- B - Blowdown Valve

For information on Big Block UMTVS-BB Connector
See Page 344

Celtron®
plastic-packed
replaceable cartridge
for fast and simple
replacement



OPERATION

Incoming air and condensate flow through the trap body and into the Celtron® cartridge. 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

LIQUIDATOR UMT-TD

UNIVERSAL MOUNT THERMODYNAMIC STEAM TRAPS

Pressures To 450 PSIG (31 barg)

Temperatures to 750°F (400°C)

Easily Maintained — Universal two bolt swivel mounting simplifies removal from system. Kits allow flexibility to replace or rebuild.

Simple Installation — Stainless mounting block mounts permanently into system. Trap installs via two bolt universal connection.

Improved Energy Savings — Lowers steam waste due to steam jacketing. Trap cycle is unaffected by ambient temperatures or precipitation.

Extended Trap Life — Integral strainer keeps disc and seat clean. Non-violent discharge reduces wear. Heavy disc prevents warpage and improves performance.

Easily Maintained — Completely renewable without disturbing piping connections by removing cover, unscrewing and replacing Celtron® cartridge. Celtron® replacement cartridges are packaged individually with cover and gaskets in a protective bag.

Freeze Proof — When mounted vertically or on its side horizontally.

Multi-functional — Integral check valve eliminates need for additional fittings.

Economical — First cost and maintenance cost are low.

MODELS

- **UMT-TD10L**—Low Capacity Trap
- **UMT-TD10**—Standard Capacity Trap
- **UMTC**—Standard connector (1/2" & 3/4" only)
- **UMTCY**—Connector w/Y strainer
- **UMTCYR**—Right Hand Connector w/Y strainer
- **UMTCYL**—Left Hand Connector w/Y strainer
- **UMTVS-BB**—Connector with Isolation Valves, Strainer, Blowdown Valve and Test Port

For complete unit, order trap and connector as separate items.

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 steam in the jacket prevents exposure of the Celtron® cartridge to ambient temperatures. Pressure inside the cap is not lowered until the trapped flash vapor condenses. Condensing steam lowers the pressure above the disc. Disc is then lifted and the cycle repeated.

LIQUIDATOR UMT-TD

UNIVERSAL MOUNT

THERMODYNAMIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of a thermodynamic capsule design. The body shall be of a 304 stainless steel 2 bolt universal swivel construction with a stainless steel in line renewable Celtron capsule. Celtron capsule shall contain all working components. Capsule shall be hardened throughout. Seat shall be stress relieved to eliminate warping. Trap shall seal to body with spiral wound graphite gaskets. Trap shall be suitable for pressures through 450 psi and available in 1/2" through 1" NPT or socketweld connections.

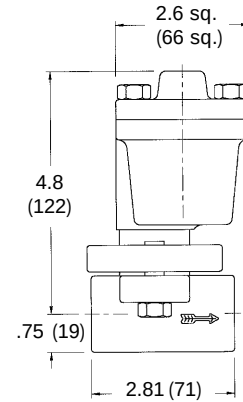
MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure	450 psig	(31 barg)
TMO: Max. Operating Temperature	750°F	(400°C)
PMA: Max. Allowable Pressure	450 psig	(31 barg)
TMA: Max. Allowable Temperature	750°F	(400°C)

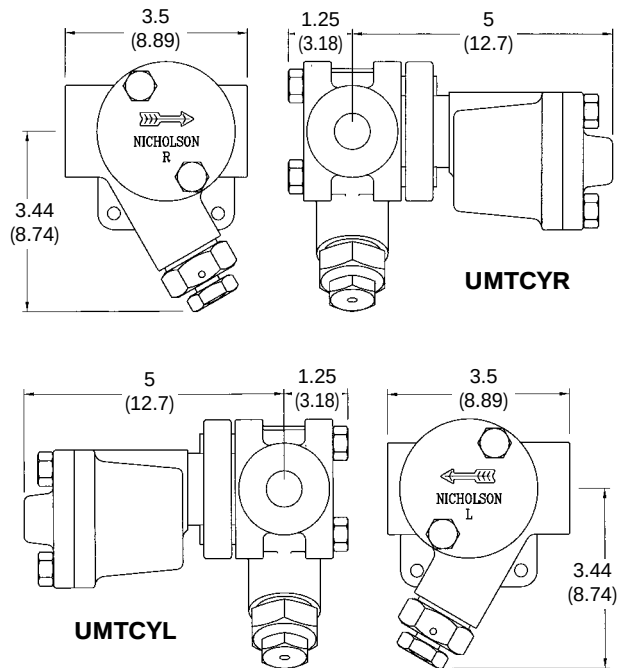
MATERIALS OF CONSTRUCTION

Body & Cover:	ASTM A351 Grade CF8 (304)
Cover Gasket:	.304 stainless spiral wound w/graphite fill
Celtron® Cartridge:	.416 Stainless Steel w/hardened disc & seat
Strainer:	.033 perf. 304 Stainless Steel
Mounting Block:	ASTM A351 Grade CF8 (304)

**UMT-TD
SERIES TRAP
AND UMT-C
CONNECTOR**



Connections:
1/2", 3/4" or 1" NPT or socketweld



DIMENSIONS - INCHES (MM)

WEIGHT

TRAP - 3.2 LBS. (1.4 KG)

STD. MOUNTING BLOCK - 1.1 LBS. (0.5 KG)

Y STRAINER MOUNTING BLOCK - 2.3 LBS. (1.0 KG)

Maximum Capacity—lbs/hr 10°F Below Saturation										
Trap	Differential - PSIG (barg)									
	5 (0.34)	10 (0.7)	25 (1.7)	50 (3.4)	75 (5.2)	100 (6.9)	200 (13.8)	300 (20.7)	400 (27.6)	450 (31)
UMT-TD10L	105	150	235	330	395	435	550	630	690	715
UMT-TD10	240	265	420	590	700	770	980	1120	1240	1280

For Kg/Hr Multiply by .454

The UMT-TD Series trap works efficiently at all line pressures between 5 and 450 psi and back pressures to 80% of line pressure.



DS200 SERIES THERMOSTATIC STEAM TRAPS

Pressures To 100 PSIG (6.9 barg)
Temperatures to 338°F (170°C)

Stainless Steel Body—Body materials are Type 316L Stainless Steel.

Self Centering Valve—Leak tight shut off. Assembly of actuator and valve to impingement plate allows valve to self-align with center of valve seat orifice. Provides long lasting valve and seat.

Temperature Sensitive Actuator—One moving part. Inconel welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Thermal and Hydraulic Shock Resistant—Impingement plate plus welded construction prevents damage to actuator.

Valve and Seat—Long life, stainless steel valve and seat lapped and matched together for water tight seal.

Maintenance—All models are sealed and maintenance free.

Three Year Guarantee—Trap guaranteed for three years against defects in material or workmanship.

Additional Features—Best air handling capability for fast start up and operation. Fastest response to condensate load or temperature changes. Broad application range. Selection of orifice and pipe sizes meet majority of condensate removal demands in deionized steam systems.

Unique SLR Orifice Option—Provides drainage at saturated temperatures, instant reaction to load changes and guaranteed fail-open operation for extra critical operations.

APPLICATIONS

- Drainage of Steam Filters and Separators
- Culinary Steam
- WFI System Sterilization
- Main Drips
- Sterilizer Drainage and Air Venting

OPTIONS

- SLR - SLR Orifice

Canadian Registration # OE0591.9C

MODELS

- **DS202**—Low capacity
- **DS203**—Medium capacity
- **DS204**—High capacity

OPERATION

Thermal actuator is filled at its free length with a liquid having a lower boiling point than water. On start-up, valve is normally open to discharge air, non-condensibles and condensate. When steam enters trap, thermal actuator fill vaporizes to a pressure higher than line pressure. This forces valve into

seat orifice to prevent any further flow. As condensate collects, it takes heat from thermal actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge condensate. Valve opening automatically adjusts to load conditions from minimum on very light loads to full lift at maximum load.

DS200 SERIES THERMOSTATIC STEAM TRAPS

SPECIFICATION

Steam trap shall be of balanced pressure design with inconel welded bellows capable of releasing condensate within 10°F of saturated pressure. Where drainage at saturated temperatures is required, trap shall have SLR orifice. All other components shall be of 316 or 316L stainless steel. Trap shall be self draining and normally open.

MAXIMUM OPERATING CONDITIONS

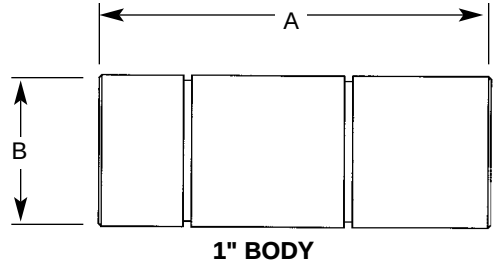
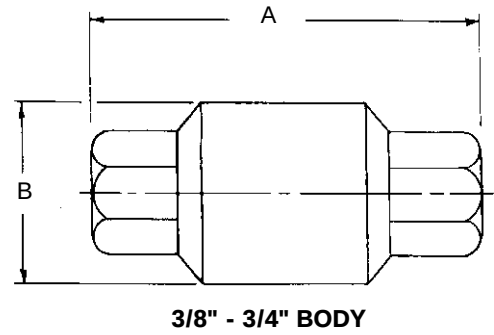
PMO: Max. Operating Pressure	100 psig	(6.9 barg)
TMO: Max. Operating Temperature	338°F	(170°C)
PMA: Max. Allowable Pressure	150 psig	(10.3 barg)
TMA: Max. Allowable Temperature	366°F	(186°C)

MATERIALS OF CONSTRUCTION

Body	ASTM 743 CF-8M Stainless Steel
Welded Actuator	316L Fittings & Plates
Valve & Seat	316L Stainless Steel

SLR ORIFICE OPTION

Specify when immediate elimination of condensate and improved sensitivity is desired. A 1/32" orifice at the apex of the valve allows for continuous discharge of condensate. Trap will nominally pass 50 lbs/hr of condensate at 50 psi within 2°F of saturated temperature.



Connections:
3/8" – 1" NPT or Socketweld

Dimensions			
NPT or Socket weld	inches (mm)		Weight Lbs. (kg)
	A	B	
3/8", 1/2"	3 3/4 (95)	1 3/4 (44)	1.1 (0.5)
3/4"	3 15/16 (100)	1 3/4 (44)	1.2 (0.54)
1"	4 3/8 (111)	1 3/4 (44)	1.6 (0.73)

Maximum Capacity—lbs/hr 10°F Below Saturation (Kg/hr 5°C Below Saturation)															
Trap	Orifice Inch (mm)	Differential PSIG (bar)													
		5 (0.34)	10 (0.7)	20 (1.4)	50 (3.5)	100 (6.9)	125 (8.6)	150 (10.3)	200 (13.8)	250 (17.2)	300 (20.7)	350 (24.1)	400 (27.6)	450 (31.0)	500 (34.5)
DS202	1/8 (3)	216 (98)	265 (120)	375 (170)	592 (269)	778 (354)	838 (381)	890 (405)	980 (445)	1055 (480)	1121 (510)	1180 (536)	1235 (561)	1284 (584)	1323 (601)
DS203	1/4 (6)	550 (249)	825 (374)	1210 (549)	1975 (896)	2825 (1281)	3140 (1424)	3425 (1554)	3650 (1656)	3960 (1796)	4100 (1860)	4230 (1919)	4420 (2005)	4600 (2086)	4760 (2161)
DS204	5/16 (8)	860 (390)	1220 (554)	1725 (783)	2725 (1237)	3575 (1623)	3850 (1748)	4090 (1857)	4505 (2045)	4850 (2202)	5155 (2340)	5425 (2463)	5675 (2576)	5900 (2679)	6110 (2774)

Applications

- Unit Heaters
- Steam Tracing
- Drip Legs
- Heating
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Plating Tanks
- Patent Presses
- Refinery
- Process

Big Block UMT Valve Station

Pressures to 1440 PSIG
Temperatures to 750°F

Zerk Cap Nut

standard grease fitting for lubrication and flushing of contaminants through one-way external seals

Snap Ring

prevents accidental removal and/or overtorque in an open position

Slip Clutch

prevents overtorque in the closed position

Packing Nut

can be tightened to prevent leaks

Adjustable Grafoil Packing

simultaneously seals stem and valve body

Blowout Proof Lower Assembly

remains intact if upper assembly is damaged

Hardened 440 Stainless Steel Ball Tip

floats for tight seal and proper alignment

Minimum 1/4" Ports Throughout

assures high flow capacity

Inner and Outer Stems

isolate rotation from packing, reducing wear

One-Way Teflon® Seals

allow lubrication and cleaning of all components while protecting from contaminants

Test Port

provides visual indication of trap function and backflow

Faceplate

illustrates operation and flow direction

Connections

available in 1/2" and 3/4" NPT or Socketweld

Ventilation Fins

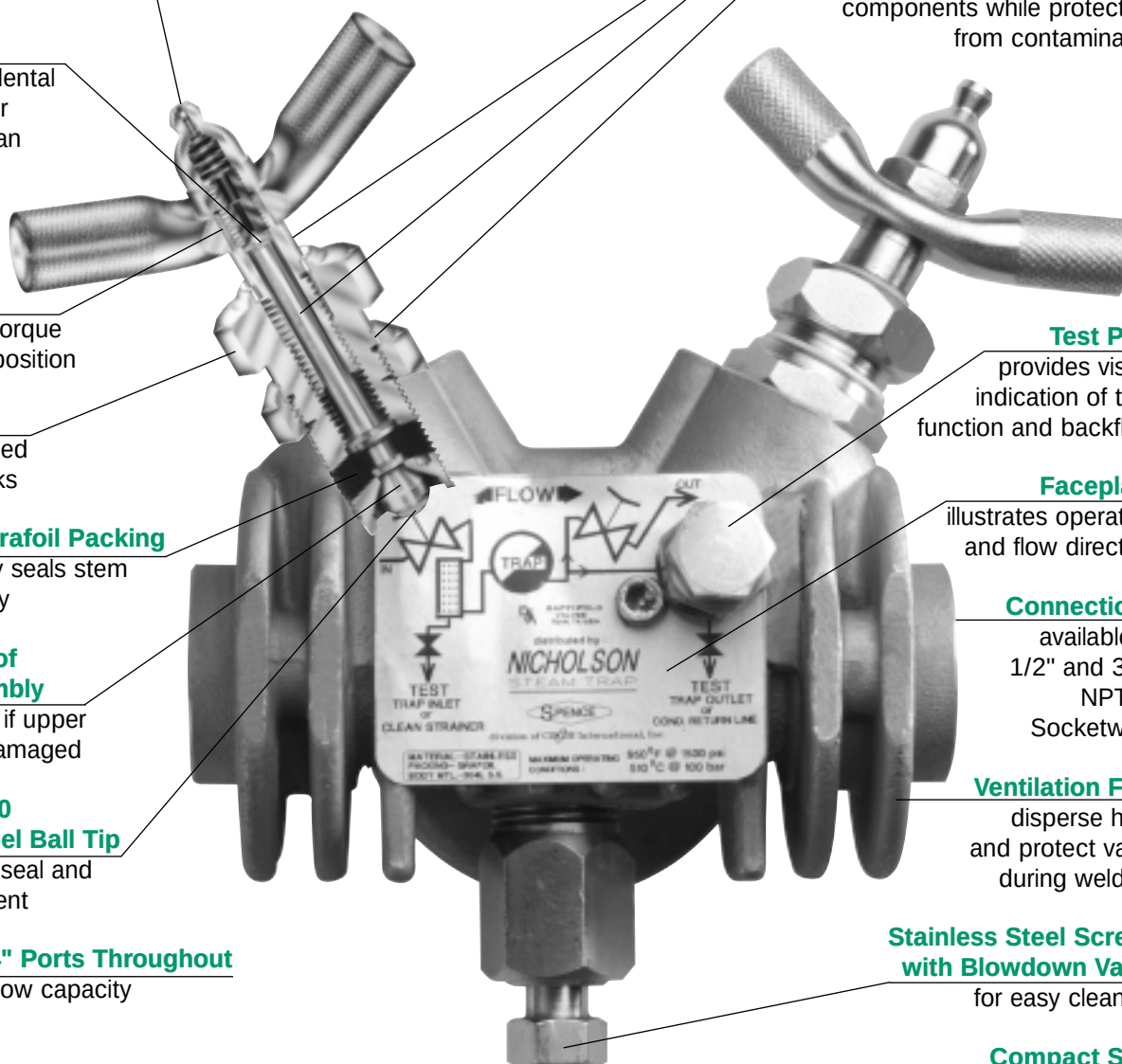
disperse heat and protect valve during welding

Stainless Steel Screen with Blowdown Valve

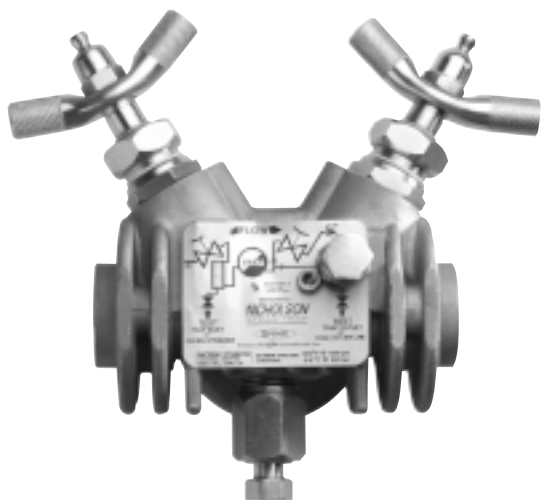
for easy cleaning

Compact Size

for easy installation



SPECIALTIES



BIG BLOCK UNIVERSAL MOUNT TRAP VALVE STATION

Pressures to 1440 PSIG (99 bar)
Temperatures to 750°F (399°C)

Compact Size — Isolation valves, test ports, strainer and blowdown valve combined in one “Big Block” for easy installation.

Universal Mount — Universal two bolt swivel trap mount installs permanently into system, simplifying installation and removal of trap.

Highest Pressure and Temperature Ratings — Suitable for virtually all applications.

All Stainless Steel — Body, internal wetted parts and polished inner stem are durable and corrosion resistant.

Blowout Proof Isolation Valves — Feature grease fittings to lubricate one way Teflon® seals and flush contaminants. Protected from overtorque.

Adjustable Grafoil Packing — Simultaneously seals stem and valve body.

Inner and Outer Valve Stems — Reduce wear.

Hardened 440 Stainless Steel Ball Tip — provides tight seal and proper alignment.

High Capacity — All internal ports at least 1/4".

MODELS*

- UMTVS-BB

APPLICATIONS

- Unit Heaters
- Steam Tracing
- Drip Legs
- Heating
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Plating Tanks
- Patent Presses
- Refinery
- Process

OPTIONS

- SW - Socketweld Connections

CODES

- Designed per ASME 16.5, Class 600

OPERATION

The UMTVS Big Block may be used in conjunction with any two-bolt universal mount steam trap. It combines a universal mount connector block with isolation valves, strainer, blowdown valves and test port to permit fast and easy testing, maintenance, and repair or replacement of a universal mount steam trap.

Integral Strainer and Blowdown Valve

The built-in strainer captures dirt and scale. The blowdown valve at the bottom of the connector block may be used periodically to clean out the strainer.

1st Inlet Isolation Valve (left)

Turning the first isolation valve to the off position (clockwise) stops the flow before it reaches the universal mount steam trap, strainer and blowdown valve. If the first isolation valve is opened (counter-clockwise) flow will be directed through the strainer and blowdown valve ports and to the universal mount steam trap.

Test port (on face)

Condensate exiting the universal mount steam trap is directed to the test port. Fully open the test port by loosening the larger test port valve located on the face of the block (counter-clockwise). This will provide a visual indication of the trap discharge pattern to determine the steam trap functionality.

2nd Outlet Isolation Valve (right)

Turning the second isolation valve to the off position (clockwise) stops the flow to the outlet connection. The flow still may be exhausted through any of the previously mentioned ports. When the second isolation valve is open (counter-clockwise), flow to the outlet connection will continue. Downstream backflow discharge may be observed through the open test port by closing the first Inlet Isolation Valve and blowdown valve and opening the second Outlet Isolation Valve.

BIG BLOCK UNIVERSAL MOUNT TRAP VALVE STATION

SPECIFICATION

Big Block Universal Mount Trap Valve Station shall be a universal mount connector block with integral strainer, blow-down valve, test ports, and dual isolation valves. Body shall be 304L stainless steel. It shall be suitable for pressures to 1440 PSIG. End connections shall be NPT or Socketweld and accommodate connection sizes of 1/2" and 3/4". It shall function in any orientation. It shall accept universal mount steam traps. The isolation valves shall be bonnetless and blowout proof with a relubrication system.

MAXIMUM OPERATING CONDITIONS*

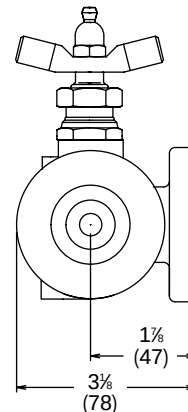
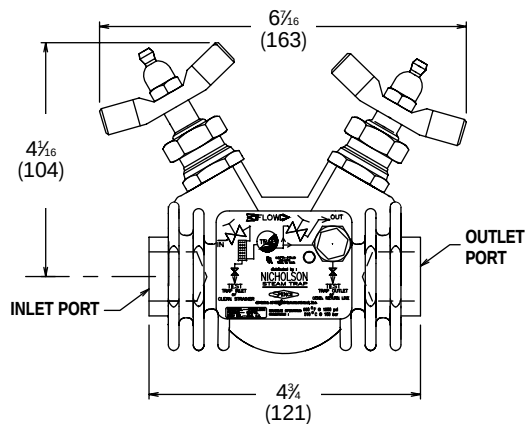
Class 600 - 855 psi (59 barg) @ 750°F (399°C)
1440 psi (99 barg) @ 100°F (170°C)

MATERIALS OF CONSTRUCTION

Body Investment Cast 304L Stainless Steel**
Blowdown Valve 304 Stainless Steel
Strainer 304 Stainless Steel .033 Perf
Test Port & Lock Nut.....303 Stainless Steel
Internal Components Stainless Steel
External Seals..... Teflon®
Packing Grafoil

* Per ASME B16.5, Class 600

** Per ASTM A351-CF



DIMENSIONS - INCHES (MM)
WEIGHT: 6 LBS. (2.7 KG)

Connections: 1/2" & 3/4" NPT or Socketweld

**BIG BLOCK UMT
VALVE STATION**



STEAM SCRUBBER FILTER

APPLICATION DATA

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

OPTIONS

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

Canadian Registration #OE8186.80

**REQUIRES DRIP TRAP.
COMBINE WITH DS200 TRAP
FOR MOST CLEAN STEAM APPLICATIONS**

DS200 TRAP
PAGE 340

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**

MODELS

- **SS2L**–2" low capacity
- **SS3L**–3" low capacity
- **SS12**–1/2" standard capacity
- **SS34**–3/4" standard capacity
- **SS1**–1" standard capacity
- **SS114**–11/4" standard capacity
- **SS112**–11/2" standard capacity
- **SS2**–2" standard capacity
- **SS212**–21/2" standard capacity
- **SS3**–3" standard capacity

NOTE: Please specify if Material Test Reports (MTR) or Certificates of Conformance (COC) are required.

Installation Tip: Add Uniflex Pipe Coupling for ease of maintenance
SEE PAGE 374

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.

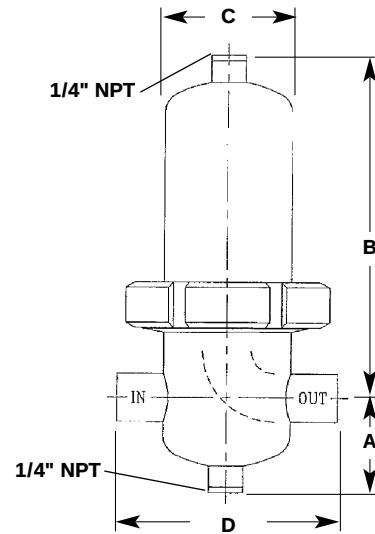
MAXIMUM OPERATING CONDITIONS*

PMO: Max. Operating Pressure	145 psig (10 barg)
Steam	Limit for Saturate
TMO: Max. Operating Temperature	125 psig (8.6 barg)
	353°F (178°C)
PMA: Max. Allowable Pressure	232 psi/g0-400°F
	(16 barg/0-204°C)
TMA: Max. Allowable Temperature	400°F/0-232 psig
	(204°C/0-16 barg)

*For differential pressures greater than 75 psig, consult factory.

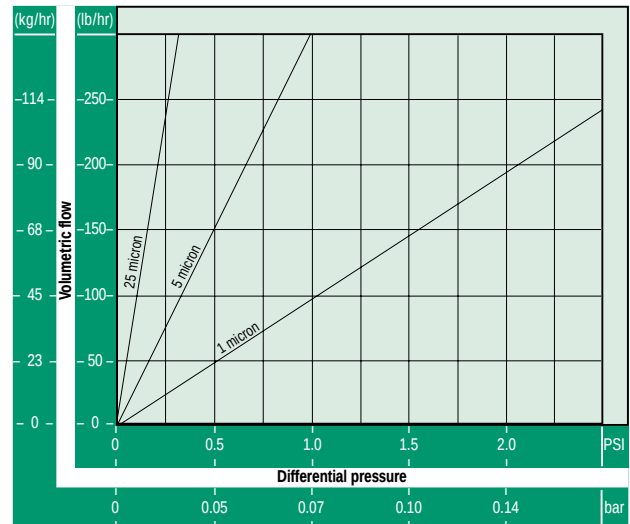
MATERIALS OF CONSTRUCTION

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



Connections:
1/2" – 3" NPT, Flanged or Welded

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



*For other pressures and sizes, see conversion factors.

DIMENSIONS AND WEIGHTS

Size in.(mm)	Dimensions, Inches (mm)				Weight lbs (kg)	Conversion Factors (Cs)
	A	B	C	D		
1/2 (15)	2 1/8 (55)	7 3/8 (188)	2 3/4 (70)	4 1/8 (108)	4.2 (1.9)	0.17
3/4 (20)	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 1/8 (74)	8 5/8 (219)	3 3/8 (85)	4 7/8 (125)	5.7 (2.6)	0.39
1 1/4 (32)	2 1/8 (74)	10 5/8 (270)	3 3/8 (85)	5 1/2 (140)	6.6 (3)	0.50
1 1/2 (40)	3 3/4 (94)	11 1/2 (292)	4 1/8 (104)	6 5/8 (170)	10.1 (4.6)	0.67
2L* (50)	3 3/4 (94)	14 3/8 (366)	4 1/8 (104)	6 5/8 (170)	10.6 (4.8)	1.00
2 (50)	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 (65)	4 1/4 (106)	24 5/8 (626)	5 1/8 (129)	8 1/2 (216)	19.8 (9)	2.00
3L* (80)	4 1/4 (106)	34 5/8 (881)	5 1/8 (129)	8 1/2 (216)	23.8 (10.8)	2.70
3 (80)	4 7/8 (119)	35 3/4 (907)	6 (154)	9 3/8 (240)	35.6 (16.2)	4.00

* L denotes low capacity

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.

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

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

STEAM SCRUBBER
STAINLESS FILTER



STEAM SEPARATOR

APPLICATION DATA

- Steam, compressed air, and gas systems
- Steam mains
- Before steam turbines
- Hot air batteries
- Heat exchangers
- Duplicators
- Boilers
- Kilns
- Radiators
- Sterilizers
- Drip stations before temperature control or pressure reducing valves
- Steam inlets to process equipment which require dry saturated steam
- Before filters and on the compressed air supply to sensitive instruments
- Laundry Processes

ORDERING CODE

MODEL # (Must be 2 Digits)	CONNECTIONS	RATING (Must be 4 Digits)	—	SIZE
example: <u>E</u> <u>S</u>	<u>I</u>	<u>0</u> <u>1</u> <u>5</u> <u>0</u>	<u>—</u>	<u>C</u>
ES - Eliminator	T - NPT	0150 - 150#		C - ½
	W - Socketweld	0300 - 300#		D - ¾
	F - Flanged	0600 - 600#		E - 1
				F - 1¼
				G - 1½
				H - 2
				J - 2½
				K - 3
				M - 4
				P - 6

Installation Tip: Always install a Steam Trap (i.e.: NFT, FTN, Max-Flo, Dura-Flo) after the Steam Separator
SEE PAGE 318

ELIMINATOR SERIES STEAM SEPARATOR

Pressures to 600 PSIG (41.1 barg)
Temperatures to 650°F (344°C)

Removal of Entrained Contaminants - Extracts nearly all moisture and solids above 10 microns

Long Service Life - No moving parts mean less wear and corrosion

High Capacities - Up to 35,000 lbs./hr steam

Steel bodies and internals - Withstand unfavorable conditions and water hammer

Drain Outlet Below Condensate Level - Prevents steam leakage

Optimal Gravity Discharge - Drain located directly below the line

Maintenance Free - Regular maintenance is not required

OPTIONS

- Optional Insulation Jacket

MAXIMUM OPERATING CONDITIONS

- ½" - 2" All
Class 600 - 600 psig (41.4 barg) @ 650°F (34°C)
- 2½" - 6" ANSI 150
Class 150 - 150 psig (10.4 barg) @ 565°F (296°C)
- 2½" - 6" ANSI 300
Class 300 - 300psig (20.7 barg) @ 650°F (344°C)
- 2½" - 6" ANSI 600
Class 600 - 600 psig (41.1 barg) @ 650°F (344°C)

MODELS

- ES-150 - 150 psig ANSI Flanged
- ES-300 - 300 psig ANSI Flanged
- ES-600 - 600 psig NPT, Socketweld, ANSI Flanged

Installation Tip: Always install a Y Strainer between the Steam Separator and Trap
SEE PAGE 381

OPERATION

When the vapor enters the steam separator, a series of baffles change its flow direction several times. During this process, the baffles in the housing collect impinged water droplets that are carried in the system. Gravity allows the accumulated water droplets and

other foreign particles to fall to the drain and exit the system through a steam trap. The remaining steam in the system is clean and dry, allowing improved and maintained performance.

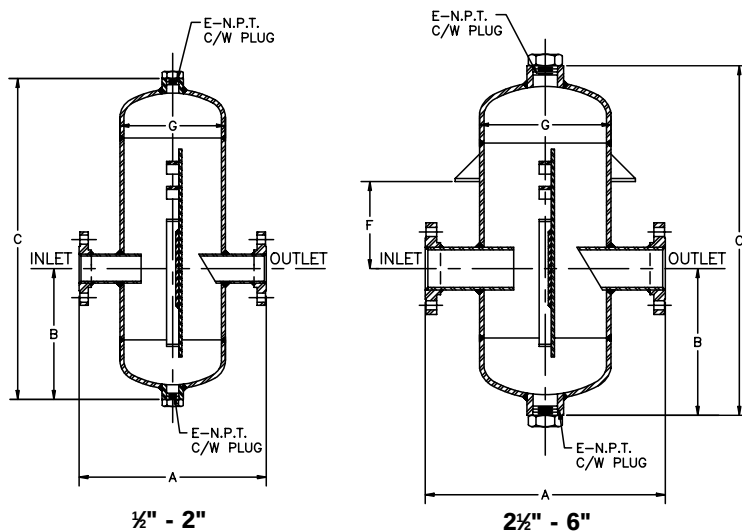
ELIMINATOR SERIES STEAM SEPARATOR

SPECIFICATION

Steam Separator shall have an internal baffle that does not exceed an equivalent length of pipe. The Steam Separator shall be installed in a horizontal pipe configuration with the drain directly below the line. The Steam Separator shall have an NPT bottom drain on which a mechanical constant flow steam trap shall be installed.

MATERIALS OF CONSTRUCTION

Body	($\frac{1}{2}$ " to 2") Carbon Steel	ASTM A106-B
	(2 $\frac{1}{2}$ " to 6") Carbon Steel	ASTM A106-B
End Caps	Carbon Steel	ASTM A-234 WPB
Coupling	Carbon Steel	ASTM A-105
Baffle	Carbon Steel	ASTM A 569
Plug	Carbon Steel	ASTM A105
End Connections:		
	($\frac{1}{2}$ " to 2") Carbon Steel	ASTM A105
	(2 $\frac{1}{2}$ " to 6") Carbon Steel	ASTM A105



Connections:
 $\frac{1}{2}$ " - 2" SW & NPT or 2 $\frac{1}{2}$ " - 6" Flanged

- Call factory for sizing information. Please provide the following:
1. Steam or Compressed Air System
 2. Flow Rate (lb/Hr) ____
 3. Separator Connection Size ____
 4. System Pressure ____

SIZING INFO
PAGE 369

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Pipe Size	Connection	A	B	C	E	F	G	Weight
1/2	NPT/SW	3 $\frac{3}{8}$ (218)	5 $\frac{1}{4}$ (132)	10 $\frac{3}{8}$ (269)	$\frac{3}{4}$ (20.3)	— —	6 (152.4)	9 (4.1)
3/4	NPT/SW	8 $\frac{3}{4}$ (224)	5 $\frac{1}{2}$ (150)	12 $\frac{1}{2}$ (307)	$\frac{3}{4}$ (20.3)	— —	6 (152.4)	10 (4.5)
1	NPT/SW	9 $\frac{1}{4}$ (236)	6 (152)	14 $\frac{1}{2}$ (358)	$\frac{3}{4}$ (20.3)	— —	6 (152.4)	19 (8.6)
1-1/4	NPT/SW	9 $\frac{3}{4}$ (238)	7 $\frac{1}{2}$ (180)	16 $\frac{1}{2}$ (416)	$\frac{3}{4}$ (20.3)	— —	6 (152.4)	30 (13.6)
1-1/2	NPT/SW	11 $\frac{1}{4}$ (287)	7 $\frac{3}{4}$ (193)	19 (483)	1 (25.4)	— —	8 (203)	43 (19.5)
2	NPT/SW	11 $\frac{3}{4}$ (295)	11 $\frac{1}{4}$ (206)	20 $\frac{3}{4}$ (523)	1 (25.4)	— —	8 (203)	50 (22.7)
2-1/2	Flanged ANSI 150	22 $\frac{1}{2}$ (572)	9 $\frac{1}{2}$ (239)	24 $\frac{1}{2}$ (622)	1 (25.4)	7 $\frac{1}{2}$ (180)	10 (254)	109 (49.4)
	Flanged ANSI 300	22 $\frac{1}{2}$ (572)	9 $\frac{1}{2}$ (239)	24 $\frac{1}{2}$ (622)	1 (25.4)	7 $\frac{1}{2}$ (180)	10 (254)	112 (50.8)
	Flanged ANSI 600	22 $\frac{1}{2}$ (572)	9 $\frac{1}{2}$ (251)	25 $\frac{1}{2}$ (650)	1 (25.4)	7 $\frac{1}{2}$ (180)	10 (254)	113 (51.3)
3	Flanged ANSI 150	25 $\frac{1}{4}$ (643)	12 (305)	28 $\frac{3}{4}$ (726)	2 (50.8)	8 (203)	10 (254)	163 (73.9)
	Flanged ANSI 300	25 $\frac{1}{4}$ (643)	12 (305)	28 $\frac{3}{4}$ (732)	2 (50.8)	8 (203)	10 (254)	169 (76.7)
	Flanged ANSI 600	25 $\frac{1}{4}$ (643)	12 $\frac{3}{4}$ (323)	29 $\frac{1}{2}$ (759)	2 (50.8)	8 (203)	10 (254)	189 (85.7)
4	Flanged ANSI 150	29 (737)	12 $\frac{3}{4}$ (320)	31 $\frac{1}{4}$ (792)	2 (50.8)	8 (203)	12 (305)	237 (108)
	Flanged ANSI 300	29 (737)	12 $\frac{3}{4}$ (320)	31 $\frac{1}{4}$ (792)	2 (50.8)	8 (203)	12 (305)	256 (116)
	Flanged ANSI 600	29 (737)	13 $\frac{3}{4}$ (335)	31 $\frac{1}{4}$ (792)	2 (50.8)	8 (203)	12 (305)	297 (135)
6	Flanged ANSI 150	35 $\frac{3}{4}$ (909)	12 $\frac{3}{4}$ (312)	36 $\frac{3}{4}$ (932)	2 (50.8)	11 $\frac{1}{2}$ (290)	16 (406)	365 (166)
	Flanged ANSI 300	35 $\frac{3}{4}$ (909)	12 $\frac{3}{4}$ (315)	36 $\frac{3}{4}$ (937)	2 (50.8)	11 $\frac{1}{2}$ (290)	16 (406)	401 (182)
	Flanged ANSI 600	35 $\frac{3}{4}$ (909)	13 (330)	37 $\frac{3}{4}$ (960)	2 (50.8)	11 $\frac{1}{2}$ (290)	16 (406)	551 (250)



APPLICATIONS

Drain-Air

- Air Header Drainage (pocket risers, end of line)
- Air Station or Location where petcock is used for blowdown, collecting wells, separators.

Mini-Drain

- Pneumatic Tools
- Air Filters
- Pneumatic Valves

Canadian Registration # OE0591.9C

DRAIN-AIR & MINI-DRAINS

Condensate Removal from Air Systems
Pressures To 600 PSIG (41.4 barg)
Temperatures to 220°F (104°C)

Automatic and Positive Drain — Effectively removes condensate from compressed air systems with minimum air loss and rapid shutoff on no load conditions.

Reliable — Only one moving part.

Low Maintenance Cost — No adjustments necessary. Replaceable cartridge for in line repair and/or cleaning.

Long Service Life — Stainless Steel internals.

Freezeproof — Will not freeze when installed in vertical position with muffler removed.

Quiet Operation — Meets OSHA noise standards.

Simplifies Startup — No need to drain air lines through manual valves or petcocks. Top performance is reached without waiting for system to purge.

Sized for Most Applications — Drain-Air available in 3/8" and 1/2"; Mini-Drain available in 1/8" and 3/8".

MODELS

- **Drain Air**—Forged body w/SS internal mechanism & nylon muffler
- **Mini Drain**—All SS integral body w/nylon muffler

Note: Pneumatic mufflers are available separately.

OPERATION

A simple disc is used with no linkage or close fitting parts to eliminate problems found in ordinary small float or piston-operated devices used in drip legs on air lines. Disc will lift off seat on a periodic time cycle, allowing moisture to be discharged and atomized through the muffler. Positive action of the disc assures reliable condensate removal with

minimum loss of air and rapid shutoff on no load condition. Intermittent discharges atomize condensate to avoid messy accumulations produced by other devices. Highly effective, specially designed muffler eliminates noise and diffuses moisture so that discharge drain piping is usually unnecessary. Freeze proof when mounted in vertical position with outlet facing down and muffler removed.

DRAIN-AIR & MINI-DRAINS

SPECIFICATION

The liquid drain trap shall be of thermodynamic design with screwed NPT connections. Internal mechanism shall be stainless steel with hardened working surfaces. A pneumatic muffler shall be employed to reduce exhaust sound pressure level.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure	600 psig	(41.4 barg)
TMO: Max. Operating Temperature	220°F	(104°C)
PMA: Max. Allowable Pressure	600 psig	(41.4 barg)
TMA: Max. Allowable Temperature	800°F	(426°C)

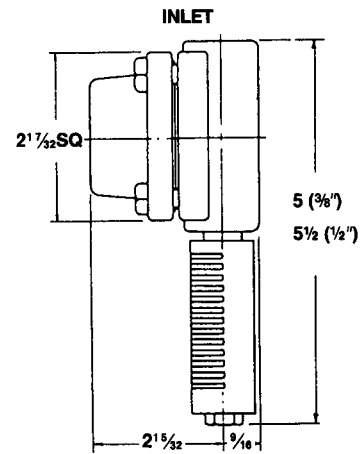
MATERIALS OF CONSTRUCTION

DRAIN-AIR

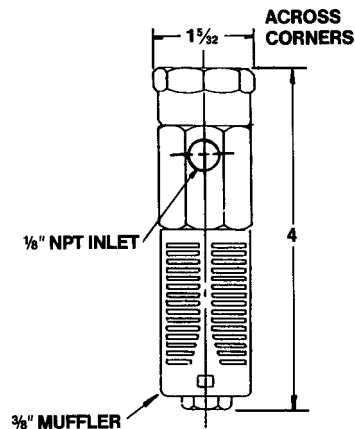
Body & Cover: ASTM A105 Forged Steel
 Celtron® Cartridge: 416 Stainless Steel
 w/hardened disc & seat
 Bolts: High temperature alloy
 Cover Gasket: 347 Stainless Spiral-wound
 w/graphite filler
 Integral Strainer: 304 Stainless Steel
 Muffler: Nylon Housing, Aluminum Screen
 Connections: 3/8"-1/2" NPT

MINI-DRAIN

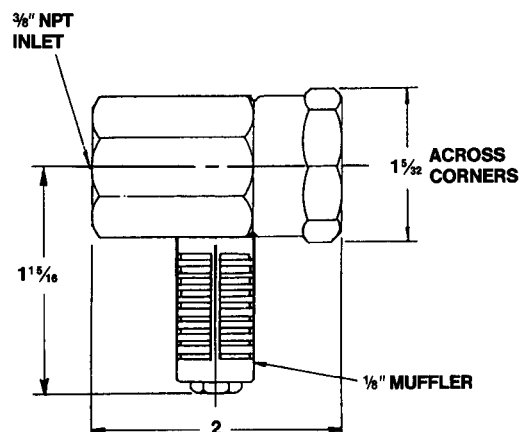
Cap, Seat & Disc: 416 Stainless, Hardened
 Muffler: Nylon Housing, Aluminum Screen



**3/8" & 1/2" DRAIN-AIR
2.3 LBS.**

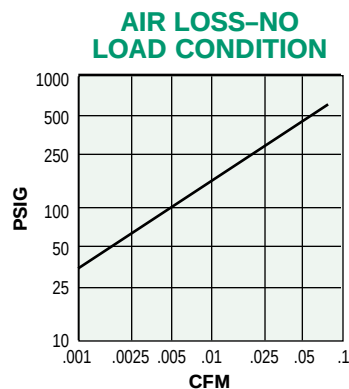
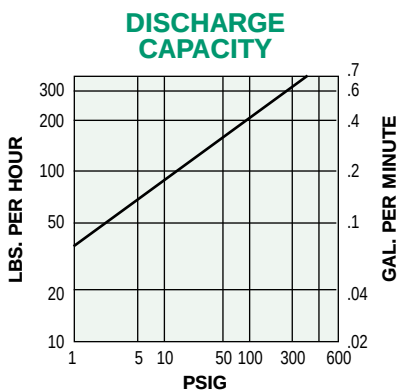


**1/8" MINI-DRAIN
.9 LBS.**



**3/8" MINI-DRAIN
.9 LBS.**

Connections: 1/8"-3/8" NPT



TAV SERIES

THERMOSTATIC AIR VENT

Pressures To 650 PSIG (44.8 barg)
Temperatures to 750°F (400°C)



Sealed Stainless Steel Body — Lightweight, compact and corrosion resistant. No bolts or gaskets. Eliminates body leaks.

Self Centering Valve — Leak tight shutoff. Improved energy savings. Assembly of actuator and valve to impingement plate allows valve to self-align with center of valve seat orifice. Provides long lasting valve and seat.

Temperature Sensitive Actuators — One moving part. Stainless Steel, fail open, welded actuator for maximum corrosion, thermal and hydraulic shock resistance.

Thermal and Hydraulic Shock Resistant — Impingement plate plus welded construction prevent damage to actuator.

Hardened Stainless Steel Valve and Seat — Long life. Lapped as a matched set for steam tight seal.

Inexpensive — Low initial cost.

Maintenance Free — Sealed unit. Replacement traps cost less than repair of more expensive in-line repairable vents.

Directional Discharge — Pipe thread erosion prevented by directing discharge to center of pipe.

Guaranteed — Guaranteed for 3 years against defects in materials or workmanship.

MODELS

- **TAV**—High capacity w/welded SS actuator

APPLICATIONS

- Platen Presses
- Plating Tanks
- Sterilizers
- Tire Presses
- Cooking Equipment
- Laundry Equipment
- Other Process Equipment

Canadian Registration # OE0591.9C

OPERATION

Thermal actuator is filled at it's free length with a liquid having a lower boiling point than water. As assembled, valve is normally open. On startup, air passes through vent. As air is eliminated, hot steam reaches vent and the thermal actuator fill vaporizes to a pressure higher than line pressure. This forces

valve into seat orifice to prevent any further flow. Should more air collect, it takes heat from the actuator, lowering internal pressure. Line pressure will then compress thermal actuator to open valve and discharge air. Valve lift automatically adjusts to variations.

TAV SERIES THERMOSTATIC AIR VENT

SPECIFICATION

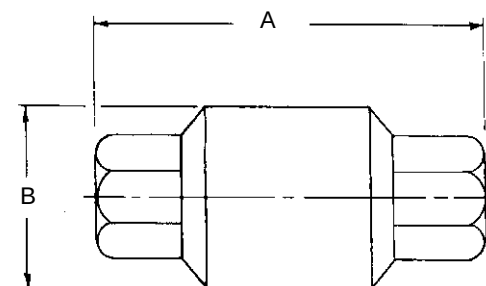
Air vent shall be of balanced pressure design stainless steel welded actuator capable of discharging air within 35°F of saturated temperature. Thermostatic actuator shall employ a conical valve lapped in matched sets with the seat ring assuring tight shut off. Vent shall be stainless steel bodied suitable for pressures to 650 psig and available in 3/8" through 1" NPT or socketweld.

MAXIMUM OPERATING CONDITIONS

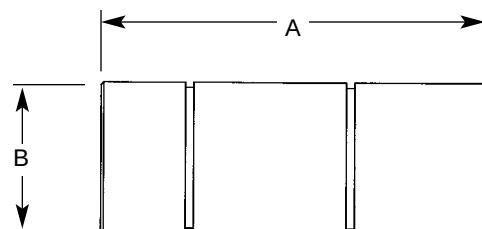
PMO: Max. Operating Pressure 650 psig (44.8 barg)
TMO: Max. Operating Temperature 650°F (343°C)
PMA: Max. Allowable Pressure 650 psig (44.8 barg)
TMA: Max. Allowable Temperature 750°F (400°C)

MATERIALS OF CONSTRUCTION

Body & Cover: ASTM A351 Grade CF3M (316L)
Actuator: Welded Stainless Steel
Valve & Seat: Hardened 416 Stainless Steel



3/8" - 3/4" BODY



1" BODY

Connections:
3/8" – 1" NPT or socketweld

Dimensions			
NPT or Socket weld	inches (mm)		Weight Lbs. (kg)
	A	B	
3/8, 1/2"	3 ³ / ₄ (95)	1 ³ / ₄ (44)	1.1 (0.5)
3/4"	3 ¹⁵ / ₁₆ (100)	1 ³ / ₄ (44)	1.2 (0.54)
1"	4 ³ / ₈ (111)	1 ³ / ₄ (44)	1.6 (0.73)

Air Capacity—SCFM for 14.7 PSIA @ 60°F (dm³/s)

Vent	Orifice Inch (mm)	Inlet Pressure (barg)														
		10 (0.7)	50 (3.5)	100 (6.9)	125 (8.62)	150 (10.3)	200 (13.8)	250 (17.2)	300 (20.7)	350 (24.1)	400 (27.6)	450 (31.0)	500 (34.5)	550 (37.9)	600 (41.4)	650 (44.8)
TAV	5/16 (8)	33 (16)	34 (20)	156 (74)	192 (91)	230 (109)	300 (142)	370 (175)	440 (208)	510 (241)	580 (274)	650 (307)	720 (340)	790 (373)	860 (406)	930 (439)



STV SERIES

COMBINATION TRAP TEST & BLOCKING STEAM VALVE

Pressures To 250 PSIG (17.2 barg)
Temperatures to 406°F (208°C)

Visual Steam Trap Test — Provides for quick visual examination of steam trap discharge.

Compact Body — Small size facilitates installation and operation in tight spaces.

Stainless Steel Internals — High quality materials provide long service life and protection against corrosion.

Repairable — All parts are easily replaceable.

Large Size Test Vent — Vent passage in ball is large enough to provide true determination of trap discharge.

Safety Designed — Bottom loaded, pressure retaining stem and packing nut threaded to body provides extra margin of safety.

Reduces Labor Costs — Eliminates need to install and maintain separate blocking and test valves.

Minimizes Risk of Connection Leaks — Eliminates the need for numerous fittings.

APPLICATIONS

- Test Steam Traps
- Sample Fluids or Gases from Process Lines

OPTIONS

- Stainless Steel Latch-lok Handle
- Extended Handle

Canadian Registration # OCO591.97

OPERATION

STV test/block valve is installed on downstream side of steam trap. During normal operation, valve is in open position with unrestricted flow through trap into the return system.

One quarter turn (90°) of STV blocks flow from return and vents trap discharge to atmosphere. Provides quick, visual check of trap operation.

STV SERIES

COMBINATION TRAP TEST & BLOCKING STEAM VALVE

MAXIMUM OPERATION CONDITIONS

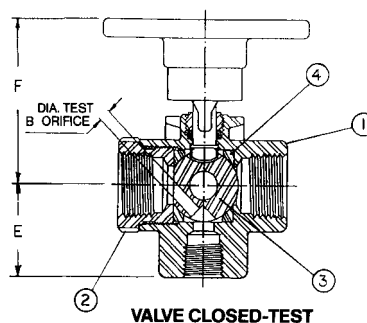
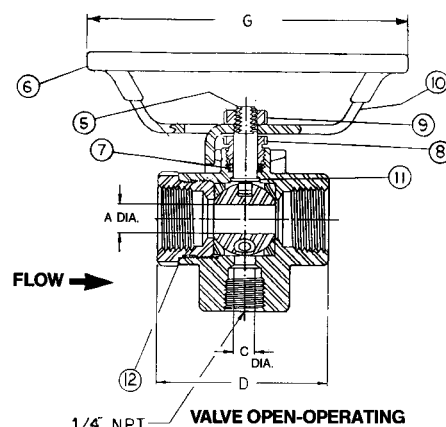
PMO: Max. Operating Pressure	250 psig	(17 barg)
TMO: Max. Operating Temperature	406°F	(208°C)
PMA: Max. Allowable Pressure	250 psig	(17 barg)
TMA: Max. Allowable Temperature	406°F	(208°C)

MATERIALS OF CONSTRUCTION

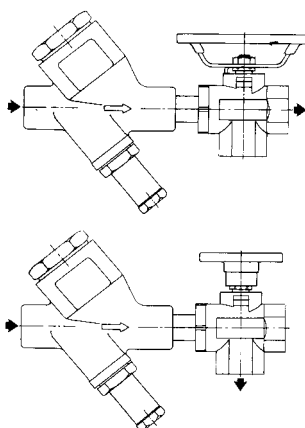
Body:	ASTM A216 WCB Carbon Steel
	(Blk oxide & oil coat)
Adapter:	.12L14C.R.S. (Blk oxide & oil coat)
Ball:	.316 Stainless Steel
Seat:	.25% Mineral Fill Virgin Teflon
Stem:	.316 Stainless Steel
Insulator:	Plastisol (Vinyl grip)
Packing Gland:	Carbon Reinforced Teflon
Packing Nut:	.12L14 C.R.S. (Blk oxide & oil coat)
Handle Nut:	Steel (Zinc plated)
Handle:	.11 Ga. C.R.S. (Zinc plated)
Thrust Washer:	Glass Reinforced Teflon
Body Seal:	Virgin Teflon

DIMENSIONS

Size	Inches (mm)							Weight Lbs. (kg)
	A	B	C	D	E	F	G	
1/2"	.375	.156	.281	2.26	1.20	2.17	4.25	1.1
(15)	(10)	(4)	(7)	(57)	(30)	(55)	(108)	(.5)
3/4"	.531	.218	.281	2.83	1.49	2.45	4.25	1.4
(20)	(13)	(6)	(7)	(72)	(38)	(62)	(108)	(.64)



Connections: 1/4" NPT Blowdown
1/2" and 3/4" NPT Inlet & Outlet



NOTES:

TRAPS & SPECIALTIES SIZING

BASICS OF STEAM TRAPS

WHY DO WE NEED STEAM TRAPS?

In order to operate economically and efficiently, all steam systems must be protected against 3 factors:

- * CONDENSATE
- * AIR
- * NON-CONDENSIBLES

Condensate is formed in a system whenever steam gives up its useable heat. And, since condensate interferes with the efficiency of the operation of a steam system, it must be removed.

Air, one of nature's finest insulators, when mixed with steam, will lower its temperature and hinder the overall effectiveness of an entire system. For example: A film of air 1/1000th of an inch thick offers as much resistance to heat transfer as 13" of copper or 3" of steel. For that reason, air **MUST** be continuously bled from a system by steam traps to have it operate efficiently and to conserve energy.

Non-condensibles, such as carbon dioxide promote corrosion and other deterioration of equipment and inhibit their function.

WHAT IS A STEAM TRAP?

A steam trap is basically an automatic valve which discharges condensate, undesirable air and non-condensibles from a system while trapping, or holding in, steam. They fall into 4 major categories; **Thermostatic**, **Mechanical**, **Thermodynamic** and **Drain Orifice**. Each type will be discussed in detail in this section.

In every steam system, there are four phases of operation in which traps play a vital role:

- 1) **Start-up** – During "start-up", when the system is initially activated, air and non-condensibles must be discharged.
- 2) **Heat-up** – During "heat-up", as the system works to achieve the desired temperature and pressure, condensate is discharged.
- 3) **At Temperature** – "At temperature", when the desired levels are reached, the valve must close to retain the steam.
- 4) **Using Heat** – At the "using heat" level, the valve's job is to stay closed unless and until condensate occurs; then the valve must open, discharge the condensate and close quickly and positively, without allowing valuable steam to escape.

WHAT ARE THE QUALITIES OF A GOOD STEAM TRAP?

A good steam trap should:

- Discharge condensate, air and non-condensibles.
- Be equal to the load over a wide range of pressures and temperatures.
- Be freeze-proof where necessary.
- Be simple and rugged.
- Have few moving parts.
- Require low maintenance and spare parts inventory.
- Have a long life.

A good steam trap should not:

- Discharge live steam.
- Fail or malfunction if pressure changes.
- Respond slowly or hesitantly.
- Open too often, too briefly or for too long.
- Require constant adjustment or frequent repair.
- Require a wide variety of models, spare parts or orifice sizes for different pressures.

THERMOSTATIC STEAM TRAPS

Thermostatic steam traps, as their name implies, operate in direct response to the temperature within the trap. There are two primary types: *BELLOWS* and *BIMETALLIC*.

BELLOWS TRAPS

Of all actuating devices, the bellows trap most nearly approaches ideal operation and efficiency and is most economical. It is positive in both directions, is fast acting and does not require adjustment. Bellows traps employ only one moving part - a liquid filled metal bellows - which responds quickly and precisely to the presence or absence of steam.

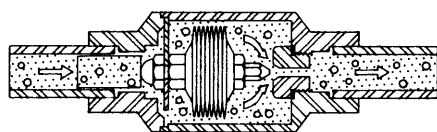


FIGURE 13

During startup and warmup, a vacuum in the bellows keeps it retracted, with the valve lifted well clear of the seat permitting air and non-condensibles to be freely discharged (**Figure 13**).

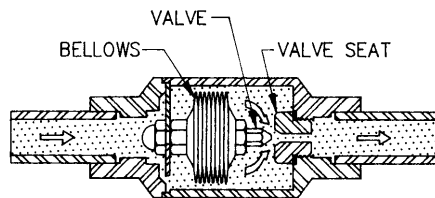
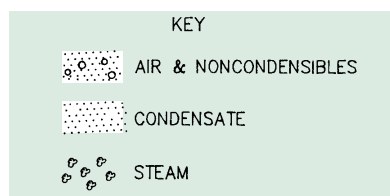


FIGURE 14

Next, condensate is discharged (**Figure 14**). Then heat from arriving steam will cause the liquid in the bellows to vaporize and close the valve (**Figure 15**).

At temperature, the valve will remain closed indefinitely opening only when condensate, air or other non-condensibles cause it to retract and open.

When live steam re-enters the trap housing, the bellows extends immediately, trapping the steam (**Figure 15**).

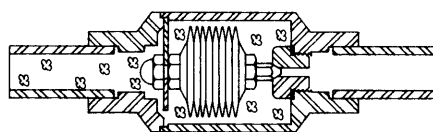


FIGURE 15

The bellows, unlike a disc trap, is a temperature sensitive rather than a time cycle device. There is no way that air can be mistaken for steam and cause binding, since bellows react to temperature only. And unlike bucket traps, bellows traps do not require a variety of sizes for valves and seats for various pressures.

BIMETALLIC TRAPS

Bimetallic traps work like the differential metal strip in a thermostat, using the unequal expansion of two different metals to produce movement which opens and closes a valve.

Figure 16: When the cooler condensate contacts the bimetallic discs, the discs relax. Inlet pressure forces the valve away from its seat and permits flow.

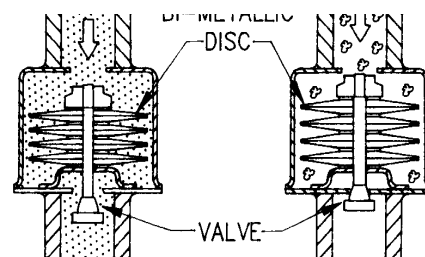


FIGURE 16

FIGURE 17

Figure 17: When steam enters the trap and heats the bimetallic discs, the discs expand forcing the valve against its seat preventing flow.

Bimetallic traps are simple and positive in both directions. However, they have a built-in delay factor which makes them inherently sluggish. Moreover, they do not maintain their original settings because the elements tend to take a permanent set after use, which requires repeated adjustment to maintain efficiency.

MECHANICAL STEAM TRAPS

There are two basic types of mechanical steam traps:

- 1) FLOAT & THERMOSTATIC
- 2) INVERTED BUCKET

Inverted bucket traps, as their name suggests, operate like an upside down bucket in water.

Figure 1: During startup, the trap is filled with water, with the bucket (A) at

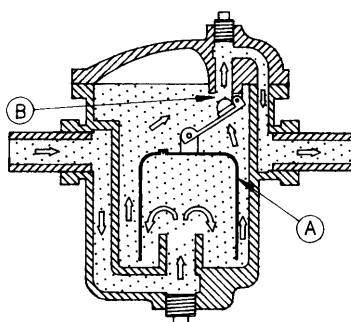


FIGURE 1

the bottom and the valve (B) fully open to allow condensate to flow out freely.

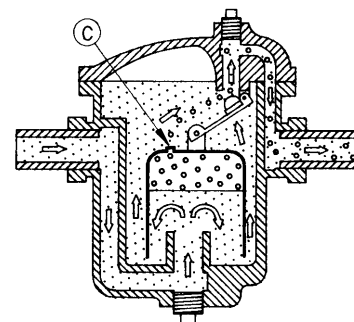
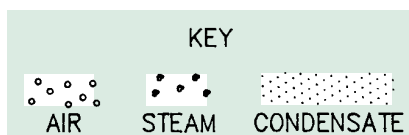


FIGURE 2

Figure 2: Air trapped in the bucket escapes through a vent hole (C). On



MECHANICAL STEAM TRAPS CONT'D.

some buckets, an additional vent hole is controlled by a bimetallic strip which is kept closed by the steam. Therefore, the vent only operates during startup. This limits bucket trap air handling capacity.

Figure 3: At temperature, steam enters

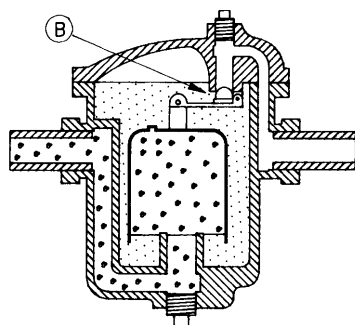


FIGURE 3

under the bucket and causes it to float up and close the valve (B). During heat use, any condensate entering the line is forced up into the bucket. The bucket loses buoyancy and drops down, reopening the valve and discharging the condensate. (see Figure 1)

Bucket traps are rugged and reliable, however, air building up in the bucket can bind them closed causing condensate to back up in the line. Also, they can waste steam if they lose their prime

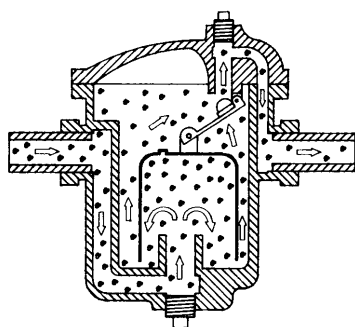


FIGURE 4

(see Figure 4). Bucket traps require priming water in the trap which makes them vulnerable to freeze up unless expensive insulation is added.

Because bucket traps rely on a fixed force, the weight of the bucket, discharge orifices must be sized by pressure. For example, a trap sized to operate at 50 PSIG will not open at 150 PSIG.

Float traps are manufactured in a variety of sizes, shapes and configurations. The most commonly used (for steam service) is the float and thermostatic, or F & T. F & T traps combine the excellent air venting capabilities of a thermostatic trap with the liquid level controlling capabilities of a float trap.

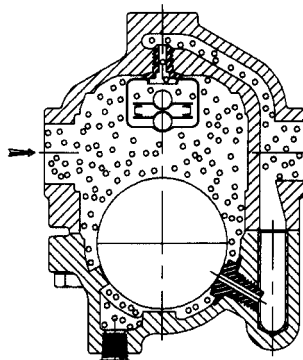


FIGURE 5

Figure 5: During startup, before condensate reaches the trap, the thermostatic element is fully open to discharge air. The float rests on the lower seat.

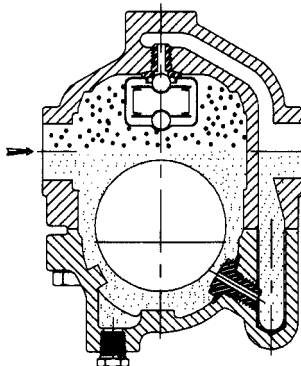


FIGURE 6

Figure 6: As hot condensate and steam reach the trap, the thermostatic element expands, closing the air vent. Condensate lifts the float, allowing condensate to flow out of the trap.

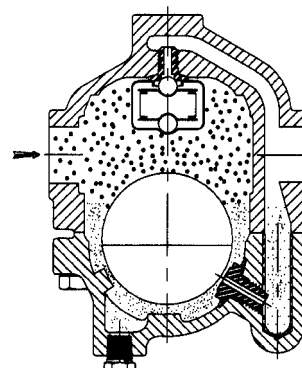


FIGURE 7

Figure 7: As the condensing rate decreases, the float lowers, reducing flow through the trap. The buoyancy of the float will maintain a liquid level seal above the lower seat ring, preventing the escape of steam. As with inverted bucket traps, float and thermostatic traps rely on a fixed force (the buoyancy of the float). Discharge orifices must be sized by differential pressure. Placing a low pressure float and thermostatic trap in high pressure service will result in the trap locking up. A contrasting characteristic of both the float and thermostatic and inverted bucket is the discharge cycle. A float & thermostatic trap tends to continuously discharge condensate while the inverted bucket trap discharges condensate in cycles.

THERMODYNAMIC STEAM TRAPS

Essentially, a thermodynamic steam trap is a time cycle device which responds to imbalances of pressure applied to a valving device, usually a disc.

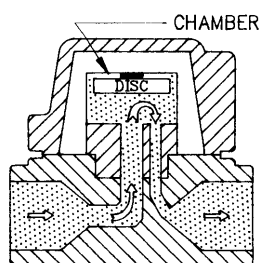


FIGURE 9

Figure 9: Pressure caused by air or condensate lifts the disc permitting flow through the trap.

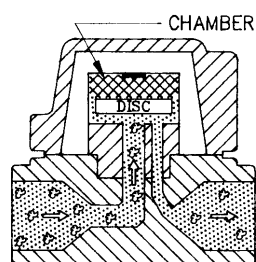


FIGURE 10

Figure 10: When steam arrives at the inlet port, blowby at a high velocity creates low pressure under the disc. Some of the flashing condensate is

blown past the disc into the upper chamber, forcing the disc downward.

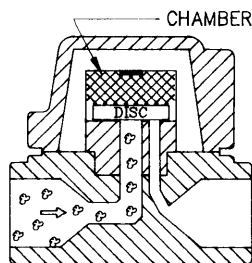


FIGURE 11

Figure 11: Further flow is stopped when sufficient pressure is trapped in the chamber above the disc. During operation, a decrease in chamber pressure permits inlet pressure to lift the disc and open the trap (**Figure 9**).

The decrease in the chamber pressure should only be caused by the presence of cooler condensate. Due to the design of most thermodynamic traps, especially in cold or wet conditions, the chamber may be prematurely cooled causing improper or frequent cycling as well as steam loss and increased wear. Advanced TD designs have a steam jacket which surrounds the chamber and prevents ambient conditions affecting the operation of the disc.

This type of trap is also subject to water binding. If water pressure is trapped above disc, trap will fail closed.

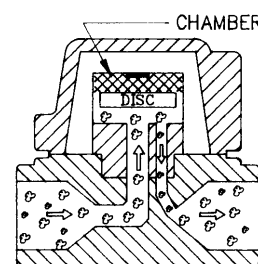
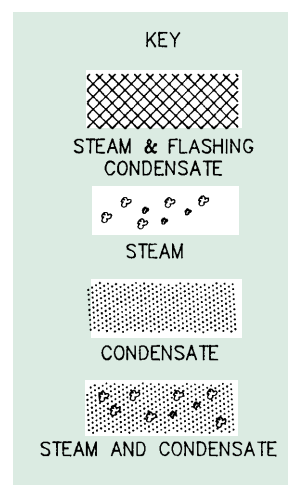


FIGURE 12

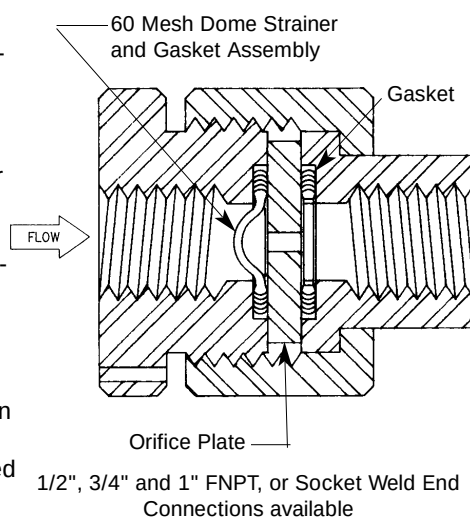
Figure 12: Trap is easily affected by dirt and/or other foreign matter which will cause trap to fail open.



ORIFICE STEAM TRAPS

Orifice type traps are engineered continuous flow devices. Orifice traps discharge air, condensate and all other non-condensable gases with minimal live steam loss.

The fixed orifice size is calculated, for a given application, to discharge the condensate load at maximum thermal efficiency. Approximately 10 to 25 percent of discharging hot condensate flashes to steam at the downstream side of the orifice, at a constant pressure drop. This flashing effect further restricts the flow of saturated steam. In actual conditions, a minimum percentage of steam, by weight, is discharged with condensate, since the specific



volume of steam is relatively large compared to that of the condensate.

The velocity through the orifice is highly turbulent. The initial calculated steam loss can be expected to remain relatively constant over the expected trap life of 10 plus years.

The major factor for energy efficient performance is based on initial orifice sizing for the application. Properly sized, thermal efficiencies of 98 percent plus can be attained.

While Orifice Traps can be applied at all pressures, they are ideally suited for use on saturated or superheated steam 250 PSIG or greater.

SIZING STEAM TRAPS

HOW TO DETERMINE THE PROPER SIZE TRAP

Capacity tables that follow show maximum discharge rates in pounds per hour. To select the correct size trap from these tables, the normal condensing rate should be converted to a "pounds per hour" basis and multiplied by a safety factor.

REASON FOR SAFETY FACTORS

For steam applications, the condensation rate varies with:

- (1) The starting or warming-up condition.
- (2) The normal operating condition.
- (3) Any abnormal operating condition.

Of these, the condensing rate for the normal condition is occasionally known, or it can be estimated with sufficient accuracy for trap selection; the loads imposed by warm-up and abnormal conditions are seldom known and practically impossible to predict.

During warm-up the trap load is heavy, since air as well as large quantities of condensate must be discharged. Condensate forms at a rapid rate as the cold equipment and connecting piping are brought up to temperature. This usually results in pressure drop at the trap inlet, thereby reducing its capacity during the period when the load is maximum.

Safety factors are therefore necessary, to compensate for start-up conditions, variation of steam pressure and product initial temperature, the process cycle speed required, and discrepancies between assumed and actual conditions which determine the normal condensing rate.

The selection of a safety factor depends on the type of trap and the operating conditions. If the known or calculated normal condensing rate is multiplied by the recommended factor from the pages which follow, efficient trapping will be assured.

EFFECT OF BACK PRESSURE ON TRAP CAPACITY

Most trap installations include piping the outlet into a common return system or to an available disposal location. In either case a constant static back pres-

sure may exist, against which the trap must discharge. This back pressure may be unintentional or deliberately produced.

Unintentional back pressure in condensate return piping is caused by lifting the condensate to a higher level, piping which is too small for the volume of liquid conveyed, piping with insufficient or no pitch in the direction of flow, pipe and fittings clogged with rust, pipe scale or other debris, leaking steam traps, etc. In steam service an intentional back pressure is instigated by means of a pressure regulating or spring-loaded valve in the discharge system, when a supply of flash steam at a pressure less than the trap pressure is needed.

If very hot condensate is discharged to a pressure less than that existing in the trap body, some of it will flash into steam, with a tremendous increase in volume and consequent choking and build-up of pressure in the trap's discharge orifice and the passages and piping adjacent thereto. For condensate at or close to steam temperature, this flash pressure is quite high, usually considerably higher than any static back pressure existing in the trap outlet piping.

For this reason, capacity tables for thermostatic and thermodynamic traps are based on gage pressure at the trap inlet, instead of on the difference between trap inlet and discharge pressures. Experiments have shown that, for the temperatures applying to these tables, unless the static back pressure in the return piping exceeds 25% of the trap inlet pressure, no reduction of the trap capacity results. For back pressures greater than 25% of the trap inlet pressure there is a progressive decrease of trap capacity.

Thus, if the return piping static pressure is less than 25% of the trap inlet pressure, the capacities shown in these tables should be utilized for trap selection. If the return piping pressure is greater than 25% of the trap inlet pressure, reduce the table capacities by the percentage indicated in second line of Table A on the following pages.

Above data does not apply to float and thermostatic traps, capacities are based on differential pressure, obtained by subtracting any static back pressure from trap inlet pressure.

WHEN THE NORMAL CONDENSING RATE IS KNOWN

Normal condensing rate means the pounds of steam condensed per hour by the average conditions which prevail when the equipment drained is at operating temperature.

If this amount is known, simply multiply by the safety factor recommended for the service and conditions, obtained from the pages which follow, and determine size directly from the capacity tables for the type of trap selected.

WHEN THE NORMAL CONDENSING RATE IS UNKNOWN

Determine by utilizing proper formula for the service and equipment to be trapped. Multiply the result by safety factor recommended for the operating conditions. See examples on the following pages.

SIZING STEAM TRAPS CONT'D.

EXPLANATION OF SYMBOLS USED IN NORMAL CONDENSING RATE FORMULAS

A = Heating surface area, square feet
(see Table B)

B = Heat output of coil or heater, BTU
per hour

C = Condensate generated by
submerged heating surfaces,
lbs/hr/sq ft (Table F)

D = Weight of material processed per hour
after drying, pounds

F = Steam flow, lbs/hr

G = Gallons of liquid heated per unit time

H = Heat loss from bare iron or steel
heating surface, BTU/sq ft/°F/hr

L = Latent heat of steam at pressure
utilized, BTU/lb (see Table C
or obtain from Steam Table)

M = Metal weight of autoclave, retort
or other pressure vessel, pounds

Qh = Condensate generated, lbs/hr

Qu = Condensate generated, lbs/unit
time (Always convert to lbs/hr
before applying safety factor. See
Examples using formulas 7 and
10 on next page).

S = Specific heat of material processed,
BTU/lb/°F

Ta = Ambient air temperature, °F

Tf = Final temperature of material
processed, °F

Ti = Initial temperature of material
processed, °F

Ts = Temperature of steam at pressure
utilized, °F (see Table C or
obtain from Steam Table)

U = Overall coefficient of heat transfer,
BTU/sq ft/°F/hr (see Table E)

V = Volume of air heated, cubic
feet/minute

Wg = Liquid weight, lbs/gallon

Wh = Weight of material processed per
hour, lbs

Wu = Weight of material processed per
unit time, lbs

X = Factor for $\frac{Tf-Ti}{L}$ (obtain from Table D)

Y = Factor for $\frac{H(Ts-Ta)}{L}$, lbs/hr/sq ft
(obtain from Table C)

AIR HEATING

**Steam Mains; Pipe Coil Radiation;
Convectors; Radiators; etc.** (Natural
Air Circulation)

$$(1) Qh = A Y$$

Recommended Safety Factors

For Steam Mains

Ambient Air Above Freezing:

1st Trap After Boiler.....	3
At End of Main	3
Other Traps	2

Ambient Air Below Freezing:

At End of Main	4
Other Traps	3

Steam mains should be trapped at all
points where condensate can collect,
such as at loops, risers, separators,
end of mains, ahead of valves, where
mains reduce to smaller diameters,
etc., regardless of the condensate load.
Installation of traps at these locations
usually provides ample capacity.

For Pipe Coil Radiation, Convectors and Radiators

Single Continuous Coil	2
Multiple Coil	4

**Damp Space Pipe Coil Radiation;
Dry Kilns; Greenhouses; Drying
Rooms; etc.** (Natural Air Circulation)

$$(2) Qh = 2.5 A Y$$

Recommended Safety Factors

Single Continuous Coil	2
Multiple Coil	4

Steam Line Separators; Line Purifiers

$$(3) Qh = .10 F$$

Recommended Safety Factors

Indoor Pipe Line	2
Outdoor Pipe Line	3
If Boiler Carry-Over Anticipated... 4 to 6 (Depending on probable severity of conditions)	

Unit Heaters; Blast Coils (Forced Air
Circulation)

(4) When BTU Output is Known:

$$Qh = \frac{B}{L}$$

(5) When BTU Output is Unknown,
Heat Transfer Area is Known:

$$Qh = 5 A Y$$

(6) When Volume of Air Heated is Known:

$$Qh = 1.09 V X$$

Recommended Safety Factors

Intake Air Above Freezing - Constant Steam Pressure	3
Intake Air Above Freezing - Variable Steam Pressure	4
Intake Air Below Freezing - Constant Steam Pressure	4
Intake Air Below Freezing - Variable Steam Pressure	5

Example: 11,500 cubic feet of air per
minute heated by blast coil from 50°F
to 170°F with 50 PSIG constant
steam pressure.

Solution: By formula (6), $Qh = 1.09 \times$
 $11,500 \times .132 = 1655$ lbs/hr. Recom-
mended safety factor, 3 for intake air
above freezing and constant steam
pressure. $3 \times 1655 = 4965$ lbs/hr trap
capacity required.

SIZING STEAM TRAPS CONT'D.

LIQUID HEATING

Submerged Coils; Heat Exchangers; Evaporators; Still; Vats; Tanks; Jacketed Kettles; Cooking Pans; etc.

- (7) When Quantity of Liquid to be Heated in a Given Time is Known:

$$Q_u = G W_g S X$$

- (8) When Quantity of Liquid to be Heated is Unknown:

$$Q_h = A U X$$

- (9) When Heating Surface Area is Larger than Required to Heat Known Quantity of Liquid in a Given Time:

$$Q_h = A C$$

When maximum heat transfer efficiency is desired, or when in doubt, use formula (9) in preference to formulas (7) and (8).

Recommended Safety Factors

For Submerged Coil Equipment; Heat Exchangers; Evaporators; etc.

Constant Steam Pressure:

Single Coil, Gravity Drainage	2
Single Coil, Siphon Drainage	3
Multiple Coil, Gravity Drainage	4

Variable Steam Pressure:

Single Coil, Gravity Drainage	3
Single Coil, Siphon Drainage	4
Multiple Coil, Gravity Drainage	5

For Siphon Drained Equipment, specify traps with "Steam Lock Release Valve".

For Jacketed Equipment; Cooling Kettles; Pans; etc.

Slow Cooking:	
Gravity Drainage	3
Siphon Drainage	4
Moderately Fast Cooking:	
Gravity Drainage	4
Siphon Drainage	5

Very Fast Cooking:	
Gravity Drainage	5
Siphon Drainage	6

For Siphon Drained Equipment, specify traps with "Steam Lock Release Valve".

Example: Heat exchanger with single submerged coil, gravity drained, heating 1250 gallons of petroleum oil

of 0.51 specific heat, weighing 7.3 lbs/gal, from 50°F to 190°F in 15 minutes, using steam at 100 PSIG.

Solution: By formula (7), $Q_u = 1250 \times 7.3 \times .51 \times .159 = 740$ pounds of condensate in 15 minutes, or $4 \times 740 = 2960$ lbs/hr. Recommended safety factor is 2 for single coil, gravity drained. $2 \times 2960 = 5920$ lbs/hr trap capacity required.

DIRECT STEAM CONTACT HEATING

Autoclaves; Retorts; Sterilizers; Reaction Chambers; etc.

$$(10) Q_u = W_u S X + .12 M X$$

Recommended Safety Factors

Slow Warm-up Permissible	3
Fast Warm-up Desired	5

Example: An autoclave which weighs 400 pounds before loading is charged with 270 pounds of material having a specific heat of .57 and an initial temperature of 70°F. Utilizing steam at 50 PSIG, it is desired to bring the temperature up 250°F in the shortest possible time.

Solution: By formula (10), $Q_u = (270 \times .57 \times .198) + .12(400 \times .198) = 40$ pounds of condensate. Using safety factor of 5 recommended for fast warm-up and assuming 5 minutes as the time required to complete the reaction, a trap capacity of $40 \times 12 \times 5 = 2400$ lbs/hr is required.

INDIRECT STEAM CONTACT HEATING

Cylinder Dryers, Drum Dryers, Rotary Steam Tube Dryers, Calenders; etc.

$$(11) Q_h = \frac{970 (W - D)}{L} + W_h X$$

Recommended Safety Factors

For Siphon or Bucket Drained Rotating Cylinder, Drum and Steam Tube Dryers; Cylinder Ironers; etc.

Small or medium Size,	
Slow Rotation	4

Small or Medium Size,	
Fast Rotation	6
Large Size, Slow Rotation	6
Large Size, Fast Rotation	8

For Siphon or Bucket Drained Equipment, specify traps with "Steam Lock Release Valve". Each cylinder should be individually trapped.

For Gravity Drained Chest Type Dryers and Ironers

Each Chest Individually Trapped...	2
Entire Machine Drained By Single Trap	4 to 6
Depending on number of Chests	

For Platen Presses

Each Platen Individually Trapped ...	2
*Entire Press Drained by Single Trap, Platens Piped in Series	3
*Entire Press Drained by Single Trap, Platens Piped in Parallel	4 to 6
Depending on number of Platens	

Example: A medium size rotary steam tube dryer with condensate lifted to a discharge passage in the trunion, dries 4000 lbs/hr of granular material to 3300 pounds, with 15 PSIG steam, initial temperature of material 70°F, final temperature 250°F.

Solution: By formula (11) $Q_h =$

$$\frac{970 (4000 - 3300)}{945} + (4000 \times .191)$$

$= 1483$ lbs/hr. Using safety factor of 4 recommended for medium size, slow rotation: $4 \times 1483 = 5932$ lbs/hr trap capacity required.

**A separate trap for each heating surface (coil, chest, platen, etc.) is recommended for maximum heating efficiency. Sluggish removal of condensate and air is certain when more than one unit is drained by a single trap, resulting in reduced temperatures, slow heating and possible water-hammer damage.*

TABLE A — EFFECT OF BACK PRESSURE ON STEAM TRAP CAPACITY

Back Pressure as Percent of Inlet Pressure	10	20	25	30	40	50	60	70	80	90
Percent Reduction of Trap Capacity	0	0	0	2	5	12	20	30	40	55

TABLE B – SQUARE FEET OF SURFACE PER LINEAL FOOT OF PIPE

Nominal Pipe Size (In.)	1/2	3/4	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	24
Area, Sq. Ft. per Lineal Ft.	.22	.28	.35	.44	.50	.63	.76	.92	1.18	1.46	1.74	2.26	2.81	3.34	3.67	4.19	4.71	5.24	6.28

TABLE C - FACTOR Y - $H(T_s - T_a)/L$ - APPROXIMATE CONDENSING RATE FOR BARE IRON AND STEEL PIPE*

Steam Pressure - PSIG	1	2	5	10	15	20	25	50	75	100	150	200	250	300	350	400	450	500	600
Steam Temperature - °F	215	219	227	239	250	259	267	298	320	338	366	388	406	422	436	448	460	470	489
Latent Heat - BTU/lb	968	966	961	952	945	939	934	911	895	879	856	839	820	804	790	776	764	751	728
Factor Y Cond - lbs/hr/sq.ft.	0.45	0.46	0.49	0.53	0.56	0.59	0.71	0.84	1.02	1.10	1.34	1.47	1.58	1.80	1.91	2.00	2.35	2.46	2.65

*Based on still air at 60F, recommended safety factors compensate for air at other temperatures. Used for steam trap selection only.

TABLE D — FACTOR X = $(T_f - T_i)/L$

Tf-Ti	STEAM PRESSURE - PSIG																			
°F	1	2	5	10	15	20	25	50	75	100	150	200	250	300	350	400	450	500	600	
40	.041	.041	.042	.042	.042	.043	.043	.044	.045	.045	.047	.048	.049	.050	.051	.052	.052	.053	.055	
60	.062	.062	.062	.063	.064	.064	.064	.066	.067	.068	.070	.072	.073	.075	.076	.077	.079	.080	.082	
80	.083	.083	.083	.084	.085	.085	.086	.087	.089	.091	.093	.096	.098	.100	.101	.103	.105	.106	.110	
100	.103	.103	.104	.105	.106	.106	.107	.110	.112	.114	.117	.120	.122	.124	.127	.129	.131	.133	.137	
120	.124	.124	.125	.126	.127	.128	.129	.132	.134	.136	.140	.144	.146	.149	.152	.155	.157	.160	.165	
140	.145	.145	.146	.147	.148	.149	.150	.154	.156	.159	.163	.167	.171	.174	.177	.180	.183	.186	.192	
160	.165	.166	.167	.168	.169	.170	.172	.176	.179	.182	.187	.191	.195	.199	.203	.206	.210	.213	.220	
180			.187	.189	.191	.192	.193	.198	.201	.204	.210	.215	.220	.224	.228	.232	.236	.240	.248	
200				.211	.212	.213	.214	.219	.224	.227	.234	.239	.244	.249	.253	.258	.262	.266	.275	
220						.235	.236	.242	.246	.250	.257	.262	.268	.274	.279	.283	.288	.293	.303	
240								.263	.268	.273	.280	.286	.292	.299	.304	.309	.314	.319	.330	
260									.290	.296	.304	.310	.317	.324	.329	.335	.340	.346	.357	
280									.313	.319	.327	.334	.342	.349	.354	.361	.367	.373	.385	
300											.350	.358	.366	.373	.380	.387	.393	.400	.412	

**TABLE E — FACTOR U, HEAT TRANSFER COEFFICIENTS
BTU/HR/SQ FT/°F TEMP. DIFFERENTIAL**

TYPE OF HEAT EXCHANGER	AVERAGE DESIGN VALUES	
	NATURAL CIRCULATION	FORCED CIRCULATION
STEAM TO WATER	125	300
STEAM TO OIL	20	45
STEAM TO MILK	125	300
STEAM TO PARAFFIN WAX	25	80
STEAM TO SUGAR & MOLASSES SOLUTIONS	75	150

Coefficients shown are suggested average design values. Higher or lower figures will be realized for many conditions. Use for steam trap selection only.

**TABLE F — FACTOR C, APPROXIMATE CONDENSING RATE FOR SUBMERGED SURFACES,
LBS/HR/SQ FT**

HEATING SURFACE	DIFFERENCE BETWEEN STEAM TEMPERATURE AND MEAN WATER TEMPERATURE*											
	25	50	75	100	125	150	175	200	225	250	275	300
IRON OR STEEL	1.6	5	10	17	25	34	45	57	70	84	99	114
BRASS	2.6	8	16	27	40	54	72	91	112	134	158	182
COPPER	3.2	10	20	34	50	68	90	114	140	168	198	228

* Mean water temperature is 1/2 the sum of inlet temperature plus outlet temperature. Table based on heating surfaces submerged in water with natural circulation. Safety factor of 50% has been included to allow for moderate scaling. If surface will remain bright, multiply above figures by 2. Use for steam trap selection only.

SIZING CONDENSATE RETURN LINES

SIZING CONDENSATE RETURN LINES

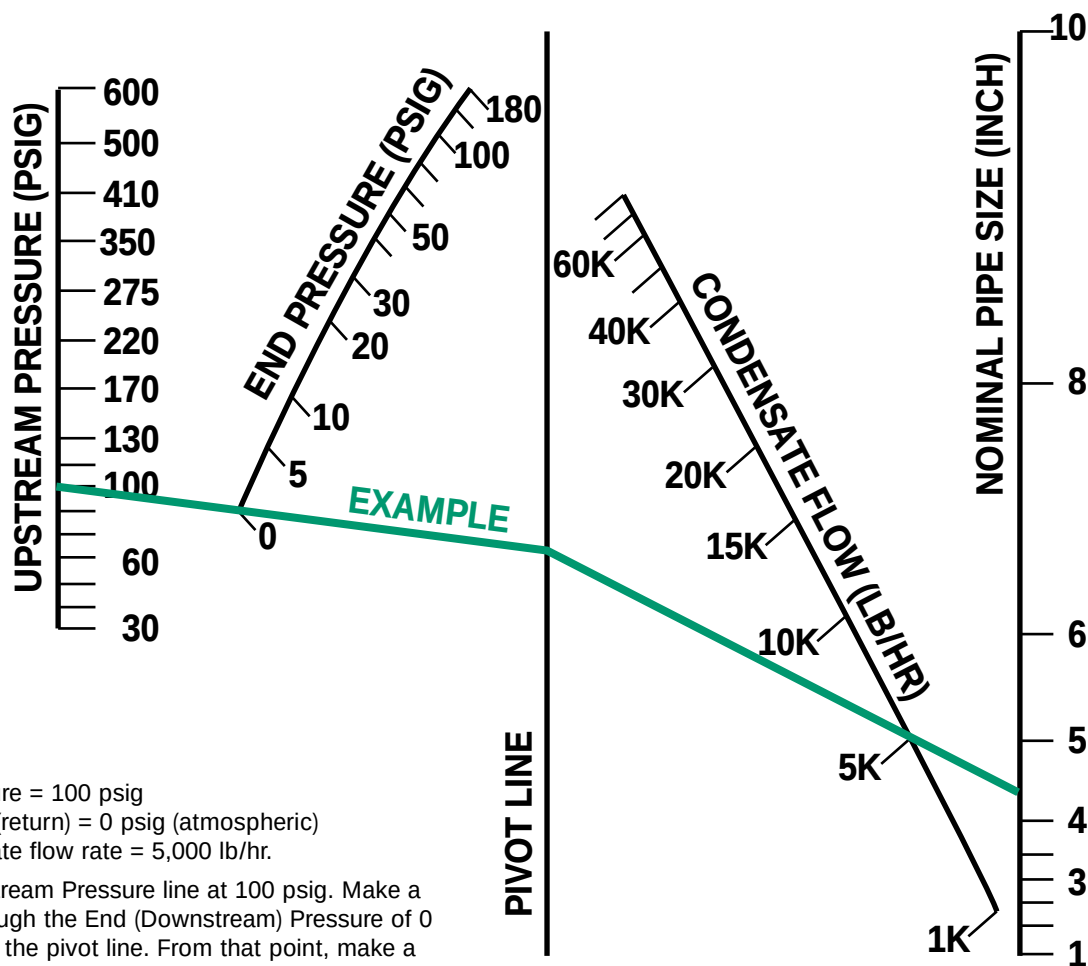
When condensate passes through a steam trap orifice, it drops from the upstream pressure in the heat exchanger to the downstream pressure in the condensate return line. The energy in the upstream condensate is greater than the energy in the downstream condensate. As the condensate passes through the steam trap, the additional energy from the upstream condensate forms a percentage of flash steam that changes

based upon the upstream and downstream pressures (this percentage can be seen in Table 5 in the Condensate Commander section).

When sizing condensate return lines after the steam trap, it is important to take into account the amount of flash steam created when hot, saturated condensate undergoes a pressure drop. The flash steam has very large volume and can cause very high velocities if the return line is not sized properly. These high velocities can create high backpres-

sure in the return line that often leads to poor steam trap performance.

We will size the condensate return line based upon flash steam velocities. The percentage of flash steam versus condensate (water) is usually on the order of 20 to 1, so the effect of the water in the system sizing is usually small. Choosing a velocity of flash steam is often subjective and different manufacturers will suggest different values. The nomograph below sizes return lines based upon 50 feet/second.



EXAMPLE:

Inlet Trap Pressure = 100 psig
Outlet Pressure (return) = 0 psig (atmospheric)
Actual condensate flow rate = 5,000 lb/hr.

Start at the Upstream Pressure line at 100 psig. Make a straight line through the End (Downstream) Pressure of 0 psig and stop at the pivot line. From that point, make a straight line through the Condensate Flow Rate of 5,000 and stop at the Nominal Pipe size line. It intersects slightly higher than 4". You may select the 4" line size without concern for undersizing the line because a low velocity of 50 ft/sec was used.

Note: If design requirements dictate using a velocity other than the 50 ft/sec value in the Nomograph, a ratio can be made of the pipe size because the velocity is proportional to the Pipe Diameter squared. For example, if you require a Pipe Diameter for 80 ft/sec, use the following equation:

$$\text{Nomograph Diameter} \times \sqrt{\frac{50 \text{ FT/SEC}}{\text{New Velocity (FT/SEC)}}}$$

Example: The Nomograph Diameter determined in the previous example is 4.2". Using the above formula, the Pipe Diameter for 80 ft/sec is 3.3".

STEAM TRACING DESIGN GUIDELINES

V.1.1 INTRODUCTION

Steam tracing is one of many ways to preheat, add heat and prevent heat loss from piping systems and their components. Some other ways are:

- ☛ Jacketed piping
- ☛ Hot water and oil tracing
- ☛ Dowtherm tracing

Jacketed piping systems are used primarily to maintain a constant high temperature. Due to its high cost of construction, jacketed systems are seldom used except where temperature control is critical. Hot water and oil must be pumped at a high velocity to maintain a desired temperature, and must have a separate return header as does Dowtherm. Hot water, oil or dowtherm are also an additional system which add to the cost of a plant.

Steam tracing is most often selected because:

- ☛ There is generally available a surplus of low and/or medium pressure steam.
- ☛ Steam has a high latent heat and heat-transfer-coefficient.
- ☛ Steam condenses at a constant temperature.
- ☛ Steam flows to end-point without the aid of pumps (when designed correctly).
- ☛ A small amount of return piping is needed due to existing condensate headers.

V.1.2 USES

Freeze Protection (winterizing)

- ☛ Adding sufficient heat to above-grade piping systems and equipment which are exposed to ambient temperatures below the freezing point of their media prevents freezing.

Maintaining A Desired Temperature

- ☛ The viscosity of some liquids becomes higher as their temperatures become lower causing more difficult and costly pumping and leading to down-time for cleaning.
- ☛ Condensation may occur in some gases if the ambient temperature falls below the dewpoint which is harmful and expensive in such systems as:
 - Natural Gas where control valves freeze up and burners malfunction.
 - Compressor Suction Lines where compressors can be damaged.

V.1.3 MATERIAL

Steam tracing material is normally as follows:

- Use the material specified for steam piping from the steam header (through the distribution manifold, if applicable) to and including the tracer block valve.
- Use 1/4" through 7/8" O.D. copper or stainless steel tubing (depending on the design conditions) from the block valve to the steam trap. Though sizes may vary with different applications, 3/8" and 1/2" O.D. are the most often used. Tube fittings and adapters are normally flareless compression type or 37 degree flared type.
- Use the material specified for condensate piping from the steam trap (through the collection manifold, if applicable) to the condensate header or end-point (drain or grade).

V.1.4 DESIGN GUIDELINES

1. Steam piping should be run within 12" of the line or equipment being traced to minimize exposed tubing.
2. Spiral tracing should be limited to vertical piping using multiple tracers on horizontal lines which require more heat.

3. Tracers should be designed so that the flow is always down. **Avoid pockets! !** Where vertical flow is unavoidable, steam pressure should be a minimum of 25 PSIG for every 10' of rise.
4. Tracers should be a maximum of 100' long and continuous from the supply to the collection manifold or endpoint. For lines over 100' long, provide another tracer and overlap the two 3 inches to avoid cold spots.
5. Tracers should have no branch tees except as indicated in *Section V.3*.
6. Provide each tracer with a separate strainer and steam trap.
7. Manifolds can be horizontal or vertical depending upon the design conditions.
8. Tracers should be attached to the pipe at 8" to 10" maximum intervals with stainless steel wire. Wire tension should be sufficient to hold the tracer secure and flush against the pipe.
9. Some piping materials, such as lined pipe, might require spacer blocks to avoid "hot spots".
10. Tracer loops with unions are necessary:
 - ☛ when joining tubing lengths.
 - ☛ at all break flanges and unions.
 - ☛ at all flanged valves.
11. Tracer discharge lines should be as short as possible since long discharge lines can freeze even with a fully functioning steam trap.

CLEAN STEAM DESIGN GUIDELINES

Clean Steam is a general term used to describe a range of steam pureness. It may be generated by such methods as:

- Filtration of plant steam typically requiring the removal of particles larger than 5 microns
- An independent steam generator. E.g. Stainless steel reboiler fed with distilled water.
- One stage of a multi-effect still within the overall water purification system.

Uses for Clean Steam vary by industry, however typical applications include:

- In-line sterilization of storage tanks and equipment
- Powering sterilizers and autoclaves
- Cleaning and sterilizing process piping systems without disassembling the piping system - commonly known as CIP (Clean in Place)
- Pasteurization utilizing Ultra High Temperature Processing (UHT)

The highest quality clean steam however, is typically used by the Pharmaceutical and Biotechnical industries. This steam, occasionally referred to as "Pure Steam", is most often supplied by an independent steam generator utilizing Water for Injection (WFI) as feed water. WFI is typically produced by a Reverse Osmosis (RO) generator

and then distilled thus removing any traces of organics, bacteria, and pyrogens. Pure steam is required for the sterilization of cell culture processing equipment such as incubators where contaminants could adversely affect cell growth. Other uses include pharmaceutical manufacture and direct steam injection pasteurization where contaminants could collect in products intended for human consumption.

Clean steam produced from high purity make up water is highly corrosive due to the minimal ion content. High purity water, pure steam and the resultant condensate will aggressively attempt to absorb or leach ions from their environment to achieve a more natural balance. Additionally, chemicals used to passivate steam and condensate in conventional systems are generally prohibited from clean steam system as such chemicals could contaminate or alter sensitive end products. Should corrosion begin, the oxidation byproducts may travel through the steam system catalyzing corrosion throughout in a process known as 'rouging'.

To combat the corrosive nature of clean steam, design practices require piping, fittings and valving to be comprised of corrosion resistant materials. Current industry accepted materials include

304L, 316 and 316L stainless steel and higher alloys such as Inconel. While these materials have proven themselves in practice, it should be noted that there are currently no U.S. governmental standards specifying materials for clean steam service. Regulatory agencies concern themselves with the purity and quality of the product, leaving the design standards entirely up to the manufacturer.

In addition to the use of corrosion resistant materials in sanitary systems, features designed to inhibit bacterial growth are often required. Piping, valves and fittings should be free draining and maintain industry standard surface finishes. Free draining valves and fittings are designed not to retain or 'Puddle' condensate when installed correctly. After shut down of the steam system, any puddled condensate could potentially promote bacterial growth. Inadequate surface finishes reduce the effectiveness of system sterilization techniques, increasing the possibility of bacterial contamination. Industry standard surface finishes are measured in micro inches, the lower the number the smoother, and are expressed as an arithmetic average (Ra). Typical industry specified surface finishes range from 32 to 10 µ in. Ra.

PIPING & TRAPPING DESIGN GUIDELINES

1. Extra care should be taken for expansion stresses due to the higher coefficient of expansion for stainless steel.
2. Branch connections are to be made from the top of headers with the block valve as close as possible to the header.
3. The recommended types of branch connections are tees and reducing tees.
4. Steam lines should slope down to traps (recommended 1% min.).
5. A dirt leg with trap station is recommended at every change of elevation (no undrainable pockets).
6. Extra care should be taken in pipe supports to eliminate sagging.
7. Instruments in general should be kept to a minimum. However, where required, it is recommended that:
 - A) All are installed in tees.
 - B) Pressure gauges be installed with diaphragm seals.
 - C) Flow meters be installed in the vertical flow-up position to eliminate pockets
 - D) Pressure reducing stations be kept to a minimum.
8. Traps should be installed in the vertical flow-down position to eliminate pockets.
9. Trap block valves should be located as close as possible to the user.
10. Condensate lines should be sloped (recommended 1% min.) to the end point. Note that contaminated condensate should always be piped to a process sewer. Uncontaminated condensate (from drip legs) may be recovered, if cost effective, and used elsewhere in the plant (not as Clean Steam make-up).
11. Condensate terminal points should contain an air break (2" or 2 pipe diameters, whichever is greater) between the end of the pipe and the drain, floor or grade.
12. Test connections for traps are recommended-trap efficiency is essential for Clean Steam.

SIZING ELIMINATOR STEAM SEPARATORS

SIZING FOR STEAM APPLICATIONS

Using your system pressure and capacity, select a size from the Pressure Drop Tables below that will yield a pressure drop in **boldface** type. This will provide the most efficient separation with velocities between 30 and 100 ft/s for sizes up to 2½" and between 30 and 90 ft/s for sizes 3" and above.

EXAMPLE

For a system under 400 PSIG with a capacity of 500#/hr, a 1½" or 3/4" separator is recommended.

- A 1½" separator will provide a 1.86 PSIG pressure drop.
- A 3/4" separator will provide a 0.59 PSIG pressure drop.

ELIMINATOR PRESSURE DROP TABLES – STEAM

1/2 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
100	0.71	0.45	0.33	0.26	0.15	0.1	0.07	0.06	0.05
200	2.83	1.8	1.32	1.05	0.62	0.39	0.3	0.24	0.2
300	6.37	4.04	2.97	2.36	1.39	0.88	0.67	0.54	0.46
400	11.33	7.18	5.28	4.19	2.47	1.56	1.19	0.96	0.81
500	17.7	11.22	8.26	6.55	3.86	2.44	1.86	1.5	1.27
600	25.49	16.16	11.89	9.43	5.55	3.52	2.69	2.16	1.82

1 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
300	0.76	0.48	0.35	0.28	0.17	0.1	0.08	0.06	0.05
500	2.11	1.34	0.98	0.78	0.46	0.29	0.22	0.18	0.15
700	4.13	2.62	1.93	1.53	0.9	0.57	0.44	0.35	0.3
900	6.83	4.33	3.19	2.53	1.49	0.94	0.72	0.58	0.49
1100	10.21	6.47	4.76	3.78	2.22	1.41	1.08	0.87	0.73
1300	14.26	9.04	6.65	5.27	3.11	1.97	1.5	1.21	1.02
1500	18.98	12.03	8.85	7.02	4.14	2.62	2	1.61	1.36

1-1/2 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
400	0.24	0.15	0.11	0.09	0.05	0.03	0.03	0.02	0.02
500	0.37	0.24	0.17	0.14	0.08	0.05	0.04	0.03	0.03
1000	1.49	0.95	0.7	0.55	0.33	0.21	0.16	0.13	0.11
2000	5.98	3.79	2.79	2.21	1.3	0.82	0.63	0.51	0.43
3000	13.45	8.52	6.27	4.97	2.93	1.86	1.42	1.14	0.96
4000	23.91	15.16	11.15	8.84	5.21	3.3	2.52	2.03	1.71

2-1/2 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
1000	0.27	0.17	0.12	0.1	0.06	0.04	0.03	0.02	0.02
2000	1.07	0.68	0.5	0.39	0.23	0.15	0.11	0.09	0.08
3000	2.4	1.52	1.12	0.89	0.52	0.33	0.25	0.2	0.17
4000	4.27	2.71	1.99	1.58	0.93	0.59	0.45	0.36	0.31
5000	6.68	4.23	3.11	2.47	1.45	0.92	0.7	0.57	0.48
6000	9.61	6.09	4.48	3.55	2.09	1.33	1.01	0.82	0.69
7000	13.08	8.29	6.1	4.84	2.85	1.81	1.38	1.11	0.94

4 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
4000	0.6	0.38	0.28	0.22	0.13	0.08	0.06	0.05	0.04
6000	1.34	0.85	0.63	0.5	0.29	0.19	0.14	0.11	0.1
8000	2.39	1.51	1.11	0.88	0.52	0.33	0.25	0.2	0.17
10000	3.73	2.37	1.74	1.38	0.81	0.51	0.39	0.32	0.27
12000	5.37	3.41	2.51	1.99	1.17	0.74	0.57	0.46	0.38
14000	7.32	4.64	3.41	2.71	1.59	1.01	0.77	0.62	0.52
16000	9.55	6.06	4.46	3.53	2.08	1.32	1.01	0.81	0.68

3/4 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
100	0.22	0.14	0.1	0.08	0.05	0.03	0.02	0.02	0.02
200	0.89	0.57	0.42	0.33	0.19	0.12	0.09	0.08	0.06
300	2.01	1.27	0.94	0.74	0.44	0.28	0.21	0.17	0.14
400	3.57	2.26	1.66	1.32	0.78	0.49	0.38	0.3	0.25
500	5.57	3.53	2.6	2.06	1.21	0.77	0.59	0.47	0.4
600	8.02	5.09	3.74	2.97	1.75	1.11	0.85	0.68	0.57

1-1/4 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
500	0.69	0.44	0.32	0.26	0.15	0.1	0.07	0.06	0.05
750	1.56	0.99	0.73	0.58	0.34	0.22	0.16	0.13	0.11
1100	3.36	2.13	1.57	1.24	0.73	0.46	0.35	0.29	0.24
1250	4.34	2.75	2.02	1.6	0.95	0.6	0.46	0.37	0.31
1500	6.25	3.96	2.91	2.31	1.36	0.86	0.66	0.53	0.45
1750	8.5	5.39	3.97	3.14	1.85	1.17	0.9	0.72	0.61
2000	11.11	7.04	5.18	4.11	2.42	1.53	1.17	0.94	0.79

2 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
1000	0.54	0.34	0.25	0.2	0.12	0.07	0.06	0.05	0.04
2000	2.17	1.37	1.01	0.8	0.47	0.3	0.23	0.18	0.16
3000	4.88	3.09	2.28	1.8	1.06	0.67	0.51	0.41	0.35
4000	8.67	5.5	4.04	3.21	1.89	1.2	0.91	0.74	0.62
5000	13.55	8.59	6.32	5.01	2.95	1.87	1.43	1.15	0.97
6000	19.51	12.37	9.1	7.22	4.25	2.69	2.06	1.66	1.4

3 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
2000	0.45	0.28	0.21	0.17	0.1	0.06	0.05	0.04	0.03
4000	1.79	1.13	0.83	0.66	0.39	0.25	0.19	0.15	0.13
6000	4.02	2.55	1.87	1.49	0.88	0.55	0.42	0.34	0.29
8000	7.15	4.53	3.33	2.64	1.56	0.99	0.75	0.61	0.51
10000	11.17	7.08	5.21	4.13	2.43	1.54	1.18	0.95	0.8
12000	16.08	10.19	7.5	5.95	3.5	2.22	1.69	1.37	1.15
14000	21.89	13.87	10.21	8.09	4.77	3.02	2.31	1.86	1.56

6 INCH ELIMINATOR

#/HR	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
5000	0.18	0.11	0.08	0.07	0.04	0.02	0.02	0.02	0.01
10000	0.72	0.46	0.33	0.27	0.16	0.1	0.08	0.06	0.05
15000	1.62	1.02	0.75	0.6	0.35	0.22	0.17	0.14	0.12
20000	2.87	1.82	1.34	1.06	0.63	0.4	0.3	0.24	0.21
25000	4.49	2.85	2.09	1.66	0.98	0.62	0.47	0.38	0.32
30000	6.46	4.1	3.01	2.39	1.41	0.89	0.68	0.55	0.46
35000	8.8	5.58	4.1	3.25	1.92	1.21	0.93	0.75	0.63

SIZING ELIMINATOR STEAM SEPARATORS

SIZING FOR AIR APPLICATIONS

Using your system pressure and capacity, select a size from the Pressure Drop Tables below that will yield a pressure drop in **boldface** type. This will provide the most efficient separation with velocities between 8 and 60 ft/s for sizes up to 2½" and between 8 and 50 ft/s for sizes 3" and above.

EXAMPLE

For a system under 400 PSIG with a capacity of 500 SCFM, a 2" or 2½" separator is recommended.

- A 2" separator will provide a 0.12 PSIG pressure drop.
- A 2½" separator will provide a 0.06 PSIG pressure drop.

ELIMINATOR PRESSURE DROP TABLES – AIR

1/2 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
10	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0
20	0.27	0.17	0.12	0.09	0.05	0.03	0.03	0.02	0.02
30	0.61	0.37	0.27	0.21	0.11	0.08	0.06	0.05	0.04
40	1.08	0.66	0.48	0.37	0.2	0.14	0.1	0.08	0.07
50	1.69	1.03	0.75	0.58	0.31	0.21	0.16	0.13	0.11
60	2.43	1.49	1.07	0.84	0.45	0.31	0.23	0.19	0.16

1 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
25	0.05	0.03	0.02	0.02	0.01	0.01	0	0	0
50	0.2	0.12	0.09	0.07	0.04	0.03	0.02	0.02	0.01
75	0.45	0.28	0.2	0.16	0.08	0.06	0.04	0.03	0.03
100	0.8	0.49	0.36	0.28	0.15	0.1	0.08	0.06	0.05
125	1.26	0.77	0.56	0.43	0.23	0.16	0.12	0.1	0.08
150	1.81	1.11	0.8	0.63	0.33	0.23	0.17	0.14	0.12

1-1/2 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
50	0.04	0.02	0.02	0.01	0.01	0	0	0	0
100	0.14	0.09	0.06	0.05	0.03	0.02	0.01	0.01	0.01
150	0.32	0.2	0.14	0.11	0.06	0.04	0.03	0.02	0.02
200	0.57	0.35	0.25	0.2	0.11	0.07	0.05	0.04	0.04
250	0.89	0.55	0.39	0.31	0.16	0.11	0.09	0.07	0.06
300	1.28	0.79	0.57	0.44	0.24	0.16	0.12	0.1	0.08

2-1/2 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
100	0.03	0.02	0.01	0.01	0	0	0	0	0
250	0.16	0.1	0.07	0.06	0.03	0.02	0.02	0.01	0.01
500	0.64	0.39	0.28	0.22	0.12	0.08	0.06	0.05	0.04
750	1.43	0.88	0.63	0.5	0.26	0.18	0.14	0.11	0.09
1000	2.54	1.56	1.13	0.88	0.47	0.32	0.24	0.2	0.16
1250	3.97	2.44	1.76	1.38	0.73	0.5	0.38	0.31	0.26

4 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
250	0.02	0.01	0.01	0.01	0	0	0	0	0
500	0.09	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01
1000	0.36	0.22	0.16	0.12	0.07	0.04	0.03	0.03	0.02
1500	0.8	0.49	0.35	0.28	0.15	0.1	0.08	0.06	0.05
2000	1.42	0.87	0.63	0.49	0.26	0.18	0.14	0.11	0.09
2500	2.22	1.36	0.98	0.77	0.41	0.28	0.21	0.17	0.14

3/4 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
10	0.02	0.01	0.01	0.01	0	0	0	0	0
25	0.13	0.08	0.06	0.05	0.02	0.02	0.01	0.01	0.01
50	0.53	0.33	0.23	0.18	0.1	0.07	0.05	0.04	0.03
70	1.04	0.64	0.46	0.36	0.19	0.13	0.1	0.08	0.07
90	1.72	1.05	0.76	0.59	0.32	0.22	0.16	0.13	0.11
110	2.57	1.58	1.14	0.89	0.47	0.32	0.25	0.2	0.17

1-1/4 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
50	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0
100	0.26	0.16	0.12	0.09	0.05	0.03	0.03	0.02	0.02
150	0.59	0.37	0.26	0.21	0.11	0.08	0.06	0.05	0.04
200	1.06	0.65	0.47	0.37	0.2	0.13	0.1	0.08	0.07
250	1.65	1.01	0.73	0.57	0.31	0.21	0.16	0.13	0.11
300	2.38	1.46	1.05	0.82	0.44	0.3	0.23	0.18	0.15

2 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
100	0.05	0.03	0.02	0.02	0.01	0.01	0	0	0
200	0.21	0.13	0.09	0.07	0.04	0.03	0.02	0.02	0.01
300	0.46	0.29	0.21	0.16	0.09	0.06	0.04	0.04	0.03
400	0.83	0.51	0.37	0.29	0.15	0.1	0.08	0.06	0.05
500	1.29	0.79	0.57	0.45	0.24	0.16	0.12	0.1	0.08
600	1.86	1.14	0.82	0.64	0.34	0.23	0.18	0.14	0.12

3 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
200	0.04	0.03	0.02	0.01	0.01	0.01	0	0	0
400	0.17	0.1	0.08	0.06	0.03	0.02	0.02	0.01	0.01
600	0.38	0.23	0.17	0.13	0.07	0.05	0.04	0.03	0.02
800	0.68	0.42	0.3	0.24	0.13	0.09	0.07	0.05	0.04
1000	1.06	0.65	0.47	0.37	0.2	0.13	0.1	0.08	0.07
1200	1.53	0.94	0.68	0.53	0.28	0.19	0.15	0.12	0.1

6 INCH ELIMINATOR

SCFM	PRESSURE (PSIG)								
	25	50	75	100	200	300	400	500	600
500	0.02	0.01	0.01	0.01	0	0	0	0	0
1000	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0
2000	0.27	0.17	0.12	0.09	0.05	0.03	0.03	0.02	0.02
3000	0.62	0.38	0.27	0.21	0.11	0.08	0.06	0.05	0.04
4000	1.09	0.67	0.48	0.38	0.2	0.14	0.1	0.08	0.07
5000	1.71	1.05	0.76	0.59	0.32	0.22	0.16	0.13	0.11

NOTES:

Applications

- Steam Systems (up to 1500 PSIG superheat)
- Dowtherm
- Process Fluids & gases to 3000 PSIG CWP (ie: Acids, Caustics Nitrogen, etc.)
- Manifolds on Steam Traps, Valves, Pumps & Compressors
- Nuclear Power Plants
- Hydraulic Fluids/ Hot Oils

UNIFLEX Carbon/ Stainless Steel Pipe Couplings

**Pressures To 3000 PSIG
Temperatures to 850°F**

Reduced Energy Costs

Spiral wound gasket assures long life and leak tight seal.

Accepted where Standard Unions are Inadequate

Seal equivalent to flange connections meets fugitive emissions needs.

Suitable for Most Services

Carbon steel and 316L stainless steel housings and a variety of gasket materials available to meet demands of most applications.

No Welding Damage to Seal

Because seal is installed after welding, the danger of damaging seal is eliminated.

Sizes to Meet Most Requirements

Available in 1/2" to 2", socketweld or threaded for a wide variety of piping needs.

Reduced Labor Costs

No need to replace union housing or spring pipe during make-up or disassembly which reduces time by more than 60%.

Reduced Cost of Materials

Only a change of gasket is required when disassembled.

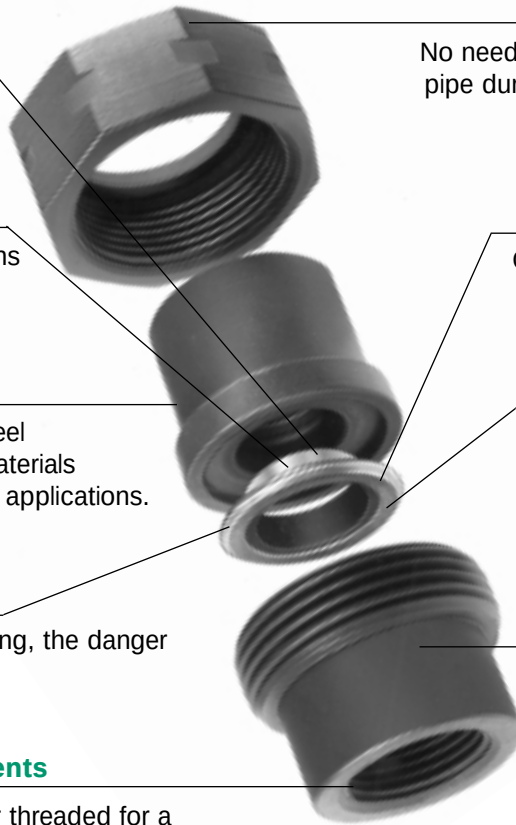
Reduced Dollars in Inventory

Only a few gasket kits required. Components may be stocked and replaced individually because mated parts are not needed.

Components Interchangeable

All components within each size class are fully interchangeable. End connections can be socket weld, threaded or a combination of both.

Meets MSS-SP-83 for 3000 pound unions.



SECTION VII

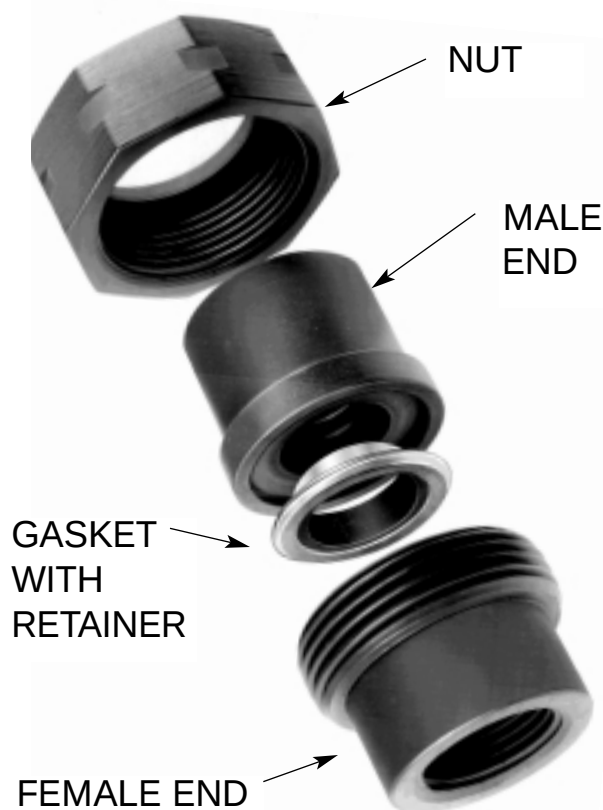
UNIFLEX

COUPLINGS &

GENERAL USE

VALVES

UNIFLEX COUPLINGS &
GENERAL USE VALVES



APPLICATIONS

- Steam Systems—up to 1500 PSIG Superheat
- Dowtherm
- Variety of process fluids and gases to 3000 PSIG CWP, i.e.: Acids, Caustics, Nitrogen, etc.
- Steam Trap, Valve, Pump & Compressor Manifolds
- Nuclear Power Plants
- Hydraulic Fluids/Hot Oils

OPTIONS

- Teflon Gasket Filler
- Type 347 SS, Type 316 SS, Monel, Inconel 600, Hastalloy, Nickel Gasket Windings (other materials available on request)

Canadian Registration # 0A0583.9C

OPERATION

The Uniflex Pipe Coupling (SUA) has successfully solved frequent leakage, intensive maintenance and stocking difficulties associated with ground joint-pipe unions.

The SUA is a modified forged steel or stainless steel pipe union utilizing a Spiral-Wound Gasket

UNIFLEX STEEL/STAINLESS PIPE COUPLINGS

Pressures To 3000 PSIG (207 barg)

Temperatures to 850°F (454°C)

No Energy Losses — from expensive steam and process fluid leaks. A spiral-wound gasket ensures a leak-tight seal.

Lower Maintenance/Labor Costs — Replacement of the union housing is eliminated. Only a change of gasket is required when the Uniflex Coupling is disassembled. No need to spring the pipe during make-up or disassembly. It is less costly to make and break than flanges.

Lower Inventory Costs — Only a few Uniflex Pipe Couplings and gasket kits in each size are required to back up installations. One Uniflex satisfies all pressure series of flanges in pipe sizes 1/2" to 2".

Ease of Installation — The gasket is held firmly in place with a patented retainer. There is no danger of damaging the seal during installation as it is fully protected from overtorquing.

Welded Piping Systems — With the gasket removed while welding coupling into the piping, the danger of damaging the seal is eliminated. Costly removal of sections of pipe to replace leaky unions is eliminated.

Component Interchangeability — All components of the Uniflex Couplings, in each size class, are fully interchangeable. End connections can be socket weld, threaded, or a combination of both.

MODELS

- **SUA-T**—Threaded Carbon Steel
- **SUA-SW**—Socketweld Carbon Steel
- **SUASS-T**—Threaded Stainless Steel
- **SUASS-SW**—Socketweld Stainless Steel
- **SUG**—Gasket Kit includes 10 gaskets.
- **SUGR**—Gasket Kit includes 10 gaskets and 10 retaining rings

Call or visit our website for *FREE* sample and cost savings spreadsheet.

Installation Tip: Use UNIFLEX in all Regulator and Trap Stations through 2" to simplify future changeouts.

to provide a leak-tight joint. This design, similar in principle to flange joints, has been proven in the field for many years. Because the joint seal is formed by the replaceable gasket (not a ground joint finish), failures caused by poor mating surfaces are eliminated. Components may be stocked and replaced individually because mated parts are not required for sealing.

UNIFLEX STEEL/STAINLESS PIPE COUPLINGS

SPECIFICATION

Union shall be of the straight-through design with connections oppositely aligned, suitable for either horizontal or vertical piping installations. Union shall meet standards of MSS SP-83 for 3000 lb. unions. Connections shall be either screwed or socketweld and union shall have threaded nut. Gasket shall be of the spiral wound design and a retainer shall be utilized to locate and hold gasket during installation.

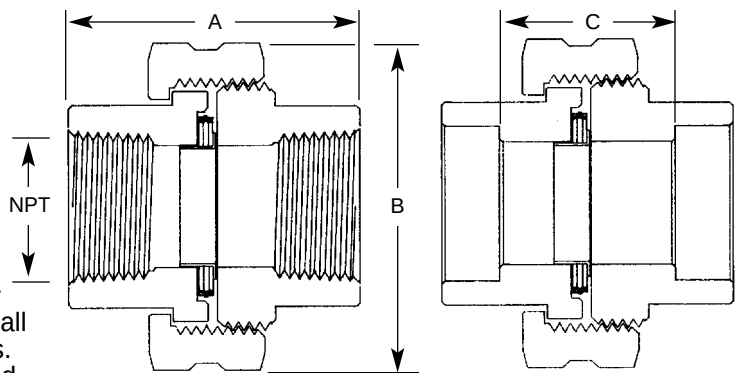
Union housing shall be forged steel ASTM A105 and have a pressure rating of 3000 PSIG at 100°F or type 316L stainless steel and have a pressure rating of 2430 PSIG at 100°F. Gasket winding shall be type 304 stainless steel with filler material of graphite. Gasket retainer shall be of type 316 stainless steel.

MAXIMUM OPERATING CONDITIONS

PMO: Max. Operating Pressure see Chart
TMO: Max. Operating Temperature see Chart

MATERIALS OF CONSTRUCTION

Housing: Forged Carbon Steel, ASTM-A-105 or Type 316L SS
Gasket: Spiral wound 304 Stainless w/graphite filler
Gasket Retainer: Type 316 Stainless Steel



Uniflex Model SUA-T

Uniflex Model SUA-SW

Connections:
1/2"-2" NPT or socketweld

Dimensions

Pipe Size	Inches (mm)			Weight Lbs (kg)
	A	B	C	
1/2"	2.0 (51)	1.8 (46)	.9 (24)	0.8 (.36)
3/4"	2.2 (56)	2.2 (56)	1.1 (29)	1.2 (.55)
1"	2.4 (62)	2.6 (65)	1.1 (29)	1.6 (.73)
1 1/4"	2.8 (71)	3.0 (77)	1.4 (35)	2.5 (1.2)
1 1/2"	3.0 (76)	3.4 (86)	1.5 (38)	3.3 (1.5)
2"	3.4 (86)	4.1 (103)	1.6 (41)	4.7 (2.2)

Average weights listed—actual weights may vary slightly

Temperature/Pressure Ratings†

Temperature	Pressure (PSIG) Carbon Steel	Pressure (PSIG) 316L SS
100°F	3000 (-20°F*)	2430 (-325°F*)
200°F	2735	2050
300°F	2655	1835
400°F	2565	1670
500°F	2425	1545
600°F	2220	1460
700°F	2155	1390
800°F	—	1330
850°F	—	1300

*Minimum recommended temperature

†For 3000 lb. unions from MSS SP-83.

SPENCE STRAINERS INTERNATIONAL

Manufactured by Spence Engineering Company, Inc.



STRAINERS



capabilities



state-of-the-art



cast products

Y-STRAINERS	381
BASKET STRAINERS.....	439
SUCTION DIFFUSERS	489
TRIPLE DUTY VALVES	498
DOUBLE DOOR CHECK VALVES	521
WAFER SILENT CHECK VALVES	541
FLANGED SILENT CHECK VALVES	555
FOOT VALVES.....	*
BUTTERFLY VALVES	565
PNEUMATIC ACTUATORS	*
CONNECTORS	*

fabricated products

AUTOMATIC STRAINERS.....	*
Y-STRAINERS	424
BASKET STRAINERS.....	456
T-STRAINERS.....	475
DUPLEX STRAINERS	*
SUCTION DIFFUSERS	494

screens

TEMPORARY STRAINERS.....	505
CUSTOM SCREENS.....	*

*consult factory



STRAINERS



The finished goods inventory of the SSI warehouse contains one of the industry's broadest inventory of cast Y and basket strainers, butterfly valves, triple duty valves, suction diffusers, check valves, foot valves and connectors which ensures quick or same day shipment delivery of its standard products.

The SSI manufacturing facility has the most up-to-date equipment and qualified staff. State-of-the art, computer controlled, automated machining equipment, such as our programmable plasma cutters and CNC machines, greatly reduce manufacturing time, improve quality of components and ensure conformance to our customers requirements.

SSI will design and fabricate strainers, from a variety of metals and alloys, to meet your exact application needs. All of its Welders are ASME Section IX certified and are dedicated to providing you with the highest quality possible.

Cell manufacturing practices translates into smoother, more efficient workflow, improved quality control. This means cost saving and quality assurance for each product.

And, because SSI is ISO-2000, PED and soon to be ASME "U" and "UM" Stamp Certified, they offer 100% testing and inspection to ensure that every product performs to design specifications before leaving the factory.



warehouse

SECTION VIII

STRAINERS

NOTES:

STRAINERS

Applications

- Process Industry
- Power Industry
- Chemical Industry
- Oil and Gas
- Metals and Mining
- Water and Waste
- Pulp and Paper

“Y” Strainers

**Pressures to 3705 PSIG
Temperatures to 800°F**

FEATURES

- Low pressure drop streamlined design
- Large strainer screens
- Compact end to end dimension
- Cast or Fabricated Construction

END CONNECTIONS

- Flat Faced
- Raised Face
- RTJ Flanged
- Butt weld
- Threaded (NPT)
- Socket weld
- Sweat

MATERIALS

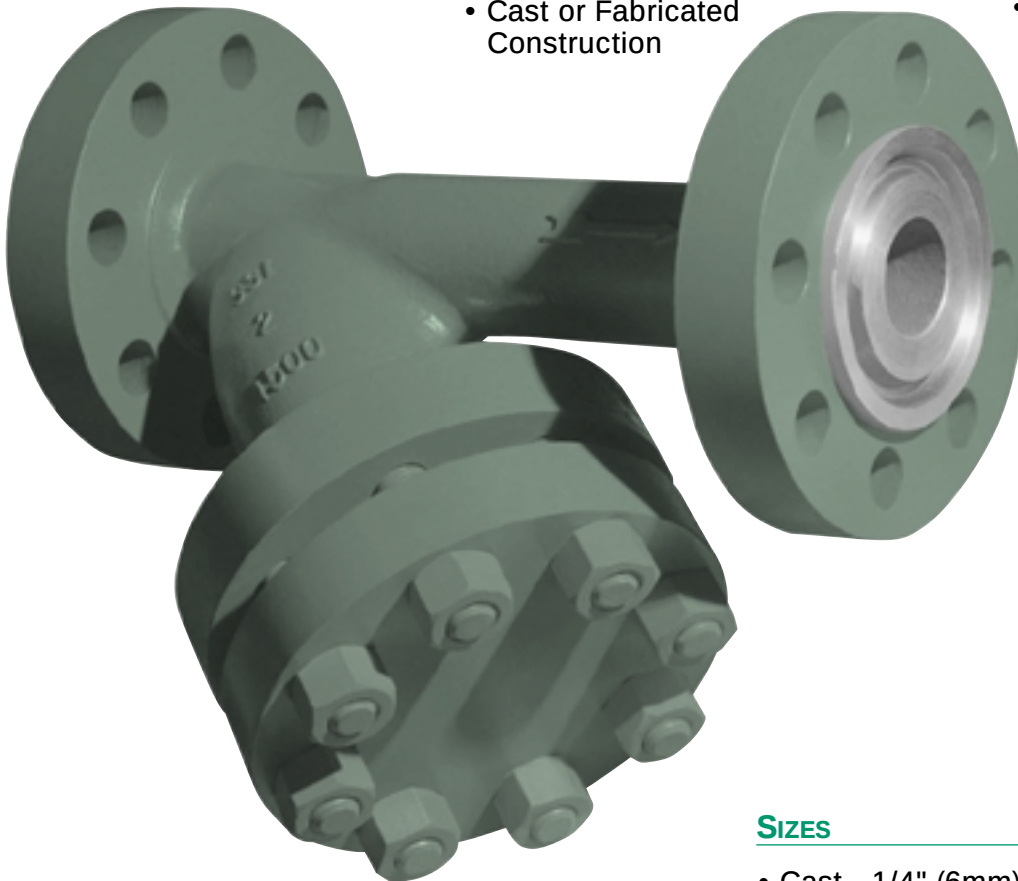
- Cast Iron
- Ductile Iron
- Bronze
- Carbon Steel
- Low Temp Steel
- Chrome Molly
- Stainless Steel
- Other Materials Upon Request

SIZES

- Cast - 1/4" (6mm) up to 16" (400mm)
- Fabricated - Custom sizes to meet any requirements

RATINGS

- ANSI 125 psig
- ANSI 150 psig
- ANSI 300 psig
- ANSI 600 psig
- ANSI 900 psig
- ANSI 1500 psig
- ANSI 2500 psig



**Y STRAINERS
FEATURES**

Y STRAINER DESIGN FEATURES

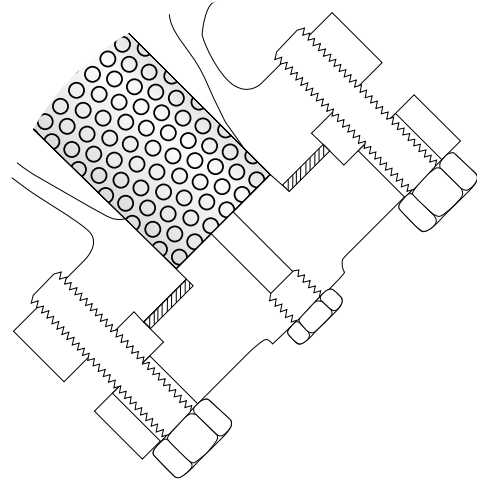
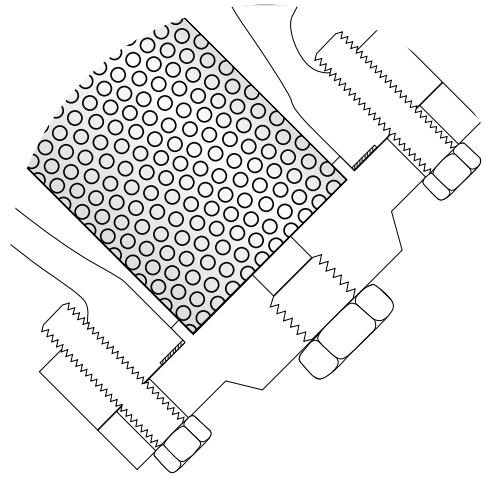
BODY-COVER FLANGED JOINTS

Flanged body-cover joints are designed to meet the requirements of ASME Section VIII, Div. 1 and/or ASME B16.5.

For Series 150Y2 and 300Y2 strainers, the body-cover joint is designed using the equations found in Appendix II of the ASME Pressure Vessel Code. Calculations are performed using standard gaskets and with the existence of a edge moment. The gasket cavity is fully enclosed ensuring proper gasket alignment while preventing unwinding of spiral wound gaskets if used.

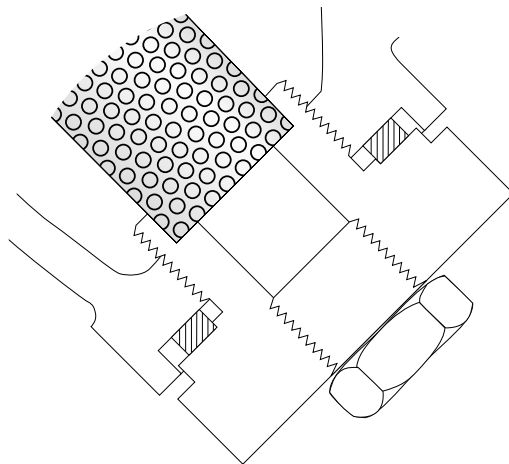
Exclusive

Series 600Y2, 900Y2 and 1500Y2 strainers incorporate a body-cover joint that is in dimensional accordance with the flange dimensions specified in ASME B16.5. Among the advantages of this strong leak-proof design is the convenience of using gaskets that are in accordance with ASME B16.20 and ASME B16.21. This feature eliminates the need for dimensionally special gaskets when maintenance is performed.



BODY-COVER THREADED JOINTS

The design of a strong threaded body-cover joint is dependent on many factors. When designing these joints for strainers, calculations are performed taking into account thread shear (ASME B16.34), cover thickness and operating/gasket seating loads (ASME Sect. VIII, Div. 1). Basic dimensions such as wall thickness and band diameters are in accordance with ASME codes.



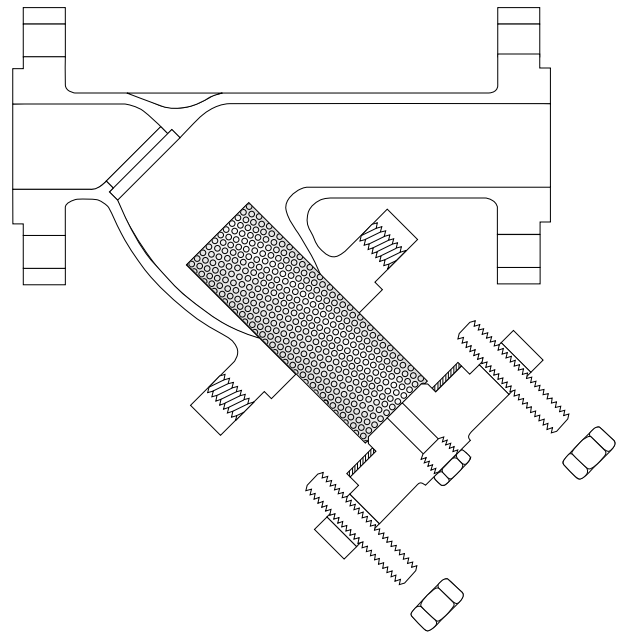
Y STRAINER DESIGN FEATURES

SCREEN SEATING

All Spence Y-Strainers are manufactured with both upper and lower machined seats. This feature eliminates debris by-pass while also acts to securely hold the screen in position when in service.

For assembly and disassembly purposes, Spence Y-Strainers are designed so that the screen is securely slid over or into a machined lip on the cover bonnet. This allows the screen to be easily guided into the upper machined seat during assembly.

In particular, for Series 600Y2, 900Y2 and 1500Y2 strainers, where the cover flange tends to be heavy and difficult to maneuver, the screen is also guided around it's circumference by the strainer body. This feature eliminates the possibility of misaligning the strainer screen during assembly while providing additional support to the screen when in service. This circumferential support reduces maintenance time and costs since the strainer can be assembled quicker and safer than with other designs.



STRAINER SCREENS

All Spence Y-Strainers are equipped with screens that have an open flow area many times greater than the pipe nominal cross-sectional area. This is important in order to reduce initial pressure drop and decrease the rate in which the pressure drop increases as the strainer screen becomes clogged. As shown in the figure the larger the screen area the lower the rate of increase in pressure drop.

A Y-Strainer screen must be strong enough to handle the resulting differential pressure that occurs when in service. In general all Spence strainer screens are designed to handle a minimum burst pressure of 50 psid. Spence calculates the burst pressure of screens using the formula:

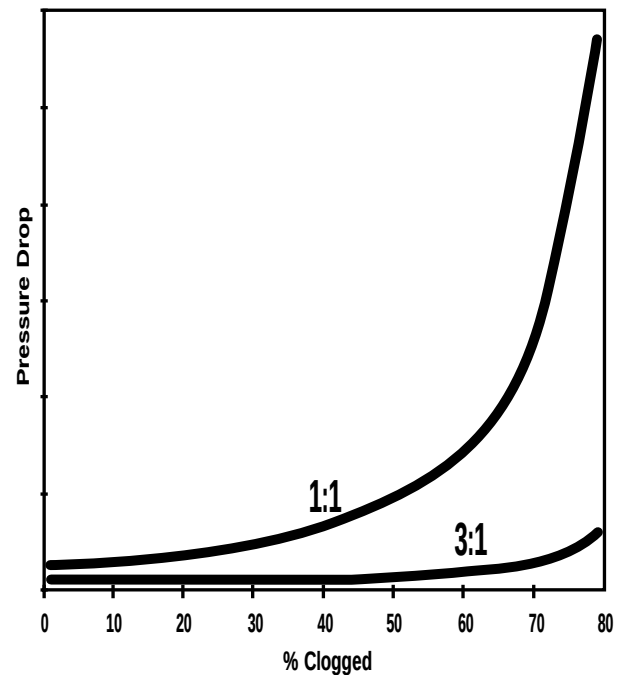
$$P = \frac{St}{R - 0.4t}$$

P	=	Burst Pressure
S	=	Reduced allowable stress
t	=	Thickness of screen material
R	=	Outside radius of screen

SOURCE: ASME Section VIII, Div. 1, Appendix 1.

Using the above formula, Spence can design and manufacture any strainer screen to suit your specific strength requirements.

EFFECT OF SCREEN AREA ON PRESSURE DROP



Note: Curves are for different ratios of free area to pipe area.



125Y SERIES

BRONZE, CAST IRON Y STRAINERS

NPT, SWEAT ENDS, FLANGED

PRESSURES TO 200 PSIG (13.8 BARG)

TEMPERATURES TO 450°F (232°C)

APPLICATIONS

- Steam, liquid, gas and oil service
- Power industry
- Pulp and paper
- Chemical industry
- Metal & Mining
- Water & Waste

OPTIONS

- Other perforated screens and mesh liners
- Other drain connections and gasket materials
- Oxygen cleaning
- Special internal/external coatings and linings
- Contact factory for other options

APPLICABLE CODES

- ANSI B16.1
- ANSI B16.15

Canadian Registration OEO591.9C for CI 125Y2F

- **ANSI 125# rated strainers**
- **NPT, SE and FF flanges in accordance with ASME 16.1 and 16.15**
- **One piece cast body**
- **Upper and lower machined seats**
- **Generous screen area and properly proportioned straining chamber to minimize initial pressure drop while maximizing time between cleanings.**

MODELS

- 125Y1T - Bronze, NPT, Threaded Cover
- 125Y1E - Bronze, Sweat Ends, Threaded Cover
- 125Y2F - Cast Iron, Flanged, Bolted Cover

125Y Series Ordering Code

Inlet Size				Dash	Model						Body Material	Dash	Perf	Mesh	Add'l Requirements
0	1	0	0	-	1	2	5	Y	1	T	B	-	A	2	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size -
Position 1 - 4
0038 - 3/8"
0050 - 1/2"
0075 - 3/4"
0100 - 1"
0125 - 1 1/4"
0150 - 1 1/2"
0200 - 2"
0250 - 2 1/2"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"
1400 - 14"
1600 - 16"

Dash - Position 5
Model - Position 6 - 11
125Y1T
125Y1E
125Y2F
Body Material -
Position 12
I - Cast Iron
B - Bronze
Dash - Position 13

Perf¹ - Position 14
304 SS Material²
A - No Perf
1 - 1/32"
B - 3/64"
4 - 1/8"
5 - 3/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"

Mesh^{1,2} - Position 15
Leave Blank If Not Required (std Y2F)
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120

Add'l Requirements -
Position 16
Leave Blank If not Required
D - Special Drain Size
F - Silicon Free
G - Special Gaskets
T - Special Testing
X - Oxygen Cleaning
Y - Other and / or Multiple Specials

Indicate Specials Clearly On the Order

1. Standard Screens: Y1T, Y1E—20 mesh, Y2F< 3"—3/64" perf, Y2F>3"—1/8" perf
2. For other screen materials contact factory.

125Y1 SERIES

BRONZE Y STRAINERS

NPT, SWEAT ENDS

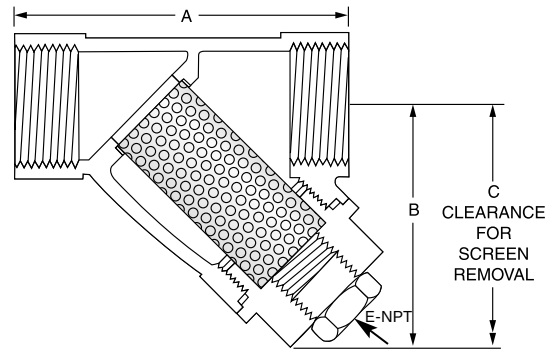
SPECIFICATION

Y Strainer shall be straight flow design with NPT or Sweat Ends inlet/outlet connections. The strainer shall be rated to ANSI 125 PSIG rating in accordance with ANSI B16.15. The Strainer shall be bronze body and the screen shall be size _____ mesh 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 125Y1 Series.

MATERIALS OF CONSTRUCTION

Body Bronze B584
 Cover Bronze B584
 Screen¹ 304 SS Mesh
 Plug Bronze B584
 Gasket¹ Garlock 2900

1. Recommended Spare Parts



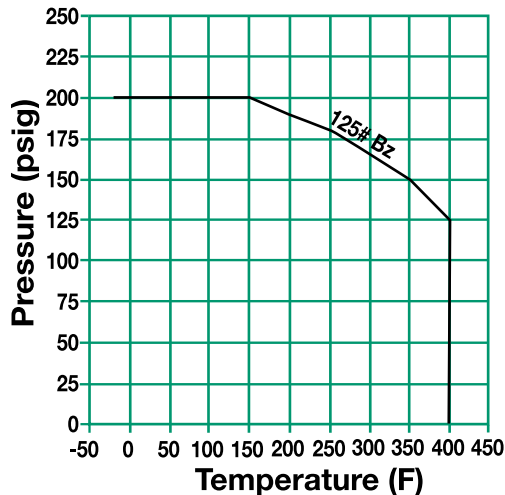
Connections:
 3/8" – 3" NPT or Sweat Ends

Note: For Butt weld sizes please indicate pipe schedule on the order.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
3/8" – 3"	20 Mesh	304 SS

PRESSURE/TEMPERATURE CHART
 ANSI B16.15



DIMENSIONS inches (mm)
AND WEIGHTS pounds (kg)

SIZE	A	B	C	E	WEIGHT
3/8 (10)	3 3/4 (82)	2 5/8 (55)	3 1/2 (89)	3/8 (10)	.8 (.36)
1/2 (15)	3 3/4 (82)	2 5/8 (55)	3 1/2 (89)	3/8 (10)	1.0 (.25)
3/4 (20)	4 (100)	2 3/4 (70)	4 1/2 (114)	3/8 (10)	1.2 (.60)
1 (25)	4 1/2 (115)	3 (75)	5 (127)	1/2 (15)	1.6 (.73)
1 1/4 (32)	5 3/8 (136)	3 9/16 (90)	5 3/4 (146)	1/2 (15)	2.5 (1.1)
1 1/2 (40)	6 5/16 (160)	3 7/8 (98)	6 3/8 (162)	1/2 (15)	3.4 (1.6)
2 (50)	7 1/2 (191)	5 1/16 (138)	9 1/16 (230)	1/2 (15)	5.8 (2.6)
2 1/2 (65)	9 1/16 (230)	5 15/16 (151)	10 (254)	1/2 (15)	10.2 (4.6)
3 (80)	10 3/16 (259)	6 5/16 (160)	10 3/8 (264)	1/2 (15)	13.7 (6.2)

Dimensions shown are subject to change. Consult factory for certified drawings when required.

**125Y SERIES
 STRAINERS**

125Y2 SERIES CAST IRON Y STRAINERS FLANGED

SPECIFICATION

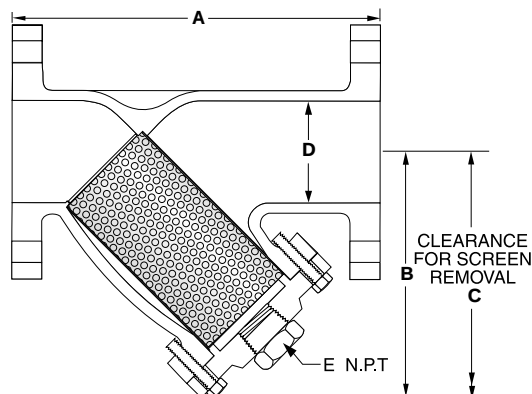
Y Strainer shall be straight flow design with FF Flanged inlet/outlet connections. The strainer shall be rated to ANSI 125 PSIG rating in accordance with ANSI B16.1. The Strainer shall be Cast Iron body and the screen shall be size _____ perforated 304 SS. The strainer shall be have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 125Y2 Series.

MATERIALS OF CONSTRUCTION

Body Cast Iron A126-B
Cover Cast Iron A126-B
Screen¹ 304 SS
Plug Cast Iron A126-B
Gasket¹ Graphite
Bolt/Stud² A307-B
Nut² A563

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted

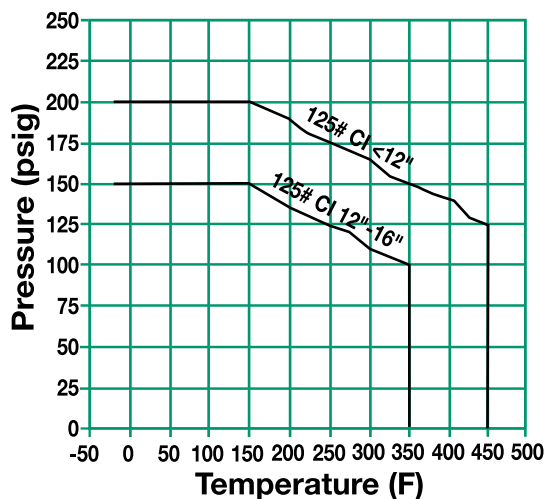


Connections:
2" – 16" FF Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" – 3"	3/64" Perf	304 SS
4" – 16"	1/8" Perf	304 SS

PRESSURE/TEMPERATURE CHART
ASME B16.1



DIMENSIONS inches (mm)
AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
2 (50)	8 7/8 (226)	6 1/8 (156)	8 7/8 (216)	2 (51)	1/2 (15)	22 (10)
2 1/2 (65)	10 3/4 (273)	8 1/8 (205)	11 1/4 (286)	2 1/2 (64)	1 (25)	35 (16)
3 (80)	11 1/8 (295)	8 1/2 (216)	12 1/4 (311)	3 (76)	1 (25)	43 (20)
4 (100)	13 3/8 (353)	9 1/8 (245)	13 3/8 (340)	4 (102)	1 (25)	75 (34)
5 (125)	16 3/8 (416)	11 1/8 (295)	16 3/8 (410)	5 (127)	1 1/4 (32)	115 (52)
6 (150)	18 1/2 (470)	12 1/8 (321)	17 1/4 (449)	6 (152)	1 1/2 (40)	154 (70)
8 (200)	21 3/8 (543)	16 3/8 (416)	23 (584)	8 (203)	1 1/2 (40)	243 (110)
10 (250)	26 (660)	19 3/8 (486)	26 1/4 (678)	10 (254)	2 (50)	390 (117)
12 (300)	30 (762)	22 1/8 (559)	31 (787)	12 (305)	2 (50)	650 (295)
14 (350)	37 3/8 (949)	30 1/4 (780)	41 (1041)	14 (356)	2 (50)	815 (370)
16 (400)	42 1/2 (1080)	33 1/8 (840)	46 (1168)	16 (406)	2 (50)	1224 (555)

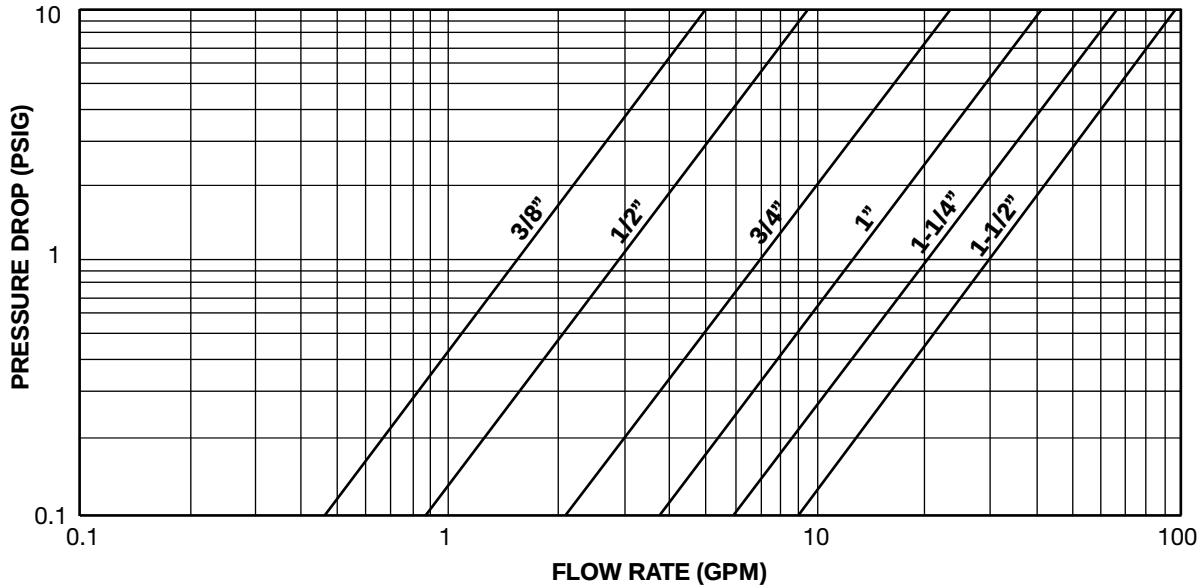
Dimensions shown are subject to change. Consult factory for certified drawings when required.

125Y SERIES BRONZE, CAST IRON

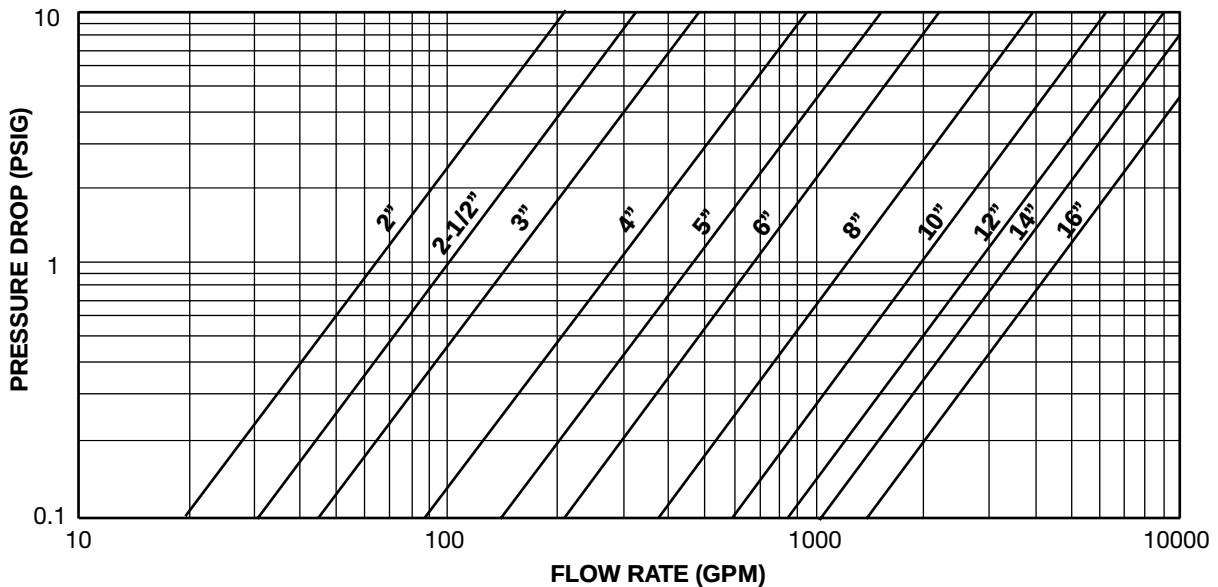
PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

(Sizes 3/8" - 1 1/2")



(Sizes 2" - 16")



* For Gas, Steam or Air service, consult factory.

Steam Service Pressure Drop
Page 433

Correction Factors for Other Viscous
Liquids and/or Mesh Liners Page 432

Correction Factors for
Clogged Screens Page 432

125Y SERIES
STRAINERS

125Y SERIES BRONZE, CAST IRON Y STRAINERS

OPEN AREA RATIOS

with Standard Perforated Screen

BRONZE

Size	Mesh	Opening %	Std Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
⅜	20	49	0.19	3.8	1.88	9.9
½	20	49	0.30	3.8	1.88	6.2
¾	20	49	0.53	5.5	2.71	5.1
1	20	49	0.86	7.0	3.45	4.0
1¼	20	49	1.50	11.1	5.42	3.6
1½	20	49	2.04	15.2	7.46	3.7
2	20	49	3.36	26.1	12.81	3.8
2½	20	49	4.79	36.6	17.95	3.7
3	20	49	7.39	49.0	24.00	3.2

CAST IRON

Size	Perf. Diameter (in.)	Opening %	Flange Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	29.4	10.58	3.4
2½	3/64	36	4.91	46.0	16.56	3.4
3	3/64	36	7.07	57.0	20.51	2.9
4	1/8	40	12.57	99.0	39.59	3.2
5	1/8	40	19.63	146.5	58.58	3.0
6	1/8	40	28.27	174.0	69.60	2.5
8	1/8	40	50.27	327.3	130.91	2.6
10	1/8	40	78.54	495.2	198.08	2.5
12	1/8	40	113.10	645.0	257.99	2.3
14	1/8	40	153.94	1149.9	459.94	3.0
16	1/8	40	201.06	1431.9	572.75	2.8

OAR = Free Screen Area / Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

NOTES:



150Y SERIES

CARBON STEEL, STAINLESS STEEL, BRONZE Y STRAINERS FLANGED, BUTTWELD

PRESSURES TO 285 PSIG (19.7 BARG)

TEMPERATURES TO 750°F (390°C)

APPLICATIONS

- Steam, liquid, gas and oil service
- Power Industry
- Pulp & Paper
- Process Equipment
- Chemical Industry
- Metal & Mining
- Water & Waste

OPTIONS

- Other perforated screens and mesh liners
- Other drain connections and gasket materials
- Oxygen cleaning
- Special internal / external coatings and linings
- Contact Factory for other Options

APPLICABLE CODES

- ANSI B16.5
- ANSI B16.25
- ANSI B16.24
- ANSI B16.34

- **ANSI 150 PSIG rated strainers**
- **RF Flanges, FF Flanges (Bronze only) and Butt weld in accordance with ANSI 16.5, 16.24, and 16.25**
- **All sizes complete with Bolted Cover**
- **Cover flange (CS, SS) in accordance with ASME Section VIII, Div 1 Appendix II and/or ANSI 16.5.**
- **One piece cast body**
- **Upper and lower machined seats**
- **Generous screen area and properly proportioned straining chamber to minimize initial pressure drop while maximizing time between cleanings**
- **Drain/Blow-off connection furnished with plug**

MODELS

- 150Y2F – Carbon, Stainless or Bronze Flanged with Bolted Cover
- 150Y2B – Carbon or Stainless Butt weld with Bolted Cover

150Y Series Ordering Code

Inlet Size				Dash	Model						Body Material	Dash	Perf	Mesh	Add'l Requirements
0	2	0	0	-	1	5	0	Y	2	F	T	-	B	—	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size -

Position 1 - 4
 0050 - ½"
 0075 - ¾"
 0100 - 1"
 0125 - 1¼"
 0150 - 1½"
 0200 - 2"
 0250 - 2½"
 0300 - 3"
 0400 - 4"
 0500 - 5"
 0600 - 6"
 0800 - 8"
 1000 - 10"
 1200 - 12"

Dash - Position 5

Model - Position 6 - 11
 150Y2F
 150Y2B¹

Body Material - Position 12

C - CS
 T - SS
 B - BZ

Dash - Position 13

1. For Butt weld connections please specify mating pipe schedule.

Perf² - Position 14

304SS Material³

A - No Perf
 1 - 1/32"
 B - 3/64
 4 - 1/8"
 2 - 1/16"
 3 - 3/32"
 5 - 5/32"
 6 - 3/16"
 7 - 7/32"
 8 - 1/4"
 9 - 3/8"

Mesh³ - Position 15

Leave Blank If not Required (std ALL)

1 - 10
 2 - 20
 3 - 30
 4 - 40
 5 - 50
 6 - 60
 7 - 80
 8 - 100
 9 - 120

Add'l Requirements - Position 16

Leave Blank If not Required

D - Special Drain Size
 F - Silicon Free
 G - Special Gaskets
 N - Nace MR01-75
 T - Special Testing
 X - Oxygen Cleaning
 Y - Other and / or Multiple Specials

2. Standard Screens: ALL 1/2"-11/2"—1/32" perf,
 ALL 2"-3"—3/64" perf,
 ALL >3"—1/8" perf .

3. For other screen material, contact factory.

150Y2 SERIES

CARBON STEEL, STAINLESS STEEL

Y STRAINERS FLANGED, BUTTWELD

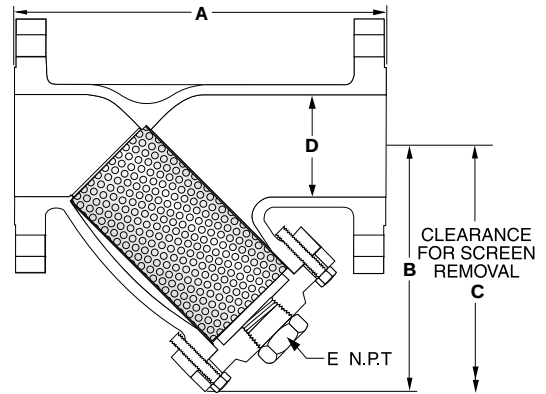
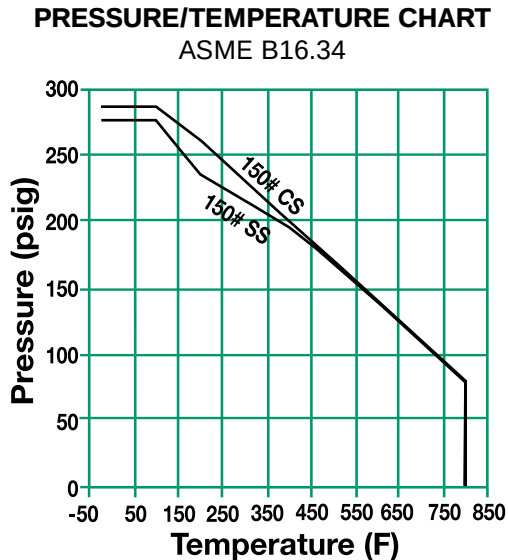
SPECIFICATION

Y Strainer shall be straight flow design with RF Flanged or Buttweld inlet/outlet connections. The strainer shall be rated to ANSI 150 PSIG rating in accordance with ANSI B16.5 or ANSI B16.25. The Strainer shall be Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 150Y2 Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cover	A216-WCB	A351-CF8M
Screen ¹	304 Stainless Steel	304 Stainless Steel
Plug ²	A105	A182-316
Gasket ¹	Teflon/Spiral Wound 304/GR ³	Teflon/Spiral Wound 304/GR ³
Stud	A193-B7	A193-B8-1
Nut ²	A194-2H	A194-8

1. Recommended Spare Parts
2. Materials of equivalent strength may be substituted
3. Teflon gasket for sizes 4" and below only.



Connections: CS - ½" to 12"
RF Flanged or Buttweld

SS - ½" to 12"
RF Flanged or Buttweld⁴

4. For Buttweld connections please specify mating pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
½" - 1½"	1/32" Perf	304 SS
2" - 3"	3/64" Perf	304 SS
4" - 12"	1/8" Perf	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
½	6 (152)	3⅞ (99)	4⅞ (121)	½ (13)	¾ (8)	5.5 (2.5)
¾	7 (178)	4⅞ (108)	5⅞ (146)	¾ (19)	¾ (10)	8 (3.7)
1	7½ (191)	4⅞ (121)	6⅞ (162)	1 (25)	½ (15)	10 (4.6)
1¼	8⅞ (222)	5⅞ (141)	8 (203)	1¼ (32)	½ (15)	16 (7.3)
1½	9 (229)	5⅞ (143)	9 (229)	1½ (38)	½ (15)	18 (8.2)
2	8⅞ (219)	5⅞ (149)	7⅞ (191)	2 (51)	½ (15)	20 (9.1)
2½	10⅞ (260)	7⅞ (191)	10⅞ (267)	2½ (64)	¾ (20)	27 (12.3)
3	11⅞ (295)	7⅞ (195)	10⅞ (276)	3 (76)	1 (25)	41 (18.6)
4	14⅞ (365)	9⅞ (232)	13 (330)	4 (102)	1½ (40)	63 (28.6)
5	17⅞ (448)	11 (279)	17 (432)	5 (127)	2 (50)	99 (45)
6	18⅞ (473)	13 (330)	18⅞ (467)	6 (152)	2 (50)	133 (60.5)
8	24⅞ (619)	15⅞ (389)	21⅞ (549)	8 (203)	2 (50)	222 (100.9)
10	26⅞ (662)	19⅞ (486)	27 (686)	10 (254)	2 (50)	409 (185.9)
12	30-3/8 (772)	22 (559)	31 (787)	12 (305)	2 (50)	605 (275)

Dimensions shown are subject to change.
Contact factory for certified prints when required.

150Y SERIES
STRAINERS

150Y2 SERIES BRONZE Y STRAINERS FLANGED

SPECIFICATION

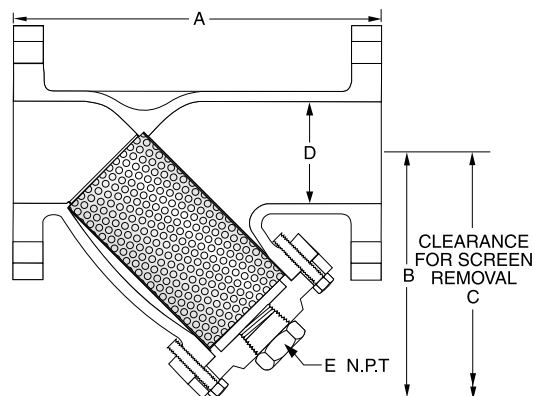
Y Strainer shall be straight flow design with FF Flanged inlet/outlet connections. The strainer shall be rated to ANSI 150 PSIG rating in accordance with ANSI B16.24. The Strainer shall be Cast Bronze body and the screen shall be size _____ perf 304 SS. The strainer shall be have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 150Y2 Series.

MATERIALS OF CONSTRUCTION

Body Bronze B62
Cover Bronze B62
Screen¹.....304 Stainless Steel
Plug² Bronze B62
Gasket¹ Teflon
Bolt/Stud² B16
Nut² B16

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted

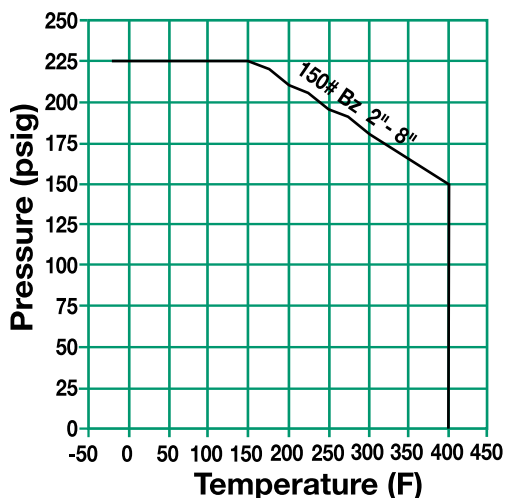


Connections:
BZ - 2" to 8" FF Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" – 3"	3/64" Perf	304 SS
4" – 8"	1/8" Perf	304 SS

PRESSURE/TEMPERATURE CHART
ANSI B16.24



DIMENSIONS inches (mm) AND WEIGHTS
pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
2 (50)	8 3/8 (219)	4 7/8 (124)	7 1/2 (191)	2 (51)	1/2 (15)	20 (9)
2 1/2 (65)	10 3/4 (260)	7 1/2 (191)	10 1/2 (267)	2 1/2 (64)	1 (25)	32 (15)
3 (80)	11 1/8 (295)	7 3/4 (197)	10 3/8 (276)	3 (76)	1 (25)	36 (16)
4 (100)	14 3/8 (365)	9 3/8 (232)	13 (330)	4 (102)	1 (25)	61 (28)
5 (125)	17 3/8 (448)	11 (279)	17 (432)	5 (127)	1 1/4 (32)	110 (50)
6 (150)	18 3/8 (473)	13 3/8 (340)	18 3/8 (467)	6 (152)	1 1/2 (40)	160 (73)
8 (200)	24 3/8 (619)	14 3/8 (389)	21 1/8 (549)	8 (203)	1 1/2 (40)	210 (95)

Dimensions shown are subject to change.
Contact factory for certified prints when required.

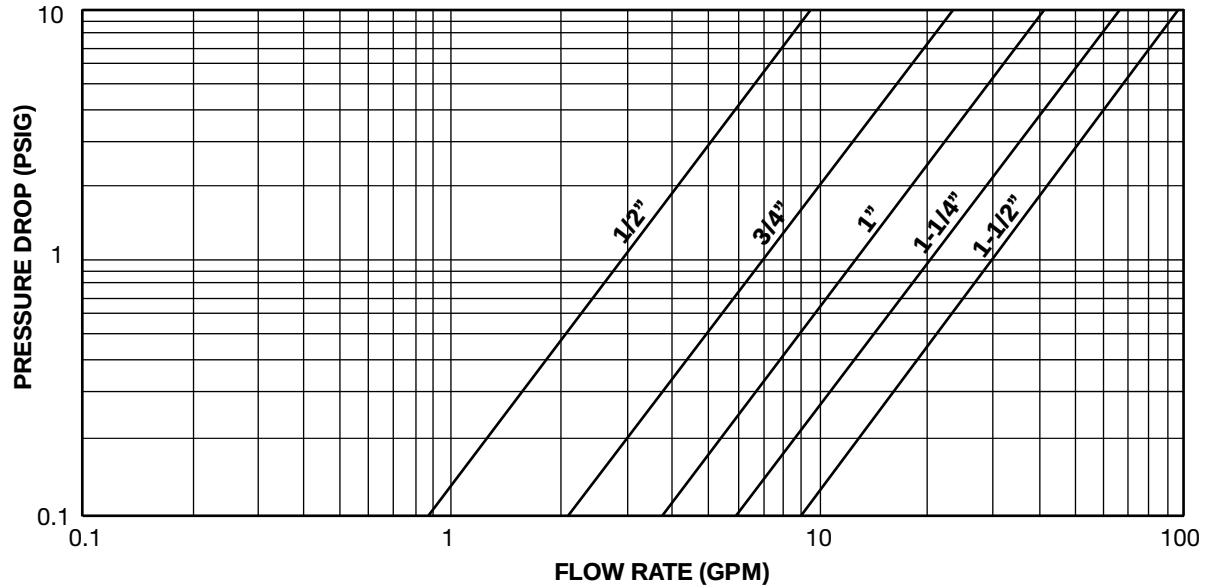
150Y SERIES

CARBON STEEL, STAINLESS STEEL, BRONZE

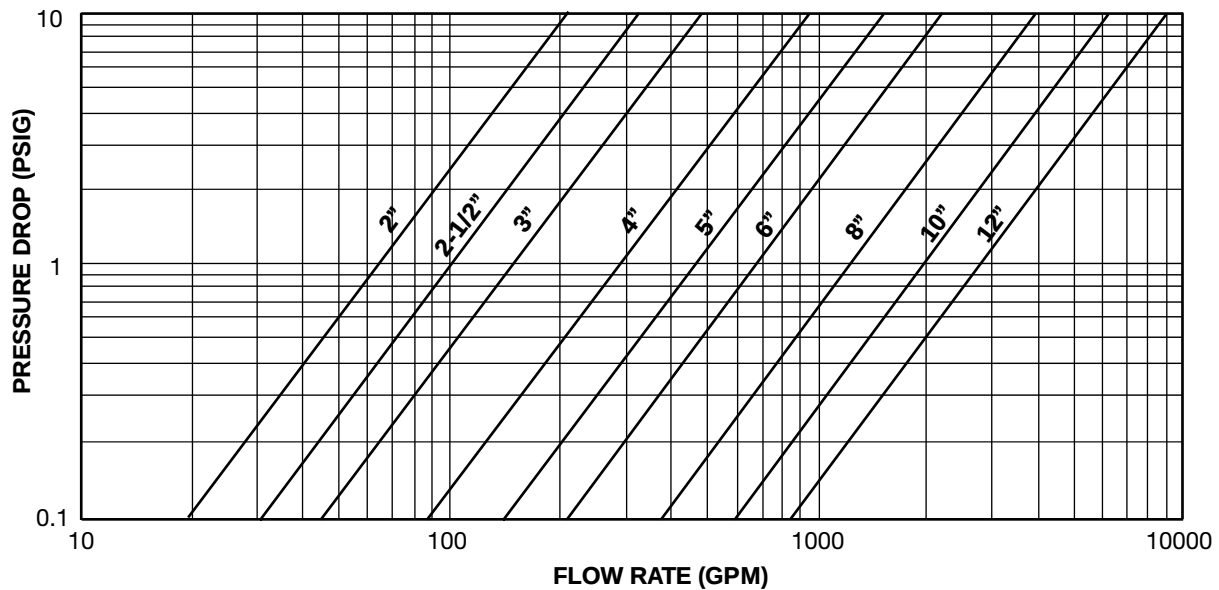
PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

(Sizes 1/2" - 1 1/2")



(Sizes 2" - 12")



* For Gas, Steam or Air service, consult factory.

Steam Service Pressure Drop
Page 433

Correction Factors for Other Viscous
Liquids and/or Mesh Liners Page 432

Correction Factors for
Clogged Screens Page 432

150Y SERIES
STRAINERS

150Y SERIES

CARBON STEEL, STAINLESS STEEL, BRONZE

OPEN AREA RATIOS

with Standard Perforated Screen*

BRONZE

Size	Perf. Diameter	Opening %	Std Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	21.1	7.60	2.4
2½	3/64	36	4.91	52.3	18.83	3.8
3	3/64	36	7.07	56.2	20.24	2.9
4	1/8	40	12.57	100.1	40.03	3.2
5	1/8	40	19.63	*	*	*
6	1/8	40	28.27	199.6	79.86	2.8
8	1/8	40	50.27	306.4	122.58	2.4

CARBON & STAINLESS STEEL

Size	Perf. Diameter	Opening %	Std Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	1/32	28	0.20	5.4	1.52	7.7
¾	1/32	28	0.44	8.5	2.37	5.4
1	1/32	28	0.79	12.4	3.47	4.4
1¼	1/32	28	1.23	22.8	6.39	5.2
1½	1/32	28	1.77	22.8	6.39	3.6
2	3/64	36	3.14	27.1	9.75	3.1
2½	3/64	36	4.91	50.5	18.17	3.7
3	3/64	36	7.07	65.9	23.71	3.4
4	1/8	40	12.57	86.9	34.74	2.8
5	1/8	40	19.63	148.7	59.47	3.0
6	1/8	40	28.27	214.4	85.74	3.0
8	1/8	40	50.27	329.3	131.71	2.6
10	1/8	40	78.54	489.9	195.96	2.5
12	1/8	40	113.10	710.9	284.36	2.5

OAR = Free Screen Area / Nominal Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

* Consult Factory.

Other Screen Openings
Page 430

Basket Burst Pressure
Page 435

NOTES:



250Y SERIES

CAST IRON, BRONZE, DUCTILE IRON Y STRAINERS NPT, FLANGED

PRESSURES TO 500 PSIG (34.5 BARG)

TEMPERATURES TO 450°F (232°C)

- ANSI 250 PSIG rated strainers
- NPT and FF Flanges in accordance with ANSI 16.1, 16.15 and 16.4
- One piece cast body
- Upper and lower machined seats
- Generous screen area and properly proportioned straining chamber to minimize initial pressure drop while maximizing time between cleanings
- Drain/Blow-off connection furnished with plug

APPLICATIONS

- Steam, liquid, gas and oil service
- Power Industry
- Pulp & Paper
- Process Equipment
- Chemical Industry
- Metal & Mining
- Water & Waste

OPTIONS

- Other perforated screens and mesh liners
- Other drain connections and gasket materials
- Oxygen cleaning
- Special internal / external coatings and linings
- Contact Factory for other Options

APPLICABLE CODES

- ANSI B16.1
- ANSI B16.4
- ANSI B16.15

Canadian Registration OEO591.9C BRZ & CI 250Y1 CI

MODELS

- 250Y1T – Bronze or Cast Iron, NPT, Threaded Cover
- 250Y2F – Ductile Iron, Flanged, Bolted Cover

250Y Series Ordering Code

250Y Series Ordering Code

Inlet Size					Model						Body Material	Dash	Perf	Mesh	Add'l Requirements
0	4	0	0	-	2	5	0	Y	2	F	D	-	4	—	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size -

Position 1 - 4
0038 - 3/8"
0050 - 1/2"
0075 - 3/4"
0100 - 1"
0125 - 1¼"
0150 - 1½"
0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"
1400 - 14"
1600 - 16"

Dash - Position 5

Model - Position 6 - 11
250Y1T
250Y2F

Body Material -

Position 12
I - Cast Iron
B - Bronze
D - Ductile Iron

Dash - Position 13

Perf¹ - Position 14

304SS Material²

A - No Perf (std Y1T Bz
All - std Y1T CI <=2")

1 - 1/32"
B - 3/64"
4 - 1/8"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"

Mesh^{1, 2} - Position 15

Leave Blank
If not Required
(std Y2F)

1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120

Add'l Requirements -

Position 16

Leave Blank
If not Required

D - Special Drain Size
F - Silicon Free
G - Special Gaskets
T - Special Testing
X - Oxygen Cleaning
Y - Other and / or
Multiple Specials

Indicate Specials
Clearly On the Order

- Standard Screens: Y1 Cast Iron 1/4"-2"—20 mesh, Y1 Cast Iron 2½"-3"—3/64" perf, Y1 Bronze 1/2"-1"—30 mesh, Y1 Bronze 1¼"-3"—20 mesh, Y2 Ductile Iron 2"-3"—3/64" perf, Y2 Ductile Iron 4"-12"—1/8" perf.
- For other screen material, consult factory.

250Y1 SERIES CAST IRON Y STRAINERS NPT

SPECIFICATION

Y Strainer shall be straight flow design with NPT inlet/outlet connections. The strainer shall be rated to ANSI 250 PSIG rating in accordance with ANSI B16.4. The Strainer shall be cast iron body and the screen shall be size _____ perf / mesh 304 SS. The strainer shall be have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 250Y1 Series.

MATERIALS OF CONSTRUCTION

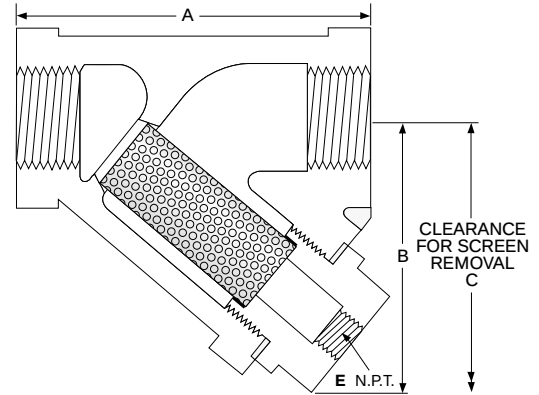
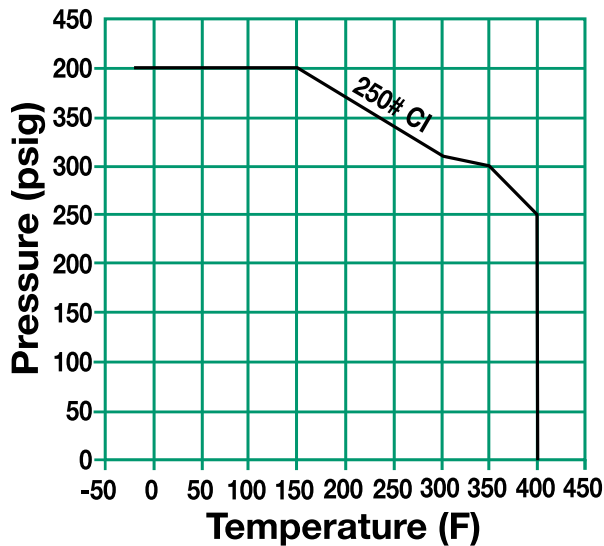
Body A126-B
Cap/Cover A126-B
Screen¹ 304 SS
Plug² A126-B
Gasket¹ Graphite

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted

PRESSURE/TEMPERATURE CHART

ASME B16.4



Connections: 1/4" – 3" NPT

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
1/4" - 2"	20 Mesh	304 SS
2 1/2" - 3"	3/64" Perf	304 SS

DIMENSIONS inches (mm)

AND WEIGHTS pounds (kg)

SIZE	A	B	C	E	WEIGHT
1/4 (8)	3 7/16 (81)	2 (50)	3 3/8 (80)	1/4 (8)	1.50 (.70)
3/8 (10)	3 7/16 (81)	2 (50)	3 3/8 (80)	1/4 (8)	1.50 (.70)
1/2 (15)	3 7/16 (81)	2 (50)	3 3/8 (80)	1/4 (8)	1.50 (.70)
3/4 (20)	3 3/4 (95)	2 1/16 (68)	3 1/2 (94)	5/16 (10)	2.50 (.50)
1 (25)	4 (102)	3 (62)	3 1/2 (94)	5/16 (10)	3.00 (1.4)
1 1/4 (32)	5 (127)	3 3/16 (87)	5 5/16 (129)	3/4 (20)	6.00 (1.4)
1 1/2 (40)	5 3/4 (146)	3 5/8 (96)	5 3/4 (146)	3/4 (20)	8.00 (3.6)
2 (50)	7 (178)	4 1/2 (110)	7 1/4 (184)	1 (25)	14.00 (3.6)
2 1/2 (65)	9 3/4 (235)	6 3/8 (155)	8 3/4 (222)	1 1/2 (40)	29.0 (10)
3 (80)	10 (254)	7 1/2 (188)	9 (2.29)	1 1/2 (40)	38.0 (13.6)

Dimensions shown are subject to change.

Contact factory for certified prints when required.

250Y SERIES
STRAINERS

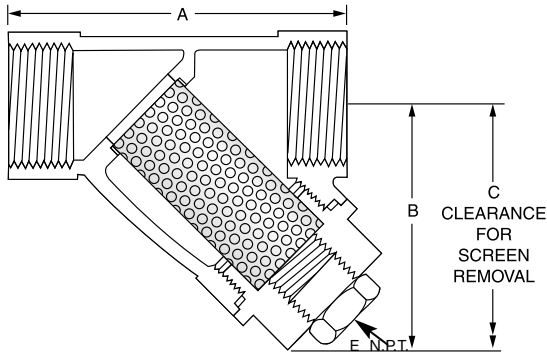
250Y1 SERIES BRONZE Y STRAINERS NPT

SPECIFICATION

Y Strainer shall be straight flow design with NPT inlet/outlet connections. The strainer shall be rated to ANSI 250 PSIG rating in accordance with ANSI B16.15. The Strainer shall be bronze body and the screen shall be size _____ mesh 304 SS. The strainer shall be have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 250Y1 Series.

MATERIALS OF CONSTRUCTION

Body B584
 Cap B584
 Screen¹ 304 SS
 Plug B584
 Gasket¹ Silicone
 1. Recommended Spare Parts

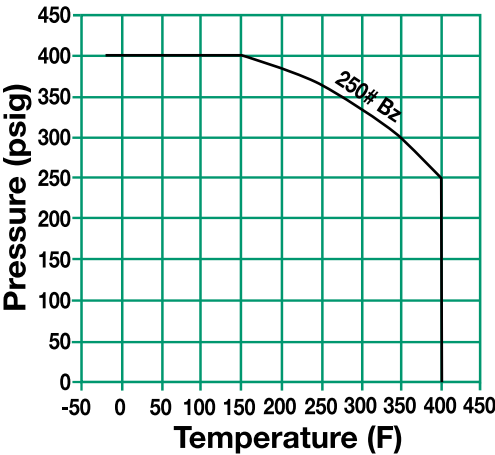


Connections: 1/2" – 3" NPT

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
½" - 1"	30 Mesh	304 SS
1¼" - 3"	20 Mesh	304 SS

PRESSURE/TEMPERATURE CHART
ANSI B16.15



DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	E	WEIGHT
½ (15)	2 ¹⁵ / ₁₆ (75)	2 ³ / ₈ (54)	3 ¹ / ₂ (89)	³ / ₈ (10)	.9 (0.4)
¾ (20)	3 ³ / ₈ (86)	2 ³ / ₈ (60)	4 ¹ / ₂ (114)	³ / ₈ (10)	1.3 (0.6)
1 (25)	4 ¹ / ₁₆ (103)	3 (76)	5 (127)	¹ / ₄ (20)	2.1 (1.0)
1¼ (32)	4 ¹⁵ / ₁₆ (125)	3 ¹ / ₁₆ (87)	5 ³ / ₈ (146)	¹ / ₄ (20)	3.0 (1.4)
1½ (40)	5 ³ / ₈ (146)	3 ¹³ / ₁₆ (97)	6 ³ / ₈ (162)	¹ / ₄ (20)	4.0 (1.8)
2 (50)	6 ¹ / ₁₆ (170)	4 ¹ / ₈ (116)	9 ¹ / ₁₆ (230)	¹ / ₄ (20)	7.1 (3.2)
2½ (64)	7 ¹ / ₂ (191)	4 ³ / ₈ (124)	10 (254)	1 ¹ / ₄ (32)	10.1 (4.6)
3 (76)	8 ¹ / ₂ (216)	5 ¹ / ₂ (140)	10 ³ / ₈ (264)	1 ¹ / ₄ (32)	13.3 (6.1)

* Consult factory for dimensions.
 Dimensions shown are subject to change.
 Contact factory for certified prints when required.

250Y2 SERIES DUCTILE IRON Y STRAINERS FLANGED

SPECIFICATION

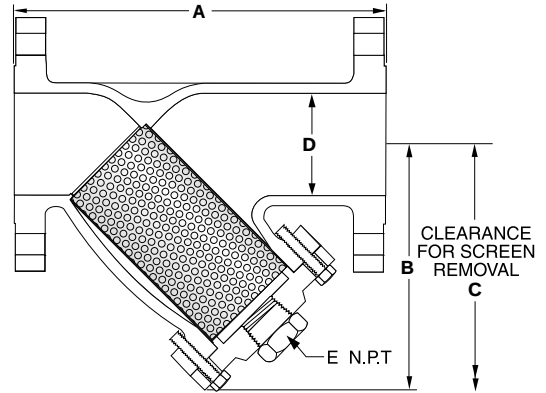
Y Strainer shall be straight flow design with RF Flanged inlet/outlet connections. The strainer shall be rated to ANSI 250 PSIG rating in accordance with ANSI B16.1. The Strainer shall be Ductile Iron and the screen shall be size _____ perf 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 250Y2 Series.

MATERIALS OF CONSTRUCTION

Body Ductile Iron A536
Cap.....Ductile Iron A536
Screen¹ 304 SS
Plug.....A126-B
Gasket¹ Graphite
Bolt/Stud² A307-B
Nut² A563

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted

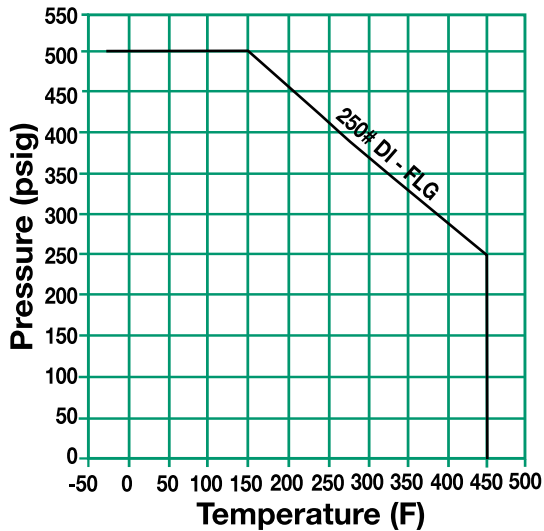


Connections: 2" – 12" RF Flanges

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" - 3"	3/64" Perf.	304 SS
4" - 12"	1/8" Perf.	304 SS

PRESSURE/TEMPERATURE CHART
ANSI B16.1



DIMENSIONS inches (mm)
AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
2 (50)	8 5/8 (226)	6 1/8 (156)	9 3/8 (232)	2 (51)	1/2 (15)	28 (13)
2 1/2 (65)	10 3/8 (273)	8 1/8 (205)	9 3/8 (251)	2 1/2 (64)	1 (25)	38 (17)
3 (80)	11 3/8 (295)	8 1/8 (214)	11 1/4 (286)	3 (76)	1 (25)	54 (24)
4 (100)	13 3/8 (353)	9 3/8 (245)	15 (381)	4 (102)	1 (25)	110 (50)
5 (125)	16 3/8 (416)	11 3/8 (295)	19 (483)	5 (127)	1 1/4 (32)	160 (73)
6 (150)	18 3/8 (470)	12 3/8 (321)	22 3/4 (578)	6 (152)	1 1/2 (40)	224 (102)
8 (200)	21 3/8 (543)	16 3/8 (416)	27 3/4 (692)	8 (203)	1 1/2 (40)	468 (212)
10 (250)	26 (660)	19 3/8 (486)	29 3/4 (756)	10 (254)	2 (50)	590 (268)
12 (300)	30 (762)	22 3/8 (560)	35 (889)	12 (305)	2 (50)	890 (404)

Dimensions shown are subject to change.

Contact factory for certified prints when required.

250Y SERIES
STRAINERS

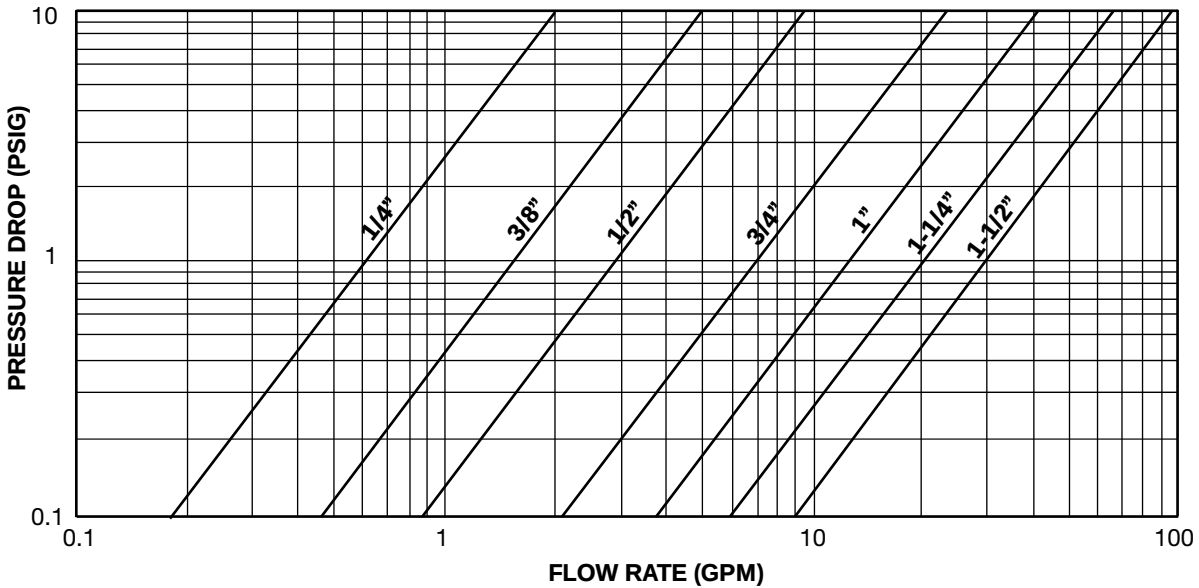
250Y SERIES

CAST IRON, BRONZE, DUCTILE IRON

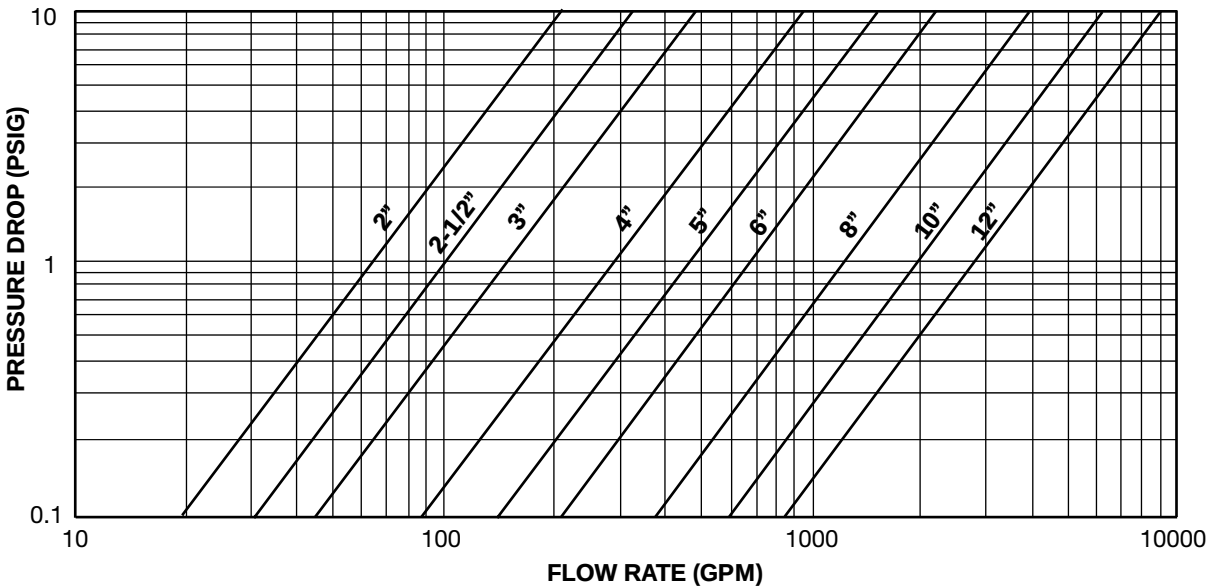
PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

(Sizes 1/4" - 1 1/2")



(Sizes 2" - 12")



* For Gas, Steam or Air service, consult factory.

Steam Service Pressure Drop
Page 433

Correction Factors for Other Viscous
Liquids and/or Mesh Liners Page 432

Correction Factors for
Clogged Screens Page 432

250Y SERIES

CAST IRON, BRONZE, DUCTILE IRON

OPEN AREA RATIOS

with Standard Perforated Screen

BRONZE

Size	Mesh	Opening %	Std Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	30	45	0.30	2.9	1.28	4.2
¾	30	45	0.53	5.6	2.52	4.7
1	30	45	0.86	9.0	4.03	4.7
1¼	20	49	1.50	15.1	7.38	4.9
1½	20	49	2.04	21.7	10.64	5.2
2	20	49	3.36	29.2	14.31	4.3
2½	20	49	4.79	35.9	17.61	3.7
3	20	49	7.39	49.9	24.45	3.3

CAST IRON

Size	Perf/Mesh Diameter	Opening %	Std Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
¼	20	49	0.30	3.7	1.80	5.9
½	20	49	0.30	3.7	1.80	5.9
¾	20	49	0.30	3.6	1.74	5.7
1	20	49	0.53	6.3	3.11	5.8
1¼	20	49	0.86	7.9	3.85	4.5
1½	20	49	1.50	13.0	6.35	4.2
2	20	49	2.04	16.6	8.13	4.0
2½	20	49	3.36	28.3	13.85	4.1
3	3/64	36	4.79	44.7	16.08	3.4
3	3/64	36	7.39	43.2	15.55	2.1

DUCTILE IRON

Size	Perf. Diameter (inches)	Opening %	Flange Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	29.4	10.58	3.4
2½	3/64	36	4.91	46.0	16.56	3.4
3	3/64	36	7.07	57.0	20.51	2.9
4	1/8	40	12.57	99.0	39.59	3.2
5	1/8	40	19.63	146.5	58.58	3.0
6	1/8	40	28.27	174.0	69.60	2.5
8	1/8	40	50.27	327.3	130.91	2.6
10	1/8	40	78.54	495.2	198.08	2.5
12	1/8	40	113.10	645.0	257.99	2.3

OAR = Free Screen Area / Nominal Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

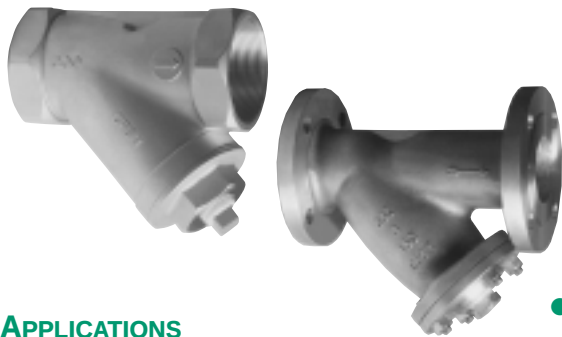
Other Screen Openings

Page 430

Basket Burst Pressure

Page 435

**250Y SERIES
STRAINERS**



300Y SERIES

CARBON STEEL, STAINLESS STEEL Y STRAINERS NPT, FLANGED, SOCKETWELD, BUTTWELD

PRESSURES TO 740 PSIG (51 BARG)
TEMPERATURES TO 800°F (427°C)

APPLICATIONS

- Steam, liquid, gas and oil service
- Power industry
- Pulp and paper
- Chemical industry
- Process Equipment
- Metal & Mining
- Water & Waste

OPTIONS

- Other perforated screens and mesh liners
- Other drain connections and gasket materials
- Oxygen cleaning
- Special internal/external coatings and linings
- Contact factory for other options

APPLICABLE CODES

- ANSI B16.5
- ANSI B16.25
- ANSI B16.34

- **ANSI 300 PSIG rated strainers**
- **NPT, RF Flanges, Socketweld and Buttweld in accordance with ANSI 16.5, and 16.25**
- **All Flanged connections complete with Bolted Cover**
- **Cover flange (CS, SS) in accordance with ASME Section VIII, Div 1 Appendix II and/or ANSI 16.5.**
- **One piece cast body – Investment cast on NPT and socketweld versions.**
- **Upper and lower machined seats**
- **Generous screen area and properly proportioned straining chamber to minimize initial pressure drop while maximizing time between cleanings**
- **Drain/Blow-off connection furnished with plug**

MODELS

- 300Y1T – Carbon or Stainless Steel, NPT with Threaded Cover
- 300Y1W – Carbon or Stainless Steel, Socketweld with Threaded Cover
- 300Y2F – Carbon or Stainless Steel, Flanged with Bolted Cover
- 300Y2B – Carbon or Stainless Steel, Buttweld with Bolted Cover

Canadian Registration

OEO447-902517 - 300YI Carbon Steel

OEO591.9C - 300YI Stainless Steel

300Y Series Ordering Code

300Y Series Ordering Code

Inlet Size					Model						Body Material	Dash	Perf	Mesh	Add'l Requirements
0	2	0	0	-	3	0	0	Y	1	W	C	-	6	—	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size -
Position 1 - 4
0050 - ½"
0075 - ¾"
0100 - 1"
0125 - 1¼"
0150 - 1½"
0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5
Model - Position 6 - 11
300Y1T
300Y1W
300Y2F
300Y2B¹
Body Material -
Position 12
C - Carbon Steel
T - Stainless Steel
Dash - Position 13

1. For Buttweld connections please specify mating pipe schedule.

Perf² - Position 14
304SS Material³
A - No Perf
1 - 1/32"
B - 3/64"
4 - 1/8"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"

2. Standard Screens:
Y1 < 2" — 1/32" perf,
Y1 > 2" — 3/64" perf,
Y2 < 1½" — 1/32" perf,
Y2 2" - 3" — 3/64" perf,
Y2 > 3" — 1/8" perf

Mesh³ - Position 15
Leave Blank If not Required (std ALL)
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120

3. For other screen material, contact factory.

Add'l Requirements -
Position 16
Leave Blank If not Required
D - Special Drain Size
F - Silicon Free
G - Special Gaskets
N - Nace MR01-75
T - Special Testing
X - Oxygen Cleaning
Y - Other and / or Multiple Specials

Indicate Specials Clearly On the Order

300Y1 SERIES CARBON STEEL, STAINLESS STEEL Y STRAINERS NPT, SOCKETWELD

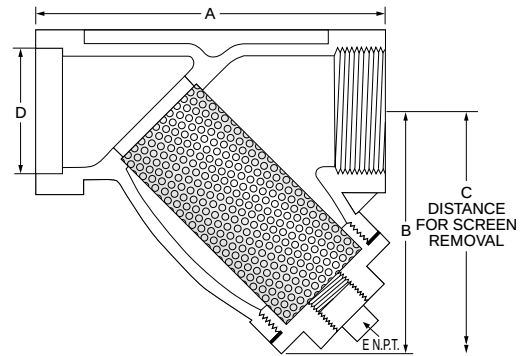
SPECIFICATION

Y Strainer shall be straight flow design with NPT or Socketweld inlet/outlet connections. The strainer shall be rated to ANSI 300 PSIG. The Strainer shall be Investment Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 300Y1 Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cap	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS
Plug	A105	A182-316
Gasket ¹	Teflon	Teflon

1. Recommended Spare Parts



Connections:

CS – 1/2" to 3" NPT or SW
SS – 1/2" to 3" NPT or S

SCREEN OPENINGS

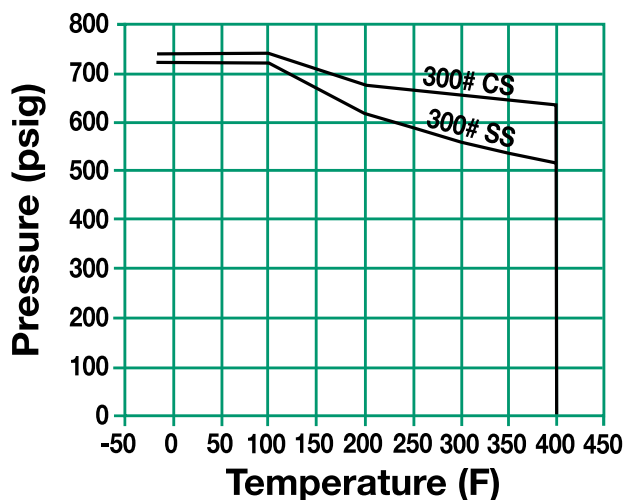
SIZE	STANDARD SCREEN	MATERIALS
1/2" – 2"	1/32" Perf	304 SS
2 1/2" – 3"	3/64" Perf	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
1/2 (15)	2 1/32 (59)	1 1/8 (41)	2 1/8 (60)	0.855 (21.72)	3/8 (10)	.50 (.22)
3/4 (20)	3 1/8 (80)	2 (51)	3 1/8 (81)	1.065 (27.05)	3/8 (10)	.82 (.37)
1 (25)	3 3/8 (84)	2 1/8 (60)	4 (102)	1.330 (33.78)	1/2 (15)	1.50 (.68)
1 1/4 (32)	4 1/8 (105)	2 3/8 (73)	4 1/2 (114)	1.675 (42.55)	1/2 (15)	2.0 (.90)
1 1/2 (40)	4 3/8 (119)	3 1/8 (83)	4 3/4 (121)	1.915 (48.64)	1/2 (15)	2.8 (1.27)
2 (50)	5 1/8 (138)	3 3/8 (97)	5 1/8 (146)	2.406 (61.11)	1/2 (15)	4.3 (1.95)
2 1/2 (65)	7 1/8 (183)	4 1/8 (124)	7 1/8 (184)	2.906 (73.81)	1/2 (15)	10 (4.54)
3 (80)	8 1/8 (205)	5 1/8 (138)	7 3/4 (191)	3.535 (89.79)	1/2 (15)	14 (6.35)

Dimensions shown are subject to change.
Consult factory for certified drawings when required.

PRESSURE/TEMPERATURE CHART
ANSI B16.34



**300Y1 SERIES
STRAINERS**

300Y2 SERIES CARBON STEEL, STAINLESS STEEL Y STRAINERS FLANGED, BUTTWELDED

SPECIFICATION

Y Strainer shall be straight flow design with RF Flanged or Buttweld inlet/outlet connections. The strainer shall be rated to ANSI 300 PSIG rating in accordance with ANSI B16.5 or ANSI B16.25. The Strainer shall be Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 300Y2 Series.

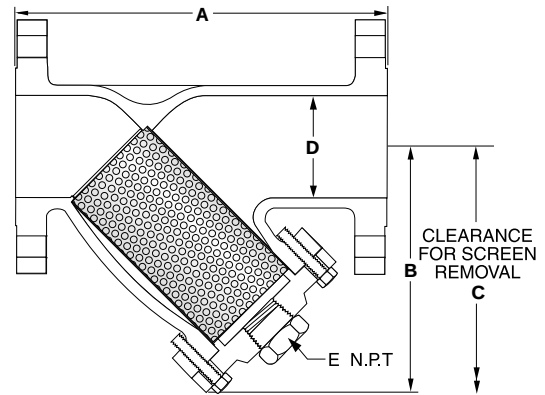
MATERIALS OF CONSTRUCTION*

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cover	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS
Plug ²	A105	A182-316
Gasket ¹	304 SS Spiral Wound	304 SS Spiral Wound
Stud	A193-B7	A193-B8-1
Nut ²	A194-2H	A194-8

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted

* Low Carbon Steel Available on request. Consult Factory



Connections:
CS - ½" to 12"
RF Flanged or Buttweld³
SS - ½" to 12"
RF Flanged or Buttweld³

3. For Buttweld connections please specify pipe schedule.

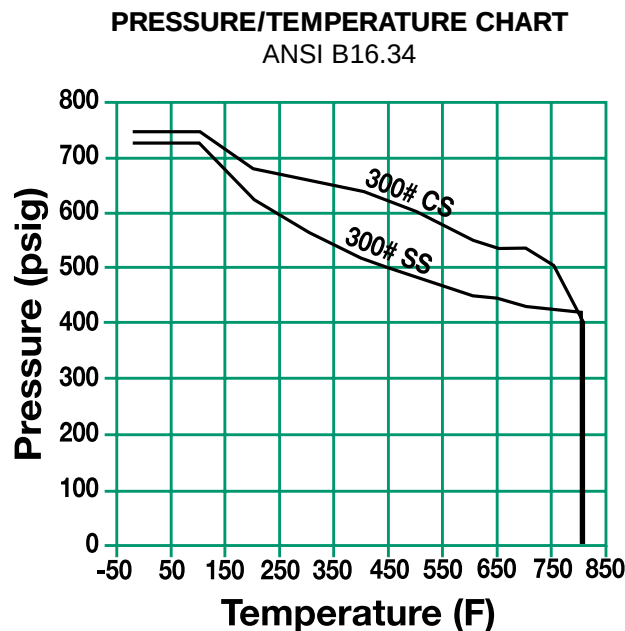
SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
½" - 1½"	1/32" Perf	304 SS
2" - 3"	3/64" Perf	304 SS
4" - 12"	1/8" Perf	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
½ (15)	6½ (165)	4¼ (108)	5¼ (146)	½ (13)	¾ (8)	8 (3.6)
¾ (20)	7¾ (197)	5 (127)	6¼ (171)	¾ (19)	¾ (10)	14 (6.4)
1 (25)	7¾ (200)	5½ (140)	8¼ (206)	1 (25)	½ (15)	15 (6.8)
1½ (40)	10¼ (267)	7 (178)	10¼ (260)	1½ (38)	½ (15)	32 (15)
2 (50)	9 (229)	5½ (145)	8 (203)	2 (51)	½ (15)	25 (11.4)
2½ (65)	10¼ (276)	7¼ (183)	10¼ (260)	2½ (64)	1 (25)	38 (17.3)
3 (80)	12¼ (320)	8¼ (207)	11¼ (292)	3 (76)	1 (25)	56 (25.5)
4 (100)	14¼ (372)	9¼ (245)	13¼ (346)	4 (102)	1½ (40)	90 (40.9)
5 (125)	18¼ (470)	15¼ (391)	21¼ (546)	5 (127)	2 (50)	180 (82)
6 (150)	19¼ (502)	15 (381)	21¼ (546)	6 (152)	2 (50)	203 (92.3)
8 (200)	25 (635)	16¼ (419)	22 (559)	8 (203)	2 (50)	323 (146.8)
10 (250)	27¼ (702)	21¼ (538)	30 (762)	10 (254)	2 (50)	571 (259.6)
12 (300)	32¼ (835)	24¼ (617)	34¼ (873)	12 (305)	2 (50)	893 (405.9)

Dimensions shown are subject to change.
Contact factory for certified prints when required.



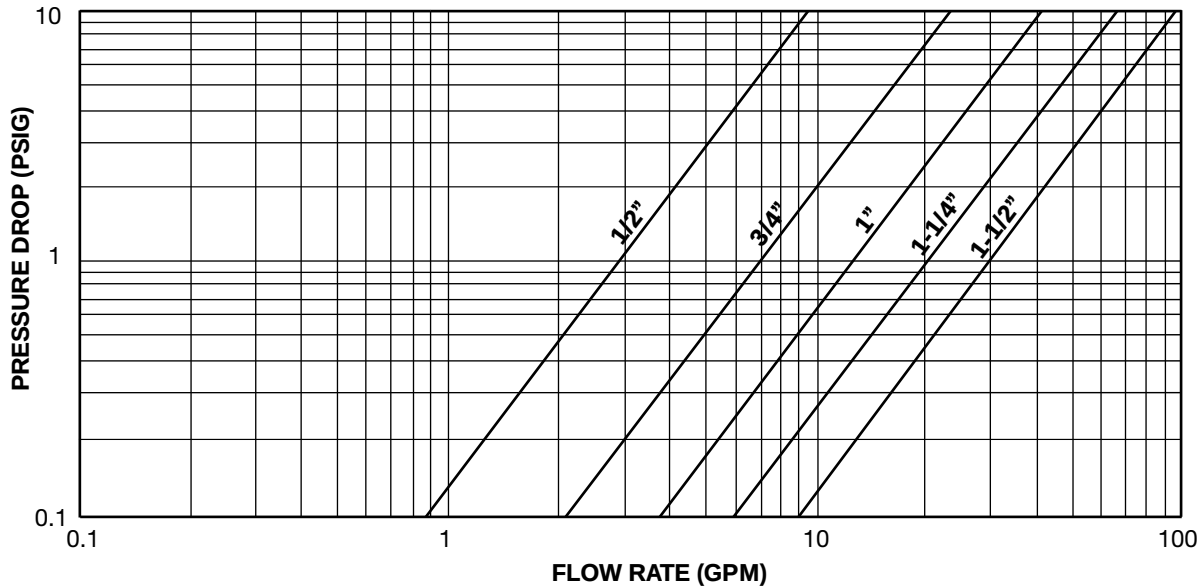
300Y SERIES

CARBON STEEL, STAINLESS STEEL

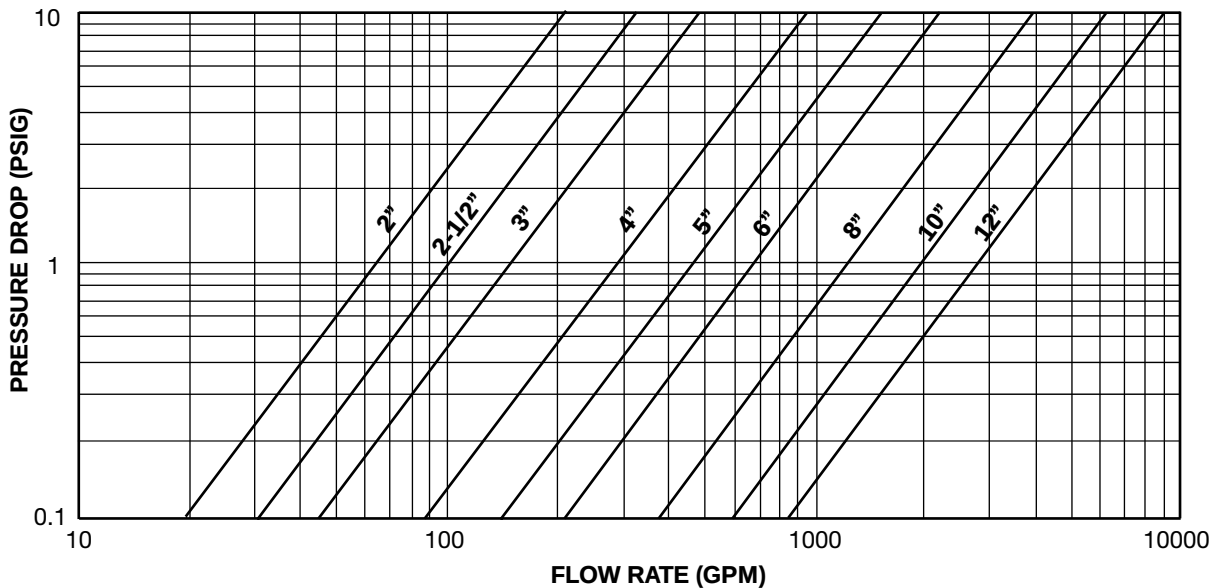
PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

(Sizes ½" - 1½")



(Sizes 2" - 12")



* For Gas, Steam or Air service, consult factory.

Steam Service Pressure Drop
Page 433

Correction Factors for Other Viscous
Liquids and/or Mesh Liners Page 432

Correction Factors for
Clogged Screens Page 432

300Y SERIES
STRAINERS

300Y SERIES

CARBON STEEL, STAINLESS STEEL

OPEN AREA RATIOS

with Standard Perforated Screen

300Y1 Carbon Steel, Stainless Steel

Size	Perf. Diameter (mm ²)	Opening %	Std Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	1/32	28	0.30	3.2	1.13	3.7
¾	1/32	28	0.53	5.1	1.80	3.4
1	1/32	28	0.86	8.1	2.82	3.3
1¼	1/32	28	1.50	10.2	3.56	2.4
1½	1/32	28	2.04	14.6	5.10	2.5
2	1/32	28	3.36	21.2	7.41	2.2
2½	3/64	36	4.79	37.0	12.94	2.7
3	3/64	36	7.39	47.6	16.66	2.3

300Y2 Carbon Steel, Stainless Steel

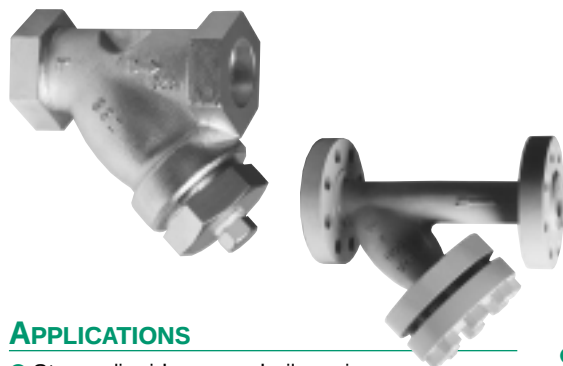
Size	Perf. Diameter (inches)	Opening %	Flange Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	1/32	28	0.20	6.8	1.91	9.7
¾	1/32	28	0.44	10.4	2.92	6.6
1	1/32	28	0.79	15.3	4.27	5.4
1½	1/32	28	1.77	32.5	9.11	5.2
2	3/64	36	3.14	28.7	10.35	3.3
2½	3/64	36	4.91	48.1	17.32	3.5
3	3/64	36	7.07	71.2	25.62	3.6
4	1/8	40	12.57	106.3	42.54	3.4
6	1/8	40	28.27	233.2	93.29	3.3
8	1/8	40	50.27	340.3	136.14	2.7
10	1/8	40	78.54	489.9	195.96	2.5
12	1/8	40	113.10	710.9	284.36	2.5

OAR = Free Screen Area / Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

NOTES:



600Y SERIES

CARBON STEEL, STAINLESS STEEL, LOW CARBON STEEL, ALLOY 20 Y STRAINERS

NPT, FLANGED, RING JOINT, SOCKETWELD, BUTTWELD

PRESSURES TO 1480 PSIG (102 BARG)
TEMPERATURES TO 800°F (427°C)

APPLICATIONS

- Steam, liquid, gas and oil service
- Power industry
- Pulp and paper
- Chemical industry
- Process Equipment
- Metal & Mining
- Water & Waste

OPTIONS

- Low Carbon Steel and Alloy 20 bodies available on Y1T and Y1W models
- Other perforated screens and mesh liners
- Other drain connections and gasket materials
- Oxygen cleaning
- Special internal / external coatings and linings
- Contact Factory for other Options

APPLICABLE CODES

- ANSI B16.5
- ANSI B16.34

Canadian Registration
OEO447.902517 - 600Y1
OE1972.2987 - 600Y2

- ANSI 600 PSIG rated strainers
- NPT, RF or RTJ Flanges, Socketweld and Buttweld in accordance with ANSI 16.34 and 16.5
- SSI Exclusive – Body blow down flange and cover flange dimensions are in dimensional accordance with ANSI B16.5
- All Flanged connections complete with Bolted Cover
- One piece cast body
- Upper and lower machined seats
- Generous screen area and properly proportioned straining chamber to minimize initial pressure drop while maximizing time between cleanings
- Drain/Blow-off connection furnished with plug

MODELS

- 600Y1T* – NPT with Threaded Cover
- 600Y1W* – Socketweld with Threaded Cover
- 600Y2F* – Flanged with Bolted Cover
- 600Y2J* – Ring Joint with Bolted Cover
- 600Y2B* – Buttweld with Bolted Cover

*Carbon Steel, Stainless Steel, Low Carbon Steel or Alloy 20

600Y Series Ordering Code

Inlet Size					Model					Body	Dash	Perf	Mesh	Add'l Requirements
0	3	0	0	-	6	0	0	Y	1	W	C	-	B	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
														16

Inlet Size -
Position 1 - 4
0050 - ½"
0075 - ¾"
0100 - 1"
0125 - 1¼"
0150 - 1½"
0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5
Model - Position 6 - 11
600Y1T
600Y1W
600Y2F¹
600Y2J¹
600Y2B^{1,2}

Body - Position 12
C - CS
T - SS
L - LCS
A - A20

Dash - Position 13

1. CS available 2" - 12", SS available 2" - 6".
2. For Buttweld connections please specify mating pipe schedule.

Perf³ - Position 14
304SS Material⁴
A - No Perf
1 - 1/32"
B - 3/64"
4 - 1/8"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"

3. Standard Screens:
All ½"-1½"—1/32" perf,
All 2"-3"—3/64" perf,
All >3"—1/8" perf.

Mesh⁴ - Position 15
Leave Blank If not Required (std ALL)
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120

4. For other screen material, contact factory.

Add'l Requirements -
Position 16

Leave Blank If not Required

D - Special Drain Size
F - Silicon Free
G - Special Gaskets
N - Nace MR01-75
T - Special Testing
X - Oxygen Cleaning
Y - Other and / or Multiple Specials

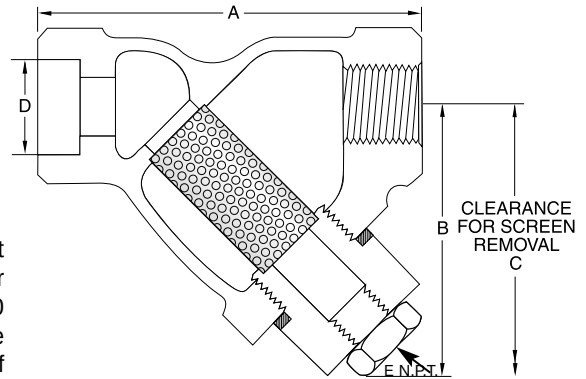
Indicate Specials Clearly On the Order

600Y1 SERIES

CARBON STEEL, STAINLESS STEEL, LOW CARBON STEEL, ALLOY 20 Y STRAINERS NPT, SOCKETWELD

SPECIFICATION

Y Strainer shall be straight flow design with NPT or Socketweld inlet/outlet connections. The strainer shall be rated to ANSI 600 PSIG. The Strainer shall be Cast Carbon Steel, Stainless Steel Low Carbon Steel or Alloy 20 body and the screen shall be size _____ perf 304 SS or Alloy 20. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 600Y1 Series



Connections:

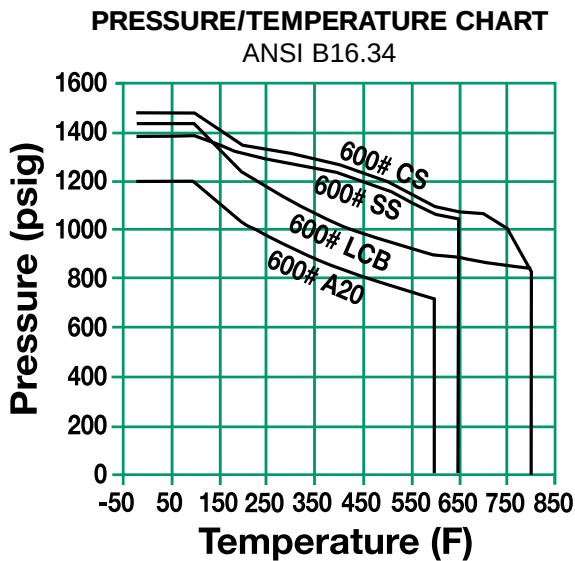
CS – ½" to 2" NPT or SW
SS – ½" to 2" NPT or SW
LCS – ½" to 2" NPT or SW
A20 – ½" to 2" NPT or SW

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel	Low Carbon Steel	Alloy 20
Body	A216-WCB	A351-CF8M	A352-LCB	A351-CN7M
Cap ²	A216-WCB	A351-CF8M	A351-CF8M	A351-CN7M
Screen ¹	304 SS	304 SS	304 SS	304 SS
Plug ²	A105	304 SS	304 SS	B462
Gasket ¹	304 SS Spiral Wound	304 SS Spiral Wound	304 SS Spiral Wound	304 SS Spiral Wound

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted



SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
½" – 1½"	1/32" Perf	304 SS/Alloy 20
2"	3/64" Perf	304 SS/Alloy 20

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
½ (15)	3 (76)	2 1/16 (62)	3 3/8 (80)	0.855 (21.72)	3/8 (8)	1.4 (0.6)
¾ (20)	3 3/8 (95)	2 1/8 (75)	3 1/2 (90)	1.065 (27.05)	7/8 (10)	2.2 (1.0)
1 (25)	4 3/8 (118)	3 3/8 (95)	3 7/8 (100)	1.330 (33.78)	1 (10)	4.1 (1.9)
1 ¼ (32)	5 (127)	4 (102)	4 1/2 (108)	1.675 (42.55)	1 1/8 (20)	5.3 (2.4)
1 ½ (40)	5 3/8 (143)	4 1/2 (122)	4 3/4 (118)	1.915 (48.64)	1 1/4 (20)	8.4 (3.8)
2 (50)	7 (178)	6 3/8 (156)	6 1/2 (171)	2.406 (61.11)	1 3/4 (25)	12.6 (5.7)

Dimensions shown are subject to change.
Consult factory for certified drawings when required.

600Y1 SERIES
STRAINERS

600Y2 SERIES CARBON STEEL, STAINLESS STEEL Y STRAINERS FLANGED, RING JOINT, BUTTWELD SPECIFICATION

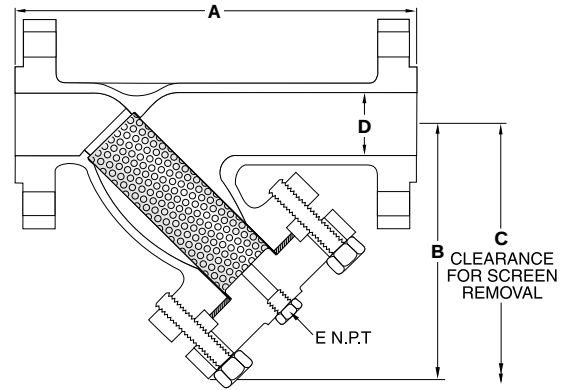
Y Strainer shall be straight flow design with RF Flanged, Ring Joint or Buttweld inlet/outlet connections. The strainer shall be rated to ANSI 600 PSIG rating in accordance with ANSI B16.5 or B16.34. The Strainer shall be Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 600Y2 Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cover	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS
Plug ²	A105	304 SS
Gasket ¹	304 SS Spiral Wound	304 SS Spiral Wound
Stud	A193-B7	A320-B8
Nut ²	A194-2H	A194-8

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted



Connections:

CS - 2" to 12" RF Flanged,
RTJ or Buttweld³

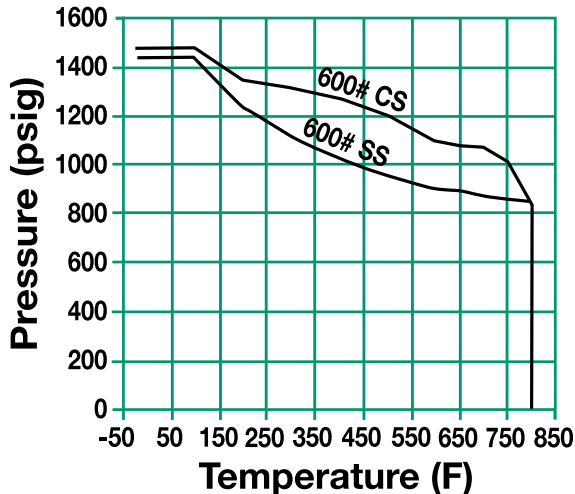
SS - 2" to 6" RF Flanged,
RTJ or Buttweld³

3. For Buttweld connections please specify mating pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" - 3"	3/64" Perf	304 SS
4" - 12"	1/8" Perf	304 SS

PRESSURE/TEMPERATURE CHART
ANSI B16.34



DIMENSIONS inches (mm)
AND WEIGHTS pounds (kg)

SIZE ⁴	A	B	C	D	E	WEIGHT
2 (50)	12½ (318)	8 (203)	9¼ (235)	2 (51)	½ (15)	46 (20.9)
3 (80)	15½ (397)	10½ (257)	11¾ (289)	3 (76)	1¼ (32)	93 (42.2)
4 (100)	20 (508)	13 (330)	14¾ (362)	4 (102)	1½ (40)	187 (85.0)
6 (150)	25½ (648)	17 (432)	18¾ (463)	6 (152)	2 (50)	403 (183.2)
8 (200)	30 (330)	21¾ (543)	22¼ (576)	8 (203)	2 (50)	660 (300.0)
10 (250)	37½ (956)	24¾ (629)	26 (660)	10 (254)	2 (50)	1428 (649.1)
12 (300)	42 (1067)	30 (762)	31¼ (794)	12 (305)	2 (50)	1608 (730.9)

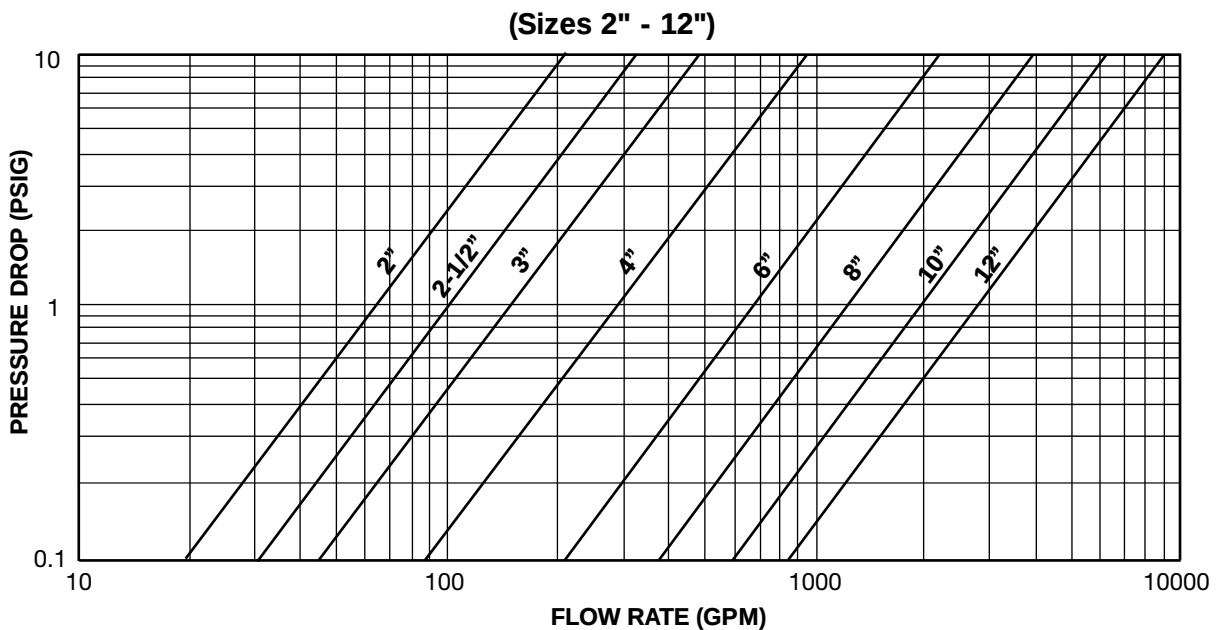
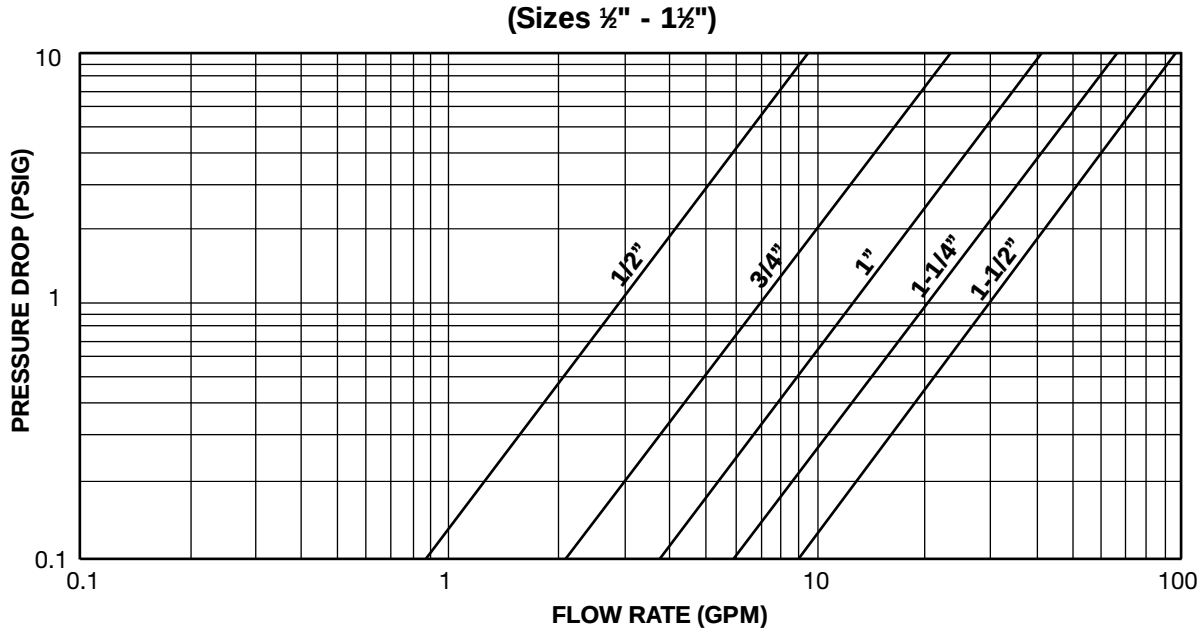
Dimensions shown are subject to change.
Consult factory for certified drawings when required.

4. CS available 2" - 12",
SS available 2" - 6".

600Y SERIES

CARBON STEEL, STAINLESS STEEL, LOW CARBON STEEL, ALLOY 20 PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*



* For Gas, Steam or Air service, consult factory.

Steam Service Pressure Drop
Page 433

Correction Factors for Other Viscous
Liquids and/or Mesh Liners Page 432

Correction Factors for
Clogged Screens Page 432

600Y SERIES
STRAINERS

600Y SERIES

CARBON STEEL, STAINLESS STEEL, LOW CARBON STEEL, ALLOY 20

OPEN AREA RATIOS

with Standard Perforated Screen

600Y1 - Threaded & Socketweld

Size	Perf. Diameter (inches)	Opening %	XH Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	1/32	28	0.23	2.7	0.76	3.3
¾	1/32	28	0.43	4.6	1.28	3.0
1	1/32	28	0.72	8.5	2.38	3.3
1¼	1/32	28	1.28	12.8	3.58	2.8
1½	1/32	28	1.77	16.5	4.61	2.6
2	3/64	36	2.95	27.8	19	3.4

600Y2 - Flanged, Ring Joint Flanged & Buttweld

Size	Perf. Diameter (inches)	Opening %	Flange Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	38.4	13.82	4.4
3	3/64	36	7.07	74.2	26.72	3.8
4	1/8	40	12.57	127.6	51.06	4.1
6	1/8	40	28.27	261.2	104.49	3.7
8	1/8	40	50.27	408.5	163.42	3.3
10	1/8	40	78.54	598.9	239.57	3.1
12	1/8	40	113.10	817.7	327.08	2.9

OAR = Free Screen Area / Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

NOTES:



900Y SERIES

CARBON STEEL, STAINLESS STEEL Y STRAINERS

FLANGED, RING JOINT, BUTTWELD

PRESSURES TO 2220 PSIG (153 BARG)

TEMPERATURES TO 800°F (427°C)

APPLICATIONS

- Steam, liquid, gas and oil service
- Power industry
- Pulp and paper
- Chemical industry
- Process Equipment
- Metal & Mining
- Water & Waste

OPTIONS

- Other perforated screens and mesh liners
- Drain connections and other gasket materials
- Oxygen cleaning
- Special internal / external coatings and linings
- Contact Factory for other Options

APPLICABLE CODES

- ANSI B16.5
- ANSI B16.34

● ANSI 900 PSIG rated strainers

● RF or RTJ Flanges, and Buttweld in accordance with ANSI 16.34 and 16.5

● SSI Exclusive – Body blow down flange and cover flange dimensions are in dimensional accordance with ANSI B16.5.

● All Flanged connections complete with Bolted Cover

● One piece cast body

● Upper and lower machined seats

● Generous screen area and properly proportioned straining chamber to minimize initial pressure drop while maximizing time between cleanings

● Drain/Blow-off connection furnished with plug

MODELS

- 900Y2F – Carbon or Stainless Steel Flanged with Bolted Cover
- 900Y2J – Carbon or Stainless Steel Ring Joint with Bolted Cover

For Buttweld connections see FY Series on page 424

NOTE: 900# flanges are the same as 1500# flanges in sizes 1/2" - 2½".

Canadian Registration OE A72.2 6"900Y2

900Y Series Ordering Code

900Y Series Ordering Code															
Inlet Size				Dash	Model						Body Material	Dash	Perf	Mesh	Add'l Requirements
0	8	0	0	-	9	0	0	Y	2	B	C	-	4	—	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size - Position 1 - 4
0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0600 - 6"
0800 - 8"
Dash - Position 5

Model - Position 6 - 11
900Y2F
900Y2J
Body Material - Position 12
C - CS
T - SS
Dash - Position 13

Perf¹ - Position 14
304SS Material²
A - No Perf
1 - 1/32"
B - 3/64"
4 - 1/8"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"

Mesh² - Position 15
Leave Blank
If not Required
(std ALL)
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120

Add'l Requirements - Position 16
Leave Blank
If not Required
D - Special Drain Size
F - Silicon Free
G - Special Gaskets
N - Nace MR01-75
T - Special Testing
X - Oxygen Cleaning
Y - Other and / or
Multiple Specials
Indicate Specials
Clearly On the Order

1. Standard Screens:
All <3"—3/64" perf,
All >3"—1/8" perf.

2. For other screen
material, contact
factory.

900Y2 SERIES CARBON STEEL, STAINLESS STEEL Y STRAINERS FLANGED, RING JOINT, BUTTWELD SPECIFICATION

Y Strainer shall be straight flow design with RF Flanged, Ring Joint or Buttweld inlet/outlet connections. The strainer shall be rated to ANSI 900 PSIG rating in accordance with ANSI B16.5 or B16.34. The Strainer shall be Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 900Y2 Series.

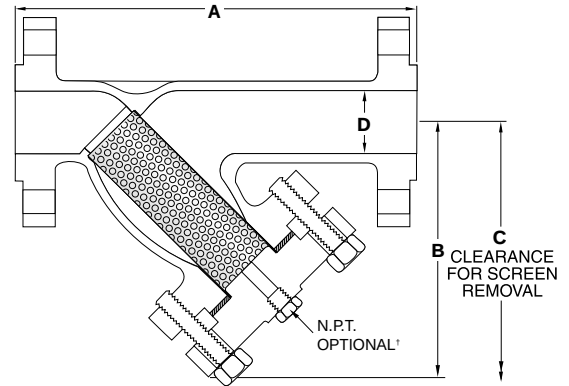
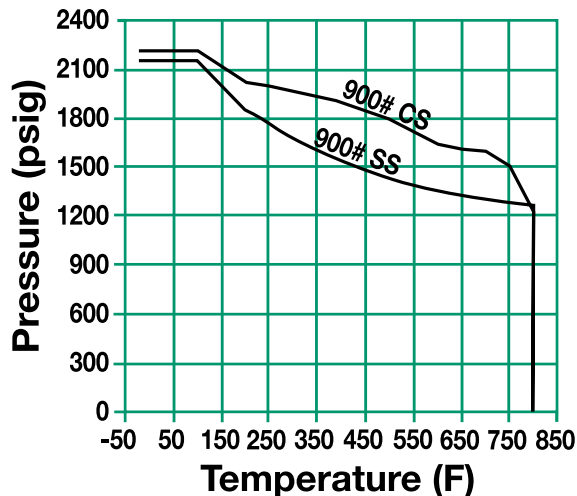
MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cover	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS
Plug ²	A105	304 SS
Gasket ¹	304 SS Spiral Wound	304 SS Spiral Wound
Stud	A193-B7	A320-B8
Nut ²	A194-2H	A194-8

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted

PRESSURE/TEMPERATURE CHART
ASME B16.34



[†] SSI Series 900Y strainers are not furnished with a drain/blow-down connection. Consult factory if required.

Connections:
CS - 2" to 8" RF Flanged or RTJ
SS - 2" to 8" RF Flanged, RTJ

For Buttweld connection use FY Series on page 424

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" - 3"	3/64" Perf	304 SS
4" - 8"	1/8" Perf	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	WEIGHT
2 (50)	16½ (413)	10½ (268)	14½ (378)	1.87 (48)	125 (57)
3 (80)	20½ (514)	12½ (324)	18 (457)	2.87 (73)	163 (74)
4 (100)	23½ (541)	15 (381)	21½ (539)	3.87 (98)	253 (115)
6 (150)	27½ (705)	18½ (480)	26½ (667)	5.75 (146)	580 (263.6)
8 (200)	34½ (876)	22½ (575)	32 (813)	7.50 (191)	1080 (490.9)

Dimensions shown are subject to change.
Contact factory for certified prints when required.

**900Y2 SERIES
STRAINERS**

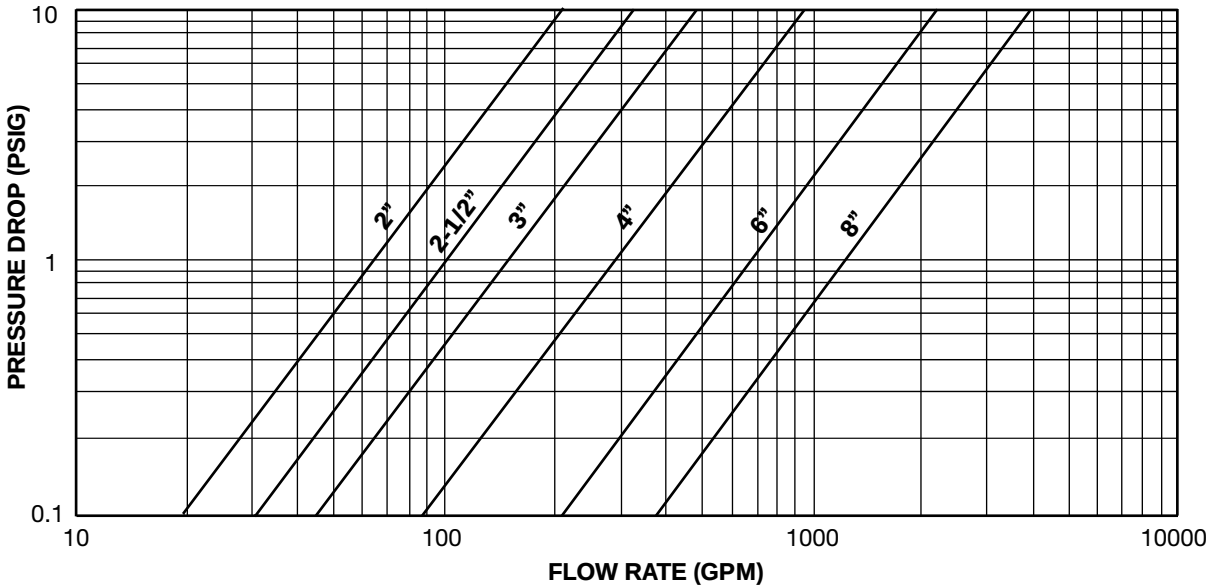
900Y SERIES

CARBON STEEL, STAINLESS STEEL

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

(Sizes 2" - 8")



* For Gas, Steam or Air service, consult factory.

Steam Service Pressure Drop
Page 433

**Correction Factors for Other Viscous
Liquids and/or Mesh Liners** Page 432

**Correction Factors for
Clogged Screens** Page 432

900Y SERIES

CARBON STEEL, STAINLESS STEEL

OPEN AREA RATIOS

with Standard Perforated Screen

900Y2 Carbon Steel, Stainless Steel

Size	Perf. Diameter (mm ²)	Opening %	Flange Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	48.9	17.61	5.6
3	3/64	36	7.07	99.5	35.83	5.1
4	1/8	40	12.57	161.6	64.62	5.1
6	1/8	40	28.27	290.7	116.28	4.1
8	1/8	40	50.27	440.2	176.08	3.5

OAR = Free Screen Area / Inlet Area

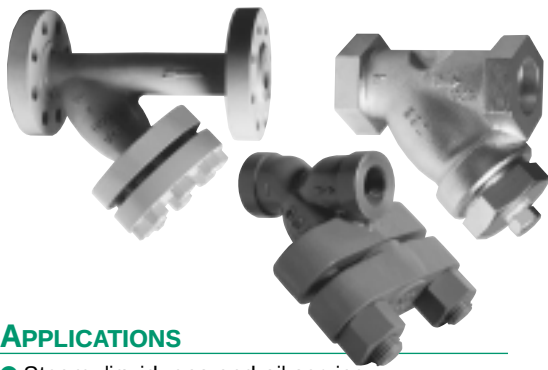
Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

Other Screen Openings
Page 430

Basket Burst Pressure
Page 435

NOTES:



1500Y SERIES

CARBON STEEL, STAINLESS STEEL, CHROME MOLY Y STRAINERS

NPT, FLANGED, RING JOINT, SOCKETWELD, BUTTWELD

PRESSURES TO 3705 PSIG (258.5 BARG)

TEMPERATURES TO 800°F (426°C)

APPLICATIONS

- Steam, liquid, gas and oil service
- Power industry
- Pulp and paper
- Chemical industry
- Process Equipment
- Metal & Mining
- Water & Waste

OPTIONS

- Chrome Moly bodies available on Y2T and Y2W models
- Other perforated screens and mesh liners
- Drain connections and other gasket materials
- Oxygen cleaning
- Special internal / external coatings and linings
- Contact Factory for other Options

APPLICABLE CODES

- ANSI B16.5
- ANSI B16.34

Canadian Registration:

OE0495.90-1500 Y1T, Y2TC

OE1972.2-1500 Y2TC

OE5779.5-1500 Y2T

- **ANSI 1500 PSIG rated strainers**
- **NPT, RF or RTJ Flanges, Socketweld and Buttweld in accordance with ANSI 16.34 and 16.5**
- **SSI Exclusive – Body blow down flange and cover flange dimensions are in dimensional accordance with ANSI B16.5.**
- **All Flanged connections complete with Bolted Cover**
- **One piece cast body**
- **Upper and lower machined seats**
- **Generous screen area and properly proportioned straining chamber to minimize initial pressure drop while maximizing time between cleanings**
- **Drain/Blow-off connection furnished with plug**

MODELS

- 1500Y1T – Carbon or Stainless NPT with Threaded Cover
- 1500Y1W – Carbon or Stainless Socketweld with Threaded Cover
- 1500Y2T – Carbon, Stainless or Chrome Moly NPT with Bolted Cover
- 1500Y2W – Carbon, Stainless or Chrome Moly Socketweld with Bolted Cover
- 1500Y2F – Carbon or Stainless Flanged with Bolted Cover
- 1500Y2J – Carbon or Stainless Ring Joint with Bolted Cover

For Buttweld connections see FY Series on page 424

1500Y Series Ordering Code

1500T Series Ordering Code

Inlet Size				Dash	Model							Body Material	Dash	Perf	Mesh	Add'l Requirements
0	1	5	0	-	1	5	0	0	Y	2	T	R	-	3	—	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Inlet Size -
Position 1 - 4
0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0600 - 6"

Dash -
Position 5

Model - Position 6 - 12
1500Y1T
1500Y1W
1500Y2T
1500Y1W
1500Y2F
1500Y2J

Body Material -
Position 13
C - CS
T - SS
R - CM

Dash - Position 14

Perf¹ - Position 15
304SS Material²
A - No Perf
1 - 1/32"
B - 3/64"
4 - 1/8"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"

- Standard Screens:
Y1T and Y2T
½"-1½"—1/32" perf,
Y2 2"-6"—1/8" perf.

Mesh² -
Position 16
**Leave Blank
If not Required
(std ALL)**
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120

- For other screen materials, contact factory.

Add'l Requirements -
Position 17
**Leave Blank
If not Required**
D - Special Drain Size
F - Silicon Free
G - Special Gaskets
N - Nace MR01-75
T - Special Testing
X - Oxygen Cleaning
Y - Other and / or
Multiple Specials

**Indicate Specials
Clearly On the Order**

1500Y1 SERIES

CARBON STEEL, STAINLESS STEEL

Y STRAINERS

NPT, SOCKETWELD

SPECIFICATION

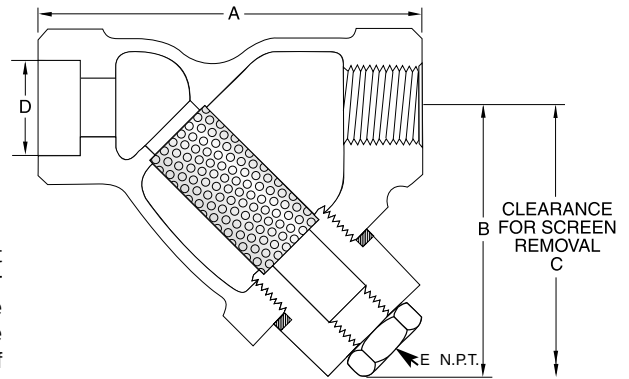
Y Strainer shall be straight flow design with NPT or Socketweld inlet/outlet connections. The strainer shall be rated to ANSI 1500 PSIG. The Strainer shall be Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have a threaded cover. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 1500Y1 Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cap ²	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS
Plug ²	A105	A182-316
Gasket ¹	304 SS Spiral Wound	304 SS Spiral Wound

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted



Connections:

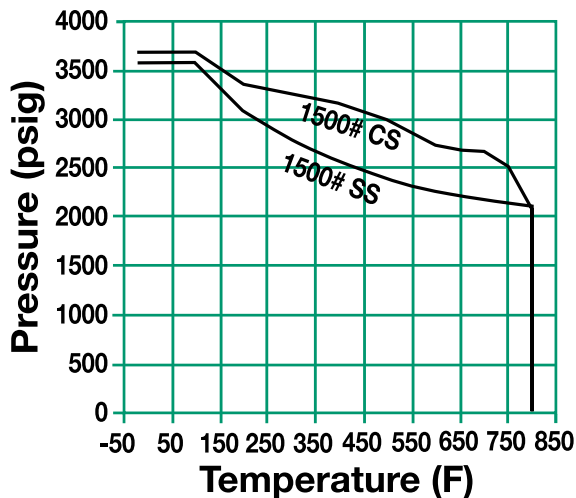
CS - ½" to 1" NPT or Socketweld
SS - ½" to 1" NPT or Socketweld

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
½" – 1"	1/32" Perf	304 SS

PRESSURE/TEMPERATURE CHART

ASME B16.34



DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	E	WEIGHT
½ (15)	3 15/16 (100)	3 7/16 (90)	5 5/16 (135)	7/8 (22.23)	¼ (8)	2.4 (1.1)
¾ (20)	4 ¼ (108)	3 5/16 (100)	5 (127)	1 1/16 (27.05)	¾ (10)	3.3 (1.5)
1 (25)	5 (127)	4 7/16 (120)	7 1/2 (178)	1 1/2 (33.78)	1 (15)	6.0 (2.7)

Dimensions shown are subject to change.

Contact factory for certified prints when required.

1500Y1 SERIES
STRAINERS

1500Y2 SERIES CARBON STEEL, STAINLESS STEEL CHROME MOLY Y STRAINERS NPT, SOCKETWELD

SPECIFICATION

Y Strainer shall be straight flow design with NPT or Socketweld inlet/outlet connections. The strainer shall be rated to ANSI 1500 PSIG. The Strainer shall be Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have a bolted cover. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 1500Y2 Series.

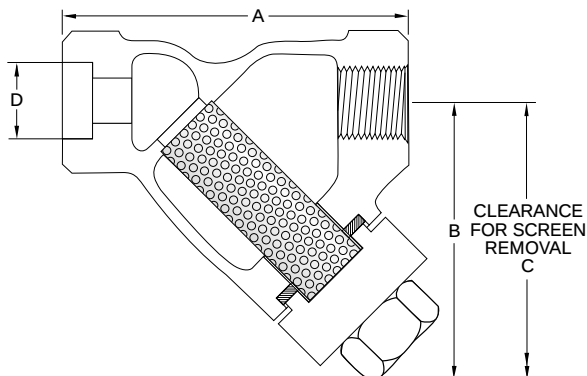
MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel	Chrome Moly
Body	A216-WCB	A351-CF8M	A217-WC6
Cover ²	A216-WCB	A351-CF8M	A217-WC6
Screen ¹	304 SS	304 SS	304 SS
Gasket ¹	304 SS Spiral Wound	304 SS Spiral Wound	304 SS Spiral Wound
Stud	A193-B7	A193-B8-1	*
Nut	A194-2H	A194-8	*

* For Chrome Moly materials of construction contact factory.

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted



1500Y2 NPT/SW strainers are not furnished with a drain/blow down connection. If required consult factory.

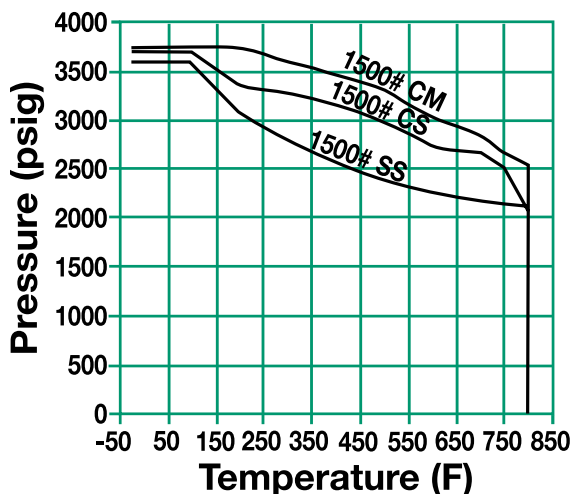
Connections:

CS – 1/2" to 2" NPT or Socketweld
SS – 1/2" to 2" NPT or Socketweld
CM – 1/2" to 2" NPT or Socketweld

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
1/2" – 1 1/2"	1/32" Perf	304 SS
2"	3/64" Perf	304 SS

PRESSURE/TEMPERATURE CHART
ASME B16.34



DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	WEIGHT
1/2 (15)	3 15/16 (100)	5 5/8 (130)	6 1/2 (165)	7/8 (22)	7 (3.2)
3/4 (20)	4 3/4 (108)	5 25/32 (150)	7 3/32 (180)	1 1/8 (29)	11 (5)
1 (25)	5 (127)	6 15/16 (170)	8 15/32 (215)	1 5/16 (33)	15 (6.8)
1 1/4 (32)	8 3/8 (213)	7 7/16 (179)	8 5/8 (219)	1 11/16 (43)	22 (10)
1 1/2 (40)	8 3/8 (213)	7 7/16 (179)	8 5/8 (219)	1 15/16 (49)	22 (10)
2 (50)	9 3/8 (238)	7 7/8 (200)	10 (254)	2 1/8 (62)	26 (11.8)

Dimensions shown are subject to change.
Contact factory for certified prints when required.

1500Y2 SERIES CARBON STEEL, STAINLESS STEEL Y STRAINERS FLANGED, RING JOINT, BUTTWELD

SPECIFICATION

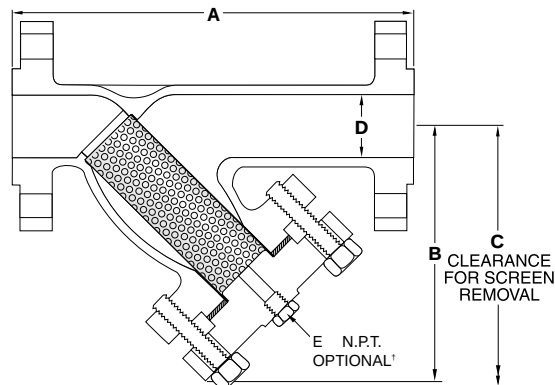
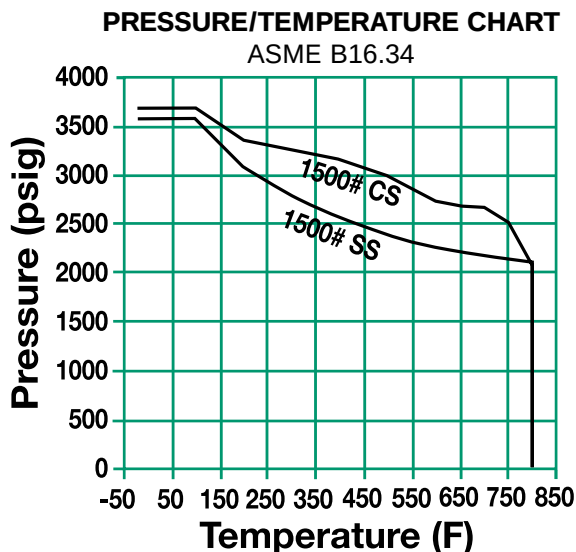
Y Strainer shall be straight flow design with RF Flanged, Ring Joint or Buttweld inlet/outlet connections. The strainer shall be rated to ANSI 1500 PSIG rating in accordance with ANSI B16.5 or B16.34. The Strainer shall be Cast Carbon Steel or Stainless Steel body and the screen shall be size _____ perf 304 SS. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI 1500Y2 Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cover	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS
Plug ²	A105	304 SS
Gasket ¹	304 SS Spiral Wound	304 SS Spiral Wound
Stud	A193-B7	A320-B8
Nut ²	A194-2H	A194-8

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted



* 1500Y2 strainers are not furnished with a drain/blowdown connection. If required consult factory.

Connections:

CS - 2" to 6" RF Flanged or RTJ

SS - 2" to 6" RF Flanged or RTJ

For Buttweld connection use FY Series on page 424

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" - 3"	3/64" Perf	304 SS
4" - 6"	1/8" Perf	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D	WEIGHT
2 (50)	16 1/4 (413)	10 1/2 (268)	14 1/4 (378)	1 1/2 (48)	125 (56.7)
2 1/2 (65)	19 1/4 (492)	13 1/4 (340)	14 1/2 (368)	2 1/4 (57)	142 (64.6)
3 (80)	22 1/4 (565)	14 1/2 (368)	20 1/2 (521)	2 3/4 (73)	243 (110.2)
4 (100)	25 1/4 (641)	16 1/4 (416)	23 (584)	3 1/4 (92)	388 (176)
6 (150)	32 (813)	21 1/4 (551)	30 1/2 (775)	5 1/4 (137)	817 (370.6)

* Consult factory for dimensions

Dimensions shown are subject to change.

Contact factory for certified prints when required.

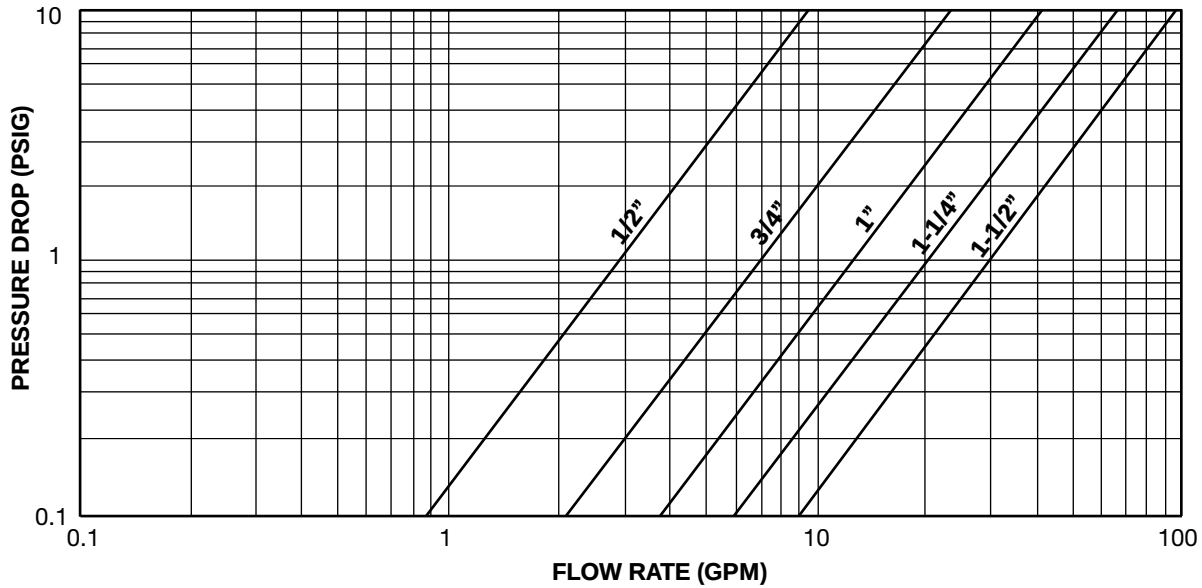
1500Y2 SERIES
STRAINERS

1500Y SERIES

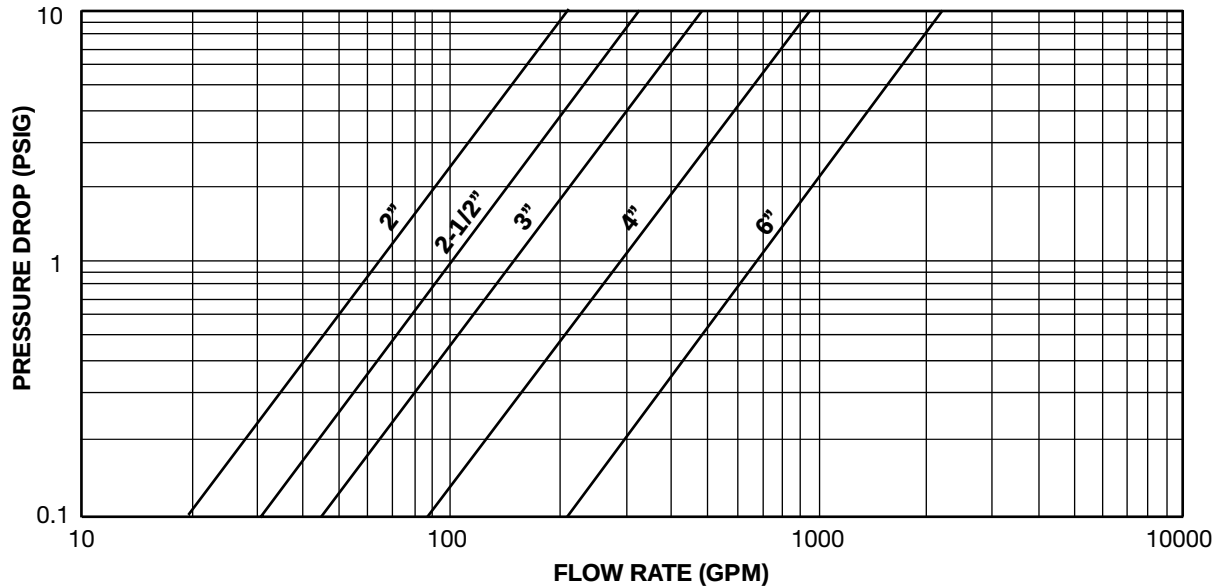
CARBON STEEL, STAINLESS STEEL, CHROME MOLY

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*
(SIZES 1/2" - 1 1/2")



(Sizes 2" - 6")



* For Gas, Steam or Air service, consult factory.

1500Y SERIES

CARBON STEEL, STAINLESS STEEL, CHROME MOLY

OPEN AREA RATIOS

with Standard Perforated Screen

1500Y1 Threaded Connections - Threaded Cover

Size	Perf. Diameter (inches)	Opening %	XH Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	1/32	28	0.23	5.0	1.4	6.0
¾	1/32	28	0.43	6.6	1.8	4.3
1	1/32	28	0.72	10.6	3.0	4.1

1500Y2 Threaded Connections - Bolted Cover

Size	Perf. Diameter (inches)	Opening %	XH Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	1/32	36	0.23	6.2	1.7	7.5
¾	1/32	36	0.43	8.3	2.3	5.4
1	1/32	36	0.72	13.7	3.8	5.4
1¼	1/32	28	1.23	24.9	7.0	5.7
1½	1/32	36	1.77	24.9	6.9	4.0
2	3/64	36	2.95	31.4	11.31	8.6

1500Y2 Flanged

Size	Perf. Diameter (inches)	Opening %	Flanged Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	48.9	17.61	5.6
2½	3/64	36	4.91	83.4	30.02	6.1
3	3/64	36	7.07	109.9	39.56	5.6
4	1/8	40	12.57	165.0	66.01	5.3
6	1/8	40	28.27	314.5	125.78	4.4

OAR = Free Screen Area / Nominal Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

1500Y SERIES
STRAINERS

Other Screen Openings

Page 430

Basket Burst Pressure

Page 435



FY SERIES FABRICATED Y STRAINERS

PRESSURES TO 6170 PSIG (425 BARG)

TEMPERATURES TO 800°F (427°C)

- Custom engineered and fabricated Y strainers
- NPT, RF or RTJ Flanges, Socketweld and Buttweld end connections in accordance with ANSI 16.34 and 16.5
- Standard thru bolt or grooved cover design.
- Installaion in horizontal or vertical pipelines.
- Stainless steel perforated screens are standard
- Drain/Blow-off connection furnished with plug

APPLICATIONS

- Steam, liquid, gas and oil service
- Power industry
- Pulp and paper
- Chemical industry
- Process Equipment
- Metal & Mining
- Water & Waste

APPLICABLE CODES

- Designed/Manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII, Div. 1.
- Canadian Registration Numbers (CRN) available
- Welders certified to ASME Section IX

MODELS

- FY1 – Standard
- FYZ – Custom Configuration

OPTIONS

- Other materials, sizes and/or configurations
- Quick Opening covers – See Page 468
- Other screen, mesh or wedgewire – See Page 466
- Vent and/or differential pressure connections
- “U” stamped vessels
- NACE MRO10-75 Certification
- External/Internal coatings
- 600# flange rating and higher
- Gooved end connections
- Oxygen cleaning
- Contact Factory for other Options

FY Series Ordering Code

Model			Material	Inlet Size	Class	Con- nection	Dash	Cover	Perf	Mesh
F	Y	1	C	Q	1	R	-	B	4	4
1	2	3	4	5	6	7	8	9	10	11

Model - Position 1-3
FY1 - Standard
FYZ - Custom Configuration

Material - Position 4
C - Carbon Steel
L - Low Temp CS
V - 304 SS
T - 316 SS
M - Monel
H - Hastelloy
Z - Other

Inlet Size - Position 5
H - 2"
J - 2-1/2"
K - 3"
M - 4"
N - 5"
P - 6"
Q - 8"
R - 10"
S - 12"
T - 14"
U - 16"
V - 18"
W - 20"
X - 22"
Y - 24"
1 - 28"
2 - 30"
3 - 36"
4 - 40"
Z - Other

Class - Position 6
1 - 150
3 - 300
4 - 600
5 - 900
6 - 1500
7 - 2500
Z - Other

Connection - Position 7
B - Buttweld¹
F - Flat Face Flange
G - Grooved
N - NPT
J - Ring Joint Flange
R - Raised Face Flange
K - Socket Weld
Z - Other

1. For Buttweld connection please specify mating pipe schedule.

Dash - Position 8

Cover - Position 9
B - Bolted
C - Bolted w/C-Clamp
D - Bolted w/Davit
J - Bolted w/Hinge
G - Grooved
H - T - Bolt Hinged
T - Threaded Hinged
Y - Yoke Hinged
Z - Other

Perf - Position 10
304SS Material Standard²
A - None
B - 3/64"
1 - 1/32"
2 - 1/16"
3 - 3/32"
4 - 1/8"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"
Z - Other

2. For other screen materials, contact factory.

Mesh² - Position 11
A - None
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120
Z - Other

For any variations, use the part Numbering system above but clearly indicate the additional requirements.

FY SERIES FABRICATED Y STRAINERS

SPECIFICATION

Y Strainer shall be designed and manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII Div. 1. The Strainer body shall be fabricated steel or other specified material. The screen shall be size _____ perf Stainless Steel. The strainer shall have a bolted cover furnished with a drain connection and plug as standard. The strainer shall be have an inlet size of _____ and Open Area Ratio of _____. The Y Strainer shall be SSI FY_____ Series.

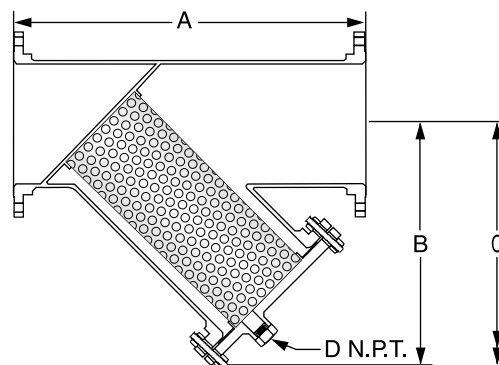
MATERIALS OF CONSTRUCTION (Carbon Steel shown*)

Shell & Nozzles	A53E/B / A106-B
Flanges.....	A105
Coupling/threadolets	A105
Plug	A105
Screen Retainer Ring	A36
Screen ¹	304 SS
Gasket ¹	304 SS Spiral Wound
Stud	A193-B7
Nut	A194-2H

* Other Materials Available. Consult Factory

1. Recommended Spare Parts

Materials specification will change when NACE MR01-75 is specified.



Shown with Bolted Cover

Connections*:
2-24" NPT, Socketweld,
RF, FF, RTJ or Buttweld

* For additional sizes consult factory.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2"-12"	1/8" Perf	304 SS
14"-24"	3/16" Perf	304 SS

DIMENSIONS inches (mm)

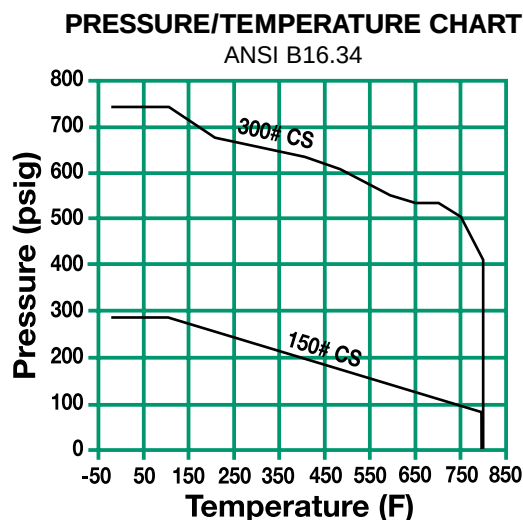
AND WEIGHTS pounds (kg)

150# Shown - Consult Factory for other ratings

SIZE	A	B	C	D	WEIGHT	
					Cover	Unit
2 (50)	10 ^{13/16} (275)	8 ^{1/4} (210)	13 ^{1/4} (337)	1/2 (15)	5 (2)	28 (13)
2 1/2 (65)	13 ^{3/8} (340)	10 ^{1/4} (260)	16 ^{7/16} (418)	1 (25)	9 (4)	81 (37)
3 (80)	13 ^{3/8} (340)	10 ^{1/4} (260)	16 ^{7/16} (418)	1 (25)	9 (4)	81 (37)
4 (100)	14 ^{3/4} (375)	10 ^{1/2} (267)	16 ^{3/4} (425)	1 1/2 (4)	17 (8)	85 (39)
5 (125)	17 ^{1/4} (438)	12 ^{1/2} (318)	20 (508)	1 1/2 (40)	20 (9)	110 (50)
6 (150)	22 (559)	14 (356)	22 ^{7/16} (570)	2 (50)	26 (12)	145 (66)
8 (200)	24 (610)	17 ^{3/4} (451)	28 ^{7/16} (722)	2 (50)	45 (20)	256 (116)
10 (250)	31 ^{1/2} (800)	22 (559)	35 ^{1/4} (895)	2 (50)	70 (32)	380 (172)
12 (300)	32 ^{3/4} (832)	25 (635)	40 (1016)	2 (50)	110 (50)	700 (317)
14 (350)	39 ^{3/4} (1010)	27 (686)	43 ^{1/4} (1099)	2 (50)	140 (63)	750 (340)
16 (400)	45 ^{1/4} (1149)	30 ^{7/8} (784)	49 ^{1/2} (1257)	2 (50)	180 (82)	905 (410)
18 (450)	48 ^{1/2} (1232)	33 ^{7/8} (861)	54 ^{1/4} (1378)	2 (50)	220 (100)	1125 (510)
20 (500)	53 ^{3/4} (1365)	39 (991)	62 ^{1/2} (1588)	2 (50)	285 (129)	1415 (641)
24 (600)	64 (1626)	44 (1118)	70 ^{1/2} (1791)	2 (50)	430 (195)	1825 (827)

Dimensions shown are subject to change.

Consult factory for certified drawings when required.



For Quick Opening Covers Ratings see page 468

For higher pressure classes and other materials, consult factory.

**FY SERIES
STRAINERS**

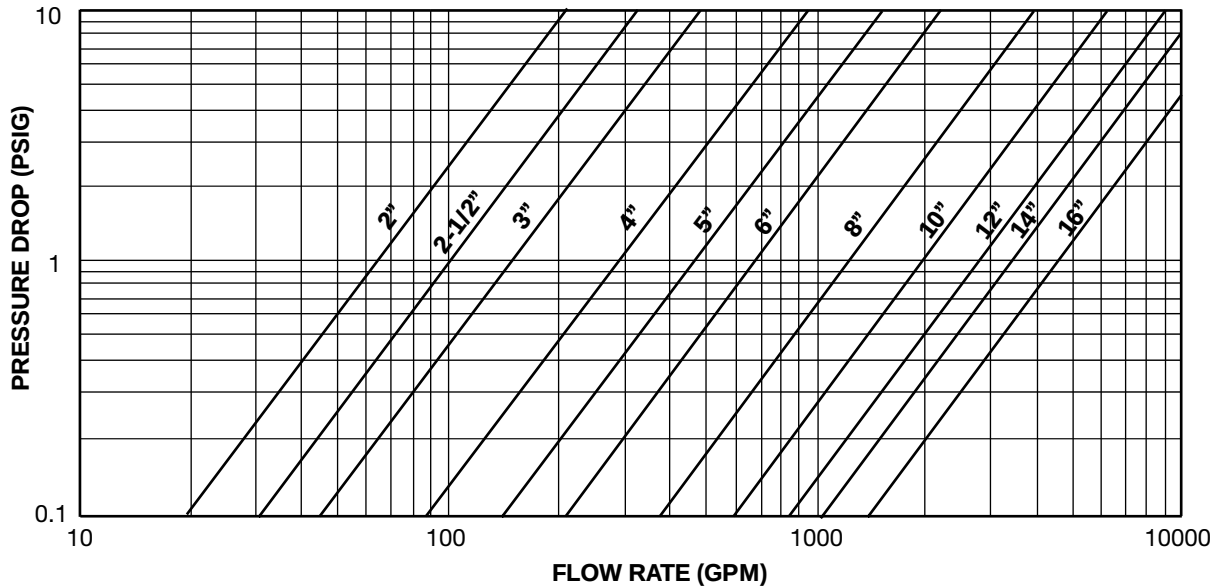
FY SERIES

FABRICATED Y STRAINERS

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

(Sizes 2" - 16")



* For Gas, Steam or Air service, consult factory.

FY SERIES

FABRICATED Y STRAINERS

OPEN AREA RATIOS

with Standard Perforated Screen

Size	Perf. Diameter (inches)	Opening %	Std Pipe Nominal Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	1/8	40	3.4	39	16	4.6
3	1/8	40	7.4	77	31	4.2
4	1/8	40	12.7	135	54	4.2
5	1/8	40	20.0	160	64	3.2
6	1/8	40	28.9	215	86	3.0
8	1/8	40	50.0	375	150	3.0
10	1/8	40	78.9	545	218	2.8
12	1/8	40	113.1	785	314	2.8
14	3/16	50	140.5	900	360	2.6
16	3/16	50	185.7	1210	484	2.6
18	3/16	50	237.1	1560	624	2.6
20	3/16	50	294.8	1950	780	2.6
24	3/16	50	429.1	2765	1106	2.6

OAR = Free Screen Area / Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

**FY SERIES
STRAINERS**

Other Screen Openings
Page 430

Basket Burst Pressure
Page 435

NOTES:

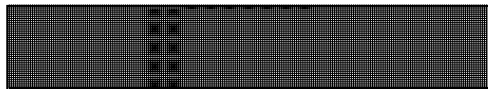
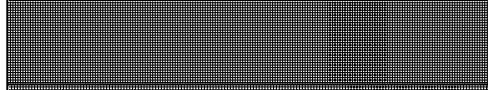
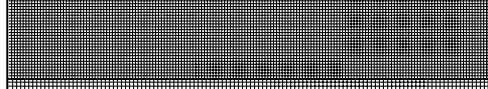
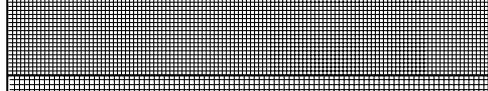
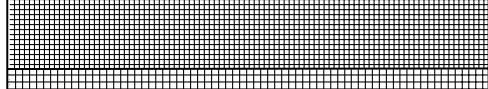
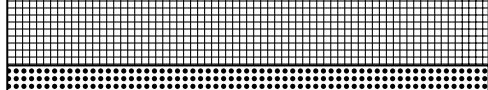
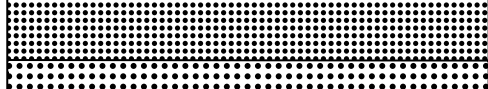
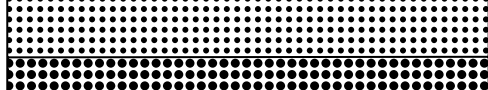
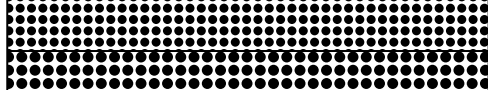
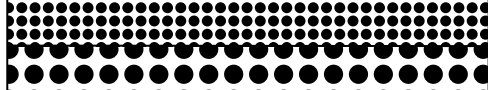
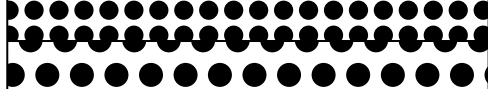
STRAINERS

Y-STRAINER TECHNICAL INFORMATION

**STRAINER TECHNICAL
INFORMATION**

SCREEN OPENINGS

STRAINERS

	100 Mesh - 30% O.A. 0.006" Openings
	80 Mesh - 36% O.A. 0.008" Openings
	60 Mesh - 38% O.A. 0.010" Openings
	40 Mesh - 41% O.A. 0.016" Openings
	30 Mesh - 45% O.A. 0.022" Openings
	20 Mesh - 49% O.A. 0.035" Openings
	0.027" Dia.- 23% O.A.
	0.033" Dia.- 28% O.A.
	3/64" Dia.- 36% O.A.
	1/16" Dia.- 37% O.A.
	3/32" Dia.- 39% O.A.
	1/8" Dia.- 40% O.A.
	5/32" Dia.- 58% O.A.
	3/16" Dia.- 50% O.A.
	1/4" Dia.- 40% O.A.

FACTORS TO CONSIDER

1 Purpose

If the strainer is being used for protection rather than direct filtration, standard screens will suffice in most applications.

2 Service

With services that require extremely sturdy screens, such as high pressure/temperature applications or services with high viscosities, perforated screens without mesh liners are recommended. If a mesh liner is required to obtain a certain level of filtration, then a trapped perf/mesh/perf combination is recommended.

3 Filtration Level

When choosing a perf. or a mesh/perf. combination, attention should be given to ensure overstraining does not occur. As a general rule, the specified level of filtration should be no smaller than half the size of the particle to be removed. If too fine a filtration is specified, the pressure drop through the strainer will increase very rapidly, possibly causing damage to the screen.

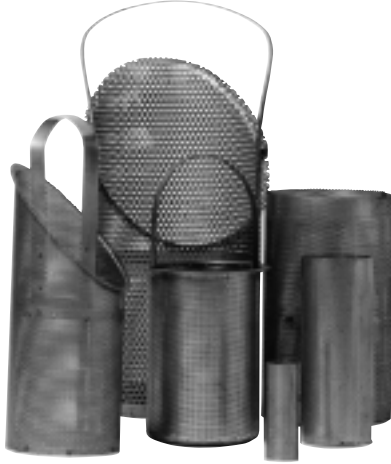
Screen openings other than those shown above are readily available. Various mesh sizes as fine as 5 micron and perforated plate as coarse as 1/2" Dia. are in inventory.

Screens are available in a wide range of materials. Screens of carbon steel, stainless steel (304, 316), alloy 20, monel 400, hastelloy C and titanium grade 2 are in inventory.

Custom manufactured screens are available upon request. Please consult factory.

Y STRAINER

REPLACEMENT CYLINDRICAL SCREENS



Spence has screens and baskets for all makes of Y, basket and duplex strainers. The range of materials and size of units is unlimited. Spence provides baskets manufactured from:

- **Perforated Plate**
- **Mesh or Mesh/Perf. combination**
- **Wedge Wire**
- **Electron Beam Small Hole Perforated Plate**

Using the above processes or combination thereof, Spence can provide screens and baskets suitable for a wide range of applications.

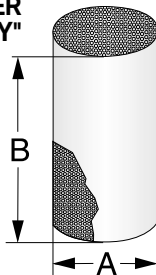
SCREEN/BASKET CHECKLIST

Kindly photocopy this page and fill out the pertinent information.

Performance Requirements

Description	Customers Requirement
Required Level of Filtration =	
Material of Construction =	
Minimum Specified Burst Pressure =	
Flow Direction =	
Other =	

**CYLINDRICAL
STRAINER
STYLE "Y"**



Dimensional Requirements

Description	Customers Requirement
Style	Y
Screen Outer Diameter	A =
Screen Height	B =

Y STRAINER

PRESSURE DROP CORRECTION FACTORS

Mesh Lined Baskets and/or Fluids with a Viscosity other than Water

Centistokes	SSU	Unlined Perforated Basket	20 Mesh Lined Basket	40 Mesh Lined Basket	60 Mesh Lined Basket	80 Mesh Lined Basket	100 Mesh Lined Basket	200 Mesh Lined Basket
2	30 (water)	1	1.05	1.2	1.4	1.6	1.7	2
100	500	1.6	1.7	1.9	2.1	2.4	2.6	3.1
216	1000	1.7	2	2.2	2.4	2.6	2.8	3.3
433	2000	1.9	2.2	2.4	2.7	2.9	3.2	3.8
650	3000	2	2.3	2.6	2.9	3.2	3.5	4.1
1083	5000	2.2	2.6	3	3.5	4	4.5	5.3
2200	10000	2.5	3	3.5	4.2	5	6	7.1

- 1) Obtain water pressure drop from graphs on appropriate product page.
- 2) Multiply the pressure drop obtained from (1) by the specific gravity of the liquid.
- 3) Multiply the pressure drop from (2) by the appropriate correction factor for the mesh liner and/or viscosity.

Example

Model: 150Y2
Size: 4"
Body: Carbon Steel
Filtration: 1/8" perforated screen 40 Mesh lines
Flow rate: 200 GPM
Fluid: Water
SG: 1
Viscosity: 30 SSI

Answer

- A) From Pressure Drop Chart *on page 393* pressure drop of water is .48 psid
- B) Multiply by specific gravity; $.48 \times 1 = .48$ psid
- C) From chart above, multiply answer from B) by correction factor $.48 \times 1.2$ (correction factor) = .576 psid

CORRECTION FACTORS FOR CLOGGED SCREENS

% Clogged	Ratio of Free Screen Area to Pipe Area						
	10:1	8:1	6:1	4:1	3:1	2:1	1:1
10							3.15
20						1.15	3.9
30						1.4	5
40						1.8	6.65
50					1.25	2.5	9.45
60				1.15	1.8	3.7	14.5
70				1.75	2.95	6.4	26
80		1.1	1.75	3.6	6.25	14	58
90	2.3	3.45	6	13.5	24	55	

* Multiply values obtained from Pressure Drop Charts by the appropriate values shown below.

Example

Strainer Size: 6"
Model: 150Y2
Body: Carbon Steel
Filtration: 1/8" Perf.
Flow rate: 1000 GPM
Service: Water
% Clogged: 60%

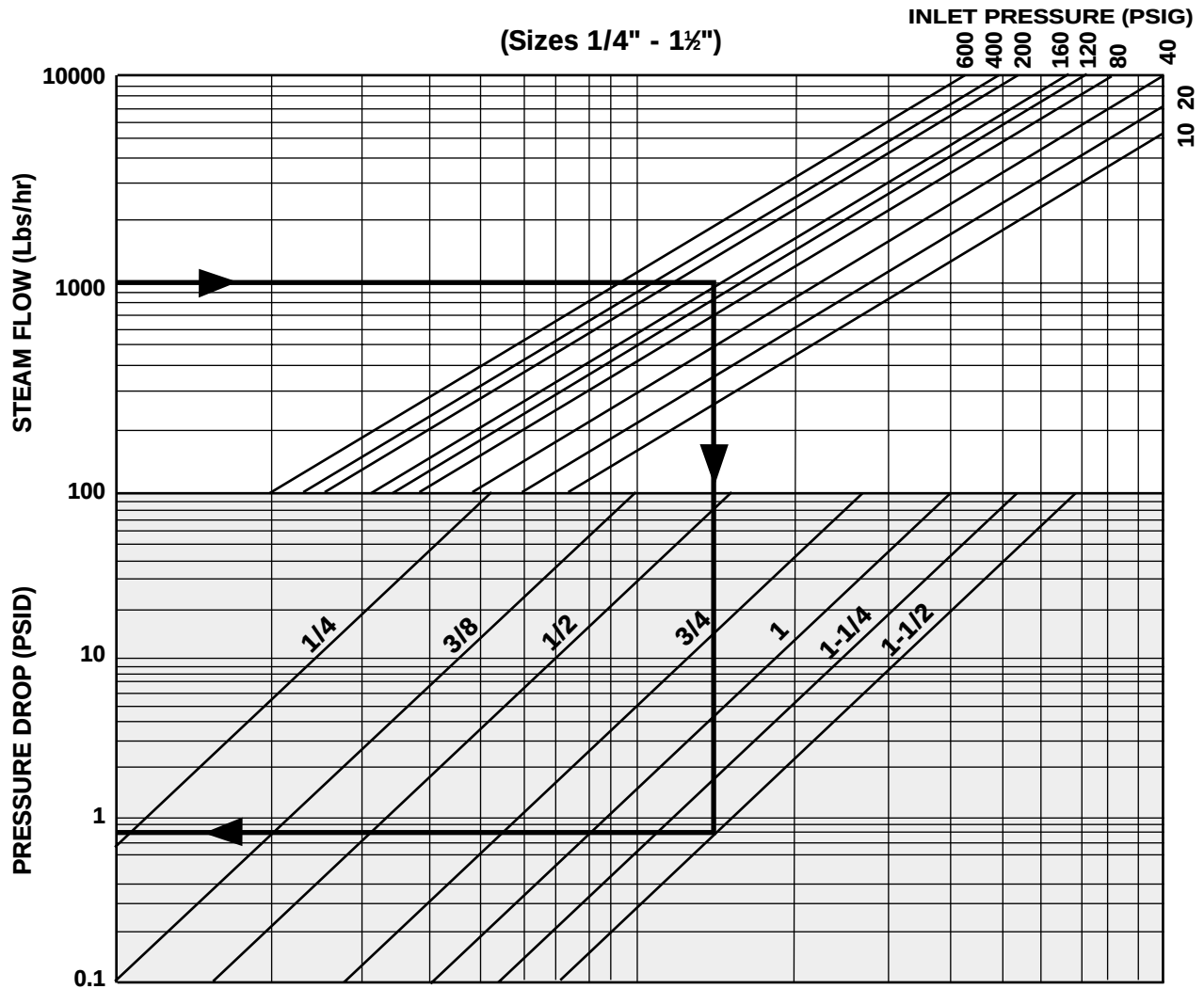
Answer

- A) The Pressure Drop Chart *on page 393* indicates a drop of 2.2 psid with standard screen.
- B) The Effective Area Chart indicates a ratio of 3.0 free area to pipe area.
- C) Using Chart above we read the correction factor of 3:1 to be 1.8 at 60% clogged.
- D) Total pressure drop equals $2.2 \times 1.8 = 3.96$ psid.

Y STRAINER

PRESSURE DROP

SATURATED STEAM



Y STRAINER
PRESSURE DROP

- Notes:**
1. Pressure drop curve is based on saturated steam flow with standard screens.
See page 432 for correction factors to be used with other fluids and/or screen openings.
 2. Chart can be used for air and gas by using the following formula:

$$Q_s = 0.138 Q_g \sqrt{(460+t) \text{ s.g.}} \left\{ \frac{DP}{P_2} < 1.0 \right\}$$

FOR NON-CRITICAL FLOW

where;

Q_s = Equivalent Steam Flow, lbs./hr.
 Q_g = Air or gas flow, SCFM.
 t = Temperature, °F.
 s.g. = Specific gravity (s.g. = 1 for air.)
 DP = Pressure Drop, psid
 P_2 = Outlet Pressure

Example:

Service: Saturated Steam Flow
 Pressure: 160 psig
 Steam Flow: 1000 Lbs/hr
 Size: 1-1/2"

- Locate steam flow
- Follow horizontal line to required pressure.
- Follow vertical line downwards to required strainer size.
- Follow horizontal line to read pressure drop.
- Pressure drop equals 0.8 psid.

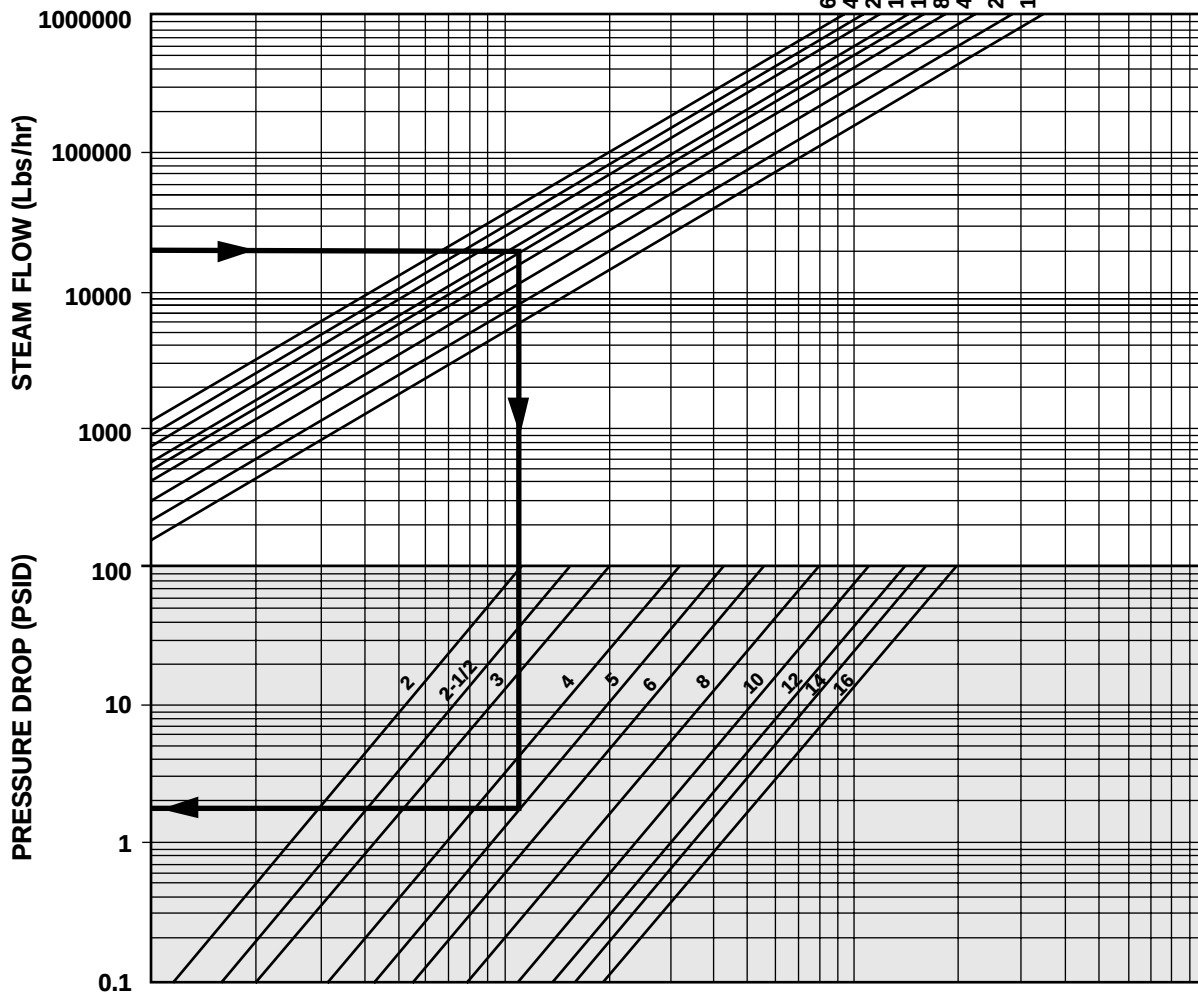
Y STRAINER

PRESSURE DROP

SATURATED STEAM

(Sizes 2" - 16")

INLET PRESSURE (PSIG)



Notes: 1. Pressure drop curve is based on saturated steam flow with standard screens.

See page 432 for correction factors to be used with other screen openings.

2. Chart can be used for air and gas by using the following formula:

$$Q_s = 0.138 Q_g \sqrt{(460+t) \text{ s.g.}} \left\{ \frac{DP}{P_2} < 1.0 \right\}$$

FOR NON-CRITICAL FLOW

where;

Q_s = Equivalent Steam Flow, lbs./hr.

Q_g = Air or gas flow, SCFM.

t = Temperature, °F.

s.g. = Specific gravity (s.g. = 1 for air.)

DP = Pressure Drop, psid

P_2 = Outlet Pressure

Example:

Service: Saturated Steam Flow

Pressure: 120 psig

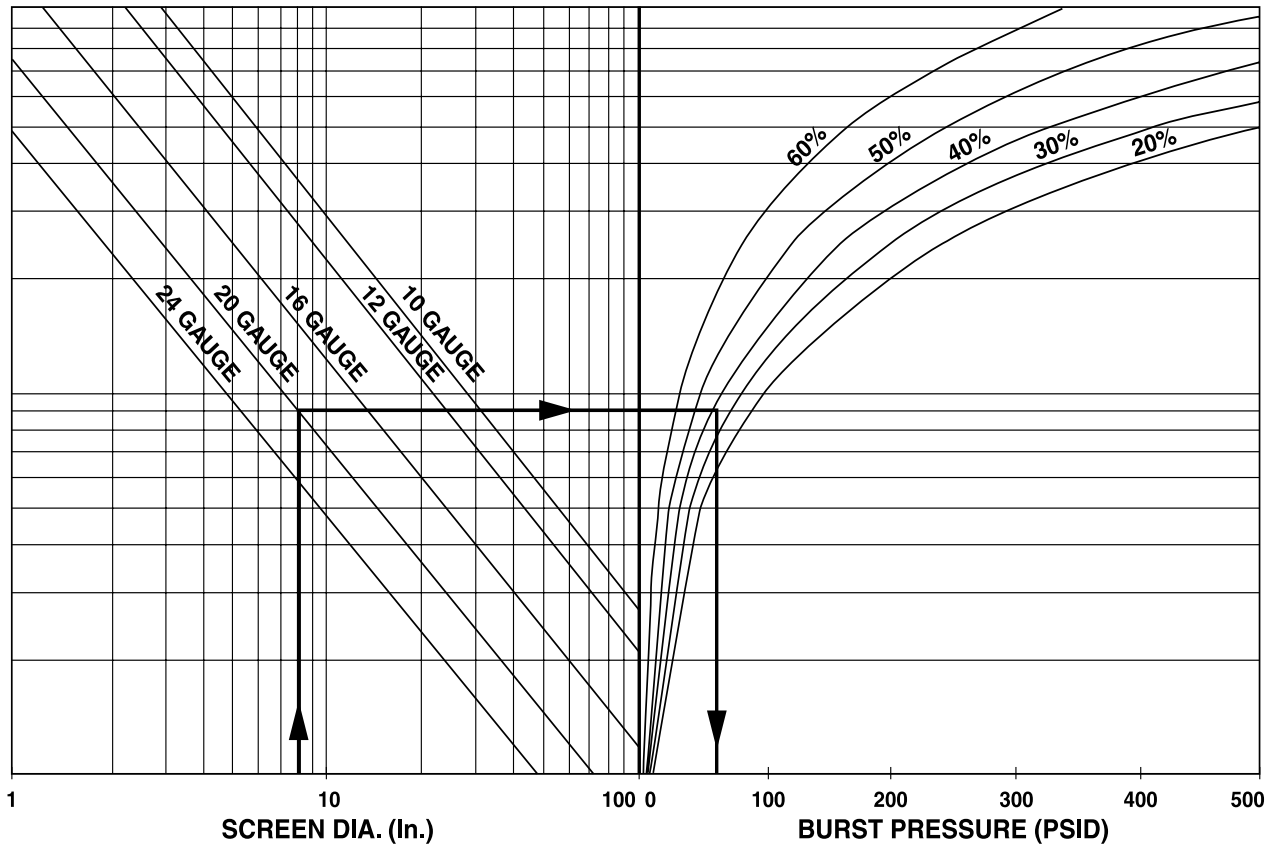
Steam Flow: 20,000 Lbs/hr

Size: 5"

- Locate steam flow
- Follow horizontal line to required pressure.
- Follow vertical line downwards to required strainer size.
- Follow horizontal line to read pressure drop.
- Pressure drop equals 1.8 psid.

Y STRAINER

SCREEN BURST PRESSURE



Notes:

(1) The above chart is for use with perforated plate and based on the formula:

$$P = \frac{St}{R - 0.4t}$$

SOURCE: ASME Section VIII, Div. 1, Appendix 1.

P = Burst pressure, psid
S = Reduced allowable stress, psi
t = Thickness of perforated plate, in.
R = Outside radius of screen, in.

- (2) The above chart is based on a screen material of stainless steel and is valid for operating temperatures up to 100°F. The chart may be used for higher temperatures however it will result in a safety factor reduction. (At 100°F the chart's safety factor is approximately four (4), at 1000°F the chart safety factor is reduced to approximately two (2). It is the responsibility of the user to determine an acceptable safety factor.)
- (3) The chart may be used for carbon steel at an approximate 25% reduction in safety factor.
- (4) See Screen Openings Chart for % Open Area's of inventoried perforated plate.

Example:

Strainer Size: 8"
Screen Thickness: 20 Gauge
Screen Perforations: 0.125" (40% O.A.)

- A) Locate screen diameter (assume a 8" diameter screen)
 B) Follow vertical line to gauge thickness.
 C) Follow horizontal line to required perforation open area.
 D) Follow vertical line downward to read burst pressure.
 E) Burst pressure equals 60 psid approx.

Y STRAINER SCREEN
BURST PRESSURE

Y STRAINER

STRAINER CHECKLIST

Please take the factors listed below into account when selecting a strainer. Kindly photocopy this page and fill out the pertinent information, to your best ability, so that we can recommend a Strainer to suit your specific requirements.

1. Fluid to be strained _____
2. Flow rate _____
3. Density of fluid _____
4. Viscosity of fluid _____
5. Fluid working pressure _____
Maximum pressure _____
6. Fluid Working Temp. _____
Maximum Temp. _____
7. Preferred material of strainer construction _____
8. Present Pipeline size & material _____
9. Nature of solids to be strained out _____
10. Size of solids to be strained out _____
Size of mesh or Perf. Req. _____

11. Clearance Limitation Above _____ Below _____
Left side facing inlet _____ Right side facing inlet _____
12. Maximum pressure drop with clean screen _____
13. Expected cleaning frequency _____
14. Any other information deemed relevant _____

Name _____
Company _____
Address _____
City/Town _____
State _____ Zip Code _____
Telephone (_____) _____
Fax (_____) _____

Y STRAINER

INSTALLATION AND MAINTENANCE INSTRUCTIONS

STRAINER INSTALLATION INSTRUCTIONS

- Ensure all machined surfaces are free of defects and that the inside of the strainer is free of foreign objects.
- For horizontal and vertical pipelines, the strainer should be installed so that the blow-down drain connection is pointed downward.
- For flanged end strainers, the flange bolting should be tightened gradually in a back and forth clockwise motion. Threaded end strainers should use an appropriate sealant.
- Once installed, increase line pressure gradually and check for leakage around joints.
- If the strainer is supplied with a start-up screen, monitor pressure drop carefully.

SCREEN REMOVAL INSTRUCTIONS

- Drain piping.
- Vent line to relieve pressure.
- Loosen cover and open to access screen.
- Remove, clean and replace screen in original position (Note: In some instances, a high pressure water jet or steam may be required for effective cleaning)
- Inspect cover gasket for damage. If necessary, replace. (Note: If spiral wound gaskets have been used, they must be replaced and can not be used again).
- Tighten cover. The strainer is ready for line start-up.

CAUTION SHOULD BE TAKEN DUE TO POSSIBLE EMISSION OF PROCESS MATERIAL FROM PIPING. ALWAYS ENSURE NO LINE PRESSURE EXISTS WHEN OPENING COVER.

MAINTENANCE INSTRUCTIONS

For maximum efficiency, determine the length of time it takes for the pressure drop to double that in the clean condition. Once the pressure drop reaches an unacceptable value, shut down line and follow the "Screen Removal Instructions" above. A pressure

gauge installed before and after the strainer in-line will indicate pressure loss due to clogging and may be used to determine when cleaning is required.

TROUBLE SHOOTING GUIDES AND DIAGNOSTIC TECHNIQUES

- After pressurizing, inspect cover and other joints for leakage. Gasket replacement or cover tightening is necessary if leakage occurs.
- If the required filtration is not taking place, ensure the screen is installed in the correct position, that being flush to the screen seating surfaces.

NOTES:

STRAINERS

Applications

- Process Industry
- Power Industry
- Chemical Industry
- Oil and Gas
- Metals and Mining
- Water and Waste
- Pulp and Paper

Basket Strainers

**Pressures to 3705 PSIG
Temperatures to 800°F**

FEATURES

- Cast or Fabricated construction
- Filtration down to 40 microns
- Large strainer baskets
- Both compact and high capacity units are available

MATERIALS OF CONSTRUCTION

- Cast Iron
- Bronze
- Carbon Steel
- Stainless Steel
- Other materials upon request

END CONNECTIONS

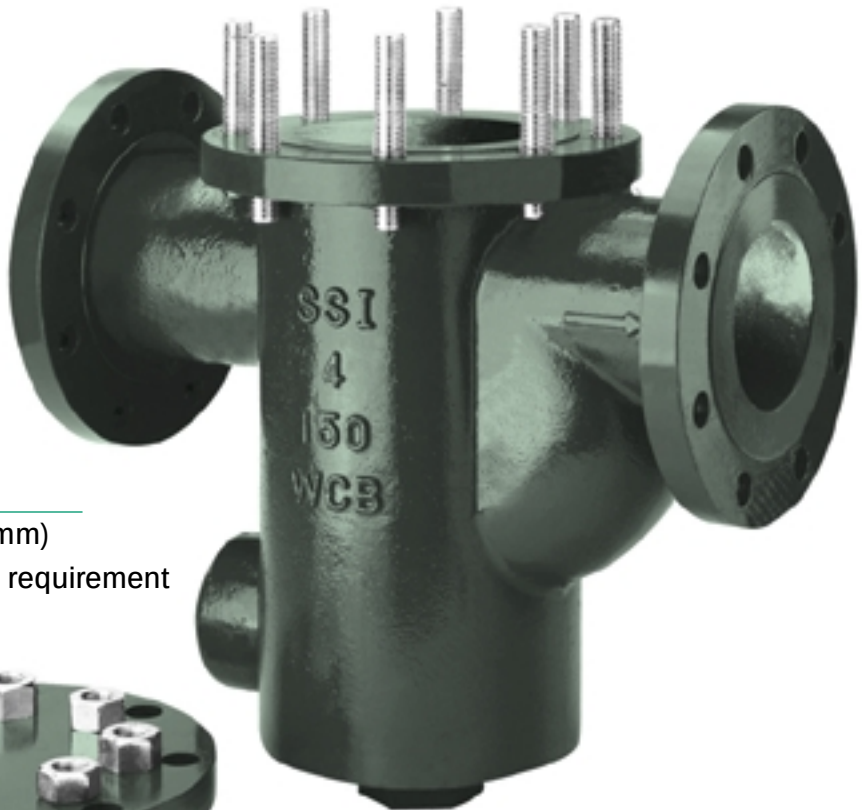
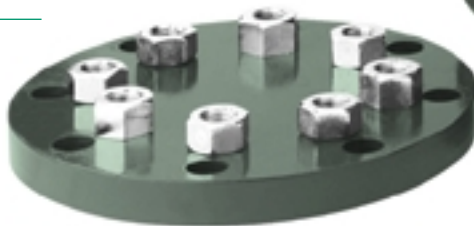
- Flat Faced
- Raised Face
- Buttweld
- Threaded (NPT)
- Socketweld

SIZES

- Cast - 1/2" (15mm) up to 20" (500mm)
- Fabricated - custom sizes to meet requirement

RATINGS

- ANSI 125 psig
- ANSI 150 psig
- ANSI 300 psig
- ANSI 600 psig
- ANSI 900 psig
- ANSI 1500 psig



BASKET STRAINERS



125B SERIES CAST IRON FLANGED BASKET STRAINERS

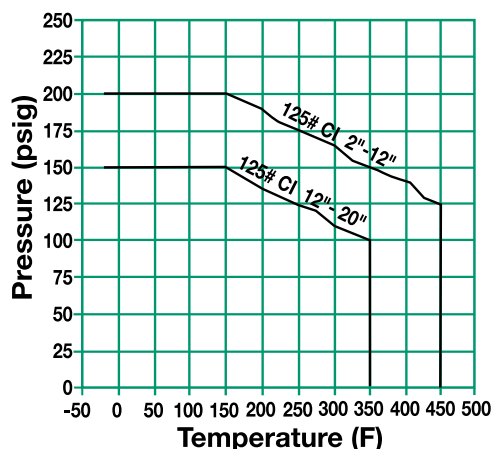
PRESSURES TO 200 PSIG (13.8 BARG)
TEMPERATURES TO 450°F (232°C)

- FF flanges in accordance with ASME B16.1
- Angular basket for straight through flow
- Stainless steel perforated basket is standard
- Recommended minimum straining level is 250 microns
- NPT drain connection furnished with plug as standard

APPLICATIONS

- Water, Oil Systems
- Other Liquid Systems
- Protection of Pumps, Meters, Valves and Similar Equipment

PRESSURE/TEMPERATURE CHART ASME B16.1



For Quick Opening Covers Ratings, see page 467.

MODELS

- 125B1F - Straight Flow

OPTIONS

- Other screen perforations and mesh liners
- Quick Opening Covers - See page 467

APPLICABLE CODES

- ASME B16.1

Canadian Registration OE 6331.5-125B1FI 10" & 12"

125B1 Series Ordering Code

Inlet Size				Model							Body Material	Dash	Perf	Mesh	Add'l Requirements
0	8	0	0	-	1	2	5	B	1	F	I	-	4	__	__
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size -
Position 1 - 4
0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"
1400 - 14"
1600 - 16"
1800 - 18"
2000 - 20"

Dash - Position 5
Model - Position 6 - 11
125B1F - Straight Flow
Body Material - Position 12
I - Cast Iron
Dash - Position 13

Perf¹ - Position 14
304 SS Material²
B - 3/64" (std < 4")
4 - 1/8" (std => 4")
A - None
1 - 1/32"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"
Z - Other

Mesh² - Position 15
Leave Blank If not Required (Std. All)
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120
Z - Other

Add'l Requirements -
Position 16
Leave Blank If not Required
D - Special Drain Size
E1 - 1/4" Vent
E2 - 3/8" Vent
E3 - 1/2" Vent
F - Silicon Free
G - Special Gaskets
T - Special Testing
V1- Clamp Cover
X - Oxygen Cleaning
Y - Other and / or Multiple Specials

Indicate Specials Clearly On the Order

For any variations, use the part numbering system above but clearly indicate the additional requirement.

1. Standard screens
All 2"-3"—3/64" perf.
All 4"-20"— 1/8" perf.

2. For other screen material, contact factory.

125B SERIES CAST IRON FLANGED BASKET STRAINERS

SPECIFICATION

Basket Strainer shall have straight flow with an angular basket. The Basket Strainer shall be cast iron with 125 PSIG ANSI rated FF flanges. The screen shall be size ____ perforated stainless steel. The Strainer shall have an inlet size of ____ and open area ratio of _____. The Basket Strainer shall be SSI 125B Series.

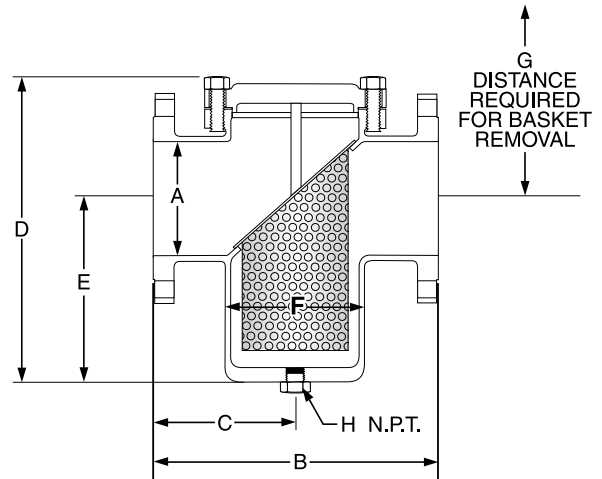
MATERIALS OF CONSTRUCTION

Body Cast Iron A126-B
Cover Cast Iron A126-B
Screen¹ 304 SS
Plug² Cast Iron A126-B
Gasket¹ Graphite³
Bolt/Stud² A307-B
Nut² A563

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted

3. Gasket for bolted cover. For Quick Opening Covers, see page 467



Connections: 2"– 20" FF Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" – 3"	3/64 Perf.	304 SS
4" – 20"	1/8 Perf.	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D*	E	F	G	H**	WEIGHT	
									Cover	Unit
2 (50)	2 (51)	8 ⁵ / ₁₆ (206)	4 ¹ / ₁₆ (103)	9 ¹ / ₁₆ (230)	5 (127)	2 ¹⁵ / ₁₆ (75)	11 ¹ / ₄ (298)	1/2 (15)	5 (2.3)	23 (10)
2½ (65)	2½ (64)	8 ¹ / ₄ (210)	4 ¹ / ₁₆ (106)	10 ¹ / ₁₆ (262)	6 ¹ / ₄ (159)	4 (102)	13 ¹ / ₄ (337)	¾ (20)	7 (3.2)	33 (15)
3 (80)	3 (76)	9 ¹ / ₁₆ (251)	4 ¹ / ₁₆ (125)	12 ¹ / ₁₆ (310)	7 ¹ / ₁₆ (181)	5 (127)	15 ¹ / ₁₆ (391)	¾ (20)	9 (4)	44 (20)
4 (100)	4 (102)	11 ¹ / ₁₆ (292)	5 ¹ / ₁₆ (146)	13 ¹ / ₁₆ (346)	8 (203)	5 ¹ / ₁₆ (148)	17 ¹ / ₁₆ (451)	1 (25)	13 (6)	67 (30)
5 (125)	5 (127)	13 ¹ / ₁₆ (333)	6 ¹ / ₁₆ (167)	14 ¹ / ₁₆ (370)	8½ (216)	7 ¹ / ₁₆ (179)	20½ (521)	1 (25)	20 (9)	88 (40)
6 (150)	6 (152)	14 ¹ / ₁₆ (378)	7 ¹ / ₁₆ (189)	15 ¹ / ₁₆ (400)	9 (229)	7 ¹ / ₁₆ (202)	23 (584)	1 (25)	26 (12)	120 (54)
8 (200)	8 (203)	18 ¹ / ₁₆ (475)	9 ¹ / ₁₆ (238)	19 ¹ / ₁₆ (506)	12 (305)	9 ²⁷ / ₃₂ (250)	30 (762)	1½ (40)	45 (20)	220 (100)
10 (250)	10 (254)	20 ¹ / ₁₆ (511)	10 (254)	26 (660)	14 (356)	12 ¹ / ₁₆ (313)	35½ (902)	1½ (40)	70 (32)	353 (160)
12 (300)	12 (305)	26 ¹ / ₁₆ (679)	13 ¹ / ₁₆ (340)	30 ¹ / ₁₆ (765)	17 (432)	15 ¹ / ₁₆ (390)	42½ (1080)	2 (50)	110 (50)	523 (237)
14 (350)	14 (356)	30 ¹ / ₁₆ (768)	15 ¹ / ₁₆ (384)	37½ (953)	22 (559)	18 (457)	53 (1346)	1½ (40)	140 (64)	815 (370)
16 (400)	16 (406)	33 ¹ / ₁₆ (841)	16 ¹ / ₁₆ (422)	39½ (997)	22½ (581)	20 ¹ / ₁₆ (527)	55½ (1413)	2 (50)	180 (82)	1041 (472)
18 (450)	18 (457)	38½ (978)	19¼ (489)	40 (1016)	19 (483)	24¼ (616)	61 (1549)	2 (50)	220 (100)	1446 (656)
20 (500)	20 (508)	41¼ (1051)	20 ¹ / ₁₆ (525)	46¼ (1175)	23¼ (591)	26¼ (673)	69¼ (1759)	2 (50)	285 (129)	1980 (898)

* For models with Quick Opening Cover, consult factory. For sizes 2"-6", allow clearance for bottom drain bolt removal.

**Side drain is standard on sizes 8" and larger. Bottom drain is optional.

Dimensions shown are subject to change. Consult factory for certified drawings.

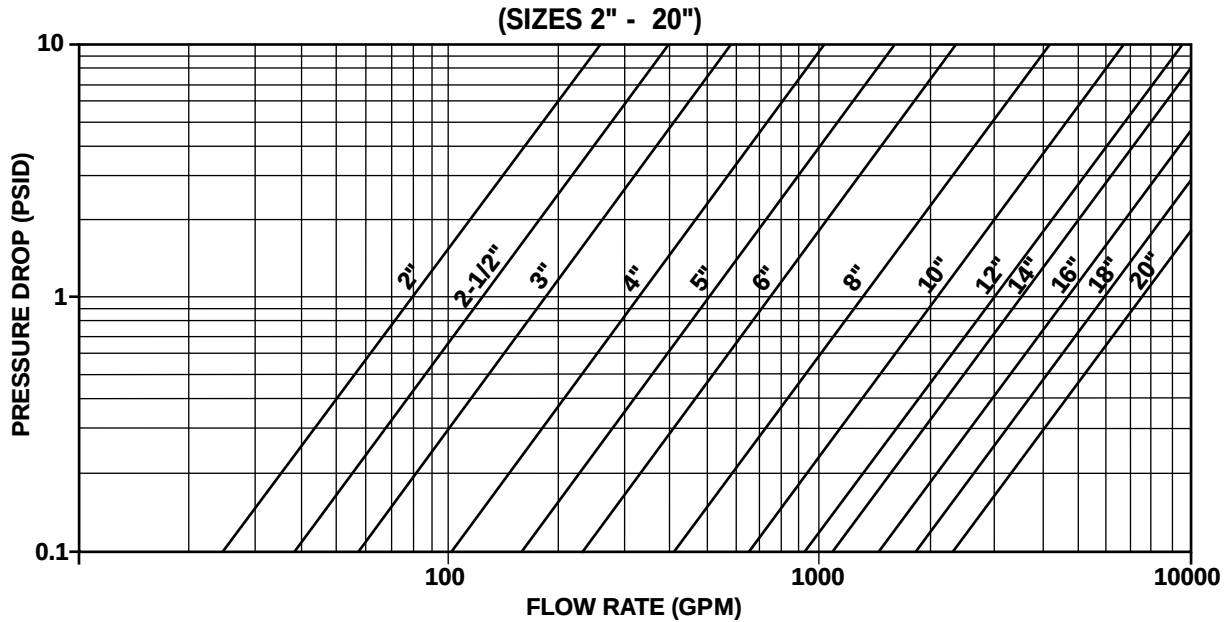
125B SERIES
BASKET STRAINERS

125B SERIES

CAST IRON FLANGED BASKET STRAINERS

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*



* For Gas, Steam or Air service, consult factory.

125B SERIES

CAST IRON FLANGED BASKET STRAINERS

OPEN AREA RATIOS

with Standard Perforated Screen

Size	Opening diameter (in)	Opening %	Nominal Outlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	29.4	10.6	3.5
2½	3/64	36	4.91	43.6	15.7	3.3
3	3/64	36	7.07	75.0	27.0	3.9
4	1/8	40	12.57	104.4	41.8	3.3
6	1/8	40	28.27	177.3	70.9	2.5
8	1/8	40	50.27	307.0	122.8	2.4
10	1/8	40	78.54	450.0	180.0	2.3
12	1/8	40	113.1	688.5	275.4	2.4
14	1/8	40	153.94	1019.1	407.6	2.6
16	1/8	40	201.06	1248.6	499.4	2.5

OAR = Free Screen Area / Nominal Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

Other Screen Openings
Page 466

Basket Burst Pressure
Page 472

Correction Factors for Other
Viscous Liquids and/or Mesh Liners
Page 471

Correction Factors
for Clogged Screens
Page 471

NOTES:



150B1 SERIES

CAST BRONZE, CARBON STEEL, STAINLESS STEEL

FLANGED BASKET STRAINERS

PRESSURES TO 285 PSIG (19.7 BARG)

TEMPERATURES TO 406°F (207°C)

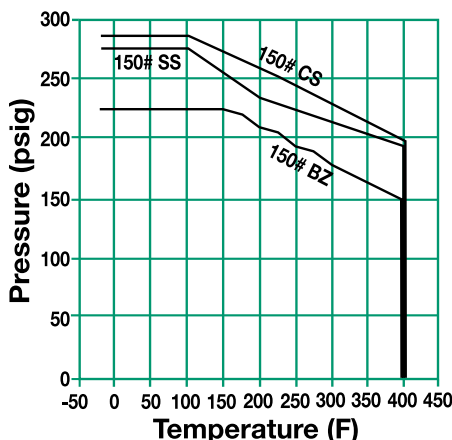
- RF or FF flanges in accordance with ASME B16.5 or B16.24
- Cover flange in accordance with ASME Section VIII, Div 1 Appendix II and ASME 16.5
- Angular basket for straight through flow
- Stainless steel perforated basket is standard
- Recommended minimum straining level is 250 microns
- NPT drain connection furnished with plug as standard

APPLICATIONS

- Water, Oil Systems
- Other Liquid Systems
- Protection of Pumps, Meters, Valves and Similar Equipment

PRESSURE/TEMPERATURE CHART

ASME B16.34, ASME B16.24



For Quick Opening Covers Ratings see page 467.

MODELS

- 150B1F – Straight Flow

OPTIONS

- Other screen perforations and mesh liners
- Quick Opening Covers - See page 467

APPLICABLE CODES

- ASME B16.5, B16.24, B16.34

Canadian Registration OE 1972.23-150B1F

150B1 Series Ordering Code

150B1 Series Ordering Code

Inlet Size				Dash	Model						Body Material	Dash	Perf	Mesh	Add'l Requirements
0	6	0	0	-	1	5	0	B	1	F	C	-	4	—	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size -
Position 1 - 4
0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5

Model - Position 6 - 11
150B1F - Straight Flow
Body Material -
Position 12
B - Bronze
C - Carbon Steel
T - Stainless Steel
Dash - Position 13

Perf¹ - Position 14
304 SS Material²
B - 3/64"
4 - 1/8"
A - None
1 - 1/32"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"
Z - Other

1. Standard Screens:
All 2"-3" — 3/64" perf,
All 4"-12" — 1/8" perf.

Mesh² - Position 15
Leave Blank If not Required (Std all)
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120
Z - Other

2. For other screen material, contact factory.

Add'l Requirements -
Position 16
Leave Blank If not Required
D - Special Drain Size
E1 - 1/4" Vent
E2 - 3/8" Vent
E3 - 1/2" Vent
F - Silicon Free
G - Special Gaskets
N - Nace MR01-75
T - Special Testing
V1- Clamp Cover
X - Oxygen Cleaning
Y - Other and / or Multiple Specials

Indicate Specials Clearly On the Order

For any variations, use the part numbering system above but clearly indicate the additional requirement.

150B1 SERIES CAST BRONZE, CARBON STEEL, STAINLESS STEEL FLANGED BASKET STRAINERS

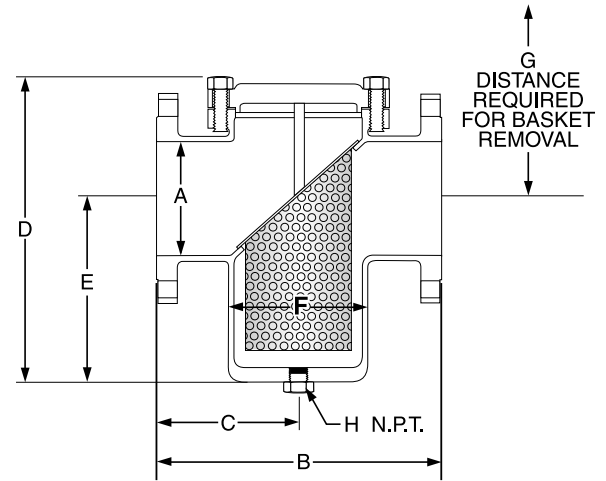
SPECIFICATION

Basket Strainer shall have straight flow with an angular basket. The Basket Strainer shall be _____ body material with 150 PSIG ANSI rated _____ flanges. The screen shall be size _____ perforated stainless steel. The Strainer shall have an inlet size of _____ and open area ratio of _____. The Basket Strainer shall be SSI 150B1 Series.

MATERIALS OF CONSTRUCTION

	Bronze	Carbon Steel	Stainless Steel
Body	Bronze B62	A216-WCB	A351-CF8M
Cover	Bronze B62	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS	304 SS
Plug ²	Bronze B16	A105	A182-316
Gasket ¹	Teflon ³	Teflon ³	Teflon ³
Bolt/Stud ²	Bronze B16	A193-B7	A193-B8-1
Nut ²	Nonferrous	A194-2H	A194-B

1. Recommended Spare Parts
2. Materials of equivalent strength may be substituted.
3. Gasket for bolted cover. *For Quick Opening Covers Ratings see page 467.*



Connections
BZ: 2" – 6" FF Flanged
CS, SS: 2"–12" RF Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" – 3"	3/64 Perf.	304 SS
4" - 12"	1/8 Perf.	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C		D*		E		F		G		H		WEIGHT	
			Stl.	Bz.	Stl.	Bz.	Stl.	Bz.	Stl.	Bz.	Stl.	Bz.	Stl.	Bz.	Cover	Unit
2 (50)	2 (51)	8 7/8 (206)	4 1/16 (103)	4 1/16 (103)	9 1/16 (243)	8 9/16 (218)	5 5/8 (143)	5 (127)	3 3/4 (83)	2 7/8 (73)	12 1/2 (318)	11 3/4 (298)	1 (25)	1/2 (13)	5 (2.3)	29 (13)
2 1/2 (65)	2 1/2 (64)	8 3/4 (222)	4 3/8 (111)	4 3/8 (111)	10 3/16 (275)	8 5/16 (227)	5 5/8 (152)	6 3/4 (159)	3 3/8 (86)	3 3/8 (98)	14 (356)	13 3/4 (349)	1 (25)	3/4 (19)	7 (3.2)	33 (15)
3 (80)	3 (76)	9 1/8 (251)	4 1/2 (125)	4 1/2 (125)	12 1/8 (316)	11 1/4 (286)	7 1/8 (192)	7 1/8 (181)	3 1/2 (90)	4 1/8 (121)	15 1/8 (391)	15 1/8 (391)	1 (25)	3/4 (19)	9 (4.1)	48 (21.8)
4 (100)	4 (102)	11 1/2 (292)	5 3/4 (146)	5 3/4 (146)	16 (406)	13 3/16 (335)	10 5/8 (257)	8 (203)	4 5/8 (118)	5 11/16 (145)	21 1/4 (540)	17 3/4 (451)	1 (25)	1 (25)	13 (5.9)	69 (31.4)
5 (125)	5 (127)	13 3/8 (333)	6 1/8 (167)	6 1/8 (167)	15 7/8 (403)	14 1/2 (368)	9 1/2 (241)	8 1/2 (216)	7 1/2 (191)	6 15/16 (176)	22 1/4 (565)	20 3/8 (521)	1 (25)	1 (25)	20 (9.1)	105 (48)
6 (150)	6 (152)	14 1/4 (378)	7 1/8 (189)	7 1/8 (189)	17 1/8 (437)	15 (381)	10 1/8 (241)	9 (229)	6 1/8 (162)	7 5/16 (202)	22 1/2 (572)	23 (584)	1 (25)	1 (25)	26 (12)	121 (55)
8 (200)	8 (203)	18 3/4 (476)	9 3/8 (238)	—	21 15/16 (559)	—	13 3/16 (332)	—	8 3/8 (226)	—	29 3/8 (746)	—	1 (25)	—	45 (20)	214 (97.3)
10 (250)	10 (254)	20 3/4 (511)	10 3/8 (256)	—	25 (629)	—	13 3/8 (340)	—	10 3/8 (270)	—	35 (889)	—	1 (25)	—	70 (32)	309 (140.5)
12 (300)	12 (305)	26 3/4 (667)	13 3/8 (333)	—	30 1/16 (780)	—	17 (432)	—	14 1/8 (378)	—	42 1/2 (1080)	—	2 (50)	—	110 (50)	476 (216.4)

*For models with Quick Opening Cover, consult factory. Allow clearance for bottom drain bolt removal.

Dimensions shown are subject to change. Consult factory for certified drawings.

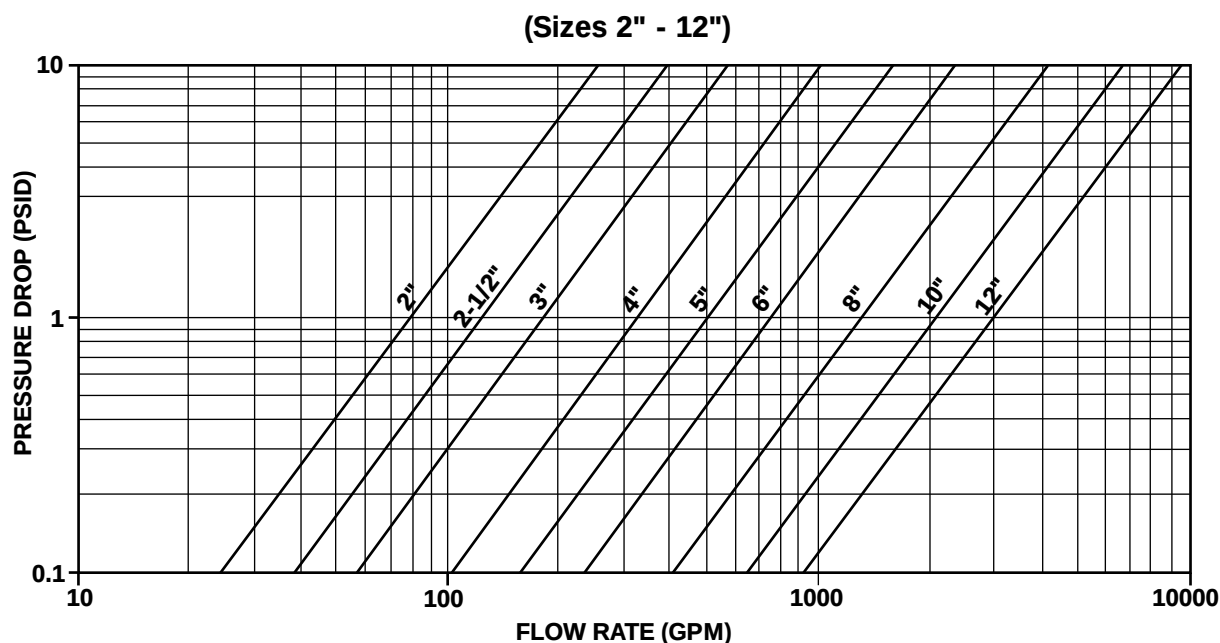
150B1 SERIES
BASKET STRAINERS

150B1 SERIES

CAST BRONZE, CARBON STEEL, STAINLESS STEEL

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*



* For Gas, Steam or Air service, consult factory.

150B1 SERIES

CAST BRONZE, CARBON STEEL, STAINLESS STEEL

OPEN AREA RATIOS

with Standard Perforated Screen

BRONZE ONLY

Size	Opening diameter (in)	Opening %	Flange Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	29.4	10.9	3.5
2½	3/64	36	4.91	44.3	16.4	3.3
3	3/64	36	7.07	66.7	24.7	3.5
4	1/8	40	12.57	97.2	38.9	3.1
5	1/8	40	28.27	170.1	68.0	2.4
6	1/8	40	50.27	318.6	127.5	2.5

CARBON STEEL & STAINLESS STEEL ONLY

Size	Opening diameter (in)	Opening %	Nominal Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	3/64	36	3.14	38.1	13.7	4.4
2½	3/64	36	4.91	41.6	15.0	3.0
3	3/64	36	7.07	59.6	21.5	3.0
4	1/8	40	12.57	119.9	48.0	3.8
6	1/8	40	28.27	177.4	71.0	2.5
8	1/8	40	50.27	296.5	118.6	2.4
10	1/8	40	78.54	413.5	165.4	2.1
12	1/8	40	113.10	730.3	292.1	2.6

OAR = Free Screen Area / Nominal Inlet Area
Free Screen Area = Opening % x Gross Screen Area
Values shown are approximate. Consult factory for exact ratios.

Other Screen Openings
Page 466

Basket Burst Pressure
Page 472

Correction Factors for Other
Viscous Liquids and/or Mesh Liners
Page 471

Correction Factors
for Clogged Screens
Page 471

NOTES:



150B2 SERIES

CAST CARBON STEEL, STAINLESS STEEL FLANGED BASKET STRAINERS

PRESSURES TO 285 PSIG (19.7 BARG)

TEMPERATURES TO 800°F (427°C)

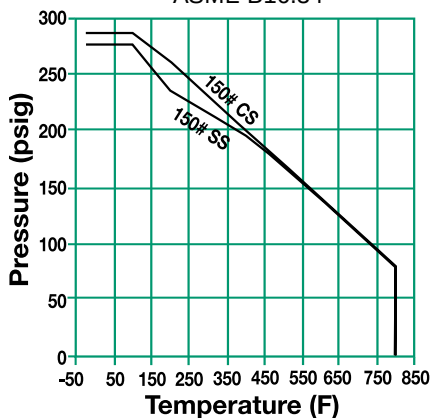
- **SSI Exclusive - Cover flange is in dimensional accordance with ASME B16.5**
- **Over the top flow and machined basket seat eliminate any chance of dirty fluid bypass**
- **Large screen area minimizes pressure drop and cleaning intervals**
- **RF flanges in accordance with ASME B16.5**
- **Stainless steel perforated baskets are standard**
- **Recommended minimum straining level is 40 microns**
- **NPT drain connection furnished with plug as standard**

APPLICATIONS

- Water, Oil Systems
- Other Liquid Systems
- Protection of Pumps, Meters, Valves and Similar Equipment

PRESSURE/TEMPERATURE CHART

ASME B16.34



For Quick Opening Covers Ratings See page 467

MODELS

- 150B2F - Over the top flow

OPTIONS

- Other screen perforations and mesh liners
- Quick Opening Covers - See page 467

APPLICABLE CODES

- ASME B16.5, B16.34

Canadian Registration OE 1972.23-150B2F

150B2 Series Ordering Code

150BZ Series Ordering Code

Inlet Size				Dash	Model						Body Material	Dash	Perf	Mesh	Add'l Requirements
0	4	0	0	-	1	5	0	B	2	F	C	-	4	—	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Inlet Size -
Position 1 - 4
0150 - 1½"
0200 - 2"
0300 - 3"
0400 - 4"
0600 - 6"
0800 - 8"

Dash - Position 5

Model - Position 6 - 11
150B2F - Straight Flow
Body Material - Position 12
C - Carbon Steel
T - Stainless Steel

Dash - Position 13

Perf¹ - Position 14
304 SS Material²

B - 3/64"
4 - 1/8"
A - None
1 - 1/32"
2 - 1/16"
3 - 3/32"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"
Z - Other

Mesh² - Position 15
**Leave Blank
If not Required
(Std. all)**

1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120
Z - Other

Add'l Requirements -
Position 16

**Leave Blank
If not Required**

D - Special Drain Size
E1 - 1/4" Vent
E2 - 3/8" Vent
E3 - 1/2" Vent
F - Silicon Free
G - Special Gaskets
N - Nace MR01-75
T - Special Testing
V1 - Clamp Cover
X - Oxygen Cleaning
Y - Other and / or
Multiple Specials

**Indicate Specials
Clearly On the Order**

1. Standard screens All 1½" — 1/32" perf, All 2"-3" — 3/64" perf, All 4"-8" — 1/8" perf.

2. For other screen material, contact factory.

For any variations, use the part numbering system above but clearly indicate the additional requirement.

150B2 SERIES

CAST CARBON STEEL, STAINLESS STEEL FLANGED BASKET STRAINERS

SPECIFICATION

Basket Strainer shall have over the top flow with a machined basket seat. The Basket Strainer shall be cast steel or stainless steel with 150 PSIG ANSI rated RF flanges. The cover flange dimensions shall be in dimensional accordance with ASME B16.5. The screen shall be size ____ perforated stainless steel. The Strainer shall have an inlet size of ____ and open area ratio of _____. The Basket Strainer shall be SSI 150B2 Series.

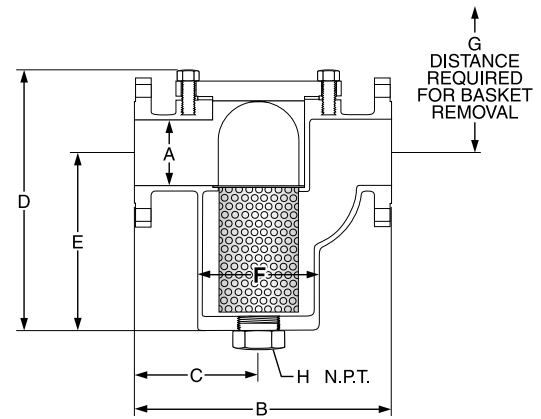
MATERIALS OF CONSTRUCTION

Item	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cover	A216-WCB	A351-CF8M
Screen ¹	304 SS	304 SS
Plug ²	A105	304 SS
Gasket ¹	304 SS Spiral Wound ³	304 SS Spiral Wound ³
Bolt/Stud ²	A193-B7	A320-B8
Nut ²	A194-2H	A194-8

1. Recommended Spare Parts

2. Materials of equivalent strength may be substituted.

3. Gasket for bolted cover. *For Quick Opening Covers, see page 467*



Connections: 1½" - 8" RF Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
1½"	1/32 Perf.	304 SS
2" - 3"	3/64 Perf.	304 SS
4" - 8"	1/8 Perf.	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C	D*	E	F	G	H NPT	WEIGHT	
									Cover	Unit
1½ (40)	1½ (38)	9½ (241)	4¾ (121)	10¼ (260)	6¾ (175)	3⅞ (87)	13½ (343)	½ (15)	5 (2.3)	30 (13.6)
2 (50)	2 (51)	10½ (267)	5¼ (133)	11¼ (300)	8¾ (208)	4¾ (105)	15½ (397)	¾ (20)	7 (3.2)	46 (20.9)
3 (80)	3 (76)	13¾ (333)	6¾ (167)	15¼ (395)	11¾ (284)	5¾ (137)	19½ (502)	1 (25)	17 (7.7)	78 (35.5)
4 (100)	4 (102)	17¼ (438)	8¾ (225)	16¾ (410)	11¾ (291)	6¾ (170)	20½ (527)	2 (50)	20 (9.1)	114 (51.8)
6 (150)	6 (152)	19¾ (498)	10¾ (276)	25¼ (649)	19¾ (491)	10 (254)	31½ (791)	2 (50)	45 (20.5)	241 (109.5)
8 (200)	8 (203)	27 (686)	14¾ (371)	35¼ (900)	27¼ (710)	12¾ (313)	42½ (1073)	2 (50)	70 (31.8)	432 (196.4)

*For models with Quick Opening Cover, consult factory. Allow clearance for bottom drain bolt removal.

Dimensions shown are subject to change. Consult factory for certified drawings.

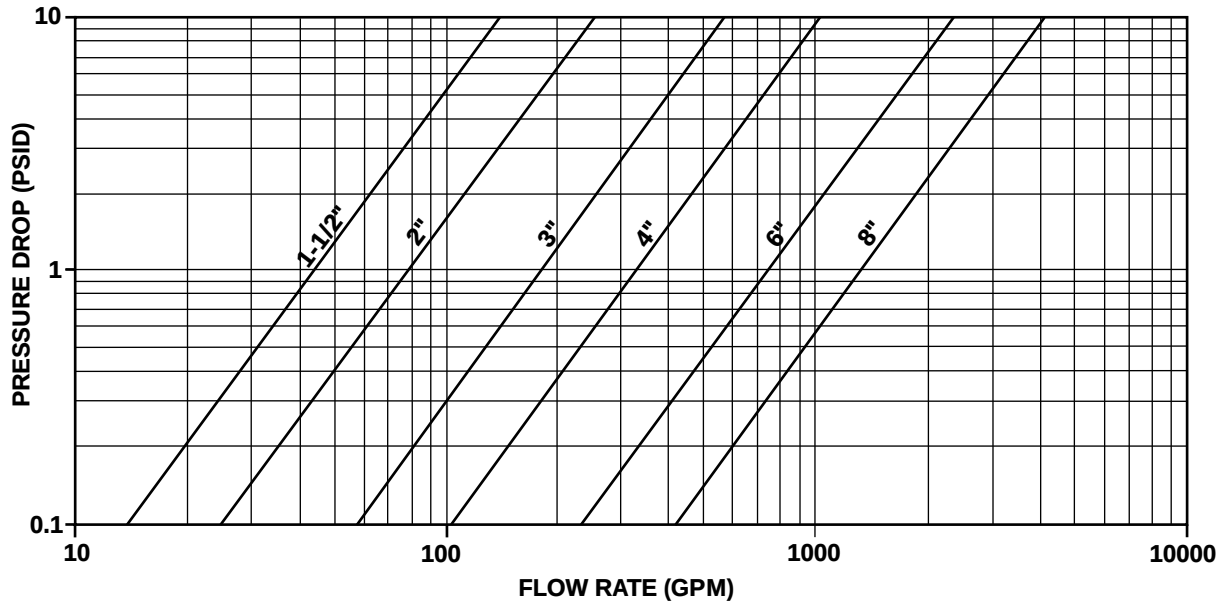
150B2 SERIES
BASKET STRAINERS

150B2 SERIES

CAST CARBON STEEL, STAINLESS STEEL

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*
(Sizes 1½" - 8")



* For Gas, Steam or Air service, consult factory.

150B2 SERIES

CAST CARBON STEEL, STAINLESS STEEL

OPEN AREA RATIOS

with Standard Perforated Screen

Size	Opening diameter (in)	Opening %	Nominal Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
1½	1/32	28	1.77	29.1	8.2	4.6
2	3/64	36	3.13	42.8	15.4	4.9
3	3/64	36	7.07	101.0	36.4	5.1
4	1/8	40	12.57	118.1	47.2	3.8
6	1/8	40	28.27	365.7	146.3	5.2
8	1/8	40	50.27	675.4	270.1	5.4

OAR = Free Screen Area / Nominal Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

Other Screen Openings
Page 466

Basket Burst Pressure
Page 472

Correction Factors for Other
Viscous Liquids and/or Mesh Liners
Page 471

Correction Factors
for Clogged Screens
Page 471

NOTES:



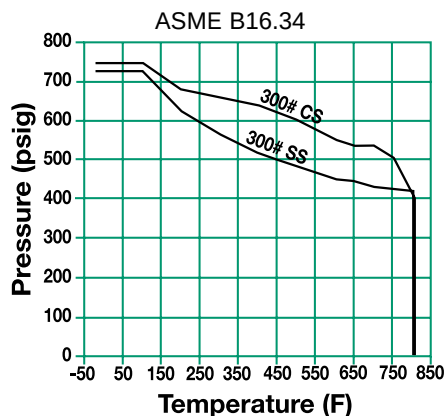
300B SERIES CAST CARBON STEEL, STAINLESS STEEL THREADED BASKET STRAINERS

PRESSURES TO 740 PSIG (51 BARG)
TEMPERATURES TO 800°F (427°C)

APPLICATIONS

- Water, oil systems
- Other liquid systems
- Protection of pumps, meters, valves and similar equipment

PRESSURE/TEMPERATURE CHART



For Quick Opening Covers Ratings, see page 467

- SSI Exclusive – Cover flange is in dimensional accordance with ASME B16.5
- Over the top flow and machined basket seat eliminate any chance of dirty fluid by-pass
- Large screen area minimizes pressure drop and cleaning intervals
- Threaded or socketweld connections
- Stainless steel perforated baskets are standard
- Recommended minimum straining level is 40 microns
- NPT drain connection furnished with plug as standard

MODELS

- 300B2T – Threaded over the top flow
- 300B2W – Socketweld over the top flow

OPTIONS

- Other screen perforations and mesh liners
- Quick Opening Covers - See page 467
- Socketweld Connections

APPLICABLE CODES

- ASME B16.5, B16.34

300B2 Series Ordering Code

Inlet Size					Model				Con- nection	Body Material	Dash	Perf	Mesh	Add'l Require- ments
0	1	5	0	-	3	0	0	B	2	T	T	-	1	—
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16														

Inlet Size - Position 1 - 4

0050 - 1/2"
0075 - 3/4"
0100 - 1"
0125 - 1 1/4"
0150 - 1 1/2"
0200 - 2"

Dash - Position 5

Model - Position 6 - 10
300B2 - Straight Flow

Connection - Position 11

T - Threaded
W - Socketweld

Body Material - Position 12

C - Carbon Steel
T - Stainless Steel

Dash - Position 13

Perf¹ - Position 14

304 SS Material²

1 - 1/32"
B - 3/64"
A - None
2 - 1/16"
3 - 3/32"
4 - 1/8"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"
Z - Other

Mesh² - Position 15

Leave Blank
If not Required
(Std. all)

1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120
Z - Other

Add'l Requirements -

Position 16

Leave Blank
If not Required

D - Special Drain Size
F - Silicon Free
G - Special Gaskets
N - Nace MR01-75
T - Special Testing
V1- Clamp Cover
X - Oxygen Cleaning
Y - Other and / or
Multiple Specials

Indicate Specials
Clearly On the Order

1. Standard screens All 1/2" - 1 1/2"—1/32" perf, All 2"—3/64" perf.

2. For other screen materials, contact factory.

For any variations, use the part numbering system above but clearly indicate the additional requirement.

300B SERIES

CAST CARBON STEEL, STAINLESS STEEL THREADED BASKET STRAINERS

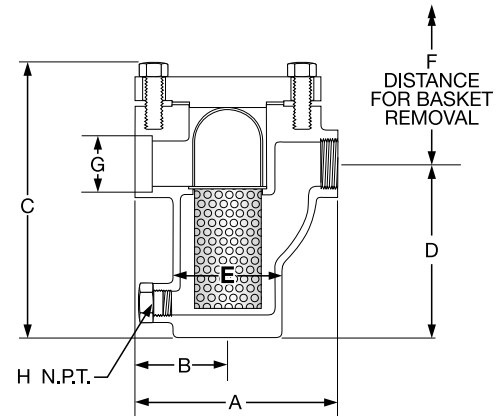
SPECIFICATION

Basket Strainer shall have over the top flow with a machined basket seat. The Basket Strainer shall be cast steel or stainless steel with 300 PSIG A rated threaded socketweld connections. The cover flange dimensions shall be in accordance with ASME B16.5. The screen shall be size _____ perforated stainless steel. The Strainer shall have an inlet size of _____ and open area ratio of _____. The Basket Strainer shall be SSI 300B2 Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Cover	A216-WCB	A351-CF8M
Screen ¹	304SS	304SS
Plug ²	A105	A182-316
Gasket ¹	304SS Spiral Wound ³	304SS Spiral Wound ³
Bolt/Stud ²	A193-B7	A193-B8-1
Nut ²	A194-2H	A194-8

1. Recommended Spare Parts
2. Materials of equivalent strength may be substituted.
3. Gasket for bolted cover. For Quick Opening Covers, see page 467



Connections: 1/2" – 2"
NPT or Socketweld

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
1/2" – 1 1/2"	1/32 Perf.	304 SS
2"	3/64 Perf.	304 SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A	B	C*	D	E	F	H	WEIGHT	
								Cover	Unit
1/2 (15)	6 1/8 (156)	3 3/8 (80)	6 1/16 (179)	4 (102)	2 1/2 (54)	5 3/4 (146)	3/8 (10)	6 (2.7)	20 (9.1)
3/4 (20)	6 3/4 (171)	3 7/16 (87)	8 3/8 (213)	5 (127)	2 1/2 (64)	7 1/16 (189)	3/8 (10)	8 (3.6)	25 (11.4)
1 (25)	6 3/4 (171)	3 7/16 (87)	8 3/8 (213)	5 (127)	2 1/2 (64)	7 1/16 (189)	1/2 (15)	8 (3.6)	25 (11.4)
1 1/4 (32)	8 3/8 (206)	4 1/8 (109)	11 15/16 (303)	7 1/4 (197)	3 1/16 (87)	11 1/16 (281)	3/4 (20)	12 (5.4)	46 (20.9)
1 1/2 (40)	8 3/8 (206)	4 1/8 (109)	11 15/16 (303)	7 1/4 (197)	3 1/16 (87)	11 1/16 (281)	3/4 (20)	12 (5.4)	46 (20.9)
2 (50)	9 (229)	4 13/16 (122)	12 7/16 (316)	7 3/4 (197)	4 1/4 (108)	11 13/16 (297)	1 (25)	16 (7.3)	61 (27.8)

*For models with Quick Opening Cover, consult factory.

Dimensions shown are subject to change. Consult factory for certified drawings.

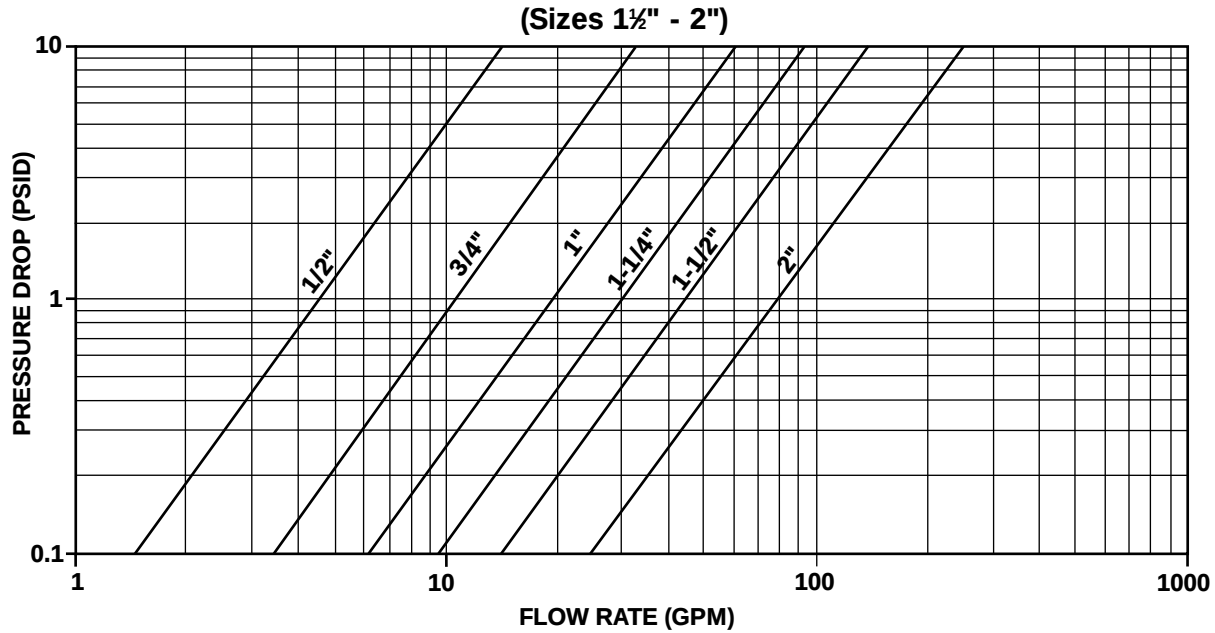
300B2 SERIES
BASKET STRAINERS

300B SERIES

CAST CARBON STEEL, STAINLESS STEEL

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*



300B SERIES

CAST CARBON STEEL, STAINLESS STEEL

OPEN AREA RATIOS

with Standard Perforated Screen

Size	Opening Diameter (in)	Opening %	Nominal Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
½	1/32	28	0.30	14.1	4.0	13.0
¾	1/32	28	0.53	22.3	6.2	11.7
1	1/32	28	0.86	22.3	6.2	7.2
1¼	1/32	28	1.50	46.9	13.1	8.8
1½	1/32	28	2.04	46.9	13.1	6.4
2	3/64	36	3.36	57.1	20.6	6.1

OAR = Free Screen Area / Nominal Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Other Screen Openings
Page 466

Basket Burst Pressure
Page 472

Correction Factors for Other
Viscous Liquids and/or Mesh Liners
Page 471

Correction Factors
for Clogged Screens
Page 471

NOTES:



FB SERIES FABRICATED BASKET STRAINERS

PRESSURES TO 3705 PSIG (255 BARG)

TEMPERATURES TO 800°F (427°C)

- Multiple and custom body configurations for tight installation, performance and economy
- Multi-baskets minimize downtime
- Stainless steel perforated baskets are standard
- Cover lifting lug standard on sizes 10" and larger
- Bottom/blowdown outlet is standard
- Drain connection with plug furnished as standard

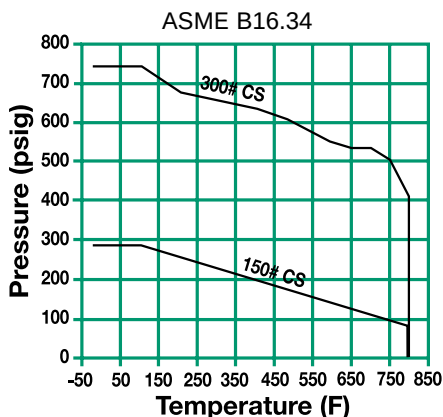
APPLICATIONS

- Water, Oil Systems
- Other Liquid Systems
- Protection of Pumps, Meters, Valves, etc.

MODELS

- FB1 - Standard Body
- FB2 - Undersized Body
- FB3 - Oversized Body
- FB4 - Low Profile Body w/Pleated Bskt
- FB5 - Low Profile Body w/Multiple Bskts

PRESSURE/TEMPERATURE CHART



For Quick Opening Covers Ratings, see page 468

For higher pressure classes and other materials, consult factory.

APPLICABLE CODES

- Designed/Manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII, Div. I.
- CRN available in all provinces
- Welders Certified to ASME Section IX

OPTIONS

- Other materials, sizes and/or configurations
- Quick Opening Covers - See page 468
- Other screen, mesh or wedgewire - See page 466
- Vent and/or differential pressure connections
- "U" stamped vessels
- Steam jacketing
- Backflush or backwash
- NACE MR010-75 Certification
- External/internal coatings
- Offset inlet/outlet Nozzles
- 600# flanges and higher
- Pleated Baskets for higher Open Area Ratios
- Consult factory for other options

FB Series Ordering Code

Model	Material	Inlet Size	Class	Con- nection	Dash	Cover Type	Perf	Mesh
F B 1 C H 1 R - B 2 3								
1 2 3 4 5 6 7 8 9 10 11								

Model - Position 1 - 3
 FB1 - Standard Body
 FB2 - Undersized Body
 FB3 - Oversized Body
 FB4 - Low Profile Body w/Pleated Bskt
 FB5 - Low Profile Body w/Multiple Bskts
 FBZ - Custom Configuration

Material - Position 4
 C - Carbon Steel
 L - Low Temp CS
 V - 304 SS
 T - 316 SS
 M - Monel
 H - Hastelloy
 Z - Other

Inlet Size - Position 5
 H - 2
 J - 2½
 K - 3
 M - 4
 N - 5
 P - 6
 Q - 8
 R - 10
 S - 12
 T - 14
 U - 16
 V - 18
 W - 20
 X - 22
 Y - 24
 1 - 28
 2 - 30
 3 - 36
 4 - 40
 Z - Other

Class - Position 6
 1 - 150
 3 - 300
 4 - 600
 5 - 900
 Z - Other

Connection - Position 7
 B - Butt weld¹
 F - Flat Face Flg
 N - NPT
 J - Ring Joint Flg
 R - Raised Face Flg
 K - Socket weld
 Z - Other

Dash - Position 8

1. For Butt weld connections please specify mating pipe schedule

Cover Type - Position 9
 B - Bolted
 C - Bolted w/C-Clamp
 D - Bolted w/Davit
 J - Bolted w/Hinge
 H - T - Bolt Hinged
 T - Threaded Hinged
 Y - Yoke Hinged
 Z - Other

For any variations, use the part numbering system above but clearly indicate the additional requirements.

Perf - Position 10
304 SS Material²
 A - None
 B - 3/64"
 1 - 1/32"
 2 - 1/16"
 3 - 3/32"
 4 - 1/8"
 5 - 5/32"
 6 - 3/16"
 7 - 7/32"
 8 - 1/4"
 9 - 3/8"
 Z - Other

2. For other screen material, contact factory.

Mesh² - Position 11
 A - None
 1 - 10
 2 - 20
 3 - 30
 4 - 40
 5 - 50
 6 - 60
 7 - 80
 8 - 100
 9 - 120
 Z - Other

FB SERIES – FB1 FABRICATED BASKET STRAINERS

SPECIFICATION

Strainer shall be designed and manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII Div. I. The Strainer body shall be fabricated steel or other specified material and inlet/outlet connections shall be in line. The Strainer shall have a single basket with a slant top. The Strainer shall have a bottom blowdown outlet. The screen shall be size ____ perforated stainless steel. The Strainer shall have an inlet size of ____ and open area ratio of _____. The Basket Strainer shall be SSI FB _____.

MATERIALS OF CONSTRUCTION (Carbon Steel Shown†)

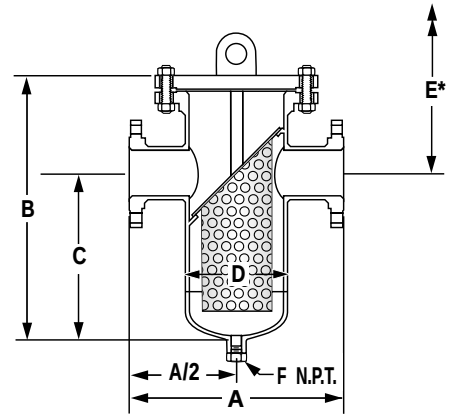
Body A53E/B or A106-B
Nozzles A53E/B or A106-B
Flanges A105
Heads A234-WPB or A516-70
Reinforcement Pads² A516-70
Couplings A105
Plug A105
Basket¹ 304 SS
Gasket¹ 304 SS Spiral Wound
Stud A193-B7
Nut A194-2H

† Other Materials Available. Consult factory.

1. Recommended Spare Parts.

2. When required.

Material specification will change when NACE MR01-75 is specified.



Standard cover is bolted.

Cover lifting lug standard on 10" sizes and larger.

Class 150# and 300# flanges are standard.

Class 600# and higher available on request.

*Distance required for basket removal.

Connections*: 2" – 24"
RF, FF, RTJ Flanged or Buttweld

*Larger sizes available. Consult Factory.

For Buttweld connection please specify mating pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" – 12"	1/8 Perf.	304 SS
14" – 24"	3/16 Perf.	304 SS

FB1 DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

For 600#. 900# and 1500# dimensions and weights contact factory.

Inlet/ Outlet	Body	A		B		C		D	E		F	Weight			
		Class 150	Class 300	Class 150	Class 300	Class 150	Class 300		Class 150	Class 300		Class 150		Class 300	
												Cover ¹	Unit	Cover ¹	Unit
2 (50)	6 (150)	12 (305)	14 ⁷ / ₈ (378)	18 ⁵ / ₈ (473)	22 (559)	11 ¹ / ₈ (283)	12 (305)	6 ⁵ / ₈ (168)	25 (635)	28 (711)	1/2 (15)	26 (12)	85 (39)	50 (23)	195 (88)
3 (80)	8 (200)	14 (356)	16 ¹ / ₂ (419)	20 ¹ / ₂ (521)	25 (635)	12 ¹ / ₂ (318)	15 ³ / ₄ (400)	8 ⁵ / ₈ (219)	28 ¹ / ₂ (724)	34 ¹ / ₄ (870)	3/4 (20)	45 (20)	140 (64)	81 (37)	250 (113)
4 (100)	8 (200)	16 (406)	18 ⁵ / ₈ (473)	22 ¹ / ₄ (565)	26 (660)	14 (356)	15 ⁷ / ₈ (403)	8 ⁵ / ₈ (219)	30 ¹ / ₂ (775)	36 ¹ / ₈ (918)	1 (25)	45 (20)	145 (66)	81 (37)	300 (136)
5 (125)	10 (250)	18 (457)	20 ³ / ₄ (514)	24 ¹ / ₄ (616)	28 (711)	17 (432)	17 ¹ / ₈ (435)	10 ³ / ₄ (273)	30 ¹ / ₂ (775)	38 ⁷ / ₈ (988)	1 (25)	70 (32)	160 (73)	125 (57)	400 (181)
6 (150)	10 (250)	20 (508)	24 ¹ / ₂ (622)	27 (686)	30 ³ / ₄ (781)	17 (432)	19 ¹ / ₈ (486)	10 ³ / ₄ (273)	36 (914)	42 ³ / ₈ (1076)	1 (25)	70 (32)	205 (93)	125 (57)	480 (218)
8 (200)	12 (300)	22 (559)	24 ⁷ / ₈ (632)	32 (813)	35 ¹ / ₂ (902)	21 (533)	22 (559)	12 ³ / ₄ (324)	43 (1092)	55 ³ / ₄ (1416)	1 ¹ / ₂ (40)	110 (50)	420 (191)	185 (84)	681 (309)
10 (250)	16 (400)	32 (813)	35 ³ / ₈ (899)	41 ¹ / ₂ (1054)	42 ¹ / ₂ (1080)	25 (635)	27 ¹ / ₄ (692)	16 (406)	58 (1473)	57 ¹ / ₄ (1454)	1 ¹ / ₂ (40)	180 (82)	650 (295)	295 (134)	1100 (499)
12 (300)	18 (450)	35 (889)	39 ³ / ₈ (1000)	44 ³ / ₄ (1137)	47 ³ / ₄ (1213)	28 (711)	30 ³ / ₈ (772)	18 (457)	61 ¹ / ₂ (1562)	65 ¹ / ₈ (1654)	1 ¹ / ₂ (40)	220 (100)	1205 (547)	395 (179)	1650 (748)
14 (350)	20 (500)	37 (940)	41 ¹ / ₂ (1054)	48 ³ / ₄ (1238)	49 ⁵ / ₈ (1260)	33 (838)	33 (838)	20 (508)	64 ¹ / ₂ (1638)	72 (1829)	2 (50)	285 (129)	1600 (726)	505 (229)	2600 (1179)
16 (400)	24 (600)	42 (1067)	47 ¹ / ₂ (1207)	54 ¹ / ₄ (1378)	60 (1524)	36 (914)	38 ⁷ / ₈ (988)	24 (610)	72 ¹ / ₂ (1842)	81 ¹ / ₈ (2061)	2 (50)	430 (195)	1965 (891)	790 (358)	2750 (1247)
18 (450)	24 (600)	46.5 (1181)	*	60 (1524)	*	40 (1016)	*	24 (610)	80 (2032)	*	2 (50)	430 (195)	2200 (998)	*	*
20 (500)	30 (750)	52 (1321)	*	68 (1727)	*	46 (1168)	*	30 (762)	90 (2286)	*	2 (50)	965 (438)	3200 (1452)	*	*
24 (600)	36 (900)	64 (1626)	*	82 ³ / ₄ (2102)	*	55 (1397)	*	36 (914)	110 ¹ / ₂ (2807)	*	2 (50)	1540 (699)	4500 (2041)	*	*

Dimensions shown are for reference only. Consult factory for certified prints when required.

* Consult factory.

1. Weight and dimension with Bolted Cover.

FB SERIES – FB2 FABRICATED BASKET STRAINERS

SPECIFICATION

Strainer shall be designed and manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII Div. I. The Strainer body shall be fabricated steel or other specified material and inlet/outlet connections shall be in line. The Strainer shall have a single basket with a slant top. The Strainer shall have a bottom blowdown outlet. The screen shall be size ____ perforated stainless steel. The Strainer shall have an inlet size of ____ and open area ratio of _____. The Basket Strainer shall be SSI FB _____.

MATERIALS OF CONSTRUCTION (Carbon Steel Shown†)

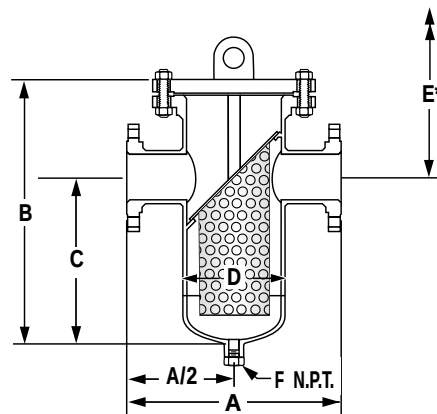
Body A53E/B or A106-B
Nozzles A53E/B or A106-B
Flanges A105
Heads A234-WPB or A516-70
Reinforcement Pads² A516-70
Couplings A105
Plug A105
Basket¹ 304 SS
Gasket¹ 304 SS Spiral Wound
Stud A193-B7
Nut A194-2H

† Other Materials Available. Consult factory.

1. Recommended Spare Parts.

2. When required.

Material specification will change when NACE MR01-75 is specified.



Standard cover is bolted.

Cover lifting lug standard on 10" sizes and larger.

Class 150# and 300# flanges are standard.

Class 600# and higher available on request.

*Distance required for basket removal.

Connections*: 2" – 24"
RF, FF, RTJ Flanged or Buttweld

*Larger sizes available. Consult Factory.
For Buttweld connection please specify mating
pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" – 12"	1/8 Perf.	304 SS
14" – 24"	3/16 Perf.	304 SS

FB2 DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

For 600#. 900# and 1500# dimensions and weights contact factory.

Inlet/ Outlet	Body	A		B		C		D	E		F	Weight-150#		Weight-300#	
		150	300	150	300	150	300		150	300		Cover ¹	Unit	Cover ¹	Unit
2	4	10 (254)	12¾ (324)	14¾ (378)	20 (508)	8¾ (226)	12 (305)	4½ (114)	22¾ (562)	26 (660)	½ (13)	17 (7.7)	34 (15.4)	28 (12.7)	50 (22.7)
3	6	13¾ (343)	11½ (292)	19¾ (486)	18¾ (480)	11¾ (295)	9 (229)	6¾ (168)	20¾ (527)	21¾ (552)	½ (13)	26 (11.8)	106 (48.1)	50 (22.7)	160 (72.6)
4	6	14 (356)	12¾ (308)	17¾ (454)	19 (483)	10¾ (270)	11½ (287)	6¾ (168)	21¾ (536)	21¾ (543)	½ (13)	26 (11.8)	114 (51.7)	50 (22.7)	175 (79.4)
6	8	14¾ (378)	15¾ (403)	22¾ (562)	23¾ (607)	12½ (318)	12½ (318)	8¾ (219)	27¾ (692)	29½ (754)	¾ (19)	45 (20.4)	140 (63.5)	81 (36.7)	225 (102.0)
8	10	18 (457)	24¾ (622)	30¾ (773)	30¾ (781)	19½ (495)	19¾ (486)	10¾ (273)	36¾ (917)	35¾ (908)	1 (25)	70 (31.7)	350 (158.7)	125 (56.7)	480 (217.7)
10	12	20 (508)	25¾ (654)	36¾ (927)	36¾ (937)	21 (533)	21 (533)	12¾ (324)	32¾ (819)	45¾ (1153)	1½ (38)	110 (49.9)	400 (181.4)	185 (83.9)	800 (362.8)
12	14	26¾ (667)	27¾ (702)	37¾ (956)	39¾ (1010)	22 (559)	21 (533)	14 (356)	46¾ (1191)	50½ (1281)	1½ (38)	139 (63.0)	595 (269.8)	241 (109.3)	930 (421.8)
14	16	30 (762)	* *	41¾ (1057)	* *	26 (660)	* *	16 (406)	46¾ (1178)	* *	1½ (38)	180 (81.6)	1208 (547.8)	295 (133.8)	* *
16	20	34 (864)	* *	45¾ (1162)	* *	30 (762)	* *	20 (508)	55 (1397)	* *	2 (51)	285 (129.3)	1900 (861.7)	505 (229.0)	* *
18	20	38¾ (975)	* *	48.12 (1222)	* *	28 (711)	* *	20 (508)	59¾ (1518)	* *	2 (51)	285 (129.3)	1965 (891.2)	505 (229.0)	* *
20	24	40¾ (1035)	* *	55.63 (1413)	* *	32 (813)	* *	24 (610)	66½ (1689)	* *	2 (51)	430 (195.0)	2600 (1179.1)	790 (358.3)	* *
24	30	45¾ (1149)	* *	62.88 (1597)	* *	38 (965)	* *	30 (762)	79 (2007)	* *	2 (51)	965 (437.6)	4000 (1814.1)	* *	* *

Dimensions shown are for reference only. Consult factory for certified prints when required.

* Consult factory.

1. Weight and dimensions with Bolted Cover.

FB SERIES – FB3 FABRICATED BASKET STRAINERS

SPECIFICATION

Strainer shall be designed and manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII Div. I. The Strainer body shall be fabricated steel or other specified material and inlet/outlet connections shall be in line. The Strainer shall have a single basket with a slant top. The Strainer shall have a bottom blowdown outlet. The screen shall be size ____ perforated stainless steel. The Strainer shall have an inlet size of ____ and open area ratio of _____. The Basket Strainer shall be SSI FB _____.

MATERIALS OF CONSTRUCTION (Carbon Steel Shown[†])

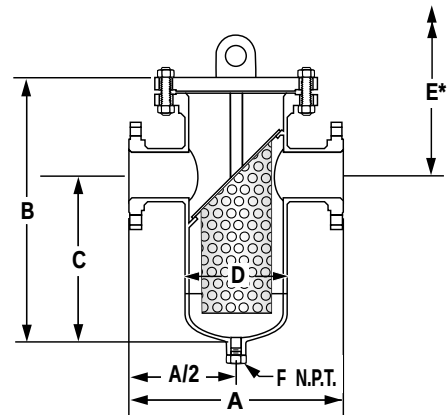
Body A53E/B or A106-B
Nozzles A53E/B or A106-B
Flanges A105
Heads A234-WPB or A516-70
Reinforcement Pads² A516-70
Couplings A105
Plug A105
Basket¹ 304 SS
Gasket¹ 304 SS Spiral Wound
Stud A193-B7
Nut A194-2H

† Other Materials Available. Consult factory.

1. Recommended Spare Parts.

2. When required.

Material specification will change when NACE MR01-75 is specified.



Standard cover is bolted.

Cover lifting lug standard on 10" sizes and larger.

Class 150# and 300# flanges are standard.

Class 600# and higher available on request.

*Distance required for basket removal.

Connections³: 2" – 20"
RF, FF, RTJ Flanged or Buttweld

3. Larger sizes available. Consult Factory.
For Buttweld connection please specify mating
pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" – 12"	1/8 Perf.	304 SS
14" – 24"	3/16 Perf.	304 SS

FB3 DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

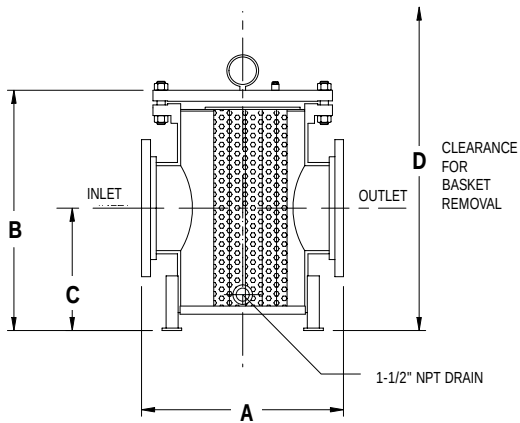
For 300#, 600#, 900# and 1500# dimensions and weights contact factory.

Inlet	Body	A	B ⁴	C	D	E	F	Weight-150#	
								Cover	Unit
2	8	15 (381)	22 ³ / ₄ (565)	14 (356)	8 ⁵ / ₁₆ (219)	25 ¹⁵ / ₁₆ (659)	¹ / ₂ (13)	45 (20)	135 (61)
3	10	22 ⁵ / ₈ (575)	26 ⁵ / ₈ (683)	15 ⁵ / ₈ (403)	10 ³ / ₄ (273)	32 ⁵ / ₈ (829)	¹ / ₂ (13)	70 (32)	150 (68)
4	10	22 ⁵ / ₈ (575)	26 ⁵ / ₈ (683)	15 ⁵ / ₈ (403)	10 ³ / ₄ (273)	32 ⁵ / ₈ (829)	¹ / ₂ (13)	70 (32)	160 (73)
6	12	25 (635)	32 (813)	21 (533)	12 ³ / ₄ (324)	37 ⁵ / ₈ (943)	³ / ₄ (19)	110 (50)	300 (136)
8	14	28 (711)	37 (940)	23 (584)	14 (356)	44 ¹ / ₁₆ (1132)	1 (25)	139 (63)	520 (236)
10	18	36 (914)	47 ⁵ / ₈ (1197)	30 ³ / ₄ (772)	18 (457)	53 ¹¹ / ₁₆ (1364)	1 ¹ / ₂ (38)	220 (100)	1150 (523)
12	20	37 (940)	46 ³ / ₄ (1175)	31 (787)	20 (508)	52 ⁵ / ₈ (1343)	1 ¹ / ₂ (38)	285 (129)	1500 (682)
14	24	42 (1067)	56 ⁵ / ₈ (1426)	34 ¹ / ₂ (876)	24 (610)	66 ⁵ / ₈ (1686)	1 ¹ / ₂ (38)	430 (195)	1850 (841)
16	30	52 (1321)	72 ¹ / ₂ (1842)	49 (1245)	30 (762)	82 ¹ / ₂ (2096)	2 (51)	965 (438)	2800 (1273)
18	30	52 (1321)	72 ¹ / ₂ (1842)	49 (1245)	30 (762)	82 ¹ / ₂ (2096)	2 (51)	965 (438)	3050 (1386)
20	36	64 (1626)	88 ⁵ / ₈ (2251)	60 (1524)	36 (914)	99 ³ / ₄ (2534)	2 (51)	1540 (699)	4000 (1909)

Dimensions shown are for reference only. Consult factory for certified prints when required.

* Consult factory.

4. Weight and dimensions with Bolted Cover.



Standard Cover is bolted. Quick Opening Cover is available on request.

Cover lifting lug standard on bolted covers.

Class 125#/150# flanges standard.

Other Classes available on request.

Connections: 10"– 18" Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
10" – 12"	1/8 Perf. Pleated	304 SS
14" – 18"	3/16 Perf. Pleated	304 SS

FB SERIES – FB4 FABRICATED BASKET STRAINERS

SPECIFICATION

Strainer shall be designed and manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII Div.1. The Strainer body shall be fabricated steel or other specified material and inlet/outlet connections shall be in line. The Strainer shall have a single pleated basket. The screen shall be size ____ perforated stainless steel. The Strainer shall have an inlet size of ____ and open area ratio of _____. The Basket Strainer shall be SSI FB4.

MATERIALS OF CONSTRUCTION (Carbon Steel Shown[†])

Body	A53E/B or A106-B
Nozzles	A53E/B or A106-B
Flanges	A105
Heads	A234-WPB or A516-70
Couplings	A105
Plug	A105
Basket ¹	304 SS
Gasket ¹	304 SS Spiral Wound
Stud	A193-B7
Nut.....	A194-2H

† Other Materials Available. Consult factory.

1. Recommended Spare Parts.

Material specification will change when NACE MR01-75 is specified.

FB4 DIMENSIONS inches (mm) and WEIGHTS pounds (kg)

For pressure classes greater than 150# consult factory.

Inlet/ Outlet	A	B	C	D	Weight	
					Cover ¹	Unit
10 (250)	23 (584)	29 (737)	12.19 (310)	47 (1194)	180 (82)	600 (272)
12 (300)	27 (686)	38 (965)	16.75 (425)	67 (1702)	220 (100)	1100 (499)
14 (350)	31 (787)	45 (1143)	18.75 (476)	77 (1956)	285 (129)	1300 (590)
16 (400)	31 (787)	45 (1143)	18.75 (476)	77 (1956)	430 (195)	1600 (726)
18 (450)	31 (787)	45 (1143)	18.75 (476)	77 (1956)	430 (195)	1800 (816)

Dimensions shown are for reference only. Consult factory for certified prints when required.

1. Weight and dimensions with Bolted Cover.

FB SERIES – FB5 FABRICATED BASKET STRAINERS

SPECIFICATION

Strainer shall be designed and manufactured to meet ANSI B31.1, ANSI B31.3 or ANSI B31.4 and/or ASME Section VIII Div.1. The Strainer body shall be fabricated steel or other specified material and inlet/outlet connections shall be in line. The Strainer shall have four independent baskets. The screen shall be size ____ perforated stainless steel. The Strainer shall have an inlet size of ____ and open area ratio of _____. The Basket Strainer shall be SSI FB5.

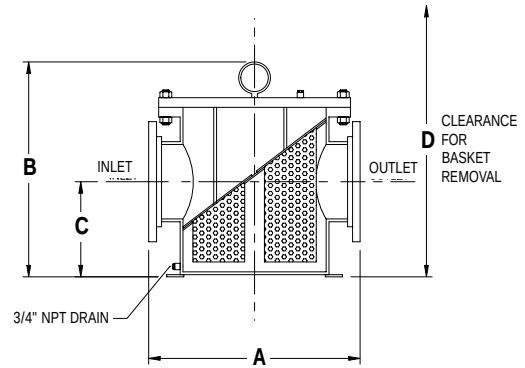
MATERIALS OF CONSTRUCTION (Carbon Steel Shown†)

Body	A53E/B or A106-B
Nozzles	A53E/B or A106-B
Flanges	A105
Heads	A234-WPB or A516-70
Couplings	A105
Plug	A105
Basket ¹	304 SS
Gasket ¹	Non Asbestos
Stud	A193-B7
Nut	A194-2H

† Other Materials Available. Consult factory.

1. Recommended Spare Parts.

Material specification will change when NACE MR01-75 is specified.



Standard cover is bolted.

Cover lifting lug standard on bolted covers.

Class 125#/150# flanges standard. Class 300# available on request.

Connections: 8"– 36" Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
8" – 12"	1/8 Perf.-multi basket	304 SS
14" – 36"	3/16 Perf.-multi basket	304 SS

FB5 DIMENSIONS inches (mm) and WEIGHTS pounds (kg)

For pressure classes greater than 150# consult factory.

Inlet/ Outlet	A	B	C	D	Weight	
					Cover ¹	Unit
8 (200)	23.35 (593)	20.13 (511)	9.13 (232)	38 (965)	180 (82)	750 (340)
10 (250)	26.13 (664)	23.75 (603)	11.38 (289)	44 (1118)	220 (100)	1100 (499)
12 (300)	29 (737)	28.38 (721)	14.63 (372)	52 (1321)	285 (129)	1500 (680)
14 (350)	30.5 (775)	31.25 (794)	16.75 (425)	60 (1524)	430 (195)	1900 (862)
16 (400)	33.5 (851)	35.5 (902)	19.13 (486)	66 (1676)	965 (438)	2400 (1089)
20 (500)	44.75 (1137)	46.25 (1175)	28.5 (724)	88 (2235)	1540 (699)	4500 (2041)
24 (600)	44.38 (1127)	52.25 (1327)	31.5 (800)	98 (2489)	1820 (826)	5900 (2676)
30 (750)	61.5 (1562)	66.5 (1689)	41.63 (1057)	125 (3175)	2240 (1016)	12100 (5489)
36 (900)	62 (1575)	66.5 (1689)	41.63 (1057)	125 (3175)	2240 (1016)	12400 (5625)

Dimensions shown are for reference only. Consult factory for certified prints when required.

1. Weight and dimensions with Bolted Cover.

FB5 FABRICATED
BASKET STRAINERS

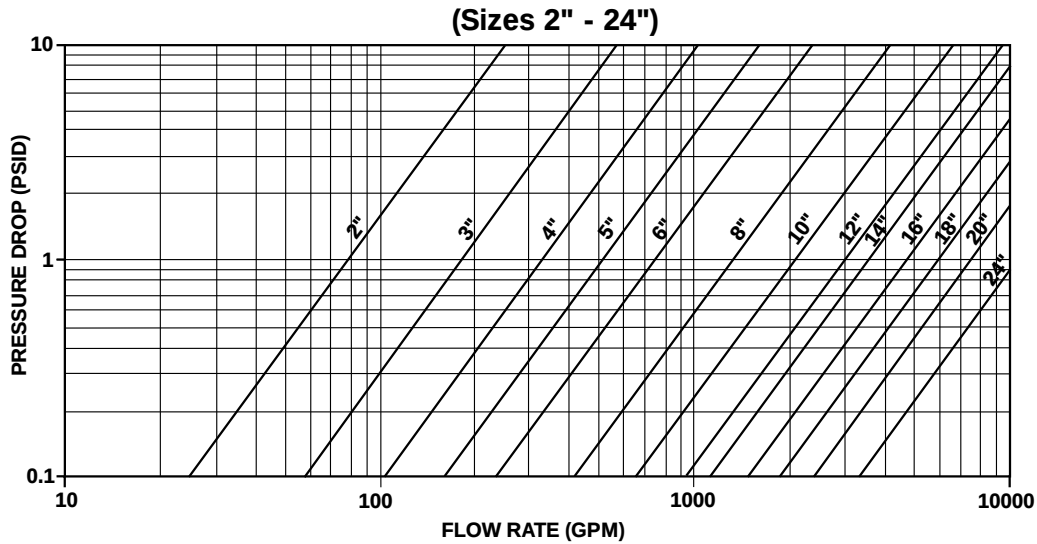
FB SERIES

FABRICATED BASKET STRAINERS

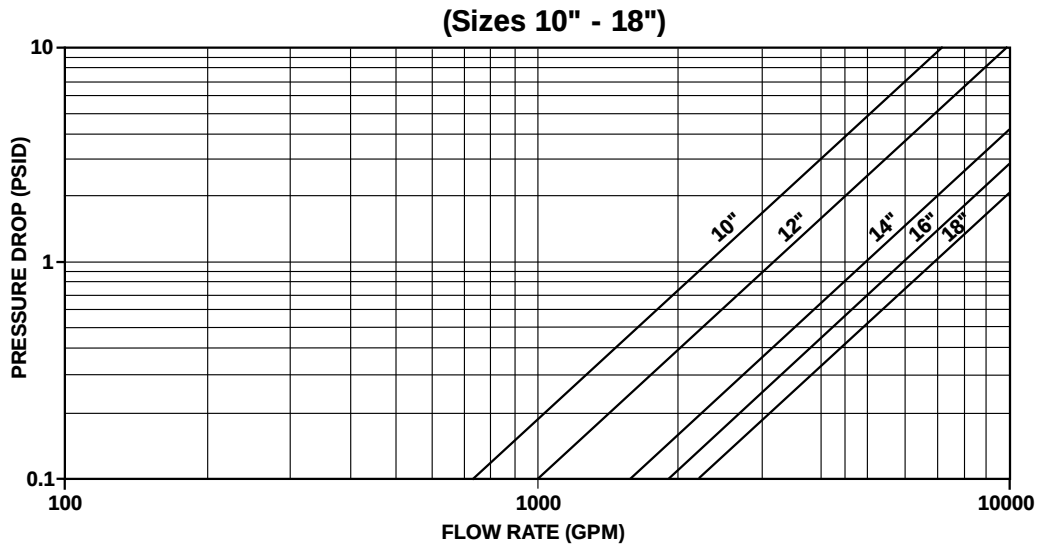
PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

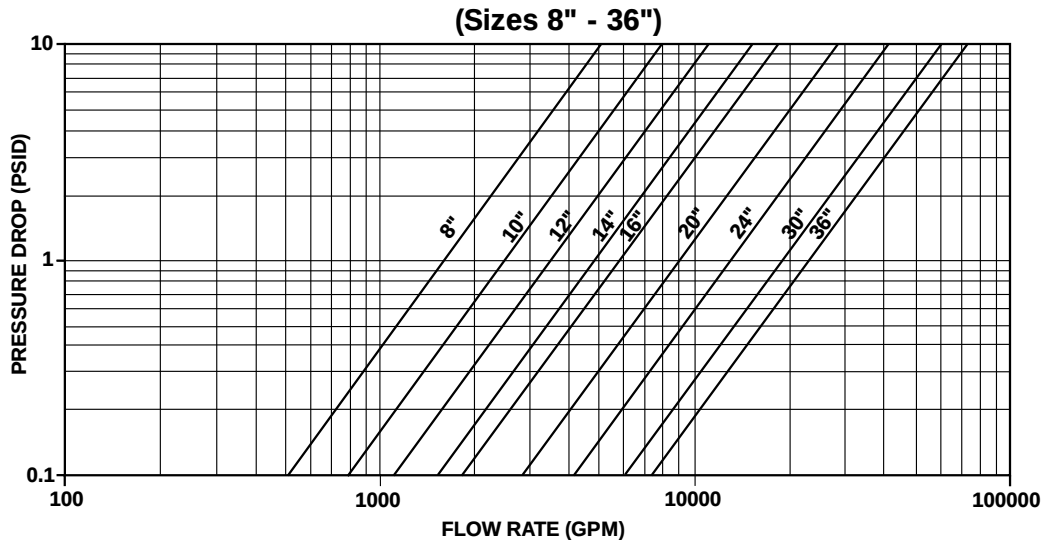
FB1
FB2
FB3



FB4



FB5



* For Gas, Steam or Air service, consult factory.

FB SERIES

FABRICATED BASKET STRAINERS

OPEN AREA RATIOS

FB1

Size	Opening diameter (in)	Opening %	Nominal Outlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	1/8	40%	3.36	171	68	20.3
3	1/8	40%	7.39	266	106	14.4
4	1/8	40%	12.73	266	106	8.4
6	1/8	40%	28.9	377	151	5.2
8	1/8	40%	50.0	562	225	4.5
10	1/8	40%	78.9	938	375	4.8
12	1/8	40%	113.1	1179	472	4.2
14	3/16	50%	137.9	1429	715	5.2
16	3/16	50%	176.7	1940	970	5.5
18	3/16	50%	227.0	2166	1083	4.8
20	3/16	50%	277.9	3393	1696	6.1
24	3/16	50%	402.0	5150	2575	6.4

FB2

Size	Opening diameter (in)	Opening %	Nominal Outlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	1/8	40%	3.4	78	31	9.3
3	1/8	40%	7.4	133	53	7.2
4	1/8	40%	12.7	133	53	4.2
6	1/8	40%	28.9	266	106	3.7
8	1/8	40%	50.0	451	180	3.6
10	1/8	40%	78.9	562	225	2.9
12	1/8	40%	113.1	703	281	2.5
14	3/16	50%	137.9	938	469	3.4
16	3/16	50%	182.7	1204	602	3.3
18	3/16	50%	227.0	1429	715	3.1
20	3/16	50%	291.0	1916	958	3.3
24	3/16	50%	402.0	3393	1696	4.2

FB3

Size	Opening diameter (in)	Opening %	Nominal Outlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	1/8	40%	3.4	266	106	31.7
3	1/8	40%	7.4	350	140	19.0
4	1/8	40%	12.7	350	140	11.0
6	1/8	40%	28.9	562	225	7.8
8	1/8	40%	50.0	762	305	6.1
10	1/8	40%	78.9	1179	472	6.0
12	1/8	40%	113.1	1338	535	4.7
14	3/16	50%	137.9	1916	958	6.9
16	3/16	50%	176.7	3393	1696	9.6
18	3/16	50%	227.0	3393	1696	7.5
20	3/16	50%	265.2	5150	2575	9.7

FB4

Size	Opening diameter (in)	Opening %	Nominal Outlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
10	1/8	40	78.85	800	320	4.1
12	1/8	40	113.1	1200	480	4.2
14	3/16	50	140.5	2000	1000	7.1
16	3/16	50	185.66	2000	1000	5.4
18	3/16	50	237.1	2000	1000	4.2

OAR = Free Screen Area / Nominal Inlet Area
Free Screen Area = Opening % x Gross Screen Area
Values shown are approximate. Consult factory for exact ratios.

Open Area Ratios can be larger with custom basket designs. Contact factory when required.

For FB5 Open Area Ratios, consult factory.

**FB FABRICATED
BASKET STRAINERS**

Other Screen Openings
Page 466

Basket Burst Pressure
Page 472

**Correction Factors for Other
Viscous Liquids and/or Mesh Liners**
Page 471

**Correction Factors
for Clogged Screens**
Page 471

NOTES:

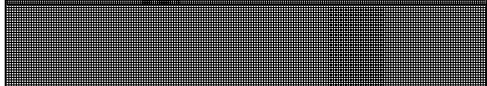
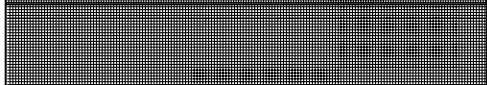
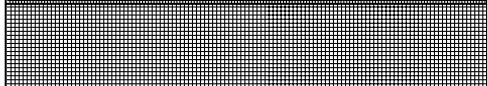
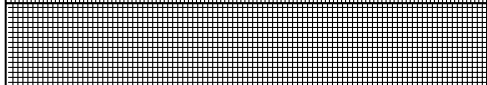
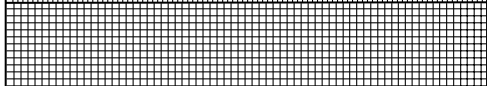
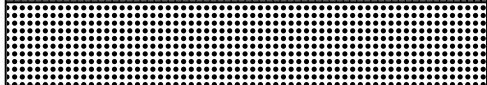
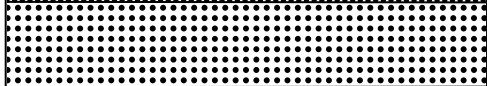
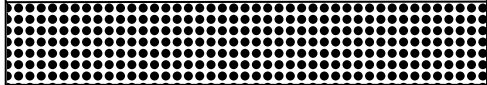
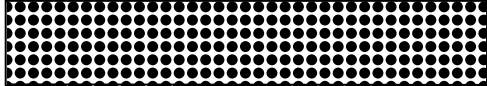
STRAINERS

BASKET STRAINER TECHNICAL INFORMATION

**BASKET STRAINERS
TECHNICAL INFO**

SCREEN OPENINGS

STRAINERS

	100 Mesh - 30% O.A. 0.006" Openings
	80 Mesh - 36% O.A. 0.008" Openings
	60 Mesh - 38% O.A. 0.010" Openings
	40 Mesh - 41% O.A. 0.016" Openings
	30 Mesh - 45% O.A. 0.022" Openings
	20 Mesh - 49% O.A. 0.035" Openings
	0.027" Dia. - 23% O.A.
	0.033" Dia. - 28% O.A.
	3/64" Dia. - 36% O.A.
	1/16" Dia. - 37% O.A.
	3/32" Dia. - 39% O.A.
	1/8" Dia. - 40% O.A.
	5/32" Dia. - 58% O.A.
	3/16" Dia. - 50% O.A.
	1/4" Dia. - 40% O.A.

FACTORS TO CONSIDER

1 Purpose

If the strainer is being used for protection rather than direct filtration, standard screens will suffice in most applications.

2 Service

With services that require extremely sturdy screens, such as high pressure/temperature applications or services with high viscosities, perforated screens without mesh liners are recommended. If a mesh liner is required to obtain a certain level of filtration, then a trapped perf/mesh/perf combination is recommended.

3 Filtration Level

When choosing a perf. or a mesh/perf. combination, attention should be given to ensure overstraining does not occur. As a general rule, the specified level of filtration should be no smaller than half the size of the particle to be removed. If too fine a filtration is specified, the pressure drop through the strainer will increase very rapidly, possibly causing damage to the screen.

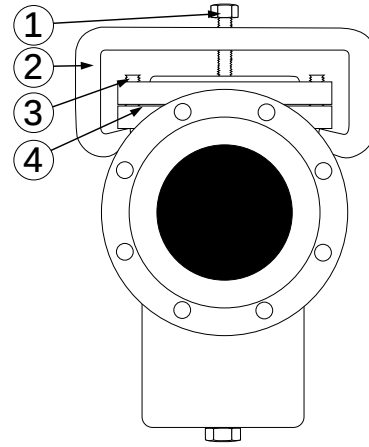
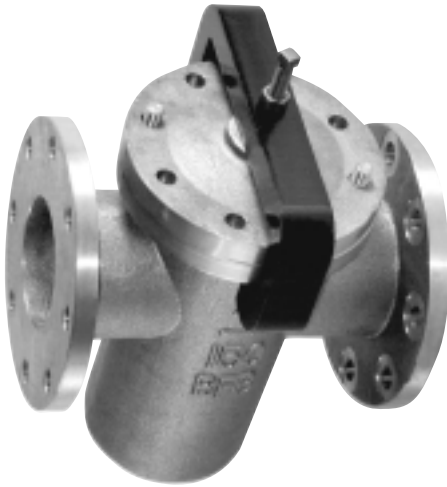
Screen openings other than those shown above are readily available. Various mesh sizes as fine as 5 micron and perforated plate as coarse as 1/2" Dia. are in inventory.

Screens are available in a wide range of materials. Screens of carbon steel, stainless steel (304, 316), alloy 20, monel 400, hastelloy C and titanium grade 2 are in inventory.

Custom manufactured screens are available upon request. Please consult factory.

CAST BASKET STRAINERS

QUICK OPENING COVERS



COVER TYPE C - QUICK OPENING C-CLAMP

COVER TYPE C - QUICK OPENING C-CLAMP

- Ideal for low pressure applications.
- Allows for extremely quick access to strainer basket.
- To be used on non-lethal liquid service only.

AVAILABILITY

1/2" - 12"

UPPER PRESSURE LIMITS (NON-SHOCK)

M.A.W.P psig (bar)	Maximum Allowable Working Temp. °F (°C)
50 (3.44)*	100 (37.8)

* Through 5" inlet consult factory for larger sizes.

MATERIALS OF CONSTRUCTION

Item #	Description	Specifications
1	Clamp Bolt (2)	A449 Grade 5
2	Clamp	A516-70 Carbon Steel
3	Anti-rotating Stud (2)	A307-B
4	Gasket - 1/2" - 6"	Flat Rubber (Non-asbestos)
	Gasket - 8" - 12"	Buna-N O-ring (Groove in Cover)

CAUTION: This type of closure does not meet the requirements of Section UG-35.2 of ASME Section VIII, Div. 1.
Use caution when utilizing this type of device.

FB SERIES

FABRICATED STRAINERS

QUICK OPENING COVERS AND COVER REMOVAL AIDS

The quick release covers and cover removal aids available on fabricated strainers are distinguished by their compact size and functional design. Materials of construction are in accordance with ASME specifications and manufacturing complies with the applicable rules of the ASME Code for Pressure Piping and with the ASME Boiler and Pressure Vessel Code.

COVER REMOVAL AID

COVER TYPE D - BOLTED WITH DAVIT ASSEMBLY

The Davit Assembly permits the user to swing the cover away to facilitate basket or screen removal for cleaning. It is used primarily for larger strainers where cover removal is difficult. The Davit Assembly is an inexpensive alternative to quick release covers, especially when operating conditions require a bolted cover.



QUICK OPENING COVERS



COVER TYPE H - T-BOLT HINGED COVER

The T-bolt Hinged Cover is the most economical quick opening closure we offer on fabricated strainers for nominal pressure applications. The T-bolt Hinged Cover utilizes an O-ring seal. It opens quickly and easily by loosening the T-bolts until they clear the holding lugs and swinging the head open on its hinge. Camlock and Break-over Wrench Assemblies that eliminate the need for a wrench are also available.

FB SERIES

FABRICATED STRAINERS

QUICK OPENING COVERS AND COVER REMOVAL AIDS

COVER TYPE Y - YOKE HINGED COVER

The Yoke Hinged Cover is a true ANSI rated closure that utilizes an O-ring seal. The Yoke Hinged Cover is used primarily on high pressure applications and is available with 150#, 300#, 600#, 900#, and 1500# ANSI ratings with a wide range of operating aids, ranging from a single lever chain and sprocket drive to completely automated.



COVER TYPE T - THREADED HINGED COVER

The Quick Opening Threaded Cover consists of a cap fastened to a hub welded to the strainer body. The female cap is threaded onto the male hub with an O-ring seal. This O-ring prevents corrosion of the closure threads, providing long, trouble free service. The Threaded Cover is for both nominal and high pressure applications.

STRAINERS

GENERAL COMPARISON OF DIFFERENT CLOSURE TYPES

Comparison Item	Closure Type				
	Bolted Type B	w/Davit Type D	T-Bolt Type H	Bolted Yoke Type Y	Threaded Type T
Cost	Lowest	Low	Moderate	High	High
Quick Opening Ability	Poor	Fair	Good	Best	Best
Low Pressure Applications	X	X	X	—	—
Nominal Pressure Applications	X	X	X	X	X
High Pressure Applications	X	X	—	X	X

BASKET STRAINERS

REPLACEMENT BASKET SCREENS



We have screens and baskets for all makes of Y, basket and duplex strainers. The range of materials and size of units is unlimited.

We provide baskets manufactured from:

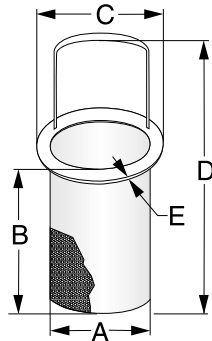
- **Perforated Plate**
- **Mesh or Mesh/Perf. Combination**
- **Wedge Wire**
- **Laser Beam Small Hole Perforated Plate**

Using the above processes or combination thereof, we can provide screens and baskets suitable for a wide range of applications.

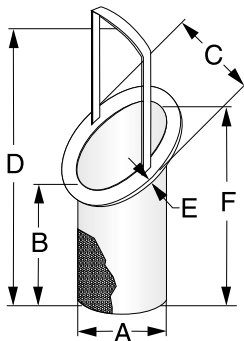
SCREEN/BASKET CHECKLIST

Kindly photocopy this page and fill out the pertinent information.

BASKET STRAINER STYLE "D"



BASKET STRAINER STYLE "B"



Performance Requirements

Description	Customers Requirement
Required Level of Filtration =	
Material of Construction =	
Minimum Specified Burst Pressure =	
Flow Direction =	
Other =	

Dimensional Requirements

Description	Customers Requirement
Style	B or D
Basket Outer Diameter	A =
Basket Height	B =
Ring OD	C =
Overall Height	D =
Ring Thickness	E =
Basket Long Height	F =

BASKET STRAINER

PRESSURE DROP CORRECTION FACTORS

Mesh Lined Baskets and/or Fluids with a Viscosity other than Water

Centistokes	SSU	Unlined Perforated Basket	20 Mesh Lined Basket	40 Mesh Lined Basket	60 Mesh Lined Basket	80 Mesh Lined Basket	100 Mesh Lined Basket	200 Mesh Lined Basket
2	30 (water)	1	1.05	1.2	1.4	1.6	1.7	2
100	500	1.6	1.7	1.9	2.1	2.4	2.6	3.1
216	1000	1.7	2	2.2	2.4	2.6	2.8	3.3
433	2000	1.9	2.2	2.4	2.7	2.9	3.2	3.8
650	3000	2	2.3	2.6	2.9	3.2	3.5	4.1
1083	5000	2.2	2.6	3	3.5	4	4.5	5.3
2200	10000	2.5	3	3.5	4.2	5	6	7.1

- 1) Obtain water pressure drop from graphs on appropriate product page.
- 2) Multiply the pressure drop obtained from (1) by the specific gravity of the liquid.
- 3) Multiply the pressure drop from (2) by the appropriate correction factor for the mesh liner and/or viscosity.

Example

Model: 150B1
Size: 4"
Filtration: 1/8" perforated screen
40 Mesh lines
Flow rate: 200 GPM
Fluid: Water
SG: 1
Viscosity: 30 SSI

Answer

- A) From Pressure Drop Chart, pressure drop of water is .38 psid
- B) Multiply by specific gravity; $.38 \times 1 = .38$ psid
- C) From chart above, multiply $.38 \times 1.2$ (correction factor) = .456 psid

CORRECTION FACTORS FOR CLOGGED SCREENS

% Clogged	Ratio of Free Screen Area to Pipe Area						
	10:1	8:1	6:1	4:1	3:1	2:1	1:1
10							3.15
20						1.15	3.9
30						1.4	5
40						1.8	6.65
50					1.25	2.5	9.45
60				1.15	1.8	3.7	14.5
70				1.75	2.95	6.4	26
80		1.1	1.75	3.6	6.25	14	58
90	2.3	3.45	6	13.5	24	55	

* Multiply values obtained from Pressure Drop Charts by the appropriate values shown below.

Example

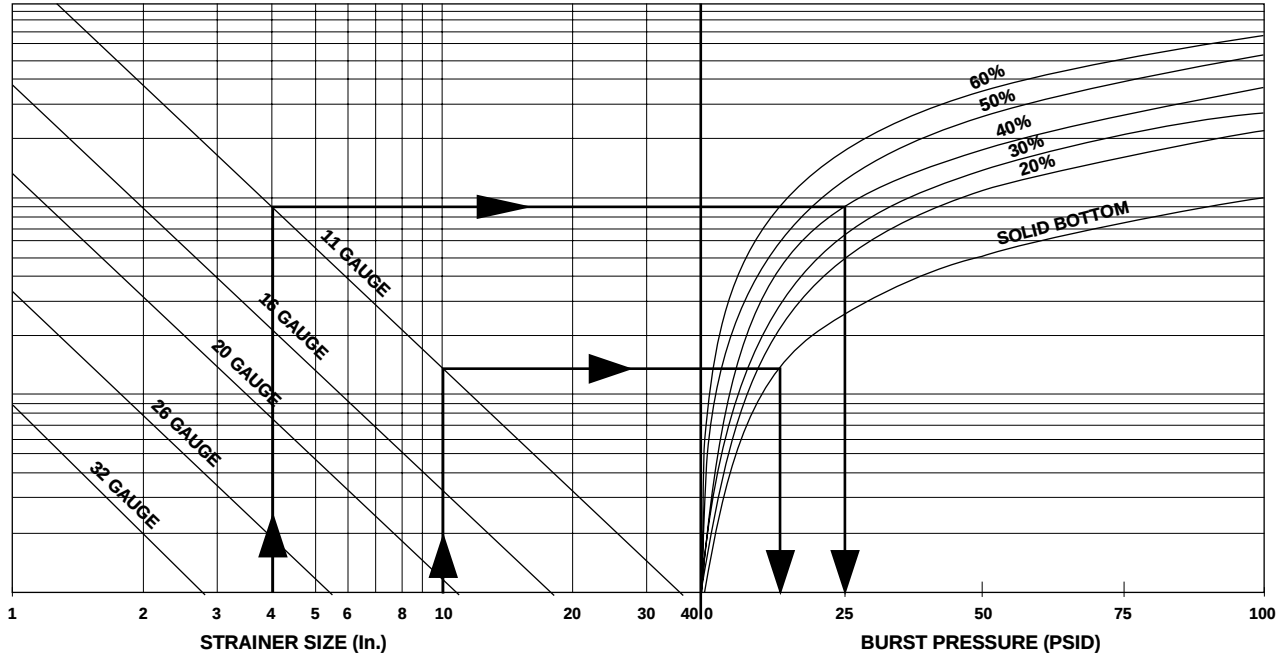
Strainer Size: 6"
Model: 150B1
Body: Carbon Steel
Filtration: 1/8" Perf.
Flow rate: 1000 GPM
Service: Water
% Clogged: 60%

Answer

- A) The Pressure Drop Chart indicates a drop of 1.50 psid with standard screen.
- B) The Effective Area Chart indicates a ratio of 2.5:1 free area to pipe area.
- C) Using Chart above we read the correction factor of 2.5:1 (2:1 approx.) to be 3.7 at 60% clogged.
- D) Total pressure drop equals $1.50 \times 3.7 = 5.55$ psid.

BASKET STRAINER

BURST PRESSURE



Baskets with perforated bottoms are standard.

Chart is based on standard dimensions. Higher burst pressure ratings are available. Please consult factory.

Chart is based on stainless steel screen material. No safety factor is incorporated. It is the responsibility of the user to determine an acceptable safety factor.

Example

Strainer Size: 10"

Basket Type: Perforated screen with 11 gauge solid flat bottom

Screen Material Open Area: 20% - 60%

Answer

- Locate Strainer size.
- Follow vertical line to solid thickness.
- Follow horizontal line to solid bottom curve.
- Follow vertical line downward to read burst pressure.
- Burst pressure equals 15 psid.

Source: ASME Section VIII, Div. 1, UG-34

BASKET STRAINERS

CHECKLIST

Please take the factors listed below into account when selecting a strainer. Kindly photocopy this page and fill out the pertinent information, to your best ability, so that we can recommend a Strainer to suit your specific requirements.

1. Fluid to be strained _____
2. Flow rate _____
3. Density of fluid _____
4. Viscosity of fluid _____
5. Fluid working pressure _____
Maximum pressure _____
6. Fluid Working Temp. _____
Maximum Temp. _____
7. Preferred material of strainer construction _____
8. Present Pipeline size & material _____
9. Nature of solids to be strained out _____
10. Size of solids to be strained out _____
Size of mesh or Perf. Req. _____

11. Clearance Limitation Above _____ Below _____
Left side facing inlet _____ Right side facing inlet _____
12. Maximum pressure drop with clean screen _____
13. Expected cleaning frequency _____
14. Any other information deemed relevant _____

Name _____
Company _____
Address _____
City/Town _____
State _____ Zip Code _____
Telephone (_____) _____
Fax (_____) _____

STRAINER
CHECKLIST

BASKET STRAINER

INSTALLATION AND MAINTENANCE INSTRUCTIONS

STRAINER INSTALLATION INSTRUCTIONS

- Ensure all machined surfaces are free of defects and that the inside of the strainer is free of foreign objects.
- For horizontal and vertical pipelines, the strainer should be installed so that the blow-down drain connection is pointed downward.
- For flanged end strainers, the flange bolting should be tightened gradually in a back and forth clockwise motion. Threaded end strainers should use an appropriate sealant.
- Once installed, increase line pressure gradually and check for leakage around joints.
- If the strainer is supplied with a start-up screen, monitor pressure drop carefully.

SCREEN REMOVAL INSTRUCTIONS

- Drain piping. (For Duplex Strainers, isolate required chamber).
- Vent line to relieve pressure.
- Loosen cover and open to access screen.
- Remove, clean and replace screen in original position (Note: In some instances, a high pressure water jet or steam may be required for effective cleaning)
- Inspect cover gasket for damage. If necessary, replace. (Note: If spiral wound gaskets have been used, they must be replaced and can not be used again).
- Tighten cover. The strainer is ready for line start-up.

CAUTION SHOULD BE TAKEN DUE TO POSSIBLE EMISSION OF PROCESS MATERIAL FROM PIPING. ALWAYS ENSURE NO LINE PRESSURE EXISTS WHEN OPENING COVER.

MAINTENANCE INSTRUCTIONS

For maximum efficiency, determine the length of time it takes for the pressure drop to double that in the clean condition. Once the pressure drop reaches an unacceptable value, shut down line and follow the "Screen Removal Instructions" above. A pressure

gauge installed before and after the strainer in-line will indicate pressure loss due to clogging and may be used to determine when cleaning is required.

TROUBLE SHOOTING GUIDES AND DIAGNOSTIC TECHNIQUES

- After pressurizing, inspect cover and other joints for leakage. Gasket replacement or cover tightening is necessary if leakage occurs.
- If the required filtration is not taking place, ensure the screen is installed in the correct position, that being flush to the screen seating surfaces.

Applications

- Steam, Liquid, Gas and Oil Service
- Process Equipment
- Power Industry
- Chemical Industry
- Water and Waste
- Pulp and Paper
- Metals and Mining

T-Strainers

**Pressures to 3705 PSIG
Temperatures to 800°F**

FEATURES

- Horizontal or Vertical Installations
- Stainless Steel Perforated Screens
- Thru Bolt Cover is Standard

MATERIALS

- Stainless Steel
- Carbon Steel
- Other materials upon request

END CONNECTIONS

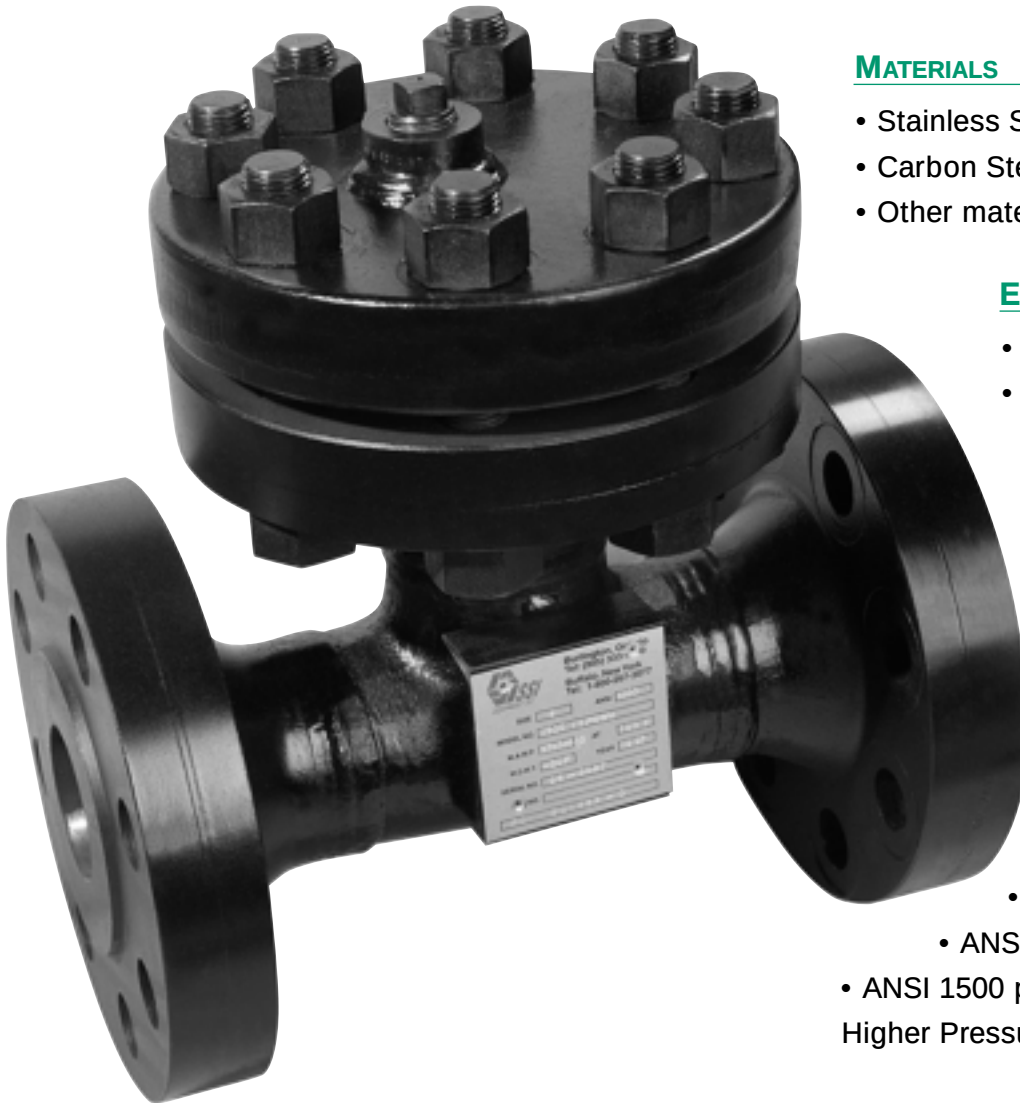
- Butt Weld End
- RTJ or RF Flanges

SIZES

- 2" (50mm) up to 24" (600mm) as standard
- Large sizes upon request

RATINGS

- ANSI 150 psig
 - ANSI 300 psig
 - ANSI 600 psig
 - ANSI 900 psig
 - ANSI 1500 psig
- Higher Pressure Classes on Request



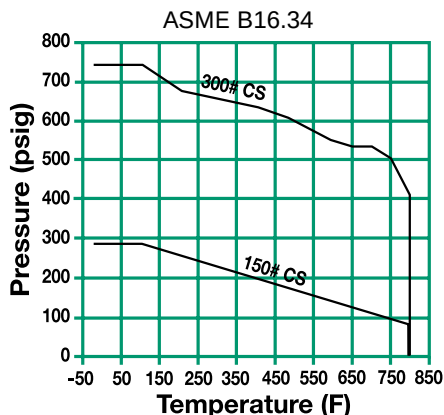
T-STRAINERS



APPLICATIONS

- Steam, liquid, gas and oil service
- Power Industry
- Pulp & Paper
- Process Equipment
- Chemical Industry
- Metal & Mining
- Water & Waste
- Metal & Mining

PRESSURE/TEMPERATURE CHART



For higher pressure classes & other materials, consult factory.
For Quick Opening Covers see page 468

FT SERIES FABRICATED T-STRAINERS

PRESSURES TO 3705 PSIG (255 BARG)
TEMPERATURES TO 800°F (427°C)

- Custom engineered and fabricated T strainers
- RF or RTJ Flanges or Buttweld end connections in accordance with ASME 16.34 and 16.5
- Standard thru bolt cover design.
- Installaion in horizontal or vertical pipelines.
- Three flow configurations available.
- Stainless steel perforated screens are standard
- Cover lifting lug standard on sizes 10" and larger

MODELS

- FT1 – Inline, straight through flow
- FT2 – 90 degree angle flow – top to side
- FT3 – 90 degree angle flow – side to top
- FTZ – Custom Configuration

OPTIONS

- Other materials, sizes and/or configurations
- Quick Opening covers – See page 468
- Other screen, mesh or wedgewire – See page 484
- Vent, Drain and/or differential pressure connections
- "U" stamped vessels
- NACE MRO10-75 Certification
- External/Internal coatings
- 600# flanges and higher
- Oxygen cleaning
- Contact Factory for other Options

APPLICABLE CODES

- Designed/Manufactured to meet ASME B31.1, ASME B31.3, or ASME B31.4 and/or ASME Section VIII, Div. 1.
- Canadian Registration Numbers (CRN)
- Welders certified to ASME Section IX

FT Series Ordering Code

Model			Material	Inlet Size	Class	Connec- tion	Dash	Cover	Perf	Mesh
F	T	2	V	P	4	R	-	B	4	A
1	2	3	4	5	6	7	8	9	10	11

Model - Position 1 - 3

- FT1 - Inline Flow
- FT2 - 90 degree angle flow
- Top to Side
- FT3 - 90 degree angle flow
- Side to Top
- FTZ - Custom Configurations

Material - Position 4

- C - Carbon Steel
- L - Low Temp CS
- V - 304 SS
- T - 316 SS
- M - Monel
- Z - Other

Inlet Size - Position 5

- H - 2
- J - 2½
- K - 3
- M - 4
- N - 5
- P - 6
- Q - 8
- R - 10
- S - 12
- T - 14
- U - 16
- V - 18
- W - 20
- X - 22
- Y - 24
- 1 - 28
- 2 - 30
- 3 - 36
- 4 - 40
- Z - Other

Class - Position 6

- 1 - 150
- 2 - 250
- 3 - 300
- 4 - 600
- 5 - 900
- 6 - 1500
- Z - Other

Connection - Position 7

- B - Butt Weld¹
- F - Flat Face Flange
- J - Ring Joint Flange
- R - Raised Face Flange
- Z - Other

Dash - Position 8

Cover - Position 9

- B - Bolted
- C - Bolted w/C-Clamp
- D - Bolted w/Davit
- J - Bolted w/Hinge
- H - T - Bolt Hinged
- T - Threaded Hinged
- Y - Yoke Hinged
- Z - Other

Perf - Position 10

304 SS Material²

- B - 3/64"
- 1 - 1/32"
- 2 - 1/16"
- 3 - 3/32"
- 4 - 1/8"
- 5 - 5/32"
- 6 - 3/16"
- 7 - 7/32"
- 8 - 1/4"
- 9 - 3/8"
- Z - Other

Mesh² -

Position 11

- A - None
- 1 - 10
- 2 - 20
- 3 - 30
- 4 - 40
- 5 - 50
- 6 - 60
- 7 - 80
- 8 - 100
- 9 - 120
- Z - Other

- For Buttweld connections please specify mating pipe schedule.
- For other screen material, contact factory.

FT1 SERIES FABRICATED T-STRAINERS

SPECIFICATION

T Strainer shall be designed and manufactured to meet ASME B31.1, ASME B31.3 or ANSI B31.4 and/or ASME Section VIII Div. 1. The strainer shall be straight flow design with vertical screen supports. The screen shall be size _____ perf Stainless Steel. The strainer shall have a bolted cover furnished. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The T Strainer shall be SSI FT1 Series.

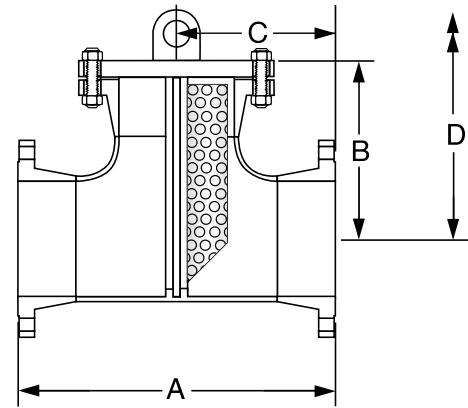
MATERIALS OF CONSTRUCTION (CARBON STEEL SHOWN*)

Part Carbon Steel
Body A234-WPB
Flanges A105
Screen¹ 304 SS
Internal support ribs Carbon Steel
Coupling / threadolet A105
Gasket¹ 304 SS Spiral Wound
Stud A193-B7
Nut A194-2H

* Other material available - consult factory

1. Recommended Spare Parts

Materials specification will change when NACE MR01-75 is specified.



Connections: 2-24"
RF, RTJ or Buttweld²

2. For Buttweld connection please specify mating pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" - 12"	1/8" Perf.	304SS
14" - 24"	3/16" Perf.	304SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

(For 600#, 900# and 1500# dimensions and weights - contact factory)

Size	A		B		C		D		Approx. Weights									
	Flanged		Buttweld		Flanged/ Buttweld		Flanged		Buttweld		Flanged/ Buttweld		Cover		Unit (Flanged)		Unit (Buttweld)	
	CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS	
	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300
2 (50)	10 (254)	10½ (267)	5 (127)	5 (127)	5⅞ (149)	6¼ (159)	5 (127)	5¼ (133)	2½ (63)	2½ (63)	11 (279)	11½ (292)	5 (2.3)	8 (3.6)	28 (12.7)	42 (19.1)	16 (7.3)	24 (10.9)
2½ (65)	11½ (292)	12 (305)	6 (152)	6 (152)	6⅞ (168)	7 (178)	5¾ (146)	6 (152)	3 (76)	3 (76)	12½ (329)	13⅞ (341)	7 (3.2)	14 (6.4)	40 (18.1)	55 (24.9)	25 (11.3)	30 (13.6)
3 (80)	12¼ (311)	13 (330)	6¾ (172)	6¾ (172)	7⅞ (182)	7¾ (197)	6⅞ (155)	6½ (165)	3⅞ (86)	3⅞ (86)	13¾ (349)	14½ (368)	9 (4.1)	16 (7.3)	52 (23.6)	72 (32.7)	32 (14.5)	42 (19.1)
4 (100)	14¼ (362)	15 (381)	8¼ (210)	8¼ (210)	8⅞ (208)	8⅞ (225)	7⅞ (181)	7½ (190)	4⅞ (105)	4⅞ (105)	16¼ (413)	17 (432)	17 (7.7)	27 (12.2)	79 (35.8)	125 (56.7)	49 (22.2)	75 (34)
5 (125)	16¾ (425)	17½ (445)	9¾ (248)	9¾ (248)	9⅞ (240)	10¼ (260)	8 3/8 (212)	8¾ (222)	4⅞ (124)	4⅞ (124)	19¼ (489)	20 (508)	20 (9.1)	35 (15.9)	105 (47.6)	160 (72.6)	67 (30.4)	96 (43.5)
6 (150)	18¼ (464)	19 (483)	11¼ (286)	11¼ (286)	10¼ (260)	11 (281)	9⅞ (232)	9½ (241)	5⅞ (143)	5⅞ (143)	21¼ (540)	22 (559)	26 (11.8)	50 (22.7)	140 (63.5)	225 (102.1)	92 (41.7)	141 (64)
8 (200)	22 (559)	22¾ (578)	14 (356)	14 (356)	12¼ (311)	13⅞ (333)	11 (279)	11⅞ (289)	7 (178)	7 (178)	26 (660)	26¾ (679)	45 (20.4)	81 (36.7)	230 (104.3)	350 (158.8)	152 (68.9)	216 (98)
10 (250)	25 (635)	26¼ (667)	17 (432)	17 (432)	13⅞ (351)	15⅞ (384)	12½ (317)	13⅞ (333)	8½ (216)	8½ (216)	30 (762)	31¼ (794)	70 (31.8)	124 (56.2)	325 (147.4)	495 (224.5)	221 (100.2)	313 (142)
12 (300)	29 (737)	30¼ (768)	20 (508)	20 (508)	15⅞ (403)	17¼ (438)	14½ (368)	15⅞ (384)	10 (254)	10 (254)	35 (889)	36¼ (921)	110 (49.9)	185 (83.9)	500 (226.8)	765 (347)	340 (154.2)	485 (220)
14 (350)	32 (813)	33¼ (845)	22 (559)	22 (559)	17½ (444)	18⅞ (479)	16 (406)	16⅞ (422)	11 (279)	11 (279)	39 (991)	40¼ (1022)	140 (63.5)	250 (113.4)	710 (322.1)	1025 (464.9)	490 (222.3)	665 (301.6)
16 (400)	34 (864)	35½ (902)	24 (610)	24 (610)	18⅞ (471)	20⅞ (511)	17 (432)	17¾ (451)	12 (305)	12 (305)	42 (1067)	43½ (1105)	180 (81.6)	295 (133.8)	860 (390.1)	1320 (598.8)	580 (263.1)	820 (372)
18 (450)	38 (965)	39½ (1003)	27 (686)	27 (686)	20¼ (525)	22¼ (565)	19 (482)	19¾ (502)	13½ (343)	13½ (343)	47 (1194)	48½ (1232)	220 (99.8)	395 (179.2)	1025 (464.9)	1700 (771.1)	725 (328.9)	1060 (480.8)
20 (500)	41⅞ (1051)	42¾ (1085)	30 (762)	30 (762)	22½ (571)	24 (609)	20¼ (525)	21⅞ (542)	15 (381)	15 (381)	51⅞ (1305)	52¾ (1340)	285 (129.3)	505 (229.1)	1350 (612.4)	2250 (1020.6)	990 (449.1)	1450 (657.7)
24 (600)	46 (1168)	47¼ (1200)	34 (864)	34 (864)	25 (635)	26½ (673)	23 (584)	23⅞ (600)	17 (432)	17 (432)	58 (1473)	59¼ (1505)	430 (195)	790 (358.3)	2100 (952.6)	2340 (1061.4)	1580 (716.7)	2240 (1016.1)

Note: Cover lifting lugs standard on sizes 10 and larger. Lifting lug dimensions are not included above. Dimensions shown are subject to change. Contact factory for certified prints when required.

FT2 SERIES FABRICATED T-STRAINERS

SPECIFICATION

T Strainer shall be designed and manufactured to meet ASME B31.1, ASME B31.3 or ANSI B31.4 and/or ASME Section VIII Div. 1. The strainer shall be 90 degree angle flow design with horizontal screen supports. The flow shall be top to side. The screen shall be size _____ perf Stainless Steel. The strainer shall have a bolted cover furnished. The strainer shall have an inlet size of _____ and Open Area Ratio of _____. The T Strainer shall be SSI FT2 Series.

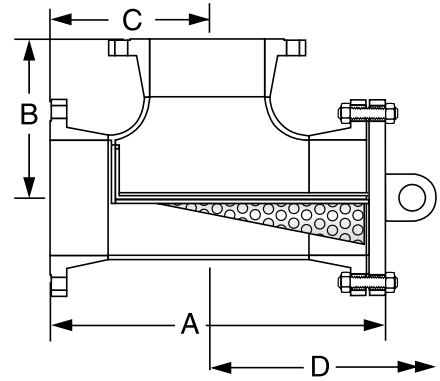
MATERIALS OF CONSTRUCTION (CARBON STEEL SHOWN*)

Part.....Carbon Steel
Body A234-WPB
Flanges A105
Screen¹ 304 SS
Internal support ribs Carbon Steel
Coupling / threadolts A105
Gasket¹ 304 SS Spiral Wound
Stud A193-B7
Nut.....A194-2H

* Other material available - consult factory

1. Recommended Spare Parts

Materials specification will change when NACE MR01-75 is specified.



Connections: 2-24"
RF, RTJ or Buttweld²

2. For Buttweld connection please specify mating pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" - 12"	1/8" Perf.	304SS
14" - 24"	3/16" Perf.	304SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg) (For 600#, 900# and 1500# dimensions and weights - contact factory)

Size	A				B				C				D		Approx. Weights					
	Flanged		Buttweld		Flanged		Buttweld		Flanged		Buttweld		Flanged/ Buttweld		Cover		Unit (Flanged)		Unit (Buttweld)	
	CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS	
	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300
2 (50)	10 ³ / ₄ (273)	11 ³ / ₈ (289)	8 ¹ / ₄ (209)	8 ⁵ / ₈ (219)	5 (127)	5 ¹ / ₄ (133)	2 ¹ / ₂ (63)	2 ¹ / ₂ (63)	5 (127)	5 ¹ / ₄ (133)	2 ¹ / ₂ (63)	2 ¹ / ₂ (63)	12 ¹ / ₂ (318)	13 (330)	5 (2.3)	8 (3.6)	28 (12.7)	42 (19.1)	16 (7.3)	24 (10.9)
2 ¹ / ₂ (65)	12 ³ / ₈ (314)	13 (330)	9 ⁵ / ₈ (244)	10 (254)	5 ³ / ₄ (146)	6 (152)	3 (76)	3 (76)	5 ³ / ₄ (146)	6 (152)	3 (76)	3 (76)	14 ³ / ₄ (375)	15 ¹ / ₂ (394)	7 (3.2)	14 (6.4)	40 (18.1)	55 (24.9)	25 (11.3)	30 (13.6)
3 (80)	13 ³ / ₁₆ (335)	14 ¹ / ₈ (359)	10 ⁷ / ₁₆ (265)	11 (280)	6 ¹ / ₈ (155)	6 ¹ / ₂ (165)	3 ³ / ₈ (86)	3 ³ / ₈ (86)	6 ¹ / ₈ (155)	6 ¹ / ₂ (165)	3 ³ / ₈ (86)	3 ³ / ₈ (86)	15 ¹ / ₄ (387)	16 (406)	9 (4.1)	16 (7.3)	52 (23.6)	72 (32.7)	32 (14.5)	42 (19.1)
4 (100)	15 ³ / ₁₆ (386)	16 ¹ / ₄ (412)	12 ³ / ₁₆ (310)	12 ⁷ / ₈ (327)	7 ¹ / ₈ (181)	7 ¹ / ₂ (190)	4 ¹ / ₈ (105)	4 ¹ / ₈ (105)	7 ¹ / ₈ (181)	7 ¹ / ₂ (190)	4 ¹ / ₈ (105)	4 ¹ / ₈ (105)	18 ³ / ₈ (467)	19 ¹ / ₈ (486)	17 (7.7)	27 (12.2)	79 (35.8)	125 (56.7)	49 (22.2)	75 (34)
5 (125)	17 ¹ / ₁₆ (449)	18 ⁷ / ₈ (479)	14 ³ / ₁₆ (361)	15 (381)	8 ³ / ₈ (212)	8 ³ / ₄ (222)	4 ⁷ / ₈ (124)	4 ⁷ / ₈ (124)	8 ³ / ₈ (212)	8 ³ / ₄ (222)	4 ⁷ / ₈ (124)	4 ⁷ / ₈ (124)	21 ⁵ / ₈ (549)	22 ³ / ₈ (568)	20 (9.1)	35 (15.9)	105 (47.6)	160 (72.6)	67 (30.4)	96 (43.5)
6 (150)	19 ¹ / ₄ (489)	20 ⁷ / ₁₆ (519)	15 ³ / ₄ (400)	16 ⁹ / ₁₆ (421)	9 ¹ / ₈ (232)	9 ¹ / ₂ (241)	5 ⁵ / ₈ (143)	5 ⁵ / ₈ (143)	9 1/8 (232)	9 ¹ / ₂ (241)	5 ⁵ / ₈ (143)	5 ⁵ / ₈ (143)	23 ¹ / ₁₆ (606)	24 ⁵ / ₈ (625)	26 (11.8)	50 (22.7)	140 (63.5)	225 (102.1)	92 (41.7)	141 (64)
8 (200)	23 ¹ / ₈ (588)	24 ³ / ₈ (619)	19 ¹ / ₈ (486)	20 (508)	11 (279)	11 ³ / ₈ (289)	7 (178)	7 (178)	11 (279)	11 ³ / ₈ (289)	7 (178)	7 (178)	29 (737)	29 ³ / ₄ (756)	45 (20.4)	81 (36.7)	230 (104.3)	350 (158.8)	152 (68.9)	216 (98)
10 (250)	26 ³ / ₁₆ (665)	28 ¹ / ₈ (714)	22 ³ / ₁₆ (564)	23 ¹ / ₂ (597)	12 ¹ / ₂ (317)	13 ¹ / ₈ (333)	8 ¹ / ₂ (216)	8 ¹ / ₂ (216)	12 ¹ / ₂ (317)	13 ¹ / ₈ (333)	8 ¹ / ₂ (216)	8 ¹ / ₂ (216)	33 ¹ / ₂ (851)	34 ³ / ₄ (883)	70 (31.8)	124 (56.2)	325 (147.4)	495 (224.5)	221 (100.2)	313 (142)
12 (300)	30 ¹ / ₄ (768)	32 ¹ / ₄ (819)	25 ³ / ₄ (654)	27 ¹ / ₈ (689)	14 ¹ / ₂ (368)	15 ¹ / ₈ (384)	10 (254)	10 (254)	14 ¹ / ₂ (368)	15 ¹ / ₈ (384)	10 (254)	10 (254)	39 (991)	40 ¹ / ₄ (1022)	110 (49.9)	185 (83.9)	500 (226.8)	765 (347)	340 (154.2)	485 (220)
14 (350)	33 ³ / ₈ (848)	35 ³ / ₈ (898)	28 ³ / ₈ (720)	29 ³ / ₄ (755)	16 (406)	16 ⁵ / ₈ (422)	11 (279)	11 (279)	16 (406)	16 ⁵ / ₈ (422)	11 (279)	11 (279)	43 (1092)	44 ¹ / ₄ (1124)	140 (63.5)	250 (113.4)	710 (322.1)	1025 (464.9)	490 (222.3)	665 (301.6)
16 (400)	35 ⁷ / ₁₆ (900)	37 ³ / ₄ (959)	30 ⁷ / ₁₆ (773)	32 (813)	17 (432)	17 ³ / ₄ (451)	12 (305)	12 (305)	17 (432)	17 ³ / ₄ (451)	12 (305)	12 (305)	46 (1168)	47 ¹ / ₂ (1207)	180 (81.6)	295 (133.8)	860 (390.1)	1320 (598.8)	580 (263.1)	820 (372)
18 (450)	39 ⁹ / ₁₆ (1005)	41 ⁷ / ₈ (1063)	34 (865)	35 ⁵ / ₈ (905)	19 (482)	19 ³ / ₄ (501)	13 ¹ / ₂ (343)	13 ¹ / ₂ (343)	19 (482)	19 ³ / ₄ (501)	13 ¹ / ₂ (343)	13 ¹ / ₂ (343)	51 ¹ / ₂ (1308)	53 (1346)	220 (99.8)	395 (179.2)	1025 (464.9)	1700 (771.1)	725 (328.9)	1060 (480.8)
20 (500)	43 (1094)	45 ¹ / ₄ (1149)	37 ³ / ₈ (949)	38 ⁷ / ₈ (987)	20 ¹ / ₁₆ (525)	21 ³ / ₈ (543)	15 (381)	15 (381)	20 ¹ / ₁₆ (525)	21 ³ / ₈ (543)	15 (381)	15 (381)	59 ¹ / ₁₆ (1516)	62 ³ / ₄ (1594)	285 (129.3)	505 (229.1)	1350 (612.4)	2250 (1020.6)	990 (449.1)	1450 (657.7)
24 (600)	47 ⁷ / ₈ (1216)	50 (1270)	41 ⁷ / ₈ (1064)	43 ³ / ₈ (1102)	23 (584)	23 ⁵ / ₈ (600)	17 (432)	17 (432)	23 (584)	23 ⁵ / ₈ (600)	17 (432)	17 (432)	63 (1600)	64 ¹ / ₄ (1632)	430 (195)	790 (358.3)	2100 (952.6)	2340 (1061.4)	1580 (716.7)	2240 (1016.1)

Note: Cover lifting lugs standard on sizes 10 and larger. Lifting lug dimensions are not included above.
Dimensions shown are subject to change. Contact factory for certified prints when required.

FT3 SERIES FABRICATED T-STRAINERS

SPECIFICATION

T Strainer shall be designed and manufactured to meet ASME B31.1, ASME B31.3 or ANSI B31.4 and/or ASME Section VIII Div. 1. The strainer shall be 90 degree angle flow design. The flow shall be side to top. The screen shall be size _____ perf Stainless Steel. The strainer shall have a bolted cover furnished. The strainer shall be have an inlet size of _____ and Open Area Ratio of _____. The T Strainer shall be SSI FT3 Series.

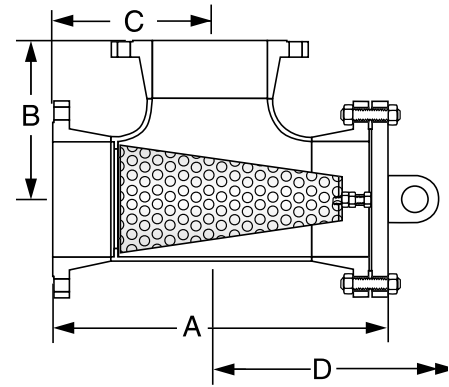
MATERIALS OF CONSTRUCTION (CARBON STEEL SHOWN*)

Part.....Carbon Steel
Body A234-WPB
Flanges A105
Screen¹ 304 SS
Internal support ribs Carbon Steel
Coupling / threadolts A105
Gasket¹ 304 SS Spiral Wound
Stud A193-B7
Nut.....A194-2H

* Other material available - consult factory

1. Recommended Spare Parts

Materials specification will change when NACE MR01-75 is specified.



Connections: 2-24"
RF, RTJ or Butt weld²

2. For Butt weld connection please specify mating pipe schedule.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
2" - 12"	1/8" Perf.	304SS
14" - 24"	3/16" Perf.	304SS

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

(For 600#, 900# and 1500# dimensions and weights - contact factory)

Size	A				B				C				D		Approx. Weights							
	Flanged		Butt weld		Flanged		Butt weld		Flanged		Butt weld		Flanged/Butt weld		Cover		Unit (Flanged)		Unit (Butt weld)			
	CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS	
	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300
2 (50)	10 3/4 (273)	11 3/8 (289)	8 3/4 (209)	8 5/8 (219)	5 (127)	5 1/4 (133)	2 1/2 (63)	2 1/2 (63)	5 (127)	5 1/4 (133)	2 1/2 (63)	2 1/2 (63)	12 1/2 (318)	13 (330)	5 (2.3)	8 (3.6)	28 (12.7)	42 (19.1)	16 (7.3)	24 (10.9)		
2 1/2 (65)	12 3/8 (314)	13 (330)	9 5/8 (244)	10 (254)	5 3/4 (146)	6 (152)	3 (76)	3 (76)	5 3/4 (146)	6 (152)	3 (76)	3 (76)	14 3/4 (375)	15 1/2 (394)	7 (3.2)	14 (6.4)	40 (18.1)	55 (24.9)	25 (11.3)	30 (13.6)		
3 (80)	13 3/16 (335)	14 1/8 (359)	10 7/16 (265)	11 (280)	6 1/8 (155)	6 1/2 (165)	3 3/8 (86)	3 3/8 (86)	6 1/8 (155)	6 1/2 (165)	3 3/8 (86)	3 3/8 (86)	15 1/4 (387)	16 (406)	9 (4.1)	16 (7.3)	52 (23.6)	72 (32.7)	32 (14.5)	42 (19.1)		
4 (100)	15 3/16 (386)	16 1/4 (412)	12 3/16 (310)	12 7/8 (327)	7 1/8 (181)	7 1/2 (190)	4 1/8 (105)	4 1/8 (105)	7 1/8 (181)	7 1/2 (190)	4 1/8 (105)	4 1/8 (105)	18 3/8 (467)	19 1/8 (486)	17 (7.7)	27 (12.2)	79 (35.8)	125 (56.7)	49 (22.2)	75 (34)		
5 (125)	17 1/16 (449)	18 7/8 (479)	14 3/16 (361)	15 (381)	8 3/8 (212)	8 3/4 (222)	4 7/8 (124)	4 7/8 (124)	8 3/8 (212)	8 3/4 (222)	4 7/8 (124)	4 7/8 (124)	21 5/8 (549)	22 3/8 (568)	20 (9.1)	35 (15.9)	105 (47.6)	160 (72.6)	67 (30.4)	96 (43.5)		
6 (150)	19 1/4 (489)	20 7/16 (519)	15 3/4 (400)	16 9/16 (421)	9 1/8 (232)	9 1/2 (241)	5 5/8 (143)	5 5/8 (143)	9 1/8 (232)	9 1/2 (241)	5 5/8 (143)	5 5/8 (143)	23 11/16 (606)	24 5/8 (625)	26 (11.8)	50 (22.7)	140 (63.5)	225 (102.1)	92 (41.7)	141 (64)		
8 (200)	23 1/8 (588)	24 3/8 (619)	19 1/8 (486)	20 (508)	11 (279)	11 3/8 (289)	7 (178)	7 (178)	11 (279)	11 3/8 (289)	7 (178)	7 (178)	29 (737)	29 3/4 (756)	45 (20.4)	81 (36.7)	230 (104.3)	350 (158.8)	152 (68.9)	216 (98)		
10 (250)	26 3/16 (665)	28 1/8 (714)	22 3/16 (564)	23 1/2 (597)	12 1/2 (317)	13 1/8 (333)	8 1/2 (216)	8 1/2 (216)	12 1/2 (317)	13 1/8 (333)	8 1/2 (216)	8 1/2 (216)	33 1/2 (851)	34 3/4 (883)	70 (31.8)	124 (56.2)	325 (147.4)	495 (224.5)	221 (100.2)	313 (142)		
12 (300)	30 1/4 (768)	32 1/4 (819)	25 3/4 (654)	27 1/8 (689)	14 1/2 (368)	15 1/8 (384)	10 (254)	10 (254)	14 1/2 (368)	15 1/8 (384)	10 (254)	10 (254)	39 (991)	40 1/4 (1022)	110 (49.9)	185 (83.9)	500 (226.8)	765 (347)	340 (154.2)	485 (220)		
14 (350)	33 3/8 (848)	35 3/8 (898)	28 3/8 (720)	29 3/4 (755)	16 (406)	16 5/8 (422)	11 (279)	11 (279)	16 (406)	16 5/8 (422)	11 (279)	11 (279)	43 (1092)	44 1/4 (1124)	140 (63.5)	250 (113.4)	710 (322.1)	1025 (464.9)	490 (222.3)	665 (301.6)		
16 (400)	35 7/16 (900)	37 3/4 (959)	30 7/16 (773)	32 (813)	17 (432)	17 3/4 (451)	12 (305)	12 (305)	17 (432)	17 3/4 (451)	12 (305)	12 (305)	46 (1168)	47 1/2 (1207)	180 (81.6)	295 (133.8)	860 (390.1)	1320 (598.8)	580 (263.1)	820 (372)		
18 (450)	39 9/16 (1005)	41 7/8 (1063)	34 (865)	35 5/8 (905)	19 (482)	19 3/4 (501)	13 1/2 (343)	13 1/2 (343)	19 (482)	19 3/4 (501)	13 1/2 (343)	13 1/2 (343)	51 1/2 (1308)	53 (1346)	220 (99.8)	395 (179.2)	1025 (464.9)	1700 (771.1)	725 (328.9)	1060 (480.8)		
20 (500)	43 (1094)	45 1/4 (1149)	37 3/8 (949)	38 7/8 (987)	20 11/16 (525)	21 3/8 (543)	15 (381)	15 (381)	20 11/16 (525)	21 3/8 (543)	15 (381)	15 (381)	59 11/16 (1516)	62 3/4 (1594)	285 (129.3)	505 (229.1)	1350 (612.4)	2250 (1020.6)	990 (449.1)	1450 (657.7)		
24 (600)	47 7/8 (1216)	50 (1270)	41 7/8 (1064)	43 3/8 (1102)	23 (584)	23 5/8 (600)	17 (432)	17 (432)	23 (584)	23 5/8 (600)	17 (432)	17 (432)	63 (1600)	64 1/4 (1632)	430 (195)	790 (358.3)	2100 (952.6)	2340 (1061.4)	1580 (716.7)	2240 (1016.1)		

Note: Cover lifting lugs standard on sizes 10 and larger. Lifting lug dimensions are not included above. Dimensions shown are subject to change. Contact factory for certified prints when required.

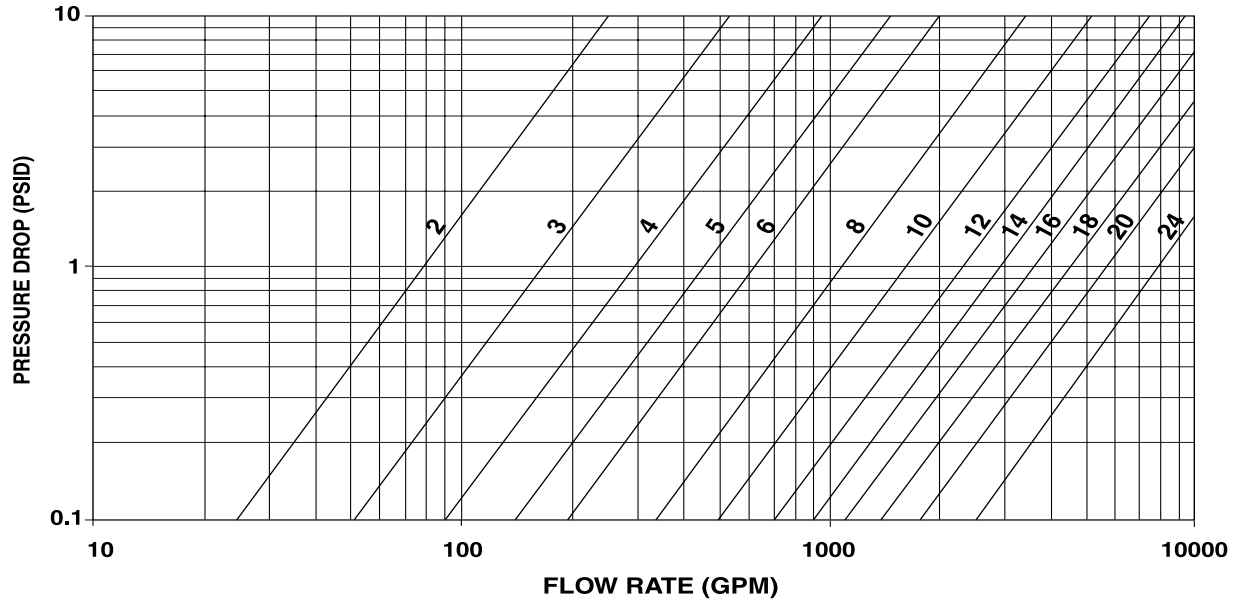
FT1 SERIES[†]

FABRICATED T-STRAINER

PRESSURE DROP - LIQUIDS

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*

(SIZES 2" - 24")



Notes:

(1) Pressure drop curves are based on water flow with standard screens. See Screen Correction Factor Chart for correction factors to be used with other fluids and/or screen openings.

* For Gas or Air service, consult Factory

[†] FT2 and FT3 - For Pressure Drop contact Factory.

FT1 SERIES
FABRICATED STRAINERS

Correction Factors for Clogged Screens Consult Factory

Steam Service Pressure Drop
Consult Factory

Correction Factors for Other Viscous Liquids and/or Mesh Liners Consult Factory

FT1 SERIES[†]

FABRICATED T-STRAINER

OPEN AREA RATIOS

with Standard Perforated Screen

For FT2, FT3 Open Area Ratios please contact SSI.

Size	Perf. Diameter (inches)	Opening %	XH Pipe Inlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2	1/8	40%	3.36	22	9	2.7
2½	1/8	40%	4.79	25	10	2.1
3	1/8	40%	7.39	40	16	2.2
4	1/8	40%	12.73	58	23	1.8
5	1/8	40%	20.01	82	33	1.6
6	1/8	40%	28.89	105	42	1.5
8	1/8	40%	50.03	167	67	1.3
10	1/8	40%	78.85	235	94	1.2
12	1/8	40%	113.10	330	132	1.2
14	3/16	50%	140.50	420	210	1.5
16	3/16	50%	185.66	510	255	1.4
18	3/16	50%	237.10	640	320	1.3
20	3/16	50%	294.83	780	390	1.3
24	3/16	50%	429.13	1,060	530	1.2

OAR = Free Screen Area / Inlet Area

Free Screen Area = Opening % x Gross Screen Area

Values shown are approximate. Consult factory for exact ratios.

[†] FT2 and FT3 - For Open Area Ratios contact Factory.

**FT1 SERIES
FABRICATED STRAINERS**

Other Screen Openings
Page 484

Basket Burst Pressure
Page 485

NOTES:

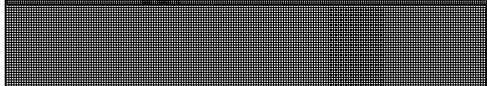
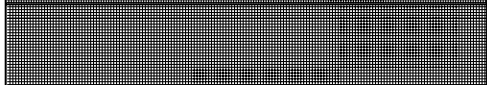
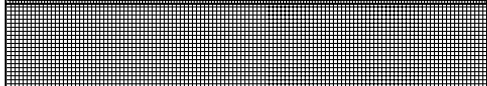
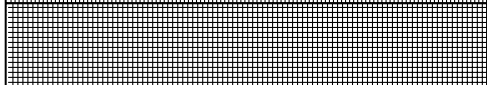
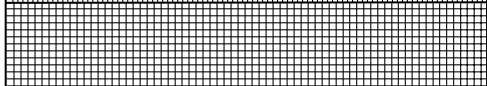
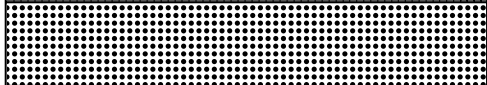
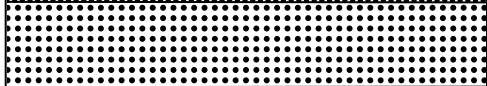
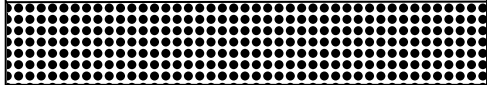
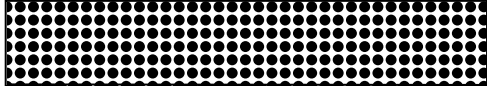
STRAINERS

T-STRAINER TECHNICAL INFORMATION

**T-STRAINERS
TECHNICAL INFO**

SCREEN OPENINGS

SCREEN OPENINGS

	100 Mesh - 30% O.A. 0.006" Openings
	80 Mesh - 36% O.A. 0.008" Openings
	60 Mesh - 38% O.A. 0.010" Openings
	40 Mesh - 41% O.A. 0.016" Openings
	30 Mesh - 45% O.A. 0.022" Openings
	20 Mesh - 49% O.A. 0.035" Openings
	0.027" Dia. - 23% O.A.
	0.033" Dia. - 28% O.A.
	3/64" Dia. - 36% O.A.
	1/16" Dia. - 37% O.A.
	3/32" Dia. - 39% O.A.
	1/8" Dia. - 40% O.A.
	5/32" Dia. - 58% O.A.
	3/16" Dia. - 50% O.A.
	1/4" Dia. - 40% O.A.

FACTORS TO CONSIDER

1 Purpose

If the strainer is being used for protection rather than direct filtration, standard screens will suffice in most applications.

2 Service

With services that require extremely sturdy screens, such as high pressure/temperature applications or services with high viscosities, perforated screens without mesh liners are recommended. If a mesh liner is required to obtain a certain level of filtration, then a trapped perf/mesh/perf combination is recommended.

3 Filtration Level

When choosing a perf. or a mesh/perf. combination, attention should be given to ensure overstraining does not occur. As a general rule, the specified level of filtration should be no smaller than half the size of the particle to be removed. If too fine a filtration is specified, the pressure drop through the strainer will increase very rapidly, possibly causing damage to the screen.

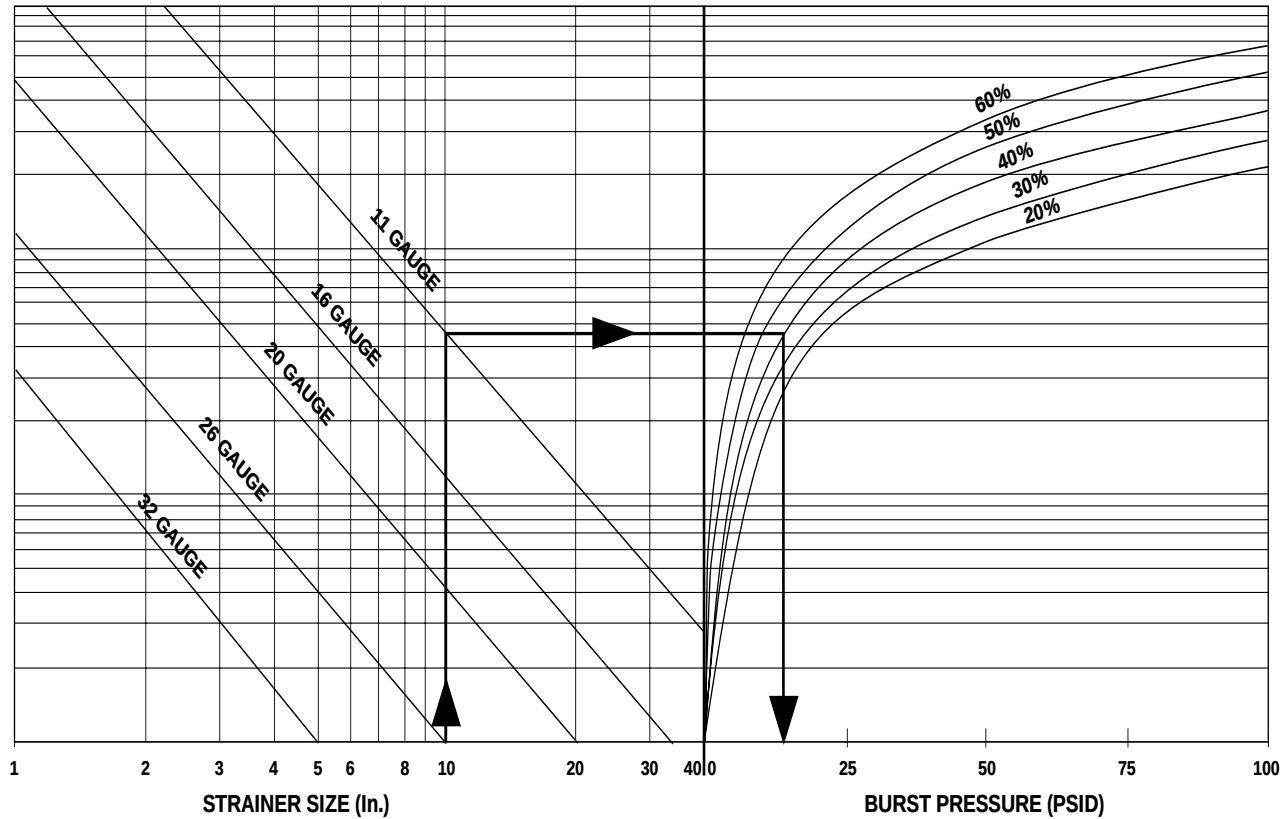
Screen openings other than those shown above are readily available. Various mesh sizes as fine as 5 micron and perforated plate as coarse as 1/2" Dia. are in inventory.

Screens are available in a wide range of materials. Screens of carbon steel, stainless steel (304, 316), alloy 20, monel 400, hastelloy C and titanium grade 2 are in inventory.

Custom manufactured screens are available upon request. Please consult factory.

T-STRAINER

SCREEN BURST PRESSURE



Notes:

(1) The above chart is to be used for strainers manufactured from perforated plate and is based on the formula:

$$t = d \sqrt{\frac{0.3P}{S}}$$

SOURCE: ASME Section VIII, Div. 1., UG-34.

t = Thickness of perforated plate, in.
d = Basket Diameter, in.
P = Burst Pressure, psi
S = Reduced allowable stress, psi

3. The above chart is based on standard dimensions. Higher burst pressure ratings are available. Please contact factory.
4. The above chart is based on a screen material of stainless steel. No safety factor is incorporated. It is the responsibility of the user to determine an acceptable safety factor.
- (4) See Screen Openings Chart for % Open Area's of inventoried perforated plate.

Example:

Strainer Size: 10"

Screen Thickness: 11 gauge

Screen Material Open Area: 40%

- A) Locate Strainer size.
- B) Follow vertical line to gauge thickness.
- C) Follow horizontal line to required perforation open area.
- D) Follow vertical line downward to read burst pressure.
- E) Burst pressure equals 13 psid.

**T-STRAINERS
BURST PRESSURE**

T-STRAINER

CHECKLIST

Please take the factors listed below into account when selecting a strainer. Kindly photocopy this page and fill out the pertinent information, to your best ability, so that we can recommend a Strainer to suit your specific requirements.

1. Fluid to be strained _____
2. Flow rate _____
3. Density of fluid _____
4. Viscosity of fluid _____
5. Fluid working pressure _____
Maximum pressure _____
6. Fluid Working Temp. _____
Maximum Temp. _____
7. Preferred material of strainer construction _____
8. Present Pipeline size & material _____
9. Nature of solids to be strained out _____
10. Size of solids to be strained out _____
Size of mesh or Perf. Req. _____

11. Clearance Limitation Above _____ Below _____
Left side facing inlet _____ Right side facing inlet _____
12. Maximum pressure drop with clean screen _____
13. Expected cleaning frequency _____
14. Any other information deemed relevant _____

Name _____
Company _____
Address _____
City/Town _____
State _____ Zip Code _____
Telephone (_____) _____
Fax (_____) _____

T-STRAINER

INSTALLATION AND MAINTENANCE INSTRUCTIONS

STRAINER INSTALLATION INSTRUCTIONS

- Ensure all machined surfaces are free of defects and that the inside of the strainer is free of foreign objects.
- For horizontal and vertical pipelines, the strainer should be installed so that the blow-down drain connection is pointed downward.
- For flanged end strainers, the flange bolting should be tightened gradually in a back and forth clockwise motion. Threaded end strainers should use an appropriate sealant.
- Once installed, increase line pressure gradually and check for leakage around joints.
- If the strainer is supplied with a start-up screen, monitor pressure drop carefully.

SCREEN REMOVAL INSTRUCTIONS

- Drain piping
- Vent line to relieve pressure.
- Loosen cover and open to access screen.
- Remove, clean and replace screen in original position (Note: In some instances, a high pressure water jet or steam may be required for effective cleaning)
- Inspect cover gasket for damage. If necessary, replace. (Note: If spiral wound gaskets have been used, they must be replaced and can not be used again).
- Tighten cover. The strainer is ready for line start-up.

CAUTION SHOULD BE TAKEN DUE TO POSSIBLE EMISSION OF PROCESS MATERIAL FROM PIPING. ALWAYS ENSURE NO LINE PRESSURE EXISTS WHEN OPENING COVER.

MAINTENANCE INSTRUCTIONS

For maximum efficiency, determine the length of time it takes for the pressure drop to double that in the clean condition. Once the pressure drop reaches an unacceptable value, shut down line and follow the

“Screen Removal Instructions” above. A pressure gauge installed before and after the strainer in-line will indicate pressure loss due to clogging and may be used to determine when cleaning is required.

TROUBLE SHOOTING GUIDES AND DIAGNOSTIC TECHNIQUES

- After pressurizing, inspect cover and other joints for leakage. Gasket replacement or cover tightening is necessary if leakage occurs.
- If the required filtration is not taking place, ensure the screen is installed in the correct position, that being flush to the screen seating surfaces.

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below: If the purchaser believes a product defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product. (b) If permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at its discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund described above, the purchaser agrees that the manufacturer shall not be liable

for any losses, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of foregoing. No other warranties, written or oral, expressed or implied, including the warranties of fitness for a particular purpose and merchantability, are made or authorized. No affirmation of fact, promise, description of product use or sample or model shall create any warranty from the manufacturer, unless signed by the president. These products are not manufactured, sold or intended for personal, family or household purposes.

NOTES:

STRAINERS

Applications

- Process Industry
- Power Industry
- Chemical Industry
- Oil and Gas
- Metals and Mining
- Water and Waste
- Pulp and Paper

Suction Diffusers

**Pressures to 285 PSIG
Temperatures to 800°F**

FEATURES

- Filtration Down to 40 Microns
- Large Diffuser Screens
- Long and Short Neck Versions Available
- Cast and Fabricated Construction

MATERIALS

- Cast Iron
- Carbon Steel
- Stainless Steel
- Other materials upon request

END CONNECTIONS

- Flat Faced
- Raised Face
- Buttweld

SIZE RANGES

- Cast-
2" x 1¼" - 12" x 12"
(50mm x 32mm -
300mm x 300mm)
- Fabricated-
Custom sizes to
meet Requirement

SUCTION DIFFUSERS





125S SERIES CAST IRON SUCTION DIFFUSERS

Pressures To 200 PSIG (18.96 barg)
Temperatures to 212°F (100°C)

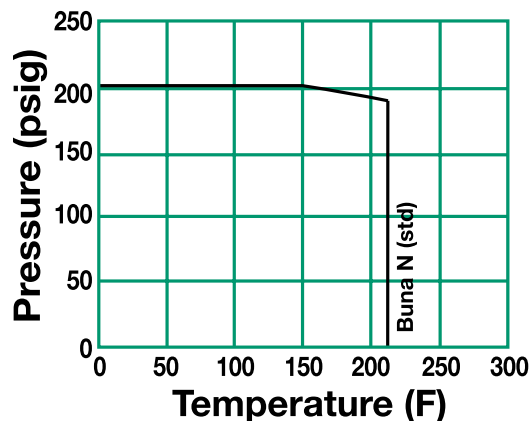
APPLICATIONS

- Pump protection

APPLICABLE CODES

- ASME B16.1

PRESSURE/TEMPERATURE CHART



- All encompassing Strainer, Flow Straightener, Elbow and Pipe Reducer for pump applications
- Direct mount to the suction side of a pump in either horizontal or vertical position
- Flow turbulence reduced through integral straightening vanes for improved pump efficiency
- All strainers supplied with removable Stainless Steel startup mesh over Stainless Steel perforated plate
- Cast Iron FF Flanges on all sizes
- All sizes complete with O-ring sealed covers with knob bolts to minimize down time
- Supporting pads for easy mounting of standard I.D. support foot
- Drain connection with plug furnished as standard

MODELS

- 125SFI – Cast Suction Diffuser

OPTIONS

- Other perforated screens and mesh liners
- EPDM or Viton cover O-ring
- Differential connections
- Bolted covers

CAST IRON SUCTION DIFFUSER ORDERING CODE

Inlet Size				Dash	Model						Outlet Size	Dash	Perf	Mesh
0	6	0	0	-	1	2	5	S	F	I	N	-	4	2
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size - Position 1-4 0200 - 2" 0250 - 2½" 0300 - 3" 0400 - 4" 0500 - 5" 0600 - 6" 0800 - 8" 1000 - 10" 1200 - 12"	Dash - Position 5 Model - Position 6 -11 125SFI - 125# Flanged	Outlet Size - Position 12 G - 1½" H - 2" J - 2½" K - 3" M - 4" N - 5" P - 6" Q - 8" R - 10" S - 12"	Dash - Position 13 Perf - Position 14 4 - 1/8" Mesh - Position 15 2 - 20"

Cast Suction Diffusers are supplied standard with Buna N cover O-ring and 1/8" perforated screen with a removable 20 mesh start up liner. For any variations, use the part numbering system above but clearly indicate the additional requirement.

125S SERIES

CAST IRON SUCTION DIFFUSERS

SPECIFICATION

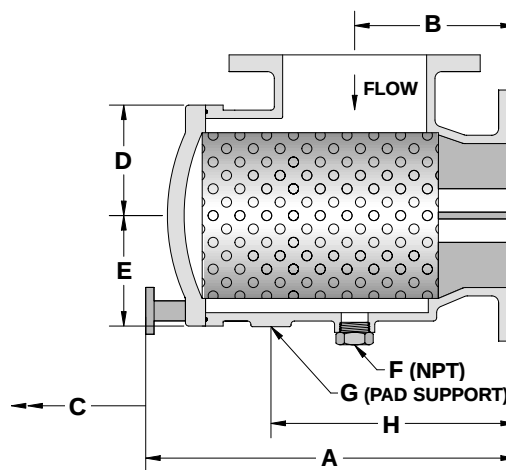
Suction Diffuser shall mount directly to the suction side of the pump in either a horizontal or vertical position. The cover shall have a Buna N O-ring and knobs to minimize down time. The Suction Diffuser shall be available with reduced outlet sizes. The Suction Diffuser shall be _____ inlet by _____ outlet with ANSI 125# FF flanges and shall have a _____ start up mesh with a _____ perforated screen. The Suction Diffuser shall be SSI S Series.

MATERIALS OF CONSTRUCTION

Body Cast Iron A126-B
 Cover Cast Iron A126-B
 Perforated Screen¹ 304 SS
 Mesh Screen 304 SS
 Knob² Ductile Iron
 O-ring¹ - Standard Buna N
 Optional EPDM
 Optional Viton
 Plug² Malleable Iron

1 Recommended Spares.

2 Materials of equivalent strength may be substituted at manufacturer's option.



Connections:
2" x 1 1/4" - 12" x 12" Flanged

SCREEN OPENINGS

SIZE	STANDARD SCREEN	START UP LINER
All	1/8" Perf.	20 Mesh*

*20 Mesh Liner is removable

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size		A	B	C ¹	D	E	F	G ²	H	Weight
Inlet	Outlet									
2 (50)	1 1/2 (40)	10.2 (260)	4.5 (114.3)	5 (127)	4.5 (114.3)	2.2 (55)	3/4 (20)	3/4 (20)	5.9 (151)	21 (9.5)
2 (50)	2 (50)	10.2 (260)	4.5 (114.3)	5 (127)	4.5 (114.3)	2.2 (55)	3/4 (20)	3/4 (20)	5.9 (151)	23 (10.4)
2 1/2 (65)	2 (50)	10.9 (276)	5 (127)	5 (127)	5 (127)	2.5 (64)	1/2 (15)	1 (25)	6.6 (167)	32 (14.5)
2 1/2 (65)	2 1/2 (65)	10.9 (276)	5 (127)	5 (127)	5 (127)	2.5 (64)	1/2 (15)	1 (25)	6.6 (167)	34 (15.4)
3 (80)	2 (50)	10.2 (260)	5.5 (139.7)	5 (127)	5.5 (139.7)	2.2 (55)	3/4 (20)	1 (25)	5.9 (151)	37 (16.8)
3 (80)	2 1/2 (65)	11.3 (288)	5.5 (139.7)	5 (127)	5.5 (139.7)	3 (76)	3/4 (20)	1 (25)	7 (179)	49 (22.2)
3 (80)	3 (80)	11.3 (288)	5.5 (139.7)	5.2 (133)	5.5 (139.7)	3 (76)	3/4 (20)	1 (25)	7 (179)	55 (24.9)
4 (100)	3 (80)	13.1 (332)	6.5 (165.1)	5.2 (133)	6.5 (165.1)	3.9 (98)	3/4 (20)	1 (25)	8.8 (223)	57 (25.9)
4 (100)	4 (100)	12.8 (325)	6.5 (165.1)	7.1 (181)	6.5 (165.1)	3.9 (98)	3/4 (20)	1 1/4 (32)	8.3 (210.1)	92 (41.7)
5 (125)	4 (100)	15.7 (400)	7.5 (190.5)	7.1 (181)	7.5 (190.5)	4.4 (112.7)	3/4 (20)	1 1/4 (32)	7.6 (194)	97 (44)
5 (125)	5 (125)	16.2 (411)	7.5 (190.5)	7.1 (181)	7.5 (190.5)	5.6 (141)	1 (25)	1 1/4 (32)	10 (254)	101 (45.8)
6 (150)	4 (100)	13.1 (332)	8 (203.2)	7.1 (181)	8 (203.2)	3.9 (98)	3/4 (20)	1 1/4 (32)	8.8 (223)	140 (63.5)
6 (150)	5 (125)	17 (433)	8 (203.2)	7.1 (181)	8 (203.2)	5.4 (138)	1 (25)	1 1/4 (32)	10.7 (272)	145 (65.8)
6 (150)	6 (150)	17 (433)	8 (203.2)	7.9 (200)	8 (203.2)	5.4 (138)	1 (25)	2 (50)	10.7 (272)	182 (82.6)
8 (200)	6 (150)	17 (433)	8 (203.2)	7.9 (200)	9 (228.6)	5.4 (138)	1 (25)	2 (50)	10.7 (272)	197 (89.4)
8 (200)	8 (200)	20.8 (528)	9 (228.6)	16.3 (413)	9 (228.6)	6.9 (176.5)	1 (25)	2 (50)	11.6 (295)	292 (132.5)
10 (250)	8 (200)	20.8 (528)	9 (228.6)	16.3 (413)	11 (279.4)	6.9 (176.5)	1 (25)	2 (50)	11.6 (295)	312 (141.5)
10 (250)	10 (250)	26.3 (667)	11 (279.4)	16.3 (413)	11 (279.4)	9.8 (248)	1 (25)	2 (50)	14.2 (360)	398 (180.5)
12 (300)	8 (200)	25.3 (643)	11 (279.4)	16.3 (413)	11 (279.4)	8.2 (209)	1 (25)	2 (50)	13.7 (349)	412 (186.9)
12 (300)	10 (250)	26.3 (667)	11 (279.4)	16.3 (413)	12 (304.8)	9.8 (248)	1 (25)	2 (50)	14.2 (360)	491 (222.7)
12 (300)	12 (300)	26.3 (667)	12 (304.8)	18.1 (461)	12 (304.8)	9.8 (248)	1 (25)	2 (50)	15.4 (390)	573 (259.9)

1. Distance required for Screen Removal.

2. Mounting Pad Support.

125S SERIES

OPEN AREA RATIOS

with Standard Perforated Screen

Opening 40%, 1/8" Diameter

Size	Nominal Outlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
2 x 1½	1.77	25	10.00	5.6
2 x 2	3.14	36	14.40	4.6
2½ x 2	3.14	36	14.40	4.6
2½ x 2½	4.91	49	19.60	4.0
3 x 2	3.14	36	14.40	4.6
3 x 2½	4.91	49	19.60	4.0
3 x 3	7.07	60	24.00	3.4
4 x 3	7.07	111	44.40	6.3
4 x 4	12.57	105	42.00	3.3
5 x 4	12.57	111	44.40	3.5
5 x 5	19.64	176	70.40	3.6
6 x 4	12.57	111	44.40	3.5
6 x 5	19.64	245	98.00	5.0
6 x 6	28.27	245	98.00	3.5
8 x 6	28.27	245	98.00	3.5
8 x 8	50.27	428	171.20	3.4
10 x 8	50.27	428	171.20	3.4
10 x 10	78.54	665	266.00	3.4
12 x 8	50.27	428	171.20	3.4
12 x 10	78.54	665	266.00	3.4
12 x 12	113.10	739	295.60	2.6

OAR = Free Screen Area divided by Nominal Outlet Area.

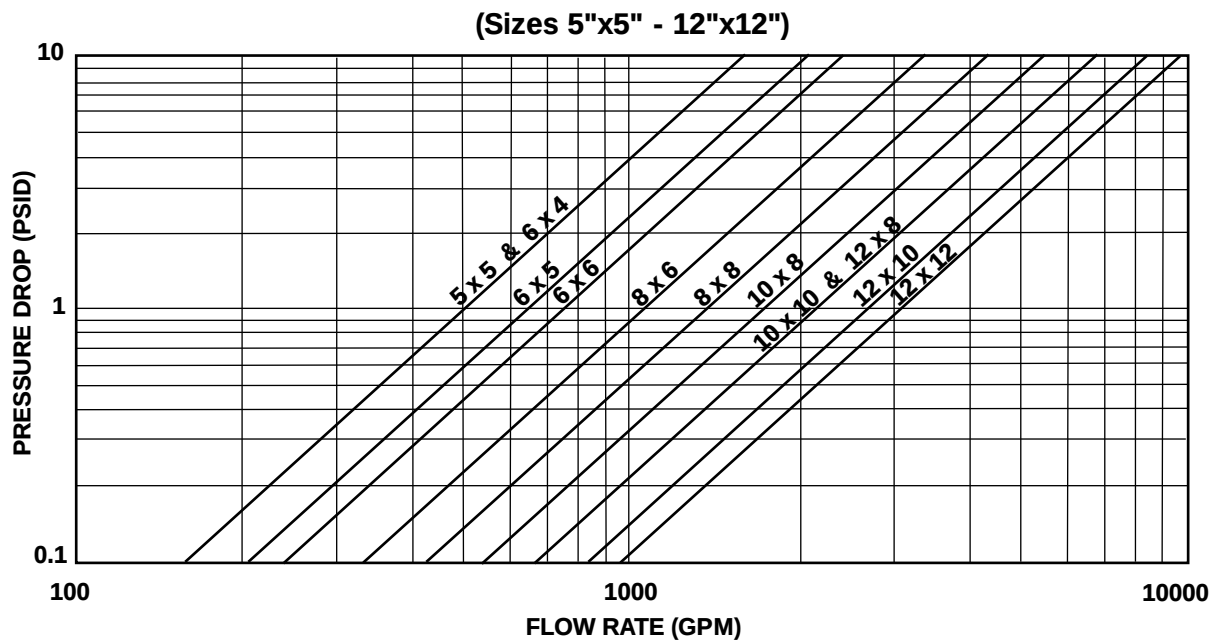
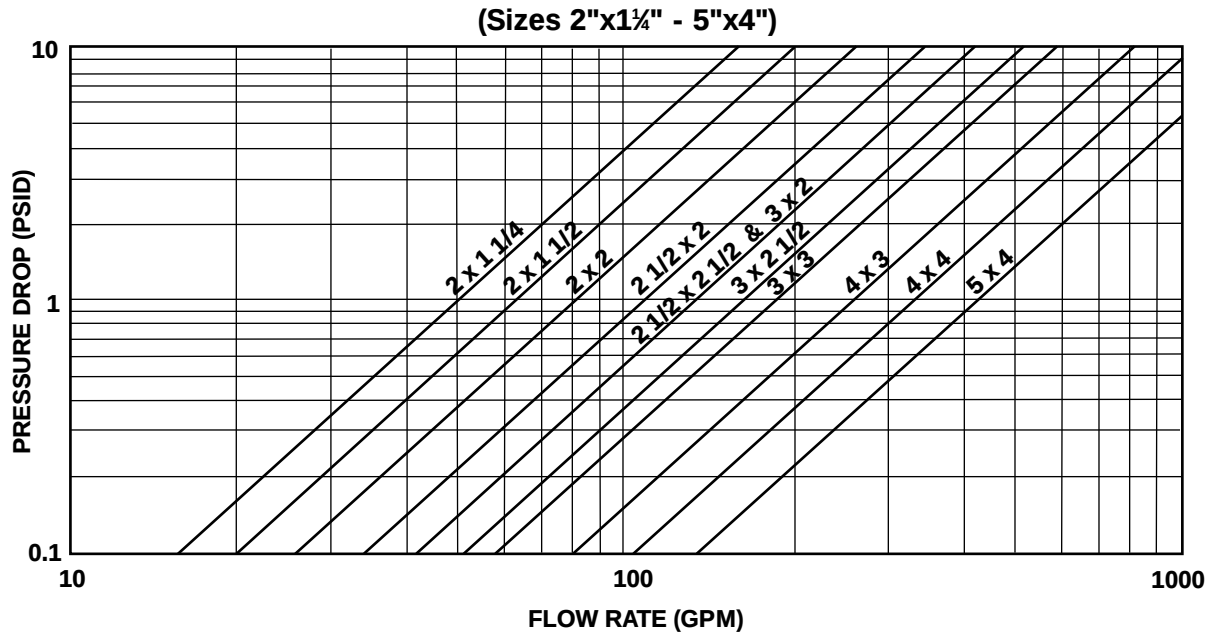
Free Screen Area = Opening % times Gross Screen Area.

Values shown are approximate. Contact factory for exact ratios.

125S SERIES

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*



For other viscous liquids or mesh liners, contact factory.

SUCTION DIFFUSERS



FF SERIES FABRICATED SUCTION DIFFUSERS

PRESSURES TO 740 PSIG (51 BARG)

TEMPERATURES TO 800°F (427°C)

- Strainer, flow straightener, elbow and pipe reducer for pump applications
- Standard and custom engineered designs
- Integral straightening vanes reduce turbulence to improve pump efficiency
- One, three or five pipe diameters of flow straightening (Type 1, 3 or 5)
- Standard, undersized or oversized outlet connections
- Direct mount to the suction side of a pump in either horizontal or vertical position
- Supporting pads for easy mounting of standard I.D. support foot
- Drain connection with plug furnished as standard

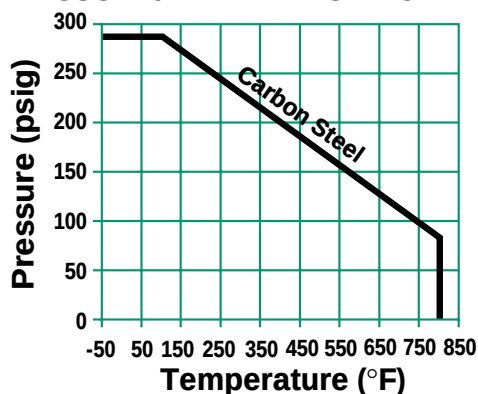
APPLICATIONS

- Pump Protection

APPLICABLE CODES

- Designed and manufactured in accordance with ASME B31.1, ASME B31.3 and/or ASME Section VIII, Div. 1
- CRN available in all Provinces
- Welders certified to ASME Section IX

PRESSURE/TEMPERATURE CHART



MODELS see Ordering Code below

- Type 1 - One pipe diameter of flow straightening
- Type 3 - Three pipe diameters of flow straightening
- Type 5 - Five pipe diameters of flow straightening

OPTIONS

- Customer specified materials, sizes and designs
- Other flow straightening quality designs
- Hinged or quick opening/operator assisted covers
- Vent and/or differential pressure connections
- ASME "U" stamped vessels on request
- Other perforated screen and mesh liner baskets
- Data Packages and MTR's available on request

FABRICATED SUCTION DIFFUSER ORDERING CODE

Model	Material	Inlet Size	Class	Con- nections	Dash	Cover	Perf.	Mesh
F F 1 C T 1 F - J 2 2								
1 2 3 4 5 6 7 8 9 10 11								

Model - Position 1 - 3

FF1 - Type 1 - Standard Outlet
FF2 - Type 1 - Undersized Outlet
FF3 - Type 1 - Oversized Outlet
FF4 - Type 3 - Standard Outlet
FF5 - Type 3 - Undersized Outlet
FF6 - Type 3 - Oversized Outlet
FF7 - Type 5 - Standard Outlet
FF8 - Type 5 - Undersized Outlet
FF9 - Type 5 - Oversized Outlet
FFZ - Custom Configuration

Standard Outlet is one size smaller than the inlet.

Undersized Outlet is two sizes smaller than the inlet.

Oversized Outlet is the same size as the inlet.

Material - Position 4

C - Carbon Steel
L - Low Temp CS
V - 304 SS
T - 316 SS
M - Monel
Z - Other

Inlet Size - Position 5

H - 2	S - 12
J - 2½	T - 14
K - 3	U - 16
M - 4	V - 18
N - 5	W - 20
P - 6	X - 22
Q - 8	Y - 24
R - 10	Z - Other
1 - 28	3 - 36
2 - 30	4 - 40

Class - Position 6

A - 125
1 - 150
2 - 250
3 - 300
Z - Other

Connection - Inlet Position 7

F - Flat Face Flange
J - Ring Joint
R - Raised Face Flange
Z - Other

Dash - Position 8

Note:
Standard Connections
RF inlet x FF outlet

Cover - Position 9

B - Bolted
C - C-Clamp
J - Bolted w/ Hinge¹
D - Davit Bolted
H - T-Bolt Hinged
T - Threaded Hinged
Y - Yoke Hinged
Z - Other

1. J-Hinged Cover is standard.

2. For other screen materials, contact factory.

Perf. - Position 10

304SS Material²

A - None	5 - 5/32"
B - 3/64"	6 - 3/16"
1 - 1/32"	7 - 7/32"
2 - 1/16"	8 - 1/4"
3 - 3/32"	9 - 3/8"
4 - 1/8"	Z - Other

Mesh² - Position 11

A - None	6 - 60
1 - 10	7 - 80
2 - 20	8 - 100
3 - 30	9 - 120
4 - 40	Z - Other
5 - 50	

FF SERIES FABRICATED SUCTION DIFFUSERS

SPECIFICATION

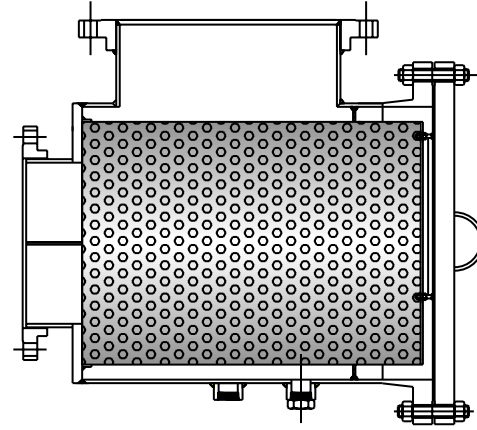
Suction Diffuser shall mount directly to the suction side of the pump in either a horizontal or vertical position. The Suction Diffuser shall be manufactured in accordance with ASME B31.1, ASME B31.3 and /or ASME Section VIII, Div. I. The Suction Diffuser shall be available with reduced outlet sizes. The Suction Diffuser shall be _____ inlet by _____ outlet and shall have a _____ perforated screen. The Suction Diffuser shall have the equivalent of _____ pipe diameters of flow straightening. The Suction Diffuser shall be SSI FF Series.

MATERIALS OF CONSTRUCTION*-(Std Carbon Steel Body)

Body.....A106-B CS
Cover A105 CS
Flanges A105 CS
Reducer Plate A516-70 CS
Coupling A105 CS
Plug A105 CS
Screen¹ 304 SS
Cover Gasket¹ 304 SS Spiral Wound
Stud A193-B7 CS
Nut A194-2H CS

* Other materials are available upon request.
Standard materials are subject to change.
Please contact factory for Certified drawings.

1 Recommended Spare Parts.



Connections:
10" x 6" – 24" x 24" RF Inlet x FF Outlet

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
All	1/8" Perf.	304 SS

OPEN AREA RATIOS with Standard Perforated Screen

Opening 40%, 1/8" Diameter

Size Inlet X Outlet	Nominal Outlet Area (in ²)	Gross Screen Area (in ²)	Free Screen Area (in ²)	Open Area Ratio (OAR)
10 x 6	28.89	455	182	6.3
10 x 8	50.03	455	182	3.6
10 x 10	78.85	700	280	3.6
12 x 8	50.03	524	210	4.2
12 x 10	78.85	700	280	3.6
12 x 12	113.10	811	324	2.9
14 x 10	78.85	700	280	3.6
14 x 12	113.10	811	324	2.9
14 x 14	137.89	1162	465	3.4
16 x 12	113.10	811	324	2.9
16 x 14	137.89	1162	465	3.4
16 x 16	182.65	1275	510	2.8
18 x 14	137.89	1162	465	3.4
18 x 16	182.65	1275	510	2.8
18 x 18	233.71	1470	588	2.5
20 x 16	182.65	1275	510	2.8
20 x 18	233.71	1470	588	2.5
20 x 20	291.04	2454	982	3.4
24 x 18	233.71	1470	588	2.5
24 x 20	291.04	2454	982	3.4
24 x 24	424.56	2454	982	2.3

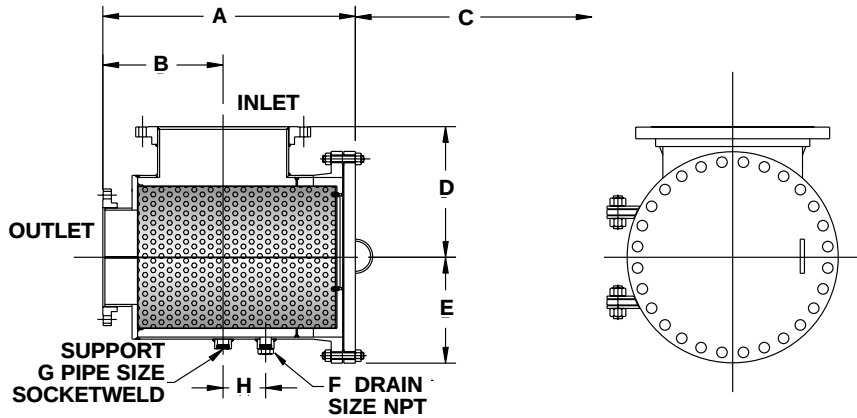
OAR = Free Screen Area divided by Nominal Outlet Area.
Free Screen Area = Opening % times Gross Screen Area.
Values shown are approximate. Contact factory for exact ratios.

FF SERIES
SUCTION DIFFUSERS

FF SERIES

FABRICATED SUCTION DIFFUSERS

DIMENSIONS & WEIGHTS



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

Inlet	Outlet	A			B			C ¹	D	E	F	G	H	Weight ²
		TYPE 1	TYPE 2	TYPE 3	TYPE 1	TYPE 2	TYPE 3							
Standard Outlet														
10 (250)	8 (200)	22.63 (575)	26.63 (676)	30.63 (778)	11.13 (283)	15.13 (384)	19.13 (486)	17.38 (441)	12.63 (321)	8 (203)	1 (40)	1 (40)	4.12 (105)	339 (154)
12 (300)	10 (250)	25.81 (656)	30.81 (783)	35.81 (910)	13.13 (333)	18.13 (460)	23.13 (587)	18.81 (478)	12.88 (327)	10.5 (267)	1.5 (40)	1.5 (40)	4.75 (121)	530 (240)
14 (350)	12 (300)	26.38 (670)	32.38 (822)	38.38 (975)	13.63 (346)	19.63 (499)	25.63 (651)	21.5 (546)	15.25 (387)	11.75 (298)	1.5 (40)	1.5 (40)	5.25 (133)	808 (366)
16 (400)	14 (350)	32.31 (821)	39.31 (998)	46.31 (1,176)	16.75 (425)	23.75 (603)	30.75 (781)	26.75 (679)	16.25 (413)	12.5 (318)	2 (50)	2 (50)	5.5 (140)	1086 (493)
18 (450)	16 (400)	32.56 (827)	40.56 (1,030)	48.56 (1,233)	10.62 (270)	18.62 (473)	26.62 (676)	26.62 (676)	17.63 (448)	13.75 (349)	2 (50)	2 (50)	6.5 (165)	1256 (570)
20 (500)	18 (450)	32.13 (816)	41.13 (1,045)	50.13 (1,273)	23.13 (588)	32.13 (816)	41.13 (1,045)	25.25 (641)	20.13 (511)	16 (406)	2 (50)	2 (50)	2.87 (73)	1793 (813)
24 (600)	20 (500)	40 (1,016)	50 (1,270)	60 (1,524)	21.13 (537)	31.13 (791)	41.13 (1,045)	32.5 (826)	22 (559)	17.47 (444)	2 (50)	2 (50)	8.94 (227)	3545 (1,608)
Undersized Outlet														
10 (250)	6 (150)	21.88 (556)	24.88 (632)	27.88 (708)	11.75 (298)	14.75 (375)	17.75 (451)	17.31 (440)	11.13 (283)	8 (203)	1 (25)	1 (25)	4 (102)	261 (118)
12 (300)	8 (200)	22.5 (572)	26.5 (673)	30.5 (775)	11.25 (286)	15.25 (387)	19.25 (489)	18.81 (478)	12.88 (327)	9.5 (241)	1.5 (40)	1.5 (40)	4.63 (118)	437 (198)
14 (350)	10 (250)	25.88 (657)	30.88 (784)	35.88 (911)	13.13 (333)	18.13 (460)	23.13 (587)	18.88 (480)	14 (356)	10.5 (267)	1.5 (40)	1.5 (40)	5.25 (133)	670 (304)
16 (400)	12 (300)	26.25 (667)	32.25 (819)	38.25 (972)	13.63 (346)	19.63 (499)	25.63 (651)	21.5 (546)	15.5 (394)	11.75 (298)	2 (50)	2 (50)	5.06 (129)	913 (414)
18 (450)	14 (350)	29.31 (744)	36.31 (922)	43.31 (1,100)	16.75 (425)	23.75 (603)	30.75 (781)	26.75 (679)	16.38 (416)	12.5 (318)	2 (50)	2 (50)	5.88 (149)	1058 (480)
20 (500)	16 (400)	32.56 (827)	40.56 (1,030)	48.56 (1,233)	17.19 (437)	25.19 (640)	33.19 (843)	26.62 (676)	17.88 (454)	13.75 (349)	2 (50)	2 (50)	6.63 (168)	1452 (659)
24 (600)	18 (450)	32.13 (816)	41.13 (1,045)	50.13 (1,273)	17 (432)	26 (660)	35 (889)	25.62 (651)	23.88 (607)	16 (406)	2 (50)	2 (50)	7.81 (198)	2382 (1,080)
Oversized Outlet														
10 (250)	10 (250)	25.81 (656)	30.81 (783)	35.81 (910)	13.13 (333)	18.13 (460)	23.13 (587)	18.81 (478)	13.63 (346)	10.5 (267)	1 (25)	1 (25)	5.31 (135)	420 (190)
12 (300)	12 (300)	26.38 (670)	32.38 (822)	38.38 (975)	13.63 (346)	19.63 (499)	25.63 (651)	21.5 (546)	15.13 (384)	11.75 (298)	1.5 (40)	1.5 (40)	4.69 (119)	650 (295)
14 (350)	14 (350)	32.13 (816)	39.13 (994)	46.13 (1,172)	16.75 (425)	23.75 (603)	30.75 (781)	26.75 (679)	16 (406)	12.5 (318)	1.5 (40)	1.5 (40)	5 (127)	964 (437)
16 (400)	16 (400)	32.56 (827)	40.56 (1,030)	48.56 (1,233)	17.19 (437)	25.19 (640)	33.19 (843)	26.62 (676)	17.5 (445)	13.75 (349)	2 (50)	2 (50)	8.06 (205)	1280 (580)
18 (450)	18 (450)	32.13 (816)	41.13 (1,045)	50.13 (1,273)	17 (432)	26 (660)	35 (889)	25.25 (641)	19.88 (505)	16 (406)	2 (50)	2 (50)	5.94 (151)	1572 (713)
20 (500)	20 (500)	40 (1,016)	50 (1,270)	60 (1,524)	21.13 (537)	31.13 (791)	41.13 (1,045)	32.5 (826)	21.63 (549)	17.47 (444)	2 (50)	2 (50)	8 (203)	2560 (1,161)
24 (600)	24 (600)	41.38 (1,051)	53.38 (1,356)	65.38 (1,661)	22.13 (562)	34.13 (867)	46.13 (1,172)	34.88 (886)	23.88 (606)	17.47 (444)	2 (50)	2 (50)	7.81 (198)	3600 (1,633)

1. Distance required for screen removal.

2. Weight shown for Type 1. For Type 3 and 5 multiply Type 1 weight by 1.1 and 1.2, respectively.

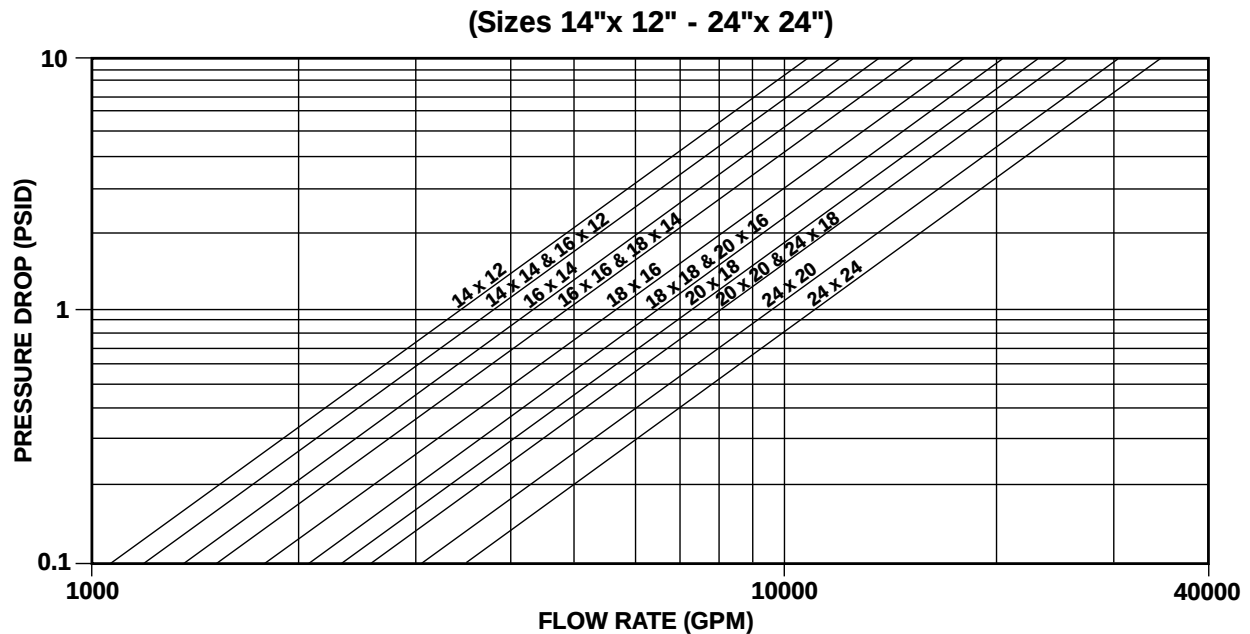
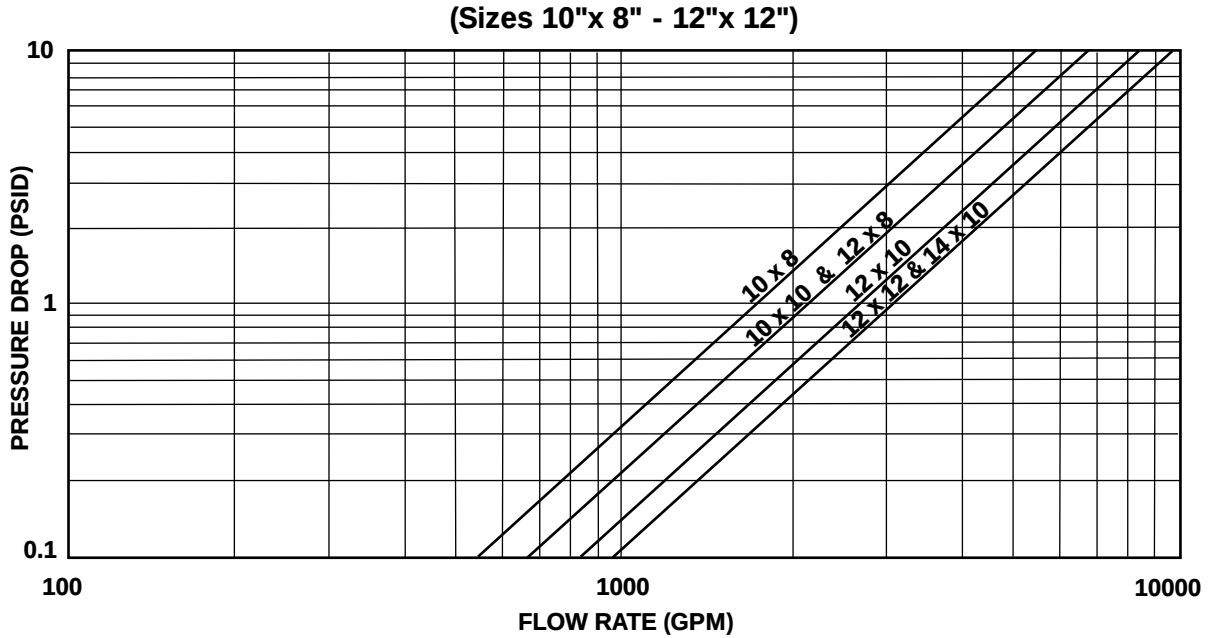
* Dimensions are subject to change. Contact factory for certified drawings when required. Custom dimensions available upon request.

FF SERIES

FABRICATED SUCTION DIFFUSERS

PRESSURE DROP VS FLOW RATE

Water Service, Clean Basket, 1/32" - 1/4" Perforated Screen*



* For other viscous liquids or mesh liners, contact factory.

FABRICATED
SUCTION DIFFUSERS



125T SERIES

CAST IRON TRIPLE DUTY VALVES

Pressures to 200 PSIG (13.8 barg)
Temperatures to 212°F (100°C)

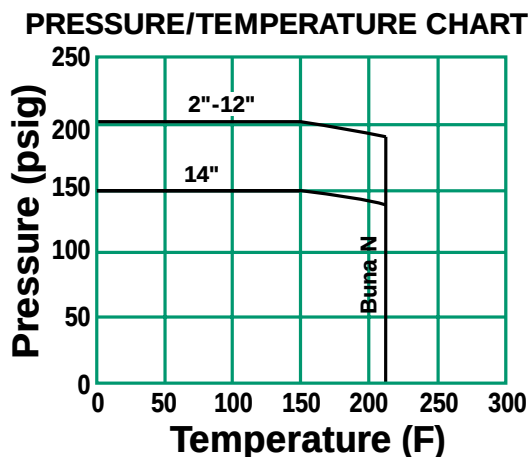
- Triple function includes a spring loaded silent check valve, balancing valve and shutoff valve to minimize cost and reduce installation time
- Operates automatically and silently
- Center guided soft seal disc ensures leak free performance
- Spring loaded Buna N disc provides no impact shutoff and prevents water hammer upon closing
- Graduated position indicator provides accurate visual check of valve position
- Standard handwheel for ease of operation
- Cracking pressure of 1/4 PSI
- Drain and differential connections with plug are furnished as standard

APPLICATIONS

- Pump protection

APPLICABLE CODES

- ASME B16.1



MODELS

- 125TFI – Cast Iron Triple Duty Valve

TRIPLE DUTY VALVE ORDERING CODE

Size				Dash	Model						Dash	O-Ring
0	4	0	0	-	1	2	5	T	F	I	-	B
1	2	3	4	5	6	7	8	9	10	11	12	13

Size - Position 1-4

0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5

Model - Position 6 -11
125TFI - Triple Duty Valve

Dash - Position 12

O-Ring - Position 13
B - Buna N

For any variations, use the part numbering system above but clearly indicate the additional requirement.

MAXIMUM RATED FLOW COEFFICIENTS (Cv)*

Valve Size									
2	2-1/2	3	4	5	6	8	10	12	14
83	129	189	335	529	766	1372	2154	3106	4016

* Maximum Cv rating is at 100% of stem rise.

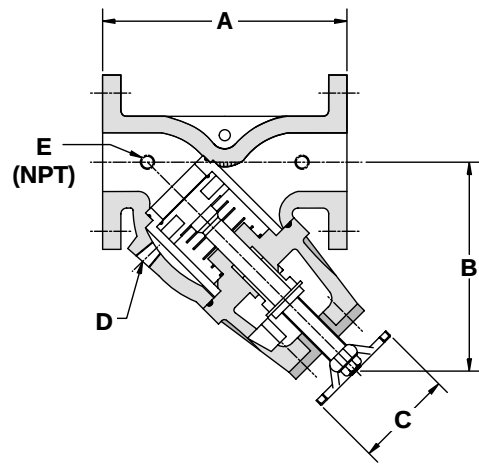
125T SERIES CAST IRON TRIPLE DUTY VALVES

SPECIFICATION

Triple Duty Valve shall install in a straight run of pipe and perform as a center guided silent check valve, shutoff valve and balancing valve. The valve shall have _____ psi cracking pressure. The valve shall have Cast Iron 125 psi ANSI rated FF flanges. The seat shall have Buna N O-ring seals. The valve shall be an inlet size of _____ and a Cv rating of _____. The Triple Duty Valve shall be SSI T Series.

MATERIALS OF CONSTRUCTION

Body & Yoke Cast Iron A126-B
Disc Guide Ductile Iron/Nickel Plate
Disc Ductile Iron
Packing Gland Ductile Iron
Packing Graphite
Spring Stainless Steel
Stem.....Stainless Steel
Seat Seal Buna N
Disc Seal Buna N



Connections:
2" - 14" FF Flanged

DIMENSIONS inches (mm)
AND WEIGHTS pounds (kg)

Size	A	B	C	D	E	Weight
2 (50)	8.4 (213)	9.6 (244)	6.3 (159)	1/2 (15)	1/4 (8)	34 (15)
2½ (65)	9.8 (250)	10 (254)	6.3 (159)	1/2 (15)	1/4 (8)	40 (18)
3 (80)	10 (254)	10.1 (257)	9.4 (238)	1/2 (15)	1/4 (8)	50 (23)
4 (100)	14.5 (368)	12.6 (321)	9.4 (238)	1/2 (15)	1/4 (8)	100 (45)
5 (125)	16 (407)	16.4 (416)	11 (279)	1/2 (15)	1/4 (8)	155 (70)
6 (150)	18 (457)	17.5 (444)	11 (279)	3/4 (20)	1/4 (8)	200 (91)
8 (200)	21.5 (546)	18.5 (470)	12.5 (317)	3/4 (20)	1/4 (8)	350 (159)
10 (250)	25.5 (648)	21.7 (552)	12.5 (317)	1 (25)	1/4 (8)	480 (218)
12 (300)	30 (762)	24.5 (622)	12.5 (317)	1 (25)	1/4 (8)	660 (299)
14 (350)	30.4 (771)	24.5 (622)	12.5 (317)	1 (25)	1/4 (8)	790 (359)

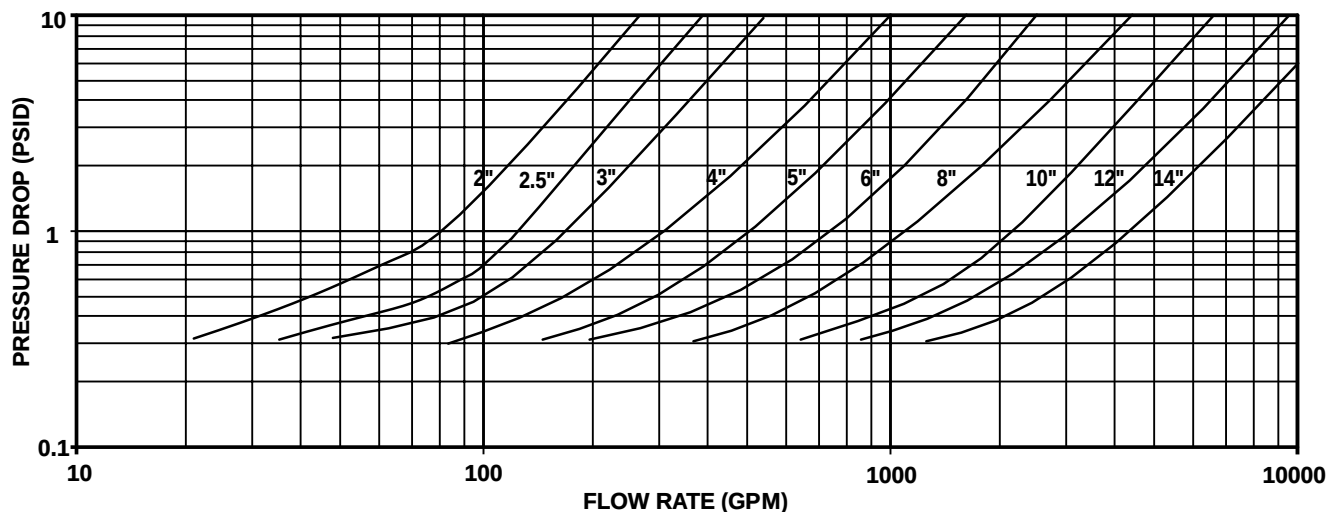
Dimensions and Weights are approximate. Contact factory for Certified Drawings.

Dimensions shown are in full open position.

**T SERIES
TRIPLE DUTY VALVES**

PRESSURE DROP VS FLOW RATE

(Sizes 2" - 14")



NOTES:

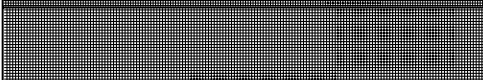
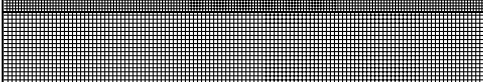
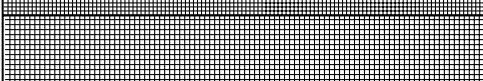
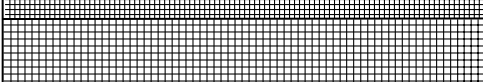
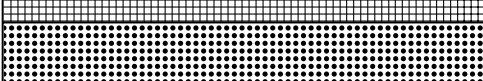
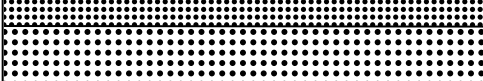
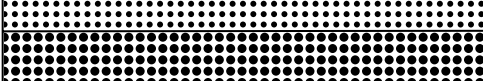
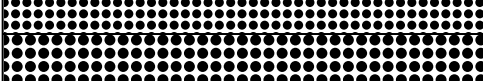
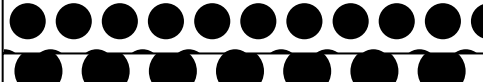
PUMP PROTECTION

PUMP PROTECTION TECHNICAL INFORMATION

**PUMP PROTECTION
TECHNICAL INFO**

SCREEN OPENINGS

PUMP PROTECTION

	100 Mesh - 30% O.A. 0.006" Openings
	80 Mesh - 36% O.A. 0.008" Openings
	60 Mesh - 38% O.A. 0.010" Openings
	40 Mesh - 41% O.A. 0.016" Openings
	30 Mesh - 45% O.A. 0.022" Openings
	20 Mesh - 49% O.A. 0.035" Openings
	0.027" Dia. - 23% O.A.
	0.033" Dia. - 28% O.A.
	3/64" Dia. - 36% O.A.
	1/16" Dia. - 37% O.A.
	3/32" Dia. - 39% O.A.
	1/8" Dia. - 40% O.A.
	5/32" Dia. - 58% O.A.
	3/16" Dia. - 50% O.A.
	1/4" Dia. - 40% O.A.

FACTORS TO CONSIDER

1 Purpose

If the strainer is being used for protection rather than direct filtration, standard screens will suffice in most applications.

2 Service

With services that require extremely sturdy screens, such as high pressure/temperature applications or services with high viscosities, perforated screens without mesh liners are recommended. If a mesh liner is required to obtain a certain level of filtration, then a trapped perf/mesh/perf combination is recommended.

3 Filtration Level

When choosing a perf. or a mesh/perf. combination, attention should be given to ensure overstraining does not occur. As a general rule, the specified level of filtration should be no smaller than half the size of the particle to be removed. If too fine a filtration is specified, the pressure drop through the strainer will increase very rapidly, possibly causing damage to the screen.

Screen openings other than those shown above are readily available. Various mesh sizes as fine as 5 micron and perforated plate as coarse as 1/2" Dia. are in inventory.

Screens are available in a wide range of materials. Screens of carbon steel, stainless steel (304, 316), alloy 20, monel 400, hastelloy C and titanium grade 2 are in inventory.

Custom manufactured screens are available upon request. Please consult factory.

SUCTION DIFFUSER

CHECKLIST

Please take the factors listed below into account when selecting a strainer. Kindly photocopy this page and fill out the pertinent information, to your best ability, so that we can recommend a Strainer to suit your specific requirements.

1. Fluid to be strained _____
2. Flow rate _____
3. Density of fluid _____
4. Viscosity of fluid _____
5. Fluid working pressure _____
Maximum pressure _____
6. Fluid Working Temp. _____
Maximum Temp. _____
7. Preferred material of strainer construction _____
8. Present Pipeline size & material _____
9. Nature of solids to be strained out _____
10. Size of solids to be strained out _____
Size of mesh or Perf. Req. _____

11. Clearance Limitation Above _____ Below _____
Left side facing inlet _____ Right side facing inlet _____
12. Maximum pressure drop with clean screen _____
13. Expected cleaning frequency _____
14. Any other information deemed relevant _____

Name _____
Company _____
Address _____
City/Town _____
State _____ Zip Code _____
Telephone (_____) _____
Fax (_____) _____

PUMP PROTECTION

SUCTION DIFFUSER

INSTALLATION AND MAINTENANCE INSTRUCTIONS

INSTALLATION

- Ensure all machined surfaces are free of defects and that the inside of the diffuser is free of foreign objects.
- Provide for distance “C” as this dimension represents the distance required for removal of strainer.
- Mount standard support leg and foot to pad of suction diffuser.
- Align inlet and outlet pipe connections. For flanged connections, the flange bolting should be tightened gradually in a back and forth clockwise motion.
- Once installed, increase line pressure gradually and check for leak around joints.
- After piping and initial circulation is complete, remove fine mesh start-up strainer.

MAINTENANCE

For maximum efficiency, determine the length of time it takes for the pressure drop to double that in the clean condition. Once the pressure drop reaches an unacceptable value, shut down the line, drain piping and

remove, clean and replace screen. A differential pressure gauge installed before and after diffuser in line will indicate pressure loss due to clogging and may be used to determine when cleaning is required.

TRIPLE DUTY VALVE

INSTALLATION AND MAINTENANCE INSTRUCTIONS

INSTALLATION

- Ensure all machined surfaces are free of defects and that the inside of the valve is free of foreign objects.
- The valve should be installed on the discharge side of the pump with the flow arrow pointed away from the pump discharge.
- Minimum recommended space for pump sizes 2” through 6” is 12”. Minimum recommended space for pump sizes 8” through 14” is 24”.
- It is not recommended to mount a valve directly to the pump.
- Sufficient clearance should be left around the valve for removal and/or repair.
- Valve should be mounted with the stem pointing up to facilitate proper seating of the valve disc.
- When connecting the valve to the line be sure that the flanges are the same – flat face to flat face. Flat face flanges require full face gaskets. The specified face-to-face dimension of the valve is approximate due to machining tolerances. Allow adjustment in prefabricated piping or request certified dimensions.
- Check to see that flange gaskets are properly positioned before tightening the bolts. Tighten bolts gradually in a back and forth clockwise motion.
- Once installed, “crack” the valve open before starting the pump.
- Gradually adjust the stem until the proper flow rate is reached. Tapped ports are provided on the valve to insert equipment to measure the valve pressure differential.

MAINTENANCE - PACKING REPLACEMENT

Before starting make a note of the position of the stem indicator.

Shut down the pump and close the isolation valves.

Open the valve completely so that the stem back seats against the inside of the yoke cover. Loosen the two nuts holding the flanged gland.

Remove the old packing and clean out the packing box.

Place a set (usually three or four) of the new packing rings around the stem. Be sure to stagger the 45 degree split in

the packing rings. Press packing rings into the packing box.

Replace the flanged gland and nuts. Do not over tighten or the stem may seize.

Adjust the valve stem indicator to its original position. If there is any leakage around the packing tighten both gland nuts a 1/4 turn at a time until the leakage stops. It is very important that the gland nuts be tightened evenly.

For all other maintenance please contact the factory.

Applications

- Process Industry
- Power Industry
- Chemical Industry
- Oil and Gas
- Metals and Mining
- Water and Waste Water
- Pulp and Paper
- Marine
- Steel Mills

Temporary Strainers

**Pressures to 3705 PSIG
Temperatures to 800°F**

FEATURES

- Cone, basket & plate strainers
- 100% to 300% open area range (OAR) as standard
- Custom engineered designs available

MATERIALS

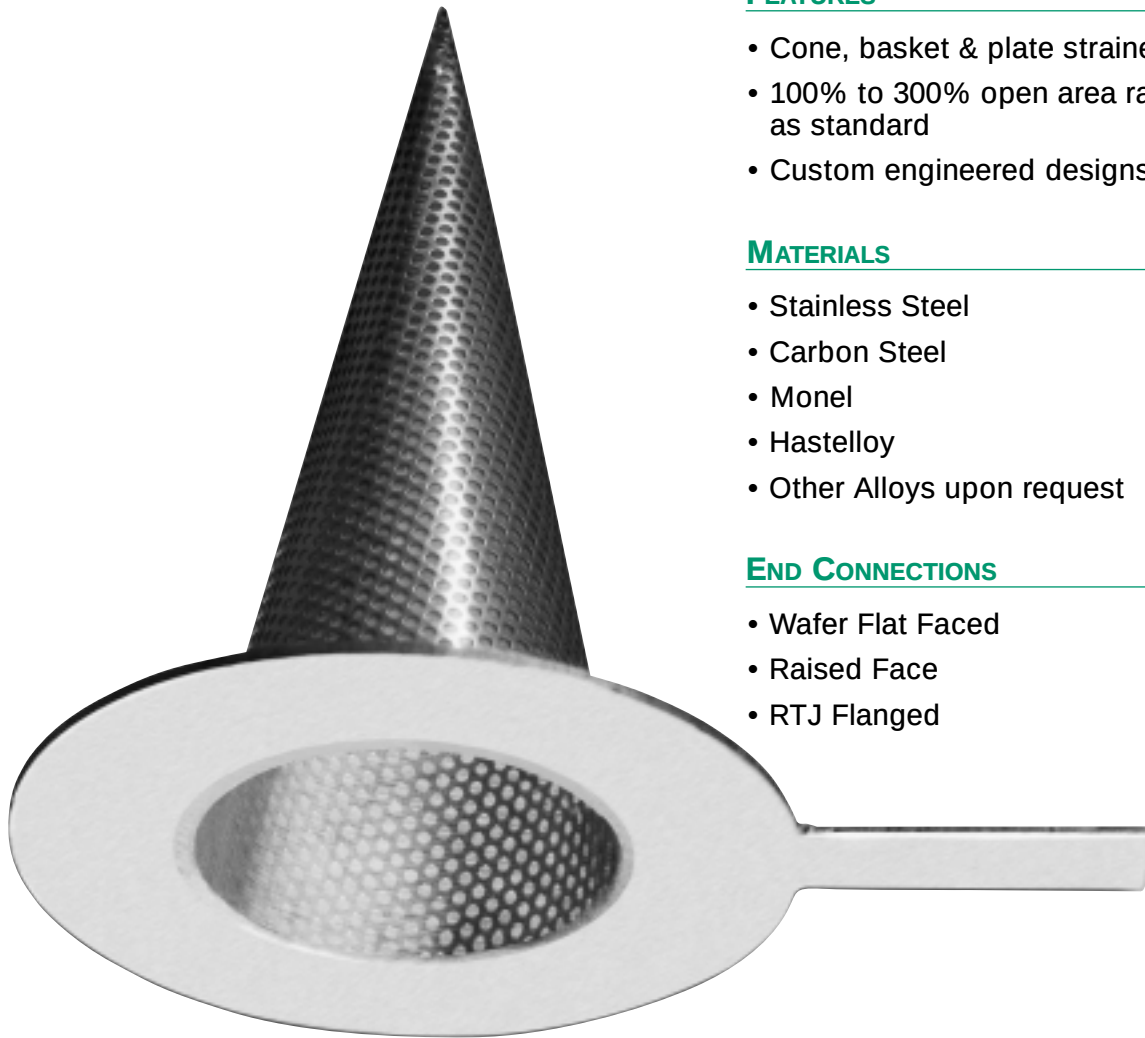
- Stainless Steel
- Carbon Steel
- Monel
- Hastelloy
- Other Alloys upon request

END CONNECTIONS

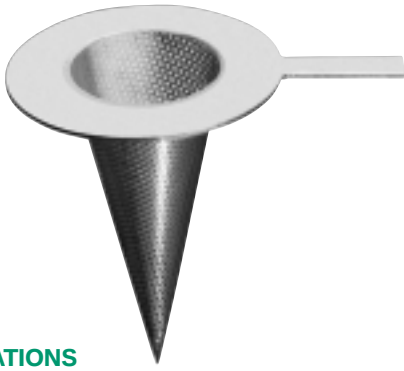
- Wafer Flat Faced
- Raised Face
- RTJ Flanged

SIZES

- 3/4" (20mm) up to 24" (600mm) as standard
- Larger sizes available upon request



TEMPORARY
STRAINERS

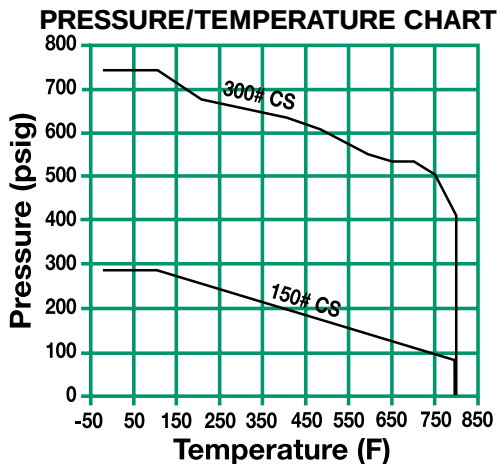


APPLICATIONS

- Water, oil systems
- Other liquid systems
- Protection of pumps, meters, valves and other similar equipment

OPTIONS

- Custom engineered designs
- Customer specified Open Area
- RF and/or RTJ connections
- Other Materials, Sizes and/or Configurations
- Other Screen and/or Mesh – See page 506



TC, TB AND TP SERIES TEMPORARY STRAINERS

PRESSURES TO 3600 PSIG (244.9 BARG)
TEMPERATURES TO 800°F (427°C)

- Standard and custom designs
- Primarily used for new pipeline start-up or where solid loading is minimal.
- Filtration down to 40 Microns available
- Available in conical, basket and plate configurations
- 100% to 300% open area range (OAR) as standard
- 304SS construction is standard. Construction in other materials is available
- May be installed in horizontal or vertical pipelines

MODELS See Construction Details on page

- T*1 – 100% open area - Flow inside to outside
- T*2 – 100% open area - Flow outside to inside
- T*3 – 100% open area – Bidirectional flow
- T*4 – 150% open area – Flow inside to outside
- T*5 – 150% open area – Flow outside to inside
- T*6 – 150% open area – Bidirectional flow
- T*7 – 200% open area – Flow inside to outside
- T*8 – 200% open area – Flow outside to inside
- T*9 – 200% open area – Bidirectional flow
- T*A – 300% open area – Flow inside to outside
- T*B – 300% open area – Flow outside to inside
- T*C – 300% open area – Bidirectional flow
- T*Z – Custom Configuration

* TC – Temporary Cone, TB – Temporary Basket, TP – Temporary Plate

APPLICABLE CODES

- Canadian Registration Numbers (CRN) available

Note: Temporary Strainers are designed for start up service of new or revamped piping systems. Temporary Strainers are not intended to be used in a permanent application. Contact factory when permanent applications are required.

TC, TB, and TP Series Ordering Code

Model			Material	Inlet Size	Class	Connec- tion	Dash	Cover	Perf	Mesh
T	B	1	V	M	1	W	-	A	4	A
1	2	3	4	5	6	7	8	9	10	11

Model - Position 1 - 3
T*1 - 100% I/O flow
T*2 - 100% O/I flow
T*3 - 100% Bidirectional
T*4 - 150% I/O flow
T*5 - 150% O/I flow
T*6 - 150% Bidirectional
T*7 - 200% I/O flow
T*8 - 200% O/I flow
T*9 - 200% Bidirectional
T*A - 300% I/O flow
T*B - 300% O/I flow
T*C - 300% Bidirectional
T*Z - Custom Configuration

* TC - Temporary Cone
TB - Temporary Basket
TP - Temporary Plate -
Only TP1, TP2, TP3

Material - Position 4
V - 304 SS (standard)
C - Carbon Steel
T - 316 SS
M - Monel
H - Hastelloy
Z - Other

Inlet Size* - Position 5
D - 3/4 Q - 8
E - 1 R - 10
G - 1½ S - 12
H - 2 T - 14
J - 2½ U - 16
K - 3 V - 18
M - 4 W - 20
N - 5 Y - 24
P - 6 Z - Other

* Contact factory for other sizes.

Class - Position 6

1 - 150
3 - 300
4 - 600
5 - 900
Z - Other

Connection - Position 7

W - Wafer Flat Face
Smooth Finish
(standard)
J - Ring Joint Flange
R - Raised Face Flange
Z - Other

Dash - Position 8

Cover - Position 9
A - None

Perf -

Position 10
B - 3/64"
1 - 1/32"
2 - 1/16"
3 - 3/32"
4 - 1/8"
5 - 5/32"
6 - 3/16"
7 - 7/32"
8 - 1/4"
9 - 3/8"
Z - Other

Mesh -

Position 11
A - None
1 - 10
2 - 20
3 - 30
4 - 40
5 - 50
6 - 60
7 - 80
8 - 100
9 - 120
Z - Other

Note: Any item outside this range must be a special and must be called out on the order (select "Z" and fill special field).

TC SERIES TEMPORARY CONE STRAINERS

SPECIFICATION

The strainer body shall be fabricated 304 stainless steel or other specified material. The strainer shall be the conical type with an extended identifier tag handle. The screen shall be size _____ perforated SS with _____ mesh liner. The flow shall be _____. The Strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Temporary Cone Strainer shall be SSI TC Series.

MATERIALS OF CONSTRUCTION (304 STAINLESS STEEL SHOWN *)

Ring A240-304
Handle A240-304
Perforated Plate A240-304
Mesh (optional) A276-304

* Other material available - consult factory

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

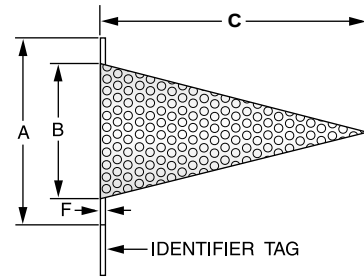
SIZE	A				B	C				F ¹	Weight
	150/300#	600#	900#	1500#		100%	150%	200%	300%		
¾ (20)	2½ (64)	2½ (64)	2½ (67)	2½ (67)	¾ (16)	1½ (29)	1 2/3 (43)	2½ (57)	3½ (86)	¾ (3)	0.5 (0.2)
1 (25)	2½ (64)	2½ (70)	3 (76)	3 (76)	¾ (19)	1½ (41)	2 ½ (64)	3 1/3 (84)	5 (127)	¾ (3)	0.5 (0.2)
1½ (40)	3½ (83)	3½ (92)	3½ (95)	3½ (95)	1½ (32)	2½ (56)	3 ¾ (86)	4½ (114)	6½ (171)	¾ (3)	0.5 (0.2)
2 (50)	4 (102)	4½ (108)	5½ (140)	5½ (140)	1½ (44)	3 (76)	4 ½ (114)	6 (152)	9½ (232)	¾ (3)	0.5 (0.2)
2½ (65)	4½ (121)	5 (127)	6½ (162)	6½ (162)	2½ (57)	3½ (81)	5 (127)	6½ (170)	10½ (257)	¾ (3)	1 (0.5)
3 (80)	5½ (133)	5½ (146)	6½ (165)	6½ (171)	2½ (70)	4 (102)	6½ (159)	8½ (216)	12½ (324)	¾ (3)	1 (0.5)
4 (100)	6½ (171)	7½ (191)	8 (203)	8½ (206)	3½ (95)	5½ (130)	7½ (200)	10½ (270)	17 (432)	¾ (3)	2 (0.9)
5 (125)	7½ (194)	9½ (238)	9½ (244)	9½ (251)	4½ (117)	6½ (165)	10½ (257)	14 (356)	21 (533)	¾ (3)	2 (0.9)
6 (150)	8½ (219)	10½ (263)	11½ (286)	11 (279)	5½ (137)	8½ (207)	13 (330)	17 (432)	26 (660)	¾ (3)	3 (1.4)
8 (200)	10½ (276)	12½ (318)	14 (356)	13½ (349)	7½ (187)	10½ (259)	16 (406)	22 (559)	33 (838)	¾ (3)	5 (2.3)
10 (250)	13½ (337)	15½ (397)	17 (432)	17 (432)	9½ (238)	13 (330)	20 (508)	27 (686)	40 (1016)	¾ (3)	7 (3.2)
12 (300)	16 (406)	17½ (454)	19½ (495)	20½ (517)	11 (279)	16 (406)	24 (610)	33 (838)	49 (1245)	¾ (3)	11 (5.0)
14 (350)	17½ (441)	19 (483)	20½ (517)	22½ (575)	12½ (311)	17 (432)	27 (686)	36 (914)	54 (1372)	¾ (3)	12 (5.4)
16 (400)	20½ (511)	21½ (555)	22½ (572)	25½ (638)	14 (356)	20 (508)	31 (787)	41 (1041)	62 (1575)	¾ (3)	16 (7.3)
18 (450)	21½ (540)	23½ (603)	25 (635)	27½ (702)	15½ (400)	23 (584)	35 (889)	47 (1194)	71 (1803)	¾ (3)	20 (9.1)
20 (500)	23½ (597)	26½ (676)	27½ (695)	29½ (753)	17½ (445)	25 (635)	39 (991)	53 (1346)	79 (2007)	¾ (3)	26 (11.8)
24 (600)	27½ (708)	30½ (784)	32½ (835)	35½ (899)	21½ (540)	30 (762)	47 (1194)	63 (1600)	95 (2413)	¾ (3)	30 (13.6)

Dimensions shown are subject to change. Contact factory for certified prints when required.

*Dimensions shown using 1/8" perf and no mesh. Open Area percentage will change with alternate perf and/or mesh. The change will equal the ratio of the open area of the perf/mesh compared to the open area of 1/8" mesh.

For Open Area percentages for perf/mesh see page 507

Please contact factory for further information.



CONICAL TYPE (TC)

Connections: 3/4" - Custom
150#, 300#, 600#, 900# and 1500#
Wafer Flat Faced Smooth Flanges
are standard
RF and RTJ Flange connections
available on request.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
3/4" - 8"	1/8" Perf.	22 Gauge ¹
10" - 24"	1/8" Perf.	16 Gauge ¹

Note: Other screens and mesh liners available upon request

The Open Area % is calculated as follows:

$$OA\% = \left[\frac{\text{Screen Area} \times \text{Open Area \%}}{\text{Area of Sch. 40/std. pipe}} \right] \times 100$$

Note: Open Area % for 1/8" perf is 40%.

TEMPORARY
STRAINERS

TB SERIES

TEMPORARY BASKET STRAINERS

SPECIFICATION

The strainer body shall be fabricated 304 stainless steel or other specified material. The strainer shall be the basket type with an extended identifier tag handle. The screen shall be size _____ perforated SS with _____ mesh liner. The flow shall be _____. The Strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Temporary Cone Strainer shall be SSI TB Series.

MATERIALS OF CONSTRUCTION

(304 Stainless Steel Shown *)

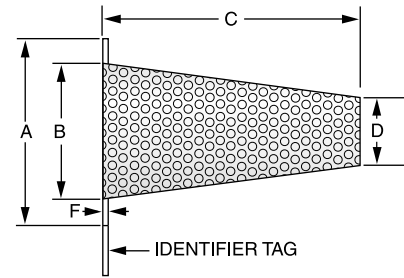
Ring.....A240-304

Handle.....A240-304

Perforated Plate A240-304

Mesh (optional) A276-304

* Other material available - consult factory



BASKET TYPE (TB)

Connections: 3/4" - Custom
150#, 300#, 600#, 900# and 1500#
Wafer Flat Faced Smooth Flanges
are standard
RF and RTJ Flange connections
available on request.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
3/4" - 8"	1/8" Perf.	22 Gauge ¹
10" - 24"	1/8" Perf.	16 Gauge ¹

Note: Other screens and mesh liners available upon request

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

SIZE	A				B	C				D	F ¹	Weight
	150/300#	600#	900#	1500#		100%	150%	200%	300%			
3/4 (20)	2 1/2 (54)	2 1/2 (64)	2 1/2 (67)	2 1/2 (67)	1/2 (16)	3/4 (19)	1 1/2 (29)	1 1/2 (38)	2 1/4 (57)	3/8 (8)	3/8 (3)	0.5 (0.2)
1 (25)	2 1/2 (64)	2 1/2 (70)	3 (76)	3 (76)	1/2 (19)	1 1/2 (29)	1 1/2 (43)	2 1/4 (57)	3 3/8 (86)	3/8 (10)	3/8 (3)	0.5 (0.2)
1 1/2 (40)	3 1/4 (83)	3 3/8 (92)	3 3/8 (95)	3 3/8 (95)	1 1/2 (32)	1 1/2 (38)	2 1/4 (57)	3 (76)	4 1/2 (114)	3/8 (16)	3/8 (3)	0.5 (0.2)
2 (50)	4 (102)	4 1/4 (108)	5 1/2 (140)	5 1/2 (140)	1 3/4 (44)	2 (51)	3 (76)	4 (102)	6 (152)	7/8 (22)	3/8 (3)	0.5 (0.2)
2 1/2 (65)	4 3/4 (121)	5 (127)	6 1/2 (162)	6 1/2 (162)	2 1/4 (57)	2 1/2 (56)	3 3/8 (86)	4 1/2 (114)	6 1/2 (171)	1 1/8 (29)	3/8 (3)	1 (0.5)
3 (80)	5 1/4 (133)	5 3/8 (146)	6 1/2 (165)	6 1/2 (171)	2 1/2 (70)	2 1/2 (70)	4 1/4 (1)	5 1/2 (145)	8 1/2 (216)	1 1/8 (35)	3/8 (3)	1 (0.5)
4 (100)	6 3/4 (171)	7 1/2 (191)	8 (203)	8 3/8 (206)	3 3/8 (95)	3 1/2 (89)	5 3/8 (136)	7 1/2 (183)	11 (279)	1 1/8 (48)	3/8 (3)	2 (0.9)
5 (125)	7 3/4 (194)	9 3/8 (238)	9 3/8 (244)	9 3/8 (251)	4 1/2 (117)	4 1/2 (114)	6 1/2 (171)	9 3/8 (232)	14 (356)	2 1/8 (59)	3/8 (3)	2 (0.9)
6 (150)	8 3/8 (219)	10 3/8 (263)	11 1/4 (286)	11 1/4 (279)	5 1/2 (137)	5 1/2 (140)	8 1/2 (216)	11 1/2 (289)	17 (432)	2 3/8 (68)	3/8 (3)	3 (1.4)
8 (200)	10 3/8 (276)	12 1/2 (318)	14 (356)	13 3/8 (349)	7 1/2 (187)	7 (178)	10 3/8 (272)	15 (381)	22 (559)	3 3/8 (94)	3/8 (3)	5 (2.3)
10 (250)	13 1/4 (337)	15 3/8 (397)	17 (432)	17 (432)	9 3/8 (238)	8 3/8 (219)	14 (356)	18 (457)	27 (686)	4 1/2 (119)	3/8 (3)	7 (3.2)
12 (300)	16 (406)	17 3/8 (454)	19 1/2 (495)	20 1/2 (517)	11 (279)	10 3/8 (267)	17 (432)	22 (559)	33 (838)	5 1/2 (140)	3/8 (3)	11 (5.0)
14 (350)	17 3/8 (441)	19 (483)	20 3/8 (517)	22 1/2 (575)	12 1/4 (311)	11 1/2 (292)	18 (457)	24 (610)	36 (914)	6 1/8 (156)	3/8 (3)	12 (5.4)
16 (400)	20 3/8 (511)	21 1/2 (555)	22 3/8 (572)	25 1/4 (638)	14 (356)	14 (356)	21 (533)	28 (711)	42 (1067)	7 (178)	3/8 (3)	16 (7.3)
18 (450)	21 1/4 (540)	23 3/8 (603)	25 (635)	27 1/2 (702)	15 1/2 (400)	16 (406)	24 (610)	32 (813)	47 (1194)	7 3/8 (200)	3/8 (3)	20 (9.1)
20 (500)	23 1/2 (597)	26 3/8 (676)	27 3/8 (695)	29 3/8 (753)	17 1/2 (445)	17 (432)	27 (686)	35 (889)	53 (1346)	8 3/8 (222)	3/8 (3)	26 (11.8)
24 (600)	27 3/8 (708)	30 3/8 (784)	32 3/8 (835)	35 3/8 (899)	21 1/4 (540)	21 (533)	32 (813)	42 (1067)	64 (1626)	10 3/8 (270)	3/8 (3)	30 (13.6)

Dimensions shown are subject to change. Contact factory for certified prints when required.

*Dimensions shown using 1/8" perf and no mesh. Open Area percentage will change with alternate perf and/or mesh. The change will equal the ratio of the open area of the perf/mesh compared to the open area of 1/8" mesh.

For Open Area percentages for perf/mesh see page 508

Please contact factory for further information.

1. Thicker material available upon request Please contact factory.

TP SERIES TEMPORARY BASKET STRAINERS

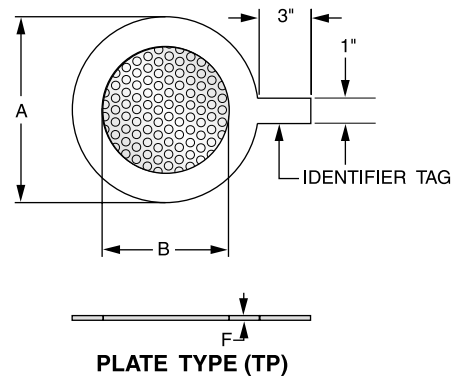
SPECIFICATION

The strainer body shall be fabricated 304 stainless steel or other specified material. The strainer shall be the plate type with an extended identifier tag handle. The screen shall be size _____ perforated SS with _____ mesh liner. The flow shall be _____. The Strainer shall have an inlet size of _____ and Open Area Ratio of _____. The Temporary Cone Strainer shall be SSI TP Series.

MATERIALS OF CONSTRUCTION (304 Stainless Steel Shown *)

Ring A240-304
Handle.....A240-304
Perforated Plate A240-304
Mesh (optional) A276-304

* Other material available - consult factory



Connections: 3/4" - Custom
150#, 300#, 600#, 900# and 1500#
Wafer Flat Faced Smooth Flanges
are standard
RF and RTJ Flange connections
available on request.

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

SIZE	A				B	D	F ¹	Weight
	150/300#	600#	900#	1500#				
¾ (20)	2½ (54)	2½ (64)	2½ (67)	2½ (67)	¾ (16)	¾ (8)	¾ (3)	0.5 (0.2)
1 (25)	2½ (64)	2¾ (70)	3 (76)	3 (76)	¾ (19)	¾ (10)	¾ (3)	0.5 (0.2)
1½ (40)	3¾ (83)	3¾ (92)	3¾ (95)	3¾ (95)	1¼ (32)	¾ (16)	¾ (3)	0.5 (0.2)
2 (50)	4 (102)	4¾ (108)	5½ (140)	5½ (140)	1¼ (44)	¾ (22)	¾ (3)	0.5 (0.2)
2½ (65)	4¾ (121)	5 (127)	6¾ (162)	6¾ (162)	2¼ (57)	1¾ (29)	¾ (3)	1 (0.5)
3 (80)	5¾ (133)	5¾ (146)	6¾ (165)	6¾ (171)	2¼ (70)	1¾ (35)	¾ (3)	1 (0.5)
4 (100)	6¾ (171)	7½ (191)	8 (203)	8¾ (206)	3¼ (95)	1¾ (48)	¾ (3)	2 (0.9)
5 (125)	7¾ (194)	9¾ (238)	9¾ (244)	9¾ (251)	4¾ (117)	2¾ (59)	¾ (3)	2 (0.9)
6 (150)	8¾ (219)	10¾ (263)	11¾ (286)	11 (279)	5¾ (137)	2¾ (68)	¾ (3)	3 (1.4)
8 (200)	10¾ (276)	12¾ (318)	14 (356)	13¾ (349)	7¾ (187)	3¾ (94)	¾ (3)	5 (2.3)
10 (250)	13¾ (337)	15¾ (397)	17 (432)	17 (432)	9¾ (238)	4¾ (119)	¾ (3)	7 (3.2)
12 (300)	16 (406)	17¾ (454)	19¾ (495)	20¾ (517)	11 (279)	5¾ (140)	¾ (3)	11 (5.0)
14 (350)	17¾ (441)	19 (483)	20¾ (517)	22¾ (575)	12¾ (311)	6¾ (156)	¾ (3)	12 (5.4)
16 (400)	20¾ (511)	21¾ (555)	22¾ (572)	25¾ (638)	14 (356)	7 (178)	¾ (3)	16 (7.3)
18 (450)	21¾ (540)	23¾ (603)	25 (635)	27¾ (702)	15¾ (400)	7¾ (200)	¾ (3)	20 (9.1)
20 (500)	23¾ (597)	26¾ (676)	27¾ (695)	29¾ (753)	17¾ (445)	8¾ (222)	¾ (3)	26 (11.8)
24 (600)	27¾ (708)	30¾ (784)	32¾ (835)	35¾ (899)	21¾ (540)	10¾ (270)	¾ (3)	30 (13.6)

Dimensions shown are subject to change. Contact factory for certified prints when required.

SCREEN OPENINGS

SIZE	STANDARD SCREEN	MATERIALS
3/4" - 8"	1/8" Perf.	22 Gauge ¹
10" - 24"	1/8" Perf.	16 Gauge ¹

Note: Other screens and mesh liners available upon request

The Open Area % is calculated as follows:

$$OA\% = \left[\frac{\text{Screen Area} \times \text{Open Area \%}}{\text{Area of Sch. 40/std. pipe}} \right] \times 100$$

Note: Open Area % for 1/8" perf is 40%.

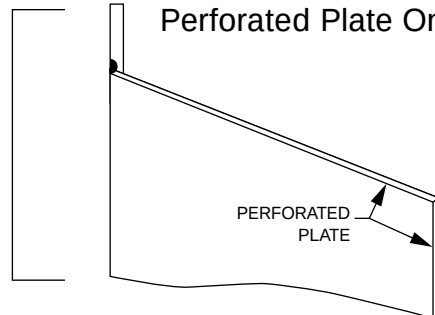
TC, TB AND TP SERIES

TEMPORARY STRAINERS

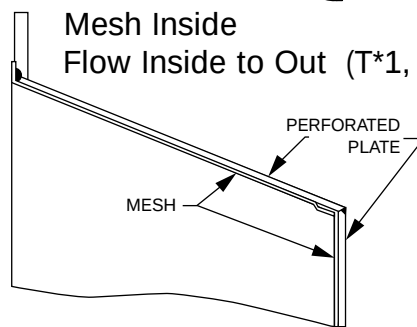
STANDARD CONSTRUCTION DETAILS

NO MESH

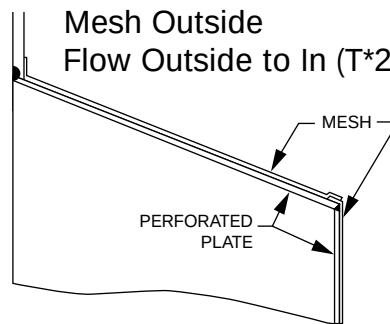
Perforated Plate Only (All)



Mesh Inside
Flow Inside to Out (T*1, T*4, T*7, T*A)

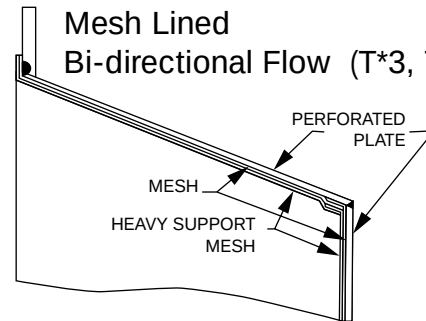


Mesh Outside
Flow Outside to In (T*2, T*5, T*8, T*B)



MESH LINED

Mesh Lined
Bi-directional Flow (T*3, T*6, T*9, T*C)



- * TC - Temporary Cone
- TB - Temporary Basket
- TP - Temporary Plate (Only TP1, TP2, TP3)

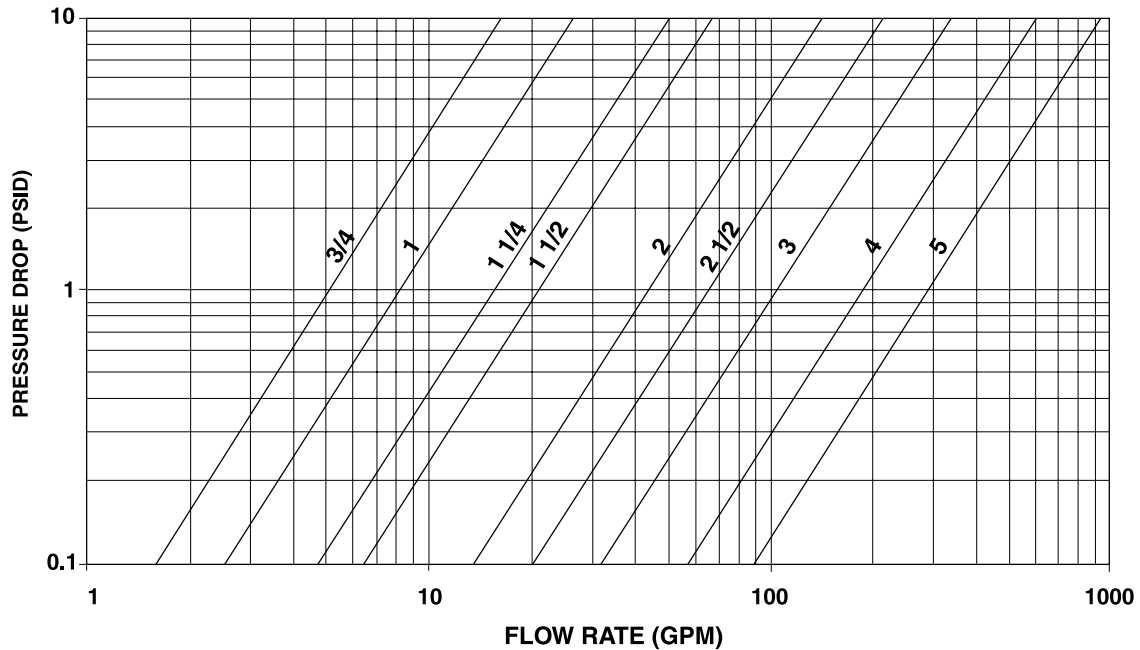
TC, TB AND TP SERIES

TEMPORARY STRAINERS

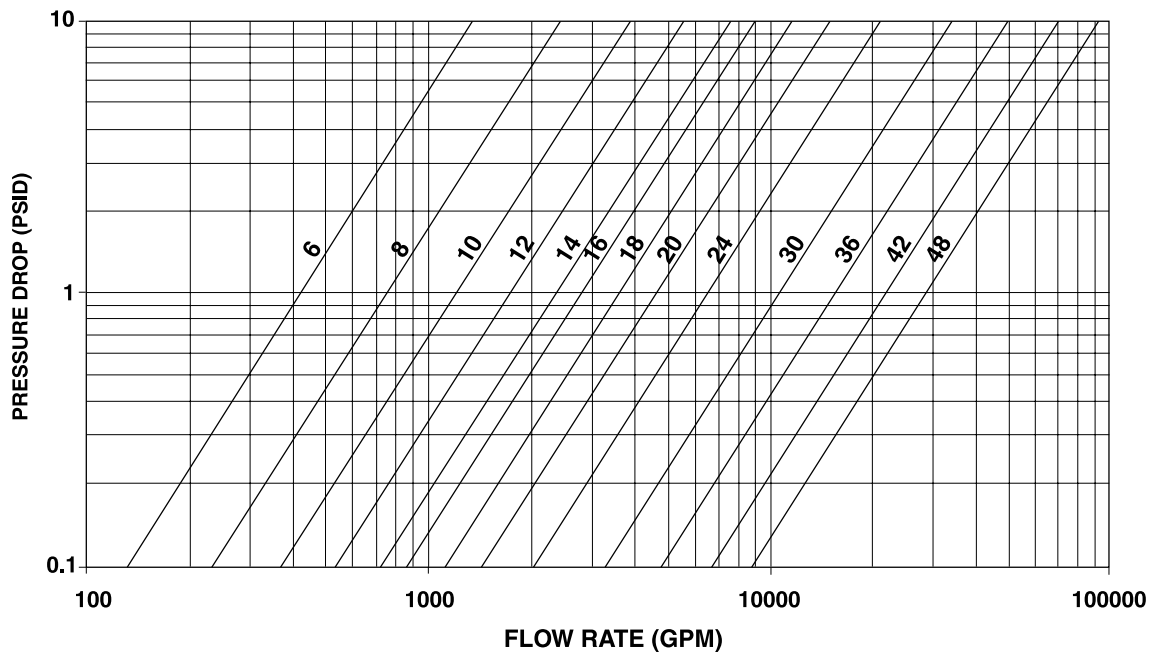
PRESSURE DROP VS FLOW RATE

Water Service Clean Screen, 1/32" - 1/4" perforator Screen*

(SIZES 3/4" - 5")



(SIZES 6" - 48")



* For Gas, Steam or Air Service, consult factory.

Correction Factors for Other Viscous Liquids
and/or Mesh Liners
Page 515

Correction Factors for Clogged Screens
Page 515

TEMPORARY
STRAINERS

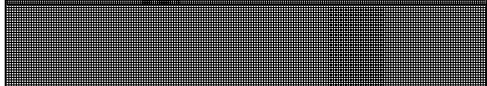
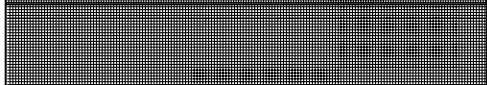
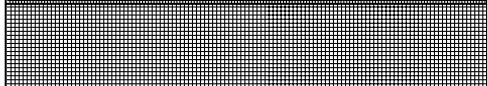
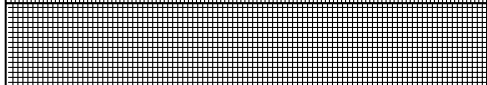
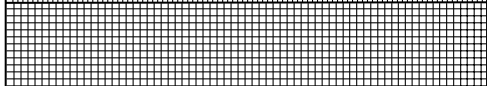
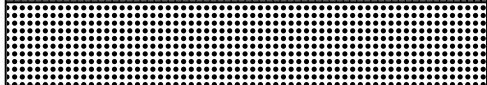
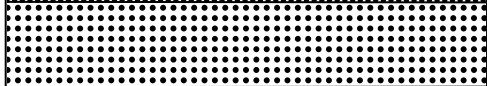
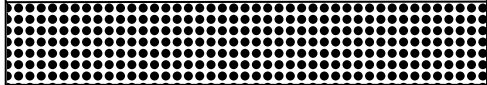
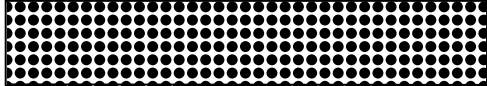
NOTES:

TEMPORARY STRAINER TECHNICAL INFORMATION

TEMPORARY STRAINER
TECHNICAL INFO

SCREEN OPENINGS

SCREEN OPENINGS

	100 Mesh - 30% O.A. 0.006" Openings
	80 Mesh - 36% O.A. 0.008" Openings
	60 Mesh - 38% O.A. 0.010" Openings
	40 Mesh - 41% O.A. 0.016" Openings
	30 Mesh - 45% O.A. 0.022" Openings
	20 Mesh - 49% O.A. 0.035" Openings
	0.027" Dia. - 23% O.A.
	0.033" Dia. - 28% O.A.
	3/64" Dia. - 36% O.A.
	1/16" Dia. - 37% O.A.
	3/32" Dia. - 39% O.A.
	1/8" Dia. - 40% O.A.
	5/32" Dia. - 58% O.A.
	3/16" Dia. - 50% O.A.
	1/4" Dia. - 40% O.A.

FACTORS TO CONSIDER

1 Purpose

If the strainer is being used for protection rather than direct filtration, standard screens will suffice in most applications.

2 Service

With services that require extremely sturdy screens, such as high pressure/temperature applications or services with high viscosities, perforated screens without mesh liners are recommended. If a mesh liner is required to obtain a certain level of filtration, then a trapped perf/mesh/perf combination is recommended.

3 Filtration Level

When choosing a perf. or a mesh/perf. combination, attention should be given to ensure overstraining does not occur. As a general rule, the specified level of filtration should be no smaller than half the size of the particle to be removed. If too fine a filtration is specified, the pressure drop through the strainer will increase very rapidly, possibly causing damage to the screen.

Screen openings other than those shown above are readily available. Various mesh sizes as fine as 5 micron and perforated plate as coarse as 1/2" Dia. are in inventory.

Screens are available in a wide range of materials. Screens of carbon steel, stainless steel (304, 316), alloy 20, monel 400, hastelloy C and titanium grade 2 are in inventory.

Custom manufactured screens are available upon request. Please consult factory.

TEMPORARY STRAINER

PRESSURE DROP CORRECTION FACTORS

Mesh Lined Baskets and/or Fluids with a Viscosity other than Water

Centistokes	SSU	Unlined Perforated Basket	20 Mesh Lined Basket	40 Mesh Lined Basket	60 Mesh Lined Basket	80 Mesh Lined Basket	100 Mesh Lined Basket	200 Mesh Lined Basket
2	30 (water)	1	1.05	1.2	1.4	1.6	1.7	2
100	500	1.6	1.7	1.9	2.1	2.4	2.6	3.1
216	1000	1.7	2	2.2	2.4	2.6	2.8	3.3
433	2000	1.9	2.2	2.4	2.7	2.9	3.2	3.8
650	3000	2	2.3	2.6	2.9	3.2	3.5	4.1
1083	5000	2.2	2.6	3	3.5	4	4.5	5.3
2200	10000	2.5	3	3.5	4.2	5	6	7.1

- 1) Obtain water pressure drop from graphs on appropriate product page.
- 2) Multiply the pressure drop obtained from (1) by the specific gravity of the liquid.
- 3) Multiply the pressure drop from (2) by the appropriate correction factor for the mesh liner and/or viscosity.

Example

Model: TCIVMIW-A44
Size: 4"
Filtration: 1/8" perforated screen
40 Mesh lines
Flow rate: 200 GPM
Fluid: Water
SG: 1
Viscosity: 30 SSI

Answer

- A) From Pressure Drop Chart, pressure drop of water is 1.25 psid
 B) Multiply by specific gravity; $1.25 \times 1 = 1.25$ psid
 C) From chart above, multiply 1.25×1.2 (correction factor) = 1.5 psid

CORRECTION FACTORS FOR CLOGGED SCREENS

% Clogged	Ratio of Free Screen Area to Pipe Area						
	10:1	8:1	6:1	4:1	3:1	2:1	1:1
10							3.15
20						1.15	3.9
30						1.4	5
40						1.8	6.65
50					1.25	2.5	9.45
60				1.15	1.8	3.7	14.5
70				1.75	2.95	6.4	26
80		1.1	1.75	3.6	6.25	14	58
90	2.3	3.45	6	13.5	24	55	

* Multiply values obtained from Pressure Drop Charts by the appropriate values shown below.

Example

Strainer Size: 6"
Model: TCIVPIW-A4A
Filtration: 1/8" Perf.
Flow rate: 200 GPM
Service: Water
% Clogged: 60%

Answer

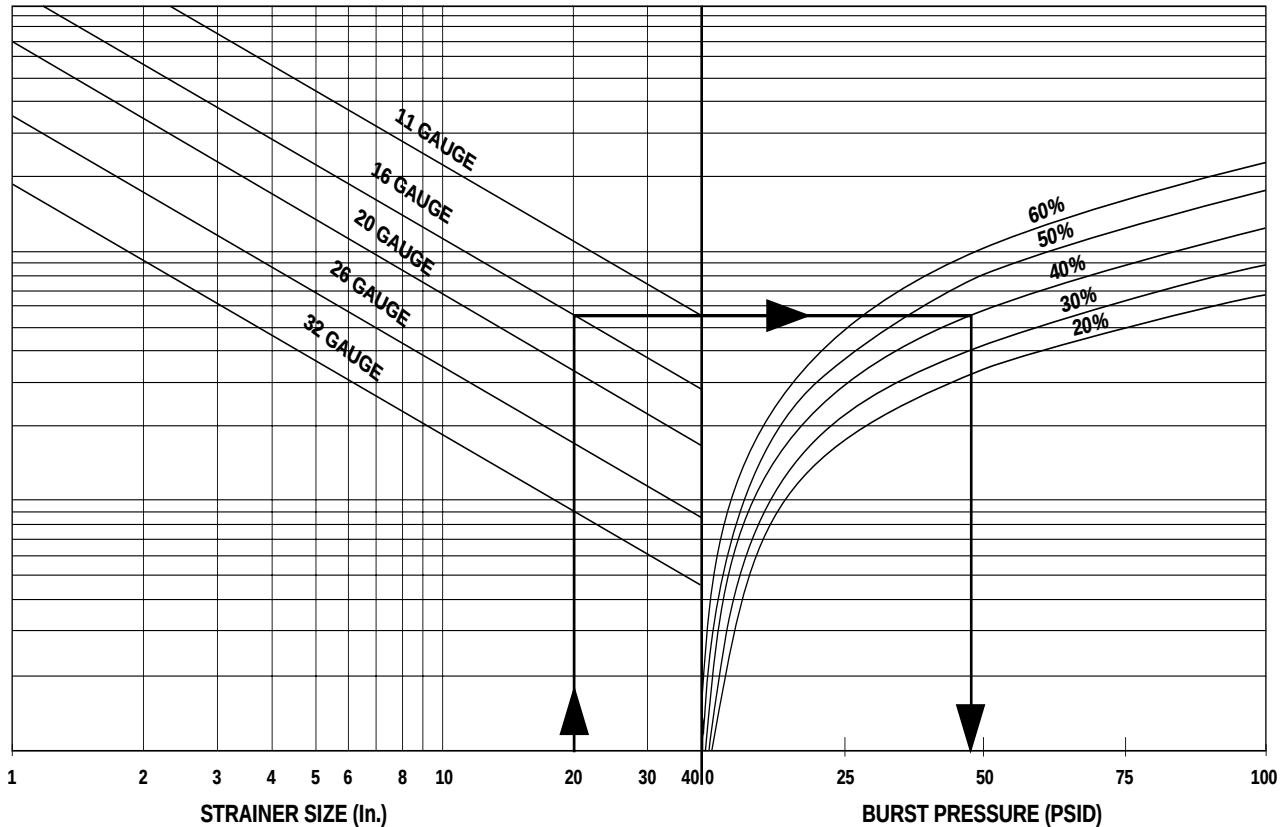
- A) The Pressure Drop Chart indicates a drop of .13 psid with standard screen.
 B) The Effective Area of TCI is 100% or 1:1.
 C) Using Chart above we read the correction factor of 1:1 to be 14.5 at 60% clogged.
 D) Total pressure drop equals $.13 \times 14.5 = 1.885$ psid.

TC SERIES

TEMPORARY STRAINER

BURST PRESSURE

TEMPORARY STRAINERS



Notes:

(1) The above chart is to be used for strainers manufactured from perforated plate and is based on the formula:

$$P = \frac{2St \cos \delta}{D + 1.2t \cos \delta}$$

SOURCE: ASME Section VIII, Div. 1., Appendix 1.

P = Burst Pressure, psi.
S = Reduced allowable stress
t = Thickness of perforated plate, in.
D = Dimension B (See page 4), in.
 δ = 15 degree

- (2) The above chart is based on standard dimensions. Higher burst pressure ratings are available. Please contact factory.
- (3) The above chart is based on a screen material of stainless steel. No safety factor is incorporated. It is the responsibility of the user to determine an acceptable safety factor.
- (4) See Screen Openings Chart for % Open Area's of inventoried perforated plate.

Example:

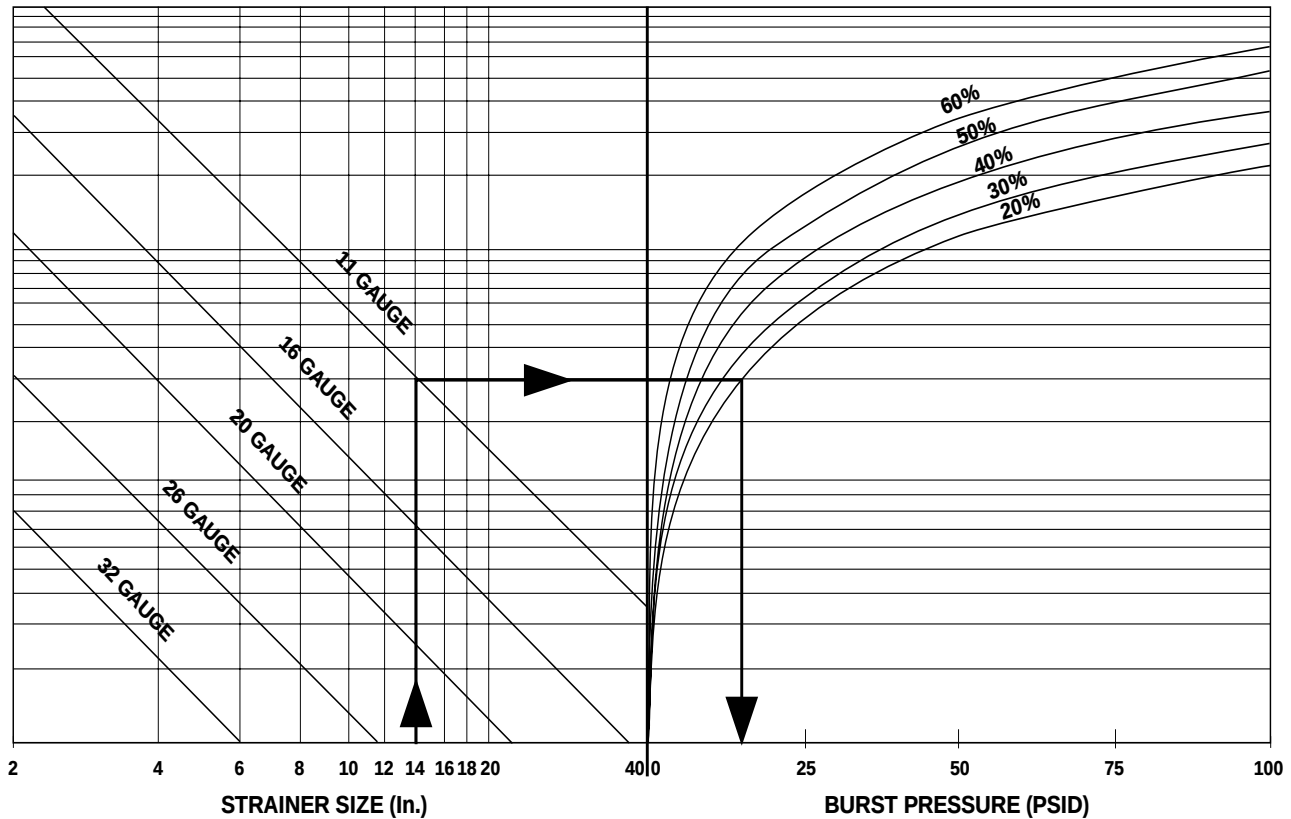
Strainer Size: 20"
Screen Thickness: 16 gauge
Screen Material Open Area: 40%

- A) Locate Strainer size.
 B) Follow vertical line to gauge thickness.
 C) Follow horizontal line to required perforation open area.
 D) Follow vertical line downward to read burst pressure.
 E) Burst pressure equals 48 psid.

TB SERIES

TEMPORARY STRAINER

BURST PRESSURE



TEMPORARY
STRAINERS

Notes:

- (1) The above chart is to be used for strainers manufactured from perforated plate and is based on the formula:

$$t = d \sqrt{\frac{0.3P}{S}}$$

SOURCE: ASME Section VIII, Div. 1., UG-34.

t = Thickness of perforated plate, in.
d = Dimension B (See page 4), in.
P = Burst Pressure, psi
S = Reduced allowable stress, psi

- (2) The above chart is based on standard dimensions. Higher burst pressure ratings are available. Please contact factory.
- (3) The above chart is based on a screen material of stainless steel. No safety factor is incorporated. It is the responsibility of the user to determine an acceptable safety factor.
- (4) See Screen Openings Chart for % Open Area's of inventoried perforated plate.

Example:

Strainer Size: 14"
Screen Thickness: 11 gauge
Screen Material Open Area: 20%

- A) Locate Strainer size.
 B) Follow vertical line to gauge thickness.
 C) Follow horizontal line to required perforation open area.
 D) Follow vertical line downward to read burst pressure.
 E) Burst pressure equals 15 psid.

TEMPORARY STRAINER

CHECKLIST

Please take the factors listed below into account when selecting a strainer. Kindly photocopy this page and fill out the pertinent information, to your best ability, so that we can recommend a Strainer to suit your specific requirements.

1. Fluid to be strained _____
2. Flow rate _____
3. Density of fluid _____
4. Viscosity of fluid _____
5. Fluid working pressure _____
Maximum pressure _____
6. Fluid Working Temp. _____
Maximum Temp. _____
7. Preferred material of strainer construction _____
8. Present Pipeline size & material _____
9. Nature of solids to be strained out _____
10. Size of solids to be strained out _____
Size of mesh or Perf. Req. _____

11. Clearance Limitation Above _____ Below _____
Left side facing inlet _____ Right side facing inlet _____
12. Maximum pressure drop with clean screen _____
13. Expected cleaning frequency _____
14. Any other information deemed relevant _____

Name _____
Company _____
Address _____
City/Town _____
State _____ Zip Code _____
Telephone (_____) _____
Fax (_____) _____

TEMPORARY STRAINERS

INSTALLATION AND MAINTENANCE INSTRUCTIONS

The temporary strainer is a device temporarily installed in a pipeline to remove sediment and debris from fluids. The temporary strainer is to be used for piping start-up applications only. The strainer is not to be used permanently installed in the process piping. If a permanent strainer is required after start-up, please contact the factory and/or refer to the SSI complete product line of pipeline strainers for your application.

STRAINER INSTALLATION INSTRUCTION

- Unpack the strainer. Inspect for any damage occurring during transit. Report damage to the carrier.
 - Ensure all machined surfaces are free of defects and that the inside of the strainers is free of foreign materials.
 - Verify that the correct size and flange rating for the application.
 - Review the application and chemical compatibility of the process fluid to the materials of construction of the strainer.
 - If the strainer application has a mesh liner, it is important to note the position of this mesh liner.
- As specified at the time of order, the mesh liner is on the inside or outside of the strainer.
- Install the strainer into the pipeline between the pipe flanges. Insure that the mesh lining (if provided) is facing the flow.
 - Be sure to install necessary gaskets and bolting. Torque bolts properly by using standard piping practices.
 - Expel air for the pipeline where the strainer is installed. Start system gradually. This will eliminate sudden shock to the strainer and other equipment in the line. Close any open pipeline vents after air is expelled.

MAINTENANCE INSTRUCTIONS

- For maximum efficiency, determine the length of time it takes for the pressure drop to double that in the clean condition.
 - Once the pressure drop reaches an unacceptable value, the strainer should be clean and/or removed.
 - A pressure gauge installed before and after the strainer in line will indicate pressure loss due to clogging and may be used to determine when cleaning is required.
- Slowly close the pipeline valves upstream and downstream for the strainer. Make sure these valves are tightly closed.
 - Relieve the fluid pressure from the pipeline where the strainer is installed. The pipeline must be drained and internal pressure relieved prior to removing the strainer. Proceed to remove the strainer.

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below: If the purchaser believes a product defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product. (b) If permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at its discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund described above, the purchaser agrees that the manufacturer shall not be liable

for any losses, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of foregoing. No other warranties, written or oral, expressed or implied, including the warranties of fitness for a particular purpose and merchantability, are made or authorized. No affirmation of fact, promise, description of product use or sample or model shall create any warranty from the manufacturer, unless signed by the president. These products are not manufactured, sold or intended for personal, family or household purposes.

NOTES:

**TEMPORARY
STRAINERS**

Applications

- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Metals & Mining
- Water & Waste Water
- Pulp & Paper

Double Door Check Valves

**Pressures to 1480 PSIG
Temperatures to 600°F**

FEATURES

- Compact Design
- Low Pressure Loss
- Minimal Installation Costs

MATERIALS OF CONSTRUCTION

- Cast Iron Body, Bronze & Stainless Steel Disc
- Carbon Steel Body, Stainless Steel Disc
- Stainless Steel Body, Stainless Steel Disc

END CONNECTIONS

- Wafer Flat Face
- Wafer Raised Face

SEAT MATERIALS

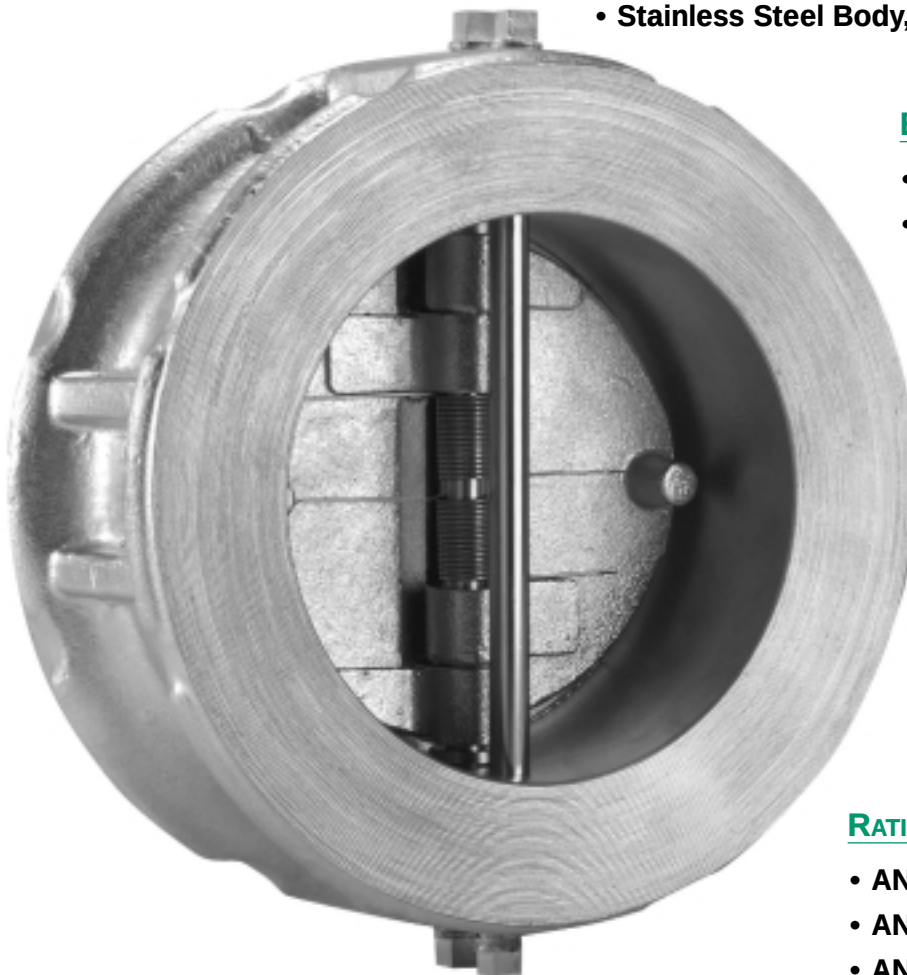
- Buna-N
- EPDM
- Viton
- Metal To Metal

SIZE RANGE

- 2" (50mm) up to 24" (600mm)

RATINGS

- ANSI 125 PSIG
- ANSI 150 PSIG
- ANSI 300 PSIG
- ANSI 600 PSIG



DOUBLE DOOR CHECK
VALVES FEATURES

DOUBLE DOOR CHECK VALVE

DESIGN FEATURES

WAFER DOUBLE DOOR DESIGN ADVANTAGE

The short face to face design inherently makes this check valve significantly lighter (10% of the weight of a conventional swing check). The valve is designed to fit between two flanges and requires no flanges of its own. The double door check valve can be

installed in any position as the spring aids in keeping the valve closed (Consult factory for vertical downward flow). These features allow you to design your piping layout in the most efficient and least expensive fashion.

SHOCK BUMPERS

An integral cast bumper is present on all Series WT double door check valves (Except class 125 Lb.). The bumpers can be found on both discs, which meet when the valve reaches a fully open position. This design feature prevents the discs from pressing against the stop pin and eliminates leverage that would cause unnecessary stresses and wear. The purpose of the stop pin is to prevent over travel of either disc, which would result in valve failure.

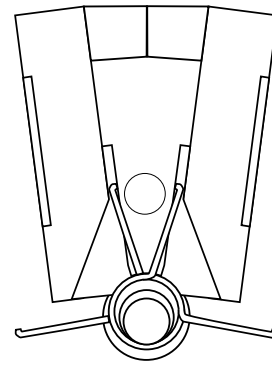


FIGURE 1

RESILIENT SEAT

The basic design of the Series WT double door check valve is illustrated in Fig. 2. This seal is chemically bonded using specially designed adhesives that provide rubber tearing bonds throughout the operating range of the seat material. In case of resilient seat failure, the design permits the doors to

float and make contact with the metal surface the seats were adhered to. This feature allows the valve to function even if the resilient seat is not present. The seat design illustrated in Fig. 3 is also available. This design results in a controlled seat squeeze and provides a metal to metal backup seal (Fig.4).

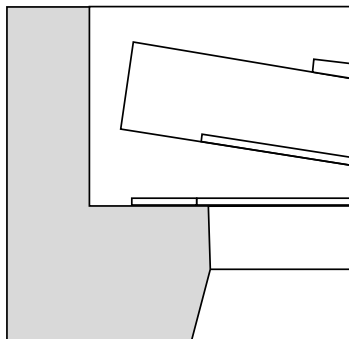


FIGURE 2

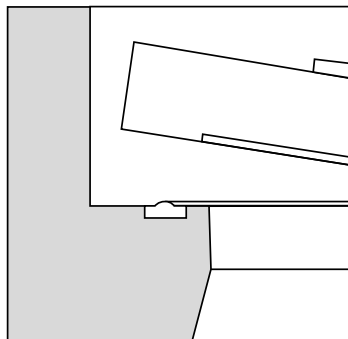


FIGURE 3

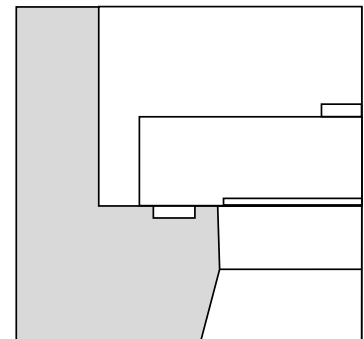


FIGURE 4

DOUBLE DOOR CHECK VALVE

DESIGN FEATURES

MINIMAL SEAT WEAR

The Series WT double door check valve was designed to eliminate the possibility of seat wear caused by friction at the heel of the double doors while maintaining low back pressure sealing capabilities. The clearance between the body, disc and hinge pin results in the discs cracking open at the

heel location first. When the valve opens the heel does not drag across the seating surface and cause wear. As the valve closes, the spring will take the toe of the disc into the seating surface first, while the line back pressure will force the heels and hinge pin back to the seat to complete the seal.

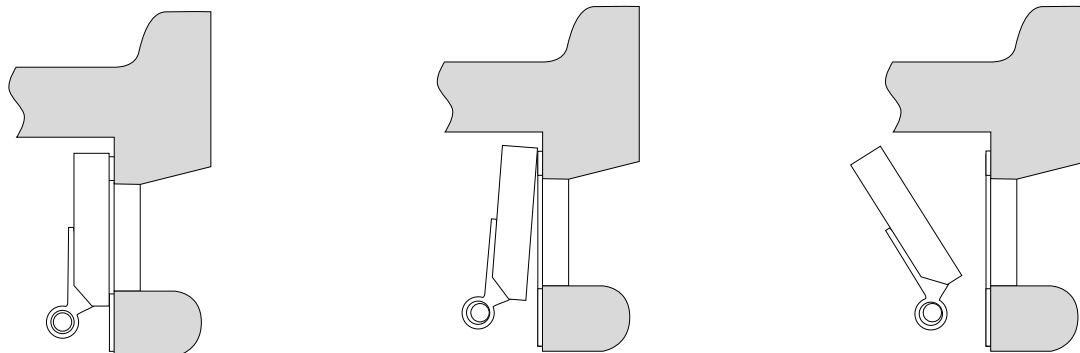
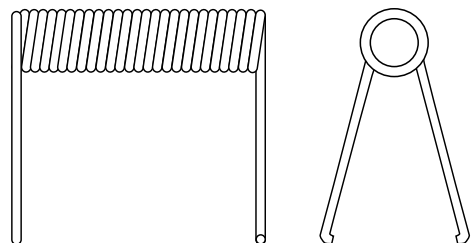


FIGURE 5

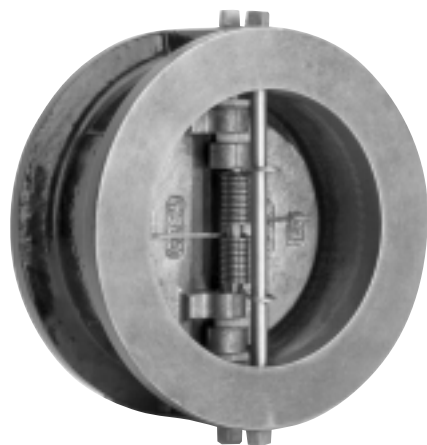
SPRING CLOSING



standard. FIGURE 6

The specially designed torsion spring in the Series WT double door check valve holds the valve discs closed under no flow conditions (Consult factory for vertical downward flow). Pipeline flow (head) causes the discs to open and conversely when flow decays to a point near zero velocity, the force from the legs of the torsion spring instantly closes the valve discs for non-slam shutoff. The Series WT double door check valve comes complete with corrosion resistant stainless steel springs as

DOUBLE DOOR
CHECK VALVE DESIGN



125WT SERIES CAST IRON DOUBLE DOOR CHECK VALVES

PRESSURES TO 200 PSIG (13.8 BARG)
TEMPERATURES TO 250°F (121°C)

- ANSI rated 125 PSIG rated Check Valves
- Wafer body style fits between FF or RF flanges
- Teflon thrust washers
- Resilient Buna-N seats
- Seat design lifts then swings discs to minimize seat wear
- Independent springs optimizes valve plate closing rates while minimizing spring stress
- Lifting lug tap on all valves 6" and larger

APPLICATIONS

- Liquid and Air Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

MODELS

- 125WTIB - Cast Iron Body, Bronze Disc, Buna Seat
- 125WTIT - Cast Iron Body, Stainless Steel Disc, Buna Seat

OPTIONS

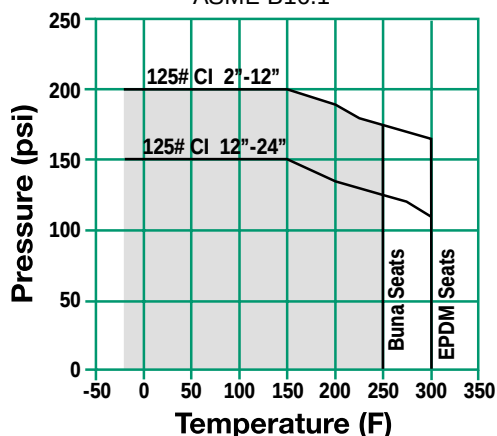
- EPDM Seats
- Other Spring Material

APPLICABLE CODES

- ASME B16.1
- API 598

PRESSURE/TEMPERATURE CHART

ASME B16.1



Contact factory for EPDM pressure/temperature range.

125WT Series Ordering Code

Inlet Size					Model							Seat	Dash	Spring
1	0	0	0	-	1	2	5	W	T	I	B	B	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size - Position 1 - 4	
0200 - 2"	1000 - 10"
0250 - 2½"	1200 - 12"
0300 - 3"	1400 - 14"
0400 - 4"	1600 - 16"
0500 - 5"	1800 - 18"
0600 - 6"	2000 - 20"
0800 - 8"	2400 - 24"

Dash - Position 5	
Model - Position 6 - 12	
125WTIB - CI Body, Bz Disc	
125WTIT - CI Body, SS Disc	
Seat - Position 13	
B - Buna-N	
Dash - Position 14	
Spring - Position 15	
T - SS	

125WT SERIES

CAST IRON DOUBLE DOOR CHECK VALVES

SPECIFICATION

Check Valve shall be dual disc design with Cast Iron wafer body style meeting ASME B16.1. The check valve shall have an integral cast bumper and Buna-N resilient seat with bronze or SS discs. The check valve shall be ANSI 125 PSIG rated. The spring shall be 316SS. The check valve shall be SSI 125WT Cast Iron Series.

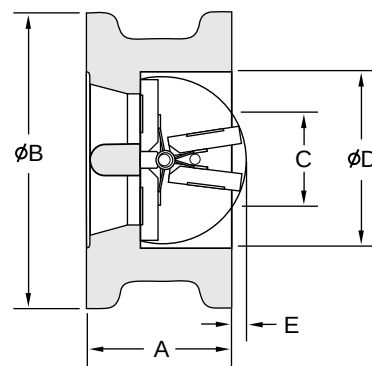
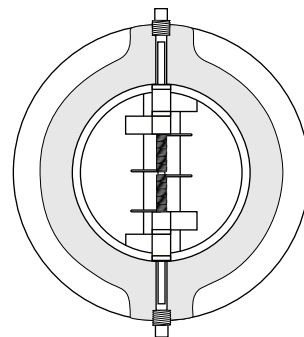
MATERIALS OF CONSTRUCTION

Body A126-B Cast Iron
Discs Al/Bz B148 C954 or 316SS A351-CF8M
Seat Buna-N
Spring 316SS

CRACKING PRESSURE

Horizontal Mounting - .3psid

Vertical Mounting - .75 to 1.25 psid



125WT DOUBLE DOOR
CHECK VALVE

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size	A	B*	C ¹	D	E	STUD SELECTION			Weight
						Qty.	Dia.	Length	
2 (50)	2.13 (54)	4.13 (105)	2.00 (51)	2.38 (60)	0.13 (3)	4	0.63 (16)	5.50 (140)	3 (1.4)
2.5 (65)	2.13 (54)	4.88 (124)	2.50 (64)	2.88 (73)	0.50 (13)	4	0.63 (16)	6.00 (152)	5 (2.3)
3 (80)	2.25 (57)	5.38 (137)	3.00 (76)	3.50 (89)	0.63 (16)	4	0.63 (16)	6.25 (159)	8 (3.6)
4 (100)	2.50 (64)	6.88 (175)	4.00 (102)	4.50 (114)	1.00 (25)	8	0.63 (16)	6.25 (159)	13 (5.9)
5 (125)	2.75 (70)	7.75 (197)	5.00 (127)	5.50 (140)	1.25 (32)	8	0.75 (19)	7 (184)	16 (7.3)
6 (150)	3.00 (76)	8.75 (222)	6.00 (152)	6.63 (168)	1.63 (41)	8	0.75 (19)	8.00 (203)	20 (9.8)
8 (200)	3.75 (95)	11.00 (279)	8.00 (203)	8.63 (219)	2.38 (60)	8	0.75 (19)	9.50 (241)	37 (16.8)
10 (250)	4.25 (108)	13.38 (340)	10.00 (254)	10.75 (273)	3.00 (76)	12	0.88 (22)	10.50 (267)	57 (25.9)
12 (300)	5.63 (143)	16.13 (410)	12.00 (305)	12.75 (324)	3.88 (99)	12	0.88 (22)	12.25 (311)	93 (42.2)
14 (350)	7.25 (184)	17.75 (451)	12.50 (318)	14.00 (356)	4.00 (102)	12	1.00 (25)	13.00 (330)	205 (93.1)
16 (400)	7.50 (191)	20.25 (514)	15.00 (381)	16.00 (406)	5.25 (133)	16	1.00 (25)	13.50 (343)	271 (123.0)
18 (450)	8.00 (203)	21.61 (549)	17.00 (432)	18.00 (457)	6.00 (152)	16	1.13 (29)	14.50 (368)	310 (140.7)
20 (500)	8.38 (213)	23.86 (606)	19.00 (483)	20.00 (508)	6.88 (175)	20	1.13 (29)	15.25 (387)	377 (171.2)
24 (600)	8.75 (222)	28.25 (718)	22.75 (578)	24.00 (610)	8.25 (210)	20	1.25 (32)	16.25 (413)	551 (250.2)

Dimensions are subject to change. Consult factory for certified drawings when required.

* Add the "B" dimensions and the diameter of the stud to achieve the ANSI B16.1 bolt hole circle diameter.

1. Minimum bore diameter of companion flanges

Connections: 2" to 24"
FF Wafer Flanged

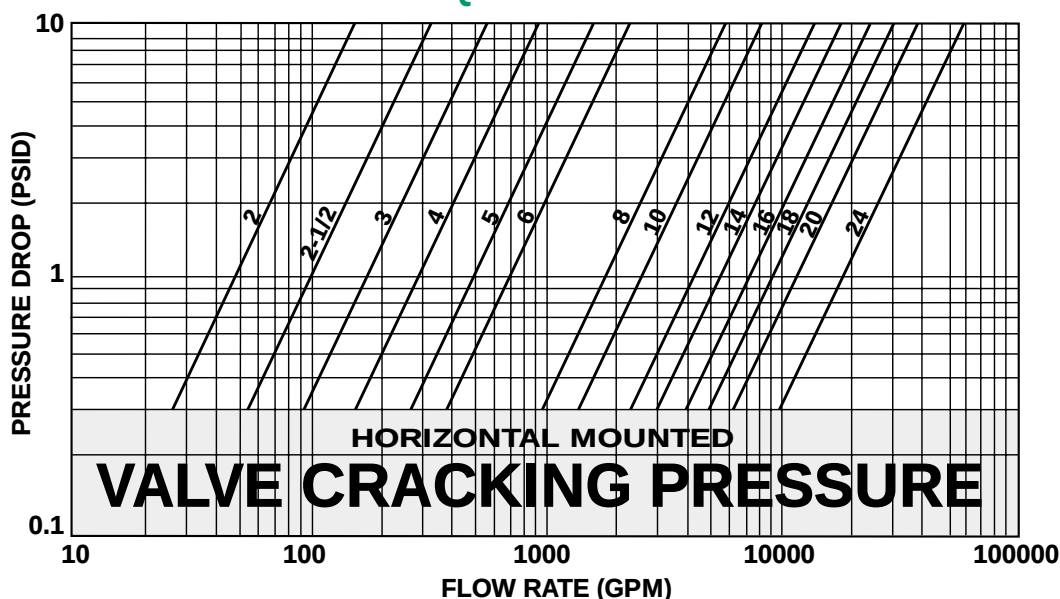
Seats: 2" to 24"
Buna-N All

125WT SERIES DOUBLE DOOR CHECK VALVES

CAST IRON

PRESSURE DROP - LIQUIDS

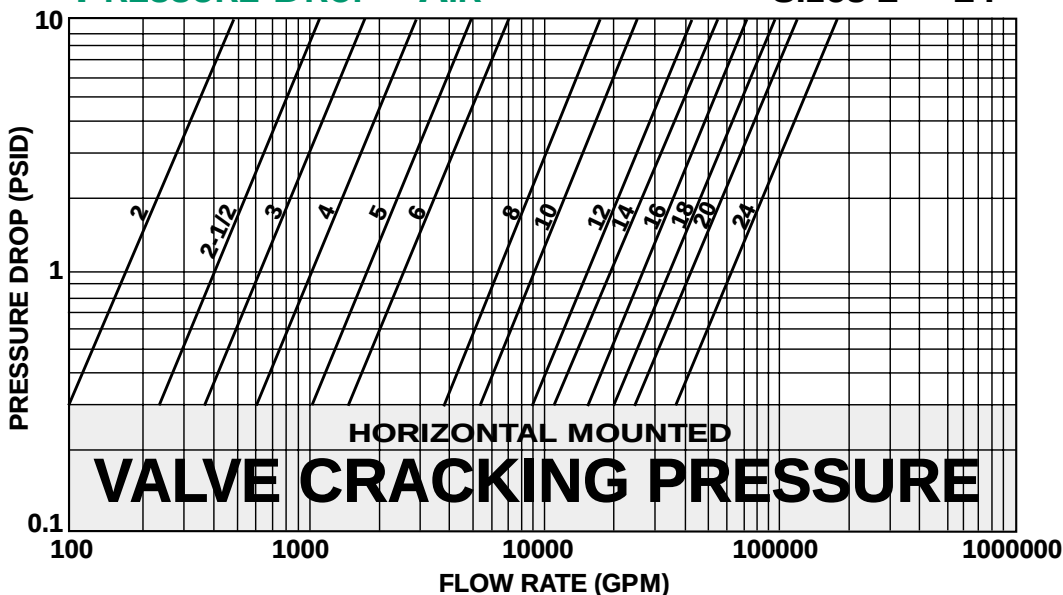
Sizes 2" - 24"



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

PRESSURE DROP - AIR

Sizes 2" - 24"



- (1) Pressure drop curves are based on air flow at 60 OF and 1 ATM pressure.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

Installation Note:

- 1) For correct installation and maintenance please see our I&M manual.
- 2) Horizontal installation – Disc pin must be installed in vertical position.
- 3) Vertical installation (downward flow) – Consult factory.

C_v VALUES (US-GPM @ 1 PSID)

Valve Size (inches)	2	2½	3	4	5	6	8	10	12	14	16	18	20	24
C _v	60	100	170	340	520	850	1600	2400	3800	4400	5800	7500	9800	15000

NOTES:



150WT SERIES

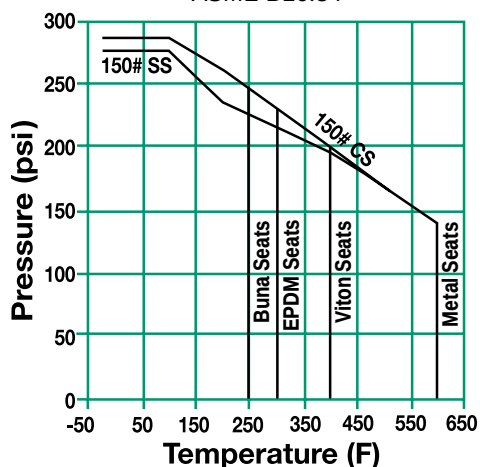
CAST STEEL AND STAINLESS STEEL DOUBLE DOOR CHECK VALVES

PRESSURES TO 285 PSIG (19.7 BARG)
TEMPERATURES TO 600°F (316°C)

APPLICATIONS

- Liquid and Air Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

PRESSURE/TEMPERATURE CHART
ASME B16.34



- ANSI 150 PSIG rated check valves
- Wafer body style fits between FF or RF flanges
- Size 6" and larger are supplied with a valve lifting lug
- Upper and lower SS thrust washers
- Resilient Buna-N , Viton and metal seats
- Seat design lifts then swings discs to minimize seat wear
- Shock bumpers minimize stresses in hinge pins
- Independent springs optimizes valve plate closing rates while minimizing spring stress
- Dual rating 2" - 3" 150#, 300# and 600#
- Dual ratings 4" 150# and 300#

MODELS

- 150WTCT – Cast Steel Body, Stainless Steel Disc, Buna Seat
- 150WTTT – Stainless Steel Body, Stainless Steel Disc, Metal or Viton Seat

OPTIONS

- EPDM Seats
- Other Spring Material

APPLICABLE CODES

- ASME B16.34
- API 594
- API 598

150WT Series Ordering Code

Inlet Size				Dash	Model							Seat	Dash	Spring
0	8	0	0	-	1	5	0	W	T	C	T	B	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size - Position 1 - 4
2", 2½", 3" sizes use 600WT Series.
4" size use 300WT Series
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5

Model - Position 6 - 12
150WTCT - CS Body
150WTTT - SS Body

Seat* - Position 13
B - Buna-N (CS Body only)
M - Metal (SS Body only)
V - Viton (SS Body only)

Dash - Position 14

Spring - Position 15
T - SS

*150WTCT - Buna-N seat only
150WTTT - Viton or Metal seat

150WT SERIES

CAST STEEL AND STAINLESS STEEL

DOUBLE DOOR CHECK VALVES

SPECIFICATION

Check Valve shall be dual disc design with Cast Steel or Stainless Steel Body wafer body style meeting ASME B16.34 and API 594. The check valve shall have an integral cast bumper and Buna-N, Viton or metal seat with SS discs. The check valve shall be ANSI 150 PSIG rated. The spring shall be 316SS. The seat design shall lift then swing discs to minimize seat wear. The check valve shall be SSI 150WT Series.

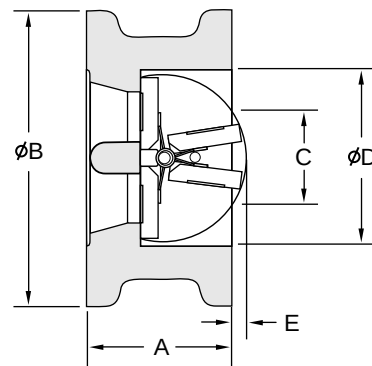
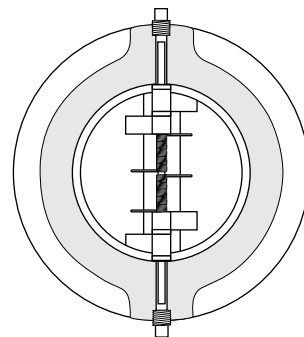
MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Discs	A351-CF8M	A351-CF8M
Seat	Buna-N	Viton or Metal
Spring	316SS	316SS

CRACKING PRESSURE

Horizontal Mounting - .3psid

Vertical Mounting - .75 to 1.25 psid



150WT DOUBLE DOOR
CHECK VALVE

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size	A ¹	B*	C ²	D	E	STUD SELECTION			Weight
						Qty.	Dia.	Length	
2 ³ (50)	Use 2" 600WT-150# on page 537								
2½ (66)	Use 2½" 600WT-150# on page 537								
3 ³ (80)	Use 3" 600WT-150# on page 537								
4 ⁴ (100)	Use 4" 300WT-150# on page 533								
6 (150)	3.88 (99)	8.75 (222)	5.38 (137)	6.63 (168)	1.38 (35)	8	0.75 (19)	8.25 (210)	35 (15.9)
8 (200)	5.00 (127)	11.00 (279)	7.38 (187)	8.63 (219)	2.00 (51)	8	0.75 (19)	9.75 (248)	70 (31.8)
10 (250)	5.75 (146)	13.38 (340)	9.50 (241)	10.75 (273)	2.88 (73)	12	0.88 (22)	11.00 (279)	114 (51.8)
12 (300)	7.13 (181)	16.13 (410)	11.25 (286)	12.75 (324)	3.38 (86)	12	0.88 (22)	12.25 (311)	180 (81.8)

Connections: 6" to 12"
RF Wafer Flanged

Seats:
CS Body - 6" to 12" Buna-N
SS Body - 6" to 12" Viton or Metal

1. Dimensions in accordance with API 594.
2. Minimum bore diameter of companion flanges.
3. Sizes 2", 2½", 3" 150WT, 300WT & 600WT are interchangeable, use 600WT for all applications in these sizes.
4. Size 4", 150WT & 300WT are interchangeable, use 300WT for 4" size.

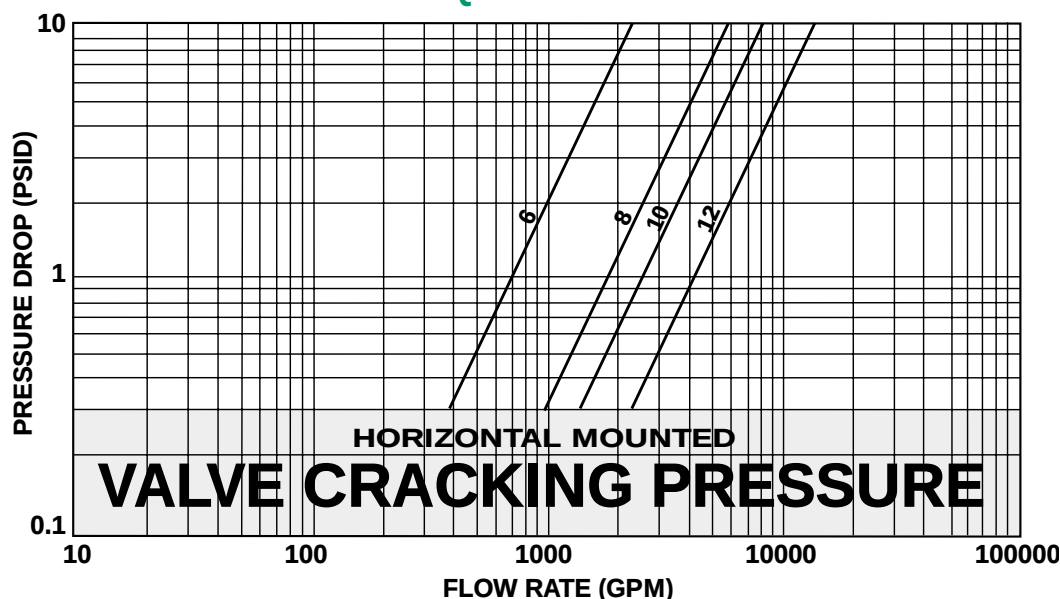
* Add the "B" dimension and the diameter of the stud to achieve the ANSI B16.5 bolt hole circle diameter.

150WT SERIES DOUBLE DOOR CHECK VALVES

CAST STEEL AND STAINLESS STEEL

PRESSURE DROP - LIQUIDS

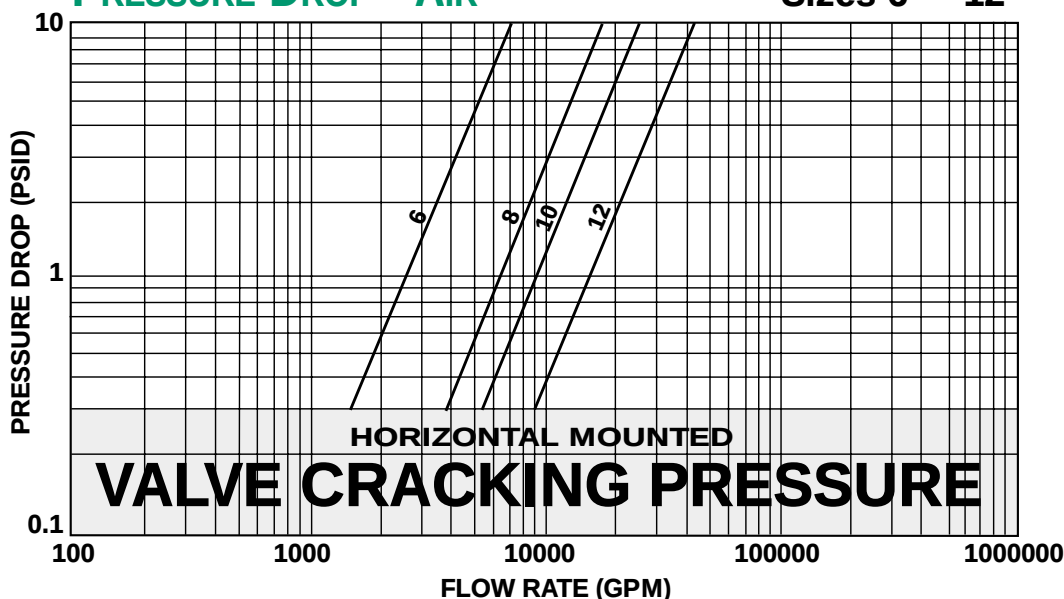
Sizes 6" - 12"



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

PRESSURE DROP - AIR

Sizes 6" - 12"



- (1) Pressure drop curves are based on air flow at 60 OF and 1 ATM pressure.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

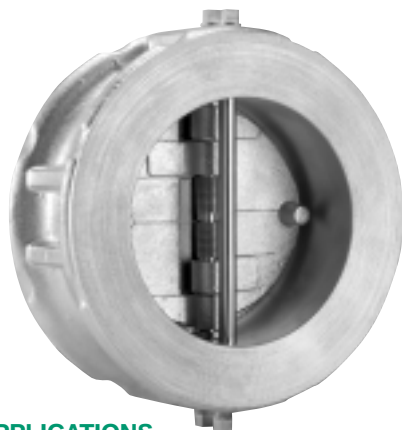
Installation Note:

- 1) For correct installation and maintenance please see our I&M manual.
- 2) Horizontal installation – Disc pin must be installed in vertical position.
- 3) Vertical installation (downward flow) – Consult factory.

C_v VALUES (US-GPM @ 1 PSID)

Valve Size (inches)	6	8	10	12
C _v	705	1795	2563	4295

NOTES:



300WT SERIES CAST STEEL AND STAINLESS STEEL DOUBLE DOOR CHECK VALVES

PRESSURES TO 740 PSIG (51 BARG)
TEMPERATURES TO 600°F (316°C)

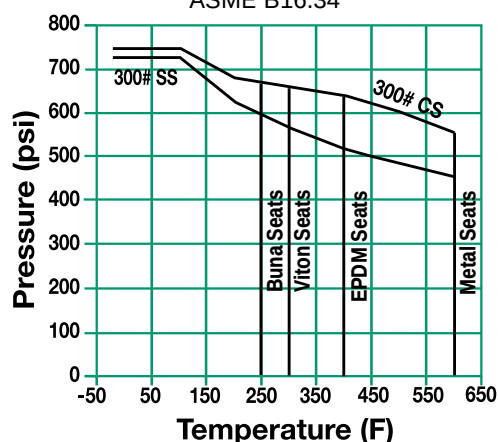
APPLICATIONS

- Liquid and Air Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

- ANSI 300 PSIG rated check valves
- Wafer body style fits between FF or RF flanges
- Size 6" and larger are supplied with a valve lifting lug
- Upper and lower SS thrust washers
- Resilient Buna-N and Viton
- Seat design lifts then swings discs to minimize seat wear
- Shock bumpers minimize stresses in hinge pins
- Independent springs optimizes valve plate closing rates while minimizing spring stress
- Dual ratings 2"-3" 150#, 300# and 600#.
- Dual ratings 4" 150# and 300#.

PRESSURE/TEMPERATURE CHART

ASME B16.34



Contact factory for EPDM pressure/temperature range.

MODELS

- 300WTCT – Cast Steel Body, Stainless Steel Disc, Buna Seat
- 300WTTT – Stainless Steel Body, Stainless Steel Disc, Viton Seat

OPTIONS (CONSULT FACTORY)

- EPDM Seats
- Other Spring Material

APPLICABLE CODES

- ASME B16.34
- API 594
- API 598

300WT Series Ordering Code

Inlet Size					Model							Seat	Dash	Spring
0	6	0	0	-	3	0	0	W	T	C	T	B	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size* - Position 1 - 4

2", 2½", 3" sizes use 600WT Series
0400 - 4"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5

Model - Position 6 - 12

300WTCT - CS Body
300WTTT - SS Body

Seat* - Position 13

B - Buna-N (CS Body only)
V - Viton (SS Body only)

Dash - Position 14

Spring - Position 15

T - SS

*300WTCT - Buna-N seat only
300WTTT - Viton seat only

300WT SERIES

CAST STEEL AND STAINLESS STEEL DOUBLE DOOR CHECK VALVES

SPECIFICATION

Check Valve shall be dual disc design with Cast Steel or Stainless Steel Body wafer body style meeting ASME B16.34 and API 594. The check valve shall have an integral cast bumper and Buna-N or Viton resilient seats with SS discs. The check valve shall be ANSI 300 PSIG rated. The spring shall be 316SS. The seat design shall lift then swing discs to minimize seat wear. The check valve shall be SSI 300WT Series..

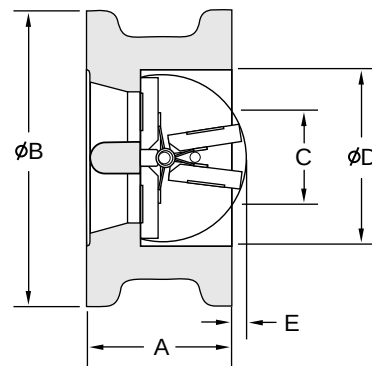
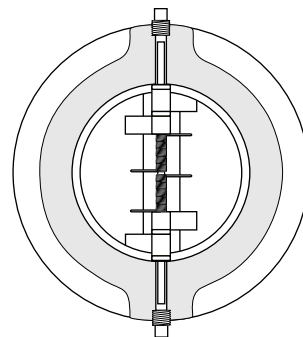
MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Discs	A351-CF8M	A351-CF8M
Seat	Buna-N	Viton
Spring	316SS	316SS

CRACKING PRESSURE

Horizontal Mounting - .3psid

Vertical Mounting - .75 to 1.25 psid



**300WT DOUBLE DOOR
CHECK VALVE**

Connections: 4" to 12"
Wafer Flanged

Seats:
CS Body - 4" to 12" Buna-N
SS Body - 4" to 12" Viton

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size		A ¹	B*	C ²	D	E	STUD SELECTION			Weight
							Qty.	Dia.	Length	
2 ³ (50)		Use 2" 600WT 300# on page 537								
2½ ³ (66)		Use 2½" 600WT 300# on page 537								
3 ³ (80)		Use 3" 600WT 300# on page 537								
4 ⁴ (100)	150WT	2.88 (73)	6.88 (175)	3.38 (86)	4.5 (114)	0.75 (19)	8	0.63 (16)	7.00 (178)	18 (8.2)
	300WT	2.88 (73)	7.13 (181)	3.38 (86)	4.5 (114)	0.75 (19)	8	0.75 (19)	8.13 (207)	18 (8.2)
6 (150)		3.88 (99)	9.88 (251)	5.38 (137)	6.63 (168)	1.38 (35)	12	0.75 (19)	9.63 (245)	44 (20.0)
8 (200)		5.00 (127)	12.13 (308)	7.38 (187)	8.63 (219)	2.00 (51)	12	0.88 (22)	11.25 (286)	75 (34.0)
10 (250)		5.75 (146)	14.25 (362)	9.50 (241)	10.75 (273)	2.88 (73)	16	1.00 (25)	12.75 (324)	123 (55.8)
12 (300)		7.13 (181)	16.63 (422)	11.25 (286)	12.75 (324)	3.38 (86)	16	1.13 (29)	14.63 (372)	196 (89.0)

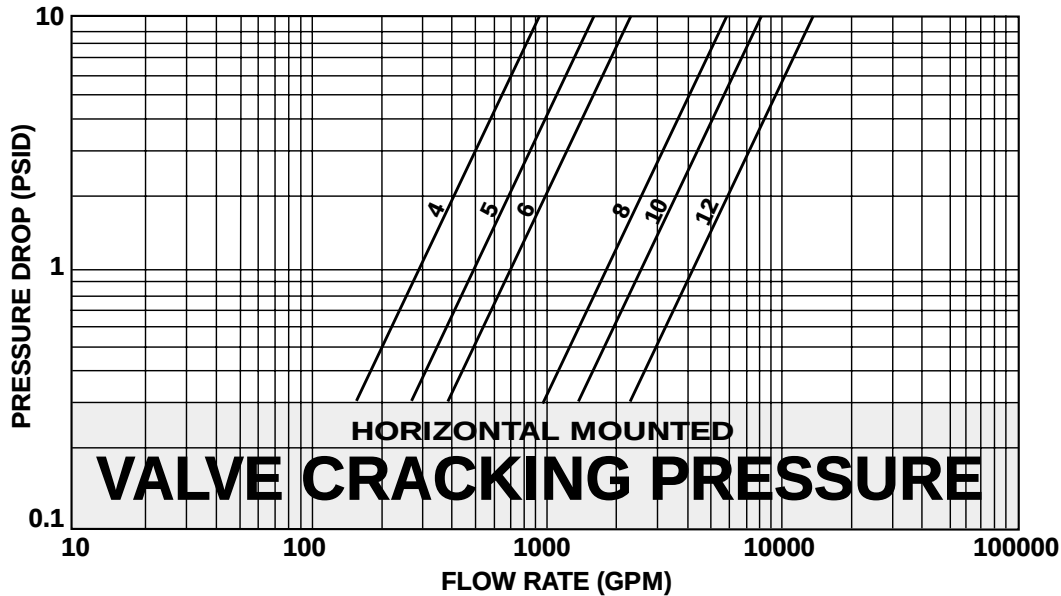
- Dimensions in accordance with API 594.
 - Minimum bore diameter of companion flanges.
 - Sizes 2", 2½" & 3" for 150WT, 300WT & 600WT are interchangeable, use 600WT for all applications in these sizes.
 - Size 4" for 150WT & 300WT are interchangeable, use 300WT for 4" size. 4" sizes fit between both 150# & 300# flanges.
- * Add the "B" dimension and the diameter of the stud to achieve the ANSI B16.5 bolt hole circle diameter.

300WT SERIES DOUBLE DOOR CHECK VALVES

CAST STEEL AND STAINLESS STEEL

PRESSURE DROP - LIQUIDS

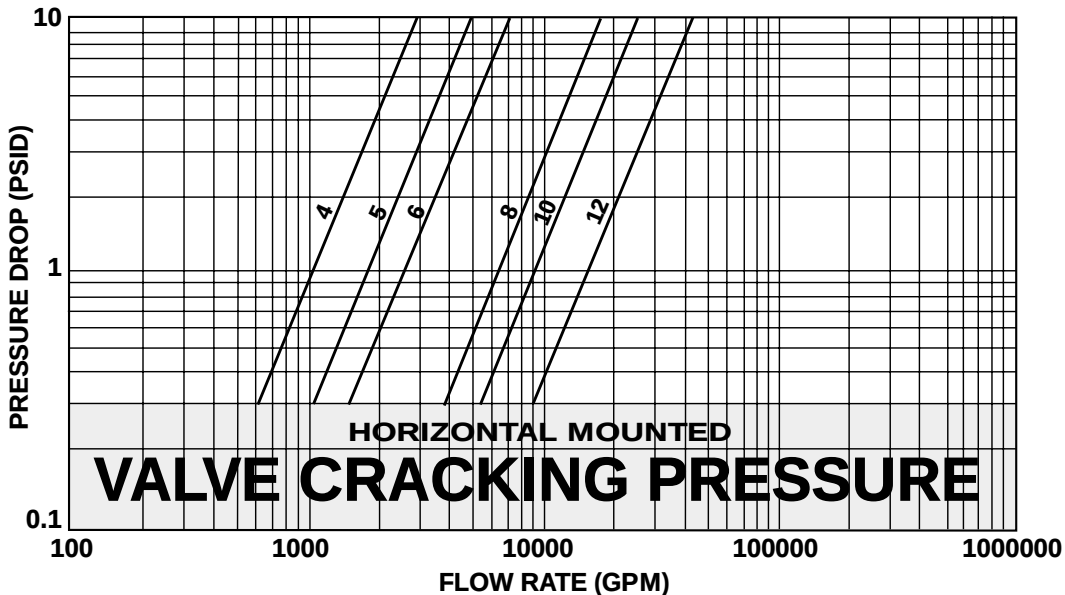
Sizes 4" - 12"



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

PRESSURE DROP - AIR

Sizes 4" - 12"



- (1) Pressure drop curves are based on air flow at 60 OF and 1 ATM pressure.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

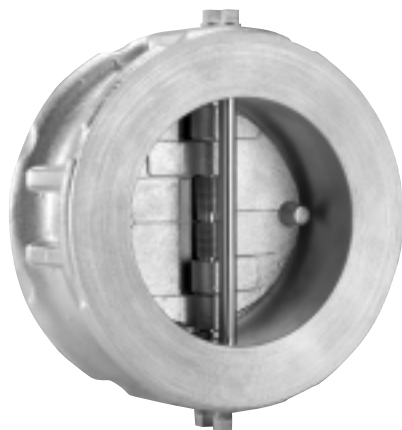
Installation Note:

- 1) For correct installation and maintenance please see our I&M manual.
- 2) Horizontal installation – Disc pin must be installed in vertical position.
- 3) Vertical installation (downward flow) – Consult factory.

C_v VALUES (US-GPM @ 1 PSID)

Valve Size (inches)	4	5	6	8	10	12
C _v	291	494	705	1795	2563	4295

NOTES:



600WT SERIES

CAST STEEL AND STAINLESS STEEL DOUBLE DOOR CHECK VALVES

PRESSURES TO 1480 PSIG (101.9 BARG)
TEMPERATURES TO 600°F (316°C)

APPLICATIONS

- Liquid and Air Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

- ANSI 600 PSIG rated check valves
- Wafer body style fits between FF or RF flanges
- Upper and lower SS thrust washers
- Resilient Buna-N , Viton and metal seats
- Seat design lifts then swings discs to minimize seat wear
- Shock bumpers minimize stresses in hinge pins
- Independent springs optimizes valve plate closing rates while minimizing spring stress
- Dual ratings 2"-3" 150#, 300# and 600#.

MODELS

- 600WTCT – Cast Steel Body, Stainless Steel Disc, Buna Seat
- 600WTTT – Stainless Steel Body, Stainless Steel Disc, Metal or Viton Seats

OPTIONS (Consult Factory)

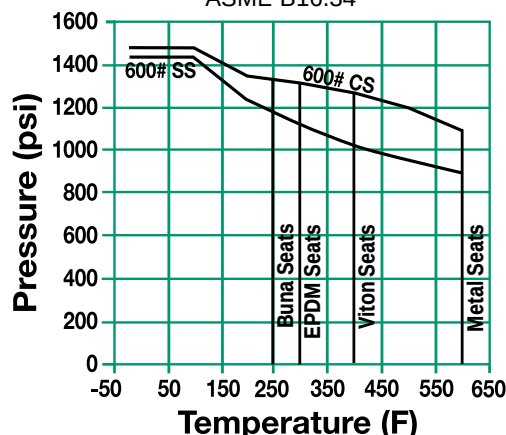
- EPDM Seats
- Other Spring Material

APPLICABLE CODES

- ASME B16.34
- API 594
- API 598

PRESSURE/TEMPERATURE CHART

ASME B16.34



600WT Series Ordering Code

Inlet Size				Dash	Model								Seat	Dash	Spring
0	2	0	0	-	6	0	0	W	T	T	T	V	-	T	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Inlet Size* - Position 1 - 4

0200 - 2"
0250 - 2½"
0300 - 3"

Dash - Position 5

Model - Position 6 - 12

300WTCT - CS Body
300WTTT - SS Body

Seat** - Position 13

B - Buna-N (CS Body only)
M - Metal (SS Body only)
V - Viton (SS Body only)

Dash - Position 14

Spring - Position 15

T - SS

* For sizes 2", 2½", 3"
600WT check valves fit
between all ANSI 150#,
300# & 600# class flanges.

** 600WTCT - Buna-N seat only,
600WTTT - Viton or Metal seat

600WT SERIES

CAST STEEL AND STAINLESS STEEL DOUBLE DOOR CHECK VALVES

SPECIFICATION

Check Valve shall be dual disc design with Cast Steel or Stainless Steel Body wafer body style meeting ASME B16.34 and API 594. The check valve shall have an integral cast bumper and Buna-N or Viton resilient seats with SS discs. The check valve shall be ANSI 600 PSIG rated. The spring shall be 316SS. The seat design shall lift then swing discs to minimize seat wear. The check valve shall be SSI 300WT Series.

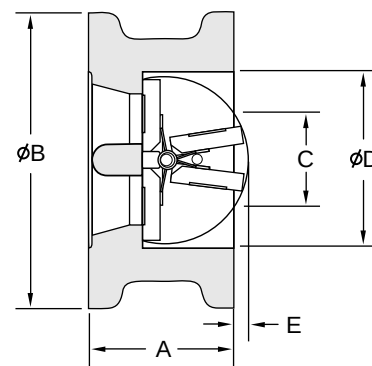
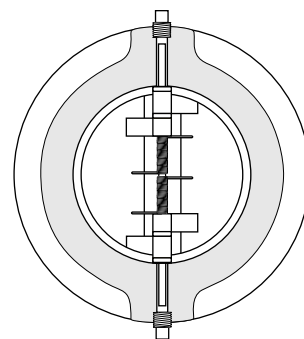
MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8M
Discs	A351-CF8M	A351-CF8M
Seat	Buna-N	Viton or Metal
Spring	316SS	316SS

CRACKING PRESSURE

Horizontal Mounting - .3psid

Vertical Mounting - .75 to 1.25 psid



**600WT DOUBLE DOOR
CHECK VALVE**

Connections: 2" to 3"
Wafer Flanged

Seats:
CS Body - 2" to 3" Buna-N
SS Body - 2" to 3" Viton or Metal

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size		A ¹	B*	C ²	D	E	STUD SELECTION			Weight
							Qty.	Dia.	Length	
2" (50)	150#	2.38 (60)	4.13 (105)	0.00 (0)	2.38 (60)	0.00 (0)	4	0.63 (15.9)	6.00 (152)	6 (2.7)
	300#/600#	2.38 (60)	4.38 (111)	0.00 (0)	2.38 (60)	0.00 (0)	8	0.63 (15.9)	6.88 (175)	6 (2.7)
2½" (65)	150#	2.64 (67)	4.87 (124)	2.00 (51)	3 (77)	.25 (6)	4	.63 (15.9)	6.25 (159)	10 (4.5)
	300#/600#	2.64 (67)	5.13 (130)	2.00 (51)	3 (77)	.25 (6)	8	.75 (19)	7.5 (190)	10 (4.5)
3" (80)	150#	2.88 (73)	5.38 (137)	2.00 (51)	3.50 (89)	0.25 (6)	4	0.63 (15.9)	7.00 (178)	13 (5.9)
	300#/600#	2.88 (73)	5.88 (149)	2.00 (51)	3.50 (89)	0.25 (6)	8	0.75 (19)	8.13 (207)	13 (5.9)

1. Dimensions in accordance with API 594.

2. Minimum diameter of companion flanges.

3. 300WT and 600WT are interchangeable, use 600WT for both applications.

Dimensions are subject to change. Consult factory for certified drawings when required.

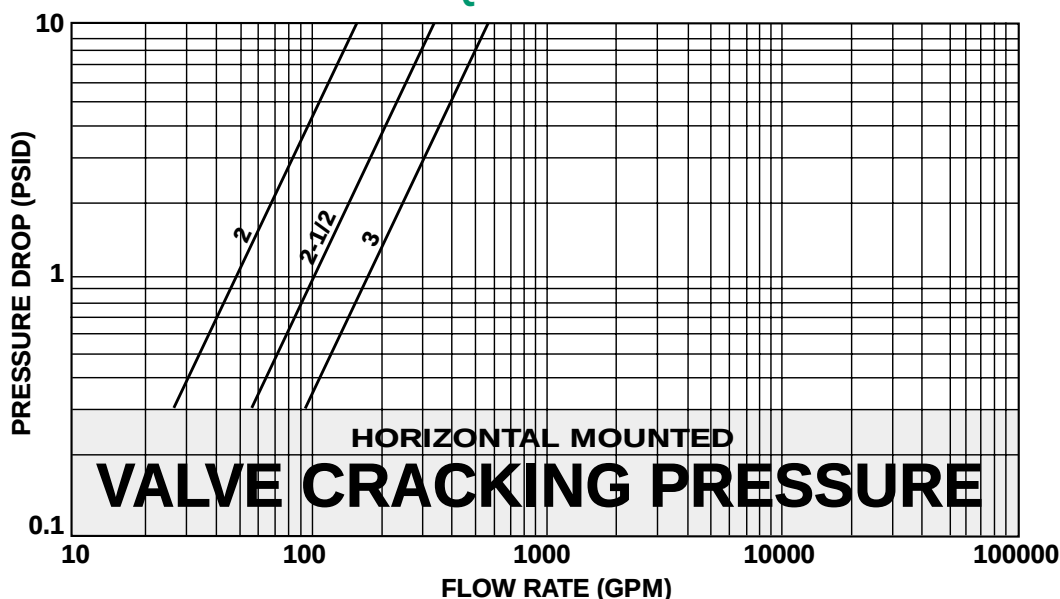
* Add the "B" dimension and the diameter of the stud to achieve the ANSI B16.5 bolt hole circle diameter.

600WT SERIES DOUBLE DOOR CHECK VALVES

CAST STEEL AND STAINLESS STEEL

PRESSURE DROP - LIQUIDS

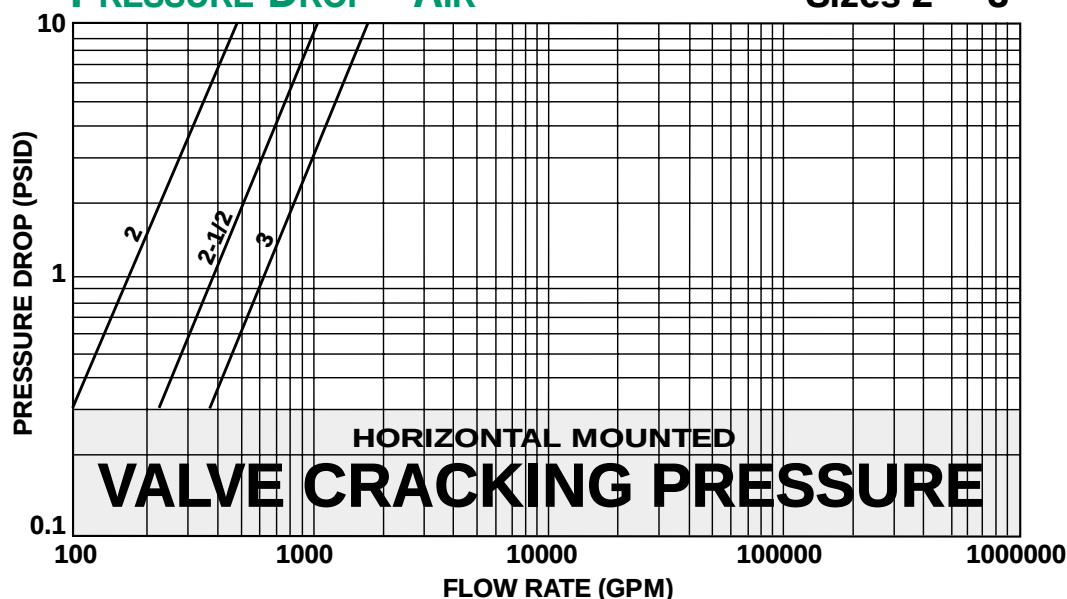
Sizes 2" - 3"



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

PRESSURE DROP - AIR

Sizes 2" - 3"



- (1) Pressure drop curves are based on air flow at 60 OF and 1 ATM pressure.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

C_v VALUES (US-GPM @ 1 PSID)

Valve Size (inches)	2	2½	3
C _v	48	90	171

Installation Note:

- 1) For correct installation and maintenance please see our I&M manual.
- 2) Horizontal installation – Disc pin must be installed in vertical position.
- 3) Vertical installation (downward flow) – Consult factory.

INSTALLATION AND MAINTENANCE INSTRUCTIONS

DOUBLE DOOR CHECK VALVES

VALVE LOCATION AND ORIENTATION IN PIPING

Check valves should be installed, if possible, a minimum of 6 pipe diameters from other line elements, i.e. elbows, pumps, valves, etc.

Horizontal Lines

- Valves installed in horizontal lines must be bolted in place with the hinge post in the vertical position, i.e. in such a manner that the hinge pin retainers are at the top and bottom of the installed valve, perpendicular to the flow.

Vertical Lines

- In the upward position, no special attention needs to be given to the hinge post position. The only exception being when mounted directly downstream of an elbow. In this case the hinge post should be mounted perpendicular to the outermost portion of the elbow. Consult factory for vertical down flow applications.

PRECAUTIONS

- Do not install Series WT check valves directly against another valve whereby the check valve discharges downstream directly into the valve.
- Do not install the valve whereby it directly discharges downstream into a tee or elbow fitting.
- Series WT check valves should not be used in severe pulsating services such as reciprocating compressor discharges.
- It is recommended that the check valves be installed a minimum of three pipe diameters downstream of a pump or compressor.

MAINTENANCE

Spence Series WT check valves are permanently lubricated and normally require no routine maintenance.

RECONDITIONING

IMPORTANT! PRIOR TO DISASSEMBLY, VALVE MUST FIRST BE ISOLATED FROM SYSTEM PRESSURE AND FLOW.

Disc & Shaft Removal

CAUTION! BEFORE ATTEMPTING THE FOLLOWING SHAFT EXTRACTION, BE SURE TO PRESS A HAND OVER THE DISC SPRING. FAILURE TO DO THIS MAY RESULT IN PERSONAL INJURY DUE TO THE SPRING "LAUNCHING" ITSELF UNEXPECTEDLY ONCE THE SHAFT IS PULLED FREE OF IT.

- After observing the above precaution, remove the valve from the pipeline and lay flat with open, body cavity side facing up. Remove pipe plugs from top and bottom of body with a wrench. Insert a punch and lightly tap the top of the shaft until it is accessible on the other side of the body. Pull shaft through body to remove. The internals of the valve are now ready to be cleaned and inspected.

REASSEMBLY

Use new replacement parts, as required and a liberal amount of general-purpose grease (such as Mystic JT-6) on seals and machined mating surfaces. Reinsert the disc into the body cavity with the shaft holes inline with top and bottom shaft port. Slide the shaft into the

body through the shaft opening on one side of the valve. Continue sliding the shaft through the disc, spring and remaining shaft port the opposite side of the body. Install pipe plugs into the body using a good industrial grade thread sealant compound.

NOTES:

Applications

- Liquid Service
- Process Industry
- Power Industry
- Chemical Industry
- Metals & Mining
- Water & Waste Water
- Pulp & Paper
- Oil & Gas

Wafer Silent Check Valves

**Pressures to 740 PSIG
Temperatures to 400°F**

FEATURES

- Silent Non-slam Closure
- Wafer Body Style
- Reduces surge and water hammer

MATERIALS

- Cast Iron Body;
Bronze & Stainless Steel Disc
- Cast Steel Body;
Stainless Steel Disc
- Stainless Steel;
Stainless Steel Disc

END CONNECTIONS

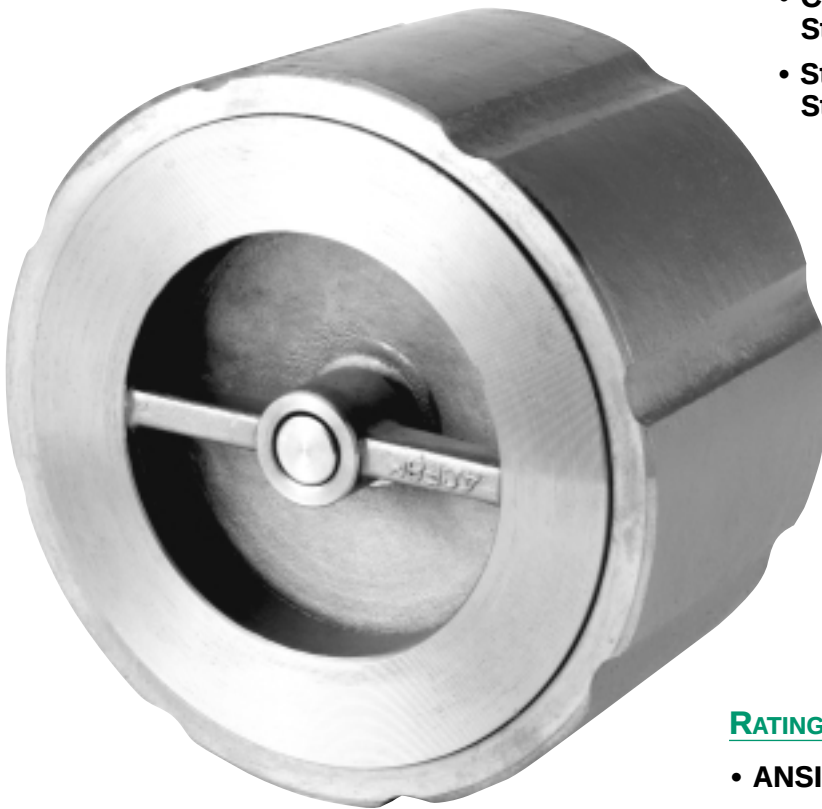
- Wafer Flat Faced
- Wafer Raised Face

SIZES

- 2" (50mm)
up to 12" (300mm)

RATINGS

- ANSI 125 PSIG
- ANSI 150 PSIG
- ANSI 300 PSIG



WAFER SILENT
CHECK VALVES



125WC SERIES

CAST IRON

WAFER SILENT CHECK VALVES

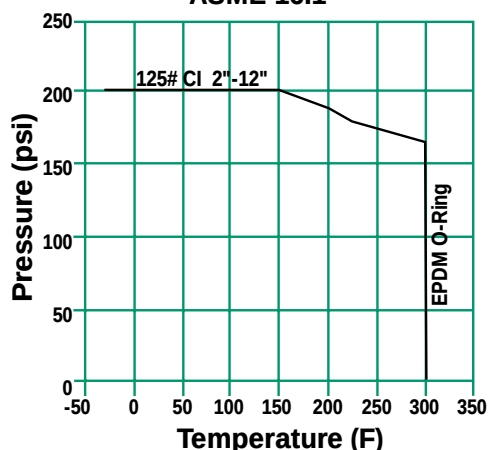
Pressures to 200 PSIG (13.8 barg)
Temperatures to 300°F (149°C)

- ANSI rated 125 PSIG rated check valves
- Designed to reduce surge and water hammer
- Silent, non-slam closure
- Center guided at both ends to prevent binding and cocking
- Compact face to face length for space saving
- Wafer body style fits between FF or RF flanges

APPLICATIONS

- Liquid Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

PRESSURE/TEMPERATURE CHART
ASME 16.1



MODELS

- 125WCIB - Cast Iron Body, Bronze Disc
- 125WCIT - Cast Iron Body, Stainless Steel Disc

OPTIONS *(Consult factory)*

- EPDM Seats
- Other Spring Material
- Heavier or Lighter Springs

APPLICABLE CODES

- ASME B16.1
- API 598

125WC Series Ordering Code

Inlet Size				Dash		Model						Seat	Dash	Spring
0	8	0	0	-	1	2	5	W	C	I	B	M	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size - Position 1 - 4

0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5

Model - Position 6 - 12

125WCIB - Cast Iron Body, Bronze Disc
125WCIT - Cast Iron Body, Stainless Steel Disc

Seat - Position 13

M - Metal

Dash - Position 14

Spring - Position 15

T - Stainless Steel

125WC SERIES

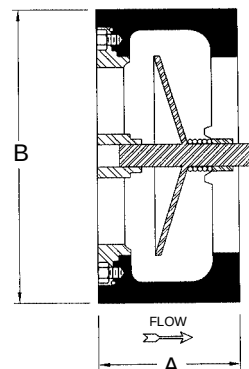
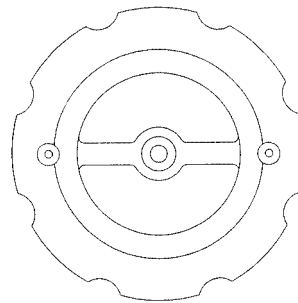
CAST IRON WAFER SILENT CHECK VALVES

SPECIFICATION

Check Valve shall be single disc design with Cast Iron wafer body style meeting ASME B16.1. The check valve shall have a metal to metal seat with bronze or SS discs and be center guided from both ends. The check valve shall be ANSI 125 PSIG rated. The spring shall be 316SS. The check valve shall be SSI 125WC Cast Iron Series.

MATERIALS OF CONSTRUCTION

Body A126-B Cast Iron
 Discs Al/Bz B148 C954 or 316SS A351-CF8M
 Seat Bronze or SS
 Spring 316SS
 O-Ring EPDM



125WC WAFER SILENT
CHECK VALVES

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size	A	B*	QTY	Stud Selection		Weight
				Dia.	Length	
2 (50)	2 ¹¹ / ₁₆ (68)	4 ¹ / ₈ (105)	4	⁵ / ₈ (16)	6 ¹ / ₂ (165)	5 (2.3)
2 ¹ / ₂ (65)	2 ⁷ / ₈ (73)	4 ⁷ / ₈ (124)	4	⁵ / ₈ (16)	6 ³ / ₄ (171)	8 (3.6)
3 (80)	3 ³ / ₁₆ (81)	5 ³ / ₈ (137)	4	⁵ / ₈ (16)	7 (178)	10 (4.5)
4 (100)	4 (103)	6 ⁷ / ₈ (175)	8	⁵ / ₈ (16)	8 (203)	19 (8.6)
5 (125)	4 ⁵ / ₈ (118)	7 ³ / ₄ (197)	8	³ / ₄ (19)	8 ³ / ₄ (222)	30 (13.6)
6 (150)	5 ⁹ / ₁₆ (142)	8 ³ / ₄ (222)	8	³ / ₄ (19)	10 ¹ / ₂ (267)	42 (19.1)
8 (200)	6 ¹ / ₂ (165)	11 (279)	8	³ / ₄ (19)	11 ¹ / ₄ (286)	87 (39.5)
10 (250)	8 ⁷ / ₃₂ (209)	13 ³ / ₈ (340)	12	⁷ / ₈ (22)	12 ¹ / ₄ (311)	146 (66.2)
12 (300)	11 ¹ / ₄ (286)	16 ¹ / ₈ (410)	12	⁷ / ₈ (22)	16 ¹ / ₂ (419)	304 (137.9)

*Add the "B" dimension and the diameter of the stud to achieve the ANSI B16.5 Bolt Hole Circle Diameter

Connections: 2" to 12" Flanged FF

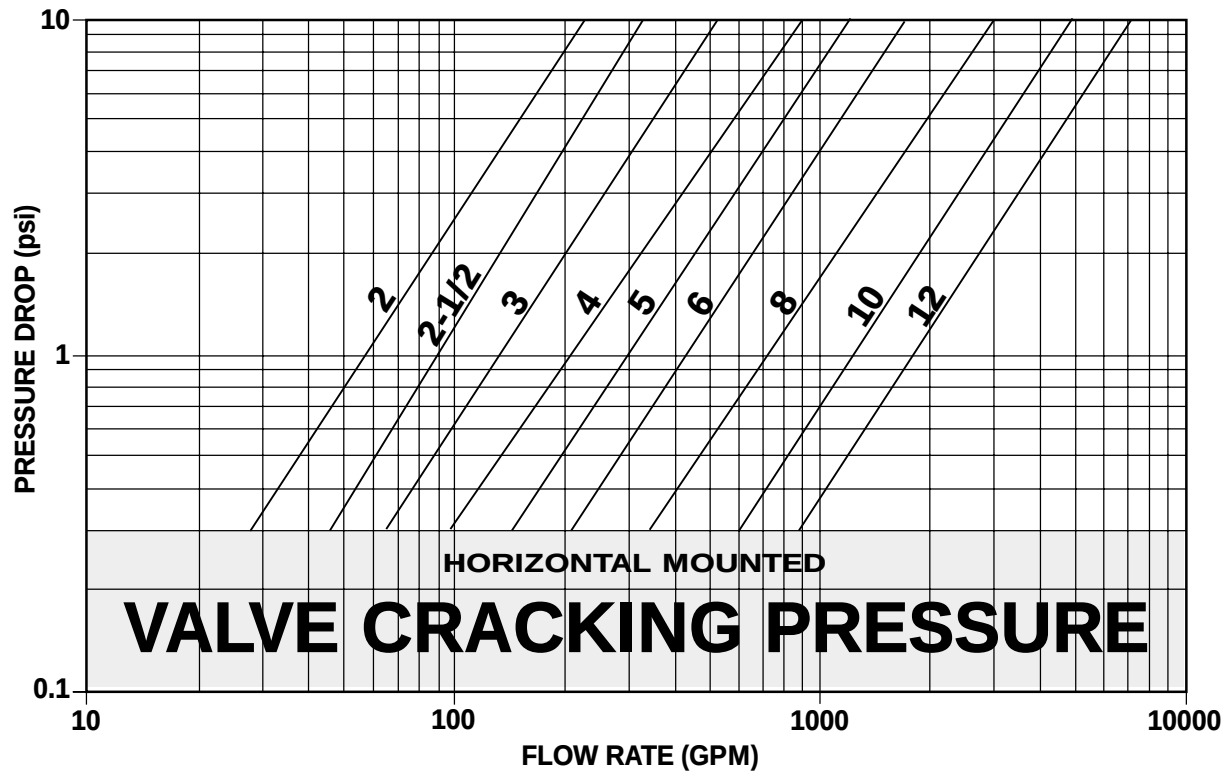
Seats: 2" to 12"
Bronze or Stainless Steel

Cracking Pressure:
Horizontal Mounting - .3 psid
Vertical Mounting - .75 to 1.25 psid

125WC SERIES WAFER SILENT CHECK VALVE

PRESSURE DROP VS FLOW RATE

(Sizes 2" - 12")



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

Installation Note:

1. For correct installation and maintenance please see our I&M manual.
2. Vertical installation (downward flow) – Consult factory.
3. Always use Strainers in upstream piping.
4. Not recommended for Steam Service

Cv Values

Size (inches)	2	2½	3	4	5	6	8	10	12
Min Cv (@ .3 PSID)	51	84	119	179	265	383	639	1114	1604
Cv (@ 1 PSID)	58	90	134	210	300	430	740	1250	1800
Max Cv (@ 10 PSID)	73	106	168	285	391	548	964	1581	2277

NOTES:



150WC SERIES

CAST STEEL AND STAINLESS STEEL WAFER SILENT CHECK VALVES

Pressures to 285 PSIG (19.7 barg)
Temperatures to 400°F (204°C)

APPLICATIONS

- Liquid Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

- ANSI rated 150 PSIG rated check valves
- Designed to reduce surge and Water Hammer
- Silent, non-slam closure
- Center guided at both ends to prevent binding and cocking
- Compact face to face length for space saving
- Wafer body style fits between FF or RF flanges
- Dual rating 150# and 300# in sizes 2" through 6"

MODELS

- 150WCCT – Cast Steel Body, Stainless Steel Disc
- 150WCTT – Stainless Steel Body, Stainless Steel Disc

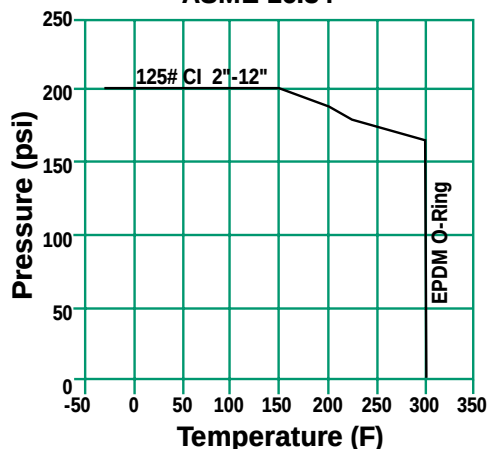
OPTIONS *(Consult factory)*

- Viton Seats
- Other Spring Material
- Heavier or Lighter Springs

APPLICABLE CODES

- ASME B16.34
- API 598

PRESSURE/TEMPERATURE CHART
ASME 16.34



150WC Series Ordering Code

Inlet Size				Dash	Model							Seat	Dash	Spring
1	0	0	0	-	1	5	0	W	C	T	T	M	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size* - Position 1 - 4
2" through 6" sizes use 300WC Series
0800 - 8"
1000 - 10"
1200 - 12"

Dash - Position 5

Model - Position 6 - 12
150WCCT - Cast Steel Body, Stainless Steel Disc
150WCTT - Stainless Steel Body, Stainless Steel Disc

Seat - Position 13
M - Metal

Dash - Position 14

Spring - Position 15
T - Stainless Steel

150WC SERIES

CAST STEEL AND STAINLESS STEEL

WAFER SILENT CHECK VALVES

SPECIFICATION

Check Valve shall be single disc design with Cast Steel or Stainless Steel wafer body style meeting ASME B16.34 and API 594. The check valve shall have a SS seat and disc and be center guided from both ends. The check valve shall be ANSI 150 PSIG rated. The spring shall be 316SS. The check valve shall be SSI 150WC Cast Steel or Stainless Steel Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8
Discs	A351-CF8	A351-CF8
Seat	A351-CF8	A351-CF8
Spring	316SS	316SS
O-Ring	Viton	Viton

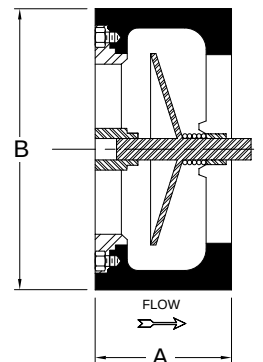
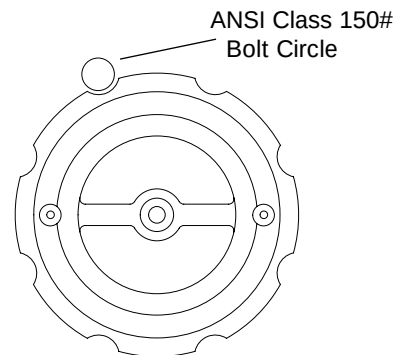
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size	A	B*	QTY	Stud Selection		Weight
				Dia.	Length	
2 ¹ (50)	Use 2" 300WC on page 551					
2 ¹ 2 ¹ (65)	Use 2½" 300WC on page 551					
3 ¹ (80)	Use 3" 300WC on page 551					
4 ¹ (100)	Use 4" 300WC on page 551					
5 ¹ (125)	Use 5" 300WC on page 551					
6 ¹ (150)	Use 6" 300WC on page 551					
8 (200)	6½ ₍₁₆₅₎	11 (279)	8	¾ (19)	11¼ (286)	79 (35.8)
10 (250)	8¼ (209)	13¾ (340)	12	7/8 (22)	12¼ (57)	147 (66.7)
12 (300)	11¼ (286)	16½ (410)	12	7/8 (22)	16½ (165)	280 (127)

1. Sizes 2" through 6" 150WC and 300WC are interchangeable, use 300WC for all applications in these sizes.

* Add the "B" dimension and the diameter of the stud to achieve the ANSI B16.5 Bolt Hole Circle Diameter.

Dimensions are subject to change. Consult factory for certified drawings when required.



Connections: 8" to 12"
Wafer Flanged RF*

* For sizes 2"-6" use 300WC on page 551

Seats: 8" to 12" Stainless Steel

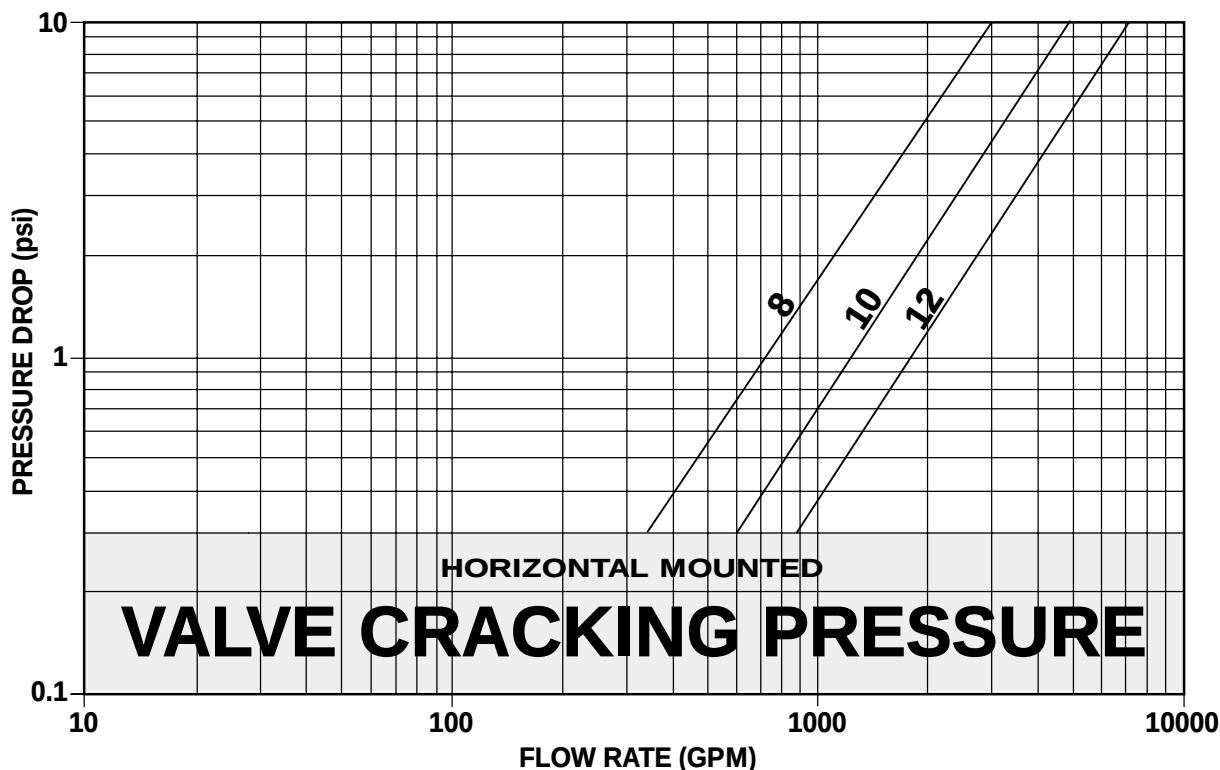
Cracking Pressure:
Horizontal Mounting - .3 psid
Vertical Mounting - .75 to 1.25 psid

150WC WAFER SILENT
CHECK VALVES

150WC SERIES CAST STEEL & STAINLESS STEEL WAFER SILENT CHECK VALVES

PRESSURE DROP VS FLOW RATE

(Sizes 8" - 12")



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

Installation Note:

1. For correct installation and maintenance please see our I&M manual.
2. Vertical installation (downward flow) – Consult factory.
3. Always use Strainers in upstream piping.
4. Not recommended for Steam Service.

Cv Values

Size (inches)	8	10	12
Min Cv (.3 PSID)	639	1114	1604
Cv (@ 1 PSID)	740	1250	1800
Max Cv (@ 10 PSID)	1297	1992	2593

NOTES:



300WC SERIES CAST STEEL AND STAINLESS STEEL WAFER SILENT CHECK VALVES

Pressures to 740 PSIG (51 barg)
Temperatures to 400°F (204°C)

APPLICATIONS

- Liquid Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

- ANSI rated 300 PSIG rated check valves
- Designed to reduce surge and Water Hammer
- Silent, non-slam closure
- Center guided at both ends to prevent binding and cocking
- Compact face to face length for space saving
- Wafer body style fits between FF or RF flanges
- Dual rating 150# and 300# in sizes 2" through 6"

MODELS

- 300WCCT – Cast Steel Body, Stainless Steel Disc
- 300WCTT – Stainless Steel Body, Stainless Steel Disc

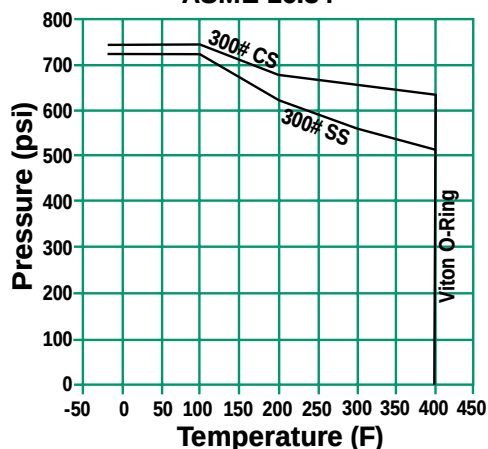
OPTIONS *(Consult factory)*

- Viton Seats
- Other Spring Material
- Heavier or Lighter Springs

APPLICABLE CODES

- ASME B16.34
- API 598

**PRESSURE/TEMPERATURE CHART
ASME 16.34**



300WC Series Ordering Code

Inlet Size				Dash		Model						Seat	Dash	Spring
0	3	0	0	-	3	0	0	W	C	C	T	M	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size* - Position 1 - 4

0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"

Dash - Position 5

Model - Position 6 - 12

300WCCT - Cast Steel Body, Stainless Steel Disc
300WCTT - Stainless Steel Body, Stainless Steel Disc

Seat - Position 13

M - Metal

Dash - Position 14

Spring - Position 15

T - Stainless Steel

300WC SERIES

CAST STEEL AND STAINLESS STEEL

WAFER SILENT CHECK VALVES

SPECIFICATION

Check Valve shall be single disc design with Cast Steel or Stainless Steel wafer body style meeting ASME B16.34. The check valve shall have a SS seat and disc and be center guided from both ends. The check valve shall be ANSI 300 PSIG rated. The spring shall be 316SS. The check valve shall be SSI 300WC Cast Steel or Stainless Steel Series.

MATERIALS OF CONSTRUCTION

Part	Carbon Steel	Stainless Steel
Body	A216-WCB	A351-CF8
Discs	A351-CF8	A351-CF8
Seat	A351-CF8	A351-CF8
Spring	316SS	316SS
O-Ring	Viton	Viton

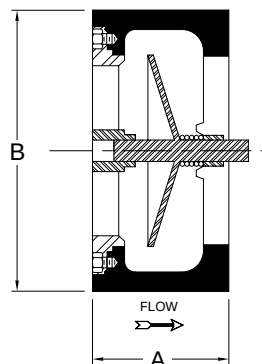
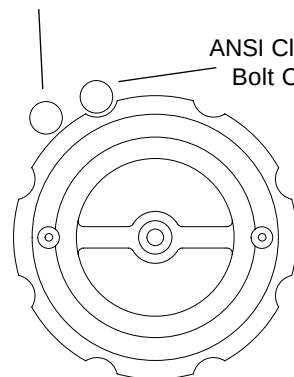
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size		A	B *	Stud Selection		Length	Weight
				QTY	Dia		
2 (50)	150	2 $\frac{5}{8}$ (67)	4 $\frac{1}{8}$ (105)	4	$\frac{5}{8}$ (16)	6 $\frac{1}{4}$ (159)	5 (2.3)
	300	2 $\frac{5}{8}$ (67)	4 $\frac{3}{8}$ (111)	8	$\frac{5}{8}$ (16)	6 $\frac{1}{2}$ (165)	5 (2.3)
2 $\frac{1}{2}$ (65)	150	2 $\frac{7}{8}$ (73)	4 $\frac{7}{8}$ (124)	4	$\frac{5}{8}$ (16)	6 $\frac{3}{4}$ (171)	7 (3.2)
	300	2 $\frac{7}{8}$ (73)	5 $\frac{1}{8}$ (130)	8	$\frac{3}{4}$ (19)	7 $\frac{1}{4}$ (184)	7 (3.2)
3 (80)	150	3 $\frac{1}{8}$ (79)	5 $\frac{7}{8}$ (137)	4	$\frac{5}{8}$ (16)	7 (178)	11 (5.0)
	300	3 $\frac{1}{8}$ (79)	5 $\frac{7}{8}$ (149)	8	$\frac{3}{4}$ (19)	7 $\frac{3}{4}$ (197)	11 (5.0)
4 (100)	150	4 (102)	6 $\frac{7}{8}$ (175)	8	$\frac{5}{8}$ (16)	8 (2.3)	20 (9.1)
	300	4 (102)	7 $\frac{1}{8}$ (181)	8	$\frac{3}{4}$ (19)	9 (229)	20 (9.1)
5 (125)	150	4 $\frac{5}{8}$ (117)	7 $\frac{3}{4}$ (197)	8	$\frac{3}{4}$ (19)	8.5 (216)	34 (15.4)
	300	4 $\frac{5}{8}$ (117)	8 $\frac{1}{2}$ (216)	8	$\frac{3}{4}$ (19)	9 $\frac{3}{4}$ (247)	34 (15.4)
6 (150)	150	5 $\frac{9}{16}$ (141)	8 $\frac{3}{4}$ (222)	8	$\frac{3}{4}$ (19)	10 (254)	42 (19.1)
	300	5 $\frac{9}{16}$ (141)	9 $\frac{7}{8}$ (251)	12	$\frac{3}{4}$ (19)	10 $\frac{3}{4}$ (273)	42 (19.1)

* Add the "B" dimension and the diameter of the stud to achieve the ANSI B16.5 Bolt Hole Circle Diameter.

ANSI Class 300# Bolt Circle

ANSI Class 150# Bolt Circle



Connections: 2" to 6"
Wafer Flanged RF*

* Sizes 2"-6" are dual rated for 150# and 300# applications and fit between both flanges.

Seats: 2" to 6" Stainless Steel

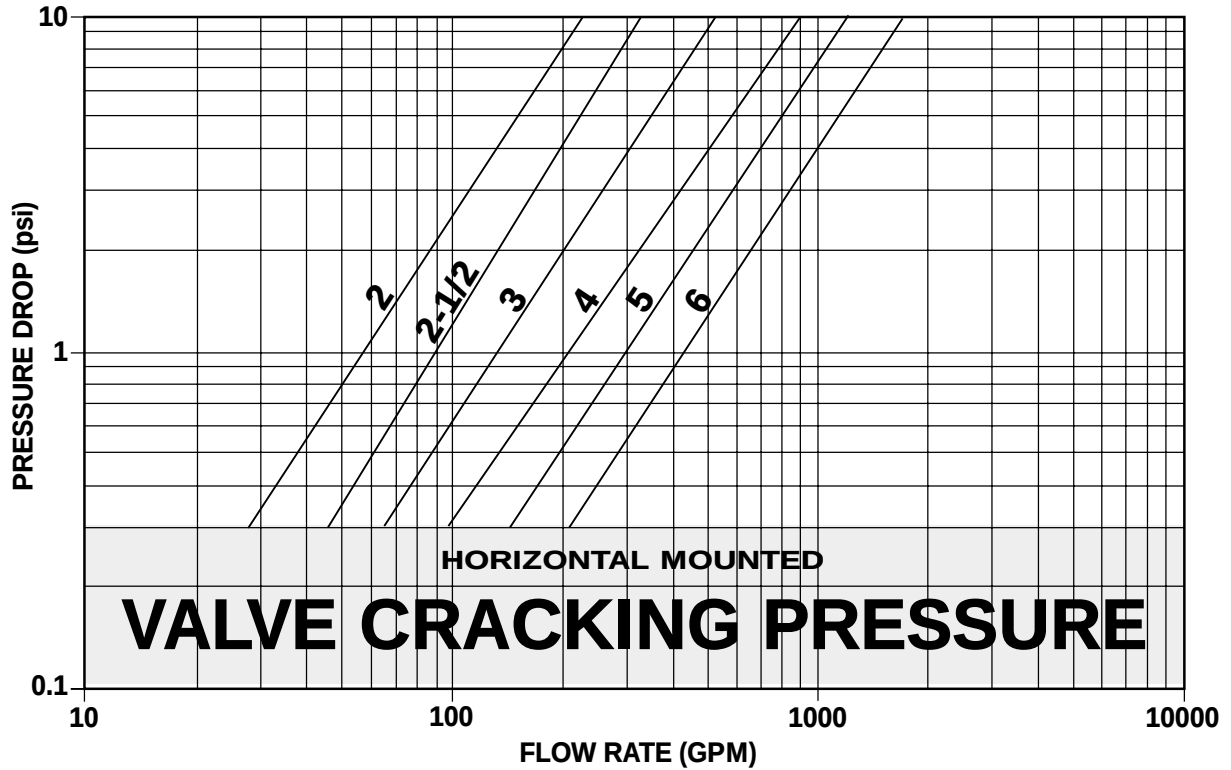
Cracking Pressure:
Horizontal Mounting - .3 psid
Vertical Mounting - .75 to 1.25 psid

300WC WAFER SILENT
CHECK VALVES

300WC SERIES WAFER SILENT CHECK VALVE

PRESSURE DROP VS FLOW RATE (Sizes 2" - 6")

300WC WAFER SILENT
CHECK VALVES



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

Installation Note:

1. For correct installation and maintenance please see our I&M manual.
2. Vertical installation (downward flow) – Consult factory.
3. Always use Strainers in upstream piping.
4. Not recommended for Steam Service

Cv Values

Size (inches)	2	2½	3	4	5	6
Min Cv (@ .3 PSID)	51	84	119	179	265	383
Cv (@ 1 PSID)	58	90	134	210	300	430
Max Cv (@ 10 PSID)	73	106	168	285	391	548

WAFER SILENT CHECK VALVES

INSTALLATION AND MAINTENANCE INSTRUCTIONS

Check valves should be installed, if possible, a minimum of 6 pipe diameters from other line elements, i.e. elbows, pipes, valves, etc.

CHECK VALVE INSTALLATION

- Valves may be installed upward vertically, horizontally, or at other angles. For vertical downward flow please consult with the factory.
- Install the valve with proper positioning of the flow arrow.
- Support and align adjacent piping and the valve
- Install lubricated flange bolts.
- Hand tighten, then torque the bolts using the cross-over flange bolt tightening method to load the bolts evenly, and eliminate concentrated stresses.
- Valves must be mounted to ANSI flanges with conventional flat face or ring gaskets.
- Proper centering of the ring gaskets is important to prevent internal leakage.
- Never lift the valve by the bronze or stainless steel trim.
- Install a strainer in the piping.

PRECAUTIONS

- Do not install check valves directly against another valve whereby the check valve discharges downstream directly into the valve.
- Do not install the valve whereby it directly discharges downstream into a tee or elbow fitting.
- These valves are not suggested for installation in sewage ejector piping.
- Careful consideration should be given to the selection of valves for use in an air, steam, hot water and boiler feed systems. Consult our factory on these applications.
- Individuals performing removal and disassembly should be provided with suitable protection from possibly hazardous liquids.
- Prior to disassembly, valve must first be isolated from system pressure and flow.
- Upon disassembly ensure spring pressure is released slowly to prevent personal injury due to the spring “launching” itself unexpectedly.

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below: If the purchaser believes a product defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product. (b) If permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at its discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund described above, the purchaser agrees that the manufacturer shall not be liable

for any losses, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of foregoing. No other warranties, written or oral, expressed or implied, including the warranties of fitness for a particular purpose and merchantability, are made or authorized. No affirmation of fact, promise, description of product use or sample or model shall create any warranty from the manufacturer, unless signed by the president. These products are not manufactured, sold or intended for personal, family or household purposes.

NOTES:

Applications

- Liquid Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Metals & Mining
- Water & Waste Water
- Pulp & Paper
- Marine

Flanged Silent Check Valves

**Pressures to 285 PSIG
Temperatures to 400°F**

FLANGED SILENT
CHECK VALVES

FEATURES

- Silent Non-slam Closure
- Flanged Body Style
- Metal to Metal Seats

MATERIALS

- Cast Iron Body;
Bronze Disc
- Cast Steel Body;
Stainless Steel Disc
- Stainless Steel Body;
Stainless Steel Disc

END CONNECTIONS

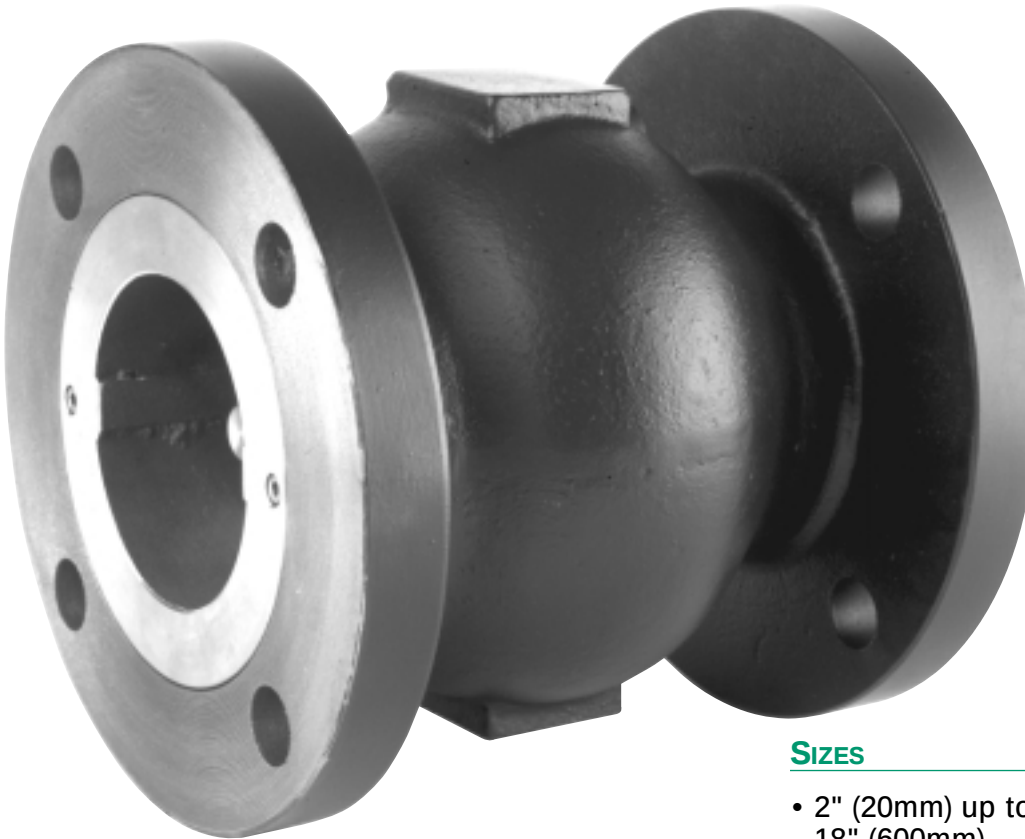
- Flat Faced
- Raised Faced

SIZES

- 2" (20mm) up to
18" (600mm)

RATINGS

- ANSI 125 psig
- ANSI 150 psig





125FC SERIES CAST IRON FLANGED SILENT CHECK VALVES

Pressures to 200 PSIG (13.8 barg)
Temperatures to 300°F (149°C)

APPLICATIONS

- Liquid Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

- ANSI rated 125 PSIG rated strainers
- Designed to reduce surge and water hammer
- Silent, non-slam closure
- Center guided at both ends to prevent binding and cocking
- Flanged body style
- Bronze Metal to Metal Seats
- Designed to reduce Water Hammer

MODELS

- 125FCIB - Cast Iron Body, Bronze Seat and Disc

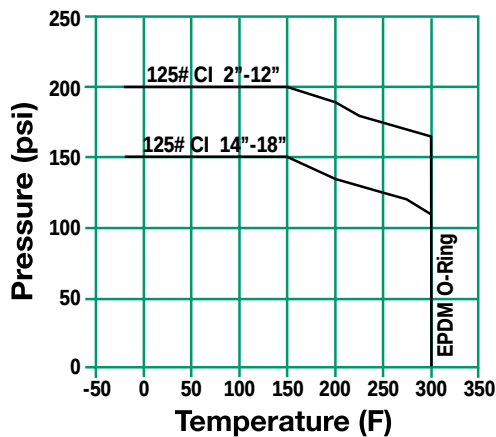
OPTIONS *(Consult factory)*

- Other Spring Material
- Heavier or Lighter Springs

APPLICABLE CODES

- ASME B16.1
- API 598

PRESSURE/TEMPERATURE CHART



125FC Series Ordering Code

Inlet Size				Dash	Model							Seat	Dash	Spring
0	8	0	0	-	1	2	5	F	C	I	B	M	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size - Position 1 - 4

0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"
1400 - 14"
1600 - 16"
1800 - 18"

Dash - Position 5

Model - Position 6 - 12
125FCIB - CI Body, Bz Disc

Seat - Position 13
M - Metal

Dash - Position 14

Spring - Position 15
T - Stainless Steel

125FC SERIES CAST IRON FLANGED SILENT CHECK VALVES

SPECIFICATION

Check Valve shall be single disc design with Cast Iron Flanged body style meeting ASME B16.1. The check valve shall have a metal to metal seat with bronze seat and disc. The check valve shall be ANSI 125 PSIG rated. The spring shall be 316SS. The check valve shall be SSI 125FC Cast Iron Series.

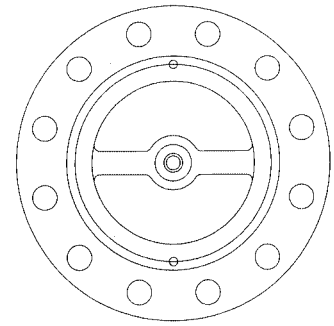
MATERIALS OF CONSTRUCTION

Body A126-B Cast Iron
Discs.....B62 Bronze
Seat B62 Bronze
Spring 316SS
O-Ring EPDM

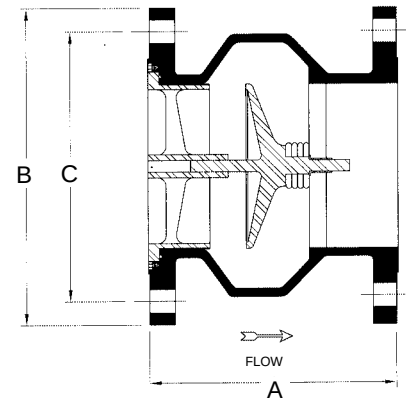
DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

Size	A	B	C	Weight
2 (50)	6½ (156)	6 (152)	4¾ (121)	21 (9.4)
2½ (65)	7 (178)	7 (178)	5½ (140)	31 (13.8)
3 (80)	7½ (191)	7½ (191)	6 (153)	37 (16.5)
4 (100)	8½ (216)	9 (229)	7½ (191)	62 (28)
5 (125)	9½ (241)	10 (254)	8½ (216)	80 (36)
6 (150)	10½ (267)	11 (280)	9½ (241)	106 (48)
8 (200)	13½ (343)	13½ (343)	11¾ (299)	175 (79)
10 (250)	16¾ (413)	16 (406)	14¾ (362)	267 (121)
12 (300)	20¾ (515)	19 (483)	17 (431)	477 (216)
14 (350)	22¾ (580)	21 (53)	18¾ (477)	785 (356)
16 (400)	24¾ (629)	23½ (597)	21¼ (540)	900 (408)
18 (450)	22½ (572)	25 (635)	22¾ (578)	1032 (468)

Dimensions shown are subject to change.
Contact factory for certified prints when required.



FRONT VIEW



Connections: 2" to 18" Flanged FF

Seats: 2" to 18" Bronze

Cracking Pressure:
Horizontal Mounting - .3 psid
Vertical Mounting - .75 to 1.25 psid

125FC FLANGED SILENT
CHECK VALVES

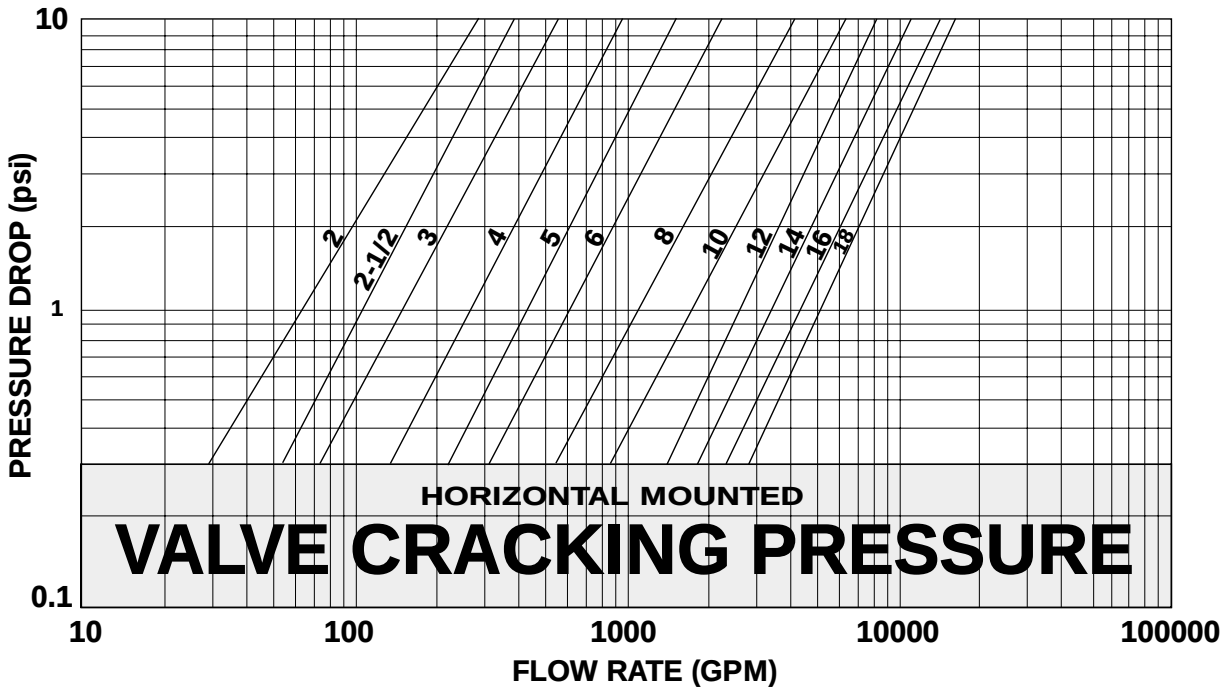
125FC SERIES

CAST IRON FLANGED SILENT CHECK VALVES

PRESSURE DROP VS FLOW RATE

(Sizes 2" - 18")

125FC FLANGED SILENT
CHECK VALVES



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

Installation Note:

1. For correct installation and maintenance please see our I&M manual.
2. Vertical installation (downward flow) – Consult factory.
3. Always use Strainers in upstream piping.
4. Not recommended for Steam Service

Cv Values

Size (inches)	2	2½	3	4	5	6	8	10	12	14	16	18
Min Cv (@.3 PSID)	53	99	135	246	402	566	1004	1579	2556	3286	4199	5112
CV (@1 PSID)	63	105	148	265	430	605	1105	1700	2575	3350	4300	5225
Max Cv (@10 PSID)	89	120	174	300	474	696	1297	1992	2593	3479	4427	5376

NOTES:



150FC SERIES

CAST STEEL AND STAINLESS STEEL FLANGED SILENT CHECK VALVES

Pressures to 285 PSIG (19.7 barg)
Temperatures to 400°F (204°C)

- ANSI rated 150 PSIG rated strainers
- Designed to reduce surge and water hammer
- Silent, non-slam closure
- Center guided at both ends to prevent binding and cocking
- Flanged body style
- Stainless Steel Metal to Metal Seats

APPLICATIONS

- Liquid Service
- Process Industry
- Power Industry
- Chemical Industry
- Oil & Gas
- Pulp & Paper
- Metal & Mining
- Water & Waste

MODELS

- 150FCCT - Cast Steel Body, Stainless Steel Seat and Disc
- 150FCTT - Cast Steel Body, Stainless Steel Seat and Disc

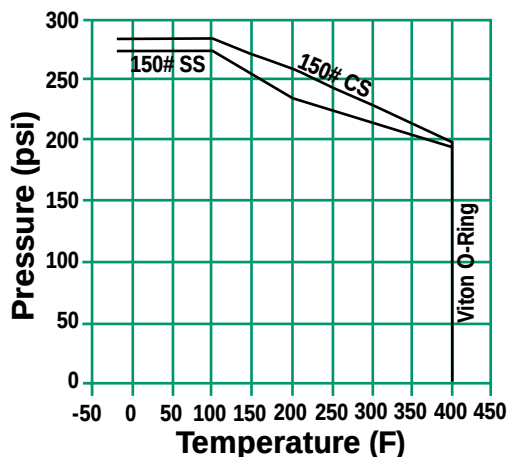
OPTIONS *(Consult factory)*

- Other Spring Material
- Heavier or Lighter Springs

APPLICABLE CODES

- ASME B16.34
- API 598

**PRESSURE/TEMPERATURE CHART
ASME 16.34**



150FC Series Ordering Code

Inlet Size				Dash	Model							Seat	Dash	Spring
0	4	0	0	-	1	5	0	F	C	T	T	M	-	T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size* - Position 1 - 4

- 0200 - 2"
- 0250 - 2½"
- 0300 - 3"
- 0400 - 4"
- 0500 - 5"
- 0600 - 6"
- 0800 - 8"
- 1000 - 10"
- 1200 - 12"
- 1400 - 14"
- 1600 - 16"

* Cast Steel body 2" - 16"
Stainless Steel body 2" - 12"

Dash - Position 5

Model - Position 6 - 12

- 150FCCTT - CS Body, SS Disc
- 150FCTTT - SS Body, SS Disc

Seat - Position 13

- M - Metal

Dash - Position 14

Spring - Position 15

- T - Stainless Steel

150FC SERIES

CAST STEEL AND STAINLESS STEEL FLANGED SILENT CHECK VALVES

SPECIFICATION

Check Valve shall be single disc design with Cast Steel or Stainless Steel Flanged body style meeting ASME B16.34. The check valve shall have a metal to metal seat with Stainless Steel seat and disc. The check valve shall be ANSI 150 PSIG rated. The spring shall be 316SS. The check valve shall be SSI 150FC Cast Steel or Stainless Steel Series.

MATERIALS OF CONSTRUCTION

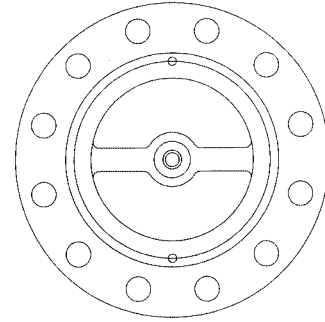
Part	Cast Steel	Stainless Steel
Body	A216 WCB	A351 CF8M
Discs	A351 CF8M	A351 CF8M
Seat	A351 CF8M	A351 CF8M
Spring	316SS	316SS
O-Ring	Viton	Viton

DIMENSIONS inches (mm) AND WEIGHTS pounds (kg)

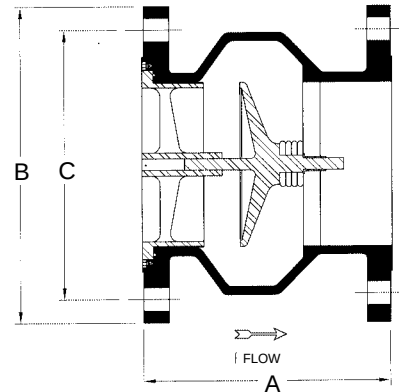
Size	A	B	C	Weight
2 (50)	6½ (159)	6 (152)	4¾ (121)	15 (6.6)
2½ (65)	7 (178)	7 (178)	5½ (140)	21 (9.3)
3 (80)	7½ (191)	7½ (191)	6 (153)	26 (11.5)
4 (100)	8½ (216)	9 (229)	7½ (191)	48 (21.3)
5 (125)	9½ (242)	10 (254)	8½ (216)	61 (27.3)
6 (150)	10½ (267)	11 (280)	9½ (241)	76 (34.1)
8 (200)	12 (305)	13½ (343)	11¾ (299)	129 (58.4)
10 (250)	14 (356)	16 (406)	14¼ (362)	183 (82.8)
12 (300)	18 (457)	19 (483)	17 (431)	344 (156)
14 * (350)	19½ (495)	21 (53)	18¾ (477)	433 (196)
16 * (400)	21 (533)	23½ (597)	21¼ (540)	607 (275)

* 14" and 16" only available in Cast Steel body, contact factory for Stainless Body availability.

Dimensions are subject to change.
Consult factory for certified drawings when required.



FRONT VIEW



Connections :

2" to 16" Cast Steel Body Flanged RF
2" to 12" Stainless Steel Body Flanged RF

Seats: All sizes - Stainless Steel

Cracking Pressure:

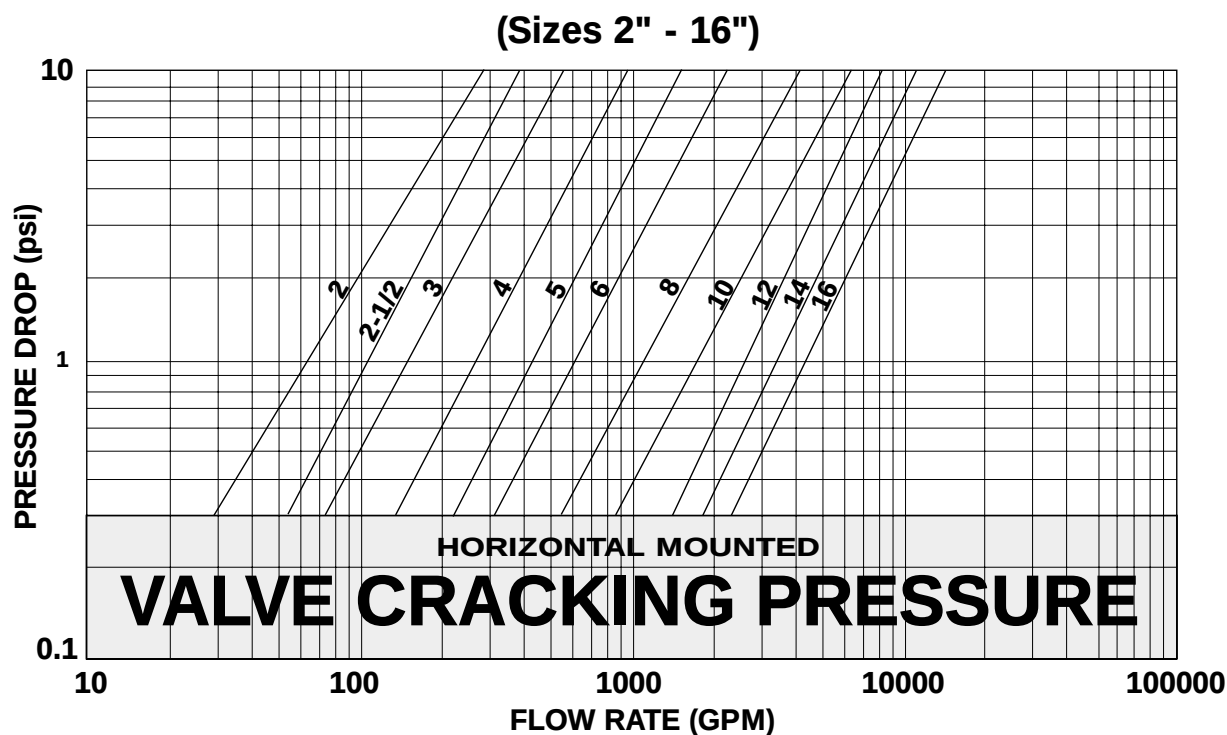
Horizontal Mounting - .3 psid
Vertical Mounting - .75 to 1.25 psid

150FC FLANGED SILENT
CHECK VALVES

150FC SERIES

CAST STEEL & STAINLESS STEEL FLANGED SILENT CHECK VALVES

PRESSURE DROP VS FLOW RATE



- (1) Pressure drop curves are based on water flow.
- (2) Valve cracking pressure is equal to or less than 0.3 psid when mounted horizontally.
- (3) Valve cracking pressure increases to between 0.75 and 1.25 psid when installed vertically with flow upwards.

Installation Note:

1. For correct installation and maintenance please see our I&M manual.
2. Vertical installation (downward flow) – Consult factory.
3. Always use Strainers in upstream piping.
4. Not recommended for Steam Service

Cv Values

Size (inches)	2	2½	3	4	5	6	8	10	12	14	16
Min Cv (@.3 PSID)	53	99	135	246	402	566	1004	1579	2556	3286	4199
Cv (@1 PSID)	63	105	148	265	430	605	1105	1700	2575	3350	4300
Max Cv (@10 PSID)	89	120	174	300	474	696	1297	1992	2593	3479	4427

FLANGED SILENT CHECK VALVES

INSTALLATION AND MAINTENANCE INSTRUCTIONS

Check valves should be installed, if possible, a minimum of 6 pipe diameters from other line elements, i.e. elbows, pipes, valves, etc.

CHECK VALVE INSTALLATION

- Valves may be installed upward vertically, horizontally, or at other angles. For vertical downward flow please consult with the factory.
- Install the valve with proper positioning of the flow arrow.
- Support and align adjacent piping and the valve
- Install lubricated flange bolts.
- Hand tighten, then torque the bolts using the cross-over flange bolt tightening method to load the bolts evenly, and eliminate concentrated stresses.
- Valves must be mounted to ANSI flanges with conventional flat face or ring gaskets.
- Proper centering of the ring gaskets is important to prevent internal leakage.
- Never lift the valve by the bronze or stainless steel trim.
- Install a strainer in the piping.

PRECAUTIONS

- Do not install check valves directly against another valve whereby the check valve discharges downstream directly into the valve.
- Do not install the valve whereby it directly discharges downstream into a tee or elbow fitting.
- These valves are not suggested for installation in sewage ejector piping.
- Careful consideration should be given to the selection of valves for use in an air, steam, hot water and boiler feed systems. Consult our factory on these applications.
- Individuals performing removal and disassembly should be provided with suitable protection from possibly hazardous liquids.
- Prior to disassembly, valve must first be isolated from system pressure and flow.
- Upon disassembly ensure spring pressure is released slowly to prevent personal injury due to the spring “launching” itself unexpectedly.

LIMITED WARRANTY

All products are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment, subject to the limitations below: If the purchaser believes a product defective, the purchaser shall: (a) Notify the manufacturer, state the alleged defect and request permission to return the product. (b) If permission is given, return the product with transportation prepaid. If the product is accepted for return and found to be defective, the manufacturer will, at its discretion, either repair or replace the product, f.o.b. factory, within 60 days of receipt, or refund the purchase price. Other than to repair, replace or refund described above, the purchaser agrees that the manufacturer shall not be liable

for any losses, costs, expenses or damages of any kind arising out of the product, its use, installation or replacement, labeling, instructions, information or technical data of any kind, description of product use, sample or model, warnings or lack of foregoing. No other warranties, written or oral, expressed or implied, including the warranties of fitness for a particular purpose and merchantability, are made or authorized. No affirmation of fact, promise, description of product use or sample or model shall create any warranty from the manufacturer, unless signed by the president. These products are not manufactured, sold or intended for personal, family or household purposes.

NOTES:

UNIFLEX COUPLINGS &
GENERAL USE VALVES

Applications

- Process Industry
- Power Industry
- Chemical Industry
- Oil and Gas
- Pulp and Paper
- Metals and Mining
- Water and Waste

Butterfly Valves

**Pressures To 200 PSIG
Temperatures to 300°F**



FEATURES

- Positive Shutoff
- Non-collapsible Phenolic Backed Seat
- Minimal Installation Costs

MATERIALS OF CONSTRUCTION

- Ductile Iron Body
- Stainless Steel Shaft
- Ductile Iron, Aluminum Bronze or 316 SS Disc

SEAT MATERIALS

- Buna-N
- EPDM
- Viton (upon request)

BODY TYPE

- Wafer
- Lug

SIZE RANGE

- 2" (50mm) upto 48" (1200mm)
- Larger Sizes upon request

RATINGS

- ANSI 125 psig

**BUTTERFLY VALVES
FEATURES**



BF SERIES BUTTERFLY VALVES

Pressures to 200 PSIG (13.8 BARG)
Temperatures to 225 F (107 C)

- Wafer or Lug body fits between FF or RF flanges
- Ductile Iron, Bronze or SS Disc
- EPDM or Buna-N Seats
- Four bushings ensure maximum shaft support and centralized alignment.
- 360 (degree) polished disc assures positive shutoff
- Non-collapsible phenolic backed seat
- Blowout proof one piece shaft and pinned disc
- Universal ISO 5211 mounting pad
- Dead end service screws standard on Lug body

APPLICATIONS

- Fluids and Gases
- HVAC
- Irrigation
- OEM
- Process Industry
- Oil and Gas
- Pulp and Paper
- Water and Waste Water

APPLICABLE CODES

- API 609-General Design (2"-24" & 24" only)
- ISO 5211 (Part I & II) - Mounting Pad
- MSS SP-67-Laying Length (2"-24" & 24" only)

MODELS

- 32 - Lug, Ductile Iron Body
- 42 - Wafer, Ductile Iron Body

OPTIONS

- 10 position or Infinite Lever handles
- Gear with handwheel and/or chain assist
- Pneumatic Actuators
- Electric Actuators
- Other electronic accessories
- Larger sizes upon request

BF Series Ordering Code

Inlet Size	Dash	Model	Disc	Seat	Bushing	Dead End	Dash	Operator	Actuator Orientation	Actuator Accessories	Positioner Set	Positioner Accessories	Dash	Inlet Pressure
0400	-	32	32	10	2	2	-	A						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Inlet Size - Box 1

0200 - 2"
0250 - 2½"
0300 - 3"
0400 - 4"
0500 - 5"
0600 - 6"
0800 - 8"
1000 - 10"
1200 - 12"
1400 - 14"
1600 - 16"
1800 - 18"
2000 - 20"
2400 - 24"

Dash - Box 2

Model - Box 3

32 - Lug, DI Body
42 - Wafer, DI Body
52 - Double Flanged, DI Body

Disc - Box 4

11 - Ductile Iron
21 - Bronze
32 - Stainless

Seat - Box 5

10 - EPDM
20 - Buna-N

Bushing - Box 6

1 - Bronze (>=14")
2 - Teflon (<14")

Dead End - Box 7

1 - STD (Only Wafer)
2 - Dead End (Only Lug)

Dash - Box 8

Operator - Box 9

A - Bare Shaft
01 - Lever - std 10 position
02 - Lever - Infinite position
03 - Gear
04 - Gear with C/W 20ft

Actuators

*A - PA / PAS100
*B - PA / PAS200
*C - PA / PAS300
*D - PA / PAS500
*E - PA / PAS700
*F - PA / PAS1030
*G - PA / PAS1400
*H - PA / PAS2200
*I - PA / PAS2900
*J - PA / PAS4100
*K - PA / PAS5800
*L - PA / PAS9000
*M - PA / PAS12100
*N - PA / PAS23600
*O - PA / PAS29500
*P - PA / PAS37200
XA - Electric Actuator
*Choose the model actuator type below
B - PA (Double Acting)
D - PAS Fail Open (Spring Return)
E - PAS Fail Closed (Spring Return)
F - PA w/100% Fail Open Travel Stop
H - PAS w/100% Fail Open Travel Stop

Box 10 -15: Only Use with Actuator Selection - Leave Blank if Actuator is Not Required

Actuator Orientation - Box 10

LP - Parallel to Pipe
RP - Perp to Pipe

Actuator Accessories - Box 11

A0 - None
L1 - Limit Switch w/Beacon
MP - Moore Pneumatic
MI - Moore E/P
4P - PMV P4 Pneumatic
5I - PMV P5 E/P
5P - PMV P5 Pneumatic
S1 - Solenoid Switch

Positioner Set - Box 12

A0 - None
02 - 3-15/4-20mA
03 - 3-9/4-12mA
04 - 9-15/12-20mA

Positioner Accessories - Box 13

A0 - None
02 - Limit Switch - Mechanical
03 - Limit Switch - Proximity Switch
04 - Feedback - Potentiometer 1K
05 - Feedback 4-20mA Pos. Trans

Dash - Box 14

Inlet Pressure - Box 15

Inlet Pressure to be given by customer

BF SERIES BUTTERFLY VALVES

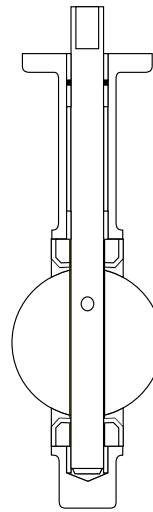
SPECIFICATION

Butterfly shall be designed and manufactured for use with ANSI Class 125 or 150 flanges and in compliance with API 609, MSS-SP-67, ISO 5211, ISO 5752 and API 598. The butterfly valves shall be Ductile Iron Body with _____ Disc and _____ resilient soft seats. The shaft shall be one piece Stainless Steel. The seat shall have a phenolic backing to prevent it from collapsing or dislodging. The strainer shall be straight flow design with vertical screen supports. The Butterfly valve shall be SSI BF Series.

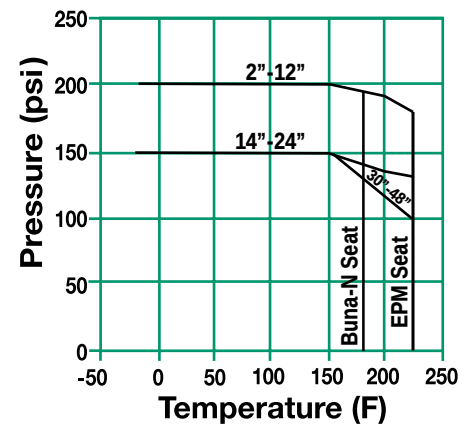
MATERIALS OF CONSTRUCTION

Body Ductile Iron A536 65-45-12
 Disc.....Ductile Iron (Nickel Plated) A536 65-45-12
 Aluminum Bronze B148 C954
 Stainless Steel 316 A351-CF8M
 Shaft Stainless Steel 416 A582 (w/DI and BZ disc)
 Stainless Steel 316 A276 (w/SS disc)
 Seat Buna-N
 EPDM
 Bushings.....Teflon/Fiberglass backed (< 14")
 Bronze (>= 14")
 Seal Buna N o-ring
 Pin Stainless Steel 316
 Key Carbon Steel (>= 12")

1. Dead End 18-8 SS screws are standard on Lug bodies



PRESSURE/TEMPERATURE CHART



Connections: 2-48" Wafer or Lug

Disc: Ductile Iron – Electrolytic Nickel Plated
 Aluminum Bronze
 Stainless Steel 316

Seats: Buna-N or EPDM, do not use EPDM
 when hydrocarbons are present

Velocity Limits
 Fluids 30 ft/s (10 m/s)
 Gases 200 ft/s (65 m/s)

Note: For greater velocities consult factory

Valve Seating Torques (lbs-in) & PA / PAS Pneumatic Actuator Selection

Size	Valve Seating Torque ¹		Actuator Selection w/80 PSIG Air Supply ³						Actuator Selection w/100 PSIG Air Supply ³					
					Fail Closed		Fail Open				Fail Closed		Fail Open	
	200/150 PSIG ²		PA		PAS ⁴		PAS ⁴		PA		PAS ⁴		PAS ⁴	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
2"	132	211	200	300	500	700	500	700	200	200	500	700	300	500
2½"	191	306	300	500	700	1030	700	1030	200	300	700	1030	500	700
3"	292	467	500	500	1030	1400	1030	1400	300	500	1030	1400	500	1030
4"	433	693	500	700	1400	2200	1400	2200	500	700	1400	2200	700	1400
5"	697	1115	1030	1400	2200	4100	2200	2900	700	1030	2200	4100	1400	2200
6"	907	1542	1030	2200	2900	5800	2900	4100	1030	1400	2900	5800	2200	2900
8"	1697	2885	2200	4100	5800	9000	5800	9000	2200	2900	5800	9000	2900	5800
10"	2857	4857	4100	5800	9000	*	9000	12100	2900	5800	9000	*	5800	9000
12"	4338	6941	5800	9000	*	*	12100	*	4100	9000	*	*	9000	12100
14"	6088	9132	*	*	*	*	*	*	*	*	*	*	*	*
16"	8356	12534	*	*	*	*	*	*	*	*	*	*	*	*
18"	11198	16797	*	*	*	*	*	*	*	*	*	*	*	*
20"	14938	22407	*	*	*	*	*	*	*	*	*	*	*	*
24"	23350	35025	*	*	*	*	*	*	*	*	*	*	*	*
30"	33336	50004	*	*	*	*	*	*	*	*	*	*	*	*
36"	46528	69792	*	*	*	*	*	*	*	*	*	*	*	*
42"	79864	119796	*	*	*	*	*	*	*	*	*	*	*	*
48"	111112	166668	*	*	*	*	*	*	*	*	*	*	*	*

Note: The maximum required operating torques for the valves will be the torques required at the valve stem to initiate disc movement out of the seat with full differential pressure across the disc for either lubricated (wet) or non-lubricated services (dry).

For information on PA (Double Acting) and PAS (Spring Return) Pneumatic Actuators contact factory.

1. Lubricating (wet) service applies only where a non-drying "oily" media is present (ex. Oil, glycerin, glycol/water, etc.). Non-Lubricating (dry) service applies where the media does not lubricate the seat elastomer (ex. Dry gas, water, dry abrasives, etc.)"

2. 2" - 12" are based 200PSIG line pressure; 14" - 48" are based 150 PSIG line pressure"

3. 10 - 15% Safety Factor built in to Actuator Selection

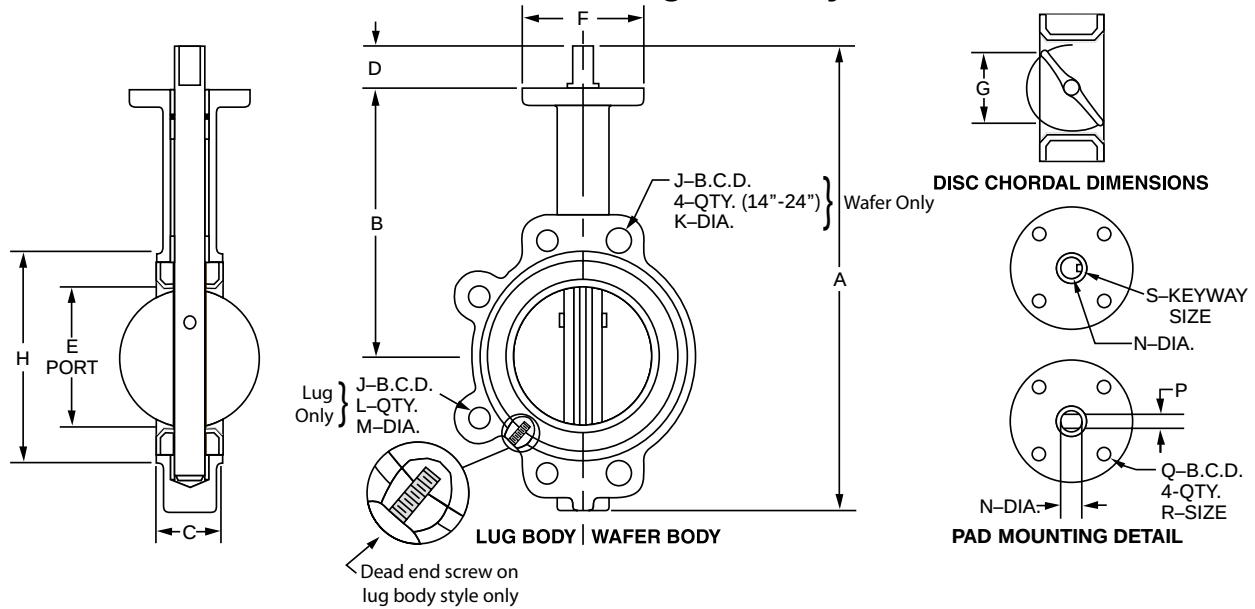
4. All PAS (spring return) actuators are selected using standard with (4) springs. The number of springs can be changed to fit a different actuator selection. Contact factory when required.

* Consult Factory

**BF SERIES
BUTTERFLY VALVES**

BF SERIES

2" - 24" Wafer and Lug Butterfly Valves



DIMENSIONS inches (mm) and WEIGHTS pounds (kg)

Size	Valve												Pad Mounting					Weight ⁴	
	A	B	C ¹	D	E	F	G	H	J	K ²	L ³	M ³	N	P	Q	R	S	Lug	Wafer
2 (50)	10 ³ / ₄ (273)	6 ¹ / ₃ (161)	1 ² / ₃ (42)	1 ¹ / ₄ (32)	2 (53)	3 (76)	1 ¹ / ₄ (32)	3 ¹⁵ / ₁₆ (100)	4 ³ / ₄ (121)	-	4	5/8-11UNC	1/2 (13)	11/32 (9)	2 (50)	9/32 (7)	-	7 (3.2)	6 (2.7)
2 ¹ / ₂ (65)	11 ² / ₃ (296)	6 ⁷ / ₈ (175)	1 ³ / ₄ (44)	1 ¹ / ₄ (32)	2 ¹ / ₂ (65)	3 (76)	1 ¹³ / ₁₆ (47)	4 ³ / ₄ (121)	5 ¹ / ₂ (140)	-	4	5/8-11UNC	1/2 (13)	11/32 (9)	2 (50)	9/32 (7)	-	8 (3.6)	7 (3.2)
3 (80)	12 ¹ / ₈ (308)	7 ¹ / ₈ (181)	1 ²⁵ / ₃₂ (45)	1 ¹ / ₄ (32)	3 ¹ / ₈ (80)	3 (76)	2 ¹ / ₂ (64)	5 (127)	6 (152)	-	4	5/8-11UNC	1/2 (13)	11/32 (9)	2 (50)	9/32 (7)	-	14 (6.3)	10 (4.5)
4 (100)	13 ⁵ / ₈ (346)	7 ⁷ / ₈ (200)	2 (52)	1 ¹ / ₄ (32)	4 ¹ / ₈ (105)	3 ⁵ / ₈ (92)	3 ¹ / ₂ (89)	6 ¹ / ₈ (156)	7 ¹ / ₂ (191)	-	8	5/8-11UNC	5/8 (16)	7/16 (11)	2 ³ / ₄ (70)	13/32 (10)	-	26 (11.8)	13 (5.9)
5 (125)	14 ² / ₃ (372)	8 ³ / ₈ (213)	2 ¹ / ₈ (54)	1 ¹ / ₄ (32)	4 ⁷ / ₈ (123)	3 ⁵ / ₈ (92)	4 ³ / ₈ (111)	7 ¹ / ₂ (191)	8 ¹ / ₂ (216)	-	8	3/4-10UNC	3/4 (19)	1/2 (13)	2 ³ / ₄ (70)	13/32 (10)	-	28 (12.7)	18 (8.2)
6 (150)	15 ⁵ / ₈ (397)	8 ⁷ / ₈ (226)	2 ³ / ₁₆ (56)	1 ¹ / ₄ (32)	6 ¹ / ₈ (156)	3 ⁵ / ₈ (92)	5 ³ / ₄ (146)	8 ³ / ₈ (213)	9 ¹ / ₂ (241)	-	8	3/4-10UNC	3/4 (19)	1/2 (13)	2 ³ / ₄ (70)	13/32 (10)	-	31 (14.1)	20 (9.1)
8 (200)	18 ⁷ / ₈ (480)	10 ¹ / ₄ (260)	2 ³ / ₈ (61)	1 ³ / ₄ (44)	8 (203)	4 ¹ / ₂ (114)	7 ⁵ / ₈ (194)	10 ⁹ / ₁₆ (268)	11 ³ / ₄ (298)	-	8	3/4-10UNC	7/8 (22)	5/8 (16)	4 (102)	15/32 (12)	-	49 (22.2)	32 (14.5)
10 (250)	21 ¹ / ₄ (540)	11 ¹ / ₂ (292)	2 ⁹ / ₁₆ (66)	1 ³ / ₄ (44)	9 ⁷ / ₈ (251)	4 ¹ / ₂ (114)	9 ¹ / ₂ (241)	12 ¹³ / ₁₆ (325)	14 ¹ / ₄ (362)	-	12	7/8-9UNC	1 ¹ / ₈ (29)	13/16 (21)	4 (102)	15/32 (12)	-	72 (32.7)	42 (19)
12 (300)	24 ⁹ / ₁₆ (624)	13 ¹ / ₄ (337)	3 (77)	1 ³ / ₄ (44)	11 ⁷ / ₈ (301)	5 ¹ / ₂ (140)	11 ¹ / ₂ (292)	15 ⁷ / ₈ (403)	17 (432)	-	12	7/8-9UNC	1 ¹ / ₄ (32)	-	4 (102)	15/32 (12)	1/4 x 1	105 (47.6)	70 (31.7)
14 (350)	26 ³ / ₄ (679)	14 ¹ / ₂ (368)	3 (76)	1 ³ / ₄ (44)	13 ¹ / ₈ (334)	5 ¹ / ₂ (140)	12 ¹³ / ₁₆ (325)	17 ³ / ₁₆ (437)	18 ³ / ₄ (476)	1 (27)	12	1-8UNC	1 ¹ / ₄ (32)	-	4 (102)	15/32 (12)	1/4 x 1	155 (70.3)	95 (43.1)
16 (400)	29 ¹⁵ / ₁₆ (760)	15 ³ / ₄ (400)	3 ¹³ / ₃₂ (87)	2 (51)	15 ³ / ₈ (391)	7 ³ / ₄ (197)	15 (381)	19 ⁷ / ₃₂ (488)	21 ¹ / ₄ (540)	1 (27)	16	1-8UNC	1 ⁵ / ₁₆ (33)	-	5 ¹ / ₂ (140)	11/16 (18)	1/32 x 1 ⁹ / ₁₆	195 (88.4)	117 (53.1)
18 (450)	31 ⁹ / ₁₆ (802)	16 ⁵ / ₈ (422)	4 ⁵ / ₃₂ (106)	2 (51)	17 ³ / ₈ (441)	7 ³ / ₄ (197)	16 ⁷ / ₈ (428)	21 ⁷ / ₃₂ (539)	22 ³ / ₄ (578)	1 ¹ / ₄ (32)	16	1 ¹ / ₈ -7UNC	1 ¹ / ₂ (38)	-	5 ¹ / ₂ (140)	11/16 (18)	3/8 x 1 ¹³ / ₁₆	230 (104)	165 (74.8)
20 (500)	35 ² / ₃ (906)	18 ⁷ / ₈ (480)	5 ³ / ₁₆ (132)	2 ¹ / ₂ (64)	19 ³ / ₈ (492)	7 ³ / ₄ (197)	18 ¹¹ / ₁₆ (475)	23 ³ / ₈ (594)	25 (635)	1 ¹ / ₄ (32)	20	1 ¹ / ₈ -7UNC	1 ⁵ / ₈ (41)	-	5 ¹ / ₂ (140)	11/16 (18)	3/8 x 1 ¹³ / ₁₆	396 (180)	275 (125)
24 (600)	43 (1091)	22 ¹ / ₈ (562)	6 (152)	2 ³ / ₄ (70)	23 ⁵ / ₁₆ (592)	10 ⁷ / ₈ (276)	22 ⁹ / ₁₆ (574)	32 ¹ / ₈ (816)	29 ¹ / ₂ (749)	1 ³ / ₈ (35)	20	1 ¹ / ₄ -7UNC	2 (51)	-	6 ¹ / ₂ (165)	7/8 (23)	1/2 x 2 ³ / ₈	610 (277)	440 (200)

Note: Dimensions are subject to change. Consult factory for certified drawings when required.

All dimensions and weights are with bare shaft. Add dimensions and weights of operators when required.

Valves are designed for installation between ASME B16.1 Class 125 and ASME B16.5 Class 150 flanges.

Gaskets are not required and should not be used.

1. Dimension C is the installed dimension. Approximately 1/8" wider when relaxed.

2. Dimension K is the untapped guide hole diameter on wafer body style only.

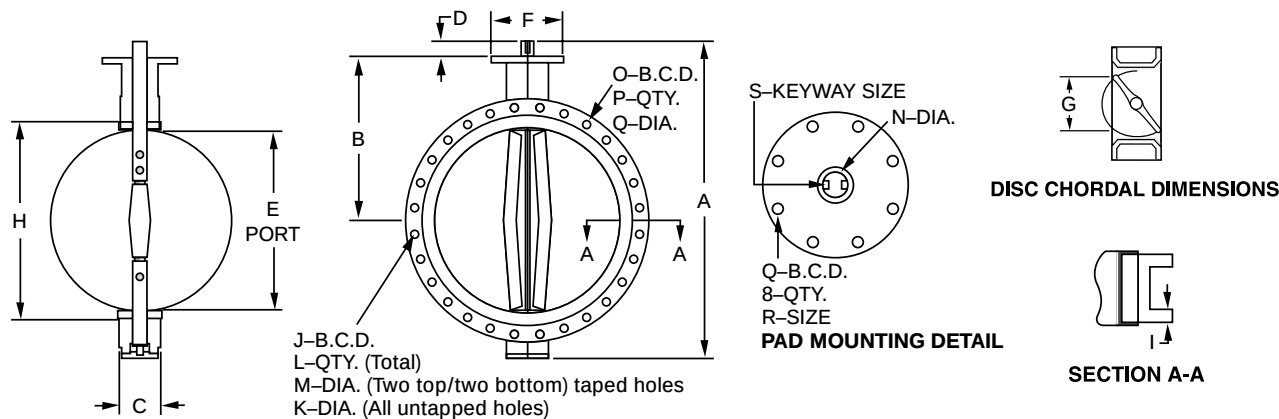
Four holes total - two on top and two on bottom. Sizes 14"-24" only, smaller sizes have no guide holes.

3. Dimension M and Quantity L refer to lug body style tapped holes only

4. Weights are with bare shaft. Add weights of operators when required.

BF SERIES

30" to 48" Double Flanged Butterfly Valves



DIMENSIONS inches (mm) and WEIGHTS pounds (kg)

Size	Valve													Pad Mounting				Weight ⁵ Double Flange
	A	B	C ¹	D	E	F	G	H	I	J	K ²	L ³	M ⁴	N	Q	R	S	
30 (750)	50 ⁹ / ₁₆ (1284)	26 (660)	6 ⁹ / ₁₆ (167)	2 ⁵ / ₈ (67)	28 ⁹ / ₁₆ (725)	11 ¹³ / ₁₆ (300)	22 ³ / ₄ (705)	31 ⁵ / ₁₆ (795)	2 ¹ / ₈ (54)	36 (914)	1 ³ / ₈ (35)	28	1 ¹ / ₄ -7UNC-2B	2 ¹ / ₂ (63)	10 (254)	23/32 (18)	23/32 x 2 ¹ / ₂	1067 (480)
36 (900)	58 ¹ / ₂ (1487)	28 ³ / ₈ (721)	8 (203)	4 ⁵ / ₈ (118)	33 ¹ / ₈ (842)	11 ¹³ / ₁₆ (300)	32 (813)	37 ⁵ / ₁₆ (974)	2 ³ / ₈ (60)	42 ³ / ₄ (1086)	1 ⁵ / ₈ (41)	32	1 ¹ / ₂ -6UNC-2B	2 ¹⁵ / ₁₆ (75)	10 (254)	23/32 (18)	13/16 x 3 ¹⁵ / ₁₆	1618 (728)
42 (1050)	70 ¹ / ₄ (1785)	33 ³ / ₄ (857)	9 ⁷ / ₈ (251)	6 (150)	39 ⁵ / ₁₆ (998)	11 ¹³ / ₁₆ (300)	38 (965)	44 ¹ / ₄ (1124)	2 ⁵ / ₈ (67)	49 ¹ / ₂ (1257)	1 ⁵ / ₈ (41)	36	1 ¹ / ₂ -6UNC-2B	3 ³ / ₄ (95)	10 (254)	23/32 (18)	1 x 5 ¹ / ₂	2889 (1300)
48 (1200)	76 ¹⁵ / ₁₆ (1954)	37 (940)	10 ⁷ / ₈ (276)	6 (150)	44 ³ / ₈ (1127)	13 ³ / ₄ (349)	42 ¹⁵ / ₁₆ (1090)	49 ³ / ₄ (1264)	2 ³ / ₄ (70)	56 (1422)	1 ⁵ / ₈ (41)	44	1 ¹ / ₂ -6UNC-2B	4 ¹ / ₈ (105)	11 ³ / ₄ (298)	7/8 (22)	1/8 x 5 ¹ / ₂	3054 (1374)

Note: Dimensions shown are subject to change. Consult factory for certified drawings when required.

All dimensions and weights are with bare shaft. Add dimensions and weights of operators when required.

Valves are designed for installation between ASME B16.1 Class 125 and ASME B16.47 Series A Class 150 flanges.

Gaskets are not required and should not be used.

1. Dimension C is the installed dimension. Approximately 3/8" wider when relaxed.

2. Dimension K refers the untapped hole diameters on all holes except the two top and two bottom tapped holes.

3. Quantity L is the total number of bolt holes including four tapped holes and the remainder untapped holes.

4. Dimension M is the tap hole size for the two top and two bottom holes.

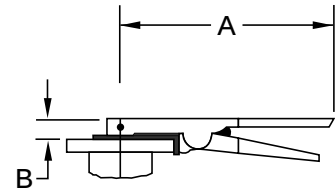
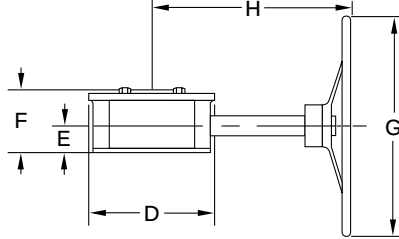
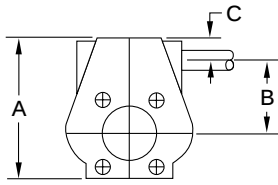
5. Weights are with bare shaft. Add weights of operators when required.

Cv VALUES (GPM @ 1 PSID)

Size (Inches)	Disc Position (Degrees)								
	10	20	30	40	50	60	70	80	90/100
2	0.06	3	7	16	27	44	70	105	115
2 ¹ / ₂	0.1	6	12	25	45	75	119	178	196
3	0.2	9	18	39	70	116	183	275	302
4	0.3	17	36	78	39	230	364	546	600
5	0.5	29	61	133	237	392	620	930	1022
6	0.8	45	95	205	366	605	958	1437	1579
8	2	89	188	408	727	1202	1903	2854	3136
10	3	151	320	694	1237	2047	3240	4859	5340
12	4	234	495	1072	1911	3162	5005	7507	8250
14	6	338	715	1549	2761	4568	7230	10844	11917
16	8	464	983	2130	3797	6282	9942	14913	16388
18	11	615	1302	2822	5028	8320	13168	19752	21705
20	14	791	1674	3628	6465	10698	16931	25396	27908
24	22	1222	2587	5605	9989	16528	26157	39236	43116
30	35	1928	4082	8844	14526	22216	35033	52550	58121
36	47	2606	5517	11953	20788	33491	52546	78531	86375
42	67	3700	7832	16969	31971	53285	85256	124605	135240
48	85	4694	9937	21530	43684	72807	114411	165376	176640

BF SERIES - MANUAL ACTUATOR GEAR AND LEVER

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



Gear Size	Ratio	A	B	C	D	E	F	G	H	Weight
2 - 6 (50 - 150)	24:1	5 (127)	1 ¹¹ / ₁₆ (45)	1 ¹ / ₈ (28)	4 ¹ / ₈ (105)	1 ⁵ / ₈ (41)	2 ⁵ / ₈ (66)	6 (152)	7 ⁵ / ₈ (193)	10 (4.5)
8 - 10 (100-300)	30:1	7 (178)	2 ⁵ / ₈ (66)	1 ⁵ / ₁₆ (34)	6 (152)	1 ¹³ / ₁₆ (46)	3 ⁵ / ₁₆ (84)	12 (305)	12 ¹ / ₂ (318)	28 (12.7)
12 - 14 (300-350)	50:1	7 ¹³ / ₁₆ (198)	3 (76)	1 ¹ / ₂ (38)	6 ⁵ / ₈ (170)	2 (51)	3 ¹ / ₂ (89)	12 (305)	12 ¹ / ₂ (318)	33 (15)
16 (400)	80:1	11 ¹ / ₂ (292)	4 ³ / ₈ (112)	1 ⁵ / ₈ (41)	10 ⁵ / ₁₆ (262)	2 ¹ / ₂ (64)	4 ⁵ / ₈ (117)	12 (305)	16 ³ / ₁₆ (411)	71 (32.2)
18 - 24 (450 - 600)	290:1	12 ⁵ / ₁₆ (313)	4 ¹¹ / ₁₆ (120)	2 ¹³ / ₁₆ (73)	10 ¹³ / ₁₆ (274)	2 ⁷ / ₈ (75)	6 ⁵ / ₁₆ (162)	12 (305)	13 ³ / ₈ (342)	118 (53.5)

Lever Size	A	B	Weight
2 - 6 (50 - 150)	10 (252)	1 (24)	3 (1.4)
8 - 10 (100-300)	14 ¹ / ₈ (359)	1 ³ / ₈ (36)	4 (1.8)

Note: Dimensions are subject to change. Consult factory for certified drawings when required.

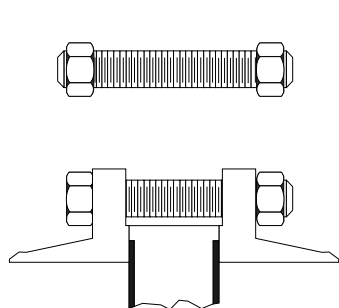
It is recommended that levers be used through 8" valve size for liquid or rated pressure service. 10"-12" valves with levers should only be used on gas and low pressure applications. 10 Position or Infinite Position levers available. Dimensions are for both options.

Note: Dimensions are subject to change.

Consult factory for certified drawings when required. Gear shown above with standard handwheel. Chainwheel option available - contact factory for dimensions and weights.

Pneumatic Actuators (PA and PAS) models and other electronic accessories available to be mounted – contact factory

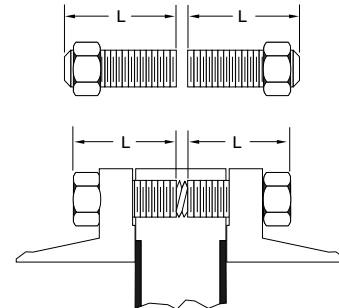
Electric Actuators available to be mounted – contact factory



WAFER STYLE - RECOMMENDED FLANGE BOLT LENGTHS inches

Valve Size	Qty.	Bolt Size	Length of Fasteners	
			Bolts	Threaded Studs
2	4	5/8-UNC	4	4 ³ / ₄
2 ¹ / ₂	4	5/8-UNC	4 ¹ / ₄	5 ¹ / ₄
3	4	5/8-UNC	4 ¹ / ₂	5 ¹ / ₂
4	8	5/8-UNC	4 ³ / ₄	5 ¹ / ₂
5	8	3/4-UNC	5	6
6	8	3/4-UNC	5 ¹ / ₄	6
8	8	3/4-UNC	5 ³ / ₄	6 ¹ / ₂
10	12	7/8-UNC	6	7
12	12	7/8-UNC	6 ³ / ₄	7 ³ / ₄
14	12	1-UNC	7	8 ³ / ₄
16	16	1-UNC	7 ¹ / ₂	8 ³ / ₄
18	16	1 ¹ / ₈ -UNC	8 ³ / ₄	10
20	20	1 ¹ / ₈ -UNC	10	11
24	20	1 ¹ / ₄ -UNC	11 ¹ / ₄	12 ³ / ₄

Note: Bolt lengths are based on ANSI class 150 weld neck flanges per ASME B16.5.



LUG STYLE - RECOMMENDED FLANGE BOLT LENGTHS inches

Valve Size	Qty.	Bolt Size	Length of Fasteners	
			Bolts	Threaded Studs
2	4	5/8-UNC	1 ¹ / ₄	2 ¹ / ₄
2 ¹ / ₂	4	5/8-UNC	1 ¹ / ₂	2 ¹ / ₄
3	4	5/8-UNC	1 ¹ / ₂	2 ¹ / ₂
4	8	5/8-UNC	1 ¹ / ₂	2 ¹ / ₂
5	8	3/4-UNC	1 ¹ / ₂	2 ¹ / ₂
6	8	3/4-UNC	1 ¹ / ₄	2 ¹ / ₂
8	8	3/4-UNC	2	3
10	12	7/8-UNC	2 ¹ / ₄	3 ¹ / ₄
12	12	7/8-UNC	2 ¹ / ₂	3 ¹ / ₂
14	12	1-UNC	2 ³ / ₄	3 ³ / ₄
16	16	1-UNC	3	4
18	16	1 ¹ / ₈ -UNC	3 ¹ / ₂	4 ³ / ₄
20	20	1 ¹ / ₈ -UNC	4	5 ¹ / ₄
24	20	1 ¹ / ₄ -UNC	4 ³ / ₄	6

Note: Bolt lengths are based on ANSI class 150 weld neck flanges per ASME B16.5.

INSTALLATION AND MAINTENANCE INSTRUCTIONS

BUTTERFLY VALVES

1.0 INSTALLATION CONSIDERATIONS

A. Piping and Flange Compatibilities - The BF Series butterfly valves have been designed to be installed between all types of ANSI 125/150 flanges, whether flat-faced, raised-faced, weld-neck, etc. They have been engineered so that the critical disc chord dimension at the full open position will clear the adjacent inside diameter of most types of piping, including Schedule 40, lined pipe, heavy wall, etc. If in question, one should compare the minimum pipe I.D. with the published disc chord dimension at full open.

B. Valve Location and Orientation in Piping.

1. Valve Location - Butterfly valves should be installed, if possible, a minimum of 6 pipe diameters from other line elements, i.e. elbows, pumps, valves, etc. Of course, 6 pipe diameters is not always practical, but it is important to achieve as much distance as possible. Where

the butterfly valve is connected to a check valve or pump, use an expansion joint between them to ensure the disc does not interfere with the adjacent equipment.

2. Valve Orientation

a) In general, we recommend the valve be installed with the stem in the vertical position and the actuator mounted vertically directly above the valve; however there are those applications as discussed below where the stem should be horizontal. The valve should not be installed upside down.

b) For slurries, sludge, mine tailing, pulp stock, dry cement, and any media with sediment or particles, we recommend the valve be installed with the stem in the horizontal position with the lower disc edge opening in the downstream direction.

2.0 INSTALLATION PROCEDURE

A. General Installation

1. Make sure the pipeline and pipe flange faces are clean. Any foreign material, such as pipe scale, metal chips, welding slag, etc., can obstruct disc movement and/or damage the disc or seat.
2. The valve has a phenolic backed seat. As a result, no gaskets are required. This seat serves the function of a gasket.
3. Align the piping and then spread the pipe flanges a distance apart so as to permit the valve body to be easily dropped between the flanges without contacting the pipe flanges.
4. Check to see that the valve disc has been positioned to a partially open position, with the disc edge about 1/4" to 3/8" from the face of the seat (approximately 10° open).
5. Insert the valve between the flanges, taking care not to damage the seat faces. Always pick the valve up by the locating holes or by using a nylon sling on the neck of the body. Never pick up the valve by the actuator or operator mounted on top of the valve.
6. Place the valve between the flanges, center it, and then span the valve body with all flange bolts, but do not tighten the bolts. Carefully open the disc to the full open position, making sure the disc does not hit the adjacent pipe I.D. Systematically remove jack bolts on other

flange spreaders and hand-tighten the flange bolts. Very slowly close the valve disc to ensure disc edge clearance from the adjacent pipe flange I.D. Open the disc to full open and tighten all flange bolts per specification. Repeat a full close to full open rotation of the disc to ensure proper clearances.

B. Installation with Flange Welding - When butterfly valves are to be installed between ANSI welding type flanges, care should be taken to abide by the following procedure to ensure no damage will occur to the seat:

1. Place the valve between the flanges with the flange bores and valve body bore aligned properly. The disc should be in the 10° open position.
2. Span the body with the bolts.
3. Take this assembly of flange-body-flange and align it properly to the pipe.
4. Tack weld the flanges to the pipe.
5. When tack welding is complete, remove the bolts and the valve from the pipe flanges and complete the welding of the flanges. Be sure to let the pipe and flanges cool before installing the valve.
6. NOTE: Never complete the welding process (after tacking) with the valve between pipe flanges. This causes severe seat damage due to heat transfer.

3.0 MAINTENANCE AND REPAIR

The many features of the BF Series minimize wear and maintenance requirements. No routine lubrication is required. If components require replacement, the

valve may be removed from the line by placing the disc near the closed position, then supporting the valve and removing the flange bolts.

NOTES:

SECTION IX

APPLICATION

GUIDE



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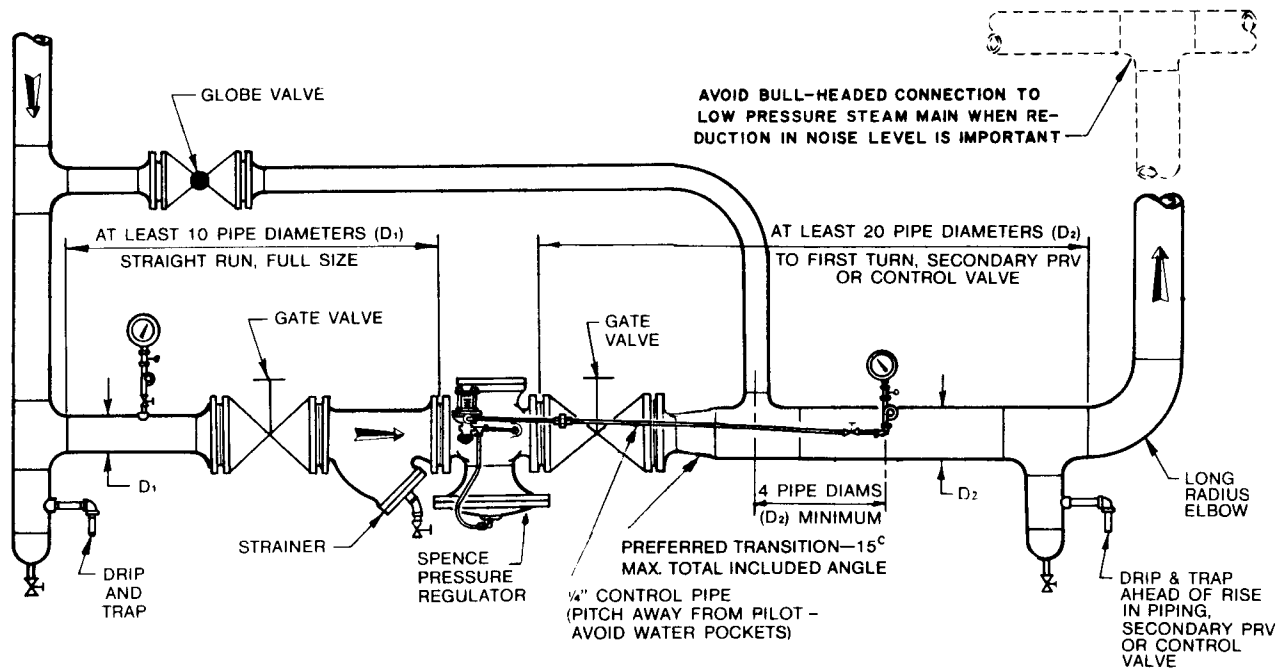
TYPE ED SINGLE STAGE PRESSURE REDUCING VALVE

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.



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ED PARALLEL

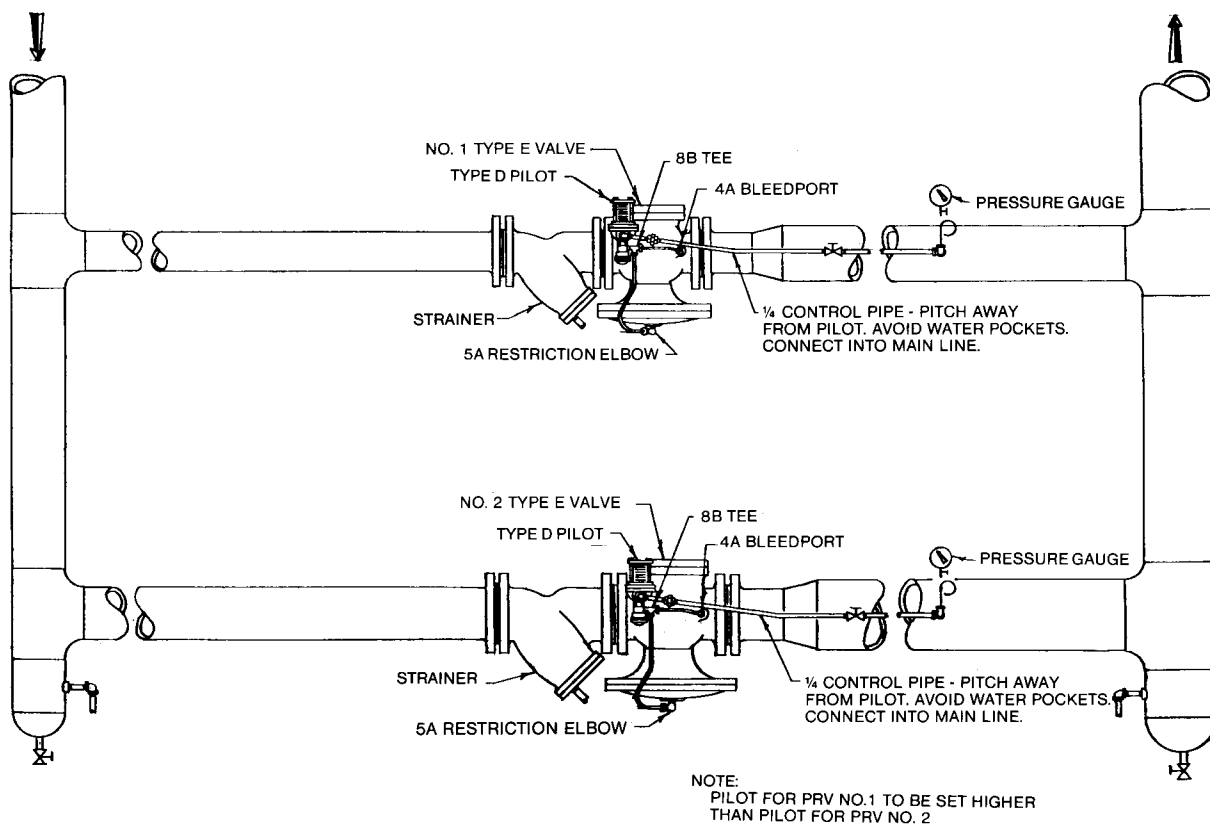
TYPE ED PARALLEL (ADDITIVE) PRESSURE REDUCING STATION

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.

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PRESS. REDUCING-STM/GAS



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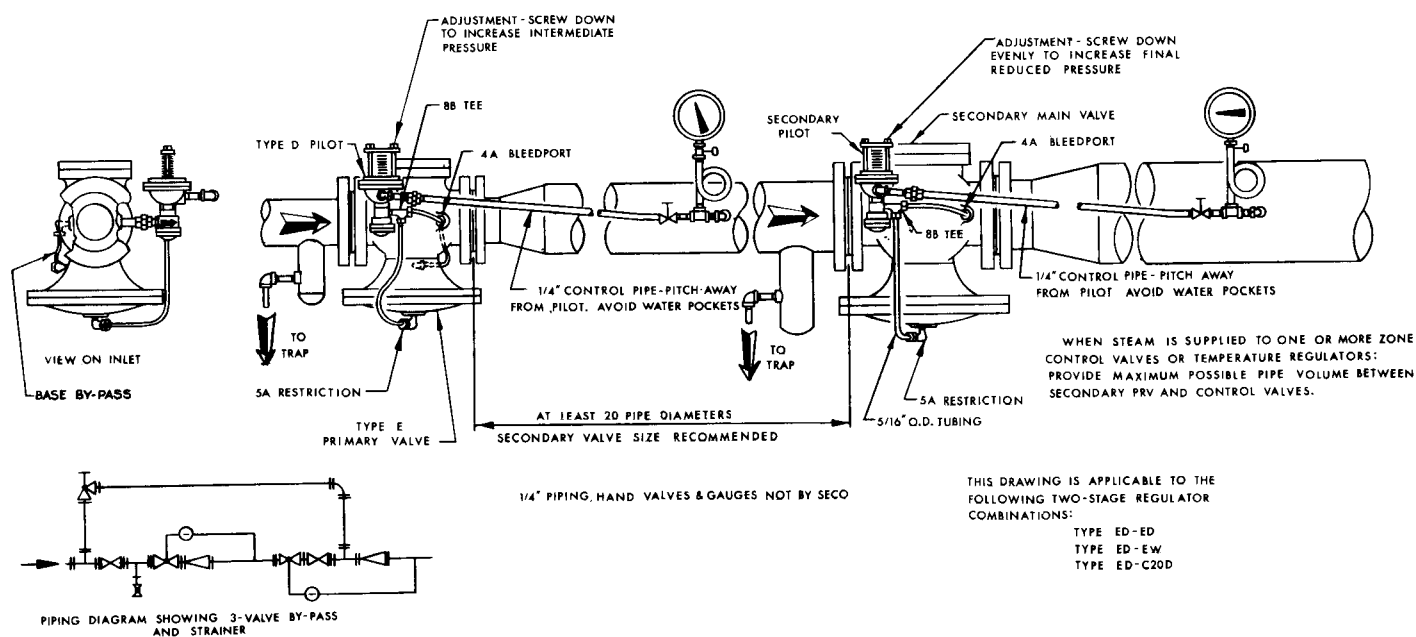
TYPE ED TWO-STAGE PRESSURE REDUCING STATION

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.



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ED TURBINE EX-
HAUST MAKE-UP

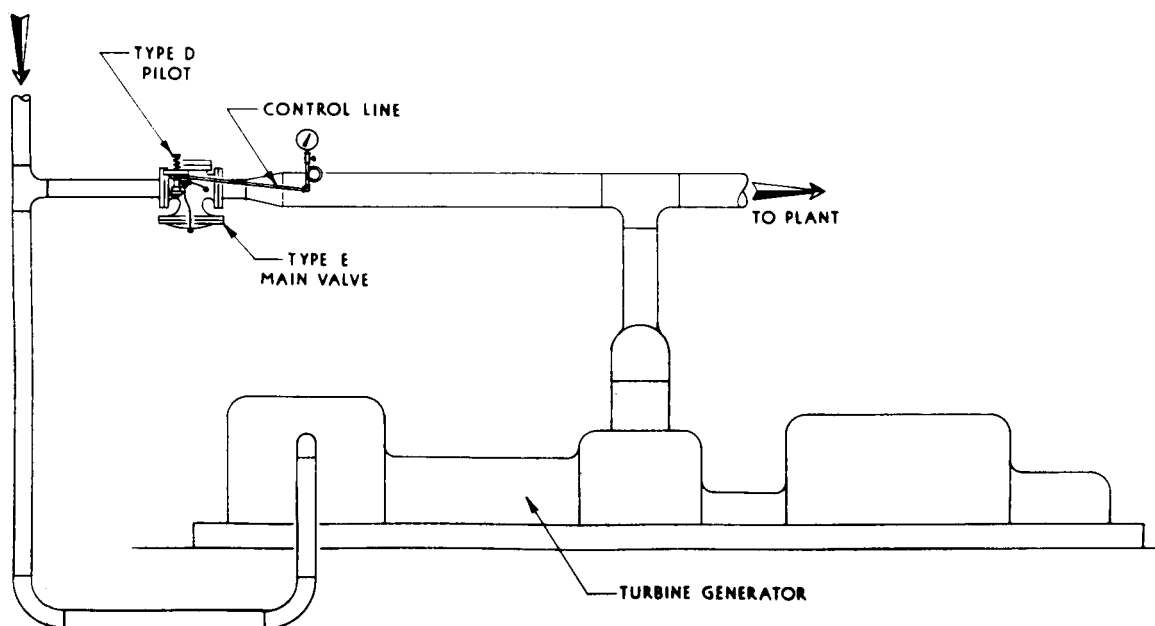
TYPE ED TURBINE EXHAUST MAKE-UP VALVE

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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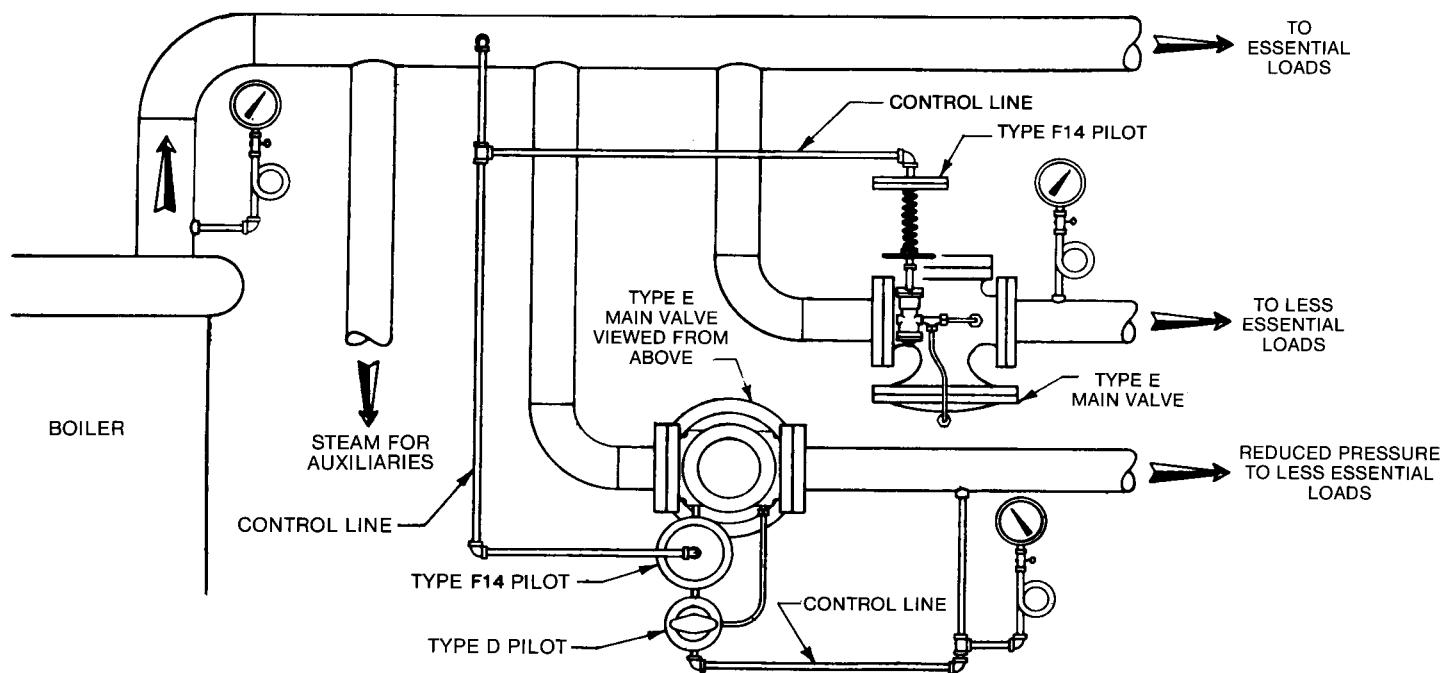
TYPE EF14 AND EF14D STEAM ALLOCATING VALVES

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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ED REMOTE
SHUTOFF

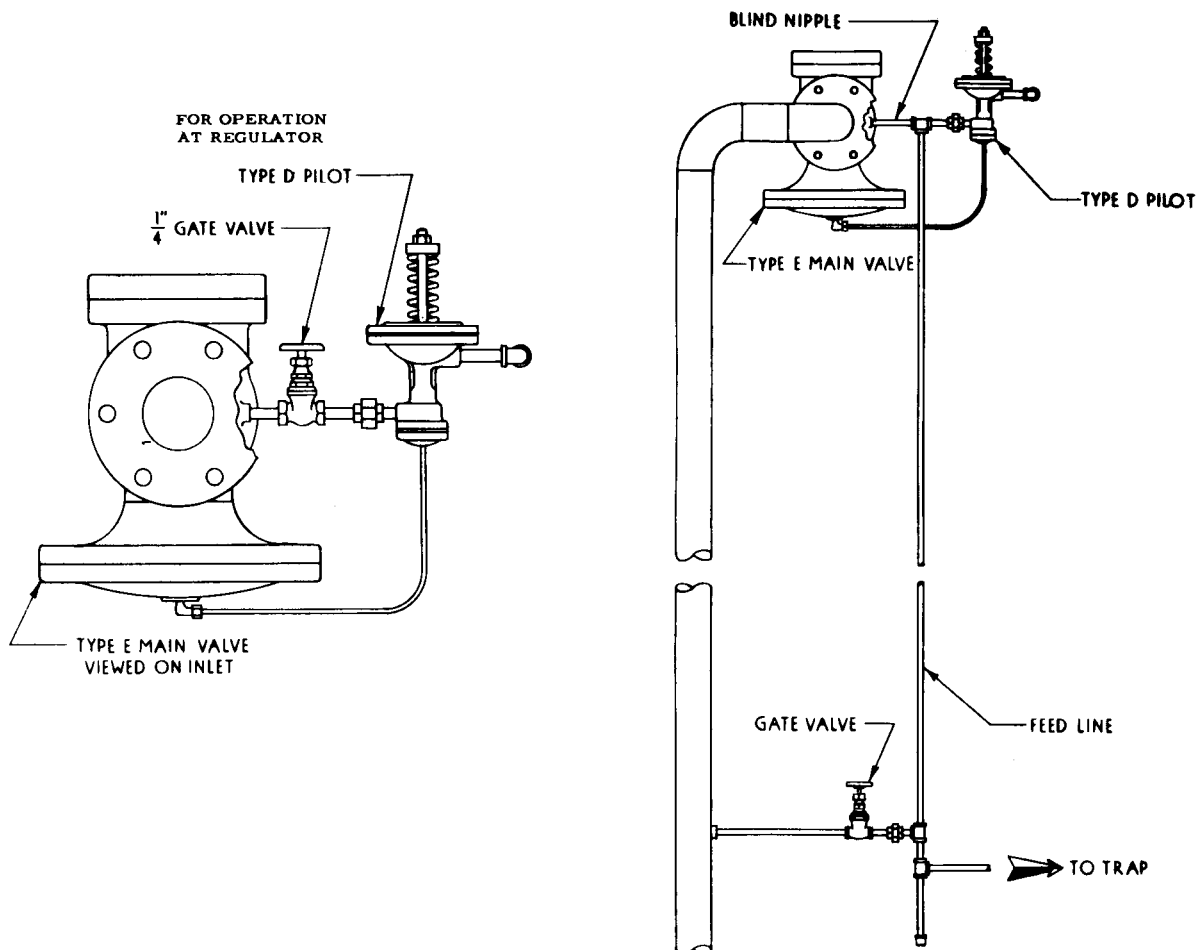
TYPE ED REMOTE SHUT OFF

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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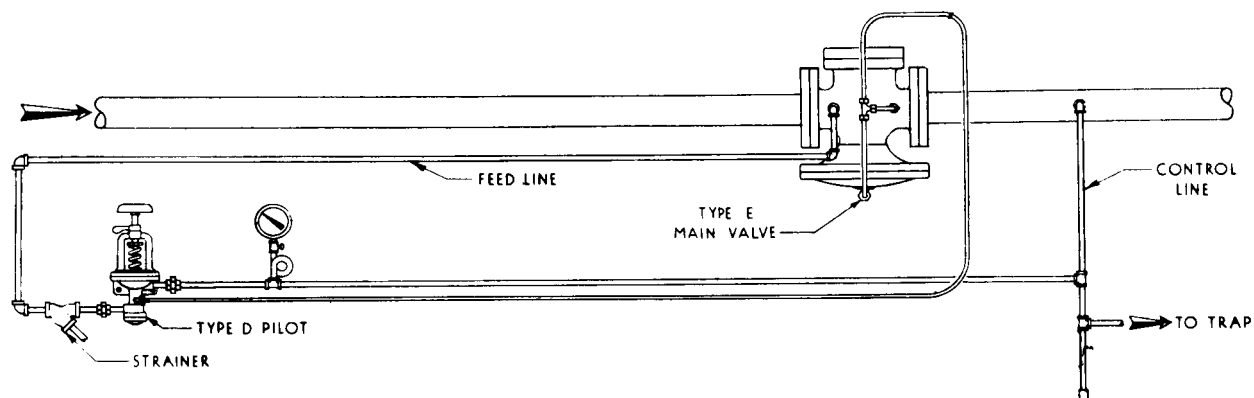
TYPE ED REMOTE MOUNTED PILOT

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.



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EP130 TRIP VALVE
FOR TALL BUILDINGS

TYPE EP125 TRIP VALVE

APPLICATION:

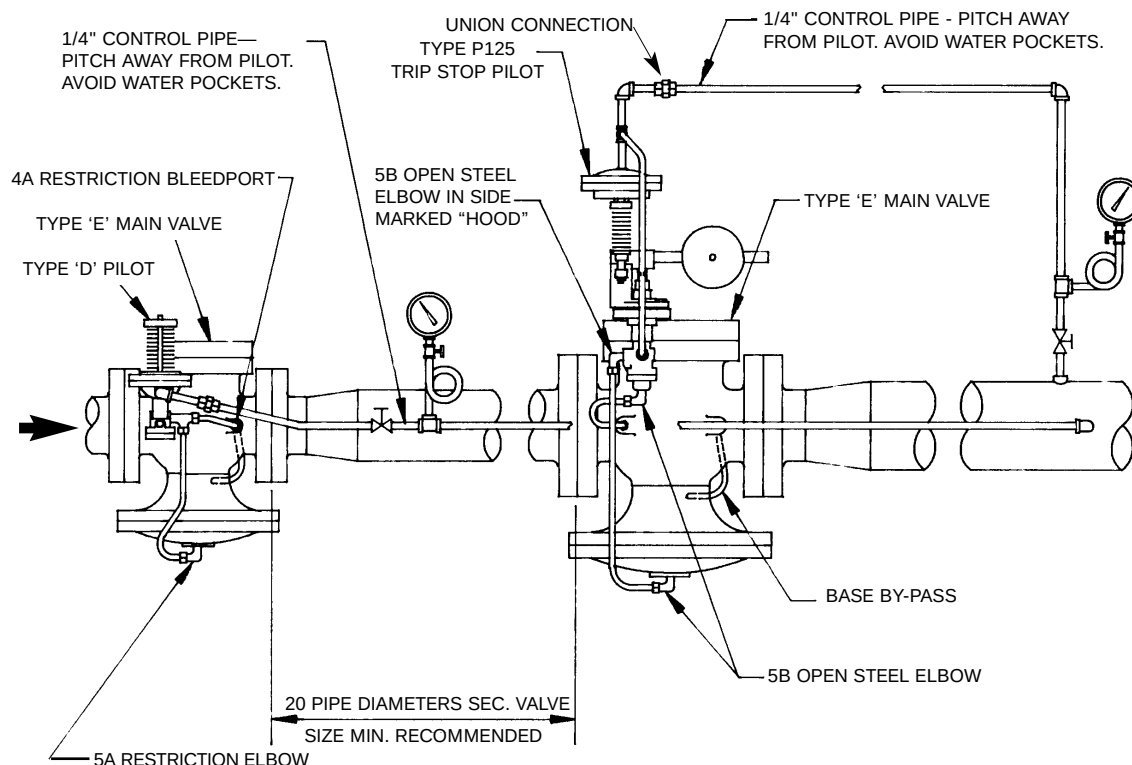
In some district heating and steam distribution systems, the use of relief valves and vent piping may not be feasible, because of building height. Where such a condition exists, and the system steam pressure does not exceed 400 psi, ANSI B31.1-1977, Paragraph 102.2.5 permits the use of a pressure reducing valve and a trip stop valve in series to provide over-pressure protection.

The P125 trip pilot is a self-operated device intended to be used in conjunction with a normally-closed Spence main valve, providing a trip stop valve, as cited in previous paragraph.

OPERATION:

During normal operation, the P125 pilot holds its main valve in the open position. Reduced pressure is under control of primary P.R.V.

If reduced pressure rises to the set point of P125 (generally 5 psig over controlled pressure), it will shut and lock closed. This action closes its main valve and shuts system off.



ADVANTAGES:

- Trip valve has to be manually reset.
- Less expensive than relief valve.
- Control accuracy of ED.

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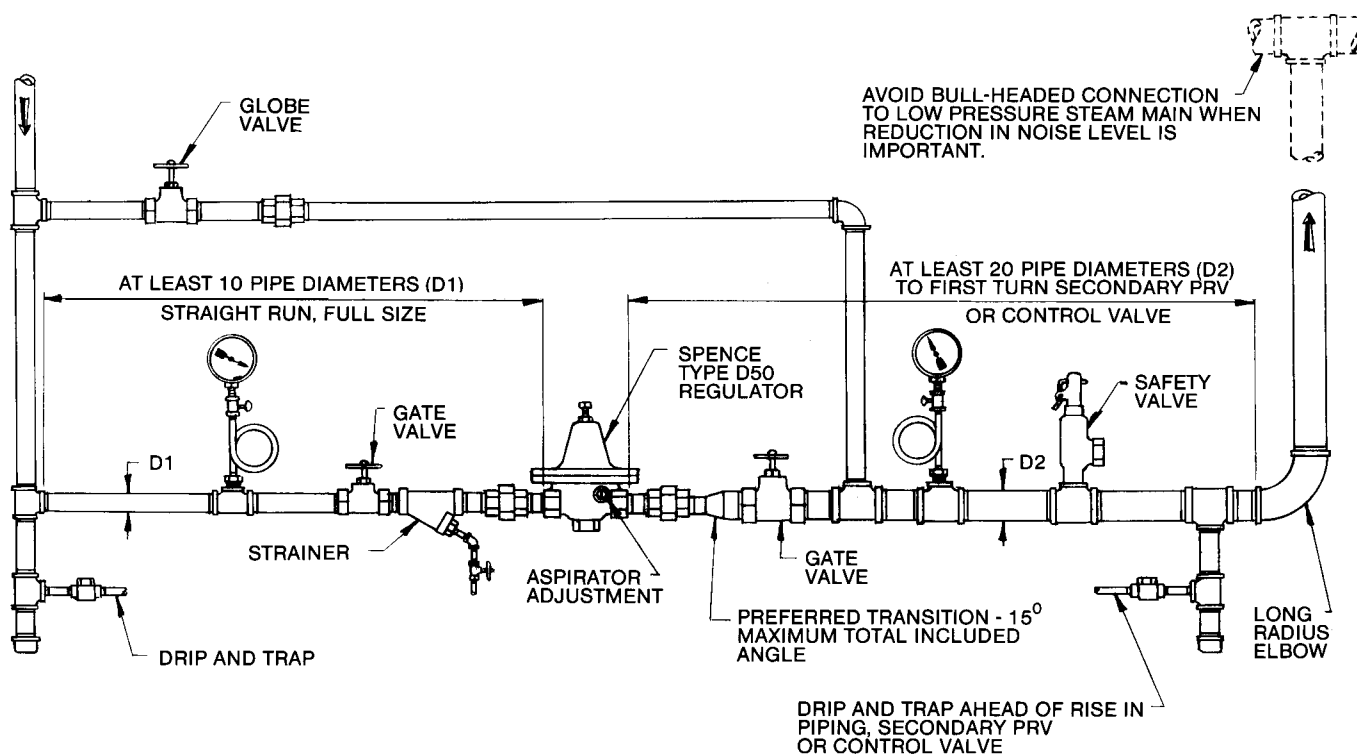
TYPE D50 DIRECT OPERATED PRESSURE REDUCING VALVE

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.



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ED5 FOR
DEAERATOR

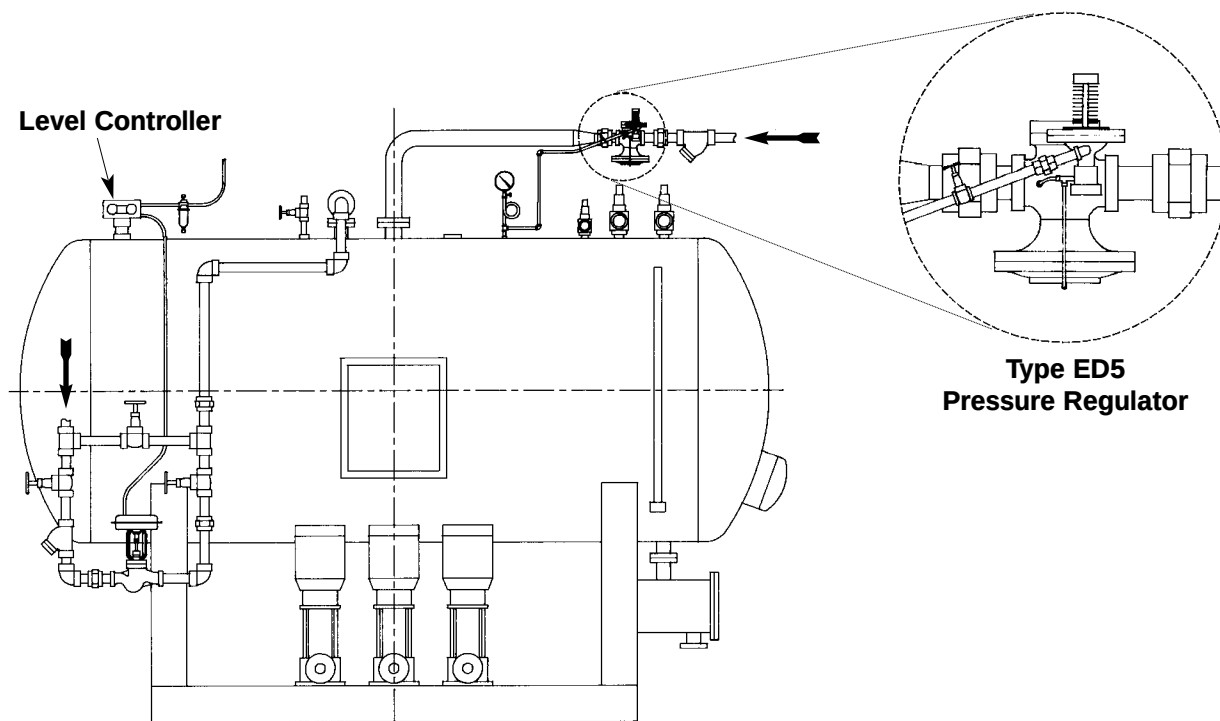
TYPE ED5 PRESSURE REGULATOR for ACCURATE CONTROL of a DEAERATOR

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 (± 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

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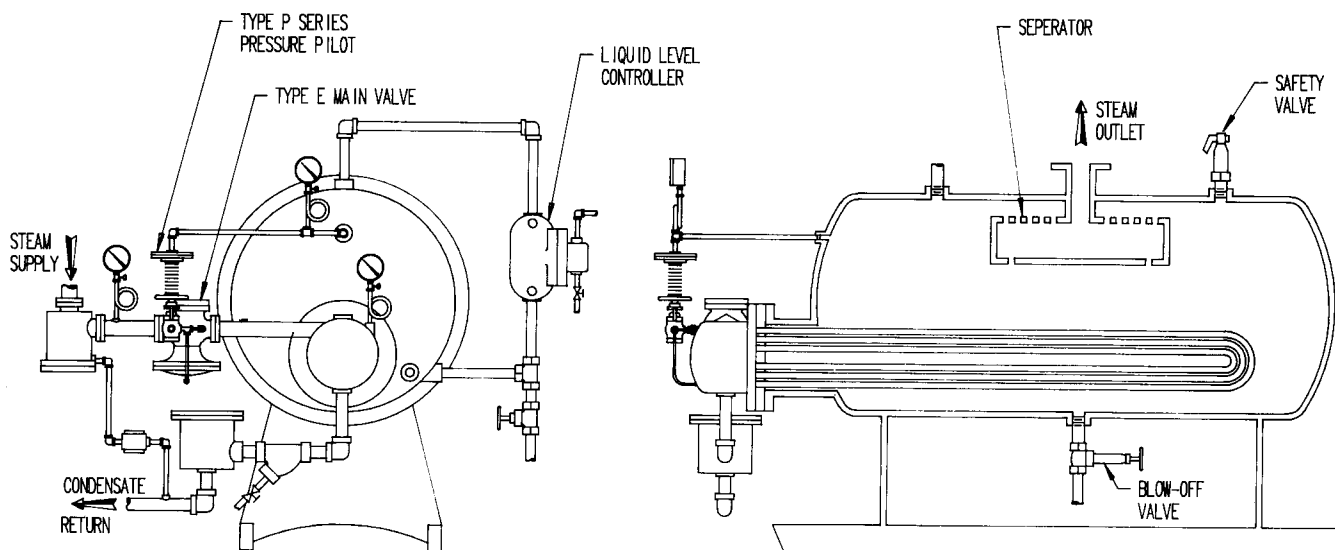
TYPE EP PRESSURE REGULATOR for SELF-CONTAINED CONTROL of an UNFIRED STEAM GENERATOR

APPLICATION:

To provide self-contained control of an Unfired Steam Generator.

OPERATION:

The Spence Type EP Pressure Regulator controls the steam 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.



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EP FOR UNFIRED
STEAM GENERATOR

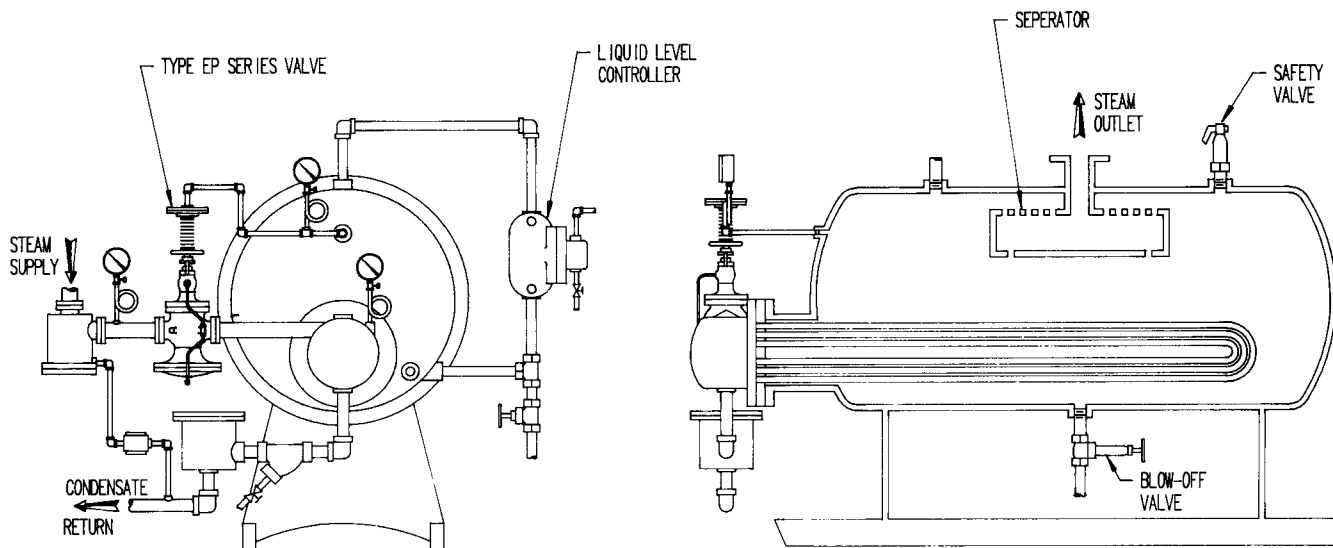
TYPE EP PRESSURE REGULATOR INTEGRALLY MOUNTED for SELF-CONTAINED CONTROL of an UNFIRED STEAM GENERATOR

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 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.



APPLICATION GUIDE
PRESS. REDUCING-STM/GAS

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.



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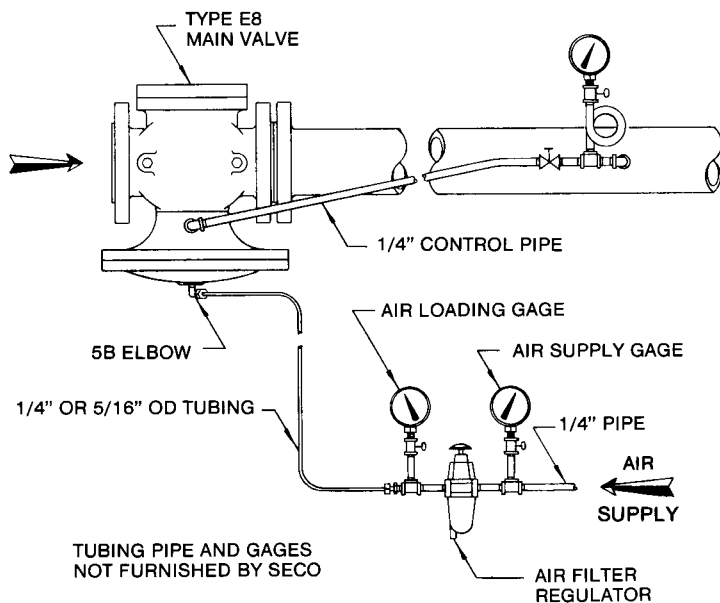
TYPE E8 AIR ADJUSTED PRESSURE REDUCING VALVE

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.



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EA AIR ADJUSTED

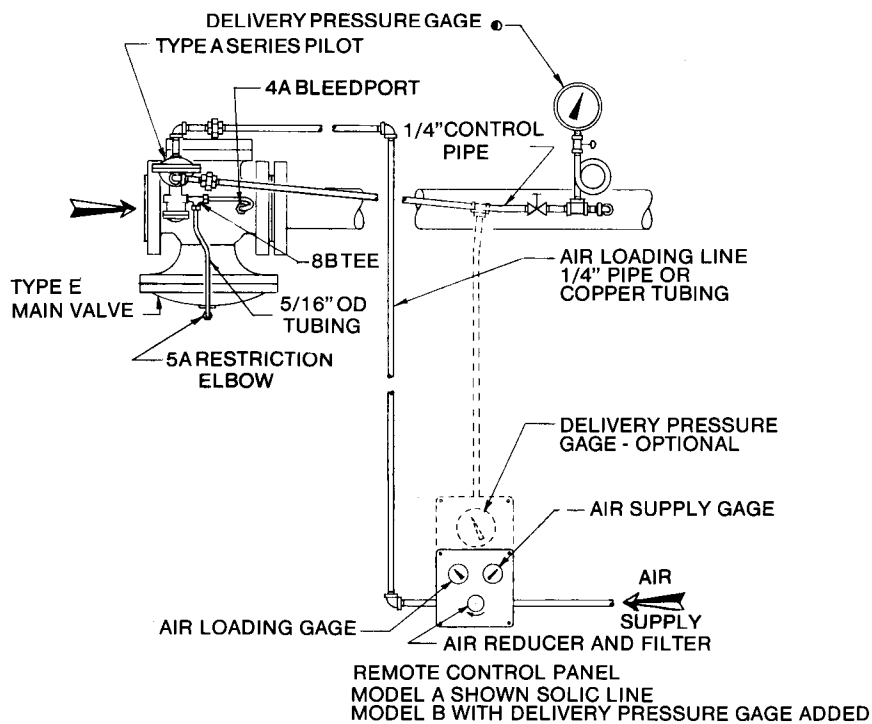
EA SERIES AIR ADJUSTED PRESSURE REGULATOR

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.

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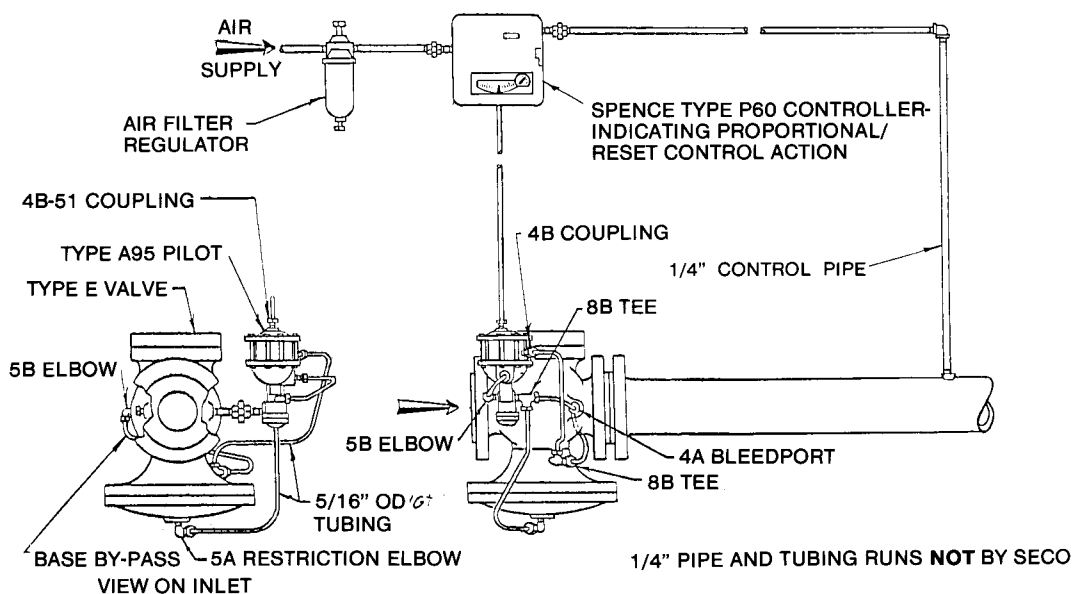
EA95P60 PNEUMATICALLY CONTROLLED PRESSURE REGULATOR

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.
- Required Balanced Main Valve



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Application Guide

EA93 AUTOMATIC
TRANSFER

EA93 AUTOMATIC TRANSFER PRESSURE REDUCING STATION

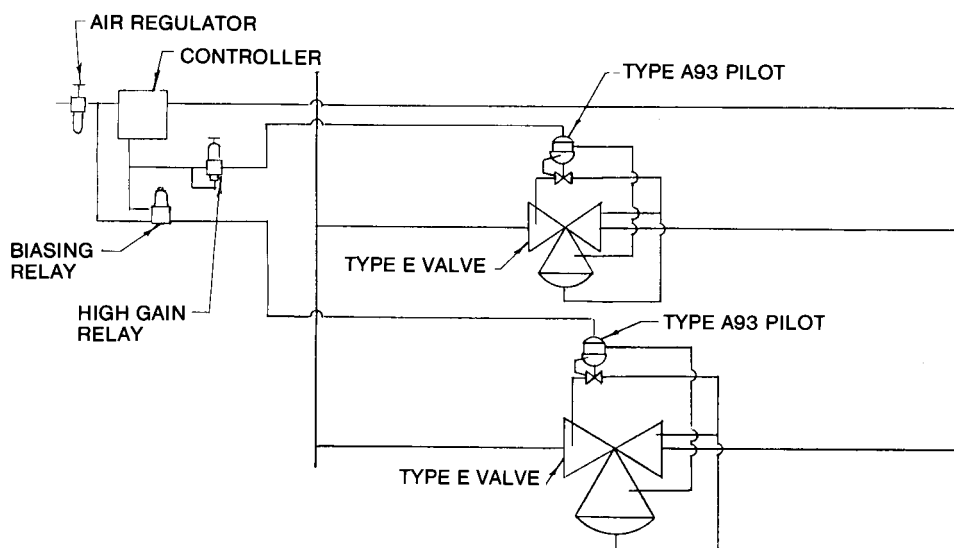
APPLICATION:

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.
- Standard stock valves can be used.

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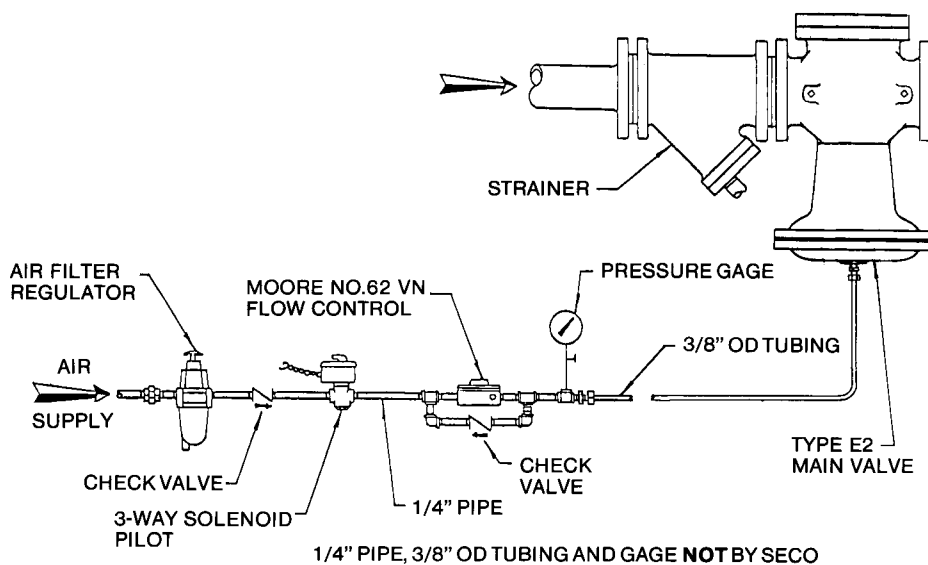
TYPE E2 SLOW OPENING VALVE

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.



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EA FOR GAYLORD
SHOWER

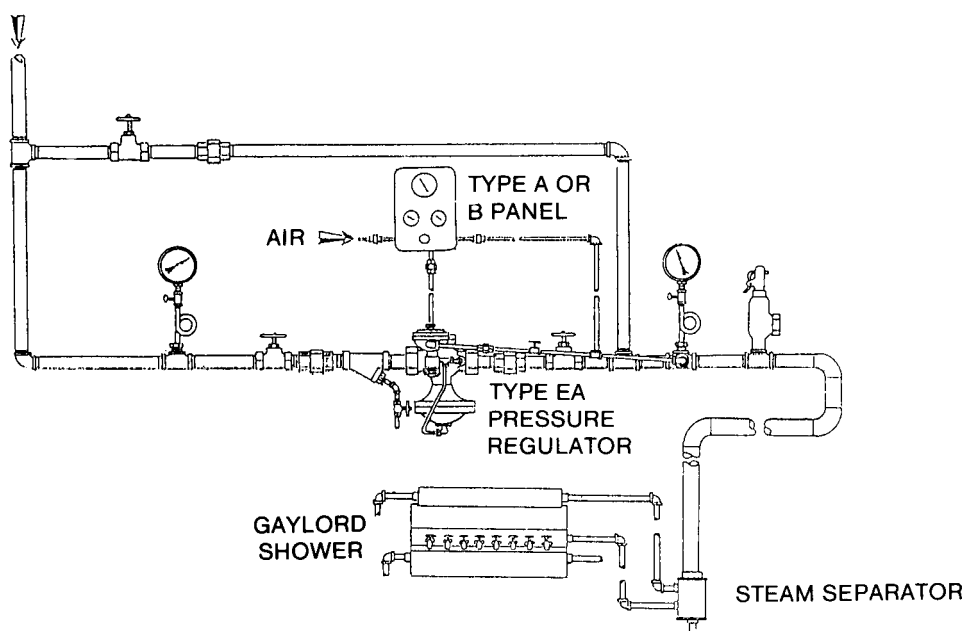
TYPE EA PRESSURE REGULATOR with TYPE B PANEL for GAYLORD SHOWER CONTROL

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.

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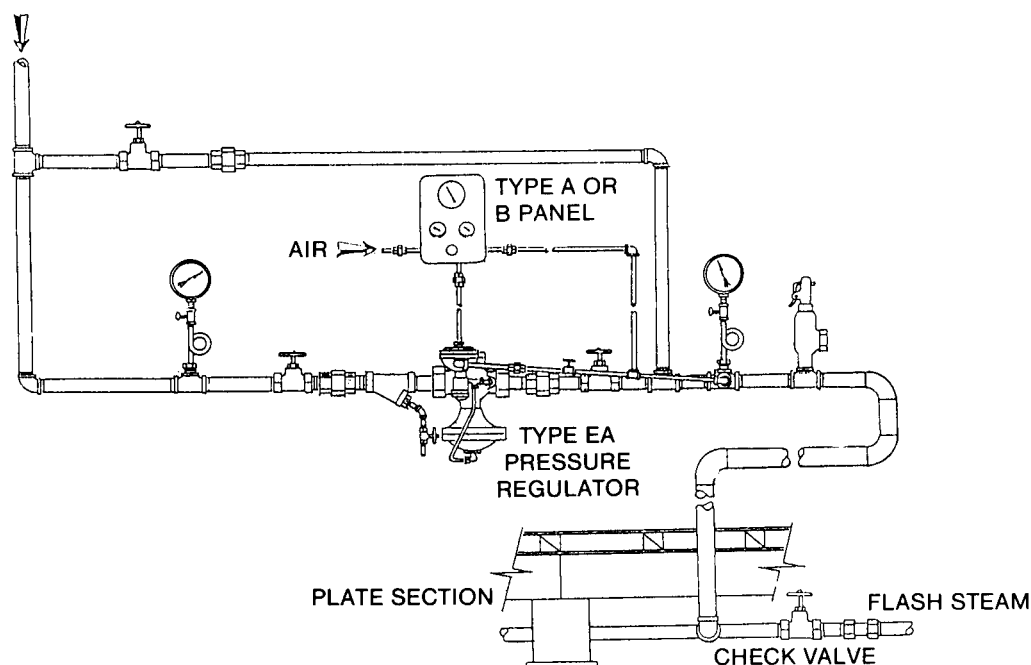
TYPE EA PRESSURE REGULATOR with TYPE B PANEL for CONTROL of the PLATE SECTIONS of a CORRUGATOR

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.



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E8 EPC ELECTRO-PNEUMATIC CONTROL

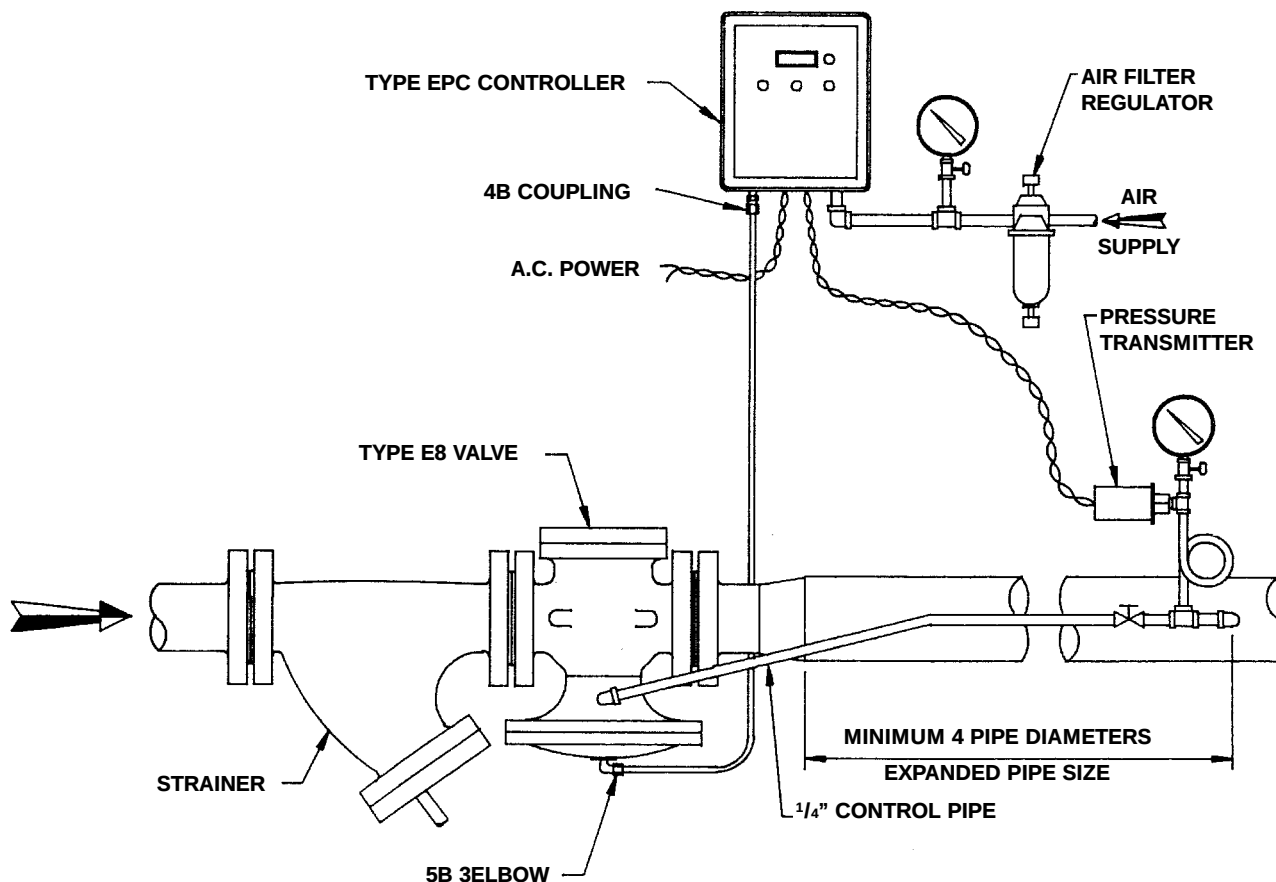
TYPE E8 EPC ELECTRO-PNEUMATICALLY CONTROLLED PRESSURE REDUCING VALVE

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. Packless main valve construction.
- Enhanced accuracy over self-contained regulator.

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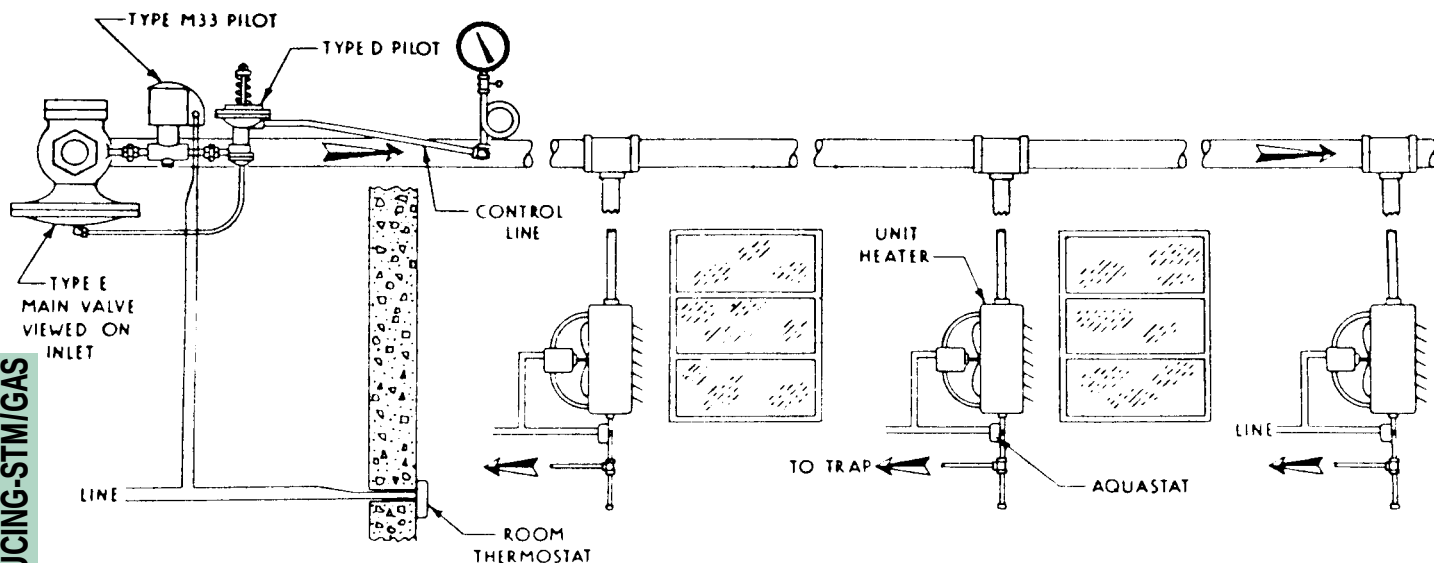
TYPE EM33D ELECTRICALLY OPERATED REDUCING VALVE

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.



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ED208D ELEC-
TRONIC STARTUP

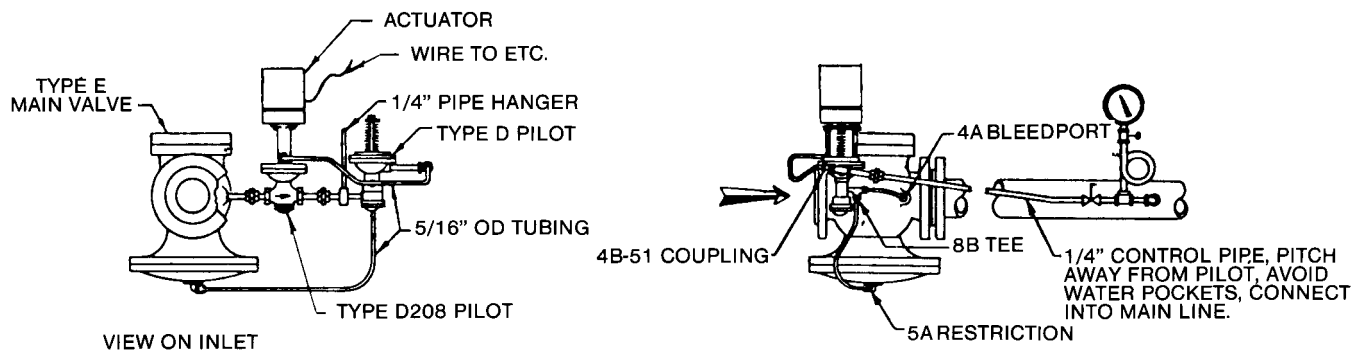
TYPE ED208D ELECTRONIC STARTUP CONTROL in conjunction with a TIME PROPORTIONING OUTDOOR RESET CONTROLLER

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
PRESS. REDUCING-STM/GAS



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Application Guide

TYPE ED208P14-EF14D ELECTRONIC SLOW STARTUP CONTROL for PARALLEL OPERATION

APPLICATION:

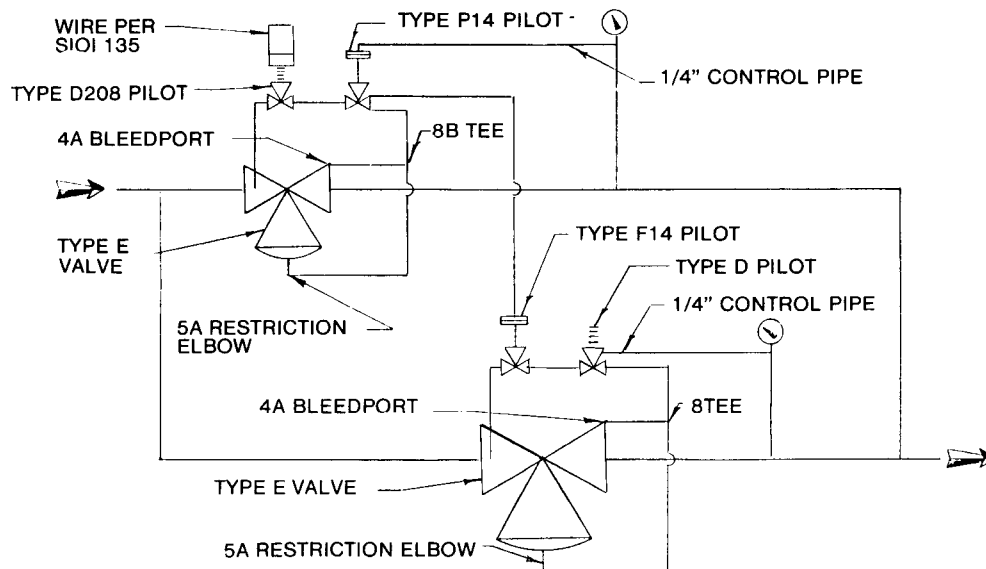
To gradually heat up and pressurize a parallel installation.

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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Application Guide

ED210 ELECTRONIC
MODULATING

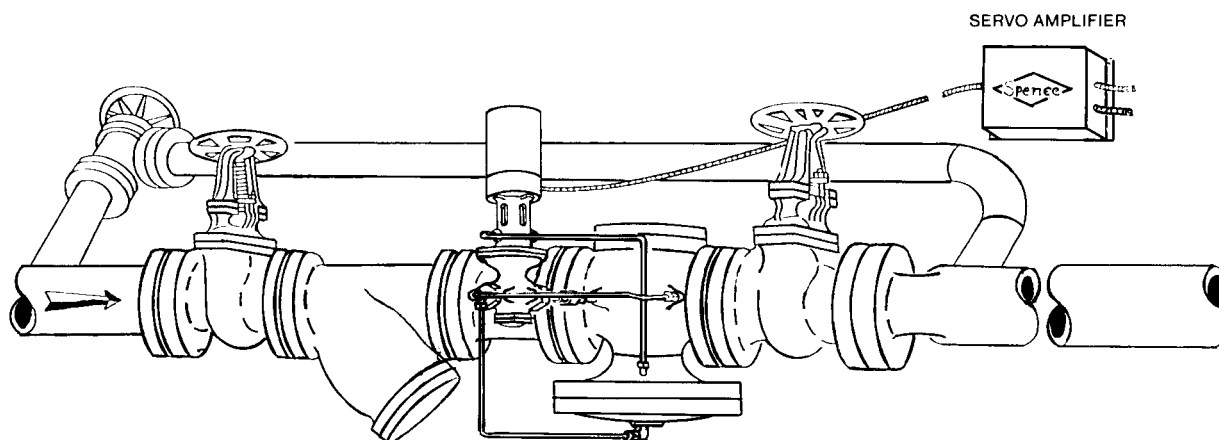
TYPE ED210 ELECTRONIC MODULATING REGULATOR

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
PRESS. REDUCING-STM/GAS



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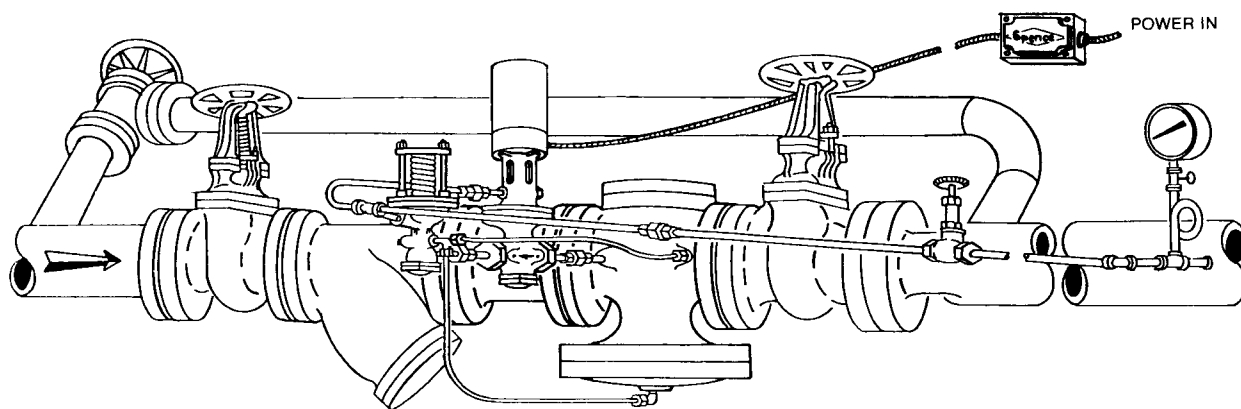
TYPE ED208D ELECTRONIC START-UP CONTROL

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.

Move 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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Application Guide

EDM33D W/TWO
SET POINT CONTROL

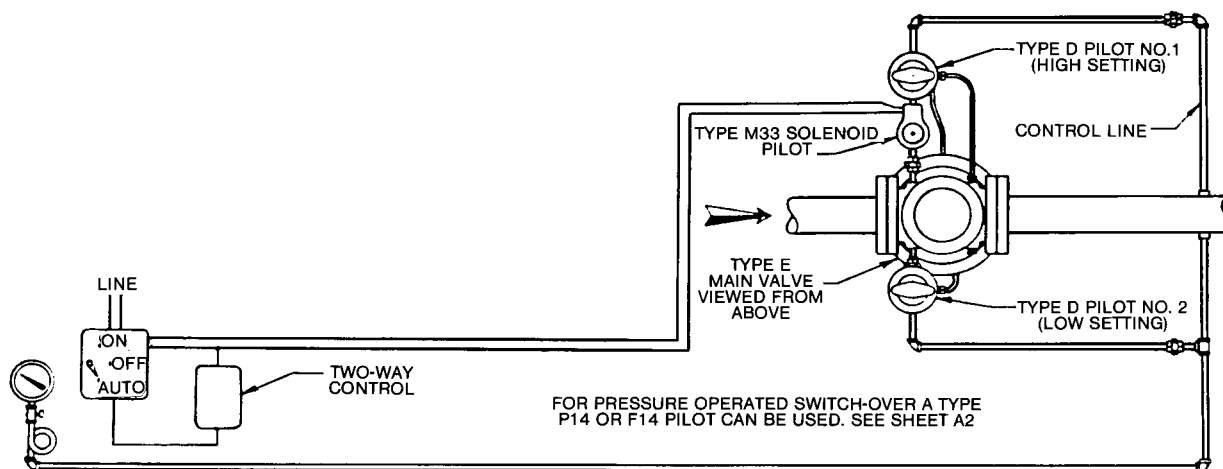
TYPE EDM33D PRESSURE REDUCING VALVE with TWO SET POINT CONTROL

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
PRESS. REDUCING-STM/GAS



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Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

D36 WATER
PRESSURE

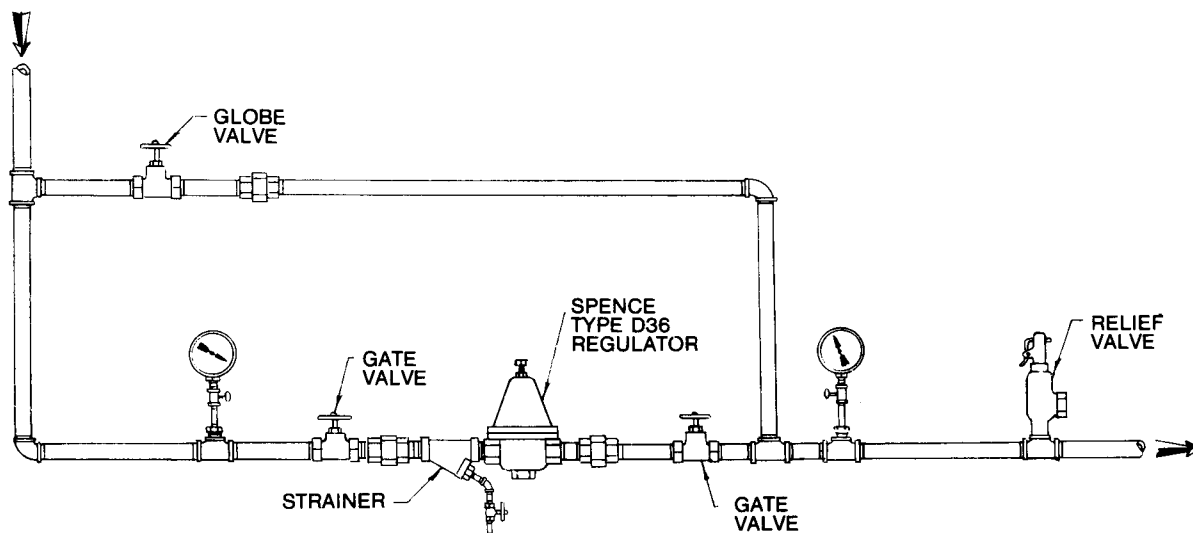
TYPE D36 WATER PRESSURE REDUCING VALVE

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.

APPLICATION GUIDE
PRESS. REDUCING-LIQUID



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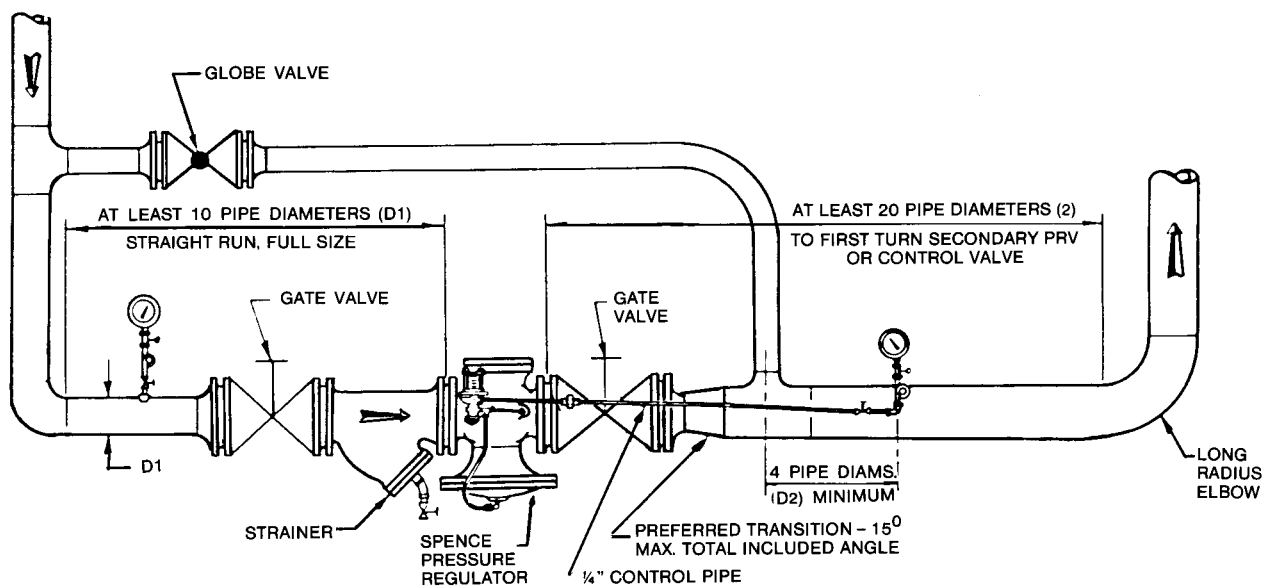
TYPE C34D PILOT OPERATED PRESSURE REDUCING VALVE

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.

C34D WATER
PRESSURE

APPLICATION GUIDE
PRESS. REDUCING-LIQUID



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Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

TYPE ET14 & ET14D TEMPERATURE REGULATOR

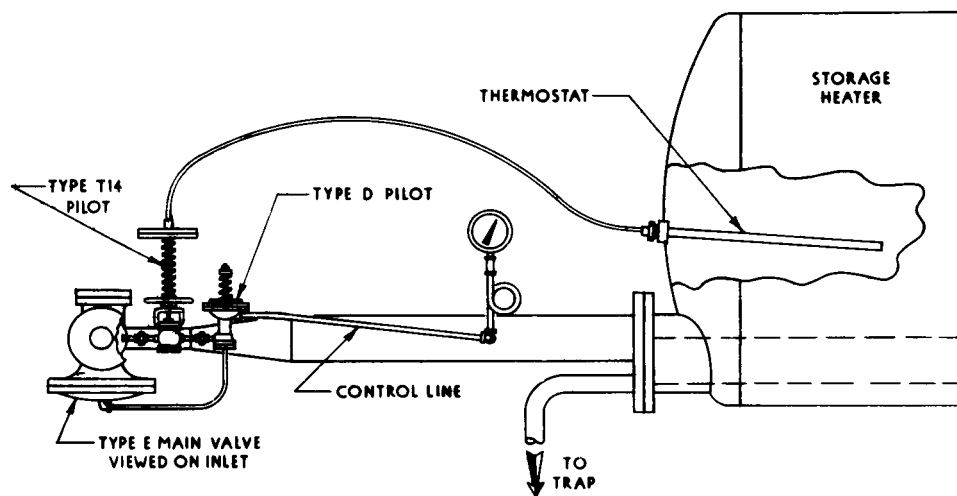
ET14/ET14D FOR
STORAGE HEATER

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.



APPLICATION GUIDE
TEMPERATURE

ADVANTAGES:

- Pilot operated accuracy.
- No separate PRV required.
- Many temperature ranges available.
- All packless construction.



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Application Guide

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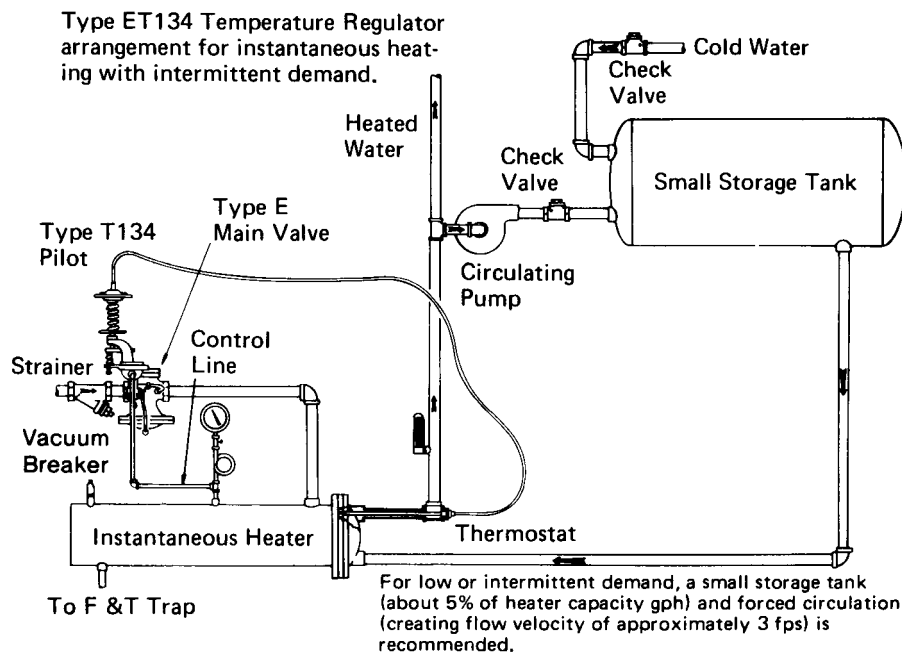
TYPE ET124 & ET134 TEMPERATURE REGULATOR

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.

ET124/ET134 FOR
INSTANT HEATER

APPLICATION GUIDE
TEMPERATURE



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Application Guide

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TYPE C34T52 COOLING REGULATOR

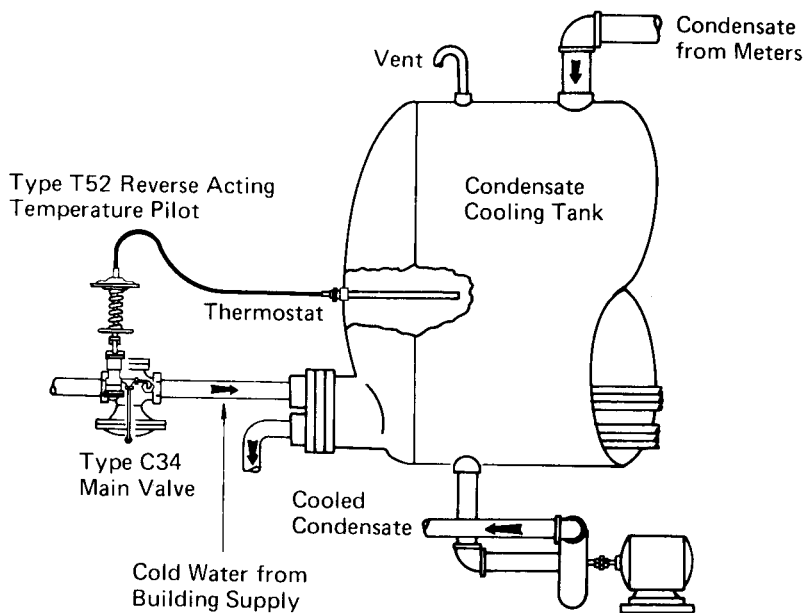
C34T52 FOR
COOLING

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.



APPLICATION GUIDE
TEMPERATURE

ADVANTAGES:

- Self contained.
- Balanced construction for greater stability.
- Can be furnished with pressure limit pilot.
- Tight shut-off.



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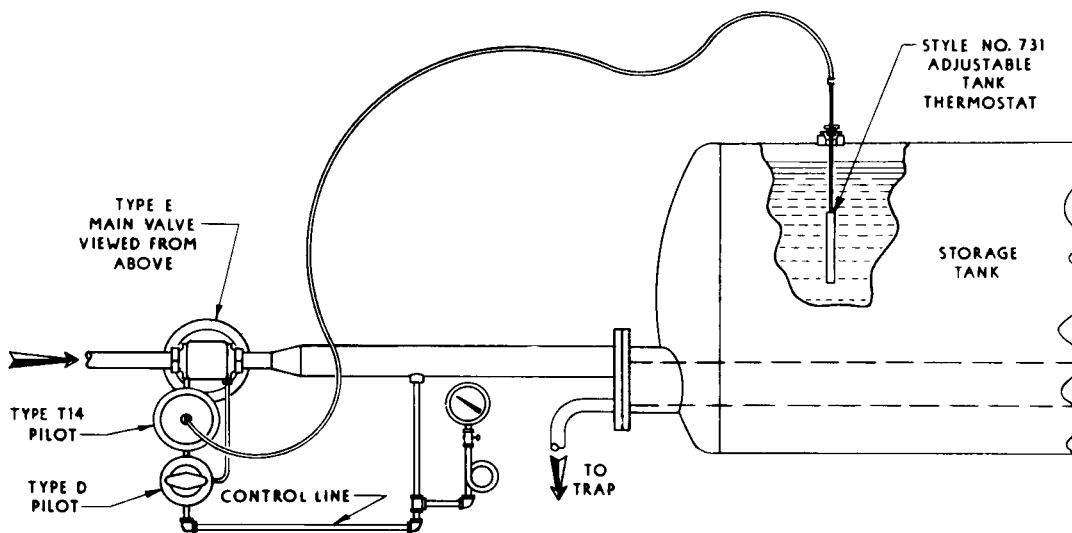
TYPE ET14D TEMPERATURE REGULATOR

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.

ET14D FOR FUEL
OIL STORAGE TANK

APPLICATION GUIDE
TEMPERATURE



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TYPE ET14T14 TEMPERATURE REGULATOR

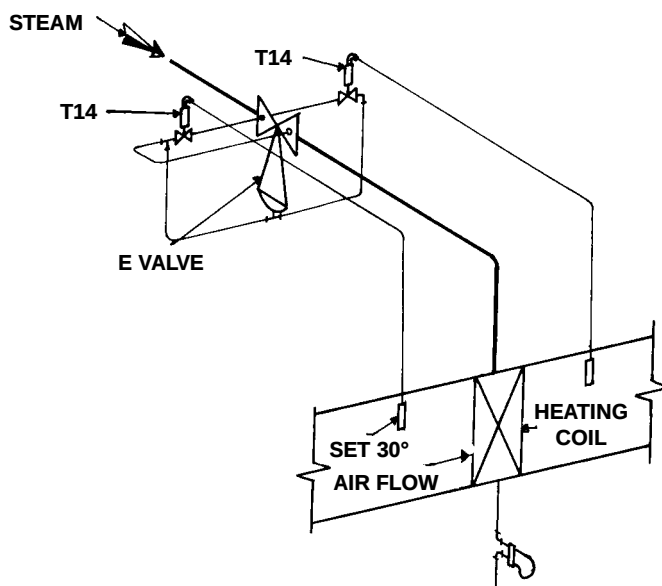
ET14T14 FOR
HEATING COILS

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.



APPLICATION GUIDE
TEMPERATURE

ADVANTAGES:

- One pilot will over-ride other.
- Pilot operated accuracy.
- Self contained.



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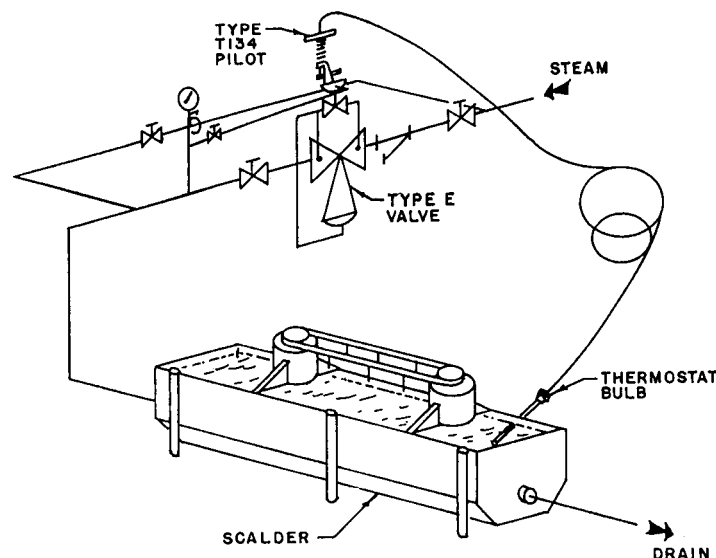
TYPE ET134 TEMPERATURE REGULATOR FOR POULTRY SCALDER

APPLICATION:

To provide self-contained pressure reduction, temperature and pressure control to a Poultry Scalders.

OPERATION:

A Poultry Scalders 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.

ET134 FOR
POULTRY SCALDER

APPLICATION GUIDE
TEMPERATURE



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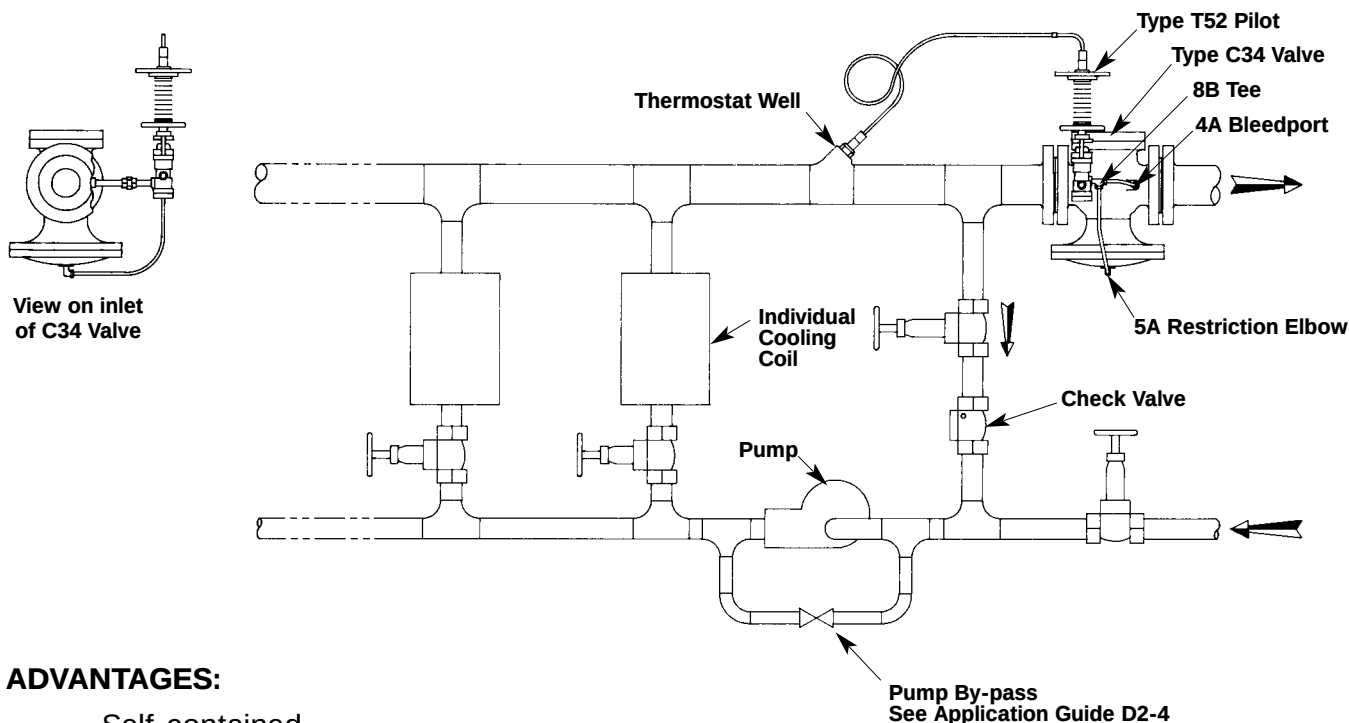
TYPE C34T52 TEMPERATURE REGULATOR for CHILLED WATER SYSTEM

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.

C34T52 FOR
CHILLED WATER

APPLICATION GUIDE
TEMPERATURE



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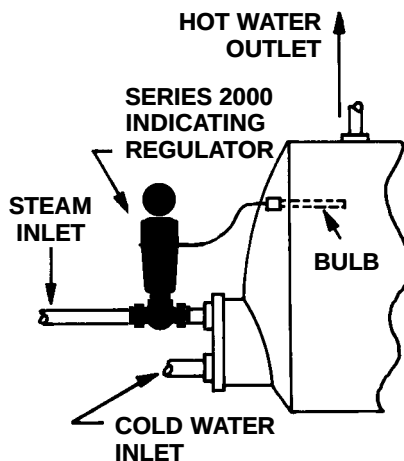
SERIES 2000 DIRECT OPERATED TEMPERATURE REGULATOR for STORAGE HEATER

APPLICATION:

To provide economical temperature control of a storage heater.

OPERATION:

Steam (or other heating medium) is supplied to the Series 2000 valve body. Variations in temperature at the bulb opens and closes the valve thus maintaining the desired temperature..



ADVANTAGES:

- Inexpensive.
- Uncomplicated
- Ideal when load fluctuations are minimal
- Self-contained

**SERIES 2000
STORAGE HEATER**

**APPLICATION GUIDE
TEMPERATURE**



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Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

SERIES 2000 DIRECT OPERATED TEMPERATURE REGULATOR for PLATE HEATER

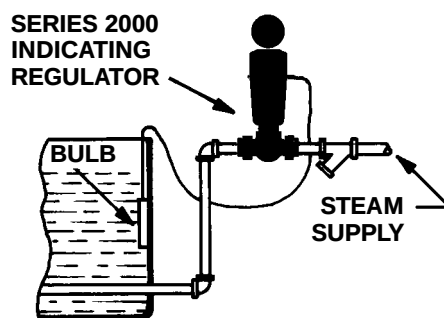
SERIES 2000
PLATING TANK

APPLICATION:

To provide economical temperature control of an open topped tank heater (ie: plating tank).

OPERATION:

Operation: Steam (or other heating medium) is supplied to the Series 2000 valve body. The bulb is suspended over the top of and into the tank. Variations in temperature at the bulb opens and closes the valve thus maintaining the desired temperature in the tank.



APPLICATION GUIDE
TEMPERATURE

ADVANTAGES:

- Inexpensive.
- Uncomplicated
- Self-contained



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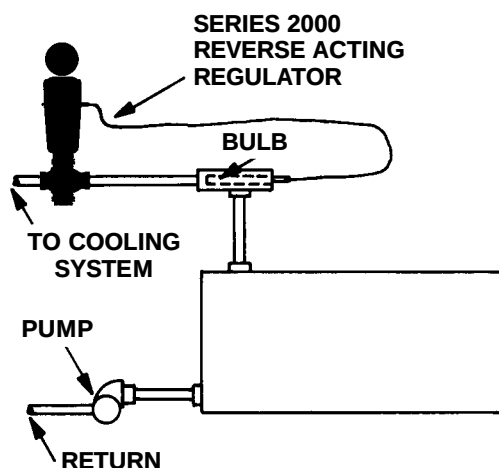
SERIES 2000 DIRECT OPERATED TEMPERATURE REGULATOR for ENGINE JACKET COOLING

APPLICATION:

To provide engine jacket cooling.

OPERATION:

Reverse acting Series 2000 is installed in the engine's cooling system as indicated in the diagram. The bulb senses the engine's coolant temperature and, when the coolant temperature reaches the Series 2000's set point, the valve opens and modulates to maintain the desired coolant temperature.



ADVANTAGES:

- Inexpensive.
- Uncomplicated
- Self-contained

SERIES 2000 ENGINE
JACKET COOLING

APPLICATION GUIDE
TEMPERATURE



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Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

SERIES 2000 DIRECT OPERATED TEMPERATURE REGULATOR for LIQUID COOLING TANK

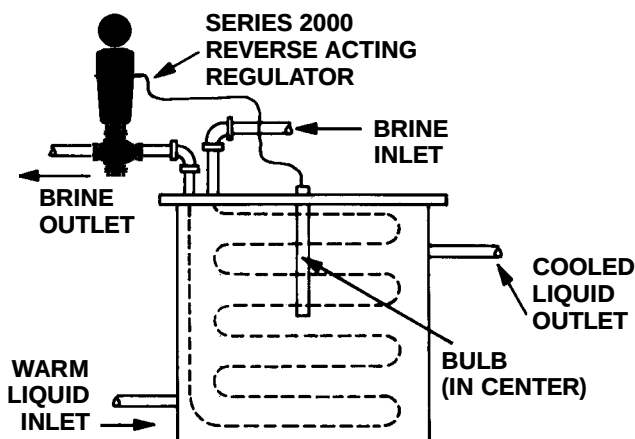
SERIES 2000
LIQUID COOLER

APPLICATION:

To operate a liquid cooling tank.

OPERATION:

As the warm liquid to be cooled reaches the Series 2000's bulb, the valve opens the by admitting coolant (brine) into the coolers coils. The Series 2000 modulates about its set point, thereby controlling the temperature of the cooled liquid.



APPLICATION GUIDE
TEMPERATURE

ADVANTAGES:

- Inexpensive.
- Uncomplicated
- Self-contained



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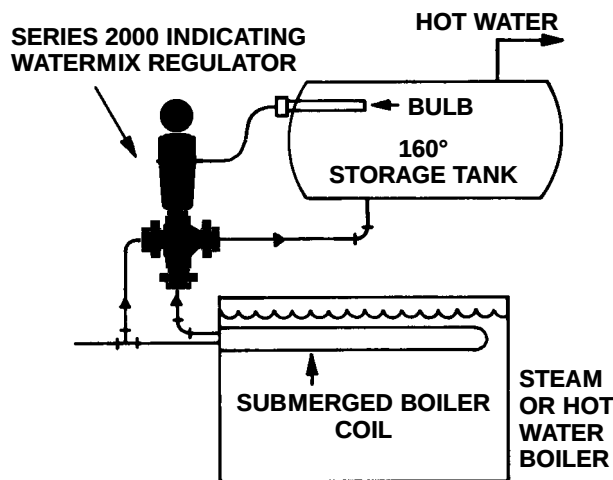
SERIES 2000 DIRECT OPERATED TEMPERATURE REGULATOR for THREE-WAY BLENDING/MIXING

APPLICATION:

To operate as a 3-way blending / mixing valve.

OPERATION:

The Series 2000 Three Way valve is installed as indicated in the diagram. In this case, cold water enters the valve from the left while the heated boiler water enters from the bottom. The bulb senses the temperature in the storage tank and modulates the amounts of cold and hot water blended (mixed) to maintain the desired temperature of the water in the storage tank.



ADVANTAGES:

- Inexpensive.
- Uncomplicated
- Self-contained

**SERIES 2000
BLENDING/MIXING**

**APPLICATION GUIDE
TEMPERATURE**



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Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

SERIES 2000 DIRECT OPERATED TEMPERATURE REGULATOR for THREE-WAY DIVERTING

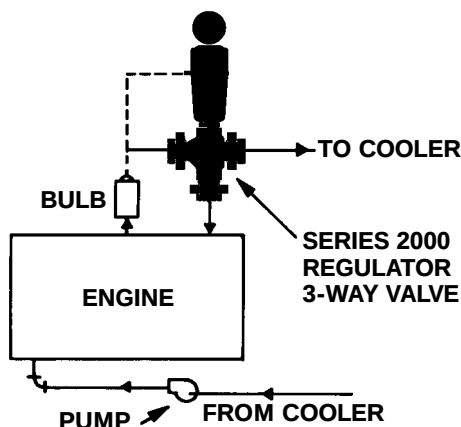
SERIES 2000
DIVERTING

APPLICATION:

To operate as a 3-way diverting valve.

OPERATION:

Engine coolant is supplied to the left, bottom discharge is returning to the engine and right discharge is to cooler. Engine coolant is returned to the engine until it reaches the valve's set point. At that point, the valve starts modulating between returning engine coolant to the engine and discharging to the cooler to maintain the desired temperature.



ADVANTAGES:

- Inexpensive.
- Uncomplicated
- Self-contained

APPLICATION GUIDE
TEMPERATURE



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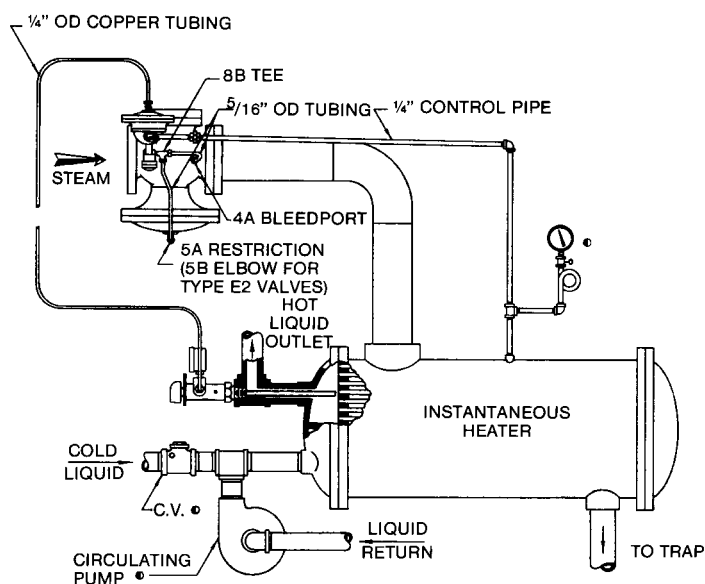
TYPE EAT61 AIR CONTROLLED TEMPERATURE REGULATOR

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.

EAT61 AIR
CONTROLLED

APPLICATION GUIDE
TEMPERATURE



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SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

TYPE EA TEMPERATURE REGULATOR for REMOTE THERMOSTAT CONTROL

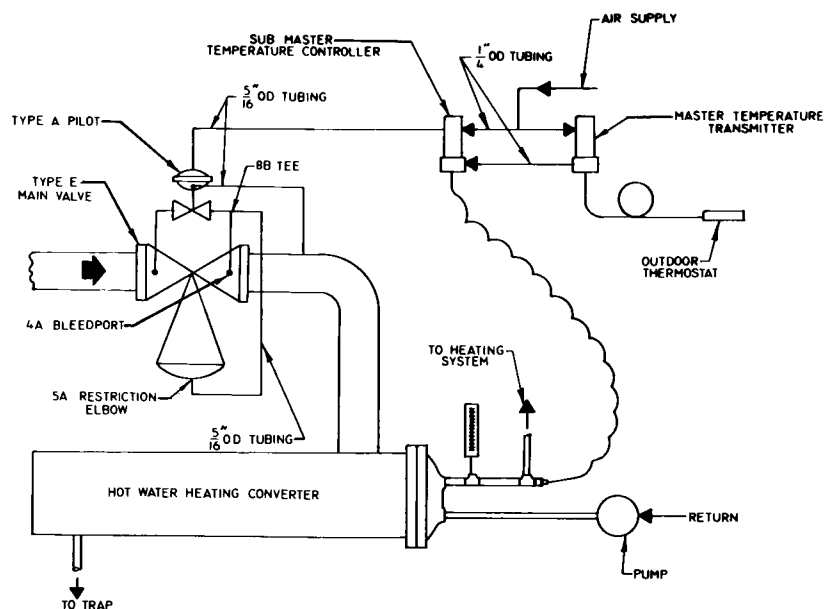
EA WIREMATE
THERMOSTAT

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
TEMPERATURE



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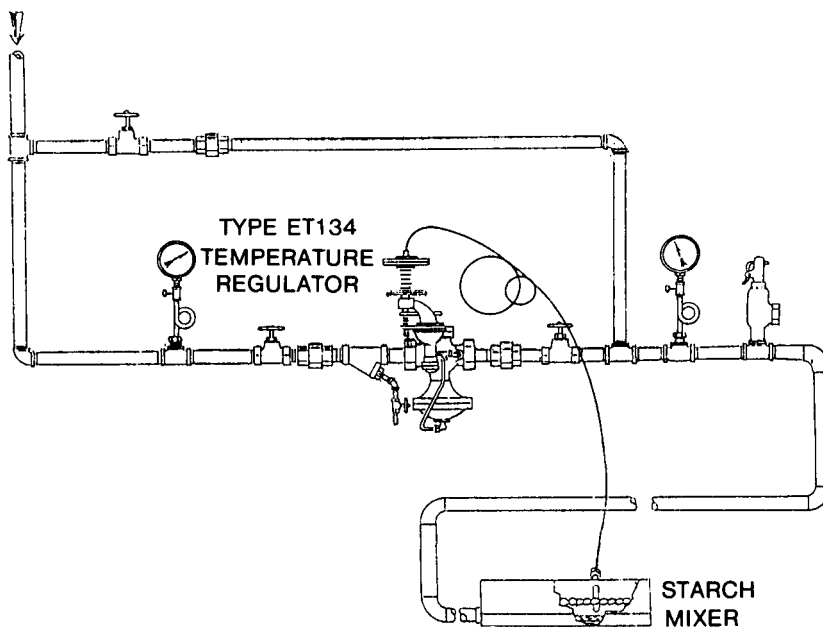
TYPE ET134 SELF-CONTAINED TEMPERATURE REGULATOR for STARCH MIXER

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

ET134 FOR
STARCH MIXER

APPLICATION GUIDE
TEMPERATURE



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Application Guide

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TYPE EAT60 TEMPERATURE REGULATOR for WAX APPLICATION CONTROL

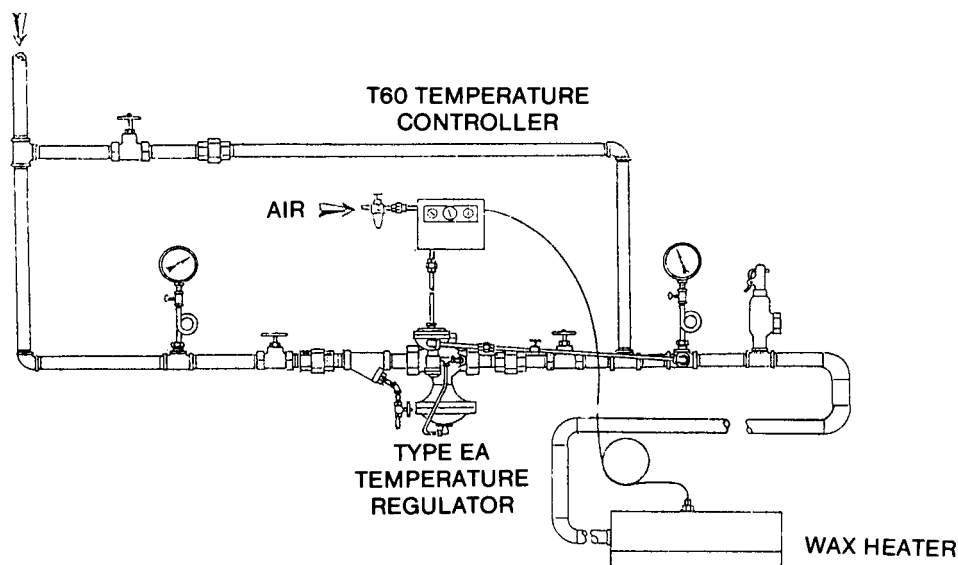
EAT60 FOR WAX
APPLICATION

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.



APPLICATION GUIDE
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.



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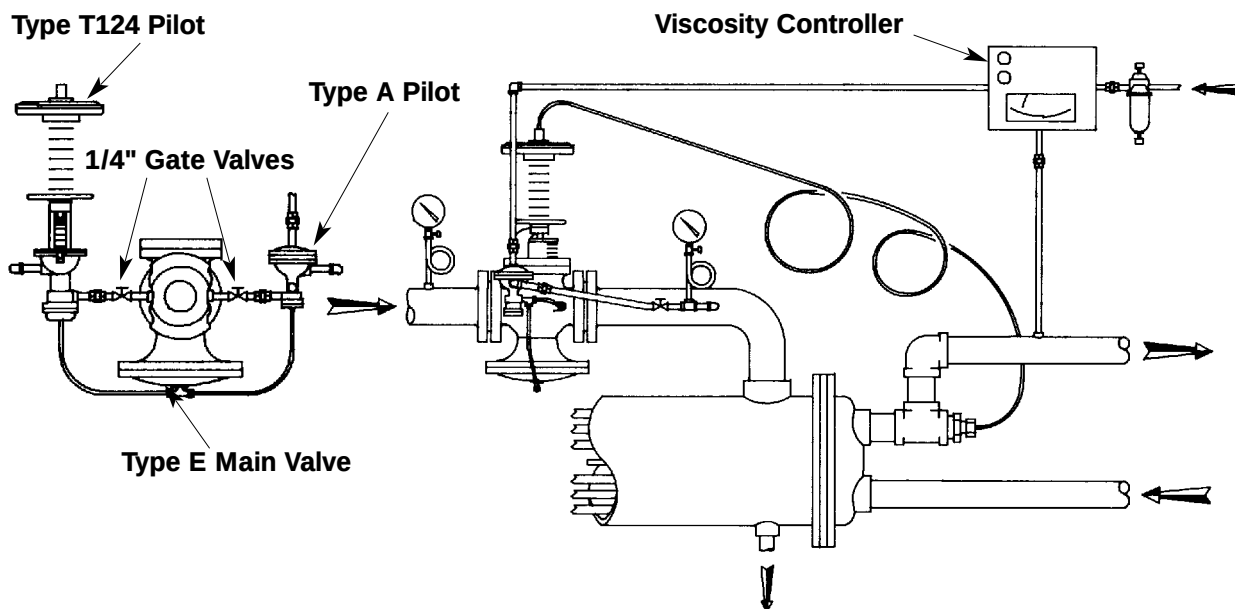
TYPE ET124A VISCOSITY/TEMPERATURE REGULATOR

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

ET124A VISCOSITY/
TEMPERATURE

APPLICATION GUIDE
TEMPERATURE



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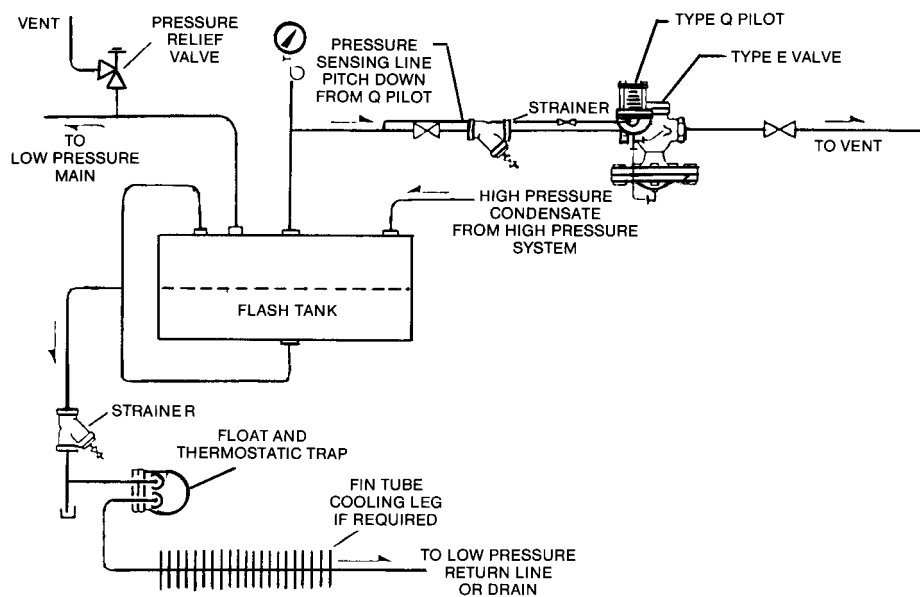
TYPE EQ BACK PRESSURE REGULATOR

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.

EQ BACK PRESS.
FLASH TANK

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OTHER PRODUCTS



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Application Guide

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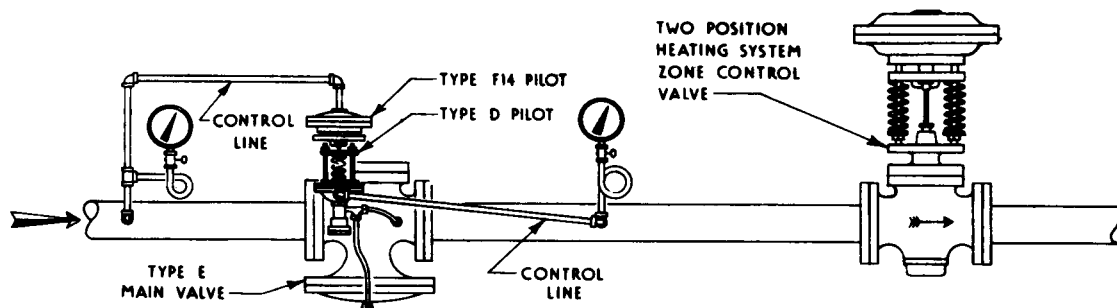
TYPE EF14D PRESSURE REDUCING VALVE with BACK PRESSURE CONTROL

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 overpressure regulator alone.
- Operates on small differential - does not allow large drop in boiler pressure.
- Prevents "upsetting" boiler controls.
- All standard equipment.

EF14D BACK PRESS.
TO RETARD FLOW

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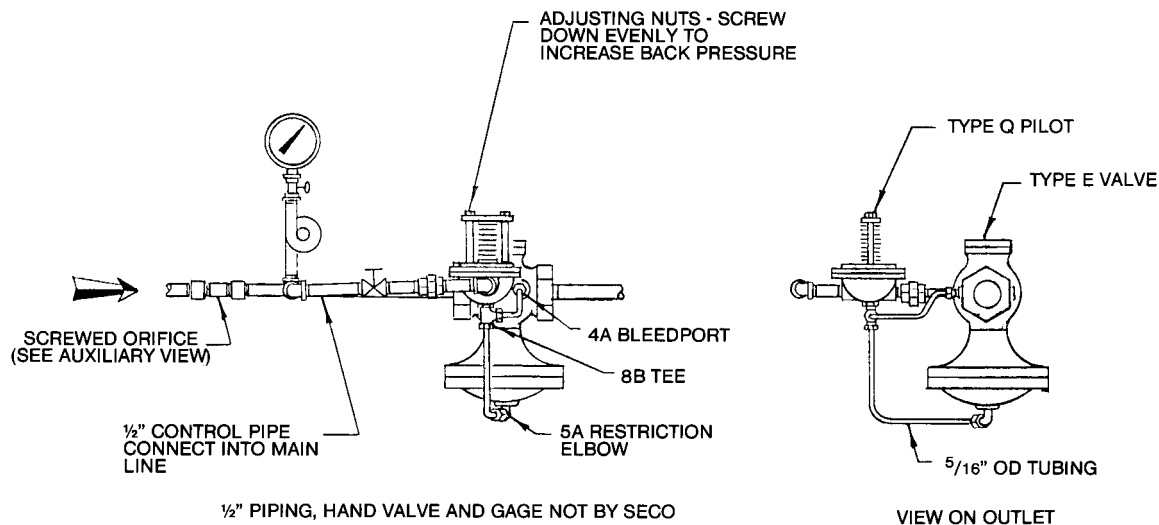
TYPE EQ BACK PRESSURE VALVE with FLOW CONTROL ORIFICE

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.

EQ BACK PRESS.
W/FLOW CONTROL

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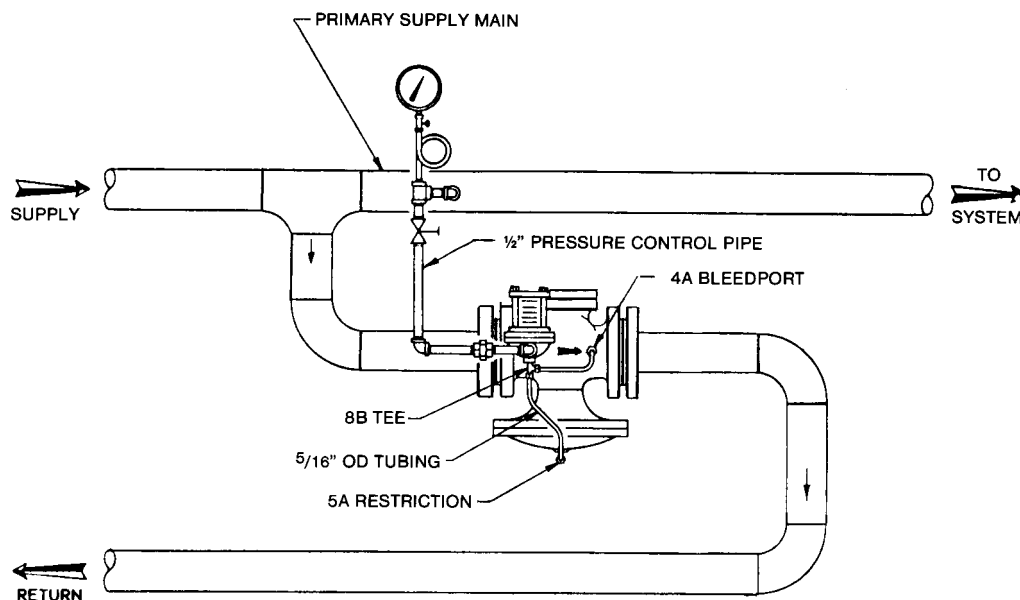
TYPE C34Q BACK PRESSURE PUMP BYPASS CONTROL

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.

C34Q BACK PRESS.
PUMP BYPASS

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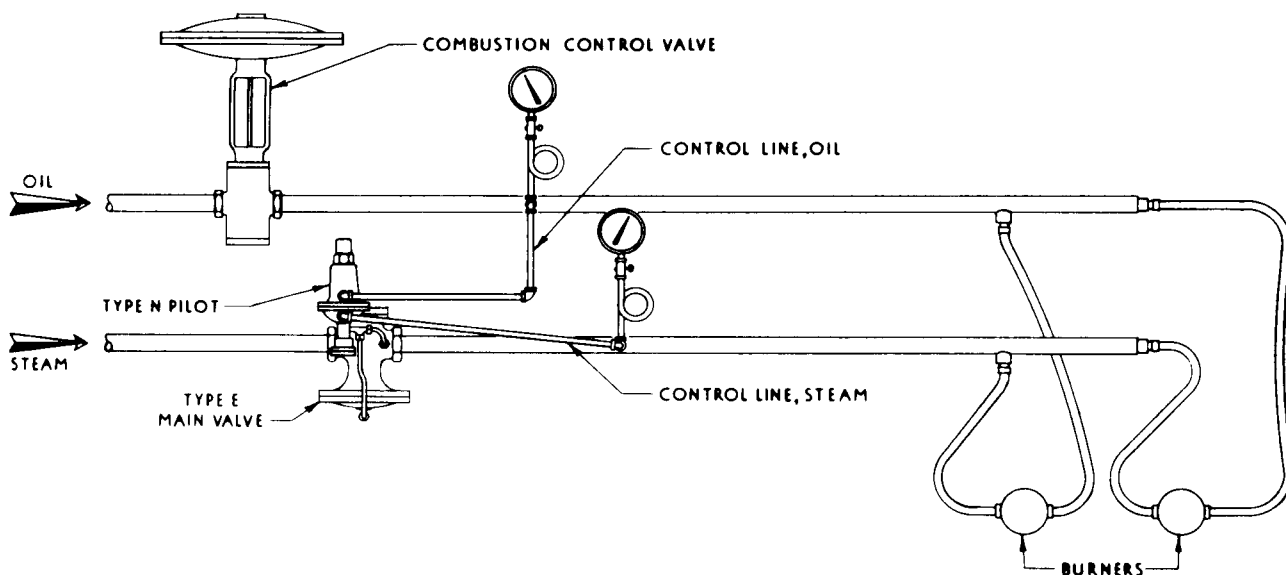
TYPE EN DIFFERENTIAL REGULATOR

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.

EN DIFFERENTIAL
FOR OIL BURNER

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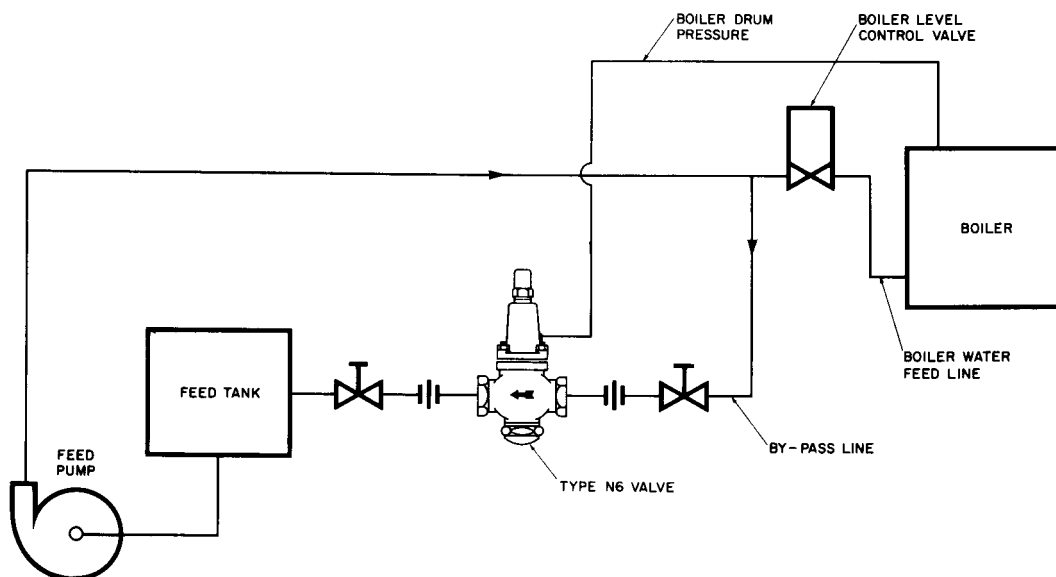
TYPE N6 DIFFERENTIAL PRESSURE VALVE

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.

N6 DIFFERENTIAL
PUMP DISCHARGE

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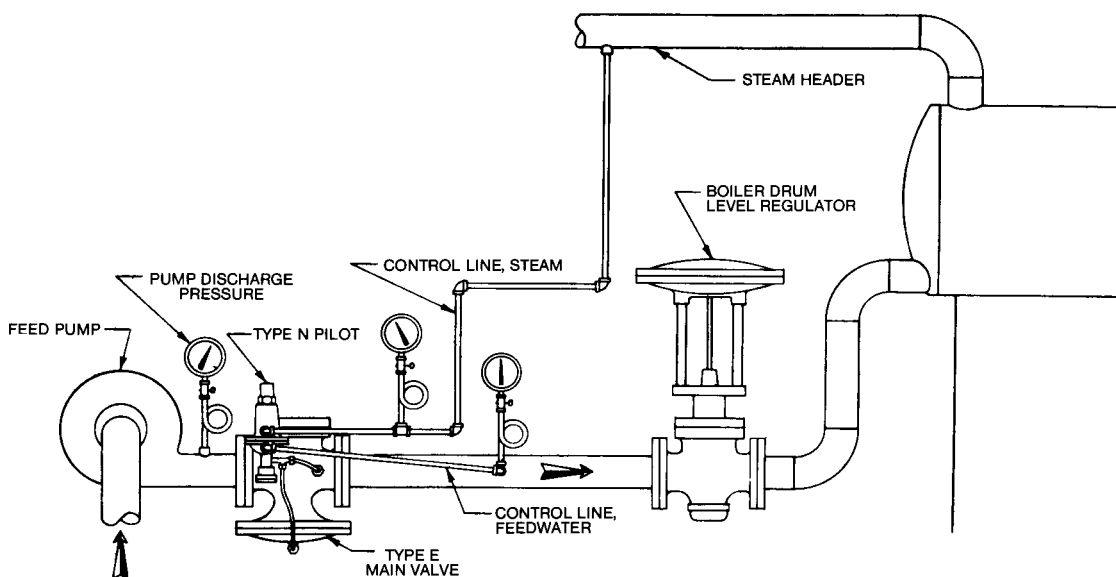
TYPE C34N DIFFERENTIAL PRESSURE REGULATOR

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.

C34N DIFFERENTIAL
BOILER LEVEL

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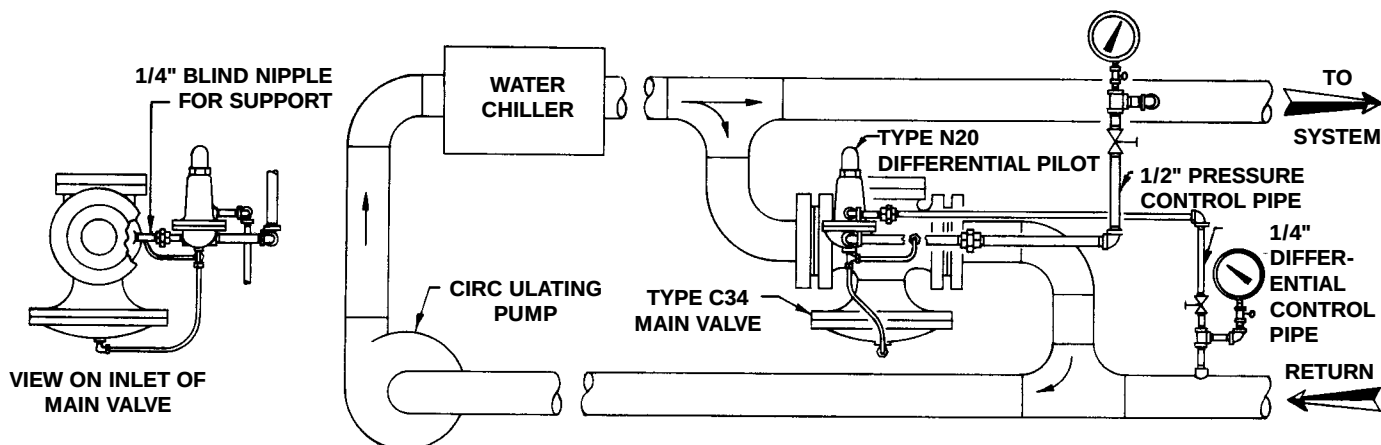
TYPE C34N20 DIFFERENTIAL REGULATOR

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 C34 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.
- E valve may be used instead of C34.

C34N20 DIFFERENTIAL
CHILLED WATER

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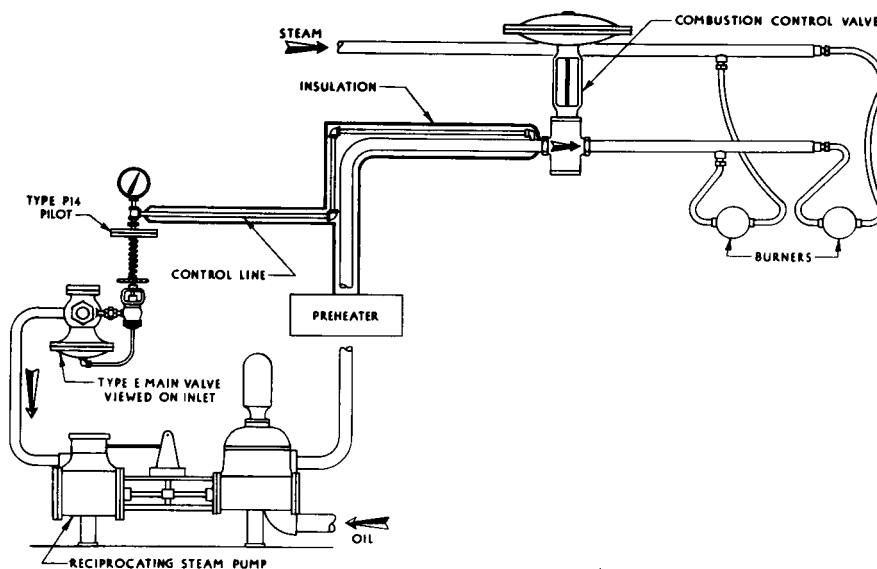
TYPE EP14 PUMP GOVERNOR

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.



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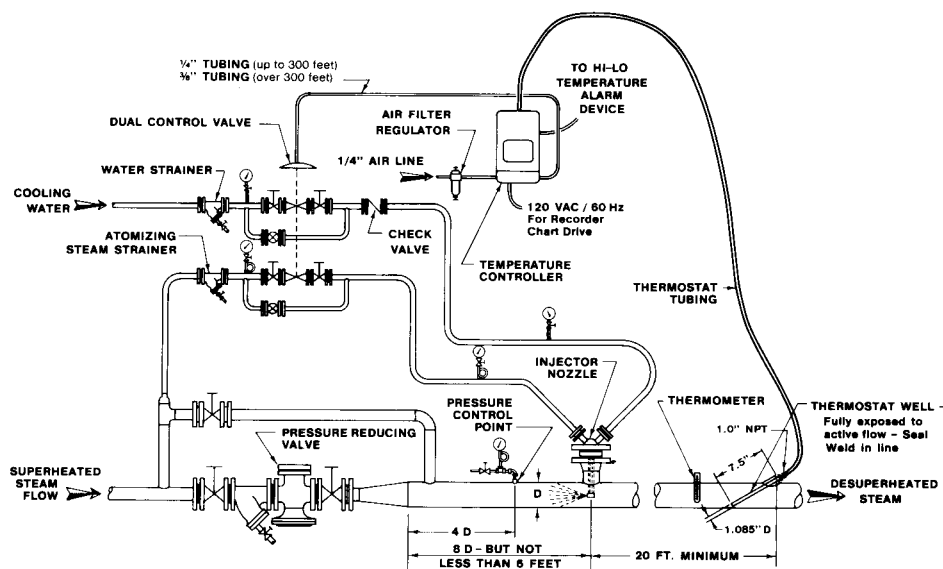
STEAM ATOMIZING AIR OPERATED DESUPERHEATER

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.

DESUPERHEATER
AIR OP/STM ATOM

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OTHER PRODUCTS



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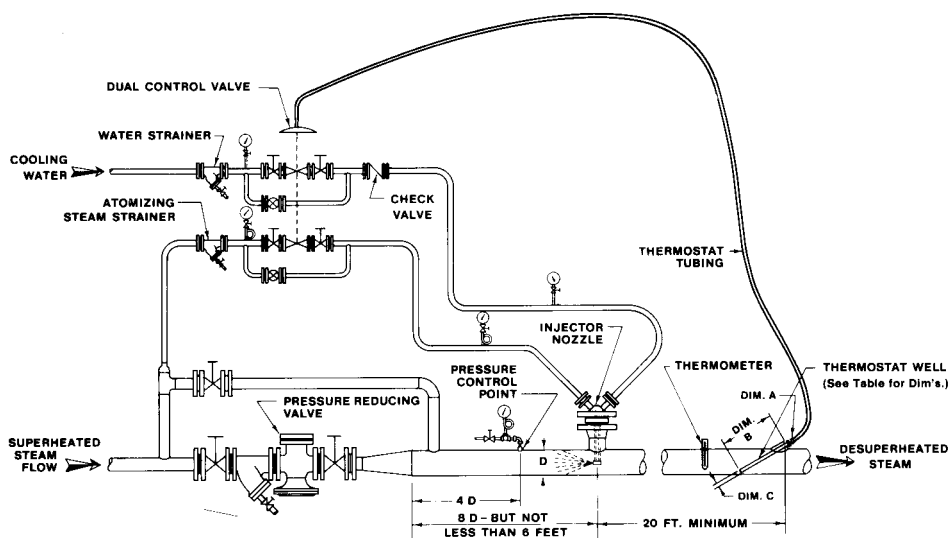
STEAM ATOMIZING DIRECT OPERATED DESUPERHEATER

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.

DESUPERHEATER
DIRECT OP/STM ATOM

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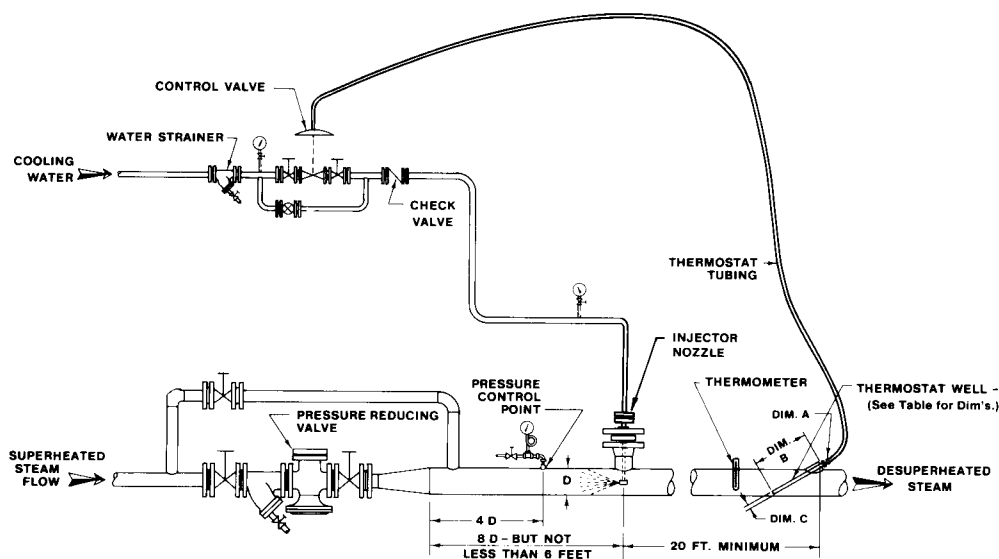
MECHANICAL ATOMIZING DIRECT OPERATED DESUPERHEATER

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.

DESUPERHEATER
DIRECT OPERATED ATOM

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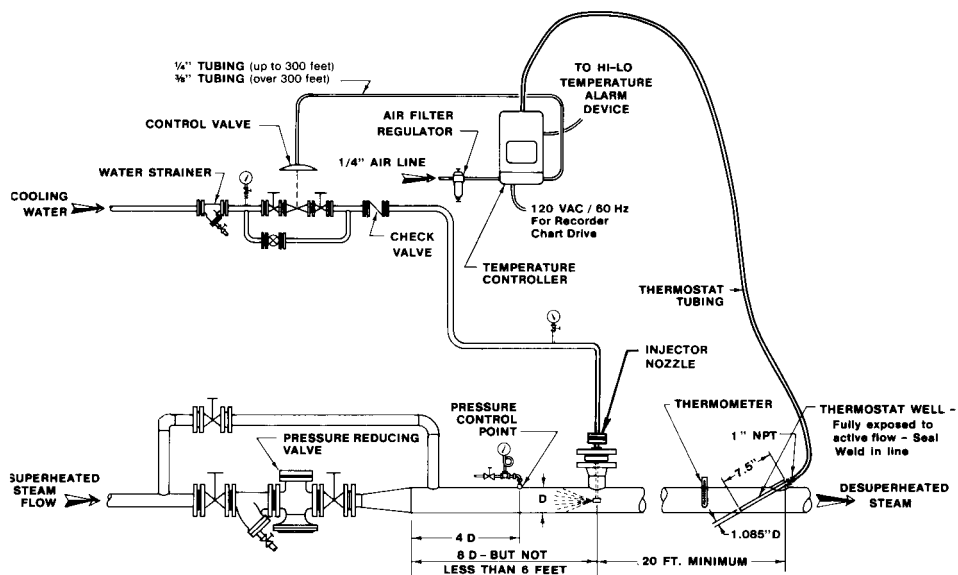
MECHANICAL ATOMIZING AIR OPERATED DESUPERHEATER

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.

DESUPERHEATER
AIR OP/MECH ATOM

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OTHER PRODUCTS



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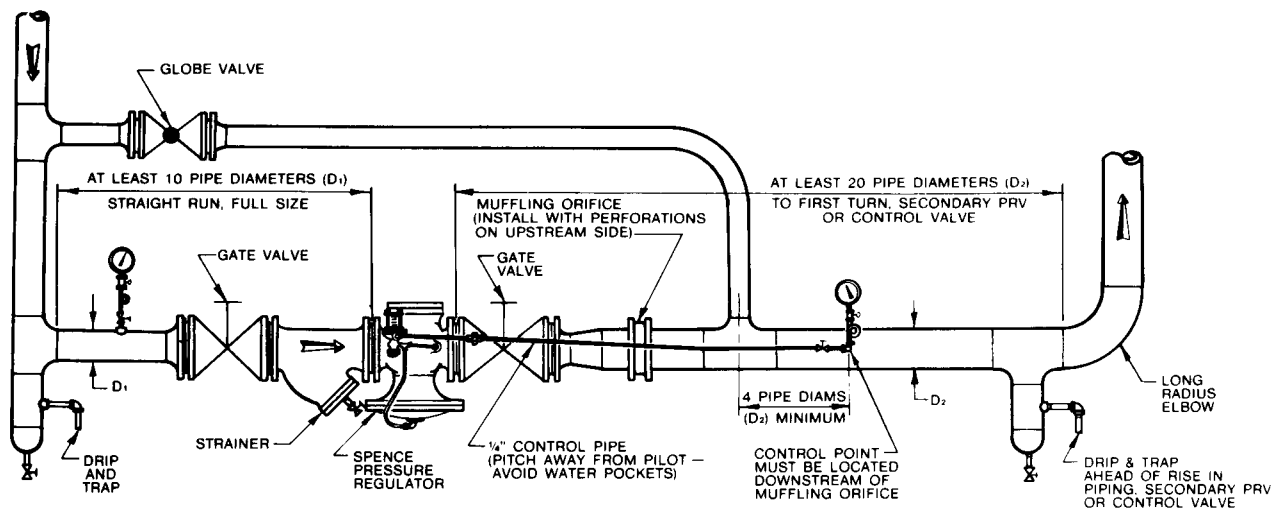
PRESSURE REGULATOR with MUFFLING ORIFICE

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.

REGULATOR W/
MUFFLING ORIFICE

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OTHER PRODUCTS



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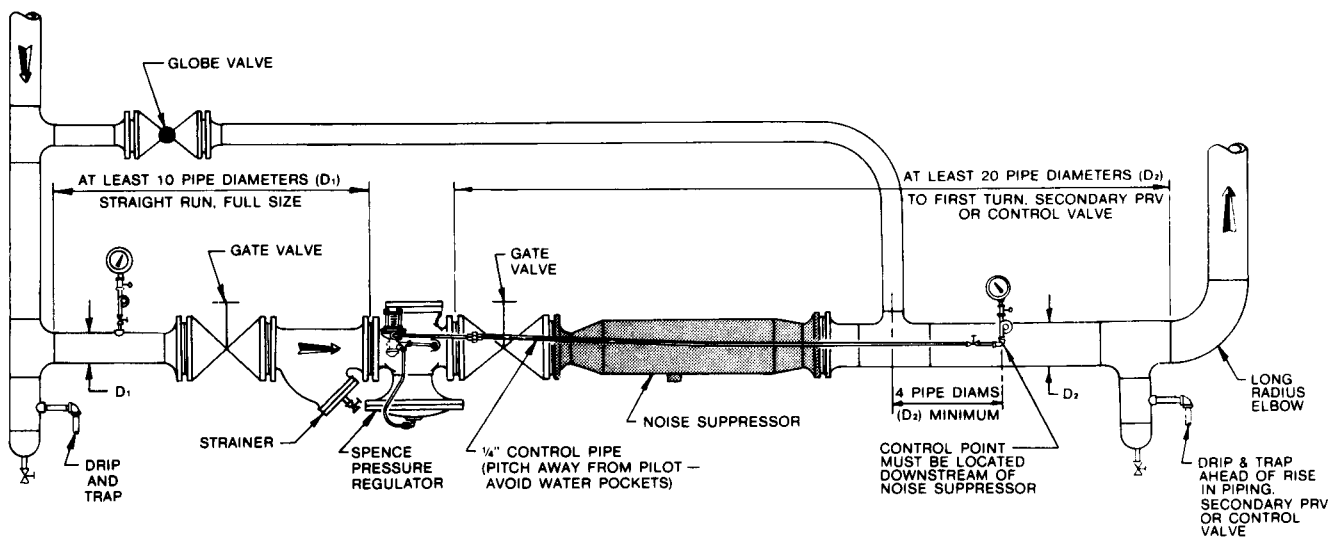
PRESSURE REGULATOR with NOISE SUPPRESSOR

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.

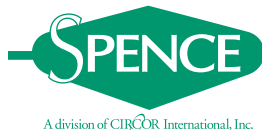


ADVANTAGES:

- Maintenance free.
- Standard Spence valves used.
- Capacity of valve not reduced.

REGULATOR W/
NOISE SUPPRESSOR

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OTHER PRODUCTS



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Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

TYPE NFT 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 with SLR (Steam Lock Release)

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.

Lifting condensate from the cylinder dryer through the rotary siphoning joint may cause the condensate to flash. Utilizing the SLR option allows a slight, continuous bleed which prevents flash steam from locking up the trap. This option is useful wherever piping configurations require a lift in elevation before the trap.

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.

NFT TRAP
CORRUGATION

APPLICATION GUIDE
OTHER PRODUCTS

Acknowledgement and thanks are credited to Kelly Equipment Inc., Wisconsin.



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SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

TYPE NFT 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 to 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.

NFT TRAP
STEAM COILS

APPLICATION GUIDE
OTHER PRODUCTS

Acknowledgement and thanks are credited to Kelly Equipment Inc., Wisconsin.



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SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

TYPE NFT 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 NFT 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.

NFT TRAP
AIR HEATING COILS

APPLICATION GUIDE
OTHER PRODUCTS



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SPENCE ENGINEERING COMPANY, INC. 150 GOLDENHAM ROAD, WALDEN, NY 12586-2035

TYPE NFT FREE FLOAT STEAM TRAP for REBOILERS

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 NFT 253. If the reboiler does not have a steam flow meter, revert to the drawing (always available) for design criteria.

ADVANTAGES OF THE NFT 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.



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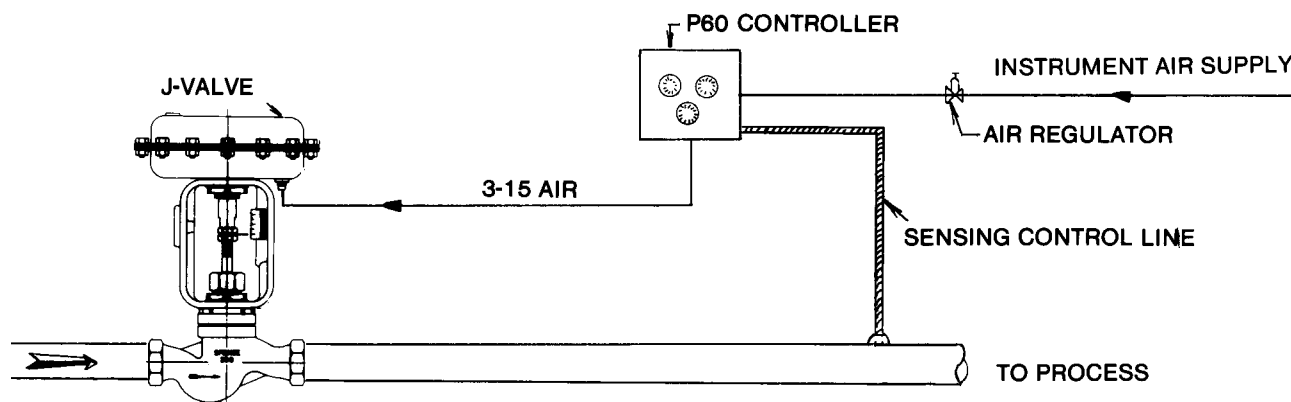
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INTIMIDATOR TYPE J CONTROL VALVE and P60 PRESSURE CONTROLLER for FAST LOAD CHANGES and VARYING PRESSURES

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

a 1" J Valve with a 7/8" port will flow 2275#/hr.

A 7/8" port at 100 psig will require an Actuator A 36-in² and 3-15 air signal.

JP60 FOR FAST
LOAD CHANGES

APPLICATION GUIDE
CONTROL VALVES



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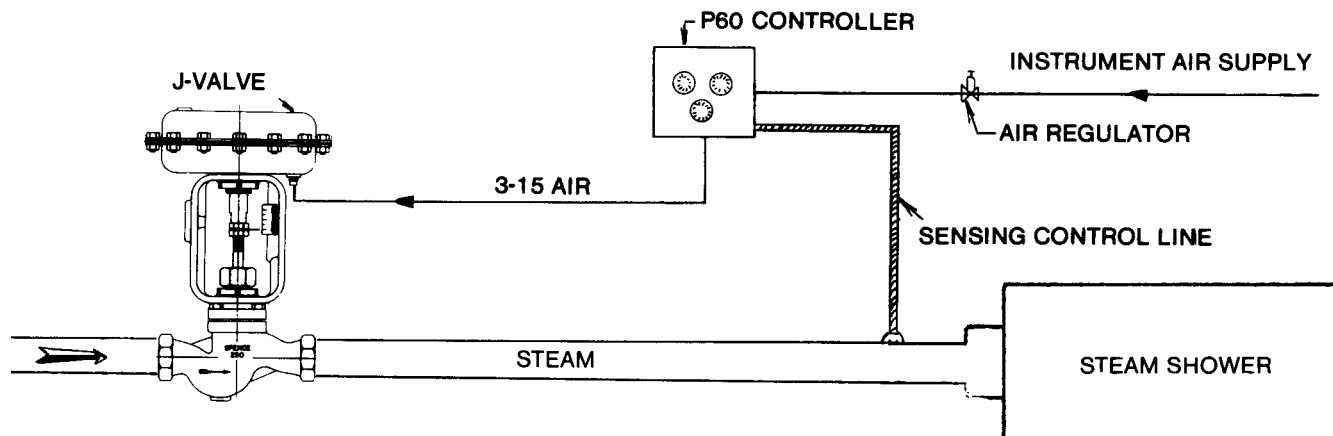
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INTIMIDATOR TYPE J CONTROL VALVE and P60 PRESSURE CONTROLLER for STEAM SHOWERS

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

a 1" J Valve with a 5/8" port will flow 920 #/hr.

A 5/8" port at 75 psig will require an Actuator A 36-in² and 3-15 air signal.

Compliments of Crane Paper Co.

JP60 FOR PAPER
PROCESS SHOWERS
APPLICATION GUIDE
CONTROL VALVES



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Application Guide

SPENCE ENGINEERING COMPANY, INC. 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

INTIMIDATOR TYPE J CONTROL VALVE and LIQUID LEVEL CONTROLLER for BOILERS

APPLICATION:

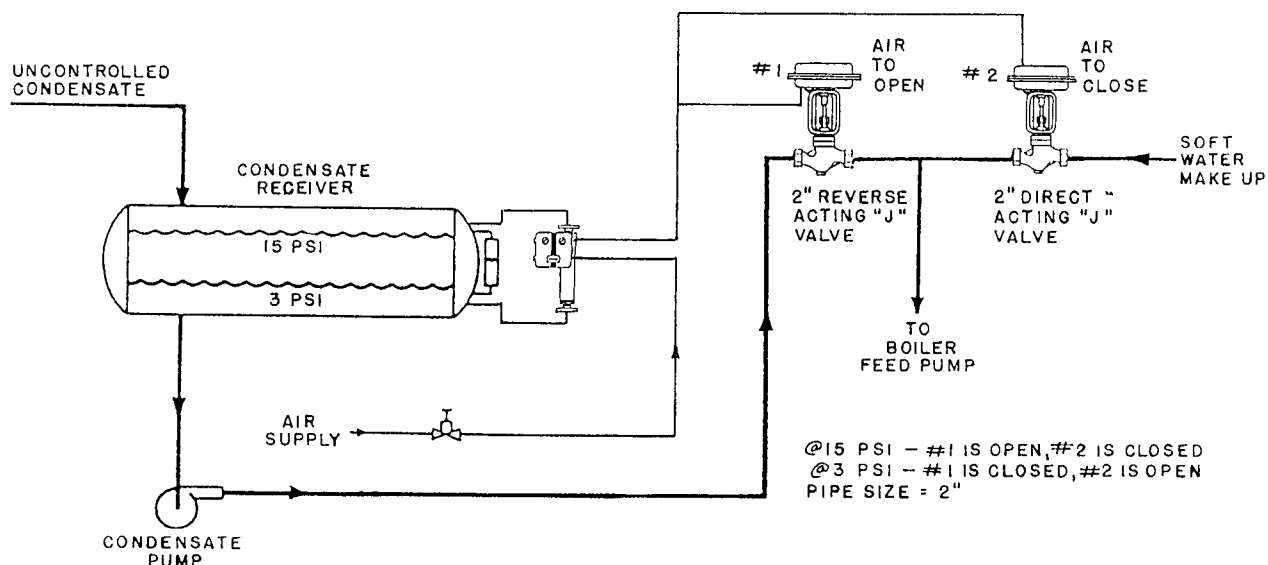
To provide water to a boiler at all times, even if water in condensate tank falls too low.

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.



TYPE J LIQUID
LEVEL CONTROL

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CONTROL VALVES



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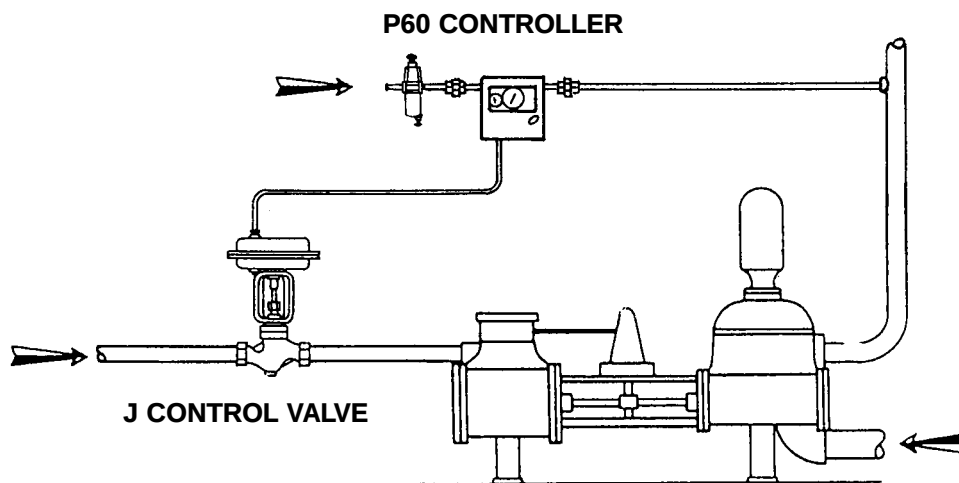
INTIMIDATOR TYPE JP60 for PUMP GOVERNOR

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.



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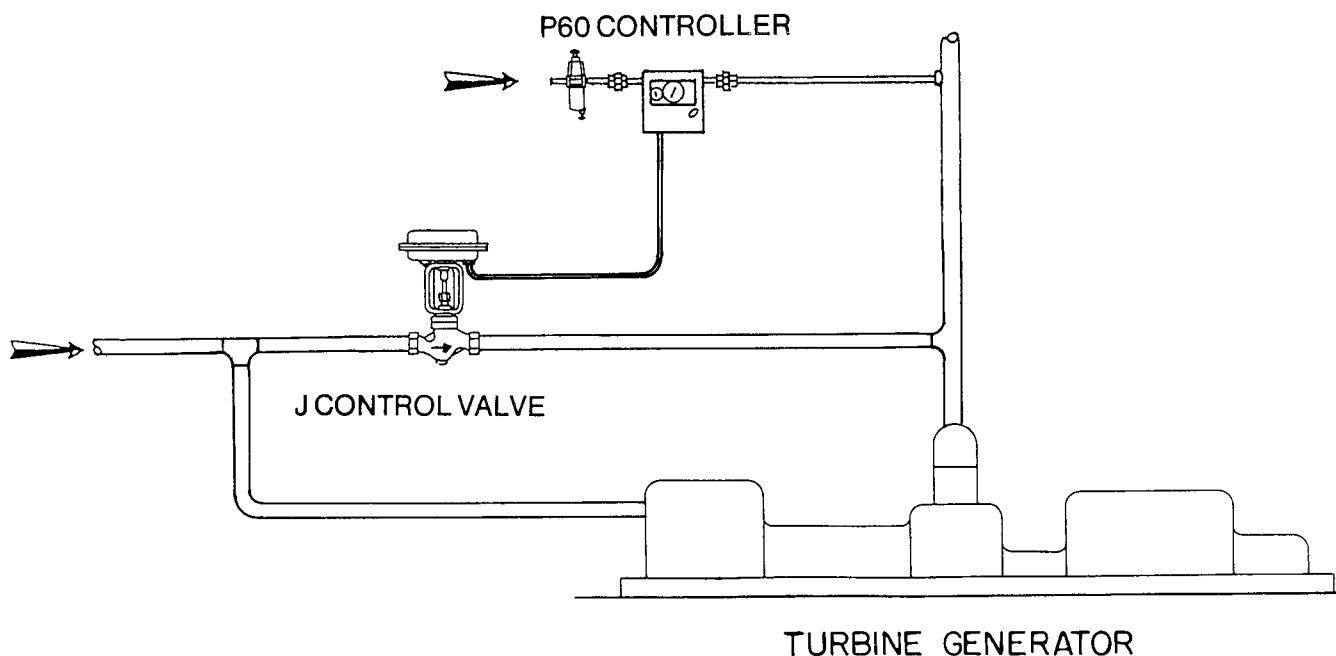
INTIMIDATOR TYPE J CONTROL VALVE with P60 CONTROLLER for TURBINE EXHAUST MAKE-UP

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

P¹ = 17 psig

W² = 8000 lbs/hr

2" J Valve, 1 3/4" Port

0-30 psig P60

For Pilot-operated equivalent, see previous page

JP60 TURBINE
EXHAUST MAKEUP

APPLICATION GUIDE
CONTROL VALVES



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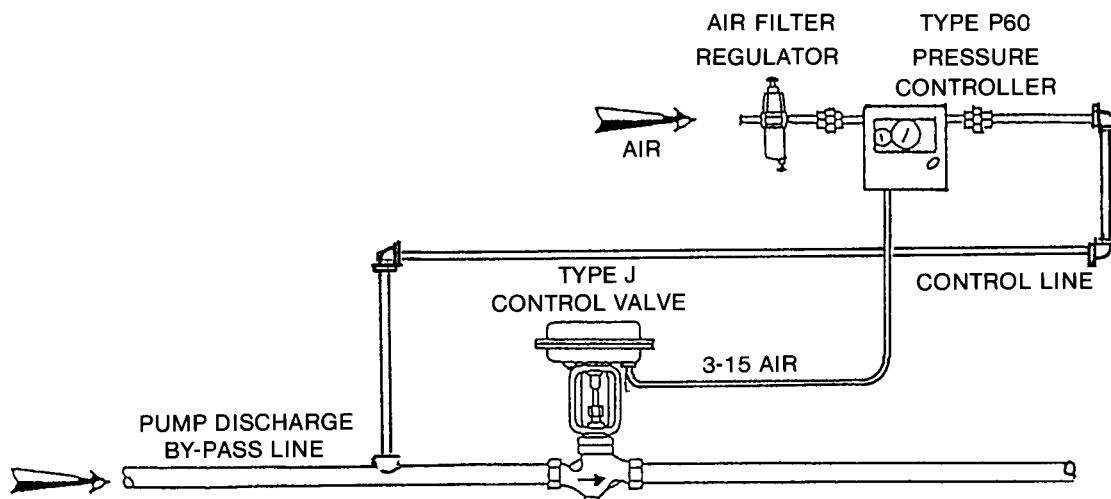
INTIMIDATOR TYPE J CONTROL VALVE and P60 BACK PRESSURE CONTROLLER for PUMP DISCHARGE

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



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Application Guide

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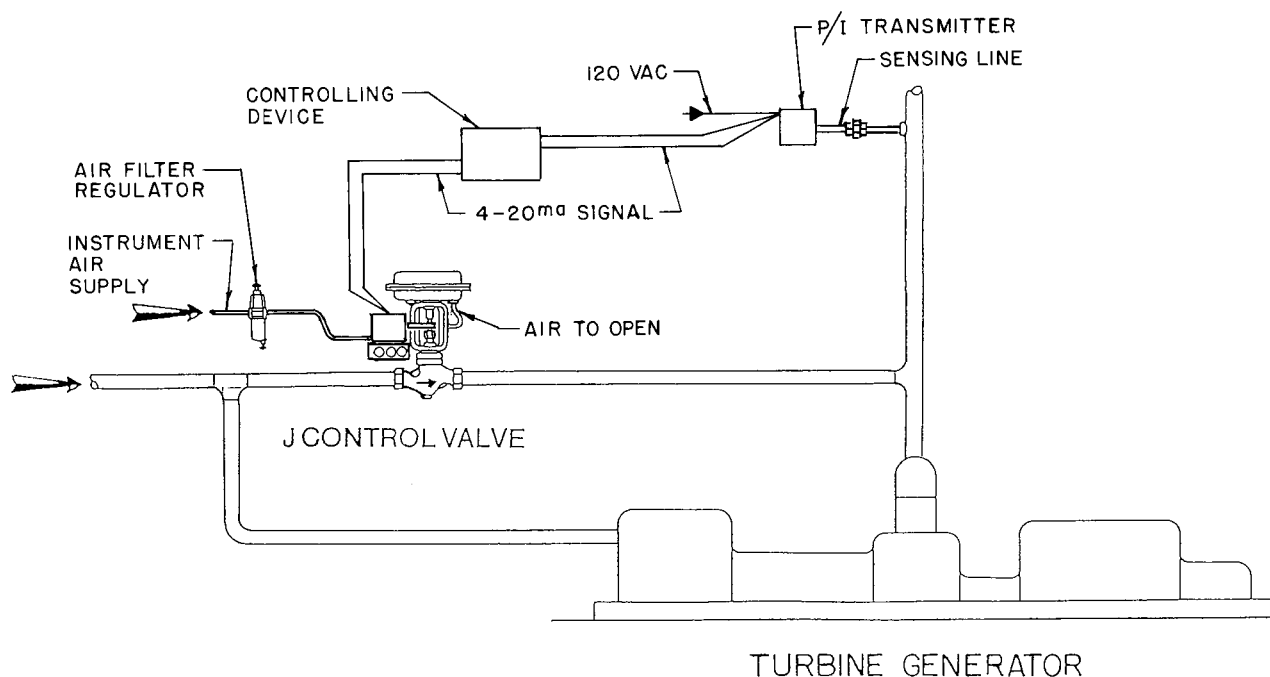
INTIMIDATOR TYPE J CONTROL VALVE with ELECTRO-PNEUMATIC POSITIONER for COMPUTERIZED COGENERATION CONTROL

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

P¹ = 17 psig

W² = 8000 lbs/hr

2" J Valve, 1 3/4" Port



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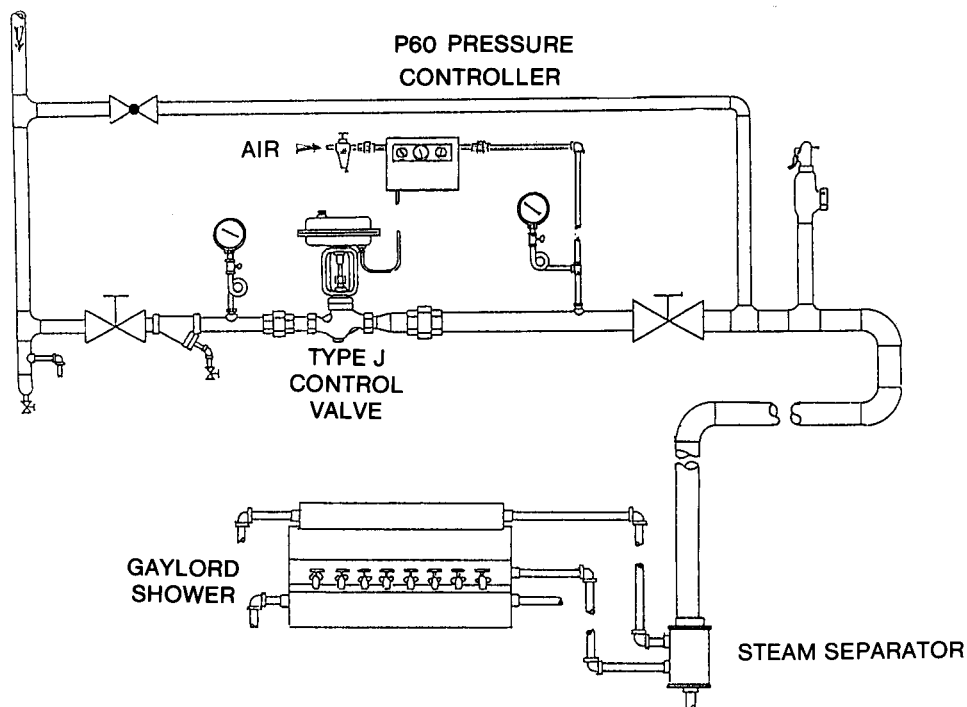
INTIMIDATOR TYPE J CONTROL VALVE with P60 CONTROLLER for GAYLORD SHOWER CONTROL

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.



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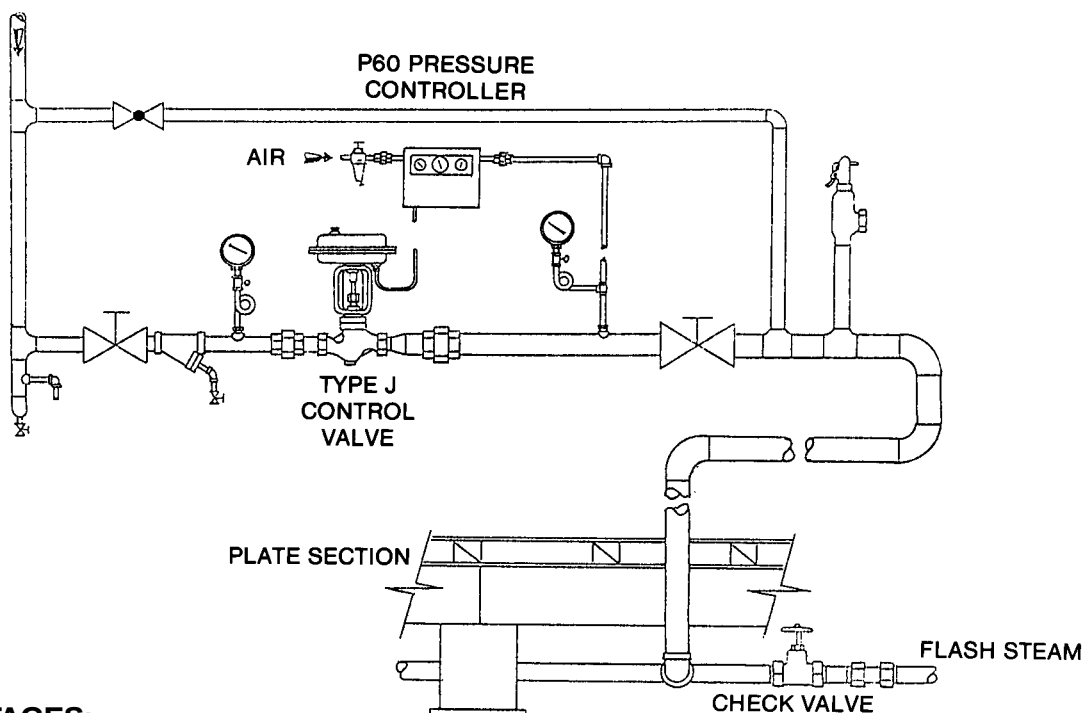
INTIMIDATOR TYPE J CONTROL VALVE with P60 CONTROLLER for PLATE SECTIONS of a CORRUGATOR

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.

JP60 CORRUGATOR
PLATE SECTIONS

APPLICATION GUIDE
CONTROL VALVES



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Application Guide

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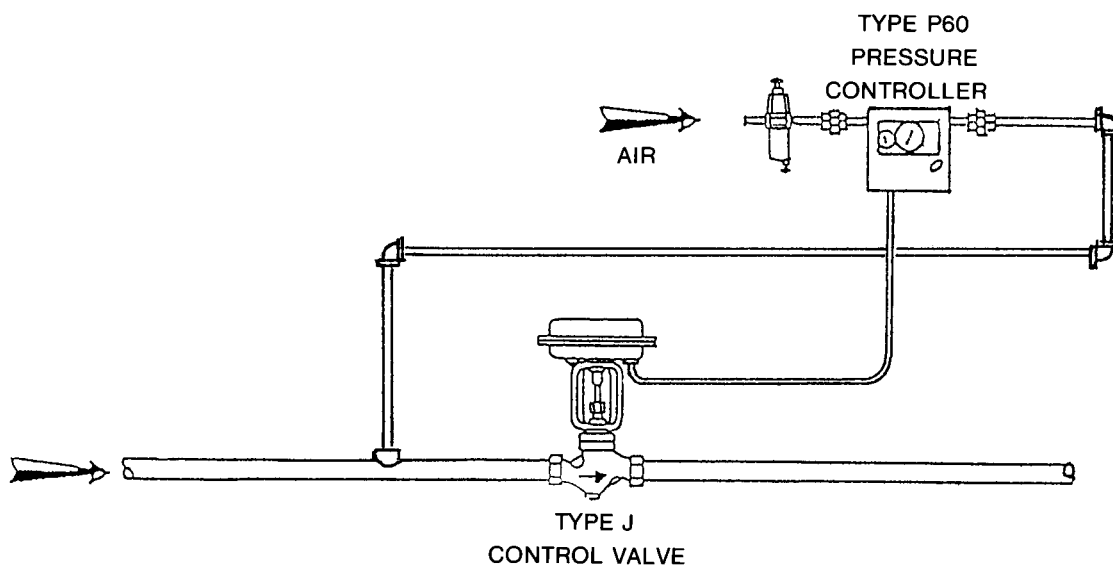
INTIMIDATOR TYPE J CONTROL VALVE with P60 CONTROLLER for BACK PRESSURE CONTROL of a DEAERATOR

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.



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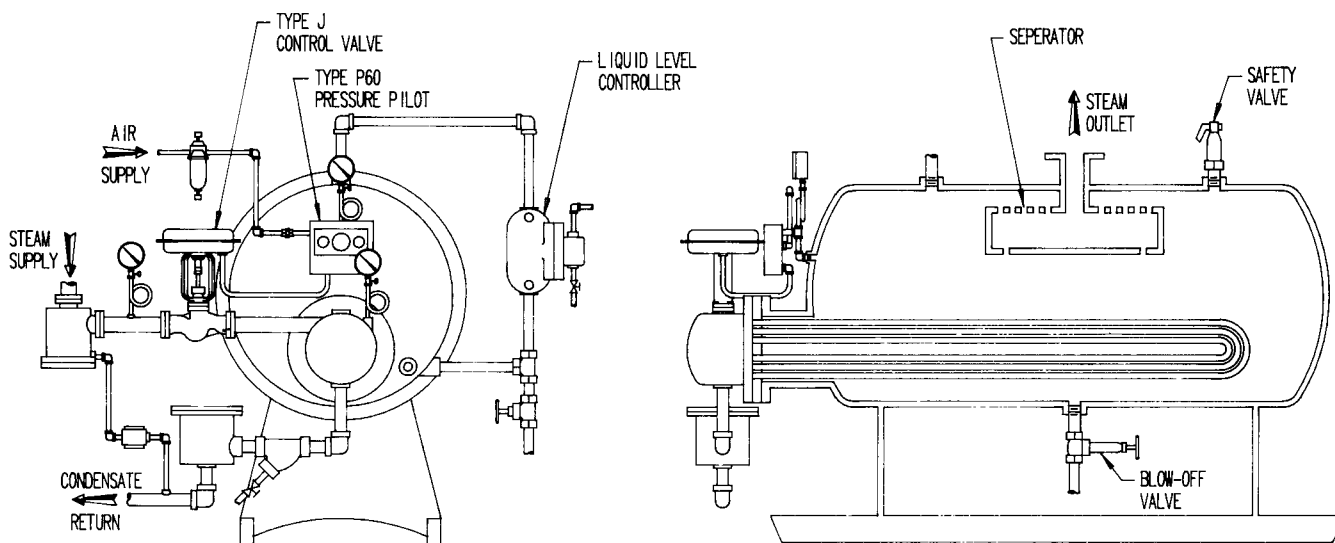
INTIMIDATOR TYPE J CONTROL VALVE with P60 CONTROLLER for UNFIRED STEAM GENERATOR

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.

JP60 UNFIRED
STEAM GENERATOR

APPLICATION GUIDE
CONTROL VALVES



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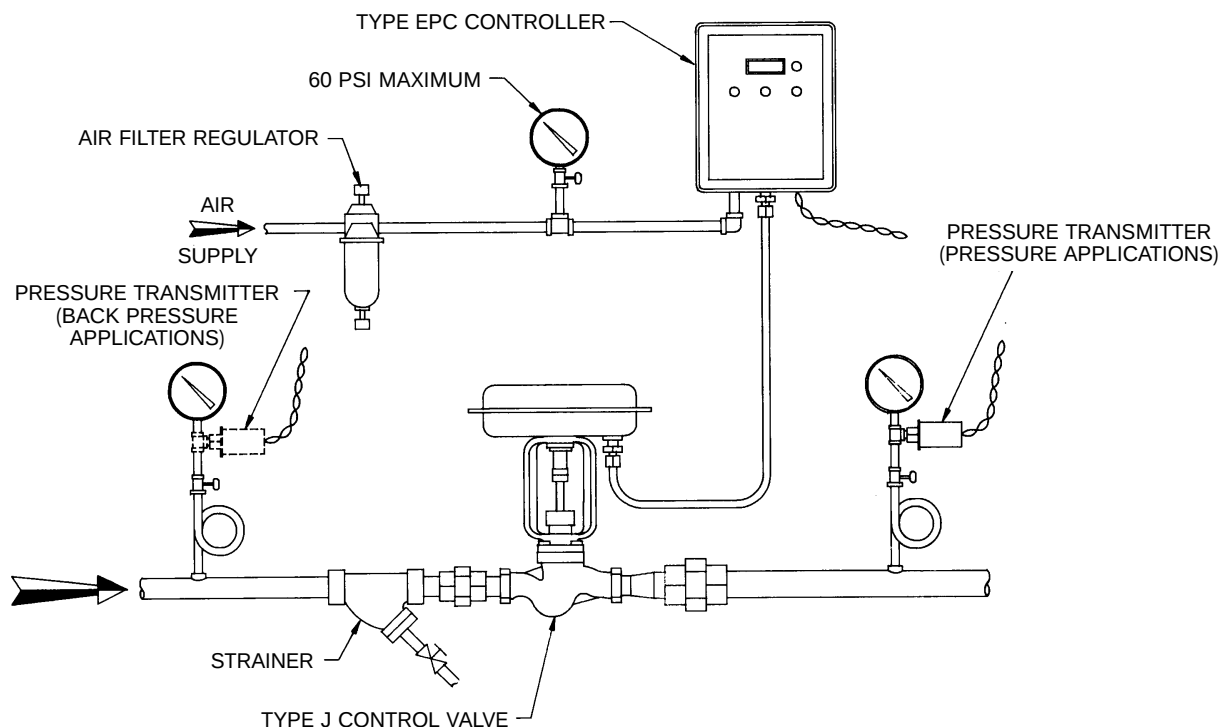
INTIMIDATOR TYPE J CONTROL VALVE with EPC ELECTRO-PNEUMATIC CONTROLLER as a PRESSURE or BACK PRESSURE CONTROLLER

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.



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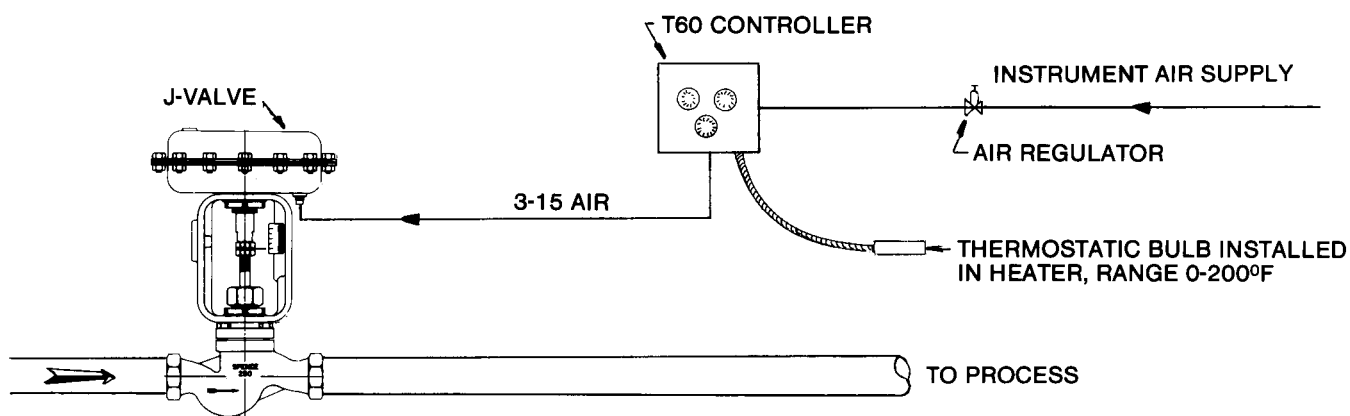
INTIMIDATOR TYPE J CONTROL VALVE and T60 CONTROLLER for INSTANTANEOUS HEATERS

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

a 2" J Valve with a 1 3/4" port will flow 1655#/hr.

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.

ET60 INSTAN-
TANEOUS HEATER

APPLICATION GUIDE
CONTROL VALVES



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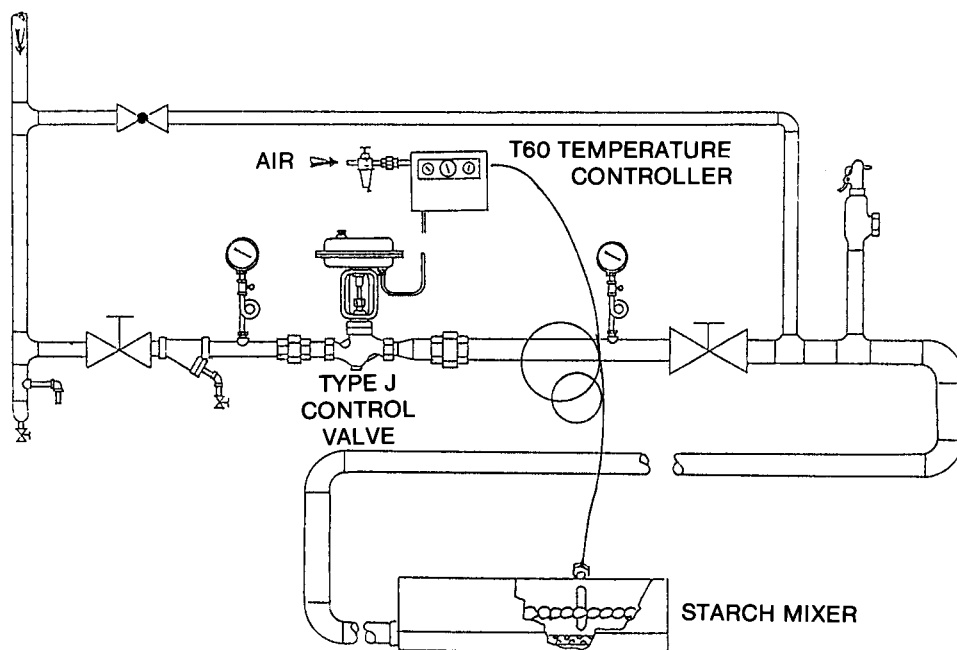
INTIMIDATOR TYPE J CONTROL VALVE with T60 CONTROLLER for STARCH MIXER

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.



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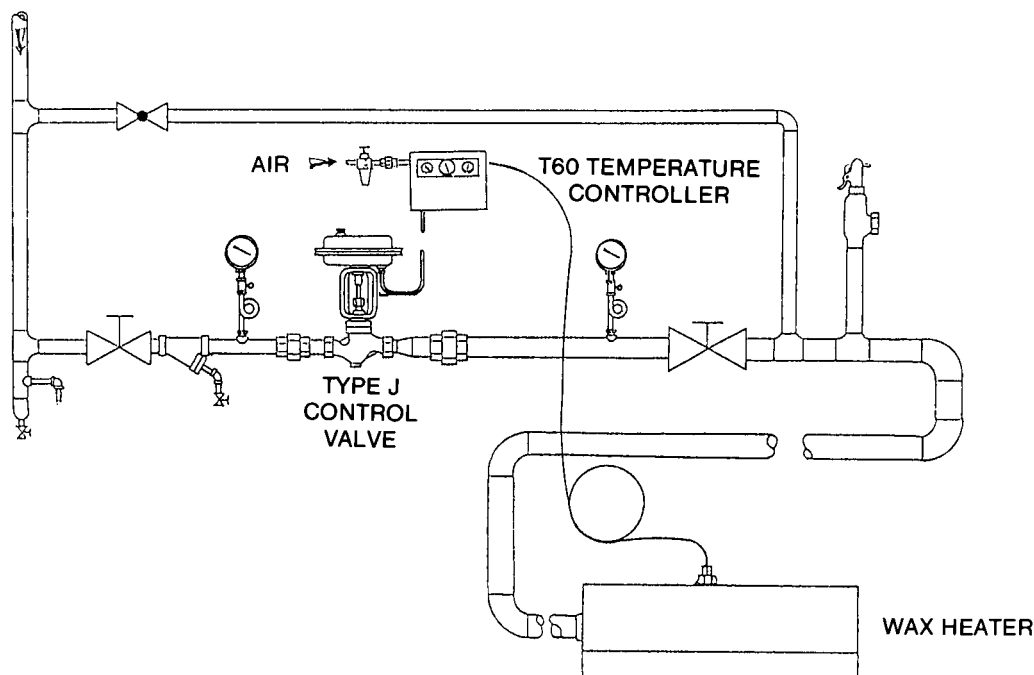
INTIMIDATOR TYPE J CONTROL VALVE with T60 CONTROLLER for WAX APPLICATION CONTROL

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.

JT60 FOR
WAX APPLICATION

APPLICATION GUIDE
CONTROL VALVES



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Application Guide

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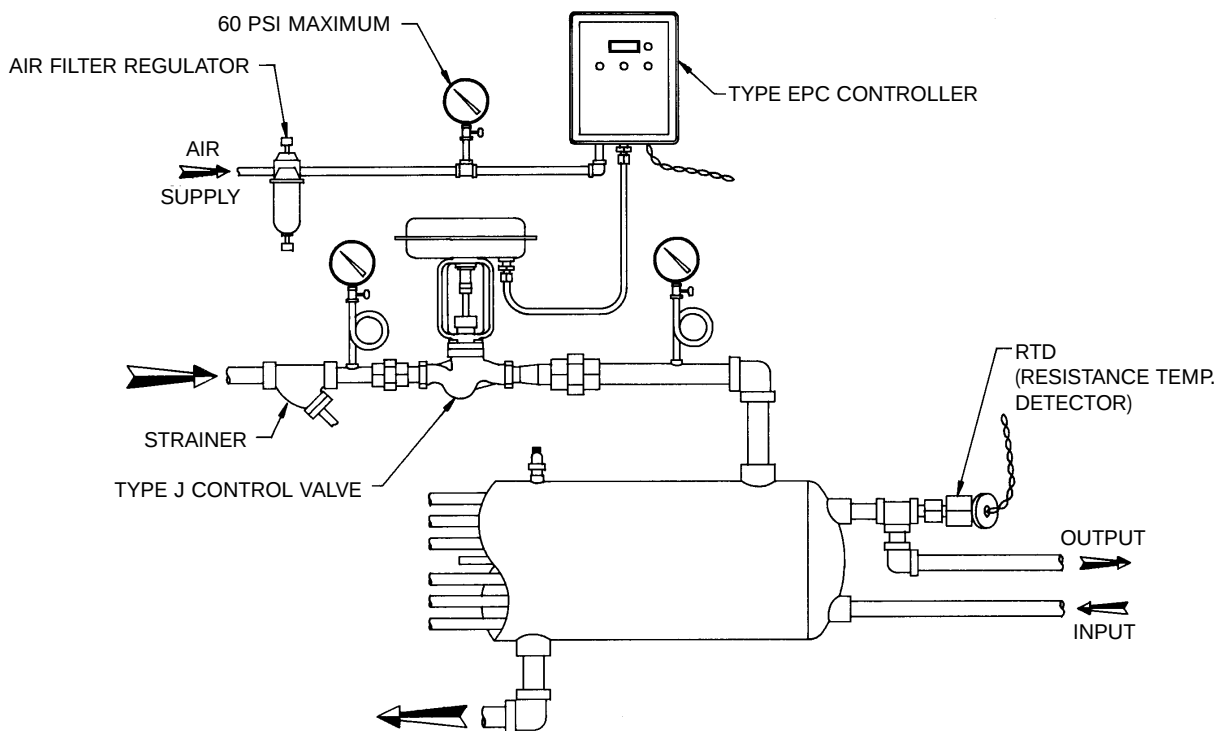
INTIMIDATOR TYPE J CONTROL VALVE with EPC ELECTRO-PNEUMATIC CONTROLLER as a TEMPERATURE CONTROLLER

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.



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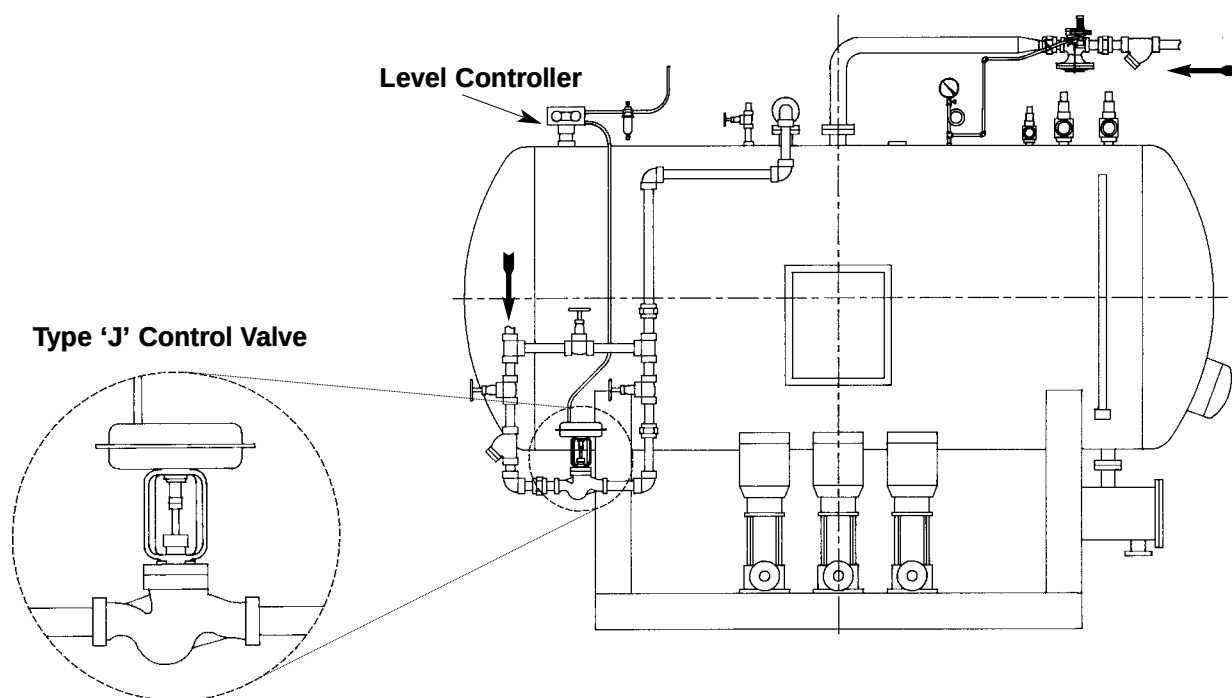
INTIMIDATOR TYPE J CONTROL VALVE for LEVEL/MAKE-UP on a DEAERATOR

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.



TYPE J FOR
DEAERATOR LEVEL

APPLICATION GUIDE
CONTROL VALVES

ADVANTAGES:

Precise control of make-up water

The standard modified equal percent plug contour provides superior throttling action



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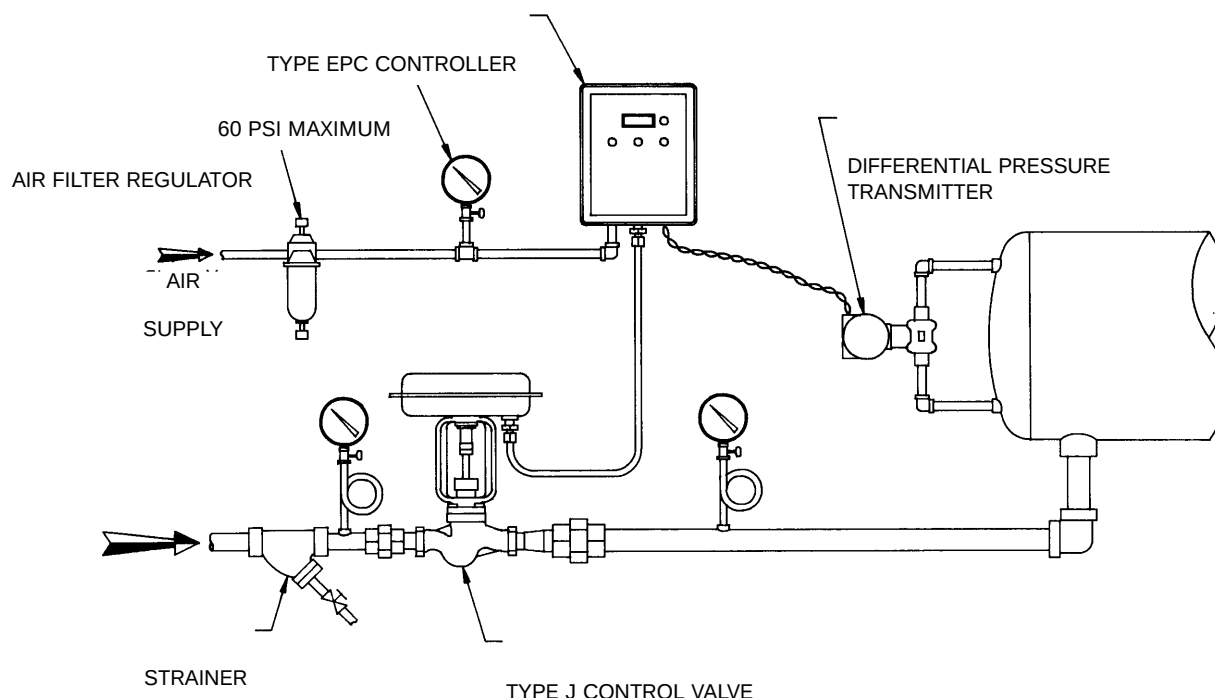
INTIMIDATOR TYPE J CONTROL VALVE with EPC ELECTRO-PNEUMATIC CONTROLLER as a DIFFERENTIAL (LEVEL) CONTROLLER

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.

SECTION X

REFERENCE &

PIPING DESIGN

GLOSSARY OF TERMS

Reprinted Courtesy Fluid Controls Institute



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 H₂O 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.

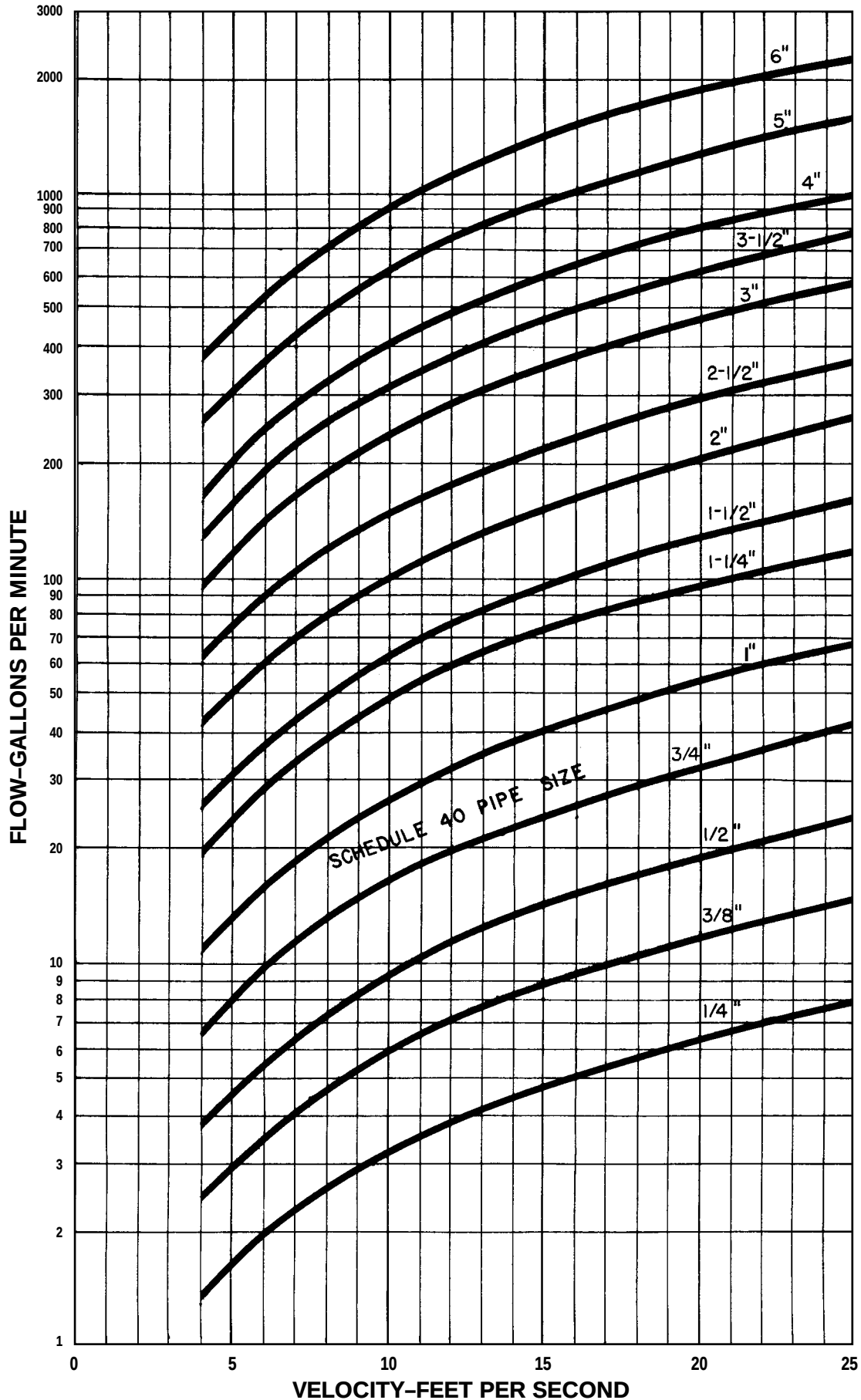
BALANCED—A regulator style featuring a pressure balanced plug. May be single or double seated.

UNBALANCED—A regulator where the plug closure member is not pressure balanced. Generally a single regulator.

DROOP—See accuracy of regulation.

FLOW VS. VELOCITY CHART

(Specific Gravity of 1)



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) ^a	—	—	7/16	1/2	9/16	5/8	11/16	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

^a 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 3/4	9	10	11	12 1/2	15	17 1/2	20 1/2
Thickness of Flange (min) ^b	—	—	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 1 1/16	3 1/16	3 9/16	4 3/16	4 13/16	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

^b 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) ^c	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	1 5/16	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

^c 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 3/4	9	10	11	12 1/2	15	—	—
Thickness of Flange (min) ^d	1/2	17/32	19/32	5/8	11/16	3/4	13/16	29/32	31/32	1 1/16	1 1/8	1 3/16	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	12	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	—	—

^d 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) ^e	—	—	7/16	1/2	9/16	5/8	11/16	3/4	13/16	15/16	1 1/16	1 1/8	1 3/16	1 3/8	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

^e 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 3/4	9	10	11	12 1/2	15	17 1/2	20 1/2
Thickness of Flange (min) ^f	—	—	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

^f 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 3/4	9	10	11	12 1/2	15	17 1/2	20 1/2
Thickness of Flange (min) ^g	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 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	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

^g 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 3/4	9	10 3/4	13	14	16 1/2	20	22
Thickness of Flange (min) ^h	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 7/8	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

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

CONVERSION TABLES

LIQUID WEIGHTS and MEASURES		
To Convert	To	Multiply By
Gallons	Liters	3.7853
Gallons	Cu. Inches	231
Gallons	Cu. Feet	0.1337
Gallons	Cu. Meters	0.00379
Gallons	Lbs. of Water	8.339
Liters	Gallons	0.26418
Liters	Cu. Inches	61.025
Liters	Cu. Feet	0.0353
Liters	Cu. Meters	0.001
Liters	Lbs. of Water	2.202
Cu. Inches	Gallons	0.00433
Cu. Inches	Liters	0.01639
Cu. Inches	Cu. Feet	0.00058
Cu. Inches	Cu. Meters	0.000016
Cu. Inches	Lbs. of Water	0.0362
Cu. Feet	Gallons	7.48052
Cu. Feet	Liters	28.316
Cu. Feet	Cu. Inches	1728
Cu. Feet	Cu. Meters	0.0283
Cu. Feet	Lbs. of Water	62.371
Cu. Meters	Gallons	264.17
Cu. Meters	Liters	999.972
Cu. Meters	Cu. Inches	61023.74
Cu. Meters	Cu. Feet	35.3145
Cu. Meters	Lbs. of Water	2202.61
Lbs. of Water	Gallons	0.11992
Lbs. of Water	Liters	0.45419
Lbs. of Water	Cu. Inches	27.643
Lbs. of Water	Cu. Feet	0.01603
Lbs. of Water	Cu. Meters	0.000454
LINEAL MEASURES		
Inches	mm	25.4
Inches	cm	2.54
Inches	Meters	0.0254
Feet	cm	30.48
Feet	Meters	0.3048
mm	Inches	0.03937
mm	Feet	0.00328
cm	Inches	0.3937
cm	Feet	0.03281
Meters	Feet	3.28
AREA		
Sq. Inches	Sq. Feet	0.006944
Sq. Inches	Sq. cm	6.4516
Sq. Feet	Sq. Inches	144
Sq. Feet	Sq. cm	929.03
Sq. Feet	Sq. Meters	0.0929
Sq. cm	Sq. Inches	0.155
Sq. cm	Sq. Feet	0.00108
Sq. cm	Sq. Meters	0.0001
Sq. Meter	Sq. Inches	1550
Sq. Meter	Sq. Feet	10.76

CONVERSIONS of PRESSURE AND HEAD					
To Convert	To	Multiply By	To Convert	To	Multiply By
Lbs. per Sq. In.	Lbs. per Sq. Ft.	144	Ins. of Mercury	Lbs. per Sq. In.	0.491154
Lbs. per Sq. In.	Atmospheres	0.06805	Ins. of Mercury	Lbs. per Sq. Ft.	70.7262
Lbs. per Sq. In.	Ins. of Water	27.728	Ins. of Mercury	Atmospheres	0.033421
Lbs. per Sq. In.	Ft. of Water	2.3106	Ins. of Mercury	Ins. of Water	13.6185
Lbs. per Sq. In.	Ins. of Mercury	2.03602	Ins. of Mercury	Ft. of Water	1.1349
Lbs. per Sq. In.	mm of Mercury	51.715	Ins. of Mercury	mm of Mercury	25.40005
Lbs. per Sq. In.	Bar	0.06895	Ins. of Mercury	Bar	0.033864
Lbs. per Sq. In.	kg per Sq. cm	0.070307	Ins. of Mercury	kg per Sq. cm	0.03453
Lbs. per Sq. In.	kg per Sq. M	703.070	Ins. of Mercury	kg per Sq. M	345.316
Lbs. per Sq. Ft.	Lbs. per Sq. In.	0.0069445	mm of Mercury	Lbs. per Sq. In.	0.019337
Lbs. per Sq. Ft.	Atmospheres	0.000473	mm of Mercury	Lbs. per Sq. Ft.	2.7845
Lbs. per Sq. Ft.	Ins. of Water	0.1926	mm of Mercury	Atmospheres	0.001316
Lbs. per Sq. Ft.	Ft. of Water	0.01605	mm of Mercury	Ins. of Water	0.53616
Lbs. per Sq. Ft.	Ins. of Mercury	0.014139	mm of Mercury	Ft. of Water	0.04468
Lbs. per Sq. Ft.	mm of Mercury	0.35913	mm of Mercury	Ins. of Mercury	0.03937
Lbs. per Sq. Ft.	Bar	0.000479	mm of Mercury	Bar	0.00133
Lbs. per Sq. Ft.	kg per Sq. cm	0.000488	mm of Mercury	kg per Sq. cm	0.00136
Lbs. per Sq. Ft.	kg per Sq. M	4.88241	mm of Mercury	kg per Sq. M	13.59509
Atmospheres	Lbs. per Sq. In.	14.696	kg per Sq. cm	Lbs. per Sq. In.	14.2233
Atmospheres	Lbs. per Sq. Ft.	2116.22	kg per Sq. cm	Lbs. per Sq. Ft.	2048.155
Atmospheres	Ins. of Water	407.484	kg per Sq. cm	Atmospheres	0.96784
Atmospheres	Ft. of Water	33.957	kg per Sq. cm	Ins. of Water	394.38
Atmospheres	Ins. of Mercury	29.921	kg per Sq. cm	Ft. of Water	32.865
Atmospheres	mm of Mercury	760	kg per Sq. cm	Ins. of Mercury	28.959
Atmospheres	Bar	1.01325	kg per Sq. cm	mm of Mercury	735.559
Atmospheres	kg per Sq. cm	1.0332	kg per Sq. cm	Bar	0.98067
Atmospheres	kg per Sq. M	10332.27	kg per Sq. cm	kg per Sq. M	10000
Ins. of Water	Lbs. per Sq. In.	0.03609	Note: All weights and measures of water are based on temperature of 60°F. Note: Temperature of Water and Mercury is 68°F and 32°F respectively. TEMPERATURE To convert Fahrenheit to Celsius: $\frac{^{\circ}\text{F} - 32}{1.8}$ To convert Celsius to Fahrenheit: $(1.8 \times ^{\circ}\text{C}) + 32$ VELOCITY 1 Ft per Sec. = 0.3048 M Per Sec. 1 M per Sec. = 3.2808 Ft. per Sec.		
Ins. of Water	Lbs. per Sq. Ft.	5.1972			
Ins. of Water	Atmospheres	0.002454			
Ins. of Water	Ft. of Water	0.08333			
Ins. of Water	Ins. of Mercury	0.07343			
Ins. of Water	mm of Mercury	1.8651			
Ins. of Water	Bar	0.00249			
Ins. of Water	kg per Sq. cm	0.00253			
Ins. of Water	kg per Sq. M	25.375			
Ft. of Water	Lbs. per Sq. In.	0.432781			
Ft. of Water	Lbs. per Sq. Ft.	63.3205			
Ft. of Water	Atmospheres	0.029449			
Ft. of Water	Ins. of Water	12			
Ft. of Water	Ins. of Mercury	0.88115			
Ft. of Water	mm of Mercury	22.3813			
Ft. of Water	Bar	0.029839			
Ft. of Water	kg per Sq. cm	0.03043			
Ft. of Water	kg per Sq. M	304.275			

PRESSURE TO VACUUM

PROPERTIES OF WATER

Gage Indicated		Absolute Pressure		
PSIG	Inches of Hg	PSIA	Inches of Hg	Torricelli
-14.70000	29.92000	0.0	0.0	0.0
-14.69998	29.91996	0.00002	0.00004	0.001
-14.69996	29.91992	0.00004	0.00008	0.002
-14.69994	29.91988	0.00006	0.00012	0.003
-14.69992	29.91984	0.00008	0.00016	0.004
-14.69990	29.91980	0.00010	0.00020	0.005
-14.69981	29.91961	0.00019	0.00039	0.010
-14.69961	29.91921	0.00039	0.00079	0.020
-14.69942	29.91882	0.00058	0.00118	0.030
-14.69923	29.91843	0.00077	0.00157	0.040
-14.69903	29.91803	0.00097	0.00197	0.050
-14.69806	29.91606	0.00194	0.00394	0.100
-14.69613	29.91212	0.00387	0.00788	0.200
-14.69449	29.90818	0.00551	0.01182	0.300
-14.69226	29.90424	0.00774	0.01576	0.400
-14.69032	29.90030	0.00968	0.01970	0.500
-14.68066	29.88063	0.01934	0.03937	1.000
-14.66698	29.84126	0.03302	0.07874	2.000
-14.64197	29.80189	0.05803	0.11811	3.000
-14.62262	29.76252	0.07738	0.15748	4.000
-14.60329	29.72315	0.09671	0.19685	5.000
-14.50658	29.52630	0.19342	0.39370	10.000
-14.40980	29.32940	0.29020	0.59060	15.000
-14.31320	29.13260	0.38680	0.78740	20.000
-14.21840	28.93570	0.48160	0.98430	25.000
-14.20870	28.920	0.49130	1.000	25.400
-14.11970	28.740	0.58030	1.181	30.000
-13.75700	28.000	0.94330	1.920	48.770
-12.28300	25.000	2.41700	4.920	124.970
-10.31800	21.000	4.38200	8.920	226.570
-8.84400	18.000	5.85600	11.920	302.770
-7.37000	15.000	7.320	14.920	378.970
-5.89600	12.000	8.804	17.920	455.770
-4.91300	10.000	9.787	19.920	505.970
-3.93000	8.000	10.770	21.920	556.770
-2.94800	6.000	11.752	23.920	607.570
-1.96500	4.000	12.735	25.920	658.370
-0.98300	2.000	13.732	27.920	709.170
-0.49100	1.000	14.209	28.920	733.570
-0.24600	0.500	14.454	29.420	747.270
ATMOSPHERIC				
0.0	0.0	14.700	29.920	760.000
+ 0.30		15.000	30.540	775.720
+ 1.00		15.700	31.970	811.910
+ 2.00		16.700	34.000	863.630
+ 10.00		24.700	50.290	277.35

Water Temp.	Saturation Pressure	Weight	Weight Density	Specific Volume
Deg. F	PSIA	lbs/Gallon	lbs/Cu.Ft.	Cu.Ft./lb
32	0.0886	8.344	62.414	0.016022
40	0.1216	8.345	62.426	0.016019
50	0.1780	8.343	62.410	0.016023
60	0.2561	8.338	62.371	0.016033
70	0.3629	8.329	62.305	0.016050
80	0.5068	8.318	62.220	0.016072
90	0.6981	8.304	62.116	0.016099
100	0.9492	8.288	61.996	0.016130
110	1.2750	8.270	61.862	0.016165
120	1.6927	8.250	61.713	0.016204
130	2.2230	8.228	61.550	0.016247
140	2.8892	8.205	61.376	0.016293
150	3.7184	8.180	61.188	0.016343
160	4.7414	8.154	60.994	0.016395
170	5.9926	8.126	60.787	0.016451
180	7.5110	8.097	60.569	0.016510
190	9.340	8.067	60.343	0.016572
200	11.526	8.035	60.107	0.016637
210	14.123	8.002	59.862	0.016705
212	14.696	7.996	59.812	0.016719
220	17.186	7.969	59.613	0.016775
240	24.968	7.898	59.081	0.016926
260	35.427	7.823	58.517	0.017089
280	49.200	7.743	57.924	0.017264
300	67.005	7.661	57.307	0.01745
350	134.604	7.431	55.586	0.01799
400	247.259	7.172	53.648	0.01864
450	422.55	6.880	51.467	0.01943
500	680.86	6.543	48.948	0.02043
550	1045.43	6.143	45.956	0.02176
600	1543.2	5.655	42.301	0.02364
650	2208.4	4.999	37.397	0.02674
700	3094.3	3.651	27.307	0.03662

NOTE:

Weight of water per gallon is based on 7.48052 gallons per cubic foot.

Specific gravity of water @ 60°F = 1.00

PIPE DATA TABLES

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
1/8	.405	—	—	10S	.049	.307	1.27	.96	.074	.19	.032	.004	.00437	1/8
		STD	40	40S	.068	.269		.85	.057	.24	.025	.003	.00523	
		XS	80	80S	.095	.215		.68	.036	.31	.016	.002	.00602	
1/4	.540	—	—	10S	.065	.410	1.70	1.29	.132	.33	.057	.007	.01032	1/4
		STD	40	40S	.088	.364		1.14	.104	.42	.045	.005	.01227	
		XS	80	80S	.119	.302		.95	.072	.54	.031	.004	.01395	
3/8	.675	—	—	10S	.065	.545	2.12	1.71	.233	.42	.101	.012	.01736	3/8
		STD	40	40S	.091	.493		1.55	.191	.57	.083	.010	.0216	
		XS	80	80S	.126	.423		1.33	.141	.74	.061	.007	.0255	
1/2	.840	—	—	5S	.065	.710	2.64	2.23	.396	.54	.172	.021	.0285	1/2
		—	—	10S	.083	.674		2.12	.357	.67	.155	.019	.0341	
		STD	40	40S	.109	.622		1.95	.304	.85	.132	.016	.0407	
		XS	80	80S	.147	.546		1.72	.234	1.09	.102	.012	.0478	
		—	160	—	.187	.466		1.46	.171	1.31	.074	.009	.0527	
		XXS	—	—	.294	.252		.79	.050	1.71	.022	.003	.0577	
3/4	1.050	—	—	5S	.065	.920	3.30	2.89	.665	.69	.288	.035	.0467	3/4
		—	—	10S	.083	.884		2.78	.614	.86	.266	.032	.0566	
		STD	40	40S	.113	.824		2.59	.533	1.13	.231	.028	.0706	
		XS	80	80S	.154	.742		2.33	.433	1.47	.188	.022	.0853	
		—	160	—	.219	.612		1.92	.296	1.94	.128	.015	.1004	
		XXS	—	—	.308	.434		1.36	.148	2.44	.064	.008	.1103	
1	1.315	—	—	5S	.065	1.185	4.13	3.72	1.103	.87	.478	.057	.0760	1
		—	—	10S	.109	1.097		3.45	.945	1.40	.409	.049	.1151	
		STD	40	40S	.133	1.049		3.30	.864	1.68	.375	.045	.1328	
		XS	80	80S	.179	.957		3.01	.719	2.17	.312	.037	.1606	
		—	160	—	.250	.815		2.56	.522	2.84	.230	.027	.1903	
		XXS	—	—	.358	.599		1.88	.282	3.66	.122	.015	.2136	
1 1/4	1.660	—	—	5S	.065	1.530	5.22	4.81	1.839	1.11	.797	.096	.1250	1 1/4
		—	—	10S	.109	1.442		4.53	1.633	1.81	.708	.085	.1934	
		STD	40	40S	.140	1.380		4.34	1.495	2.27	.649	.078	.2346	
		XS	80	80S	.191	1.278		4.02	1.283	3.00	.555	.067	.2913	
		—	160	—	.250	1.160		3.64	1.057	3.76	.458	.055	.3421	
		XXS	—	—	.382	.896		2.81	.630	5.21	.273	.033	.4110	
1 1/2	1.900	—	—	5S	.065	1.770	5.97	5.56	2.461	1.28	1.066	.128	.1662	1 1/2
		—	—	10S	.109	1.682		5.28	2.222	2.09	.963	.115	.2598	
		STD	40	40S	.145	1.610		5.06	2.036	2.72	.882	.106	.3262	
		XS	80	80S	.200	1.500		4.71	1.767	3.63	.765	.092	.4118	
		—	160	—	.281	1.338		4.20	1.406	4.86	.608	.073	.5078	
		XXS	—	—	.400	1.100		3.46	.950	6.41	.420	.049	.5977	
2	2.375	—	—	5S	.065	2.245	7.46	7.05	3.958	1.61	1.72	.206	.2652	2
		—	—	10S	.109	2.157		6.78	3.654	2.64	1.58	.190	.4204	
		STD	40	40S	.154	2.067		6.49	3.355	3.65	1.45	.174	.5606	
		XS	80	80S	.218	1.939		6.09	2.953	5.02	1.28	.153	.7309	
		—	160	—	.344	1.687		5.30	2.241	7.46	.97	.116	.9790	
		XXS	—	—	.436	1.503		4.72	1.774	9.03	.77	.092	1.1040	
2 1/2	2.875	—	—	5S	.083	2.709	9.03	8.51	5.764	2.48	2.50	.299	.4939	2 1/2
		—	—	10S	.120	2.635		8.28	5.453	3.53	2.36	.283	.6868	
		STD	40	40S	.203	2.469		7.76	4.788	5.79	2.07	.249	1.064	
		XS	80	80S	.276	2.323		7.30	4.238	7.66	1.87	.220	1.339	
		—	160	—	.375	2.125		6.68	3.546	10.01	1.54	.184	1.638	
		XXS	—	—	.552	1.771		5.56	2.464	13.69	1.07	.128	1.997	

PIPE DATA TABLES CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs./Ft.)	Weight of Water (lbs./Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
3	3.500	—	—	5S	.083	3.334	11.00	10.47	8.730	3.03	3.78	.454	.744	3
		—	—	10S	.120	3.260		10.24	8.347	4.33	3.62	.434	1.041	
		STD	40	40S	.216	3.068		9.64	7.393	7.58	3.20	.384	1.724	
		XS	80	80S	.300	2.900		9.11	6.605	10.25	2.86	.343	2.225	
		—	160	—	.438	2.624		8.24	5.408	14.32	2.35	.281	2.876	
		XXS	—	—	.600	2.300		7.23	4.155	18.58	1.80	.216	3.424	
4	4.500	—	—	5S	.083	4.334	14.14	13.62	14.75	3.92	6.39	.766	1.249	4
		—	—	10S	.120	4.260		13.38	14.25	5.61	6.18	.740	1.761	
		STD	40	40S	.237	4.026		12.65	12.73	10.79	5.50	.661	3.214	
		XS	80	80S	.337	3.826		12.02	11.50	14.98	4.98	.597	4.271	
		—	120	—	.438	3.624		11.39	10.31	19.00	4.47	.536	5.178	
		—	160	—	.531	3.438		10.80	9.28	22.51	4.02	.482	5.898	
5	5.563	—	—	5S	.109	5.345	17.48	16.79	22.44	6.36	9.72	1.17	2.498	5
		—	—	10S	.134	5.295		16.63	22.02	7.77	9.54	1.14	3.029	
		STD	40	40S	.258	5.047		15.86	20.01	14.62	8.67	1.04	5.451	
		XS	80	80S	.375	4.813		15.12	18.19	20.78	7.88	.945	7.431	
		—	120	—	.500	4.563		14.34	16.35	27.04	7.09	.849	9.250	
		—	160	—	.625	4.313		13.55	14.61	32.96	6.33	.759	10.796	
6	6.625	XXS	—	—	.750	4.063	20.81	12.76	12.97	38.55	5.61	.674	12.090	6
		—	—	5S	.109	6.407		20.13	32.24	7.60	13.97	1.68	3.576	
		—	—	10S	.134	6.357		19.97	31.74	9.29	13.75	1.65	4.346	
		STD	40	40S	.280	6.065		19.05	28.89	18.97	12.51	1.50	8.496	
		XS	80	80S	.432	5.761		18.10	26.07	28.57	11.29	1.35	12.22	
		—	120	—	.562	5.501		17.28	23.77	36.39	10.30	1.24	14.98	
8	8.625	—	—	5S	.109	8.407	27.10	26.41	55.51	9.93	24.06	2.88	6.131	8
		—	—	10S	.148	8.329		26.17	54.48	13.40	23.61	2.83	8.212	
		—	20	—	.250	8.125		25.53	51.85	22.36	22.47	2.69	13.39	
		—	30	—	.277	8.071		25.36	51.16	24.70	22.17	2.66	14.69	
		STD	40	40S	.322	7.981		25.07	50.03	28.55	21.70	2.60	16.81	
		—	60	—	.406	7.813		24.55	47.94	35.64	20.77	2.49	20.58	
10	10.750	XS	80	80S	.500	7.625	33.77	23.95	45.66	43.39	19.78	2.37	24.51	10
		—	100	—	.594	7.437		23.36	43.46	50.95	18.83	2.26	28.14	
		—	120	—	.719	7.187		22.58	40.59	60.71	17.59	2.11	32.58	
		—	140	—	.812	7.001		21.99	38.50	67.76	16.68	2.00	35.65	
		XXS	—	—	.875	6.875		21.60	37.12	72.42	16.10	1.93	37.56	
		—	160	—	.906	6.813		21.40	36.46	74.69	15.80	1.89	38.48	
10	10.750	—	—	5S	.134	10.482	33.77	32.93	86.29	15.19	37.39	4.48	11.71	10
		—	—	10S	.165	10.420		32.74	85.28	18.65	36.95	4.43	14.30	
		—	20	—	.250	10.250		32.20	82.52	28.04	35.76	4.29	21.15	
		—	30	—	.307	10.136		31.84	80.69	34.24	34.96	4.19	25.57	
		STD	40	40S	.365	10.020		31.48	78.86	40.48	34.20	4.10	29.90	
		XS	60	80S	.500	9.750		30.63	74.66	54.74	32.35	3.88	39.43	
		—	80	—	.594	9.562		30.04	71.84	64.43	31.13	3.73	45.54	
		—	100	—	.719	9.312		29.25	68.13	77.03	29.53	3.54	53.22	
		—	120	—	.844	9.062		28.47	64.53	89.29	27.96	3.35	60.32	
		XXS	140	—	1.000	8.750		27.49	60.13	104.13	26.06	3.12	68.43	
		—	160	—	1.125	8.500		26.70	56.75	115.64	24.59	2.95	74.29	

PIPE DATA TABLES CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
12	12.750	—	—	5S	.156	12.438	40.06	39.08	121.50	20.98	52.65	6.31	19.2	12
		—	—	10S	.180	12.390		38.92	120.57	24.17	52.25	6.26	22.0	
		—	20	—	.250	12.250		38.48	117.86	33.38	51.07	6.12	30.2	
		—	30	—	.330	12.090		37.98	114.80	43.77	49.74	5.96	39.0	
		STD	—	40S	.375	12.000		37.70	113.10	49.56	49.00	5.88	43.8	
		—	40	—	.406	11.938		37.50	111.93	53.52	48.50	5.81	47.1	
		XS	—	80S	.500	11.750		36.91	108.43	65.42	46.92	5.63	56.7	
		—	60	—	.562	11.626		36.52	106.16	73.15	46.00	5.51	62.8	
		—	80	—	.688	11.374		35.73	101.64	88.63	44.04	5.28	74.6	
		—	100	—	.844	11.062		34.75	96.14	107.32	41.66	4.99	88.1	
		XXS	120	—	1.000	10.750		33.77	90.76	125.49	39.33	4.71	100.7	
		—	140	—	1.125	10.500		32.99	86.59	139.67	37.52	4.50	109.9	
		—	160	—	1.312	10.126		31.81	80.53	160.27	34.89	4.18	122.6	
14	14.000	—	—	5S	.156	13.688	43.98	43.00	147.15	23.07	63.77	7.64	23.2	14
		—	—	10S	.188	13.624		42.80	145.78	27.73	63.17	7.57	27.8	
		—	10	—	.250	13.500		42.41	143.14	36.71	62.03	7.44	36.6	
		—	20	—	.312	13.376		42.02	140.52	45.61	60.89	7.30	45.0	
		STD	30	—	.375	13.250		41.63	137.88	54.57	59.75	7.16	53.2	
		—	40	—	.438	13.124		41.23	135.28	63.44	58.64	7.03	61.3	
		XS	—	—	.500	13.000		40.84	132.73	72.09	57.46	6.90	69.1	
		—	60	—	.594	12.812		40.25	128.96	85.05	55.86	6.70	80.3	
		—	80	—	.750	12.500		39.27	122.72	106.13	53.18	6.37	98.2	
		—	100	—	.938	12.124		38.09	115.49	130.85	50.04	6.00	117.8	
		—	120	—	1.094	11.812		37.11	109.62	150.79	47.45	5.69	132.8	
		—	140	—	1.250	11.500		36.13	103.87	170.28	45.01	5.40	146.8	
		—	160	—	1.406	11.188		35.15	98.31	189.11	42.60	5.11	159.6	
16	16.00	—	—	5S	.165	15.670	50.27	49.23	192.85	27.90	83.57	10.02	32.2	16
		—	—	10S	.188	15.624		49.08	191.72	31.75	83.08	9.96	36.5	
		—	10	—	.250	15.500		48.69	188.69	42.05	81.74	9.80	48.0	
		—	20	—	.312	15.376		48.31	185.69	52.27	80.50	9.65	59.2	
		STD	30	—	.375	15.250		47.91	182.65	62.58	79.12	9.49	70.3	
		XS	40	—	.500	15.000		47.12	176.72	82.77	76.58	9.18	91.5	
		—	60	—	.656	14.688		46.14	169.44	107.50	73.42	8.80	116.6	
		—	80	—	.844	14.312		44.96	160.92	136.61	69.73	8.36	144.5	
		—	100	—	1.031	13.938		43.79	152.58	164.82	66.12	7.93	170.5	
		—	120	—	1.219	13.562		42.61	144.50	192.43	62.62	7.50	194.5	
		—	140	—	1.438	13.124		41.23	135.28	233.64	58.64	7.03	220.0	
		—	160	—	1.594	12.812		40.26	128.96	245.25	55.83	6.70	236.7	
18	18.00	—	—	5S	.165	17.67	56.55	55.51	245.22	31.43	106.26	12.74	40.8	18
		—	—	10S	.188	17.62		55.37	243.95	35.76	105.71	12.67	46.4	
		—	10	—	.250	17.50		54.98	240.53	47.39	104.21	12.49	61.1	
		—	20	—	.312	17.38		54.59	237.13	58.94	102.77	12.32	75.5	
		STD	—	—	.375	17.25		54.19	233.71	70.59	101.18	12.14	89.6	
		—	30	—	.438	17.12		53.80	230.30	82.15	99.84	11.96	103.4	
		XS	—	—	.500	17.00		53.41	226.98	93.45	98.27	11.79	117.0	
		—	40	—	.562	16.88		53.02	223.68	104.87	96.93	11.62	130.1	
		—	60	—	.750	16.50		51.84	213.83	138.17	92.57	11.11	168.3	
		—	80	—	.938	16.12		50.66	204.24	170.92	88.50	10.61	203.8	
		—	100	—	1.156	15.69		49.29	193.30	207.96	83.76	10.04	242.3	
		—	120	—	1.375	15.25		47.91	182.66	244.14	79.07	9.49	277.6	
		—	140	—	1.562	14.88		46.73	173.80	274.22	75.32	9.03	305.5	
		—	160	—	1.781	14.44		45.36	163.72	308.50	70.88	8.50	335.6	

PIPE DATA TABLES CONT'D.

Pipe Size (in.)	Outside Diameter (in.)	Weight Class	Carbon Steel Sched.	Stainless Steel Sched.	Wall Thickness (in.)	Inside Diameter (in.)	Circum. (Ext.) (in.)	Circum. (Int.) (in.)	Flow Area (sq. in.)	Weight of Pipe (lbs/Ft.)	Weight of Water (lbs/Ft.)	Gallons of Water per Ft.	Section Modulus	Pipe Size (in.)
20	20.00	—	—	5S	.188	19.62	62.83	61.65	302.46	39.78	131.06	15.71	57.4	20
		—	—	10S	.218	19.56		61.46	300.61	46.06	130.27	15.62	66.3	
		—	10	—	.250	19.50		61.26	298.65	52.73	129.42	15.51	75.6	
		—	20	—	.375	19.25		60.48	290.04	78.60	125.67	15.12	111.3	
		STD	30	—	.500	19.00		59.69	283.53	104.13	122.87	14.73	145.7	
		XS	40	—	.594	18.81		59.10	278.00	123.11	120.46	14.44	170.4	
		—	60	—	.812	18.38		57.73	265.21	166.40	114.92	13.78	225.7	
		—	80	—	1.031	17.94		56.35	252.72	208.87	109.51	13.13	277.1	
		—	100	—	1.281	17.44		54.78	238.83	256.10	103.39	12.41	331.5	
		—	120	—	1.500	17.00		53.41	226.98	296.37	98.35	11.79	375.5	
		—	140	—	1.750	16.50		51.84	213.82	341.09	92.66	11.11	421.7	
		—	160	—	1.969	16.06		50.46	202.67	379.17	87.74	10.53	458.5	
22	22.00	—	—	5S	.188	21.62	69.12	67.93	367.25	43.80	159.14	19.08	69.7	22
		—	—	10S	.218	21.56		67.75	365.21	50.71	158.26	18.97	80.4	
		—	10	—	.250	21.50		67.54	363.05	58.07	157.32	18.86	91.8	
		STD	20	—	.375	21.25		66.76	354.66	86.61	153.68	18.42	135.4	
		XS	30	—	.500	21.00		65.97	346.36	114.81	150.09	17.99	117.5	
		—	60	—	.875	20.25		63.62	322.06	197.41	139.56	16.73	295.0	
		—	80	—	1.125	19.75		62.05	306.35	250.81	132.76	15.91	366.4	
		—	100	—	1.375	19.25		60.48	291.04	302.88	126.12	15.12	432.6	
		—	120	—	1.625	18.75		58.90	276.12	353.61	119.65	14.34	493.8	
		—	140	—	1.875	18.25		57.33	261.59	403.00	113.36	13.59	550.3	
		—	160	—	2.125	17.75		55.76	247.45	451.06	107.23	12.85	602.4	
24	24.00	—	—	5S	.218	23.56	75.40	74.03	436.10	55	188.98	22.65	96.0	24
		—	10	10S	.250	23.50		73.83	433.74	63	187.95	22.53	109.6	
		STD	20	—	.375	23.25		73.04	424.56	95	183.95	22.05	161.9	
		XS	—	—	.500	23.00		72.26	415.48	125	179.87	21.58	212.5	
		—	30	—	.562	22.88		71.86	411.00	141	178.09	21.35	237.0	
		—	40	—	.688	22.62		71.08	402.07	171	174.23	20.88	285.1	
		—	60	—	.969	22.06		69.31	382.35	238	165.52	19.86	387.7	
		—	80	—	1.219	21.56		67.74	365.22	297	158.26	18.97	472.8	
		—	100	—	1.531	20.94		65.78	344.32	367	149.06	17.89	570.8	
		—	120	—	1.812	20.38		64.01	326.08	430	141.17	16.94	652.1	
		—	140	—	2.062	19.88		62.44	310.28	483	134.45	16.12	718.9	
		—	160	—	2.344	19.31		60.67	292.98	542	126.84	15.22	787.9	
30	30.00	—	—	5S	.250	29.50	94.25	92.68	683.49	79	296.18	35.51	172.3	30
		—	10	10S	.312	29.38		92.29	677.71	99	293.70	35.21	213.8	
		STD	—	—	.375	29.25		91.89	671.96	119	291.18	34.91	255.3	
		XS	20	—	.500	29.00		91.11	660.52	158	286.22	34.31	336.1	
		—	30	—	.625	28.75		90.32	649.18	196	281.31	33.72	414.9	

PRESSURE TEMPERATURE LIMITS

Body Material and End Connection Selection

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

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

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

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

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

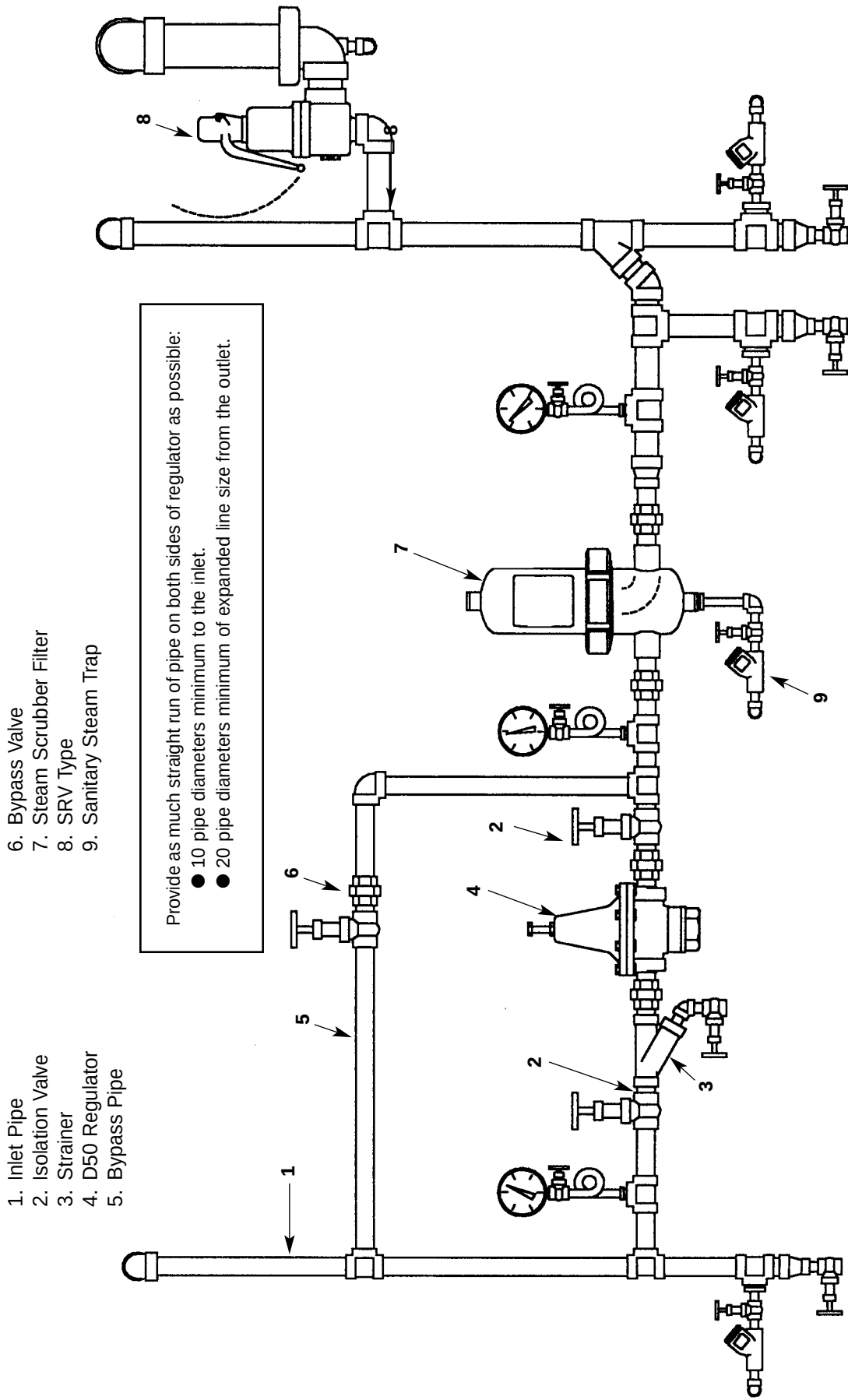
Code Designations

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

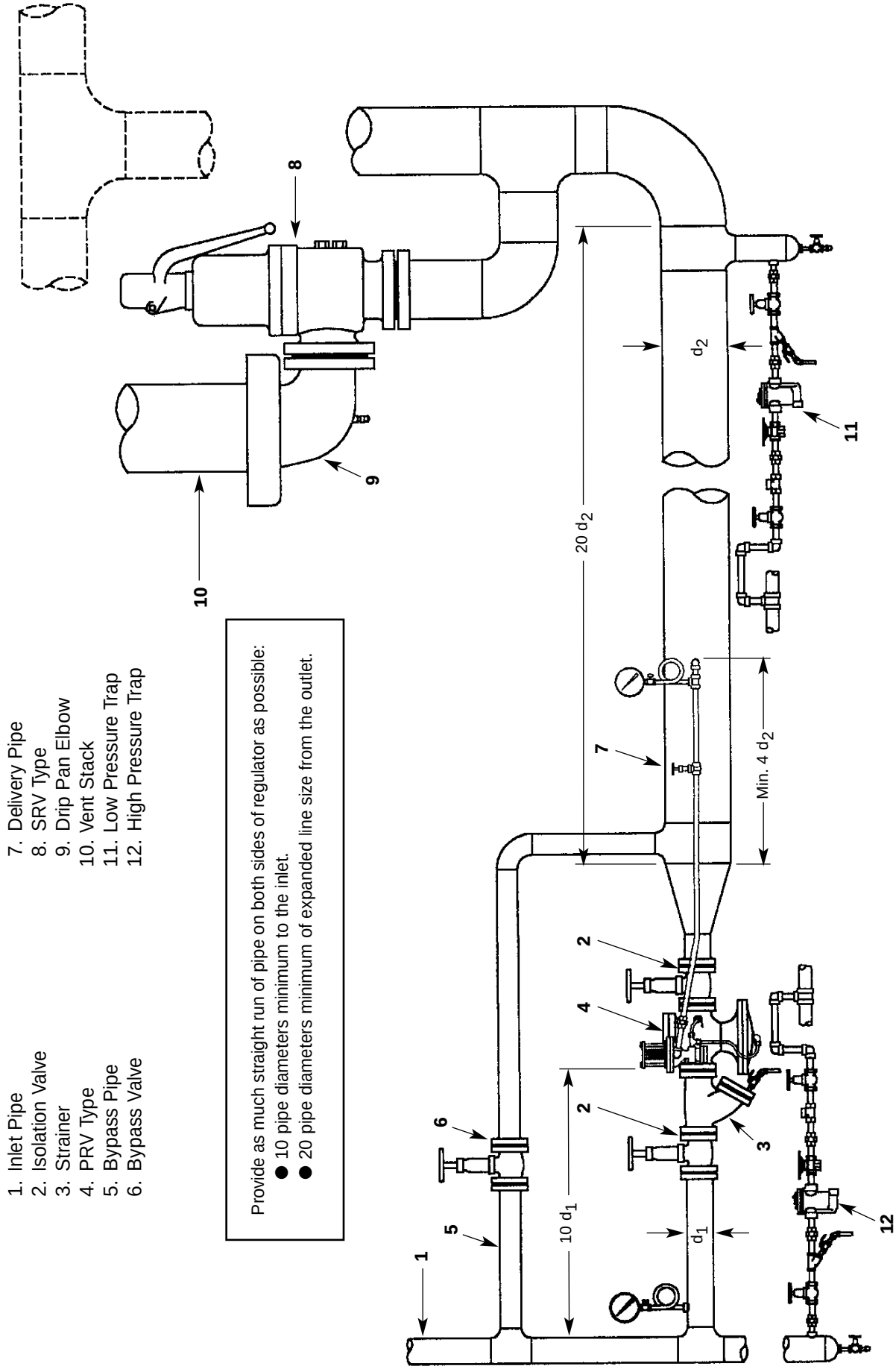
MAXIMUM PRESSURE (PSIG) AT SERVICE TEMPERATURE (°F) - (NON-SHOCK)

END CONNECTIONS	BODY MAT'L CODE	ASTM SPEC.	TEMPERATURE (°F)																			
			100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	1050
125# FLANGES THREADS 2"-12"	2 22	A126 B62	200 200	200 200	190 190	175 180	165 165	150 150	140 125	125												
125# FLANGES THREADS 14" - 24"	2 22	A126 B62	150 200	150 200	135 190	125 180	110 165	100 150	125													
150# FLANGES SWE, BWE THREADS	22	B61	225	225	215	205	195	180	170	160	150	140										
	22	B62	225	225	210	195	180	165	150													
	3	A216	285	285	260		230		200		170		140	125	110	95	80	65	50	35	20	
	6	A217	265		260		230		200		170		140	125	110	95	80	65	50	35	20	
	8	A217	290		260		230		200		170		140	125	110	95	80	65	50	35	20	
	7	A217	290		260		230		200		170		140	125	110	95	80	65	50	35	20	
	4	A217	290		260		230		200		170		140	125	110	95	80	65	50	35	20	
	9	A351	275		230		205		190		170		140	125	110	95	80	65	50	35	20	
5	A351	275		235		215		195		170		140	125	110	95	80	65	50	35	20		
250# FLANGES THREADS	2 22	A126 B62	500 400	500 400	460 385	415 365	375 335	335 300	290 250	250												
300# FLANGES SWE, BWE THREADS	22	B61	500	500	475	450	425	400	375	350	325	300										
	22	B62	500	500	465	425	390	350	315													
	3	A216	740		675		655		635		600		550	535	535	505	410	270	170	105	50	
	6	A217	695		680		655		640		620		605	590	570	530	510	485	450	320	215	
	8	A217	750		750		720		695		665		605	590	570	530	510	485	450	375	260	145
	7	A217	750		750		730		705		665		605	590	570	530	510	485	450	375	260	175
	4	A217	750		745		715		705		665		605	590	570	530	510	485	370	275	200	145
	9	A351	720		600		540		495		465		435	430	425	415	405	395	390	380	329	305
5	A351	720		620		560		515		480		450	445	430	425	420	420	415	385	350	345	
600# FLANGES SWE, BWE THREADS	3	A216	1480		1350		1315		1270		1200		1095	1075	1065	1010	825	535	345	205	105	
	6	A217	1390		1360		1305		1280		1245		1210	1175	1135	1065	1015	975	900	560	330	
	8	A217	1500		1500		1445		1385		1330		1210	1175	1135	1065	1015	975	900	640	430	290
	7	A217	1500		1500		1455		1410		1330		1210	1175	1135	1065	1015	975	900	755	520	350
	4	A217	1500		1490		1430		1410		1330		1210	1175	1135	1055	1015	965	740	550	400	290
	9	A351	1440		1200		1080		995		930		875	860	850	830	805	790	780	765	640	615
	5	A351	1440		1240		1120		1025		955		900	890	870	855	845	835	830	775	700	685
900# FLANGES SWE, BWE	3	A216	2220		2025		1970		1900		1795		1640	1610	1600	1510	1235	805	515	310	155	
	6	A217	2085		2035		1955		1920		1865		1815	1765	1705	1595	1525	1460	1350	845	495	
	8	A217	2250		2250		2165		2080		1995		1815	1765	1705	1595	1525	1460	1350	955	650	430
	7	A217	2250		2250		2185		2115		1995		1815	1765	1705	1595	1525	1460	1350	1130	780	525
	4	A217	2250		2235		2150		2115		1995		1815	1765	1705	1585	1525	1450	1110	825	595	430
	9	A351	2160		1800		1620		1490		1395		1310	1290	1275	1245	1210	1190	1165	1145	965	925
	5	A351	2160		1860		1680		1540		1435		1355	1330	1305	1280	1265	1255	1245	1160	1050	1030
1500# FLANGES SWE, BWE	3	A216	3705		3375		3280		3170		2995		2735	2685	2665	2520	2060	1340	860	515	260	
	6	A217	3470		3395		3260		3200		3105		3025	2940	2840	2660	2540	2435	2245	1405	825	
	8	A217	3750		3750		3610		3465		3325		3025	2940	2840	2660	2540	2435	2245	1595	1080	720
	7	A217	3750		3750		3640		3530		3325		3025	2940	2840	2660	2540	2435	2245	1885	1305	875
	4	A217	3750		3725		3580		3530		3325		3025	2940	2840	2640	2540	2415	1850	1370	995	720
	9	A351	3600		3000		2700		2485		2330		2185	2150	2125	2075	2015	1980	1945	1910	1605	1545
	5	A351	3600		3095		2795		2570		2390		2255	2220	2170	2135	2110	2090	2075	1930	1750	1720
2500# FLANGES SWE, BWE	3	A216	6170		5625		5470		5280		4990		4560	4475	4440	4200	3430	2230	1430	860	430	
	6	A217	5785		5660		5435		5330		5180		5040	4905	4730	4430	4230	4060	3745	2345	1370	
	8	A217	6250		6250		6015		5775		5540		5040	4905	4730	4430	4230	4060	3745	2655	1800	1200
	7	A217	6250		6250		6070		5880		5540		5040	4905	4730	4430	4230	4060	3745	3145	2170	1455
	4	A217	6250		6205		5965		5880		5540		5040	4905	4730	4400	4230	4030	3085	2285	1655	1200
	9	A351	6000		5000		4500		4140		3880		3640	3580	3540	3460	3360	3300	3240	3180	2675	2570
	5	A351	6000		5160		4660		4280		3980		3760	3700	3620	3560	3520	3480	3460	3220	2915	2865
3500# FLANGES SWE, BWE	3	A216	8640		7870		7655		7390		6985		6385	6265	6215	5880	4800	3120	2000	1200	600	
	6	A217	8100		7920		7605		7460		7250		7055	6865	6620	6200	5920	5680	5240	3720	2520	
	8	A217	8750		8750		8420		8085		7750		7055	6865	6620	6200	5920	5680	5240	3720	2520	1680
	7	A217	8750		8750		8495		8230		7750		7055	6865	6620	6200	5920	5680	5240	4405	3040	2040
	4	A217	8750		8685		8350		8230		7750		7055	6865	6620	6160	5920	5640	4320	3200	2320	1680
	9	A351	8400		7000		6300		5795		5430		5095	5010	4955	4845	4705	4620	4535	4450	3745	3600
	5	A351	8400		7225		6525		5990		5570		5265	5180	5065	4925	4845	4730	4590	4505	4240	4200
4500# FLANGES SWE, BWE	3	A216	11110		10120		9845		9505		8980		8210	8055	7990	7560	6170	4010	2570	1545	770	
	6	A217	10415		10185		9785		9595		9320		9070	8825	8515	7970	7610	7305	6740	4215	2470	
	8	A217	11250		11250		10830		10400		9965		9070	8825	8515	7970	7610	7305	6740	4785	3240	2160
	7	A217	11250		11250		10925		10585		9965		9070	8825	8515	7970	7610	7305	6740	5665	3910	2625
	4	A217	11250		11170		10740		10585		9965		9070	8825	8515	7970	7610	7250	5555	4115	2985	2160
	9	A351	10800		9000		8100		7450		6985		6550	6445	6370	6230	6050	5940	5830	5725	4815	4630
	5	A351	10800		9290		8390		7705		7165		6770	6660	6515	6410	6335	6265	6230	5795	5245	5155

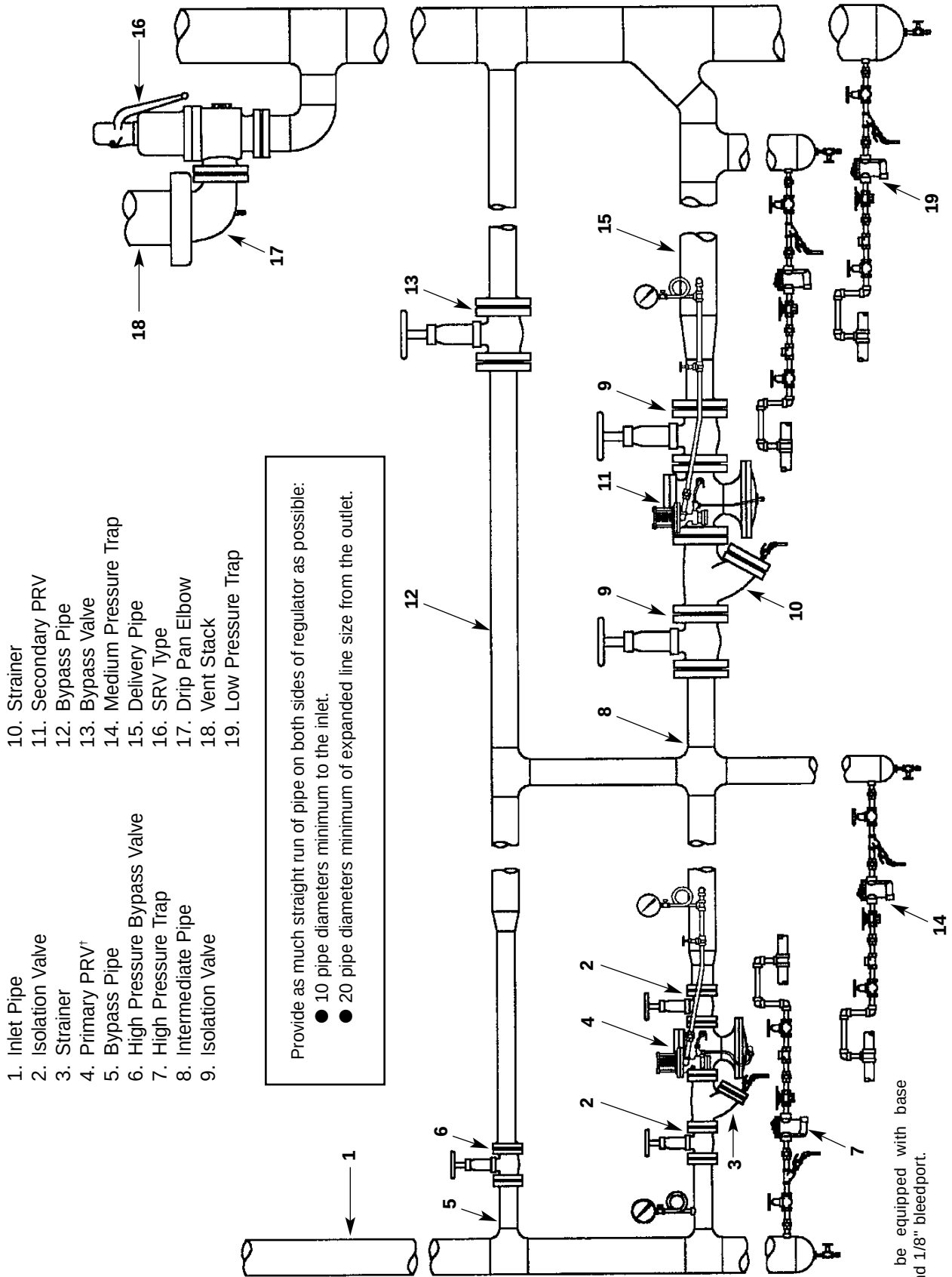
SPENCE TYPICAL INSTALLATION FOR SANITARY STEAM SYSTEM



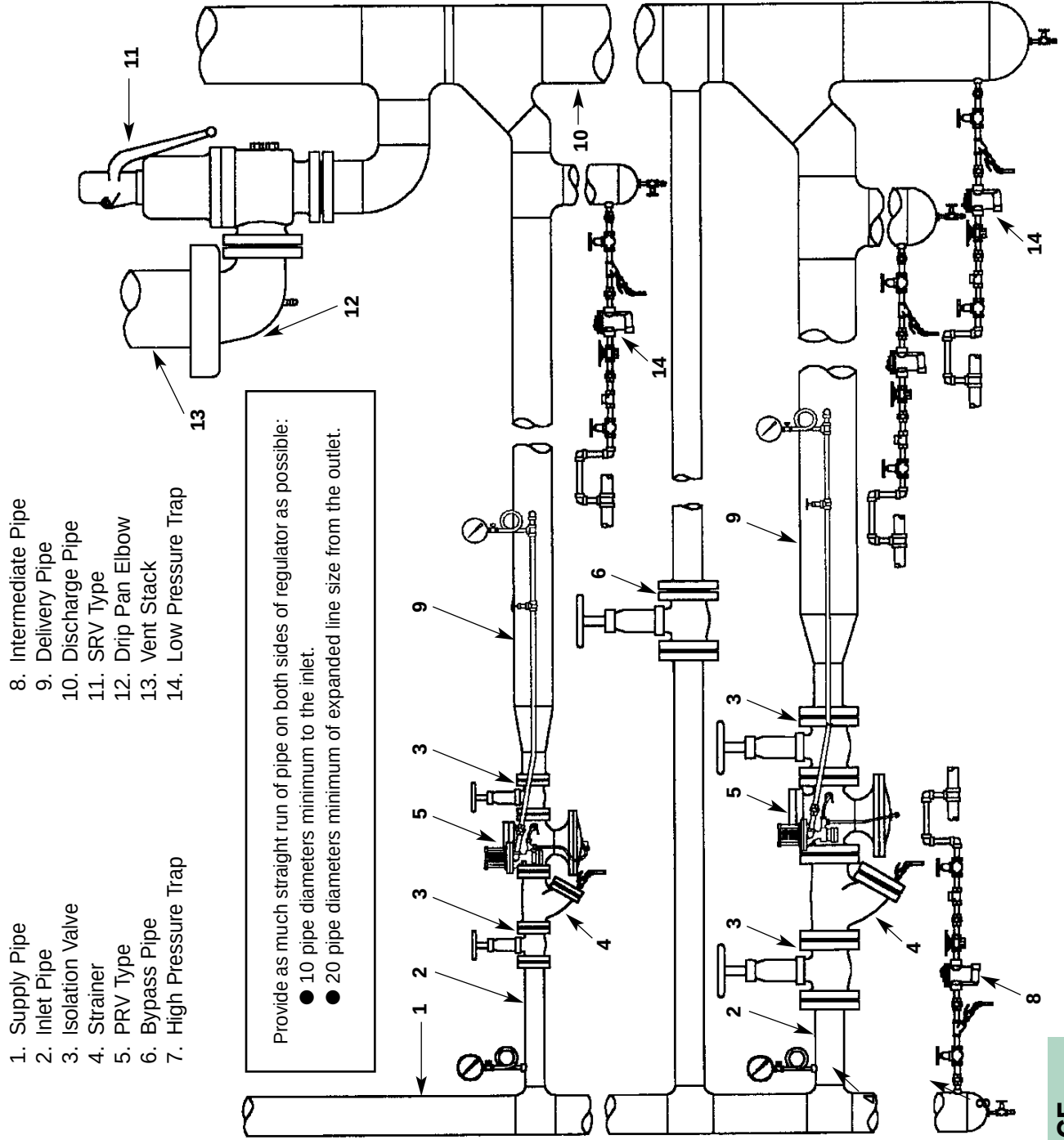
SPENCE SINGLE STAGE PRESSURE REDUCING STATION



SPENCE TWO STAGE PRESSURE REDUCING STATION

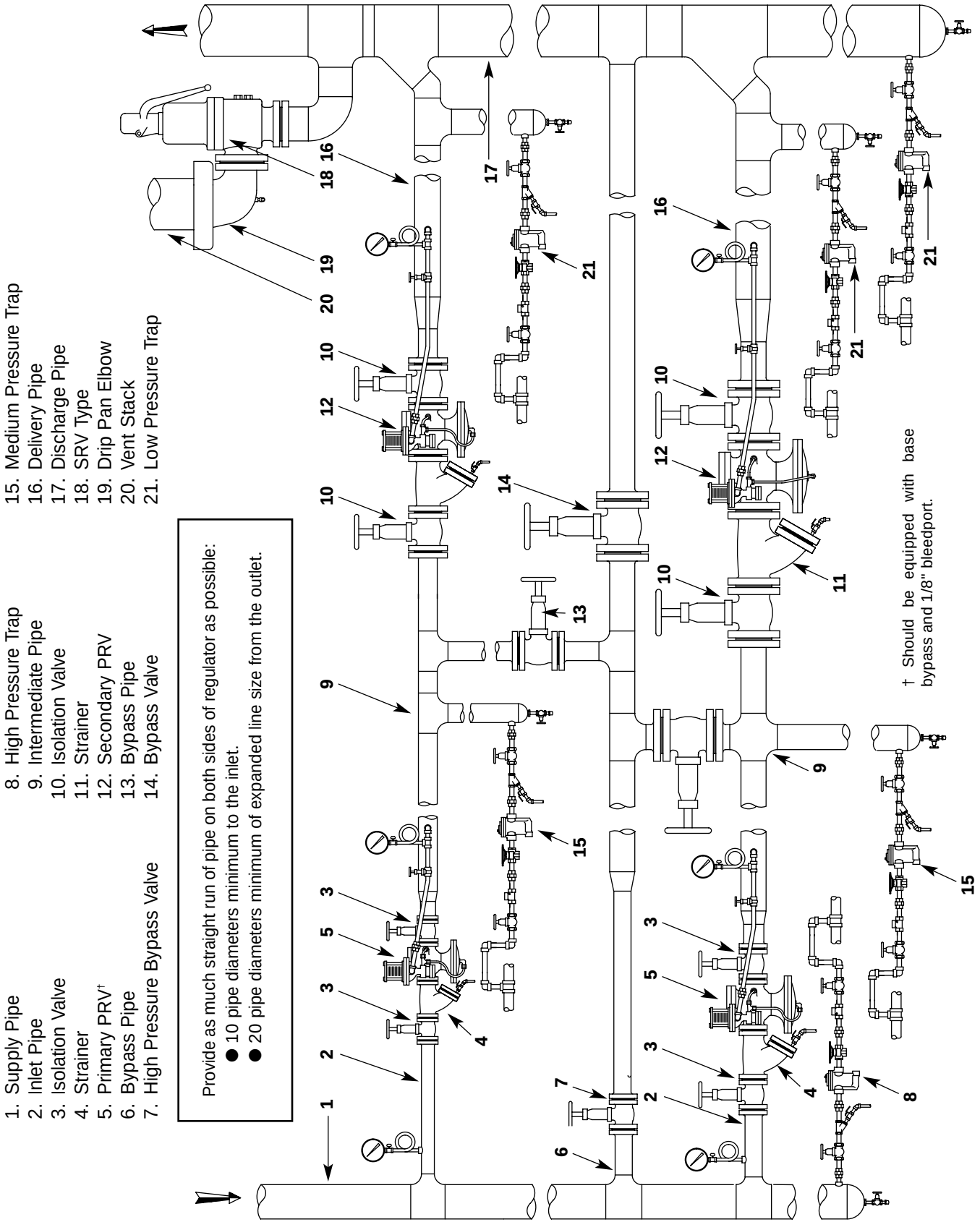


SPENCE SINGLE STAGE PARALLEL PRESSURE REDUCING STATION

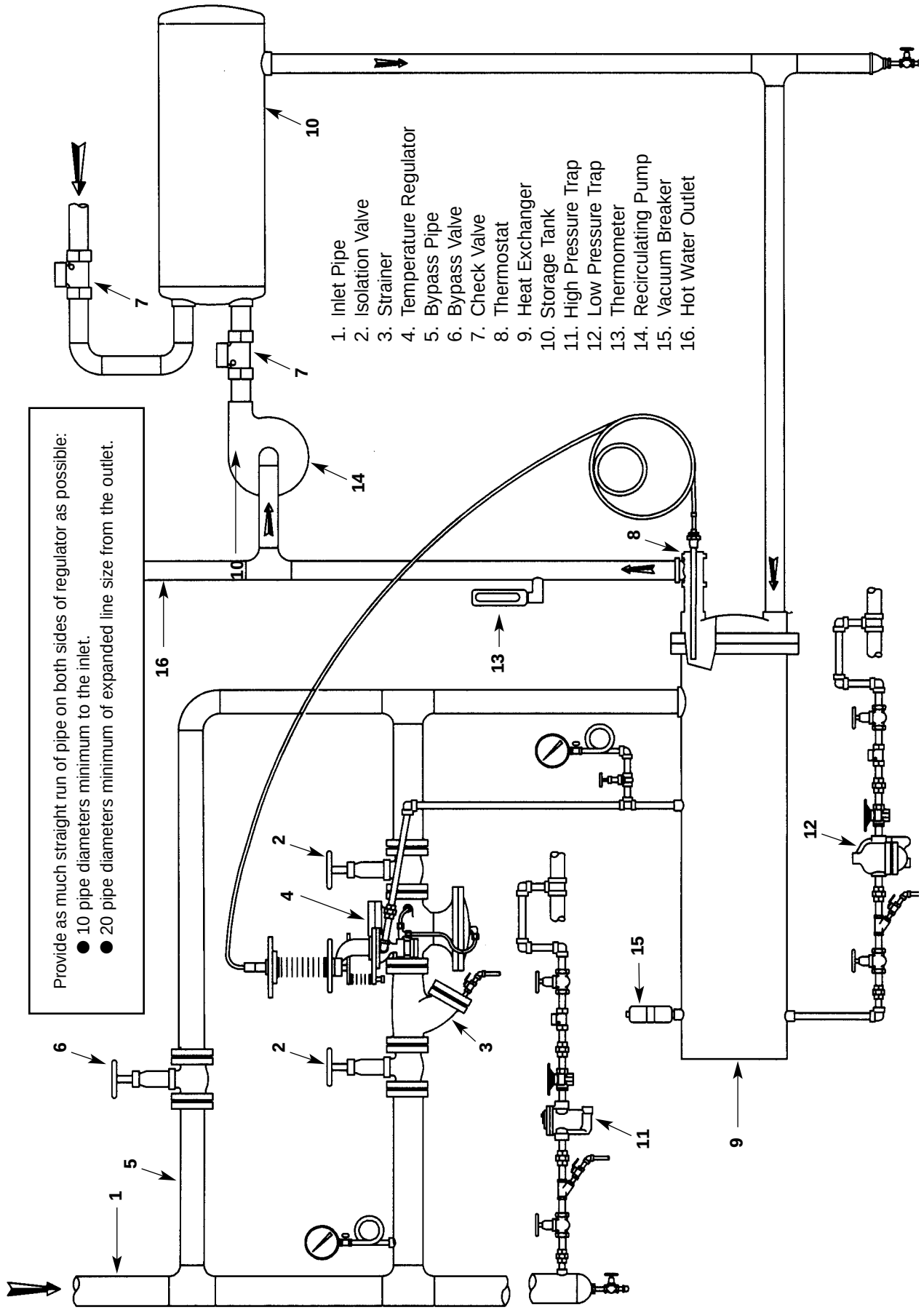


SINGLE STAGE
PARALLEL PR STATION

SPENCE TWO STAGE PARALLEL PRESSURE REDUCING STATION

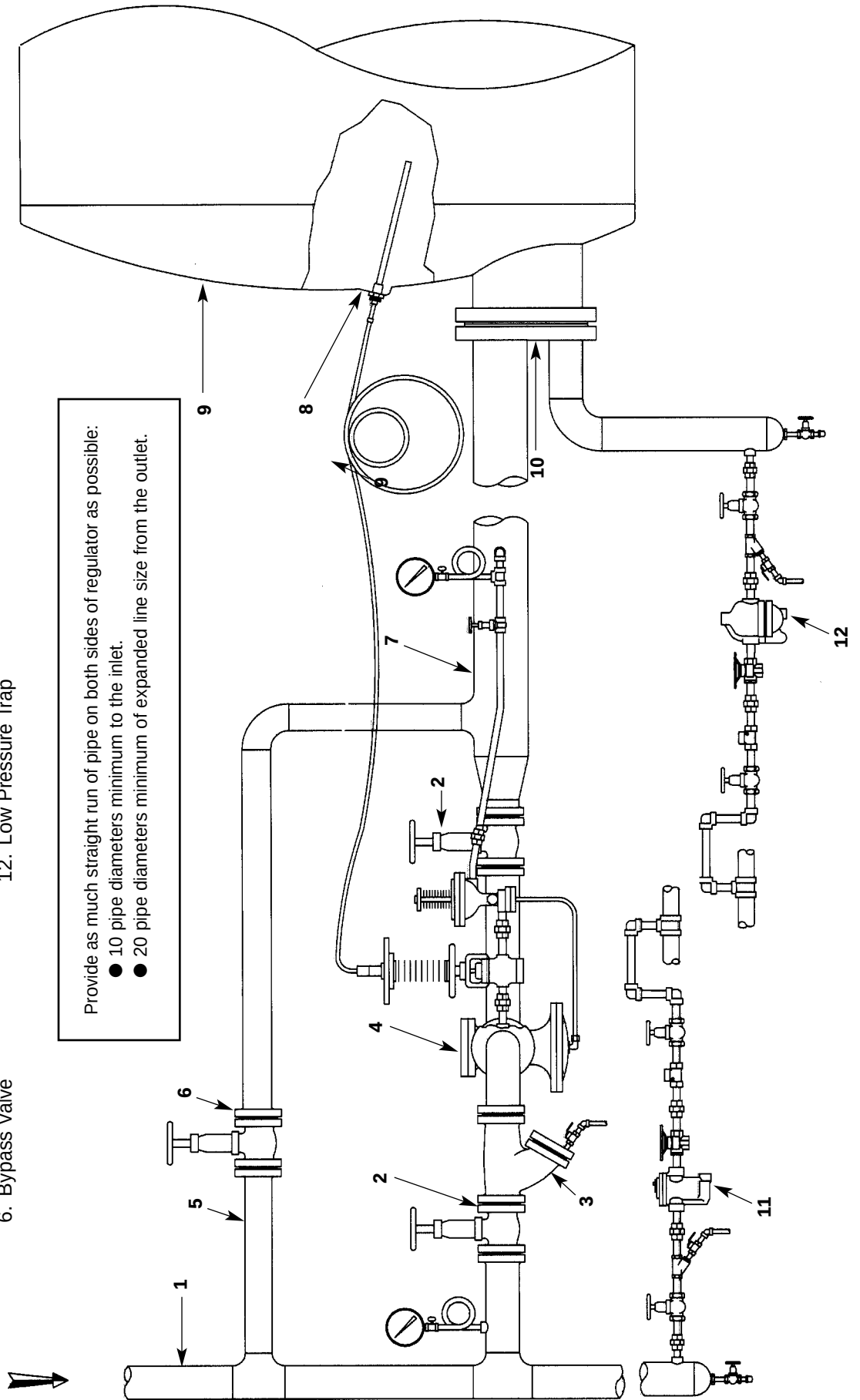


SPENCE TYPICAL INSTALLATION FOR INSTANTANEOUS HEATER



SPENCE TYPICAL INSTALLATION FOR STORAGE HEATER

1. Inlet Pipe	7. Delivery Pipe
2. Isolation Valve	8. Thermostat
3. Strainer	9. Storage Heater
4. Temperature Regulator	10. Tube Bundle
5. Bypass Pipe	11. High Pressure Trap
6. Bypass Valve	12. Low Pressure Trap



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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	1221.1 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															Temper- ature °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

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